

Re-use & decommissioning report

2018



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1 Foreword



This is the first Re-use and Decommissioning Report produced by Nexstep. We will publish this report annually and this first addition provides insight into the expected numbers of oil and gas infrastructure items that will be taken out of production in the Netherlands in the period 2018–2027.

In the Netherlands, a sizeable production infrastructure has been built up over the past decades for the production and transport of oil and gas. Many of the oil and gas fields are approaching the end of their economic life. We are therefore faced with a formidable task: the re-use and decommissioning of the associated infrastructure. The National Platform for Re-use & Decommissioning, Nexstep was established in October 2017 by the Dutch oil and gas industry and Energie Beheer Nederland (EBN), which invests in the exploration, production and storage of oil and gas on behalf of the Dutch state. Nexstep coordinates, facilitates and accelerates the agenda for the re-use and decommissioning of oil and gas infrastructure in the Netherlands.

The total remaining costs for plugging wells and decommissioning infrastructure were estimated at 7 billion euro in 2017. Nexstep wants to reduce these costs by thirty percent by means of mutual cooperation between parties, sharing knowledge and through use of innovative technology, to about five billion euro. One precondition is that the decommissioning is carried out in a safe manner and environmental interests are safeguarded.

Nexstep is continuing its efforts to investigate how re-use of infrastructure could contribute to the energy transition.

Nexstep aims to achieve a number of goals by publishing this report. First, we want to provide more clarity about the expected decommissioning activities of wells, platforms and pipelines. We show these here based on the latest information from the operators. By doing this, Nexstep wants to enable the service industry to prepare well for the work ahead and to be able to offer alternatives in order to carry out the decommissioning more efficiently where possible. This stocktaking exercise

also enables the operators to work together and coordinate decommissioning operations. With the efficiency savings that this achieves, both operators and the service companies can save costs in the decommissioning of infrastructure in the North Sea and onshore. It is important to bear in mind that the numbers stated here will vary from year to year; timing will depend on the gas price and the costs of keeping the infrastructure in production. Each year, we will provide the best possible estimate of numbers.

Decommissioning is not new, as the oil and gas industry has already decommissioned a considerable number of platforms and wells in recent years. We will therefore begin by providing an overview of the number of wells and platforms that have been decommissioned and/or re-used in recent years.

Finally, Nexstep explores in this report which opportunities for re-use are the most feasible in the light of current expertise and the regulatory regime. Examples include offshore electrification of production platforms, production of hydrogen, CO₂ storage in depleted gas fields and geothermal applications in onshore wells.

The final product is a result of intense cooperation between Nexstep and the operators. This is the first time that we give an insight into when the infrastructure will become available for re-use and decommissioning based on operator data. I would now like to enter into a dialogue with you and therefore invite you to give your response to this report. Only by receiving this we can learn from one another and new possibilities for cooperation will arise.

I hope you enjoy reading this report.

Jacqueline Vaessen
General Manager Nexstep

2 Introduction by Sandor Gaastra



Director-General for Energy, Telecom and Competition at the Ministry of Economic Affairs & Climate Policy

The publication of this “Re-use and decommissioning report 2018” represents the first attempt to identify the oil and gas infrastructure that will be taken out of use in the next ten years.

You will not have failed to notice that we are on the verge of a transition to a sustainable energy supply in the Netherlands. In recent years, we have already taken important steps in our vision for the future energy supply. We now face the major societal task of actually getting there. In that context, it is good to see that this report explicitly positions the clean-up of the oil and gas infrastructure in the light of the energy transition.

The fact that we will ultimately phase out natural gas use for heat and electricity does not mean that we now have to focus on the immediate and total abandonment of our oil and gas infrastructure. Even during the energy transition, we must still have a safe, reliable and affordable energy supply. It is therefore expected that natural gas will still form an essential part of the Dutch energy mix in the coming decades.

Producing natural gas in the Netherlands from our own indigenous sources has the least impact on the global environment and hence the climate. The production of our own gas also has a number of other advantages, such as natural gas revenues, employment and helping contribute to the security of supply. It also has a favourable effect on the speed and affordability of the energy transition.

Provided that production can take place safely and responsibly, and as long as we need the gas ourselves, the government is also in favour of gas production from the Netherlands' marginal fields. For this reason alone, we need to be careful with our oil and gas infrastructure as long as we still have it and need it.

Before turning to the decommissioning and removal of platforms, wells and pipelines, it is also desirable to see whether we can partly use this infrastructure for other, perhaps sustainable, applications such as wind energy, CO₂ storage, storage and transport of hydrogen or geothermal energy.

In that light, it is good to see in the naming of this report that re-use comes before decommissioning. This is an interesting and important shift of emphasis for industry too, because the energy transition offers the mining industry opportunities to work with partners in the world of energy supply to explore and utilise the possibilities to re-use infrastructure in order to facilitate and accelerate the energy transition.

By working together on decommissioning, re-using what we can, and by sharing knowledge and experiences and learning from each other, synergy and efficiency benefits can be achieved for all stakeholders. The fact that this report also provides an impetus to agree how the decommissioned infrastructure might contribute to the energy transition and also sets out the number of platforms that are eligible for re-use endorses the good will of the mining industry. We must, however, remain realistic when studying the possibilities of re-use. It must not be used as an excuse to not remove the infrastructure.

“We must, however, remain realistic when studying the possibilities of re-use.”

Where infrastructure can no longer be used efficiently and there is no prospect of re-use, mining companies are responsible for removing it as quickly as possible in a safe and environmentally friendly manner. They must do this pursuant to the provisions of the Mining Act and must also ensure that they have sufficient financial resources to do so.

On a final note, The Master Plan on Decommissioning and Re-use was launched as a positive initiative of NOGEPa and EBN to look together at aspects of efficiency and cooperation in removing our oil and gas infrastructure. Nexstep has also become a suitable platform for exploring, facilitating and coordinating re-use of the infrastructure to help contribute to the energy transition. This is a positive development.

I look forward to working with Nexstep and the other partners to jointly take on the challenge.

3 Decommissioning & re-use up to 2018

Decommissioning and re-use is nothing new in the Netherlands. Many wells that have failed to find economic reserves of hydrocarbons were decommissioned soon after they were first drilled. Other wells that have reached the end of their producing life have also been decommissioned. Once all the wells on a platform have been decommissioned the platform itself can be decommissioned. The first time that an offshore platform was decommissioned in the Netherlands was in 1988.

The economic lifespan of wells and platforms is difficult to predict. Gas prices, the volumes produced, operational costs, but also the costs of exploring for new oil and gas fields all play a role. The map on the right clearly shows that decommissioning is nothing new in the Netherlands. The map also provides an indication of the number of wells and platforms that will be eligible for decommissioning or re-use in the coming years. Of the 24 offshore platforms that have already been decommissioned, the top sides of 13 of them have been re-used. A complete overview of what infrastructure has been decommissioned and re-used to date is available on the Nexstep website.

Transition to sustainable energy

While in the past, the re-use of installations was mainly focused on the continued production of oil and gas, in the future we will mainly be looking at how we can use the current infrastructure to store and transport other molecules and energy (see section 6).

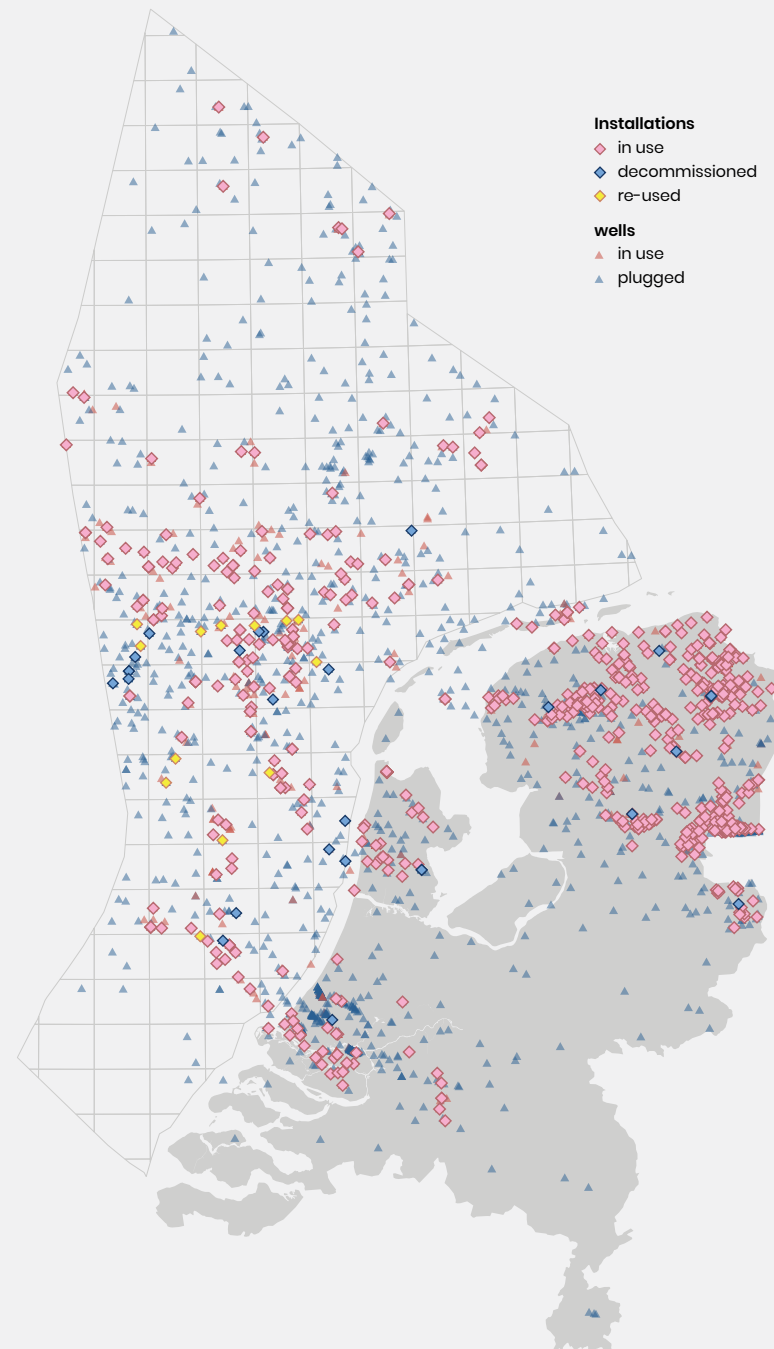


Figure 3.01
Overview of oil and gas infrastructure and wells in the Netherlands.

Case

Re-use of platform P14-A by Wintershall Noordzee

In 1993, the satellite platform P14-A, located 50 km off the coast of Scheveningen, started production. The platform produced around 3 billion cubic metres of gas until 2006.

In June 2008, the top sides were removed from the platform to be cleaned and prepared for re-use in Ridderkerk. The installation of the re-used top sides followed a year later, this time about 150 km northwest of Den Helder. They were re-used on platform E18-A, a platform which has now almost reached the end of its economic life. Wintershall Noordzee has plans to re-use the top sides once again for a gas production project. The new location is located 75 km northwest of the current position.





Directeur of Stichting De Noordzee

A Master Plan for the North Sea

The North Sea will undergo a complete makeover in the coming years. The use of the sea will change and use of the space will be reorganised. There will be new risks, but certainly also new opportunities for the ecosystem. A combination of transitions now offers us the unique opportunity to restore the balance between natural and human use in the North Sea.

The North Sea is now at the start of a number of far-reaching and largely simultaneous changes. First, the energy transition will leave a big mark on the largest nature reserve in the Netherlands. The number of wind farms is being significantly expanded while oil and gas production is being phased out. Both the economic and social interests associated with this transition are enormous.

There is also a food transition: how do we ensure that the sea continues to feed us, while ensuring the sustainability of existing technologies and developing new technologies? Finally, there is also the nature transition: the call for a clean and healthy North Sea is not just coming from nature conservationists. Politicians have also set important and enforceable environmental and nature goals for the North Sea – including protected natural areas.

How do we guarantee that all these simultaneous developments do not get in the way of each other, but instead strengthen and complement each other? In the coalition agreement of the Rutte III administration, the responsibilities relating to the North Sea are divided over more than four ministries. This does not make matters easier. Strong government control is indispensable to steer turbulent developments in the North Sea in the right direction.

For this reason, Stichting De Noordzee is calling for a comprehensive and well-coordinated Master Plan for the North Sea. An integrated spatial plan – drawn up based on input from all stakeholders – that ensures good zoning and smart combinations. An integrated plan that creates the preconditions for sustainable use of the North Sea, where economic activities are in balance with nature. A Scientific North Sea Commission will ensure that we operate in a science-based way and can make timely adjustments. A transition fund will help the parties in the North Sea including nature in the transition to the new situation.

“A Master Plan for the North Sea to ensure that the changes benefit both people and nature.”

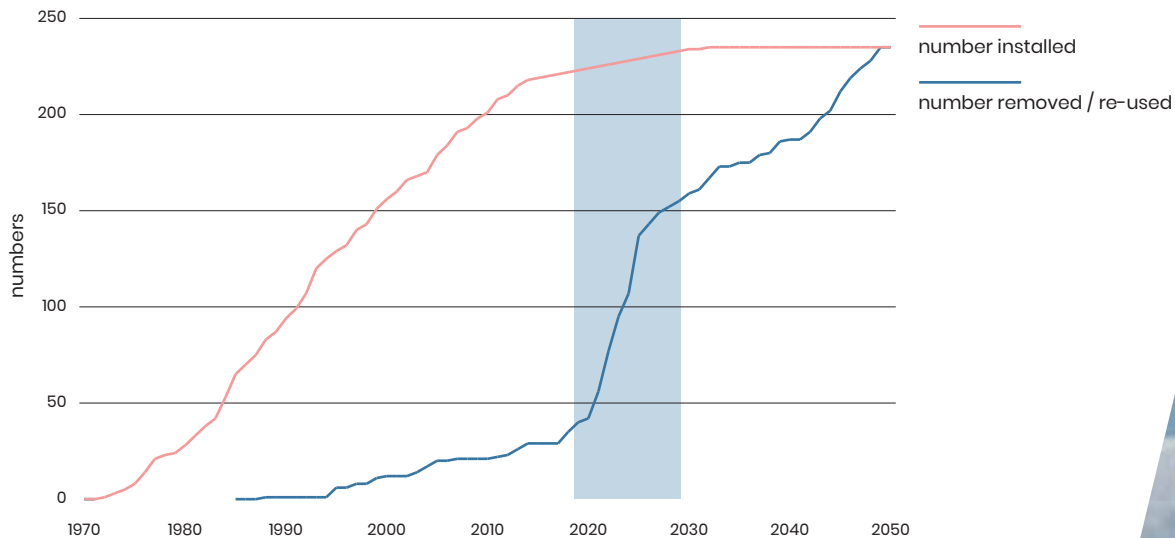
In addition to smart use of space, a thorough approach to old and new infrastructure will be of great importance. From an ecological point of view, the re-use of the oil and gas infrastructure for new purposes may offer benefits, because we prevent the environmental impact of new construction and the decommissioning of installations. And from an economic perspective, an overarching vision is crucial: while an individual business case for re-use might be negative, the sum total of several business cases may be positive. Nexstep is pre-eminently the platform to help develop this overarching business case, with a long-term perspective and an eye for various social interests.

In the coming years, billions of euro will be invested in the North Sea. The choices that are made in this respect will determine the future of our largest nature reserve for a long time to come. In order to take advantage of the many unique opportunities that the transitions offer us, a clear and integrated vision is needed on the future of the North Sea, under the leadership of a good executive. With a thorough Master Plan for the North Sea, we can ensure that the forthcoming changes will benefit both people and nature.

4 Expected decommissioning in the Netherlands 2018 - 2027

Many oil and gas fields in the Netherlands are approaching the end of their economic life. Figure 5.0.1 shows that the decommissioning of offshore platforms will accelerate in the next 10 years.

Figure 4.0.1. The cumulative number of installed and removed offshore infrastructure items.



In order to provide more clarity about the expected decommissioning activities relating to wells, installations and pipelines, Nexstep will be mapping this out over the next 10 years. The data used is based on the latest information from the operators.

Because costs and the gas price vary over time, it is difficult to determine precisely when a well has reached the end of its economic life. The industry therefore provides an indicative date for wells, installations and pipelines. This date is adjusted depending on production volume, gas prices and operational costs. The indicative date may therefore seem irrelevant, but it is important because the parties involved must determine before that time what is eligible for re-use and think about how the remaining infrastructure can be decommissioned as efficiently as possible.

4.1 Total overview offshore & onshore

Figure 4.1.1. Offshore infrastructure that becomes available.

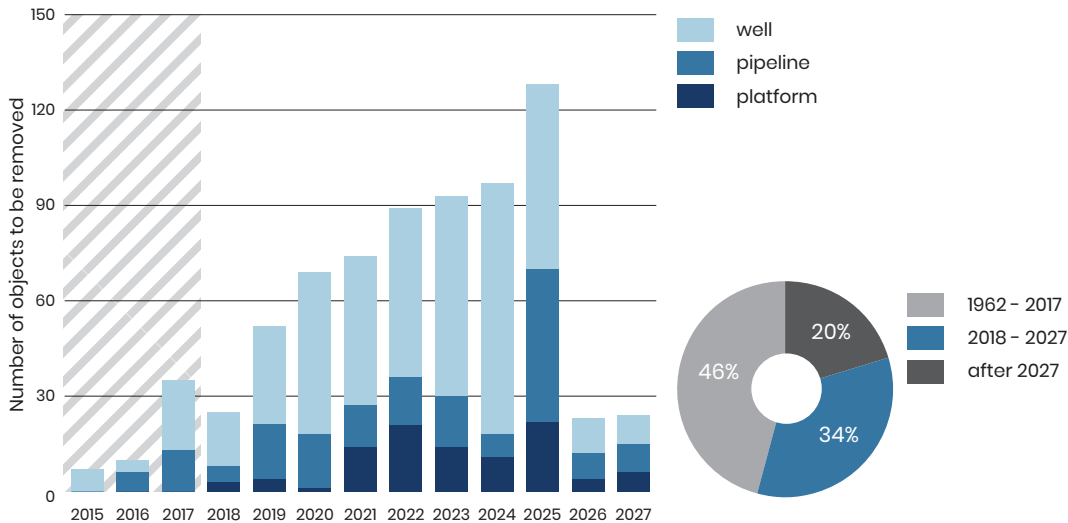
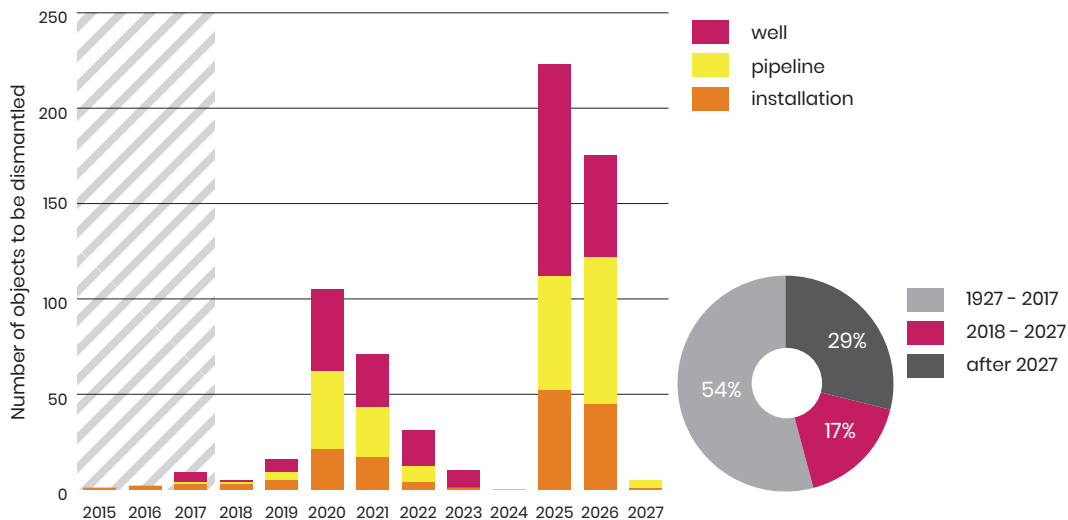


Figure 4.1.2. Onshore infrastructure that becomes available.



For offshore, it is expected that by 2027 two-thirds of all wells, platforms and pipelines will have been decommissioned or re-used. The decommissioning of offshore infrastructure will peak in 2025, followed by a sharp decline in 2026. It is expected that this peak will plateau and some of the work scheduled for 2025 will be pushed back to 2026 or later. The same applies to onshore. It is therefore more realistic to expect that by 2027 half of the offshore infrastructure will have been decommissioned, rather than two-thirds.

The decommissioning of offshore installations requires a different approach and different logistics than onshore. Working offshore is complex and often takes place under difficult circumstances, resulting in higher decommissioning costs.

In order to be well-equipped in the coming years, the sector must start to prepare itself now. The decommissioning activities can be carried out in a safe and cost-efficient manner if operators and service companies act together.

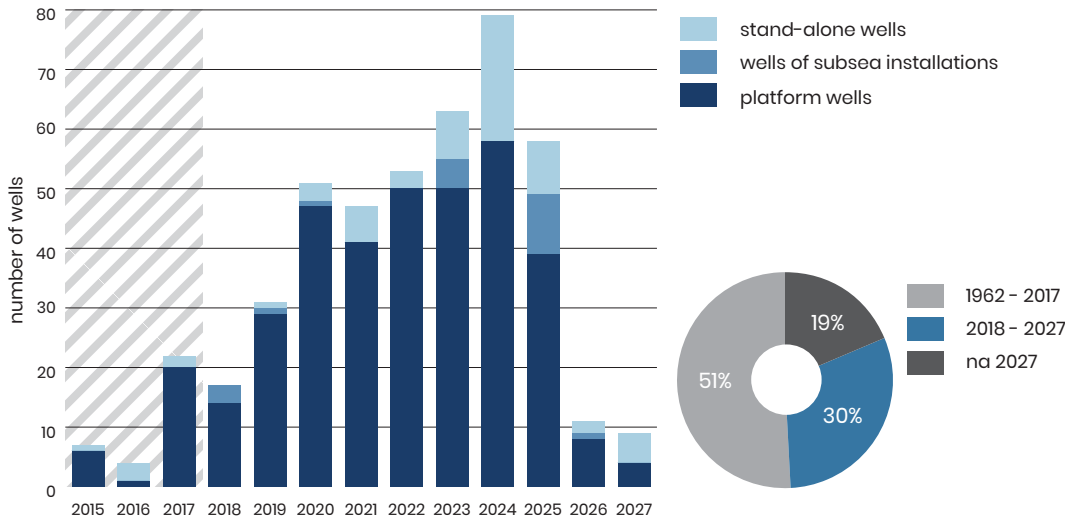
Technical versus economic life

A well has a technical and an economic lifespan. The technical lifespan depends on whether a well is still producing and offers back pressure. If this is not the case, the well is plugged. The technical life span of a well can be reasonably predicted by monitoring, excluding unforeseen circumstances.

The economic life span of a well is partly dependent on the technical lifespan. For example, does the well still produce enough to account financially for maintenance and repairs? Furthermore, things like the gas price, the costs of keeping a well in production and how much a well still has in reserves. Since the costs and the gas price vary over time, it is difficult to determine exactly when a well has reached its economic lifespan. Usually, operators will therefore give an indicative date.

4.2 Offshore wells

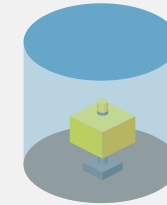
Figure 4.2.1. Well type that becomes available.



The figure shows that the number of offshore wells becoming available for re-use and decommissioning will increase over the next seven years with a peak in 2025.

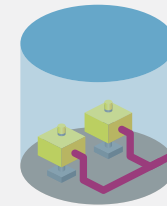
What is striking is that the vast majority of the wells are accessible from a platform. Depending on the situation on site, a choice must be made as to how the well can best be plugged. The type of well and the space on the platform are the deciding factors here. If the platform is suitable, a lattice mast is used on the platform itself (rigless). In many other cases, a jack-up drilling rig is used.

Offshore wells can roughly be divided into three types:



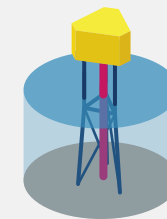
Stand alone wells

These are wells that were used in the past for exploration and that have not yet been completely decommissioned.



Subsea installation wells

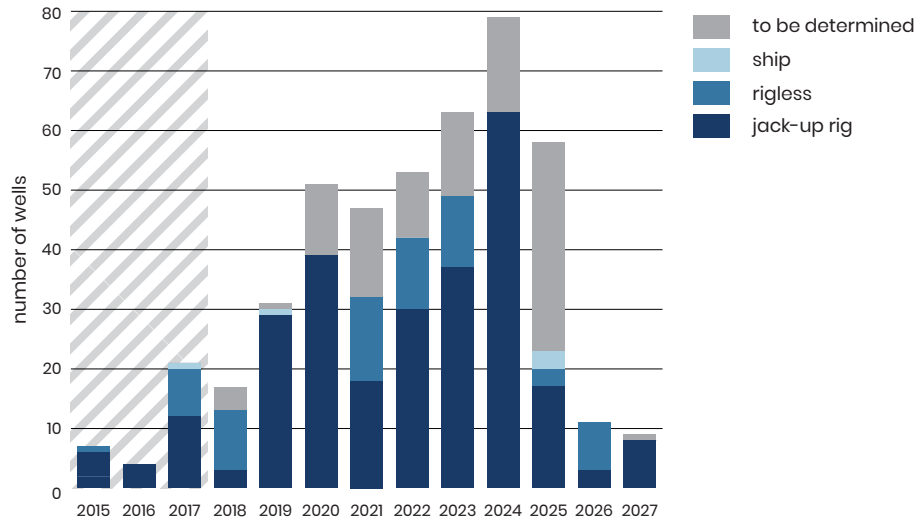
Wells for which the installations and infrastructure are on the sea bed while the controls are managed from the main platform.



Platform wells

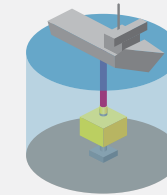
These are wells that are accessible from an installation above the surface.

Figure 4.2.2. Expected method for decommissioning offshore wells.



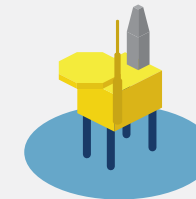
Because the majority of Dutch offshore platforms are not equipped with a drilling installation, a mobile drilling installation will be required. In most cases a jack-up rig will be used. In some case it will be possible to decommission without a rig, as the available cranes will be used. A ship can be used for some stand-alone wells.

Nexstep will look for innovative methods of decommissioning the wells. The aim is to find new methods that allow efficient and effective decommissioning of the wells, subject to the precondition that it is done in a safe manner. This means that the methods presented here may still be subject to change in the years ahead.



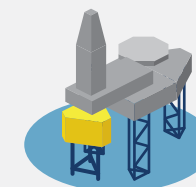
Ship

A ship with a drilling installation which uses an anchor or dynamic positioning to stay in place can conduct decommissioning activities.



Rigless

Decommissioning by using the crane present at the platform.

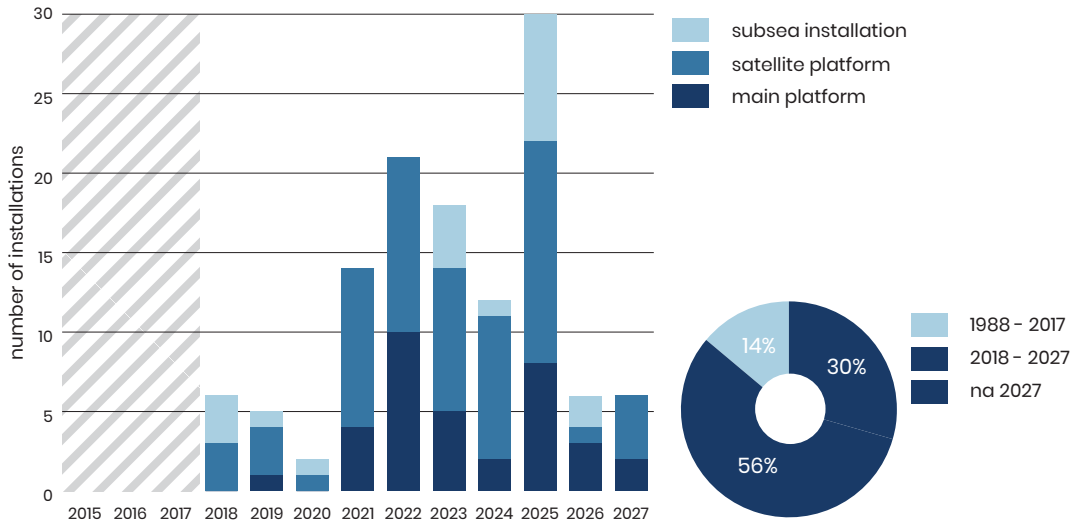


Jack-up rig

A floating drilling platform with jack-up legs. The drilling installation is positioned over the existing platform or stand-alone well.

4.3 Offshore installations

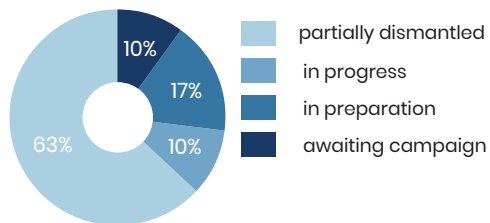
Figure 4.3.1a. Offshore installations becoming available for decommissioning.



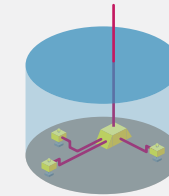
Once the wells have been plugged, the decommissioning of the installations can begin. The graph shows that the expected peak in decommissioning will be between 2021 and 2025.

Decommissioning of offshore installations will take many years. First, the wells are plugged and the pipelines for the process installations are depressurised. In most cases, the top sides will then be cleaned. Next, the subsea installations and the top sides can then be removed. Of the 180 offshore installations, 30 have so far been decommissioned. Wells have been plugged in 63% of these, and the oil or gas has been removed from the pipelines and appliances.

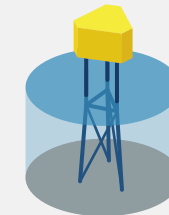
Figure 4.3.1b Decommissioning phase for offshore installations.



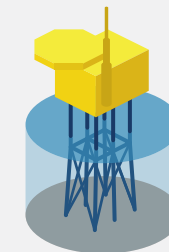
The decommissioning process is actively ongoing in 10% of cases, while it is currently in preparation by the project team in 17% of cases. In 10% of cases, decommissioning is waiting for a campaign.



Subsea installation
equipment on the sea bed connected to subsea wells.

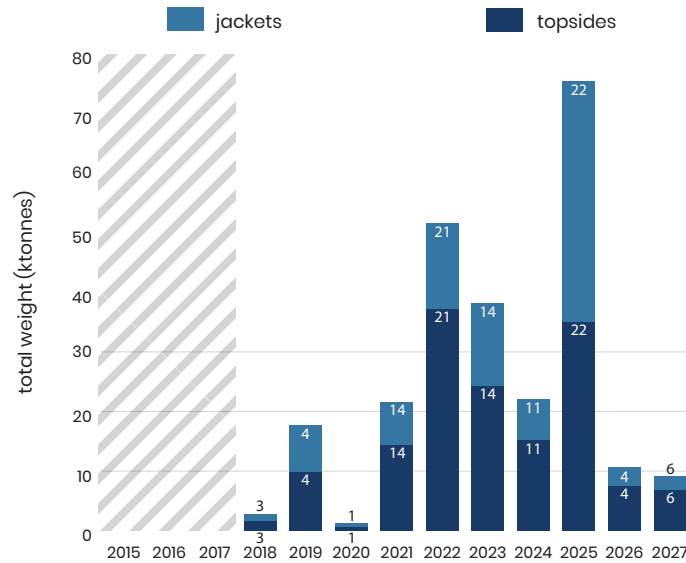


Satellite platform
Unmanned production platform connected to the main platform by pipelines.



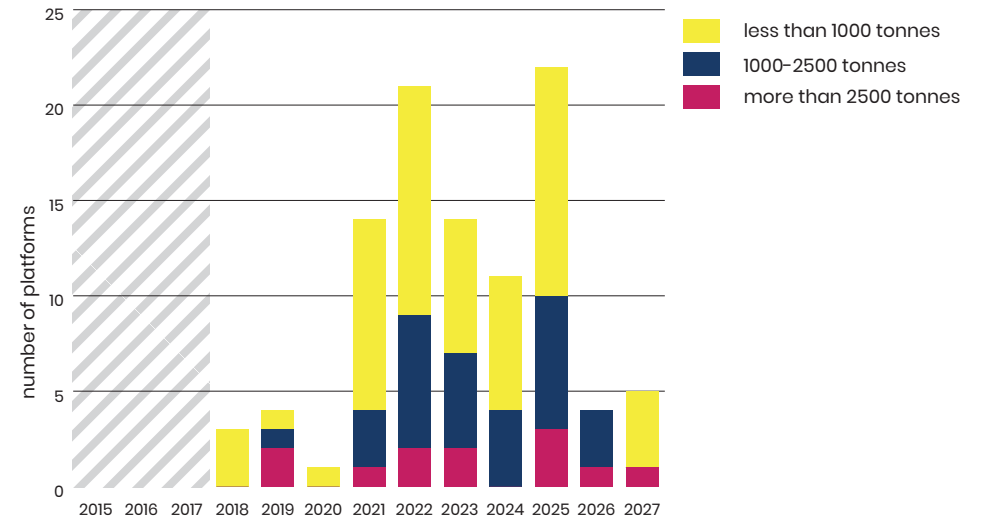
Main platform
Manned platform which in most cases also has a gas treatment facility and a compressor station.

Figure 4.3.2. Expected decommissioning per platform component.



When decommissioning offshore facilities, the top side of the platform is removed. This is done using heavy crane vessels with a large lifting capacity. The jackets are then removed from the seabed. Dutch offshore installations are almost always made of steel. This means that in the next ten years, 250,000 tonnes of steel will be brought to shore, equivalent to 200,000 cars. More than 95% of this will be recycled.

Figure 4.3.3. Expected decommissioning by weight module.



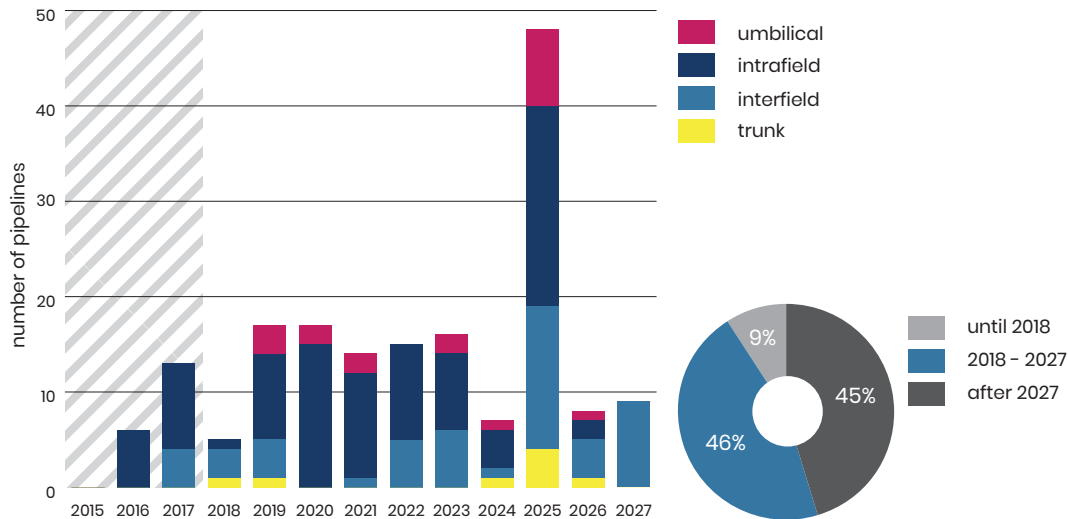
During the construction of the installations in the North Sea, the top sides were fitted using crane vessels. At the time, these ships did not have the capacity that modern ships have, so that older top sides were fitted in separate modules. When removing these top sides, it will have to be done in reverse order. This is why the choice of the crane vessel is based on the heaviest module on the platform.

Because Dutch offshore installations are relatively small and light, a larger section of the crane fleet will be available for decommissioning operations. It is also worth noting here that the same fleet is also used for the construction of wind farms, for example. Good planning and cooperation with other operators and the builders of wind farms will be necessary to ensure sufficient availability.

4.4 Offshore pipelines

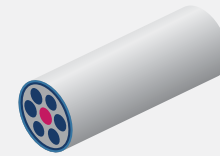
Offshore pipelines can be divided into interfield, intrafield and trunk pipelines. The trunk pipelines will remain in operation until the last connected field ceases production.

Figure 4.4.1. Expected decommissioning by pipeline type.



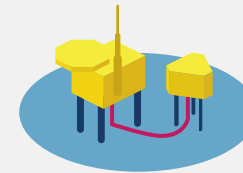
The graph shows that in the coming years it is expected that around 15 pipelines per year will be decommissioned, with a peak in 2025. When the pipelines are no longer needed for oil and gas, they can be re-used. If this is not possible, the pipelines will be cleaned and decommissioned. The pipelines will be removed where necessary.

The pipelines used for the transport of oil and gas from the offshore fields vary greatly in diameter. Pipelines with a diameter of about 15 centimetres are used for transport between platforms. Pipelines with a diameter of about 70 to 122 centimetres are used for the transport of oil and gas to shore. These trunk lines can be more than 150 kilometres long and will remain in production until the last connected gas field ceases production.



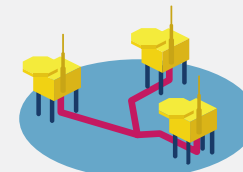
Umbilical

An outer pipeline containing several smaller lines for liquids and cables.



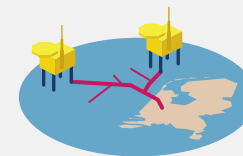
Intrafield

Often smaller pipelines between the installations at a single field. These pipelines are sometimes also used to transport liquids used during production. The diameter varies between 5 and 15 centimetres for liquid pipelines and 15 to 25 centimetres for gas pipelines.



Interfield

Pipelines between the various fields and blocks, from 5 to 20 kilometres long, that transport hydrocarbons to another platform for processing and ultimately transport the product to shore.



Trunkline

Large pipeline that transports hydrocarbons from a main platform to shore. These pipelines can be more than 150 kilometres long and often have a large diameter of about 70 to 122 centimetres. Pipelines of this type are often shared with other main platforms and companies that are connected to it.



Director of Gas Technology - TNO Energy

Offshore system integration, as a transition accelerator for the North Sea

The North Sea is full of infrastructure for the production of oil and gas, including about 150 platforms, 3,000 kilometres of pipeline and 700 wells. In the coming decades, these will gradually disappear, depending on the remaining volumes of gas and the gas price. The hubs in particular will remain in place for a longer period of time. These are about a dozen larger platforms that play a central role in the North Sea, because they provide compression and gas treatment facilities. Is there another useful function for this infrastructure once gas production has stopped? This is what we are looking at in the North Sea Energy programme, together with partners from the wind and gas sectors.

There has long been talk of CO₂ storage in depleted gas fields, and it seems inevitable that these will indeed be needed to meet the Dutch CO₂ reduction targets. In the first instance, the focus will be on depleted gas fields close to the coast, while later CO₂ will be injected into depleted fields further out in the North Sea. Some 5 to 10 fields will probably be needed, the first of which should be available within a few years.

While offshore wind energy is being accelerated to bring 4.5 gigawatt on stream by 2023 and 11.5 gigawatt by 2030, concerns have emerged about the capacity to integrate this electricity in the onshore grid and the costs of offshore transport. Power to Gas - converting electricity into gas, especially hydrogen - is an attractive option for storing electricity from wind farms and then transporting it cheaply to shore via existing pipelines. Large-scale application will be needed in about 10 years,

but initial demonstration projects are needed to scale up to the volumes that will be needed by around 2030. This will mainly happen on larger platforms and old gas fields further out to sea, in the vicinity of future wind farms far from the coast. And later still, perhaps on energy islands.

“Electrification of platforms, CO₂ injection and Power to Gas are therefore relevant to the creation of a sustainable, stable and affordable energy system for the future in the North Sea.”

For these applications, it will be essential to construct an offshore electricity network that connects wind farms and platforms. CO₂ injection and hydrogen production requires electricity, which should preferably be generated by wind farms. To realise this offshore, the largest hubs and wind farms will have to be connected. This can be economical if the distance to the substations at wind farms is short and the remaining period of gas production is still substantial. Otherwise, a social business case will have to be developed in which future functions, such as CO₂ storage and H₂ production gain recognition and public investments are justified.

Electrification of platforms, CO₂ injection and Power to Gas are therefore relevant to the construction of a sustainable, stable and affordable energy system for the future in the North Sea, but are very dependent on the availability of the oil and gas infrastructure at the right time and at the right location. This is a puzzle that no party can solve on its own, and careful planning will be required. We call this 'system

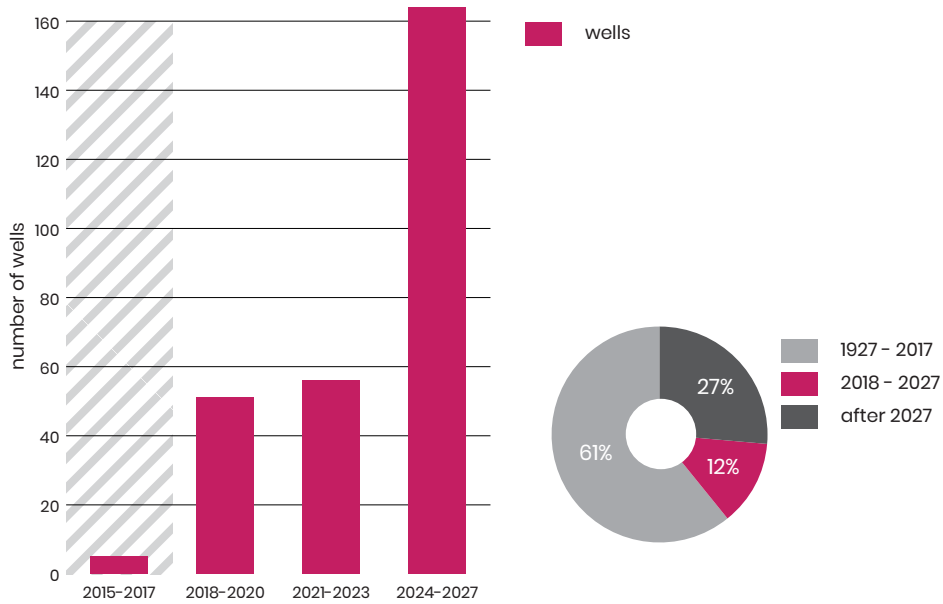
integration', perhaps the biggest challenge of the energy transition. Cooperation between operators of wind energy and gas production, suppliers, EBN, TenneT and the government will be necessary to achieve an optimal transition model for the North Sea.

At TNO, we consider the following actions will be necessary for the energy transition in the North Sea:

- Removing legal barriers in order to make system integration options, such as platform electrification and Power to Gas, possible.
- Providing stimulus measures for the construction of an offshore electricity network that connects the wind farms with the platforms that are needed to facilitate future functions, in particular CO₂ storage and hydrogen production.
- Making a decision on the strategic fields that need to be kept available for CO₂ storage, together with the associated pipelines and platforms. This requires a co-decision on funding.
- Facilitating pilots on existing platforms to demonstrate the technology of Power to Gas so that experience can be gained in relation to costs, efficiency and dynamic behaviour of differing technologies.
- The development of a strategic spatial plan for the development of offshore energy in the North Sea, in space and time, which will be used to optimise the planning of the decline and re-use of gas infrastructure.

4.5 Onshore wells

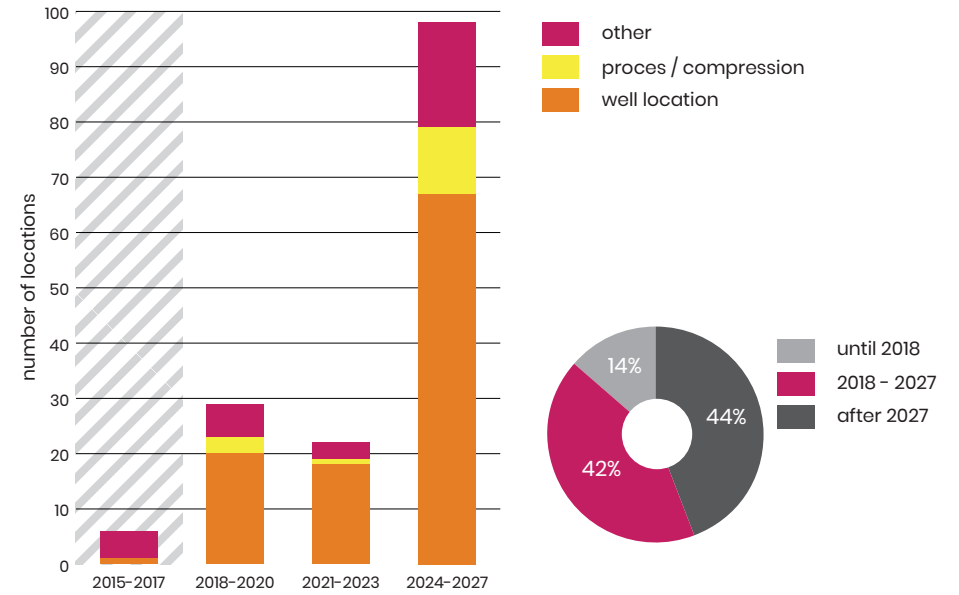
Figure 4.5.1. Expected decommissioning of onshore wells.



This chart shows that 60% of the 1,932 wells had already been abandoned between 1927 and 2017. Of the remaining 40 percent the majority will be decommissioned from 2025 onwards.

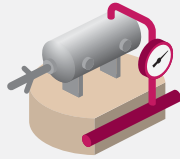
4.6 Onshore locations

Figure 4.6.1. Expected decommissioning of onshore installations.



The various types of onshore locations are shown on this chart. About half of the onshore well locations will become available for decommissioning before 2028. This is relevant for the recovery of the landscape. The decommissioning of most onshore locations is expected from 2025 onwards.

Used onshore installations in the Netherlands



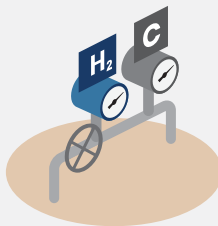
Compression installation

A compressor or compressor station is used to pressurise gas for transport to and within the Gasunie network. The national gas grid is kept at high pressure in the main pipes, approximately 70 bar, to help prevent energy losses during transport.



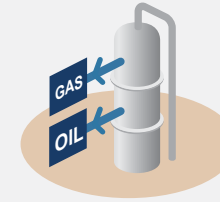
Injection station

A location where fluids are pumped into the deep subsoil. This may concern the injection of gases and liquids. In many cases, however, it concerns produced water injection. Produced water is water that comes up during the production of oil and gas. After separation of usable profitable substances, the water is injected back into the deep subsoil.



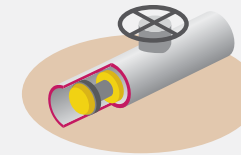
Metering installation

An installation where the volume of hydrocarbons is measured, often just before transfer to another party, such as Gasunie, or for transport by water or via pipeline to a refinery for further processing and sale.



Processing installation

An installation where gas or oil are separated from all non-usable substances before sale.



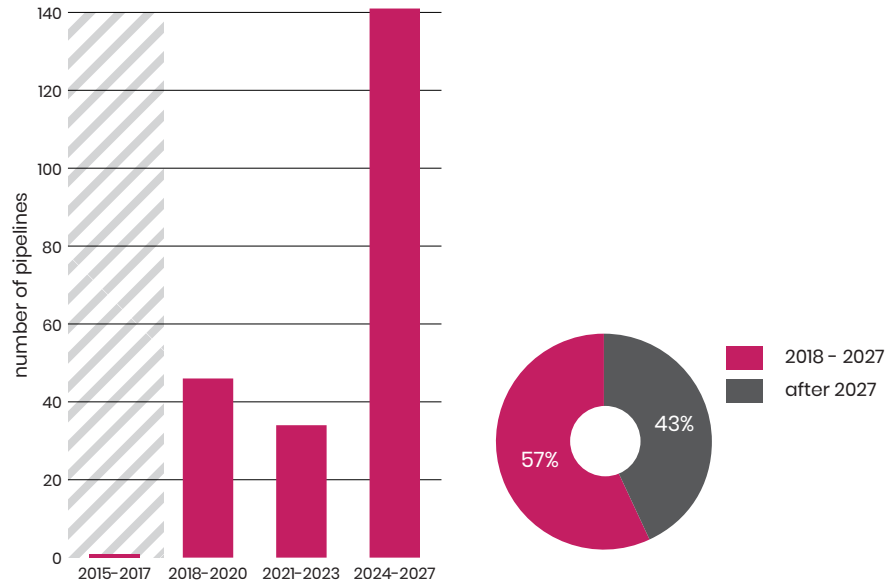
Scraper station

A location with an inlet connection to a pipeline where a scraper or inline inspection tool can be launched in the pipeline for the cleaning or inspection of the pipeline. In many cases, this facility is already built into the processing installation, but sometimes it is at a separate location in the field, for example, in oil systems where there is a lot of wax. The scraper station prevents pipelines from clogging up. Furthermore, these set-ups are used to launch and re-capture inspection equipment to detect possible damage to the pipelines.

4.7

Onshore pipelines

Figure 4.7.1. Expected decommissioning of onshore pipelines.



The figure shows that in the period 2018 to 2027, 57% of the onshore pipelines will become available for re-use or will be decommissioned.

The onshore pipelines are usually located underground. Just like offshore pipelines, we can make a distinction between inter- and intrafield pipelines. The first category will be decommissioned if production from the related field stops. The second category will continue to transport gas until the last connected field ceases production.

The pipelines will become available for possible re-use once the transport of gas has finished. If it is not clear whether re-use will be possible, they could be temporarily preserved. If ultimately, re-use is not possible, the pipelines will be decommissioned in consultation with local stakeholders. Depending on the specific circumstances, this could vary from leaving in place to complete removal.

Pieter van Oord



IRO Chairman
(Association of Dutch Suppliers in the Oil and Gas Industry and Offshore Renewable Industry)

Service companies must be able to prepare themselves

The pace of the decommissioning activities of the obsolete oil and gas infrastructure in the Netherlands must be ramped up, says Pieter van Oord. The current standstill in activities is a problem for service companies. Furthermore, decommissioning offers opportunities for renewable energy. What possibilities does Van Oord see exactly? And does he have any advice for the sector?

“If you talk about the decommissioning of the oil and gas infrastructure in the broadest sense, there is a degree of scepticism among service companies,” says Van Oord. “It’s been talked about for ten years, and we’ve heard that it’s going to happen for ten years. But so far it hasn’t happened. Yet we all know about the potential that decommissioning has. There is an incredible amount of work to do. The service companies are, of course, extremely keen to play a role in this. But the unpredictability that now prevails is a problem. The service companies want to know: when the platforms will be removed and how large they are. Because only then will we be able to prepare for things and make the necessary investments. This is ultimately in the interest of the operators themselves; as they want the decommissioning operations to be as cost-efficient as possible. This opportunity is actually available because of the large density of the platforms and the infrastructure in the North Sea. Because in these types of projects, the larger the volume and the closer the infrastructure is to other infrastructure, the greater the chance of an efficiency gain. But I repeat, the service companies must be able to prepare for this.”

Powerhouse of the future

The energy system in the world is changing from a fossil-based system to a low-CO₂ energy system, says Van Oord. “I see potential in the re-use of depleted gas fields and abandoned pipelines for CO₂ storage and transport. And maybe also in infrastructure that can be re-used for offshore wind, the offshore high-voltage stations. But we are of course highly dependent on the North Sea planners. How will the Ministry of Economic Affairs and Climate Policy organise the new North Sea? Ultimately, the Paris Climate Agreement will be the driving force that will transform the North Sea over the next thirty years from a fossil energy source to a source of renewable energy. The North Sea will be the powerhouse of the future. Furthermore, the fossil infrastructure can be gradually decommissioned and the infrastructure for renewable production can be gradually scaled up.

“In these types of projects, the larger the volume and the closer the infrastructure is to other infrastructure, the greater the chance of an efficiency gain.”

Clean up responsibly

“My advice on decommissioning? Government, take your role in the new North Sea! The government should be both the director and the driver of the plans and should not allow developments to depend on private initiatives alone. This role of government also includes taking measures, for example, introduction of new legislation and tax relief. And to the service companies: prepare for a new line of business that is on its way. It will be substantial and offer opportunities. At the same time, I would like to say to the oil and gas industry: take your responsibility seriously and clean up responsibly.

Fortunately, we now see that the promising game is nearing its conclusion, and that a number of large projects from the operators are coming onto the market. It is therefore right that EBN now takes on its role on behalf of the government and is saying: we are going to coordinate this and we are now actually going to do it!

5 Expected decommissioning costs in the period 2018 – 2027

The total cost of decommissioning the oil and gas installations and wells was estimated at 7 billion euro in 2017. The industry aims to reduce this amount by 30 percent. One precondition is that the decommissioning is carried out in a safe manner and environmental interests are safeguarded. Cooperation will be needed to achieve this. Not just between the operators themselves, but also with the service companies, the government, and the regulatory authorities. Furthermore, a good estimate of the actual costs will be needed.

The decommissioning costs for offshore installations will amount to two-thirds of the total costs of decommissioning. The 30 percent cost reduction relates to all offshore and onshore infrastructure.

Figure 5.01

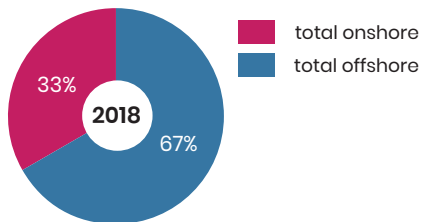


Figure 5.0.2a: total decommissioning costs of offshore infrastructure subdivided by activities.

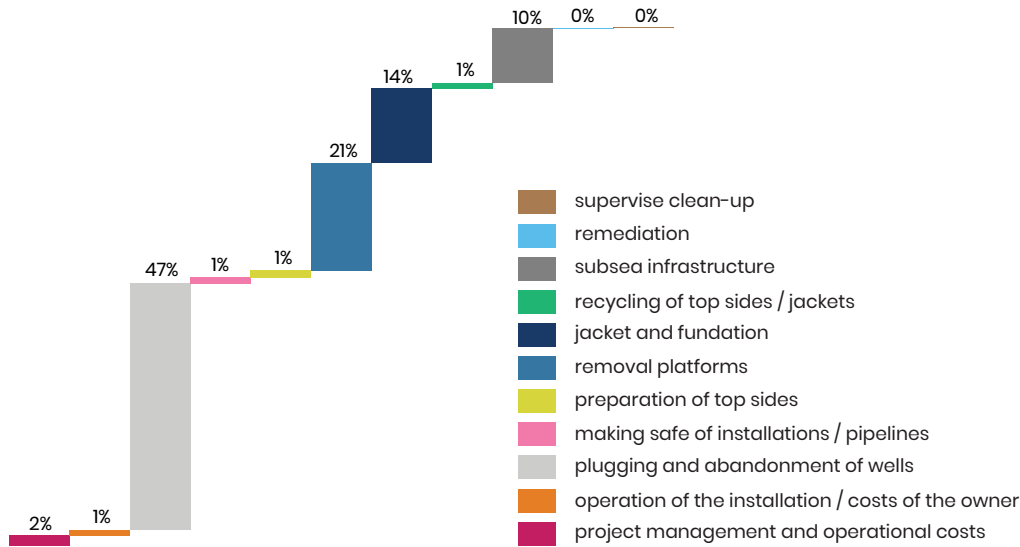
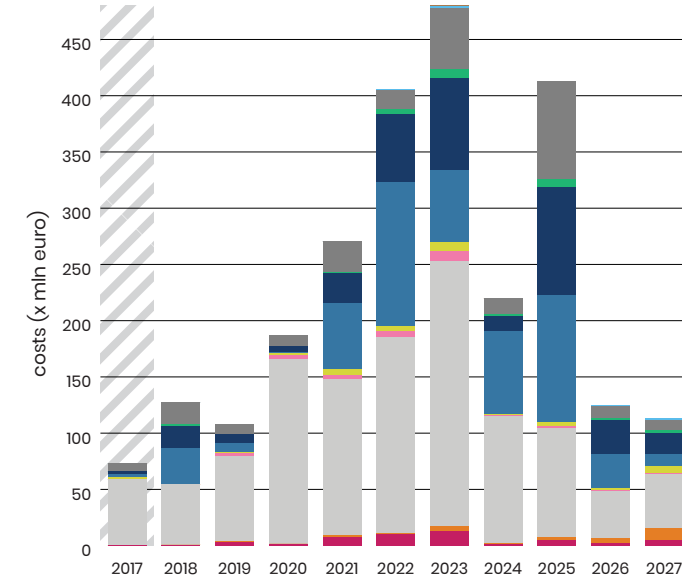


Figure 5.0.2a shows that the decommissioning of offshore wells and installations accounts by far for most of the costs. It therefore makes sense that this is where the greatest savings can be made. Since the formation of Nexstep, operators have shared their experiences and best practices. The aim of this is to raise the knowledge level of the sector. Furthermore, operators have started to coordinate their activities. This should lead to joint decommissioning campaigns. The North Sea is unique because installations here are built relatively close together and are numerous. By combining decommissioning activities, you create scale and the costs can be substantially reduced. Nexstep has identified a first multi-party decommissioning campaign for stand-alone wells. The operators want to deploy a ship to decommission a number of these wells in a joint operation.

Figure 5.0.2b shows that the cost trend is in line with the expected peak in the decommissioning of the wells and platforms. The total offshore decommissioning costs amount to 2.5 billion euro over the next ten years. Nexstep is committed to reducing this by 30%.

The total costs of decommissioning the installations and wells are subdivided into the following activities:

Figure 5.0.2b: annual expected costs of offshore decommissioning installations per category.



Project management and operational costs

- offshore work
- project management
- preparations for the decommissioning programme

Plugging and abandoning wells

- project management
- specialist work

Preparation of top sides

- cleaning of top sides and associated installations
- other offshore activities

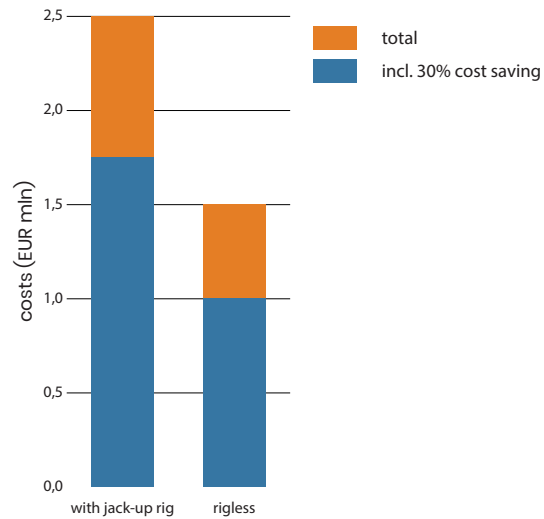
Removal of platforms

- offshore lifting work
- loading and securing the cargo on the ship, and transport

Decommissioning of subsea infrastructure and pipelines

- leaving pipelines in place clean and safe
- subsea work

Figure 5.0.3. Average decommissioning costs for offshore wells.



The costs of decommissioning are sometimes largely determined by the choice of decommissioning method. To save costs it is therefore worthwhile to look at the use of different methods. Figure 6.0.3 shows by way of example how the average cost of plugging platform wells can be reduced by 40% when avoiding the use of a relatively expensive jack-up rig, if possible.

Nexstep is also studying the use of innovative methods for plugging wells. The expectation is that wells can be plugged at much lower cost, while maintaining optimal safety and effectiveness.

Theodor Kockelkoren



Inspector-General of the State Supervision of Mines

It is clear that the priority for the State Supervision of Mines (SSM) during decommissioning activities is safety, but how far does this go and until when?

SSM is responsible for the integrated supervision of the entire decommissioning chain. This means that our supervision includes a role in the planning, the transport phase, the removal of the platform and the phase in which the final decommissioning takes place. We focus on a safe and environmentally sound approach.

Since the start of offshore gas production, more than 20 installations have been removed. There have been no incidents and SSM's ambition is to keep it that way.

With regard to the time frame: as far as we are concerned we will dismantle the platform as soon as possible after decommissioning unless there is a clear plan for the responsible re-use of the platform. However, SSM will not seek to enforce timely decommissioning where the integrity of the platform can be guaranteed.

What opportunities does SSM see for re-use?

Approximately half of the installations that were removed were partly re-used. Re-use is certainly an option. The extent to which re-use will involve purposes other than gas production is difficult to estimate at the present time. If CO₂ storage takes off, storage in depleted gas fields offshore speaks for itself. It is also conceivable that hydrogen could be generated offshore using wind energy, and then be transported to shore. The existing infrastructure could then be partly re-used. Which new options will lead to the energy transition? As a regulator, I have no preference other than that re-use must not lead to reduced safety or any environmental damage. Integrity must therefore also be safeguarded at all times. It is also important for the crisis response in the North Sea that the crisis communication infrastructure does not simply disappear without coordination. Existing infrastructure plays an important role.

What is SSM's focus in the issue of re-use?

SSM has no directing role in the desirability of CO₂ storage, for example. This does not mean, however, that SSM is idle until an application for a permit is submitted. Even now, SSM has launched studies via the Knowledge Programme for Mining (KEM) to seek answers to questions about the possible effects and risks of new initiatives.

“Since the start of offshore gas production, more than 20 installations have been removed. There have been no incidents, and SSM's ambition is to keep it that way”

What solutions do you envisage for restrictive regulations in the Netherlands?

As a regulator, SSM's primary role is to enforce regulations. However, SSM also has a reflective role, and based on this, we have repeatedly raised the problem of the obligation to monitor abandoned pipelines with both the policymakers within the Ministry and with the oil and gas companies. I am therefore delighted that Nexstep is looking for possible solutions and that the policymakers have also put the topic high on their agenda. Even in the distant future, there will always be a need for supervision, and there will always therefore have to be a legal entity that can be contacted. This may be a company, a legal successor (foundation) or the government itself.

Theodor Kockelkoren

What about where there are differences with UK regulations? In the UK, tubing may be left behind in the well.

SSM is primarily focused on Dutch policy, and aims for a high level of safety and environmental protection. We discuss differences in practises with our regulatory partner organisations, but sometimes they take different views on things and this can lead to different outcomes.

Timing is an issue. What are your views on this and where do you see a possible solution?

As a regulator, I prefer operators to start making plans and potential scenarios for decommissioning or re-use as soon as possible, keeping in mind the common interests for safe infrastructure operation and removal and ensure that safety and environmental interests are safeguarded.

What role do you see here for innovation?

It goes without saying that innovation plays an important role. Innovation plays a role in the cradle to grave principle and can positively influence costs, safety and the environmental impact. In terms of the size of the ship, the Pioneering Spirit is a “big” example of this. Unfortunately, however, I also see examples of innovation that lead to lower costs, but possibly also to greater risks. For example, rigless abandonment is an innovation where we need to carefully examine new and potentially greater risks. In cases like this, it is important to ensure that the innovation does not just lead to cost savings, but also to reduced risks (win/win).

How can SSM support this?

SSM's primary role is not to support innovation, but to ensure that activities are conducted more safely and in an environmentally responsible way. It is also the case that good supervision creates support in society for new solutions, ensuring that pilots can be carried out in anticipation of policy. It is therefore important to deal intelligently with regulations if these unnecessarily restrict innovation.

Which advice would you like to give the sector?

In recent years, the sector has been cast in a bad light in the news. It is therefore important for the sector to be transparent and to provide accurate and clear information to the public. Explain how and why certain choices are made and that the sector feels the responsibility to clean up the sea once production has

ceased. Also make it clear that when the infrastructure is re-used, this is done safely, sustainably and in a way that contributes to the energy transition.

Also think about a future role during the aftercare phase. It would not be right to want to leave with unfinished business. For example, I am thinking of the possibility of setting up a non-profit organisation to provide aftercare once oil and gas production has ceased.

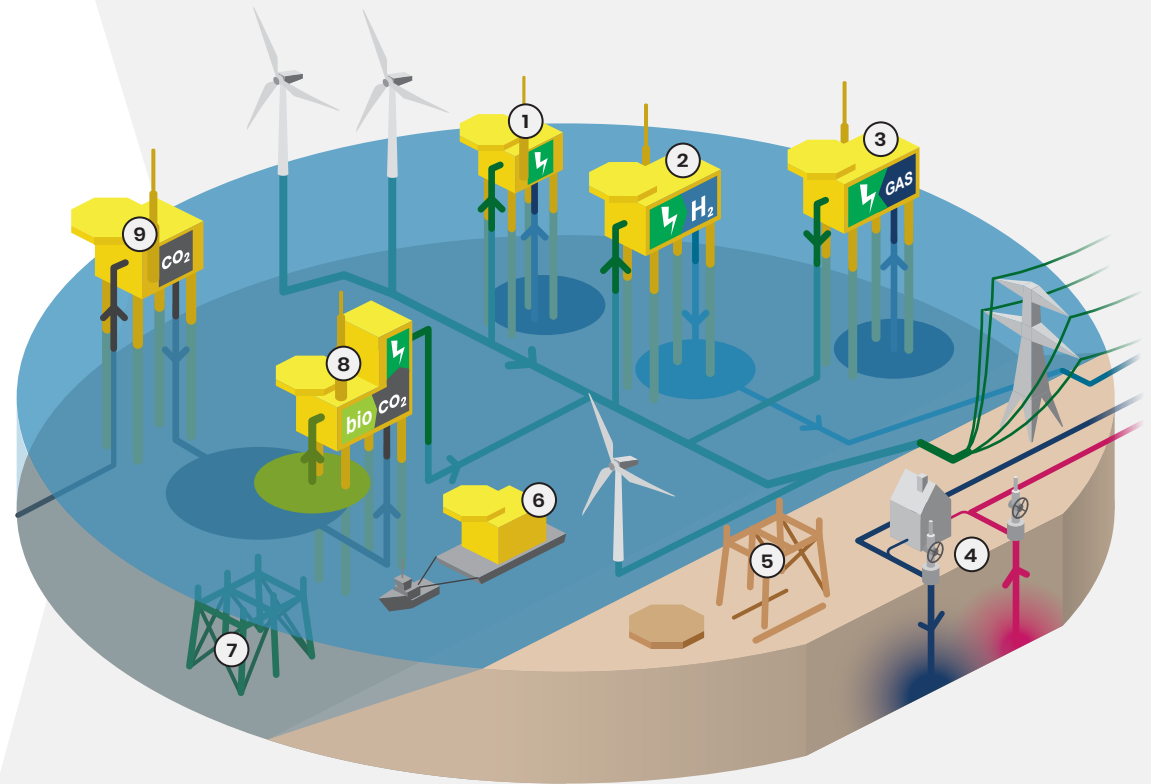
“Have a care for the shared interests and ensure that the safety and environmental interests are adequately safeguarded.”

6 Re-use

A large number of wells, platforms and pipelines are approaching the end of their economic life. This means installations that can be re-used will become available and can therefore make a contribution to the energy transition in the Netherlands. For this reason, it is important to map out now which installations are suitable for re-use and which options are most feasible.

Nexstep has investigated how existing infrastructure can be re-used. We also looked at how and in what way the knowledge and expertise of the sector can be enhanced. This involved looking beyond the boundaries of the oil and gas industry. Nexstep has contacted a number of different parties, ranging from wind turbine constructors, electricity companies, port authorities and research institutions.

Nexstep then went on to identify the most promising options which the oil and gas sector can use to contribute to the energy transition. Below we set out a classification by urgency based on the estimated number of installations that will become available and the need to take action.



- | | |
|---------------------------------------|--|
| 1. offshore electrification | 6. relocation |
| 2. production and storage of hydrogen | 7. rigs to reef |
| 3. gas to wire | 8. biomass production |
| 4. geothermal | 9. CO ₂ capture and storage |
| 5. recycling | |



1 Offshore electrification

Nexstep considers the electrification of centrally located platforms as an important condition for future re-use for CO₂ storage or hydrogen production. Both activities require electricity and this would no longer be possible once a platform is taken out of gas production. By connecting the platforms with the offshore electricity network, the platforms would then be suitable for re-use. Electrification of 8 to 10 of the largest platforms would potentially also result in a CO₂ reduction of 0.5 to 1 million tonnes per year while gas production is continuing.

It is a challenge to find a solution to the business case for electrifying offshore platforms because the costs are high, and the future gas price and in particular the future price of CO₂ and hydrogen are uncertain. Furthermore, the cost of some of the current production equipment will have to be written off in one go. Recouping the investment in electrification will depend on ensuring a sufficient life span. But because of the decline in gas production, the payback period is under pressure to an extent that quick decisions are needed on where electrification is necessary.



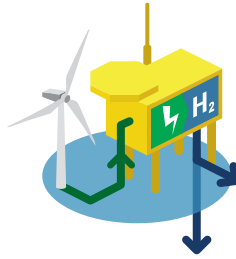
2 Carbon capture and storage

Re-use of offshore infrastructure for CO₂ storage holds potential for the energy transition. It offers onshore industries the opportunity to capture and store CO₂ while they work on a structural solution for their CO₂ emissions. Dutch offshore gas fields have space for the storage of more than 1,600 million tonnes of CO₂. This is sufficient capacity to meet the ambitions in the next eighty years set out in the coalition agreement by the Dutch government. This technology can be safely deployed in the North Sea.

CO₂ storage could help accelerate a reduction in greenhouse gas emissions. It is one of the most cost-effective and large-scale measures that would enable the Netherlands to meet its Paris Climate Agreement commitments.

The storage potential also has value when it comes to CO₂ emissions rights (EUA) and the possibility of international cooperation. Given the relative density of Dutch industry along the coast and the proximity of depleted offshore gas fields, the Netherlands has the potential to become a leader in this field.

A review by Nexstep shows that between 30 and 50 platforms and reservoirs, at least one, but probably two trunk lines and collecting stations are suitable for CO₂ storage. Furthermore, the sector has extensive knowledge of project management and logistics, and management of facilities and underground storage locations.

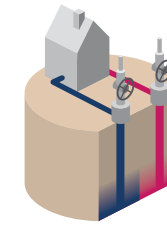


3 Production and storage of hydrogen

The production of hydrogen offshore offers a solution for the transport and storage of offshore wind energy. Transporting energy in the form of molecules is more efficient and cheaper than in the form of electrons. The conversion of wind-generated electricity to hydrogen (power to gas) therefore offers advantages. This also offers an extra storage opportunity for times when there is overcapacity.

Power to Gas is still in its infancy. Carrying out hydrogen pilots in an operational environment offshore will be the first step towards offshore hydrogen that makes use of the existing infrastructure. Although the expectations regarding the use of hydrogen are high, the number of active pilots in this area is still very small.

At the moment, Nexstep is working with TNO to prepare a pilot study into the application of offshore hydrogen conversion.



4 Geothermal

Geothermal energy can provide a heating solution for the urban environment, light industry and greenhouse horticulture.

The Netherlands has approximately 500 oil and gas locations onshore, 300 of which have enough space for future operations. Of these, 190 locations have a subsoil that is suitable for geothermal energy, and 120 of these are located in the vicinity of homes or industry that require heating. Of the approximately 500 locations that have been identified, 120 locations have the potential for geothermal energy.

In addition to suitable locations, the expertise that the oil and gas industry possesses in the field of safety can also be put to good use.

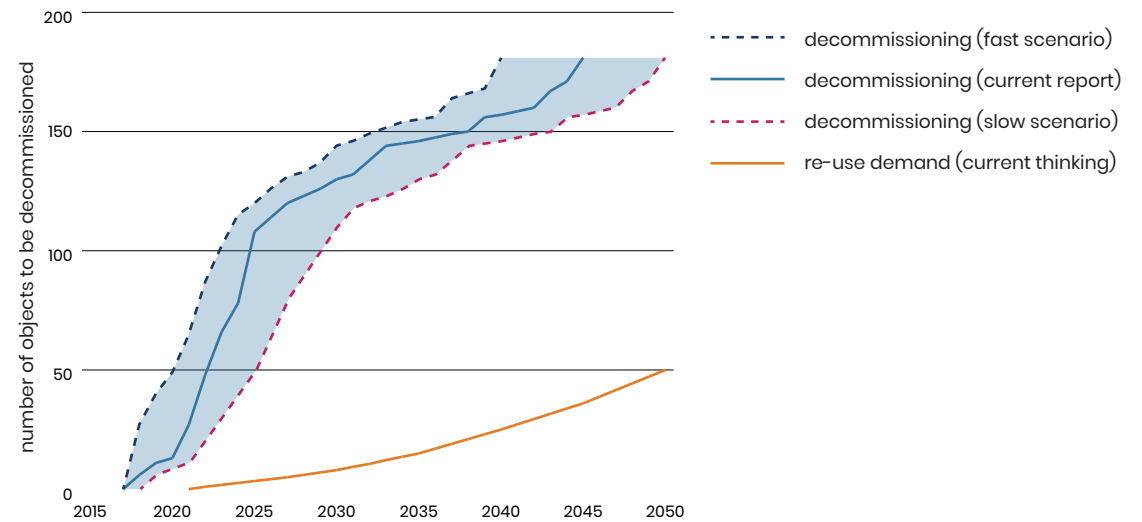
Timing

Timing is a recurring factor in re-use scenarios. When will infrastructure become available and when can it be used for other uses? The oil and gas industry supports various spatial planning zoning plans put forward by ministries to coordinate the timing of re-use and decommissioning. Figure 6.4.1a shows that the expected decommissioning of offshore installations will take place earlier than the re-use opportunities become available. By 2025, more than half of offshore installations will have been removed.

The decommissioning of infrastructure will see around 50 installations lost for re-use in the next 10 years. This will result in the loss of the immediate availability of 900 megatonnes of CO₂ storage capacity. 400 megatonnes could remain available if six main platforms are retained.

Infrastructure maintenance will be needed to bridge the time until the infrastructure can be re-used. This involves costs. Temporary use functions of platforms, such as a hotel, a lighthouse, or a test location for scientific research will not cover these costs. Nexstep wishes to explore with various stakeholders how the time to re-use can be effectively bridged, where necessary.

Figure 6.4.1a. Offshore installations available for re-use (platforms and subsea installations)



Since the presentation of the Master Plan in November 2016, a considerable number of steps have been taken to organise re-use and decommissioning in the Netherlands safely, efficiently and effectively.

Nexstep, the National Platform for Re-use & Decommissioning, was established in response to this Master Plan. Its aim is to reduce the costs of safe and environmentally-friendly decommissioning in the Netherlands (estimated at 7 billion euro in 2017) by 30%. How Nexstep aims to achieve this is set out in this section.

Transparency

We want to promote transparency on the issue of re-use and decommissioning in the Netherlands. This report is a first step in this process. We want to inform and involve stakeholders directly (such as the operators, service companies, the government and regulatory authorities). NGOs and the general public will also be involved at a later stage. Throughout the year, we inform the market about the progress of our activities at conferences and in relevant forums.

Knowledge sharing

Nexstep is strongly committed to sharing knowledge. We are already organising regular “shared learning” workshops for operators in which specific cases are presented. In addition to successes, we also discuss matters that should certainly not be repeated. The lessons learned are elaborated and stored in a database so that they are accessible to all members of Nexstep.

Collaboration

The overview of expected decommissioning activities as outlined in this report offers opportunities for collaboration. For example, by operators sharing materials. In order to promote this, Nexstep will set up a database listing the tools and materials held by each of the operators. This will make it possible to re-use materials rather than repeatedly buying them, subject to specific agreements.



In the long term, we want to encourage operators to approach each other in a campaign-minded way. Consider, for example, offshore wells that are relatively close together; these could be offered to the market as a single decommissioning job, allowing economies of scale to be achieved for both the operators and the service companies.

Nexstep also wants to build and maintain contacts with international partner organisations involved in the re-use and decommissioning of installations in the southern North Sea.

Stimulus measures for re-use

The working method of Nexstep is: first see whether something can be re-used; if not, decommission it. The ideas we have for re-use have been discussed in section 6.

Nexstep is committed to creating the preconditions that are necessary to enable re-use. Take, for example, the electrification of offshore platforms. Nexstep has taken the initiative to launch a pilot that will study the production of hydrogen offshore. This is important because the viability of offshore electrolysis has not yet been demonstrated. In the coming years, Nexstep will also be driving these kinds of innovative developments.

Innovation agenda

Nexstep has an innovation agenda to identify new challenges and stimulate technological developments, for example, with the decommissioning of wells which will account for about half of the estimated costs. Nexstep has therefore identified a number of alternative methods for plugging wells. These are arranged according to market maturity, the number of wells on which these methods can be used in the Netherlands, and the potential cost savings. Nexstep is committed to testing the most promising innovations in 2019 at a number of wells. Every year, we will present an update of the developments with new, innovative abandonment methods, ensuring that the latest technologies are continually examined. The knowledge gained from the innovative decommissioning of wells in the Netherlands can also be put to use elsewhere in the world, and vice versa.

Nexstep wishes to collaborate with the service industry in scouting for innovations, as well as with operators and knowledge institutions. Nexstep therefore emphatically

invites the service industry to develop new concepts and innovative techniques during a hackathon at the Offshore Energy Conference in October 2018. The aim is to reduce decommissioning costs and at the same time to strengthen the service industry in the Netherlands.

Role of Nexstep

Nexstep is an inclusive umbrella organisation established by the government and the oil and gas industry, which coordinates and facilitates dialogue and cooperation in the field of re-use and decommissioning in the Netherlands. Nexstep is explicitly not a financier of these activities; the operators themselves are responsible for this aspect. The removal of installations is their responsibility pursuant to legislation and regulations.

Nexstep wishes to connect stakeholders and encourage them to think about a better coordination of re-use and decommissioning, in order to achieve the most efficient and safe way to remove superfluous infrastructure.

Nexstep wishes to be a driver of new, state-of-the-art technologies. On the one hand, the aim is to save costs, but also to use this knowledge worldwide to take a leading position when it comes to re-use and decommissioning.

Finally, Nexstep has to deal with a complex field of a variety of players who all have differing interests. Yet despite these differences, we also have shared goals, and we can save money by working together. Nexstep wishes to play the role of coordinator, the driver, the connector, the source of inspiration, and the initiator so that we can achieve the set goals together. We therefore invite all interested parties to enter into dialogue with us.