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REPORT

Understanding decommissioning of offshore infrastructures: A legal and economic appetizer

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Understanding decommissioning of offshore infrastructures: A legal and economic appetizer

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UNDERSTANDING DECOMMISSIONIG OF OFFSHORE WIND STRUCTURES

1. Introduction

1.1 Objective and scope

Sea spaces have been vital for humankind. Thanks to technological development and ingenuity, we harvest, use, consume and exhaust resources located in the sea or the seabed. To do so, we make use of different man-made structures. These range from fish farms and simple buoys, to complex and large energy structures such as wind farms or oil and gas rigs, such as the Norwegian Troll A oil platform, the heaviest structure ever made at the time of its construction. [*1]

In 1996, Troll A, located in the Norwegian Continental Shelf, broke world records as the largest oil platform ever made. Standing at 472 metres above the seabed and 300 metres above the waterline, this giant of the sea has a weight of 683,600 tonnes. Other structures are even larger. Hibernia, an oil field located offshore of the Canadian New Foundland is the world's heaviest oil platform with a combined weight of more than 701,000 short tonnes.

Man-made structures populate the seas. For oil and gas alone, recent literature refers to more than 12,000 of them,[2] including about 7,000 offshore oil and gas platforms in 53 different countries.[3] In the case of offshore wind farms, the numbers vary. The 4C Offshore Database listed 2,197 global offshore wind farms and projects in 53 countries in June 2021.[4] WindEurope reports an offshore wind electricity generation capacity of 22,072 Megawatts (MW) from 5,047 grid-connected wind turbines in 110 farms in 12 countries in European waters.[5] Offshore wind farms break records year after year, in terms of their size, capacity and number of installed turbines. The North Sea is home to the two largest offshore wind farms in the world: London Array, covering a space of 245 km^2, and Hornsea 1, with 175 and 174 turbines respectively.[6] The North Sea seabed is home to more than 10,000 km of cables and pipelines.[7]

Oil and gas platforms and wind turbines have a finite life span. Their location at sea means that there is erosion, causing mechanical attrition and increasing the repair and maintenance costs. This makes wind farms become inefficient or no longer operative. The same applies to oil and gas platforms, with the added complication that as fields mature, fewer hydrocarbons remain, and they are either impossible to extract or it is not cost-effective to do so. In addition, there are structural factors that cause problems, such as the fact that offshore energy structures are typically built on the terms set by a government-granted license or permit. These authorizations are granted with time limits and upon their expiration, they request the operators and owners of the offshore structures to remove them from the sea. This process is known as *decommissioning*.

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[*] All websites were last visited on 30 June 2021.

[1] NES Fircroft: https://www.nesfircroft.com/blog/2018/12/6-more-of-the-biggest-offshore-structures-in-the-world; and Popular Mechanics, author: Tim Newcomb: https://www.popularmechanics.com/technology/infrastructure/g2926/7-of-the-biggest-offshore-structures/.

[2] van Elden S and others, 'Offshore Oil and Gas Platforms as Novel Ecosystems: A Global Perspective' 6 Frontiers in Marine Science [2019], p. 1; https://www.bbc.com/future/article/20210126-the-richest-human-made-marine-habitats-in-the-world.

[3] Minas S, 'Energy and the Law of the Sea' in Leal-Arcas; R and Wouters J (eds), *Research Handbook on EU Energy Law and Policy* (Elgar 2017), p. 303; Hunton, Andrews, Kurth LLP, *Decommissioning Hydrocarbon Assets: Finding Value in a Shifting Regulatory Landscape* (2018), p. 2.

[4] 4C Offshore, Global Offshore Wind Farms Database, available at: https://www.4coffshore.com/windfarms/.

[5] WindEurope, Offshore Wind in Europe: Key trends and statistics 2019 (2020), p. 8.

[6] HIS Markit, News Release, Nov. 29, 2016: https://www.power-technology.com/projects/london-array/; https://en.wikipedia.org/wiki/List_of_offshore_wind_farms visited June, 2021.

[7] NES Fircroft: https://www.nesfircroft.com/blog/2019/07/everything-you-need-to-know-about-offshore-decommissioning.

Decommissioning takes place based on legal mandate. Public International Law as well as national rules impose obligations on coastal states and owners/operators of offshore structures to remove them. As we will discuss at length, the obligation is to remove them in full, with exceptions allowing partial removal or even leaving them in place. The reasoning behind this obligation is to protect sea spaces, ecosystems and other sea users. In particular, to secure the safety of navigation, minimize environmental impact and prevent accidents or disturbances.

Offshore energy activity has been with us for many decades. However, the construction of oil and gas platforms and other energy structures have surged since the 1960s, especially in the North Sea. Many of these structures have reached maturity and have seen their productive life come to an end or approach it.[8] In 2020 Rystad Energy estimated that by 2024 the value of decommissioning projects worldwide will reach $42 billion.[9] In the North Sea alone it is estimated that decommissioning activity will be worth €52 billion by 2040.[10] These almost numbers are confirmed by other reports. For example, in 2016 IHS Market forecast a global expenditure of $210 billion for the period 2010 to 2040.[11] The law firm Hunton, Andrews, Kurth estimated a yearly expenditure from 2021 until 2040, oscillating between $2.4 billion and $13 billion per year.[12] In 2020 Oil and Gas UK (OGUK) estimated a global decommissioning market with a value of £65 billion for the period 2019–2028.[13]

(C) Equinor, photo by Jan Arne Wold

Decommissioning is growing at an unprecedented rate and posing logistical and engineering challenges as well as regulatory and economic ones. This report offers a thorough introduction to the governance of decommissioning offshore energy structures: oil and gas platforms and offshore wind parks. Our focus will be a discussion about the most salient legal and economic implications of decommissioning. They shape and limit the way these activities are conducted. Their proper understanding will also allow us to highlight new challenges that decommissioning ought to address and

[8] Falconer C and Wicks C, 'Decommissioning and the Offshore Oil and Gas Life Cycle' in M H and N A (eds), *Oil and Gas Decommissioning: Law, Policy and Comparative Practice* (2nd edn, Globe Law and Business 2016), p. 14-15.

[9] Rystad Energy (2020), Press release https://www.rystadenergy.com/newsevents/news/press-releases/global-oil-gas-decommissioning-costs-to-total-$42-billion-through-2024-dominated-by-uk-north-sea/.

[10] The RSA Great Recovery & Zero Waste Scotland Programme (2015), North Sea Oil and Gas Rig Decommissioning & Re-use Opportunity Report, p. 5.

[11] HIS Markit, Decommissioning of Aging Offshore Oil and Gas Facilities Increasing Significantly, with Annual Spending Rising to $13 Billion by 2040, IHS Markit Says (November 29, 2016) https://news.ihsmarkit.com/prviewer/release_only/slug/energy-power-media-decommissioning-aging-offshore-oil-and-gas-facilities-increasing-si.

[12] Hunton, Andrews, Kurth LLP, Decommissioning Hydrocarbon Assets: Finding Value in a Shifting Regulatory Landscape (2018)

[13] OGUK, Decommissioning Insight 2019 (2020), p. 4.

pave the way for future studies on the promotion of innovative circular-economy ideas about decommissioning.

Our report takes a holistic approach to offshore energy decommissioning in the North Sea. We study the rules applicable to offshore oil and gas operations and offshore wind. This is a novel approach compared to that of existing literature. This will allow us to compare how decommissioning is conducted in different industries and answer whether oil and gas decommissioning rules can be readily applied to offshore wind. Furthermore, our research will identify challenges that these two sectors are facing in light of the need for further circularity and sustainability. Additionally, we adopt a legal and economic standpoint to study the governance of these activities in order to understand the incentives and challenges in decommissioning.

1.2 Report structure

In this report, we present a description of the main legal and economic implications of decommissioning offshore energy structures. The report is divided into three parts, each of them comprising different chapters.

Part I includes three chapters and deals with decommissioning from a conceptual perspective, its justifications and main legal features. In Chapter 2, we discuss what decommissioning involves, when it happens, the different terms associated with decommissioning, the decommissioning of oil and gas as well as offshore wind farms, which are the industries we are discussing, and what needs to be decommissioned in the different structures. Chapter 3 discusses the importance of decommissioning from an economic perspective. In this chapter, we deal with the reasoning behind creating a removal requirement and in which way auction theory has an effect on decommissioning and re-commissioning (i.e., reutilization, repurposing, or recycling). Chapter 4 discusses at length the main contractual and extracontractual obligations that are included in a decommissioning agreement. We focus on which party has a duty to decommission and who is the recipient of such an obligation, then we address the complex and very important issue of liability and risk defaults and finally deal briefly with tax implications.

Part II, on the other hand, conducts a comparative legal study of the decommissioning obligations as stipulated by the governance framework in the North Sea. In Chapter 5, we focus on the minimum requirements imposed by Public International Law on coastal states in the North Sea as well as some soft-law provisions and guidelines dealing with decommissioning. This is followed by a discussion about decommissioning in three jurisdictions: Norway, UK (focusing on Scotland) and Denmark. We have chosen these countries because all of them have oil and gas activity and existing or planned offshore wind activity, and because they represent different levels of maturity in decommissioning activity and different regulatory regimes. Chapter 6 considers the national regulation of decommissioning in Norway. Chapter 7 discusses the UK focusing on Scotland. Chapter 8 analyses the Danish regulation of decommissioning.

Part III concludes this report with some reflections on the challenges ahead that are foreseen. In Chapter 9, we focus on particular aspects related to circularity and sustainability, how offshore wind decommissioning and its regulation remain uncharted territory, and the land-sea interactions around decommissioning.

PART I

2. What is decommissioning?

2.1 Understand what decommissionig is

Decommissioning or abandonment is one part of the last stages of the life of any oil, gas or wind project. Included as a sub-part of the process of cessation, a broader concept discussed in more detail later, decommissioning is a multi-stage process through which energy production and extraction operations have to go in order for the offshore site to be restored to a safe and environmentally sound condition.[14] Decommissioning typically involves the complete, but sometimes partial, removal of the structure from the sea. It may also imply leaving the infrastructure in place in the sea. There are two main reasons for the decommissioning process: the dismantling of structures must be conducted in a safe manner in order not to endanger other sea users in the sea spaces around them, and the sea spaces around the structures should be protected as much as possible from environmental damage.

There are three types of decommissioning options: a) total removal – the default option in most legal systems; b) partial removal; and c) leaving the installation in place.[15] Partial removal or leaving the infrastructure in place are exceptions legally permitted under certain criteria (imposed legally or left to some degree of administrative discretion) to mitigate a negative environmental impact,[16] because it is technically impossible to remove the structure due to, for example, weight, or excessive or prohibitive costs.

New decommissioning options are gradually being introduced. These include innovative ways to remove the materials, or simply being able to dismantle larger structures in more efficient ways. An area that has been gaining impetus is the reutilization, recycling and repurposing of these offshore energy structures. The high rate of recycling of decommissioned oil and gas platforms in the North Sea is generally acknowledged, with as much as 98 % of the total weight of the structure being recycled in some recent oil and gas projects.[17] However, recycling offers a sub-optimal value of the decommissioned parts, so there is an increasing effort to find ways to repurpose them, for example transforming them for use in other energy projects or as artificial reefs. We discuss this further in Chapter 9.

2.1.1 Decommissioning timeline

Decommissioning activity happens many years after the installation has been placed offshore. This coincides with either the end of the active and efficient lifetime of the structure and/or the end of a license or a concession to exploit the natural resources. Times vary, but in the case of offshore wind farms, this happens typically between 20 and 30 years after the turbines have been installed. In the case of oil and gas activity, decommissioning typically happens when extraction is no longer profitable. Decommissioning, however, is planned well ahead of the time of the actual removal. Most legal systems include some discussion about the decommissioning of offshore energy structures at the time a license

[14] Wawryk A, 'Introduction' in Pereira; EG and others (eds), The Regulation of Decommissioning, Abandonment and Reuse Initiatives in the Oil and Gas Industry: From Obligation to Opportunities (Wolters Kluwer 2020), p. 7.
[15] Yiallourides C and Gordon GW, 'Decommissioning of (Abandoned or Disused) Offshore Installations' in Roggenkamp; MM, de Graff KJ and Fleming RC (eds), *Elgar Encyclopedia of Environmental Law*, vol Volume IX (EE 2021) (Edward Elgar Publishing Limited 2021), p. 278.
[16] Yiallourides C and Gordon GW, 'Decommissioning of (Abandoned or Disused) Offshore Installations' in Roggenkamp; MM, de Graff KJ and Fleming RC (eds), *Elgar Encyclopedia of Environmental Law*, vol Volume IX (EE 2021) (Edward Elgar Publishing Limited 2021), p. 279.
[17] Energy Voice, Penelope Warne, From recycling to re-use (2019), https://www.energyvoice.com/oilandgas/north-sea/decom/189628/from-recycling-to-re-use/

is awarded, but typically 2 or 3 years before the end of the operation of the activity. This discussion includes an evaluation of a decommissioning plan proposed by the operators and reviewed by the energy authorities in the coastal state.

Decommissioning can take several years from planning to execution. The first stage of decommissioning involves pre-abandonment surveys which are followed by a decommissioning plan. The plan is usually submitted to the respective regulatory authorities for approval. Plans include information about the removal of the structure, such as technical aspects of the operation, financial considerations, environmental implications, or health and safety measures to be undertaken.

Upon the approval of the plan, the decommissioning of the structure is initiated. In the case of oil and gas fields, this includes the plugging and abandonment of the wellbores, as well as the removal of the topsides, foundations and other substructures. For offshore wind farms, this will include the foundations, blades and tower. In parallel, decisions concerning what to do with the infrastructure being dismantled are made. As stated, the general rule is the complete removal of the structure from the sea. However, options for partial removal or even leaving the structure in place exist. When this happens, the structure may be toppled into the seabed – which may qualify as dumping. For total or partial removal, the structures are dismantled and taken onshore to go through recycling, scrapping or reutilizing processes. Land-sea synergies and conflicts are discussed briefly in Chapter 9.

Finally, once the structures have been removed, the seabed and site have to be cleared, restoring it to a good environmental status. This may or may not involve removing structures located on the seafloor, such as cables or pipelines.

2.2 Decommissioning, abandonment, cessation and dumping: synonyms?

Decommissioning is often the term used to encompass different concepts related to the shutting down and removal of an installation. To clarify things, we define some of these.

Abandonment is often used as a synonym of decommissioning. The UK regulation of decommissioning in the oil and gas industry is a good example of this, as both terms are used interchangeably. Abandonment, however, is not the term preferred by decommissioning agents as it has the somewhat negative connotation that structures are not removed but simply left in place untreated.

Cessation is another term often used when speaking about decommissioning, for example in the Norwegian Petroleum Act of 1996,[18] and by the Norwegian authorities entrusted with the governance of oil and gas activities.[19] Cessation is a broader term than decommissioning. In Norway, the term comprises decommissioning as well as the complete termination of operations related to the extraction of oil and gas. It includes the planning of the decommissioning, the regulatory oversight given by the state and even the right of the state to "take over the licensee's fixed facility when a licence expires, is surrendered or revoked, or when the use of such facility has been terminated permanently",[20] against compensation. An installation might be taken over even if the production is not to be ceased and even if the structures are to be left in place for future use.

[18] "Chapter 5 Cessation of petroleum activities'.

[19] Norwegian Petroleum, Cessation and Decommissioning, available at: https://www.norskpetroleum.no/en/developments-and-operations/cessation-and-decommissioning/

[20] §5–6 of the Norwegian Petroleum Act.

Dumping refers to the willful disposal of material into the sea where this material has no future use.[21] Decommissioning may lead to dumping if structures are toppled into the sea after being dismantled or when they have been moved to a different place to lay them on the seabed. As we discuss in Chapter 5, dumping is forbidden in principle under Public International Law, most notably by the London Convention and its Protocol.[22]

2.3 Industries, numbers and costs

2.3.1 Oil and gas

Most of the literature on offshore decommissioning centres around oil and gas activities. This is hardly surprising as offshore decommissioning of petroleum fields has been taking place all over the world since the 1970s. In the Gulf of Mexico alone more than 4,000 offshore oil and gas related structures have been decommissioned to date.[23]

A considerable amount of decommissioning has also taken place in the North Sea. According to the OSPAR Commission, 170 offshore installations have been decommissioned in the OSPAR Maritime Area,[24] including the coastal areas of Denmark, Norway and the UK. No oil and gas platforms have been decommissioned in Denmark to date, only one offshore wind farm. Other reports speak of 88 oil and gas installations being decommissioned in the North Sea,[25] with studies indicating that about 10 % of all the offshore oil and gas installations in the North Sea have already been decommissioned.[26] The decommissioning of hydrocarbon-related structures has also taken place in other parts of the world, Southeast Asia and Australia being particular examples.

The cost and size of decommissioning offshore oil and gas projects vary enormously. They depend on the size of the infrastructure to be removed, the depth of the water and the complexity and type of installation. In the Gulf of Mexico and Southeast Asia, the installations are small and there are a lot of them. The costs of projects in these areas have been estimated to range between $500,000 and $4,000,000.[27] In stark contrast, the decommissioning of oil and gas platforms in the North Sea, where installations are much larger, can cost as much as 2 billion euros per project.[28]

As mentioned in the Introduction, the costs associated with decommissioning in the North Sea are staggering. Recent numbers from the countries studied in this report confirm this. In its 2020 Decommissioning Insight Report OGUK indicates that £1.1 billion was spent on decommissioning in the UK in 2020, about 30 % less than originally forecast, probably as a result of the COVID-19 pandemic.[29]

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[21] Yiallourides C and Gordon GW, 'Decommissioning of (Abandoned or Disused) Offshore Installations' in Roggenkamp; MM, de Graff KJ and Fleming RC (eds), *Elgar Encyclopedia of Environmental Law*, vol Volume IX (EE 2021) (Edward Elgar Publishing Limited 2021), p. 282.

[22] Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972

[23] HIS Markit, Decommissioning of Aging Offshore Oil and Gas Facilities Increasing Significantly, with Annual Spending Rising to $13 Billion by 2040, IHS Markit Says (November 29, 2016) https://news.ihsmarkit.com/prviewer/release_only/slug/energy-power-media-decommissioning-aging-offshore-oil-and-gas-facilities-increasing-si.

[24] OSPAR Commission, offshore Installations. https://www.ospar.org/work-areas/oic/installations

[25] ARUP https://www.arup.com/perspectives/publications/research/section/decommissioning-in-the-north-sea, p.11.

[26] Shell, Decommissioning in the UK: https://www.shell.co.uk/sustainability/decommissioning/brent-field-decommissioning/decommissioning-in-the-uk.html

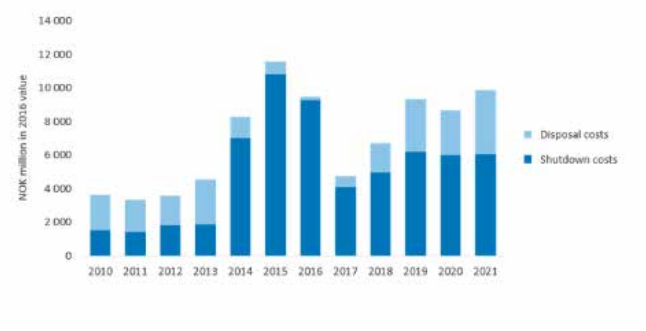
[27] HIS Markit, Decommissioning of Aging Offshore Oil and Gas Facilities Increasing Significantly, with Annual Spending Rising to $13 Billion by 2040, IHS Markit Says (November 29, 2016) https://news.ihsmarkit.com/prviewer/release_only/slug/energy-power-media-decommissioning-aging-offshore-oil-and-gas-facilities-increasing-si.

[28] Ibid.

[29] OGUK, *Decommissioning Insight 2020* (2021), p. 4 and 6.

OGUK estimates that decommissioning activities represent "10 % of UK oil and gas expenditure", estimating that at least £15 billion will be spent on them in the next ten years, in the UK alone.[30]

Data available in Norway illustrates the costs of cessation, which also includes decommissioning. Some authors point out that decommissioning costs are comparable to (but not as high as) those of the construction, transport or installation of the infrastructure,[31] while other sources are more conservative. According to the Norwegian Petroleum Directorate, decommissioning activities represent about **3 %** of the total sums spent on petroleum activities.[32] Although this appears to be a modest amount, decommissioning costs rank third highest after operating costs (24 %), and exploration costs (12 %). Investment costs, which are not connected to any specific activity and could encompass many different expenses represent 58 % of the expenditure on oil and gas activity in the Norwegian Continental Shelf. However, it must be stressed that decommissioning takes place at the end of the project and for a relatively short period compared to the operation of an oil and gas platform which can span more than 30 or even 40 years.



https://www.npd.no/en/facts/publications/reports2/resource-report/resource-report-2017/cessation/decommissioning-costs/

Decommissioning costs for Norwegian projects are high. The official estimates report that between 2010 and 2016 NOK 32.5 billion and NOK 8.5 billion (around €3.2 and €0.8 billion) were spent on shutting down and disposing of operations respectively. The estimates for shutting down and disposal for the period 2016 and 2021 are NOK 23.4 billion and NOK 12 billion (ca. €2.3 and €1.2 billion).[33]

Not only there is plenty of experience in the North Sea. The regulatory landscape in our area is also quite developed. Decommissioning rules for oil and gas activity have been adopted across the world and have evolved since the 1970s, with jurisdictions in the North Sea, notably Norway and the UK, being leading examples. We return to this topic in detail later in the report.

2.3.2 Offshore wind

Offshore wind is a different story. To date, only a handful of offshore wind projects have been decommissioned worldwide. Rapid and large-scale offshore wind farm construction only started relatively recently, with the North Sea being a pioneering area. However, as most offshore wind farms have been built with an estimated life span of between 20 and 30 years,[34] a timeline also reflected in the

[30] OGUK, Decommissioning Insight 2020 (2021), p. 15.
[31] Andersen RT and Kirkvaag O, 'The Tax Treatment of Decommissioning: The Example of Norway' in Pereira; EG and others (eds), The Regulation of Decommissioning, Abandonment and Reuse Initiatives in the Oil and Gas Industry: From Obligation to Opportunities (Wolters Kluwer 2020), p. 167.
[32] Norwegian Petroleum Directorate, Decommissioning Costs, available at: https://www.npd.no/en/facts/publications/reports2/resource-report/resource-report-2017/cessation/decommissioning-costs/
[33] Ibid.
[34] Ziegler, L., Gonzalez, E., Rubert, T., Smolka, U., & Melero, J. J. (2018). Lifetime extension of onshore wind turbines: A review covering Germany, Spain, Denmark, and the UK. Renewable and Sustainable Energy Reviews, 82, 1261-1271.

length of the concessions or licenses, in the 2020s and 2030s we will see a marked increase in decommissioning activity.

To date, however, we have limited experience of decommissioning. Topham et alia report that by 2019 only four offshore wind farms, excluding prototypes, had been decommissioned in Northern Europe. Adepipe and Shafie expand the number to a total of seven worldwide by 2021.[35]

Yttre Stengrund (10 MW, Sweden) was the first, in 2015, after only 15 years of operation (Vattenfall Wraps Up First Ever Offshore Wind Farm Decommissioning, 2016). This was then followed by Lely (2 MW, Netherlands) which was removed from the sea in 2016 after operating for 20 years (Offshore Wind Farm Dismantled in the Netherlands, 2016). Vindeby (5 MW, Denmark), the first offshore wind farm to be installed in 1991, was the third project to be dismantled in 2017, operational for 26 years (World's first offshore wind farm now dismantled, 2017). And the most recent project to be decommissioned was Utgrunden I (10.5 MW, Sweden), in operation for 18 years (ZITON completes decommissioning of Utgrunden Offshore Windfarm, 2018).

Cost estimates concerning decommissioning of offshore wind projects vary and there is little existing experience. There appear to be some parallels to the oil and gas industry as some studies point to decommissioning costs amounting to about 3 % of the total cost of construction of the wind farm.[36] Other reports argue that these estimates are too low, such as the one prepared by the DecomTools project, in which they calculate decommissioning costs to be between £100,000 and £300,000 per MW for modern wind parks.[37] Although offshore wind decommissioning is not directly comparable to that of oil and gas, there are indications that offshore wind decommissioning is less costly. This is partially because there is not a well to be closed.

Time estimates regarding the decommissioning of wind farms are different from those for oil and gas. Reports calculate the removal of turbines or installed MW capacity seems to be relatively quick, with DecomTools estimating that decommissioning takes between 0.7 and 1.7 days per MW for most projects.[38]

The lack of technical experience in offshore wind decommissioning is reflected in the paucity of regulation of offshore wind activity, with the UK being something of an exception – particularly when contrasted to Norway. Yet, the North Sea differs from most of the states in the world in which few countries have even rules for the development of projects, let alone decommissioning. As we discuss in Chapter 9, offshore wind farm decommissioning is uncharted territory.

2.4 What is to be decommissioned?

When decommissioning an offshore installation different parts of it or attached to it are the subject of different removal engineering solutions and regulatory requirements. Decommissioning

https://www.sciencedirect.com/science/article/pii/S1364032117313503 ; https://link.springer.com/article/10.1007/s11367-020-01793-x

[35] Adedipe, T., Shafiee, M. An economic assessment framework for decommissioning of offshore wind farms using a cost breakdown structure. *Int J Life Cycle Assess* **26,** 344–370 (2021). https://doi.org/10.1007/s11367-020-01793-x https://link.springer.com/article/10.1007/s11367-020-01793-x

[36] Smith, G., Garrett, C., & Gibberd, G. (2015). Logistics and Cost Reduction of Decommissioning Offshore Wind Farms. Presented at EWEA Offshore, 2015, 10-12: https://www.researchgate.net/publication/274896458_Logistics_and_Cost_Reduction_of_Decommissioning_Offshore_Wind_Farms; OE, Offshore Engineer: https://www.oedigital.com/news/473730-10-billion-offshore-wind-decommissioning-bill.

[37] DecomTools; and Kruse M, *Market Analysis – Decom Tools 2019* (2019), p. 29.

[38] Ibid, p. 29.

governance applies to the structure as a whole but removal requirements vary depending on the location of the structure, whether it is over the water column, in the water column and over or under the seabed. These requirements could well apply to the oil and gas well or parts of the wind turbine but could also apply to pipelines or cables, for example. Removal can be total, partial or the structure may be left intact and in place. If structures or parts of them are left in place, this may lead to accidents, damage to other sea users or a negative environmental impact. However, installations left in place may also create synergies, such as them being used for reefs or different purposes.

Offshore energy structures are far from standardized. However, they tend to share some common parts which are often removed using various engineering solutions. We briefly discuss the parts and their removal below.

Source Pixabay

Topsides are the structures found above the water column. In the case of offshore wind farms, these will be the blades, rotor-nacelle and tower. For offshore oil and gas platforms, these are structures typically made of steel. Topsides can be decommissioned in different ways. For instance, by cutting the parts into smaller pieces to be carried onshore, by removing whole modules of the installation sequence or by removing the whole piece with a single lift. Alternatively, the topside may be cut from the jacket and taken ashore in a single piece.[39] The removal of topsides for offshore oil and gas installations has been estimated to amount to about 8 % of the total cessation costs.[40]

Substructures and foundations are located within the water column and serve to support it. Usually, these are jackets made of steel or concrete pillars or a combination of both. They are removed through the use of similar techniques as for topsides: lifting, cutting/explosion, reverse installations or single lifts. They can also be removed by making them float with buoys. Removal of substructures accounts for about 6 % of the total cessation costs.[41] The removal of the foundations of offshore wind farms amounts to about 35 % of the total cessation costs.[42]

Wells are closed through plugging and abandonment (P&A) operations. This is a critical element of the oil and gas decommissioning phase, but it does not apply to offshore wind. P&A operations "usually consist of placing several cement plugs in the wellbore to isolate the reservoir and other fluid-bearing

[39] ARUP, Decom North Sea and Scottish Enterprise, Decommissioning in the North Sea: Review of Decommissioning Capacity (2014), p. 14.
[40] OGUK, Decommissioning Insight 2020 (2021), p. 16.
[41] Ibid, p. 16.
[42] DecomTools; and Kruse M, *Market Analysis – Decom Tools 2019* (2019), p. 29.

formations".[43] P&A is by far the most expensive part of decommissioning, accounting for 49 % of the total costs, according to OGUK.[44]

Pipelines and cables are located either under or on the seabed. As we will discuss below, not all regulations require the removal of elements located under the seabed, particularly pipelines and/or cables. Practice in the North Sea shows that decommissioning does not necessarily include the removal of pipelines and/or cables. Smaller pipelines and shorter cables can be removed without impacting on the seabed in a major way.[45]

It is important to stress two aspects concerning the removal of cables and pipelines. First, unbundling rules to energy transport –the separation of ownership or control over transmission and generation/extraction/production assets – may imply that the owner of an offshore energy infrastructure is different from that of the cable or pipeline.[46] Furthermore, the removal of cables or pipelines may cause complications if these are part of a meshed or shared network as their removal may compromise the rest of the structure.

[43] Vrålstad T and others, 'Plug & abandonment of offshore wells: Ensuring long-term well integrity and cost-efficiency' 173 Journal of Petroleum Science and Engineering [2019], 478, p. 478.
[44] OGUK, Decommissioning Insight 2020 (2021), p. 16.
[45] Ibid, p. 15.
[46] See on this, inter alia: Herrera Anchustegui I, 'Transmission Networks in Electricity Competition: Third-Party Access and Unbundling – a Transatlantic Perspective' in Ruiz Peris JI and Cerdá Martínez-Pujalte CM (eds), *Competencia en mercados con recursos esenciales compartidos: telecomunicaciones y energía* (Aranzadi 2019); Guayo Id, Kühne G and Roggenkamp M, 'Ownership Unbundling and Property Rights in the EU Energy Sector' in Aileen McHarg BB, Adrian Bradbrook, and Lee Godden (ed), *Property and the Law in Energy and Natural Resources* (Oxford University Press 2010)

3. Economic and policy challenges in decommissioning

3.1 Circularity and reuse: the market economy and its limitations

When analysing the desirability of policy options, economist applies what is referred to as cost-benefit analysis (CBA). In its most general for, a CBA involves listing all benefits and costs arising due to the proposed policy and comparing this to a baseline scenario. While the proposed policy describes the positive and negative impacts from a policy alternative e.g. a strict decommissioning policy, the baseline scenario describes the impacts if this policy were not introduced. Hence, the CBA of decommissioning must define the relevant stakeholders to the policy, and then the positive and negative impacts for the stakeholders. The relevant stakeholders is not only the oil and gas operators, also the O&G service sector, other users of the oceans (maritime sector) and seabed (fisheries) and governments must be included. And not only impacts measured in monetary units, also impacts not measured using monetary units should be listed and evaluated in a CBA. In the current section, we discuss how market failures may affect the desirability of decommissioning, once the structures placed on the seabed approaches the end of their physical or economic life. In the following, we discuss several aspects relating to the economic aspects of decommissioning end-of-life capital assets.

3.1.1 End-of-life for a capital asset, and the 'waste is a god-mine' perspective

A good starting point is to look at a structure such as an energy asset (e.g. an oil rig or a wind farm) in the same way as any capital asset that has reached the end of its life. If cars, maritime vessels and homes typically are retired when they are 10, 30 and 60 years old respectively – with vast variations in each class – then a simple circular perspective is that these need not be worthless: *Either they can be reused in some reformed state, or parts or materials can be recovered and reused.*

Indeed, it is not difficult to see that in a market economy it may be advisable to explore, develop and implement such circularity from the outset. If profit-seeking entrepreneurs and adventurers can venture into the wilderness to look for undervalued mineral ores, they can in similar ways sift through and organize circularity enterprises in wrecks and junkyards, and bid for maritime vessels and oil rigs that are about to be retired.

3.1.2 Classically recognized 'market failures' beind 'too little' circularity

Two important obstacles to such circularity – market failures, if you like – are important in the general literature.[47]

a) Virgin materials are – for some reason – underpriced. If so, recycling will be undervalued if markets are left unregulated. A suitable example may be when mining is causing pollution, which is in itself underregulated or undervalued.[48]

[47] Peter Bohm (1981). Deposit-Refund Systems: Theory and Applications to Environmental, Conservation and Consumer Policy. Johns Hopkins/RFF.

[48] See, for instance, Peter Bohm (1981). Deposit-Refund Systems: Theory and Applications to Environmental, Conservation and Consumer Policy. Johns Hopkins/RFF., for a discussion of these issues.

b) Waste – as in left-behind car wrecks or rigs – causes harm that is not sufficiently taxed or regulated. The abandonment of wrecks in woods or fjords could be avoided by the use of a well-run junkyard. Similarly, returning batteries for recycling would reduce intoxication in ecosystems and humans.

Several solutions to the above-mentioned market failures have been proposed, e.g.:

- Deposit refund schemes for cars, bottles
- Scrappage subsidies
- Virgin material taxes
- Regulations
- Certification
- Bond placements
- Sectoral arrangements (as with electronic waste, in Norway).

3.1.3 Life cycle perspectives

One could also question whether end-of-life plans are given adequate consideration in project and product design.

Regarding a), above, one might for instance use more valuable materials – alloys, for instance – if this prolongs the asset's useful life, or if it would enhance the residual value in recycling or reuse. Or one might use less harmful materials. Or, regarding b), one might use less harmful substances, if this would reduce the disposal costs.

Our timeline perspective in Figure 3.1, points out that in the petroleum sector in the North Sea, simple discounting implies that decommissioning deserves limited attention in project planning and design. This tendency is even stronger – and still possibly socially efficient – under uncertainty and under technological change.

Once the rig has been built and extraction has begun, it is quite possible that thought has not been given as to how to plug and abandon, and how to dispose of the rig. This may be OK, if in fact, the world was changing, and 'I'll think it through later' was not an escapist's statement but a responsible one.

3.1.4 The ex post problem for a host confronting a left-behind structure, or pollution damages

There are numerous examples in maritime shipping of left-behind vessels or wrecks becoming a host's problem.

When a wreck is abandoned and no owner can be held responsible or liable, in principle, it will have valuable parts as well as removal costs, and the former shall as far as it goes pay for the latter. At that point, it may be there is a bond (money in an escrow account, for instance) or insurance that is sufficient to cover the costs.

An interesting question is whether abandonment is 'final', signed off by the host in any way, or if an oil (or wind) company retains any responsibility for the asset, and, if so, for how long. A possibility is that if there is a liability remains, on the books, for 'infinite time', then a likely effective damage responsibility that might be discovered over time – and some interval – must both be harder to detect and harder to effectuate.

A formulation in the economics literature is ex post liability versus ex ante regulation.[49] In the case of plugging, abandonment and removal of offshore oil structures, the host admits some responsibility through the act of approving plans for both the field's construction and removal, and this might set some limits on what damages can be brought against an oil company, as long as it has been compliant and acted in good faith.

3.2 A removal obligation

3.2.1 Background

A removal obligation implies that at a later stage the project will shift to having a negative net present value to the operator. This may entail a commitment problem as the host government may demand a bond or a guarantee posted by the project owner before the commencement of the project. The bond is released when the obligation is fulfilled. If such a bond is not posted (or is not sufficient to cover the costs), questions may be raised as to whether the removal will take place, what happens if the license is sold to parties with less equity or less competence, etc.

Such a removal obligation also entails incentive problems, and in his article 'Closing an Oil Field' Michael Hoel analyses the case in which the timing of the removal obligation is given by cessation of extraction.[50] In that case, additional finds can benefit the project owner in part through postponing the removal of the structure. There are then incentive issues if some costs – either in operation or in removal/nonremoval – are different for the host than for the owner, such as when the environmental costs of operation, of removal or of nonremoval- are not fully priced to the owner/operator.

3.2.2 Why a removal obligation?

The obvious case for a removal obligation is that removal costs are less than the costs – environmental and other – of nonremoval-, perhaps of nonremoval- forever.

Another way of thinking about a removal obligation is as a constitutional or moral obligation: nature may offer projects of all kinds, but only those that are attractive with a removal obligation should be realized. A constitution may constrain the government from 'expropriation without compensation', and such a constraint can put society on a sound footing regardless of whether it is always 'optimal'.

In a similar way, when oil extraction or mining projects are engaged in, a removal obligation could serve as a sensible constitutional commitment. It might, in such a case, involve two types of 'errors' or consequences that on a case-by-case basis are not optimal:

i) In the case of some profitable projects for which removal is costly and does not deliver important benefits, the removal obligation would result in foregone opportunities

[49] Kolstad, C. D., Ulen, T. S., & Johnson, G. V. (1990). Ex post liability for harm vs. ex ante safety regulation: substitutes or complements? The American Economic Review, 888-901.

[50] Hoel, Michael, 2018. Closing of oil fields. Consultancy Report for Petroleum Directorate, Norway. Vista Analyse, 2018, no 36.

ii) Some profitable projects would be less profitable because a costly removal has to be executed even though it is not beneficial.

Source: Pexels - Katalin Rhorvát

A law similar to the expropriation example, but more closely linked to environmental issues is the USA's Endangered Species Act of 1973. The act gives good reasons for stopping projects or activities that risk the extinction of a species. Although such a law might fail to save many endangered species, and could also risk preventing projects that are of more value to mankind than a species, it might be beneficial because it lends certain soundness across a wide range of questions or conflicts.

3.2.3 A simple example: justified by environmental costs of leaving the installation in place

A simple example to illustrate some issues is a very 'symmetric' project over six decades, with a negative outlay of one (called investment) in the first decade. Then a positive cash flow of the same amount in four subsequent decades (oil production, say). And then finally, a removal outlay of one in the sixth decade.

Figure 3.1. Calculated at the midpoint of each of six decades, this project has a net present value of zero at 6.5 %, which means that it will be profitable at any cost of capital lower than 6.5 % (or between 6.5 % and minus 6.5 %).

Including the removal costs, such a project has an internal rate of return of 6.5 %.

If the removal obligation is imposed as a result of the environmental costs of leaving the asset in place, an assumption could be that the installation would otherwise involve a perennial cost, ecological or otherwise. If such an environmental cost were of the same net present value (assuming the same discount rate), the cost per year, *b*, would satisfy:

$$\frac{b}{r} = 1, \text{or } b = 0.065$$

The removal cost *D* (for decommissioning) is assumed to be 1.

As a general rule, a removal obligation reflects an implicit or explicit assumption (or opinion or fact) that the annual cost of leaving an asset in place – in environmental or other terms – is greater than the discount rate times the removal cost, *D*. Here as above, the removal cost *D* (for decommissioning) is assumed to be 1.

As a general rule, a removal obligation could reflect an implicit or explicit assumption (or opinion or fact) that the annual cost of leaving an asset in place – environmental or in other terms - is greater than the discount rate times the removal cost, *D*.

$$\frac{b}{r} \geq D$$

3.2.4 Decommissioning: uncertainty and revelation of removal costs and benefits

Say a removal obligation is 'signed' upon commencement of a project. Subsequently, new information is revealed, either in the process of designing or building the project, or in the production phases. A possible outcome is that removal is no longer optimal. Not only is removal costly and – upon

approaching the finalization of extraction – unattractive for the owner/operator, it may also appear less important to the host, or counterpart (Figure 3.2).[51]

Expanding upon the above example, two alternative scenarios could be that removal proves:

a) To cost nothing (recommissioning pays as much as removal costs: a scrap broker offers to plug the holes and remove it all for free)
b) To be twice as costly as assumed at time zero.

These two modifications would – respectively – add and subtract 30 basis points to the internal rate of return (to 6.8 % and 6.2 %, respectively). Briefly put, these are quite substantial variations for the project, but still of moderate significance to the project as a whole, and the reason is that the impact is in year 55 of the project, and 6.5 % at such a horizon moderates their impact very little (a dollar of removal costs in year 55 is worth 3 cents in year zero).[52] In year 54 a dollar of removal costs in year 55 is worth 93.5 cents.

3.2.5 Decommissioning: uncertainty and gaming along a time line

Now consider the possibility of communication and behavior along the timeline of the project. For simplicity, there is a host government (host) and a project owner. The project owner wants to extract the oil, and submits a plan, underpinning cash flow projections similar to those in Figure 3.1. The host, on the other hand, approves the plan (and authorizes the project to start), in part to ascertain the project is doable, including what we call removal, or cleanup.[53]

The host's commitment to insisting on removal is not explicitly doubted at this stage, but we keep in mind the possibility that an expected cost of minus 1 in year 55 embodies a likelihood that removal costs are either zero or minus two (further details below). Consequently, to be allowed to proceed with the project, the project owner needs to signal not only that the environmental risks in the course of and after the project are small, but also that the removal costs are moderate, and that they are committed to a removal that is envisaged to be entirely safe and doable. Nevertheless, as is shown in Figure 3.1, even big removal costs appear small at time zero: they can be plus or minus 30 basis points.

Later in the project, incentives shift dramatically. Even if more detailed planning for decommissioning were to start as early as at the commencement of the fourth decade, with two decades of harvesting remaining before removal, the net present value of the project, at this date, is just shy of 1 (0.91). If the decommissioning cost could be cancelled (set to zero), net present value jumps to 1.12 (or by 23 %). The picture is even starker at the commencement of the fifth decade, when only one decade of extraction remains before a decade of removal. At this point, the remaining net present value is 0.34, but jumps to 0.73, or by 114 %, if the removal can be renegotiated to cost zero.

As indicated in Figure 3.2, a way of looking at the change in incentives through the project is that the project owner at the commencement of the licence will demonstrate that removal is predictable, affordable and a total commitment, shifting later to signal that complete removal is risky or costly, and to downplay the environmental costs of leaving the installation in place, either partially or fully.

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[51] Decommissioning costs are inherently hard to estimate, see Kaiser, Mark J. and Snyder, Brian , 2012. Modelling the decommissioning costs of offshore wind development on the U.S. Outer Continental Shelf. Marine Policy, 36, 153—164 for an illustration of modelling.

[52] An aspect explored by Michael Hoel,, is that towards the end of the project, delaying the removal has a value to the license owner, and this value may entice the owner to pursue development of additional smaller finds adjacent to the project.

[53] At the corporate side – which involves also its relations to financiers, for instance – the corporation and its auditors need to book the removal obligation as a liability. For a large petroleum corporation in Norway, such an obligation may represent about a fifth of its market value, as an illustrative example.

This predictable process of changes in incentives has interesting and conflicting aspects. One of these is that the government may want to retain credibility in its commitment to a removal obligation for various reasons (across projects, including future projects).[54] On the other hand, if the new scenario is quite separate, clear and important (as in 'we can save a lot of money, between the two of us'), it will be both difficult and costly for the host to maintain its commitment. In the Norwegian case, the government's share in net cash flow *as realized* is quite significant (a 78 % tax on profits *plus*, in many cases, additional government ownership shares). This might in itself make it difficult for the government to maintain commitment to complete removal, i.e. resist saving on decommissioning.

If this approaching dilemma is thought about as a signaling game along a timeline, the two parties – owner and host – are quite disinterested in the removal obligation at the commencement of the project (plus or minus 30 basis points in the rate of return in the example above). As removal approaches, the span around an expected cost of 1 and (perhaps) a realized removal cost of zero or 2 becomes very big.

A formalization of such a game might suggest that the company invests in analysis and research, *a* (ecosystem research, recommissioning technologies and consequences). In doing so, it hopes to reveal – in a way acceptable to the host – that an optimal D is zero, rather than 2. It will then invest in *a* up to the point where the net expected gains in terms of reduced removal costs are zero.

De- or recommissioning: a time line for a 'project' or a licence

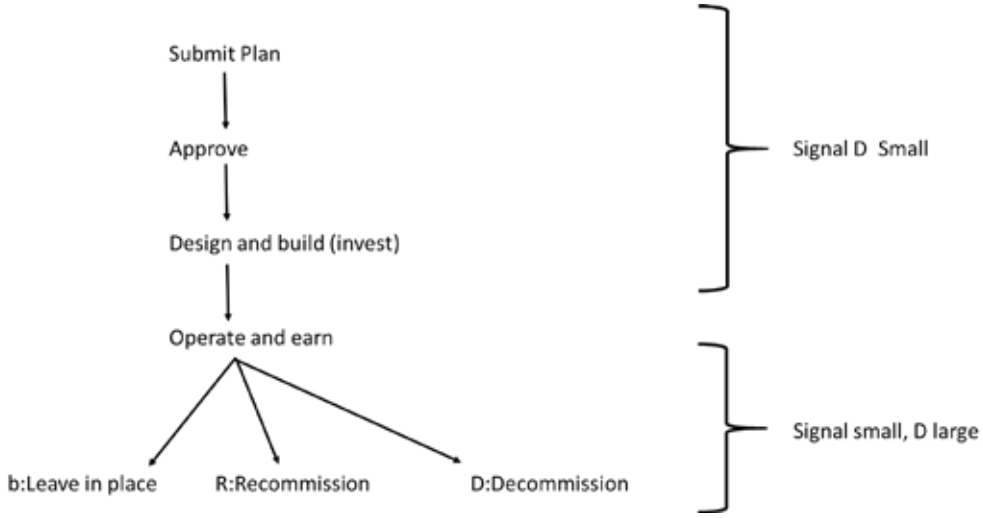

Figure 2: De- or recommissioning: a time line for a 'project' or a licence

This process of shifting incentives and incomplete information – perhaps on both sides – is highlighted below.

An important part of the complications that arise is related to the fact that decommissioning decisions are heterogeneous, and case-specific both for the company and its host, so there may be limits to what one can get out of competition in terms of the revelation of costs and opportunities. It is only after the company has invested in, and learned about, its field and constructed its installations that a firm-specific liability begins to become clear and grows in importance. At the same time, the host

[54] As with *general prevention* in the crime literature, the host might to enforce the obligation even for a removal that for specific reasons in itself serves no purpose (is too costly compared to the benefits of removal), in order to retain a general setting in which no project owner advances with a project unless removal is intended.

government, whose obligation to be a counterpart increases, and in certain cases, there may be a third party (like fishers, or environmental NGOs) who will be affected by the project and watch it attentively.

Finally, the company may consider how to contract out the removal, in whole or in part as removal typically includes plugging, lifting and towing, cutting and recycling, no party has this competency in house.

An experienced industry hand said: '*these contracts are written with rejection of responsibility as a guiding principle'.*

A further complication that needs to be mentioned is that a removal obligation might be unenforceable if a company cannot meet the obligation and is or would go bankrupt. Leaving a mature field in the hands of a single limited liability company or selling it to a company with less equity or competence would then be issues of interest to the host. In theory, such predicaments are preventable (a bond is posted with the host and released when the obligation is met), but one still needs to be alert to these aspects of the game.[55] Since petroleum licences to some extent share aspects of beauty contests (Is this company a competent partner? Does it engage with its full reputation?), the contest probably involves making sure that licence holders are not void of equity either if disaster strikes or when the project reaches the end of its life span.

Two dynamic aspects of the regulation of decommissioning oil and gas - and also wind power - assets are worth mentioning.

First, as noted above, oil and gas operators have a strong incentive to invest in long-term deployment of assets due to its profitability. The decommissioning costs were far ahead and due to discounting, these costs did not affect net present values much. However, as the reservoir approaches its terminal year, the net present value of decommissioning increases, and the private incentives for leaving the assets in place become stronger. And when the decision regarding the decommissioning approach is to be decided upon, hardly any revenues are expected, only the costs of decommissioning. As such, the operating firms have both strong incentives to deploy the oil and gas installations, but also strong incentives to leave the assets in place rather than bringing the assets ashore.

Second, as the oil and gas installations are given derogations from the regulations on decommissioning, this may cause other oil and gas installations to be put in place with the expectations that derogations to the regulations will be given also in the future. And what is more, when e.g. offshore and near-shore wind power assets are deployed, these may also be put in place expecting derogations of the regulations regarding decommissioning. This may affect the design of subsea structures to be put in place in the future. If one uses the principles of the circular economy, the entire life-cycle of the assets to be put in place must be considered. Hence, when designing assets to be put in place, one should not only consider the deployment and operational phase of the assets' lifespan. Rather, the deployment, operational and decommissioning phase must be taken into account.

[55] Webinar presentations from OSPAR and Norway's Ministry of Petroleum and Energy (May 19th, 2021, Laura DeLa Torre and Mette Agerup, respectively) state that responsibilities with regard to removal are backed by mother company (as daughter operates in Norway) are is retained through license sales for recourse.

3.3 De- and recommissionig: auction theory and negotiations

3.3.1 Introduction

We have made the argument above that plans will be made or remade for the decommissioning (and most likely full removal) of major capital assets, or installations, in a situation that to some extent is site-specific, thus *new*.[56]

The situation is new in the sense that many years – four decades typically (a professional lifetime) – have passed since removal was promised, or indicated.

Now consider a situation in which a company is considering bids for the complete removal of its aging installation, or is contemplating how it can be done, by whom, at what price and with what conditions. Imagine that the company announces a price that is more than sufficient to do the job, and asks potential removers how much they are willing to pay to get the removal job, and then be paid the prize upon completion.

The buyer is completely committed, and bids are credible, having been submitted in a sealed bid auction. There must be at least two bidders. Auction theory starts with what is called distribution of values, where x_i would be the price at which bidder *i* would be willing (indifferent, in fact) to take on the job. To demonstrate the importance of the number of bidders, in a first price auction (more frequently applied, perhaps) with independent values, the equilibrium bid of player *i* is:

1) $\beta_i(x) = \frac{N-1}{N}x,$

Where β_i is the optimal bid for bidder i and N is the number of participants in the auction. So, this simple expression conveys that bidders bid less than their value, so the oil company pays 'too much' 3/2 of the costs if there are three bidders, or twice the cost if there are only two bidders. This illustrates that if the recommissioning/decommissioning market is not very competitive, the oil company (and taxpayers) will pay for it, in this case in pure monetary terms. If there are many players, the bid converges to the bidders' true valuations. This conveys that the buyer of the service transfers no rent to the service provider as the market approaches perfect competition. However, there is no efficiency loss, since we have assumed the bidders are identical in competence and effort.

A question associated with (1) is that in auction theory and procurement practice, the oil company may need to decide between several smaller jobs and a one-provider solution. Typically, for a one-provider solution (a consortium, perhaps) there will be fewer bidders, so one can expect a higher markup in the bids from potential providers. An associated driving force may be that bidders for larger jobs are stretching their resources, so the buyer will pay a higher risk premium (including, perhaps, risking that the provider defaults without completing the job). This is partially compensated for if one big contract is chosen as the energy company saves itself the expense of liaising between the contracting parties. With one large contract, the energy company only needs to describe the boundaries and requirements of the whole job, rather than of each of the subprojects and how they fit together.

3.3.2 Auctions and environmental protection in the job specification

Apart from subcontracts in the job specification, environmental protection in principle means that the job was not well described from the outset: For example, the Norwegian people, or people living in

[56] Krishna, Vijjay (2002) "Auction Theory" provides and excellent overview of the illustrations using auction theory used in this report.

countries surrounding the North Sea including future generations simply want a minimal cost solution. That is, one that pays what is necessary to leave the North Sea unharmed environmentally. In other words: *one that pays as much as it is worth to minimize environmental damages*, *and in the process gets as much as possible out of recommissioning and recycling.*

Of course, it is possible there are also environmental benefits in which case they should in principle be paid for.

A consequence of this is that in an ideal world, time and money should be invested in working out a creative plan for the project in the first place. Could the facility, or parts of it, be left in place, or recommissioned, to save on costs? But what are the payoffs to such an inventive activity? Auction theory says that the job should be described in as detailed a manner as possible from the outset. This could mean specifying precisely how the job is to be done, but would ideally just be a statement of functional requirements, as in: full removal or any other solutions that leave cod and fishers equally happy.

Importantly, it may be risky for the oil company to invite creative solutions, as the host government may have to approve them. Similarly, for bidders, being creative introduces an element of risk, if you do not know how creativity is valued by the energy company, or by authorities. And the host government, in turn, may need to discuss the matter or obtain approval of it from fishermen, or perhaps with international agreements or authorities, such as OSPAR. In other words, both the oil company and the host may find it riskier than rewarding to be open-minded and invite creativity when looking for solutions to the removal obligation.

3.3.3 Winner's curse: the competence need in whomever buys a re-or decommissioning service

Now think of uncertainty – to bidders – in terms of what a re- or decommissioning job will cost, or the value of the job, if recommissioning or reuse would pay more than the costs of the removal obligation.

As an illustration imagine there are two potential bidders who each do a small study on their own, by rolling a dice once. The roll picks a face with an integer between 1 and 6.

The typical interpretation is a common value private information auction for an oil field licence, so each bidding firm may have shot its own seismics, and each bidder thinks her/his result a signal of the oil field's value. So, if you (Yngvild, Y) roll the dice and the face shows 2 dots, you bid 2, because your expectation for the oil field's value is 2.

In this case, the bidding is between two potential providers of a decommissioning service, and in order to keep a positive perspective that the oil rig is to be dismantled is a potential gold mine. The bidders are identical, the rig's value to the dismantler is *a priori* distributed with equal probabilities of 1/6 for the six potential outcomes of 1, 2, ..., 6, and an expectation of 3.5.

Winner's curse is a phenomenon of 'interrelated values', where the interrelation lies in the auction itself: so if I (Gandolf, G) roll a face (not observable to Yngvild) of G = 4, I am interested in what happens *if I submit a winning bid*. So the question is: what is my expected value of the field, given that my bid was the winning one? Well, if my bid was the winning one, then Yngvild did not bid more than me. A strategy of bidding my unconditional expectation, i.e. bidding 4 if I rolled a face of 4 dots, can be called a *naïve bid*. In contrast, let an *informed bid* be a strategy of bidding what is my expected value for the rig conditional on my bid being the winning one.

Table 1: Illustration of winner's curse. Gandolf's draw

	1	2	3	4	5	6
Naive bid	1	2	3	4	5	6
Informed bid, no risk aversion	1	1.75	2.5	3.25	4	4.25
Winner's curse	0	0.25	0.5	0.75	1	1.75

The figures in the row informed bid are calculated as follows: if Gandolf draws G = 2, and bids 2, and wins, and Yngvild does something similar, then I know that she has drawn either a 1 or a 2. Let us make the simplifying assumption that if Yngvild and Gandolf bid the same, then Gandolf wins (as in mild quota preference). Then, if Gandolf bids 2 and wins, Gandolf may assign equal probability to Yngvild having drawn 1 or 2, so Gandolf's expected value of Yngvild's draw given that Gandolf won, is 1.5. And Gandolf's draw was 2. So Gandolf's expected value for the field given that G = 2 and won is 0.5×(1.5 + 2) = 1.75. *Winner's curse*, or my informed regret if I had actually submitted the naïve bid, is 0.25.

Table 2: Illustration of what Yngvild may have drawn if Gandolf had won as a function of what he drew.

Y\G	1	2	3	4	5	6
1	**1**	**1.5**	**2**	**2.5**	**3**	**3.5**
2		**2**	**2.5**	**3**	**3.5**	**4**
3			**3**	**3.5**	**4**	**4.5**
4				**4**	**4.5**	**5**
5					**5**	**5.5**
6						**6**

What we can see in the table above is that if bidders are risk averse, the buyer of the recommissioning service would get exactly the same. In effect, what Gandolf is doing in Table 2 if he throws a 2, is to say: 'If I win, I do not know whether Yngvild threw a 1 or a 2, but I'm not really bothered, as I'll pay what I'm expecting her draw to be, which is 1.5, so I'll bid 1.75'. So, in the case of no risk aversion, further value for Gandolf is not relevant. This is a rather extreme assumption: in fact, this would be a situation in which if Gandolf and Ingvild had to pay a small amount to roll the dice (i.e. to inform themselves), they would decline, and assume the rig is worth 3.5.

Risk aversion is thus one way to illustrate the value of discovery. That value of discovery would also apply to the energy company buying the service. In effect, when there is a value in discovery (as in shooting seismics, or examining the rig before offering to remove it), the energy company would want the result of discovery efforts to be available to all parties, to all potential bidders. In other words, the challenge to the energy company, if it wants the best out of bidders (the most revenue for itself, or the least cost for itself) is:

To acquire information about recommissioning costs (and methods?) itself.

To convey this information in a credible way to potential bidders.

A simple part of this process is well illustrated by the role of a seller or an auctioning company in the sale of a painting, or of a host government soliciting bids for oil licences. The seller would be interested in making available credible information about the painting's likelihood of being an authentic and important Picasso. To the extent that this saves effort and costs, a bidder would herself undertake to assess the item before bidding, this has two types of benefits. First, a duplication of such costs is saved, possibly attracting buyers and bids. Secondly, this reduces their suspicion of private information, and thus raise their bids in reflection of reduced winner's curse.

In the case of recommissioning/decommissioning, the benefits of expertise – a public centre of competence – may go beyond this. First, in the case of environmental concerns as well as solutions and their acceptability, bidders' uncertainty may be exactly what is required ecologically and by the government. So it is quite natural for the government to create mechanisms to reduce such uncertainty (In courts? In environmental impact assessments? In standardized and approved bidding documents?). Secondly, with respect to developing and certifying engineering solutions, there may well be public good aspects, in the sense of gains to research that cuts across single rigs.

An important illustration of this might be if the project requires more lifting capacity than the industry would otherwise use. This could mean that lifting capacity is not invested in, so that industry participants conclude that removal is not possible. Alternatively, lifting capacity is provided by more than one company, the market is insufficiently competitive, and society is left with services that are substandard, excessively costly or both.

It is possible to address all these problems through investments in competence on the buying side of these services, possibly by cooperative efforts between energy companies, by host governments or by a combination of the two. The competency challenge may be in environmental innovations or threats might indicate that it is not only industry, but also the government that may be at risk of getting too close to industry, and to the financial aspect of the project, which in turn might suggest that broader mechanisms, such as courts, should also play a role in addressing these problems.

Such a competence center could fund or execute studies, or in other ways build competence, in such areas as the ecological consequences as well as engineering opportunities in 'rigs to reefs' projects, the opportunities for valuable material recovery or reuse in rig dismantling or for the possibilities to reuse structures in ocean wind, in aquaculture, in urban development or in temporary housing, etc. Part of this competence would also involve analysis of incentives and tax systems and regulations, with a particular focus on the greater facilitation of valuable reuse.

4. Key features of decommissioning obligations

4.1 Introduction

The technical requirements of decommissioning are complex engineering operations. The rules and contractual and extra-contractual implications surrounding cessation and decommissioning are equally complex. The decommissioning governance and regulatory schemes take or ought to take into account incentives, different stakeholders' perspectives and legal and societal values to accommodate them in what are perceived to be solid regulatory choices.

Governance schemes ought to determine not only what structures need to be decommissioned and to what extent but also clearly allocate decommissioning responsibilities, decide who bears the costs for the operation, generate the necessary incentives so these activities are conducted in a responsible, adequate and safe manner and ensure the environmental impact is minimized.[57]

In this chapter, we focus our discussion around three large conceptual issues regarding decommissioning. First, how legal systems allocate decommissioning responsibilities. Second, how to ensure that decommissioning is conducted and how default risks are managed. Third, what the relationship is between decommissioning and tax benefits and burdens. The discussion applies to both offshore wind and oil and gas decommissioning projects.

The discussion takes a conceptual and general approach. These same issues will be addressed again in Chapters 6, 7 and 8 when we study the specific rules applicable to decommissioning in Denmark, Norway and the UK, respectively. This reveals how legally complex decommissioning is and the many issues that the regulator needs to consider when developing decommissioning rules.

4.2 Who has to decommission?

4.2.1 Asking who is responsible

Asking who is responsible for conducting the decommissioning of oil and gas fields and offshore wind farms would seem to be a fairly straightforward question to answer. It should be the operator or current owner of the installation, right?

However, a closer analysis of this issue and the regulation that is applied to it shows that a more complex answer is required. In addition to the current operator and/or owner, decommissioning obligations may also apply to previous owners and/or operators of the installations. Ultimately, the state may be required to conduct decommissioning either on behalf of its own enterprises or to conduct an operation when the entrusted parties fail to do so. The question of who has to decommission offshore energy installations may also lead to discussions regarding shared liability, which in some circumstances may result in joint and several liability among parties that operate and/or jointly own an offshore energy structure.

[57] Hunton, Andrews, Kurth LLP, Decommissioning Hydrocarbon Assets: Finding Value in a Shifting Regulatory Landscape (2018), p. 3.

4.2.2 Allocating decommissioning responsibilities

Under Public International Law, as we discuss in Chapter 5, treaties and, arguably, customary law impose an obligation on coastal states to decommission offshore structures and ensure the safe use of the sea by other users and the preservation of the environment. Public International Law also imposes an obligation on states to prevent any dumping of man-made installations in the sea. Based on this premise, states decide in their national energy laws which party is responsible for conducting these removal operations. As discussed above, this can be the owner/operator of the infrastructure or the state itself. Examples of both modalities are encountered across the globe.

Determination of decommissioning responsibility is tied to the ownership, control or operation of the infrastructure. In systems based on licensing, leases or concession systems, such as the jurisdictions in the North Sea, the common practice is that the entity(ies) responsible for the development and operation of the offshore installation will also be the one(s) expected to conduct its decommissioning.[58] This can include private operators or publicly owned oil and gas or energy companies, but not the state itself. The oil and gas decommissioning framework of Denmark, Norway and the UK are examples of this modality.

In these systems, large energy companies will often be entrusted with the decommissioning process. However, a trend has emerged in the oil and gas sector for licences or operation rights to be transferred from these large companies to smaller independent firms devoted to enhancing reserve recovery and exploiting these types of fields. This has raised concerns regarding default risks. To address default risks of both small and large offshore energy operators, regulatory systems have developed rules creating joint and several liability, in addition to requiring the consent of regulatory authorities for a transfer of operation or ownership rights. It remains to be seen whether this trend will be followed in offshore wind assets. However, in the case of wind farms, there is not a clear need for technology to maximize the harvesting of resources as the wind will not be exhausted with its use and, therefore, there is no need to have special enhanced recovery techniques as is the case in extending the operational life of hydrocarbon depositions.

In other countries that typically have a less mature industry or where there is heavy reliance on international investment, it is found that in the production sharing agreements the rules determine that after a period of operation has elapsed the assets are transferred to the state. If the state is the owner and/or operator of the assets, then it will be the party entrusted to conduct the decommissioning. Some variations in state-led decommissioning (often through the publicly owned national company) are found, for instance, in Brazil,[59] with similar situations also reported in Indonesia,[60] and Mexico.[61] Such operations are typically financed through a decommissioning fund.[62]

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[58] Highlighting this regarding the UK as an example, see: Trischmann H, 'Decommissioning Security Agreements' in Pereira; EG and others (eds), *The Regulation of Decommissioning, Abandonment and Reuse Initiatives in the Oil and Gas Industry: From Obligation to Opportunities* (Wolters Kluwer 2020), p. 120; Wawryk A, 'Introduction' in Pereira; EG and others (eds), *The Regulation of Decommissioning, Abandonment and Reuse Initiatives in the Oil and Gas Industry: From Obligation to Opportunities* (Wolters Kluwer 2020), p. 16.

[59] Roque G and others, 'Brazil' in Pereira; EG and others (eds), The Regulation of Decommissioning, Abandonment and Reuse Initiatives in the Oil and Gas Industry: From Obligation to Opportunities (Wolters Kluwer 2020), p. 285.

[60] Akin Gump Strauss Hauer & Feld, LLP, AG Speaking Energy, available at: https://www.akingump.com/en/experience/industries/energy/speaking-energy/the-coming-decommissioning-wave-in-southeast-asia-what-to-expect-and-the-relevance-of-experiences-in-the-north-sea-and-us-gulf-of-mexico.html

[61] Escoto Carranza C and Borja Charles A, 'Mexico' in Pereira; EG and others (eds), The Regulation of Decommissioning, Abandonment and Reuse Initiatives in the Oil and Gas Industry: From Obligation to Opportunities (Wolters Kluwer 2020), p. 483-484.

[62] Wawryk A, 'Introduction' in Pereira; EG and others (eds), The Regulation of Decommissioning, Abandonment and Reuse Initiatives in the Oil and Gas Industry: From Obligation to Opportunities (Wolters Kluwer 2020), p. 16.

There are also instances in which the regulatory regime and international contracts between a coastal host state and an international oil and gas company do not include an assignment of the decommissioning obligation. In these cases, the state will be the one obliged to conduct the decommissioning through its oil and gas company.[63]

4.3 Liabilities and default risks

Legal regimes must address the risks related to the failure to fulfil decommissioning obligations. In simple terms, how do legal regimes prevent an operator or owner of an energy infrastructure from simply defaulting on its removal obligation? Naturally, these problems arise whenever the coastal state is not in principle obliged to conduct the decommissioning. Issues related to residual liability, obligations that remain *after* the decommissioning has been completed will be addressed in Section 4.4.

Default risks are quite an important theoretical and practical problem when dealing with decommissioning. The costs of these procedures can be enormous, and even oil and gas majors and super majors have limited funds. Furthermore, with the growing trend of small and specialized firms being used to enhance the recovery of a matured field, the theoretical default risks increase as these firms might be unable to pay the high decommissioning costs.

In any case, whenever an operator or owner of an offshore energy installation fails to comply with its decommissioning obligations there are two main consequences. First, this will lead to a breach of the licensing conditions, triggering contractual liabilities from the company to the coastal state and possibly other parties. Second, the coastal state will have to find a way to conduct the decommissioning as it is obliged to do so by the requirements imposed by Public International Law. If the state is the entity that has to conduct the decommissioning, then the operations will eventually be paid for by taxpayers.

To mitigate and prevent default regarding liability obligations governance systems have sought to find solutions. We identify different approaches that serve the same function and which have been developed in the North Sea and the US. These approaches have been developed for the oil and gas sector and to a minor extend some of them have been replicated to offshore wind regulation.

The first solution is to expand those held liable for decommissioning, including not only the current operator/holder of the licence but also those who are entitled to derive a financial or other benefit from the offshore asset.[64] This solution typically creates joint and several liability which lasts *in perpetuity.* An example of this is the UK regime for oil and gas decommissioning.[65] The Danish regime imposes a joint liability between the different parties under the licence for damages as well as for obligations owed to the state.[66] In Norway, the situation is slightly different. The Norwegian decommissioning sets up a system of joint and several liability for the current owners and licences of the installation in case of damages caused during or after the entity has been decommissioned.[67] Additionally, the Norwegian system creates secondary liabilities in cases of transferred licenses before the decommissioned has taken place. Here the assignor (previous lincecee) will be liable in the case of decommissioning default for the part it held previously, both towards the State and other licencees.

[63] Hunton, Andrews, Kurth LLP, Decommissioning Hydrocarbon Assets: Finding Value in a Shifting Regulatory Landscape (2018), p. 5.
[64] This is the approach done by Section 29 of the UK Petroleum Act of 1998.
[65] Trischmann H, 'Decommissioning Security Agreements' in Pereira; EG and others (eds), The Regulation of Decommissioning, Abandonment and Reuse Initiatives in the Oil and Gas Industry: From Obligation to Opportunities (Wolters Kluwer 2020), p. 121.
[66] Stanescu CG, 'Denmark ' in Pereira; EG and others (eds), The Regulation of Decommissioning, Abandonment and Reuse Initiatives in the Oil and Gas Industry: From Obligation to Opportunities (Wolters Kluwer 2020), p. 330.
[67] §5-4 of the Norwegian Petroleum Act.

Another approach, sometimes used independently or along with expanded liability is to set up cost-sharing mechanisms between the companies or the state, the development of a decommissioning fund to be administered by a third party or requiring resources to be set aside to ensure compliance with the decommissioning obligations.[68] In the case of Norway, for instance, it is common practice to create decommissioning securities at the time an exploration and production licence is granted, or once the decommissioning plan has been submitted.[69] This is done, for example, through the decommissioninig security agreement that regulates secondary liabilities.

Finally, the systems that are applied in the case of licences granted to private or public companies typically include fines and penalties for defaulting on decommissioning obligations. In addition, they might also grant the coastal states power to conduct decommissioning at the licencee's/operator's cost and risk,[70] such as the case of Norway.[71]

Emerging and developing offshore energy markets have looked at existing and previous systems for inspiration as to how to assign decommissioning liability. However, as these systems used production sharing agreements and are often aimed at developing national competence and/or transferring ownership over assets other characteristics have to be considered. For example, decommissioning funds are a common solution. In this system, field operators are obliged to deposit contributions to insure against default in decommissioning, with examples being salient in African and Asian countries such as Indonesia, Tanzania, Mozambique or Ghana.[72]

As mentioned, in the case of production sharing agreements with a public oil and gas company, either the state takes property over the assets and must conduct decommissioning itself or contractors are liable for a fraction of the decommissioning costs; Malaysia is a good example of this.[73] In Malaysia, the country in Asia with the largest number of offshore infrastructures to be decommissioned, operators have to pay annual decommissioning fees into a fund that is owned by Petronas, the national oil and gas company. Petronas uses the money in the fund to conduct the decommissioning itself.[74]

Surprisingly, some countries do not require operators or titleholders of oil and gas licences to guarantee funds to cover decommissioning costs nor to make a contribution to some statutory fund for this. An example of this is Australia.[75] A similar situation arises in other jurisdictions, such as Indonesia, where contracts signed more than 20 years ago do not define who is liable for conducting the decommissioning.[76]

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[68] Hunton, Andrews, Kurth LLP, Decommissioning Hydrocarbon Assets: Finding Value in a Shifting Regulatory Landscape (2018),p. 3.

[69] Ibid,p. 4.

[70] Hunton, Andrews, Kurth LLP, Decommissioning Hydrocarbon Assets: Finding Value in a Shifting Regulatory Landscape (2018),p. 4; Stanescu CG, 'Denmark ' in Pereira; EG and others (eds), The Regulation of Decommissioning, Abandonment and Reuse Initiatives in the Oil and Gas Industry: From Obligation to Opportunities (Wolters Kluwer 2020), p. 330.

[71] §10-16 of the Norwegian Petroleum Act.

[72] Hunton, Andrews, Kurth LLP, *Decommissioning Hydrocarbon Assets: Finding Value in a Shifting Regulatory Landscape* (2018),p. 5; Akin Gump Strauss Hauer & Feld, LLP, AG Speaking Energy, available at: https://www.akingump.com/en/experience/industries/energy/speaking-energy/the-coming-decommissioning-wave-in-southeast-asia-what-to-expect-and-the-relevance-of-experiences-in-the-north-sea-and-us-gulf-of-mexico.html

[73] Hunton, Andrews, Kurth LLP, Decommissioning Hydrocarbon Assets: Finding Value in a Shifting Regulatory Landscape (2018),p. 5.

[74] Akin Gump Strauss Hauer & Feld, LLP, AG Speaking Energy, available at: https://www.akingump.com/en/experience/industries/energy/speaking-energy/the-coming-decommissioning-wave-in-southeast-asia-what-to-expect-and-the-relevance-of-experiences-in-the-north-sea-and-us-gulf-of-mexico.html.

[75] Wawryk A, 'Australia' in Pereira; EG and others (eds), The Regulation of Decommissioning, Abandonment and Reuse Initiatives in the Oil and Gas Industry: From Obligation to Opportunities (Wolters Kluwer 2020), p. 261.

[76] Offshore Technology, Decommissioning Indonesia's oil rigs: a vast but challenging market (2015), available at: https://www.offshore-technology.com/features/featuredecommissioning-indonesias-oil-rigs-a-vast-but-challenging-market-4470226/.

4.4 Residual liability

Licensees, operators and owners of offshore energy structures might be tied by different obligations even after they have conducted the decommissioning process and have disposed of the installations. These obligations, known as residual liabilities, are a significant addition to the planning of decommissioning activity, particularly when these may be in perpetuity or unlimited, as is the case in some circumstances.[77] Residual liabilities will typically include pecuniary responsibility in the form of compensation, but could well involve an obligation to act (i.e. repair the damage, close a leaking well, clean the seabed space, etc).

The logic behind establishing residual liability is manyfold. Operators of offshore energy structures may remove them totally, partially or leave them in place. In any of these circumstances, their activity and what is left behind may cause damage or be a source of significant risk to other users of the sea or the environment. Partially removed installations may catch on vessels, fishing nets or be a source of sea pollution. Wells not properly sealed might leak, leading to potential environmental disasters, and be a source of concern in the North Sea,[78] as well as more common than expected regarding onshore hydrocarbons.[79] Furthermore, if an operator does not have any residual liability, there may be a temptation to cut corners when decommissioning the structure as once the process is completed the operator has no further responsibility for it. Added to which, if there are no residual liabilities, then the state and eventually the taxpayer will bear any associated costs related to damages arising from post-decommissioning activities.

Typically, residual liability exists when the structure has not been fully decommissioned or has simply been left in place. Rather obvious situations are likely to occur in the case of impact with other surfaces, for example. Where a structure has been totally removed, there are fewer risks as structures have been removed from the water column and the seabed. However, even then, it may become apparent after a few years that damage has been done to the seabed due to the installation of columns that supported the wind farms, or because wells have started leaking.

Public international law does not set up specific obligations for residual liabilities. The IMO Guidelines, however, do state that coastal states should ensure that "responsibility for maintenance and the financial ability to assume liability for future damages are clearly established".[80]

National regimes, including those in the North Sea, have resorted to including rules establishing residual liabilities. The general assumption is that entities obliged to conduct the decommissioning will bear the residual liability, unless otherwise agreed. Such is the case, for instance, in the AIPN 2021 Model International Joint Operation Agreement.[81] The UK regime is an example of residual liabilities in perpetuity and of parties being jointly and severally liable.

Issues of residual liability, particularly when in perpetuity and shared among different parties, create disincentives for operators and states alike. They may also be a reason for stakeholders to prefer

[77] Ole NC and others, 'Decommissioning Oil and Gas Installations: The Challenge of Residual Liability' in Pereira; EG and others (eds), *The Regulation of Decommissioning, Abandonment and Reuse Initiatives in the Oil and Gas Industry: From Obligation to Opportunities* (Wolters Kluwer 2020).

[78] Tveit MR and others, 'The fate of hydrocarbon leaks from plugged and abandoned wells by means of natural seepages' 196 Journal of Petroleum Science and Engineering [2021], 108004.

[79] Reuters, Special Report: Millions of abandoned oil wells are leaking methane, a climate menace (2020), available at: https://www.reuters.com/article/us-usa-drilling-abandoned-specialreport-idUSKBN23N1NL; Researching Fracking in Europe (REFINE), ReFINE Briefing Note, available at: http://www.refine.org.uk/media/sites/researchwebsites/1refine/wellsurveyrb/Well%20Survey%20RB.pdf.

[80] Article 3(11) IMO Guidelines.

[81] See articles 3 and 10 of the AIPN 2021 Model International Joint Operation Agreement.

total removal options, being more aligned with the default rule as it is perceived as the solution that generates fewer risks to the environment and other sea users. Unlimited and undefined liabilities may trigger two reactions from operators. First, they might be willing to invest in jurisdictions in which the property of the assets is transferred to the state before or when decommissioning is conducted. Alternatively, operators might wish to shift the responsibility to the coastal state. Transferring responsibility is done to a state body or to the national oil and gas company for a fee, something that is possible in Norway, for example. The 1996 Norwegian Petroleum Act states in §5-4 that "it may be agreed between the licensees and the owners on one side and the State on the other side that future maintenance, responsibility and liability shall be taken over by the State based on an agreed financial compensation". How large such compensation should be is a matter for discussion.

It would seem likely that issues and instances of triggered residual liabilities are more likely to arise in the decommissioning of wind farms than in the case of oil and gas decommissioning projects. Wind farms occupy a much larger space in the sea. The three Dogger Bank wind farm projects, 130 kilometres off the northeastern coast of England, are about the same size as Greater London,[82] home to about 9 million people in 2021. There is a greater risk of accidents or damage to the seabed in the case of partial removal of structures.

4.5 Tax Implications

Decommissioning costs can be very large and are often incurred when an infrastructure is no longer producing revenue. Because of this, decisions regarding when decommissioning costs will be paid or set aside are important. Also, the way coastal states use tax systems to attract offshore energy investment and generate revenue for themselves has implications for decommissioning.

Costs arising from decommissioning activities in the North Sea tend to benefit from the same tax treatment as is applied to hydrocarbon activities: decommissioning expenses may be reclaimed as a tax deduction on their tax return.[83] This allows operators to recoup these costs as losses from profits from their oil and gas activity.

Key questions to be answered by the regulatory regimes have been put forward by the literature.[84] Among these are: What 'costs' are accepted to be deducted? When is the tax obligation determined and when is the benefit accounted for – in the lifetime of the infrastructure or only when decommissioning is being conducted? Lastly, should the tax rate be the same or different from the one applicable during the operational life of the field? Should this tax rate be lower, the same or higher?

Offering tax relief for decommissioning costs may be justified on several grounds. Firstly, these costs are likely to be extremely high and without such offsetting the original investment might never have been made. Secondly, tax relief is only offered when decommissioning activity takes place and when there is no income from the particular field as it has been closed and the structures removed. Thirdly, absent tax relief the risk of the state having to carry the financial decommissioning burden increases and these costs would be borne by the taxpayer eventually.

[82] Reve, Dogger Bank, world's largest offshore wind farm (2021), available at: https://www.evwind.es/2021/05/17/dogger-bank-worlds-largest-offshore-wind-farm/80819.
[83] Trischmann H, 'Decommissioning Security Agreements' in Pereira; EG and others (eds), The Regulation of Decommissioning, Abandonment and Reuse Initiatives in the Oil and Gas Industry: From Obligation to Opportunities (Wolters Kluwer 2020), p. 128.
[84] Andersen RT and Kirkvaag O, 'The Tax Treatment of Decommissioning: The Example of Norway' in Pereira; EG and others (eds), The Regulation of Decommissioning, Abandonment and Reuse Initiatives in the Oil and Gas Industry: From Obligation to Opportunities (Wolters Kluwer 2020), p. 168-169.

However, granting tax relief to decommissioning results in foregone tax revenue which means that society and taxpayers assume part of the financial burden.[85] Thus, ensuring cost savings in decommissioning activities and the maximization of the value of the materials of these offshore structures positively impacts society as fewer resources will be spent.

[85] Wawryk A, 'Introduction' in Pereira; EG and others (eds), The Regulation of Decommissioning, Abandonment and Reuse Initiatives in the Oil and Gas Industry: From Obligation to Opportunities (Wolters Kluwer 2020), p. 17.

PART II

5. Public International Law Perspectives

5.1 Introduction

Under public international law, states are obliged to remove any offshore installations that are abandoned or disused. This obligation was first prescribed by the Convention on the Continental Shelf in 1958, ensuring that energy companies are liable for their infrastructure even after the production stops.[86] The rationale behind rules concerning disposal of installations is primarily connected with navigation safety, as perhaps the main driver,[87] fishing, environmental protection and the rights of other states.[88] In some of them, special emphasis is placed on the importance of the safety of navigation.

Denmark, Norway, the UK and many other nations around the globe have acquired decommissioning obligations by being party to different international treaties. We study the most important of them to understand what the basic governance of decommissioning in public international law is. We focus on the Convention on the Continental Shelf of 1958, the London Convention of 1972, the United Nations Convention on the Law of the Sea (UNCLOS) of 1982 and the Convention for the Protection of the Marine Environment of the North-East Atlantic of 1992 (OSPAR Convention). Our analysis focuses on determining and assessing the obligations imposed by Public International Law to coastal states regarding decommissioning. This will allow us to identify the minimum framework that national regimes must be based on what the implications are for states and operators of offshore energy structures alike.

5.2 1958 Convention on the Continental Shelf

The 1958 Geneva Convention prescribes that the coastal states possess sovereign rights over the continental shelf for the purpose of exploration and exploitation of its natural resources.[89] At the same time, while entitled to extract oil and gas on its shelf, the state cannot enjoy its rights in a way that will lead to unjustifiable interference with navigation, fishing or conservation of living resources.[90]

With regard to decommissioning, although the Convention does not explicitly use this term – nor does any other international legal instrument[91] –Article 5(5) is of crucial importance, as it established an absolute-removal regime for offshore installations:

Due notice must be given of the construction of any such installations, and permanent means for giving warning of their presence must be maintained. *Any installations which are abandoned or disused must be entirely removed*.[92]

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[86] Fowler AM et alia (2018). Environmental benefits of leaving offshore infrastructure in the ocean. *Frontiers in Ecology and the Environment*, *16*(10), p.571.

[87] Article 60(3) of UNCLOS highlights explicitly safety of navigation and "due regard to fishing, the protection of the marine environment and the rights and duties of other States"; the IMO Guidelines, on their part, stress the "potential effect on the safety of surface or subsurface navigation, or of other uses of the sea".

[88] Gao Z, "Current Issues of International Law on Offshore Abandonment, with Special Reference to the United Kingdom," *Ocean Development and International Law 28*, no. 1 (1997): 59-78.

[89] Gutteridge, J. A. C. (1959). The 1958 Geneva Convention on the Continental Shelf. *British Yearbook of International Law*, *35*, 102.

[90] Hamzah BA (2003). International rules on decommissioning of offshore installations: some observations. *Marine Policy*, *27*(4), p. 344.

[91] Ibid, 339.

[92] Article 5 of the Convention on the Continental Shelf, 1958 (emphasis added). Text available at: https://legal.un.org/ilc/texts/instruments/english/conventions/8_1_1958_continental_shelf.pdf

The Convention on the Continental Shelf applies to the abandoned or disused installations on the continental shelf of the contracting parties. The Convention defines the seabed includes "seabed and subsoil of the submarine areas adjacent to the coast but outside the area of the territorial sea",[93] which limits the scope of its application.

The main concern of the Convention on the Continental Shelf in setting this removal obligation is an unjustifiable interference with navigation and other marine uses. At the time of the drafting of the Convention the possible practical advantages or needs that might justify partial removal of installations were not considered.[94]

Despite its clear wording, in the light of developments in international law regarding decommissioning, this convention is of less practical importance and need to be read in conjunction with state practice and more recent conventions regarding decommissioning, which require total removal of the installation only to the extent necessary in order to secure safe passage. This interpretation is generally accepted in international law based on the change of circumstances in the industry and the installation used.[95]

One important unsolved question is whether the Convention on the Continental Shelf applies to wind farms. This international treaty focuses on the exploration and exploitation of natural resources on the continental shelf. An interpretation found in the literature is that as wind installations do not exploit the continental shelf and are placed above it, the removal obligation in the Convention does not apply to wind facilities.[96] At the same time, this interpretation does not seem to take into account the fact that all wind installations are fixed to the seabed, even floating turbines, and they are, therefore, utilizing the seabed.

5.3 1972 London Convention on Dumping

The objective of the 1972 London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other matter[97] is to protect the marine environment from pollution by dumping and prevent hindrance to other legitimate uses of the sea such as fishing and navigation.[98]

The London Convention expressly regulates the disposal of offshore installations. Namely, Article III provides that any deliberate disposal at sea of vessels, aircraft, platforms or other man-made structures is considered to be dumping. Dumping does not include the possibility of deposing an offshore installation for other uses in the sea, such as for artificial reefs as the "placement of matter for a purpose other than the mere disposal thereof, provided that such placement is not contrary to the aims of this Convention".[99]

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[93] 1958 Convention on the Continental Shelf, Article 1(a).

[94] Gao Z, "Current Issues of International Law on Offshore Abandonment, with Special Reference to the United Kingdom," *Ocean Development and International Law 28*, no. 1 (1997), p. 60.

[95] https://www.adeb.no/globalassets/nyheter/decommissioning_norway.pdf

[96] Fink CS (2005). *The International Regulation of Offshore Wind Farms: under the 1982 Law of the Sea Convention (UNCLOS)*, p. 36.

[97] Full text available at: https://www.imo.org/en/OurWork/Environment/Pages/London-Convention-Protocol.aspx

[98] Ijlstra T. (1989). Removal or disposal of offshore installations? *Marine Pollution Bulletin*, *20*(11), 544.

[99] Article III.1(b)(ii) of the London Convention. For more on artificial reefs see, inter alia, OSPAR Guidelines on Artificial Reefs in relation to Living Marine Resources (Reference number: 2012-32); Jørgensen D. (2012). OSPAR's exclusion of rigs-to-reefs in the North Sea. *Ocean & Coastal Management* , 58; Nordquist M. H., Chircop A., Long, R., and Moore, J. N. (Eds.). (2013). Regulation of continental shelf development: Rethinking international standards (Brill), p. 269; de La Fayette L. (1999). New developments in the disposal of offshore installations. *International Journal of Marine and Coastal Law*, 14(4), 531; Soldal A.V., Humborstad O.B., Løkkeborg S., Svellingen I., Jørgensen T. (1999). Decommissioned oil platforms as artificial reefs. *Etterlatte oljeplattformer*

It worth noting that the terms «dumping» and «decommissioning» are interconnected but not interchangeable. Decommissioning is a complex process consisting of multiple stages such as planning, approval and implementation, while «dumping» is a deliberate disposal of the installation at sea, which is prohibited by international law as it is done without meeting certain requirements and obtaining necessary permits.[100]

The London Convention was expanded in 1996 with the adoption of its Protocol. This instrument expanded the definition of dumping by adding in Article 1 para 4.1: "any abandonment or toppling at site of platforms or other man-made structures at sea, for the sole purpose of deliberate disposal". With the expanded definition, the Convention now specifically covers the abandonment or toppling of installations. Under this provision, it is not the placing of the structure but the purpose of the placement that determines whether or not it is dumping.[101]

It is also important for our discussion that the Protocol in this same Article 1 contained a new exception to dumping. According to the provision, the "abandonment in the sea of matter (e.g. cables, pipelines and marine research devices) placed for a purpose other than the mere disposal thereof" will not be dumping.

Furthermore, the 1996 Protocol outlines the regime for what is permitted to be abandoned at sea. The current approach is that the dumping of any waste is *prohibited* except for those listed in the Protocol's Annex 1. Even then the dumping of waste requires a permit. However, great consideration must be given to environmentally preferable alternatives to avoid dumping.[102] The permit must be refused if the respective authority finds that an appropriate opportunity exists to re-use, recycle or treat the waste without undue threats to human health, the environment or disproportionate costs.[103]

All abandoned and disused installations that are placed in marine waters other than internal ones fall under the provision of the London Convention and its Protocol. In their internal waters, states should either apply the Convention or adopt their own measures to control dumping.

5.4 1982 UN Convention on the Law of the Sea

UNCLOS[104] is a comprehensive international treaty on marine governance which covers almost all legal aspects of uses of the sea: navigation, resource exploitation and exploration, marine environment, shipping, etc.[105] Among this extensive codification of rules applicable to the sea, UNCLOS includes provisions on the removal of offshore installations. The solution here is different to the total removal rule included in the 1958 Convention on the Continental Shelf.

Article 60.3 creates a default rule of preferred total removal but allows for exceptions. This provision states:

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som kunstige fiskerev. Fisken og havet, Report No. 1-1999. Institute of Marine Research. Bergen; Fowler AM et alia (2018). Environmental benefits of leaving offshore infrastructure in the ocean. *Frontiers in Ecology and the Environment*, 16 (10).

[100] Pereira E, Wawryk A, Trischmann H, Banet C and Hall K (eds), *The Regulation of Decommissioning, Abandonment and Reuse Initiatives in the Oil and Gas Industry: From Obligation to Opportunities* (Kluwer Law International, 2020), p.27.

[101] Lyons Y. (2014). The new offshore oil and gas installation abandonment wave and the international rules on removal and dumping. *International Journal of Marine and Coastal Law*, 29(3), p. 487.

[102] Article 4 of the 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972.

[103] Annex 2 of the 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972.

[104] United Nations Convention on the Law of the Sea, 1982. Full text available: https://www.un.org/depts/los/convention_agreements/texts/unclos/unclos_e.pdf

[105] Hamzah BA (2003). International rules on decommissioning of offshore installations: some observations. *Marine Policy*, *27*(4), p. 344.

"Any installations or structures which are abandoned or disused *shall be removed* to ensure safety of navigation, taking into account any generally accepted international standards established in this regard by the competent international organization. Such removal shall also have due regard to fishing, the protection of the marine environment and the rights and duties of other States. *Appropriate publicity shall be given to the depth, position and dimensions of any installations or structures not entirely removed*", (emphasis added).

This removal requirement also applies "mutatis mutandis to artificial islands, installations and structures on the continental shelf", pursuant to Article 80 of UNCLOS.

It stems from Article 60.3 of UNCLOS that the removal of abandoned installations is principally to avoid a possible threat to navigation. In addition, removal is required because of the negative impact these installations may have on the environment, fishing and the rights of other states.

A comparison between the obligations for decommissioning in UNCLOS with those in Article 5(5) of the Continental Shelf Convention shows that a different standard is required by law. From the formulation of Article 60, it is evident that UNCLOS does not impose an absolute obligation to remove all installations completely; in certain cases, when the safety of navigation is ensured, structures can be partially removed or left in place.[106] This is in contrast to the full removal obligation imposed by the Convention on the Continental Shelf.

This issue, however, is partially resolved. UNCLOS has a prevailing status over the Geneva Conventions on the Law of the Sea of 1958, which includes the Convention on the Continental Shelf. However, this supremacy applies only to states party to both instruments.[107] States that are not party to UNCLOS but are party to the Convention on the Continental Shelf need to comply with a full removal. That said, this incompatibility between a complete removal requirement and the possibility of partial removal makes a comprehensive and conclusive resolution to the problem necessary.[108]

Pipelines and cable decommissioning remain unaddressed in UNCLOS. It is not clear in the provisions and the literature whether they are considered to be a part of the installation and whether they need to be removed or can be left in place.[109] The only provision regarding pipelines is Article 79 which sets out the right of all states to lay submarine cables and pipelines on the continental shelf with due regard to cables or pipelines already in a position that could be used or repaired.

The provisions of Articles 60 and 80 on decommissioning obligations only apply to the exclusive economic zone (EEZ) and the continental shelf (CS) of the contracting parties. UNCLOS does not include obligations for the states in the maritime zones under the sovereignty of the coastal state: the territorial sea, archipelagic waters or internal waters, which is the same solution as the one adopted in the Convention on the Continental Shelf.

5.5 1992 OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic

The OSPAR Convention of 1992, to which Denmark, Norway and the UK are party, sets a common collaborative framework for the environmental protection of the North-East Atlantic ocean. The OSPAR

[106] Trevisanut S. (2020). "Chapter 18 Decommissioning of Offshore Installations: a Fragmented and Ineffective International Regulatory Framework". In *The Law of the Seabed*. Leiden, The Netherlands: Brill | Nijhoff.
[107] Article 311 of UNCLOS.
[108] Gao Z, "Current Issues of International Law on Offshore Abandonment, with Special Reference to the United Kingdom," *Ocean Development and International Law 28*, no. 1 (1997), p. 71.
[109] Nordquist M. H., Chircop A., Long, R., and Moore, J. N. (Eds.). (2013). Regulation of continental shelf development: Rethinking international standards (Brill), p. 262.

Convention also deals with aspects related to dumping and decommissioning. Unlike UNCLOS, the main focus for the obligation to decommission installations is based on the idea of protecting the environment and preventing marine pollution.

The OSPAR Convention imposes a general obligation to protect the environment. The states will, therefore:

> "take all possible steps to prevent and eliminate pollution and shall take the necessary measures to protect the maritime area against the adverse effects of human activities so as to safeguard human health and to conserve marine ecosystems and, when practicable, restore marine areas which have been adversely affected".[110]

Additionally, Article 5.1 of Annex III on the prevention and elimination of pollution from offshore sources prescribes an obligation to ensure that no disused offshore installation is dumped without authorization:

No disused offshore installation or disused offshore pipeline shall be dumped and no disused offshore installation shall be left wholly or partly in place in the maritime area without a permit issued by the competent authority of the relevant Contracting Party on a case-by-case basis. The Contracting Parties shall ensure that their authorities when granting such permits shall implement the relevant applicable decisions, recommendations and all other agreements adopted under the Convention.

These general provisions are complemented by a specific Decision, adopted under the OSPAR Commission and decision-making mechanism dealing with the disposal and decommissioning of offshore installations, including those related to energy. The Decision referred to is OSPAR Decision 98/3 of 1998.[111]

[110] Article 2.1(a) of the OSPAR Convention.

[111] OSPAR Decision 98/3 on the Disposal of Disused Offshore Installations (1998), available at https://www.ospar.org/documents?v=6875.

5.5.1 Ospar Decision 98/3

The Brent Spar was an oil storage facility operated by Shell UK. In 1995 Shell decided to dispose of the Spar in deep water, the initial plan was later authorized by the UK Government. This decision had been strongly criticized by the general public and a strong campaign was initiated by Greenpeace International in order to stop the deep-water disposal of the installation. Subsequent events led Shell to change the decision and dismantle the installation on land. Source: Petter Osmundsen and Ragnar Tveteras, 2003) Picture credit: AP.

Following the Brent Spar incident in the North Sea, OSPAR states decided to adopt new rules on the disposal of offshore installations.[112] This led to the adoption of the OSPAR Decision 98/3 on the disposal of disused offshore installations. Article 2 of the Decision clearly states that the "dumping, and the leaving wholly or partly in place, of disused offshore installations within the maritime area *is prohibited*".[113]

As it can be seen, Decision 98/3 refers to the structures in the «maritime area». In the understanding of the OSPAR Convention, the maritime area as «the internal waters and the territorial seas of the Contracting Parties, the sea beyond and adjacent to the territorial sea under the jurisdiction of the coastal state to the extent recognised by international law, and the high seas, including the bed of all those waters and its subsoil».[114] Consequently, the geographical scope of the OSPAR Convention and Decision 98/3 covers the internal waters, territorial sea, EEZ and CS of the Contracting States.

As a rule, the OSPAR Decision 98/3 prohibits leaving in place any offshore installation. However, Decision 98/3 does not apply to pipelines or cables or any installation located below the surface of the seabed.[115]

Some categories of disused installations are eligible for less than complete removal, meaning that they can be left in place at least partially.[116] These exceptions can be made based on environmental and technical assessments.[117] Article 3 of the Decision 98/3 prescribes three possible derogations from the general rule:

[112] Osmundsen P, and Tveterås R (2003). Decommissioning of Petroleum Installations—Major Policy Issues. *Energy policy*, *31*(15), 1581.
[113] Article 2 OSPAR Decision 98/3, emphasis added.
[114] Article 1(a) of the OSPAR Convention.
[115] Para 1(c) of the Decision excludes any part of an offshore installation which is located below the surface of the sea-bed from the definition of the "disused offshore installation". See also: Hughes WE (2016). Fundamentals of International Oil & Gas Law PennWell, p. 399.
[116] Park PD (2002). *Energy Law and the Environment*. Taylor & Francis, 59.
[117] Annex 2 of the OSPAR Decision 98/3.

"a. all or part of the footings of a steel installation in a category listed in Annex 1, placed in the maritime area before 9 February 1999, to be left in place;

b. a concrete installation in a category listed in Annex 1 or constituting a concrete anchor base, to be dumped or left wholly or partly in place;

c. any other disused offshore installation to be dumped or left wholly or partly in place, when exceptional and unforeseen circumstances resulting from structural damage or deterioration, or from some other cause presenting equivalent difficulties, can be demonstrated."

Decommissioning of the Norwegian Frigg field was completed in 2012 following a decision by the OSPAR Commission. The installations were partially removed in accordance with the decommissioning plan, leaving the concrete gravity-based structure (GBS) in place while the rest of the installations were brought to land for further disposal and recycling.

The decision was subject to an OSPAR derogation case, and the solution of partial abandonment met no objections from OSPAR contracting parties. The remaining GBS structure (TCP2 Frigg) is equipped with navigation lights in compliance with recommendations from IMO under the UNCLOS.

Further developing this exception, the OSPAR Decision 98/3 applies the same 'reverse listing' approach as the 1996 London Protocol. Only a limited group of exceptions based on the type of installations may be disposed of at sea.[118] These are listed in Annex 1 of the OSPAR Decision 98/3:

"a. steel installations weighing more than ten thousand tonnes in air;

b. gravity based concrete installations;

c. floating concrete installations;

d. any concrete anchor-base which results, or is likely to result, in interference with other legitimate uses of the sea."

Only after a procedure has been followed may a state grant permission to leave the structure in place. This involves a consultation process and the development of an assessment to determine if the extremes demanded in Annex 2 of the Decision 98/3 are met. The aim of the assessment is to consider the potential impact on the environment and on other legitimate uses of the sea. Also, consideration ought to be given to the circularity aspects, including the possibilities of reuse, recycling and disposal options, of the decommissioning.

In 2019, the first special consultative meeting was held under Annex 3 of the OSPAR Decision 98/3. The meeting discussed the UK's decision to issue a permit for leaving in place the Brent field gravity-based concrete installations Brent Bravo, Brent Charlie and Brent Delta and the footings of the Brent Alpha Steel Jacket. The operator, Shell UK Limited, stated that after exploring potential reuse options they were not considered credible due to the age and distance from shore of the platforms.
The formal objection to the abandonment of the installations was raised by Germany in April 2019. The German government expressed its concerns about the methodology of assessment used and the possible threats to the marine environment, shipping and fishing due to the hazardous substances and oil residues left in the cell tank structures. The German position was supported by Belgium, the European Union, the Netherlands and Sweden.

This assessment is done in combination with a 32-week consultation procedure between all the OSPAR parties and conducted following Annex 3 of the Decision 98/3. If any state party to the OSPAR Convention raises an objection, mutual consultations start to address its

[118] de La Fayette L. (1999). New developments in the disposal of offshore installations. *International Journal of Marine and Coastal Law,* 14(4), 529.

concerns. However, the objections of other parties are not of a binding nature, meaning that the state in question is required to "consider ... any views expressed by Contracting Parties" but is not obliged to follow them.[119]

All permits for dumping or leaving installations in place must be issued following the conditions set out in Annex 4. Every permit should specify the terms and conditions of the disposal and should provide a framework for assessing and ensuring compliance. Annex 4 also establishes the requirements for the implementation reports that the Contracting Party must submit to the Commission in accordance with paragraphs 9 and 10 of the Decision. In this way, the OSPAR Commission will constantly be updated on the number of installations under the jurisdiction of contracting member states.[120]

5.6 1989 Internationl Maritime Organization Guidelines

5.6.1 Introduction

In 1989 the IMO, as part of its powers,[121] adopted the Guidelines and Standards for the Removal of Offshore Installations and Structures on the Continental shelf and in the Economic Exclusive Zone[122] on the basis of the above-mentioned Article 60(3) of UNCLOS.[123]

Although the Guidelines are a soft law instrument they are quite influential in decommissioning practices, as also seen in their incorporation into national standards and practices. Moreover, they have been praised for their flexibility,[124] and serve as a stepping stone for the development of legally binding instruments.[125]

The IMO Guidelines, like the OSPAR Decision 98/3, allow a number of possible derogations to the general obligation of removal. These derogations can only be granted on a *case-by-case basis* for large structures after a series of factors are considered, namely: safety, navigation in the area, natural conditions, effect on the marine environment, costs, new possible uses, etc. By adopting this mixed approach to removal, the Guidelines balance costs, risks, technical capacity and the environmental effects of the decision.[126]

Elements of circularity are also included in the Guidelines. Since 1 January 1998, the Guidelines have recommended not placing installations on any continental shelf or in any EEZ unless the design and construction of the installation or structure are such that entire removal upon abandonment or permanent disuse would be feasible. Also, they allow the possibility of using disused installations as artificial reefs, on condition that they are located away from traffic lanes and comply with standards and guidelines on maintaining maritime safety.

[119] Ole N, and Faga HP (2017). Assessing the Impact of the Brent Spar Incident on the Decommissioning Regime in the North East Atlantic. *Hasanuddin Law Review*, *3*(2), 146.
[120] de La Fayette L (1999). New developments in the disposal of offshore installations. *International Journal of Marine and Coastal Law*, 14(4), 529.
[121] Article 15(j) of the 1948 Convention on the International Maritime Organization
[122] The IMO Guidelines are available at: https://wwwcdn.imo.org/localresources/en/KnowledgeCentre/IndexofIMOResolutions/AssemblyDocuments/A.672(16).pdf
[123] Kasoulides GC (1989). Removal of offshore platforms and the development of international standards. *Marine Policy*, *13*(3), p. 249.
[124] Henry CH (1985). *The Carriage of Dangerous Goods by Sea: The Role of the International Maritime Organization in International Legislation*. Frances Pinter, London, p. 82.
[125] Hassan D, Kuokkanen T, and Soininen N (2015). *Transboundary marine spatial planning and international law*, p. 86.
[126] Hughes WE (2016). Fundamentals of International Oil & Gas Law PennWell, p. 396.

Source: Pexels

5.6.2 What needs to be removed?

The Guidelines apply to the installations and structures on the continental shelf and in the EEZ. All abandoned or disused offshore installations standing in less than 75 metres of water (100 metres from 1998) and weighing less than 4,000 tonnes should be entirely removed. In exceptional cases of an unobstructed water column no less than 55 metres above any partially removed installation should be ensured. In a similar fashion to, UNCLOS and the OSPAR Convention, the Guidelines do not cover the issue of decommissioning pipelines and cables.

Large structures may be left in place or partially removed, according to Paragraph 3.4 of the Guidelines, subject to particular conditions. One of these is if it will serve a new use such as enhancement of a living resource; or if leaving it in place would not cause unjustifiable interference with other uses of the sea. Additionally, pursuant to Paragraph 3.5, where entire removal is not technically feasible or would involve extreme cost, or unacceptable risk to personnel or the marine environment, the coastal state may determine that it need not be entirely removed.

As for their application to wind facilities, the Guidelines state that "the standards should be applied to existing as well as future installations or structures", which is open to interpretation that wind farms are also covered by them by analogy.[127] That said, the wording of the Guidelines appears to be aimed at the regulation of petroleum activities (which is understandable given the time of their adoption). Most offshore wind farms (i.e. each individual turbine) would probably fall under a requirement of full removal based on their height and depth as well as their weight.[128]

The fact that the issue of pipeline decommissioning is not addressed and the poor coverage of fisheries can, however, be subjects of criticism.[129] It was also noted that the Guidelines do not provide guidance on the methods to be used for complete removal, they focus more on laying down the principles of partial or nonremoval.[130]

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[127] Fink CS (2005). *The International Regulation of Offshore Wind Farms: under the 1982 Law of the Sea Convention (UNCLOS)*, p. 37.

[128] Smyth K, Christie N, Burdon D, Atkins JP, Barnes R, and Elliott M (2015). Renewables-to-reefs? – Decommissioning options for the offshore wind power industry. *Marine pollution bulletin*, *90*(1-2), p. 250.

[129] Gao Z, "Current Issues of International Law on Offshore Abandonment, with Special Reference to the United Kingdom," *Ocean Development and International Law 28*, no. 1 (1997), p. 71.

[130] Kasoulides GC (1989). Removal of offshore platforms and the development of international standards. *Marine Policy*, *13*(3), p. 262.

5.6.3 Removal Standards

According to the IMO Guidelines, when making a decision about the removal of installation, the following standards should be taken into account:

"3.1 All abandoned or disused installations or structures standing in less than 75m of water and weighing less than 4,000 tonnes in air, excluding the deck and superstructure, should be entirely removed.

3.2 All abandoned or disused installations or structures emplaced on the sea-bed on or after 1 January 1998, standing in less than 100m of water and weighing less than 4,000 tonnes in air, excluding the deck and superstructure, should be entirely removed.

3.3 Removal should be performed in such a way as to cause no significant adverse effects upon navigation or the marine environment. Installations should continue to be marked in accordance with IALA recommendations prior to the completion of any partial or complete removal that may be required."

The standards also require a duty of maintenance, as per Paragraph 3.6. According to this provision “any abandoned or disused installation or structure, or part thereof, which projects above the surface of the sea should be adequately maintained to prevent structural failure”. When partial removal is allowed, but there is no part of the installation projects above the surface, an unobstructed water column sufficient to ensure the safety of navigation, but not less than 55 metres, should be provided.

6. Decommissioning in Denmark

6.1 Oil and gas decommissioning

6.1.1 Background to the industry

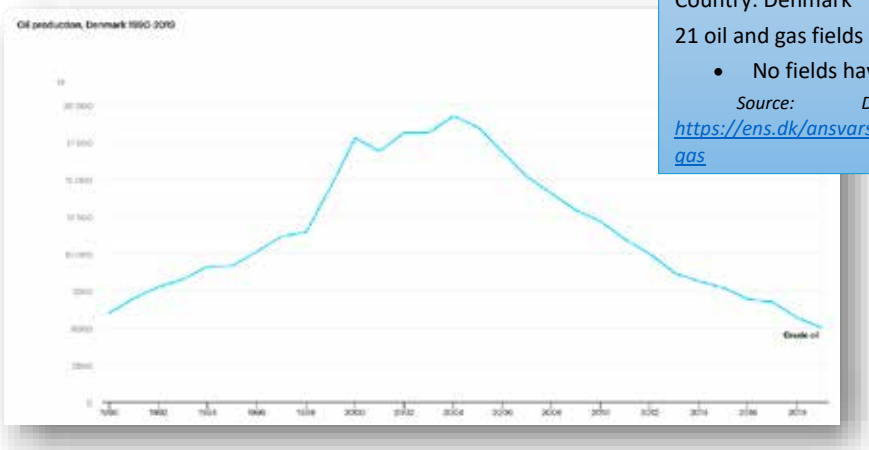
The Kingdom of Denmark has traditionally been one of the largest oil producers in Europe.[131] Since 2004, which was the peak year for oil production in Denmark, production has been declining.

Country: Denmark

21 oil and gas fields and 55 platforms

- No fields have been decommissioned

Source: Danish Energy Agency: https://ens.dk/ansvarsomraader/olie-gas/om-olie-og-gas



Source: https://www.iea.org/fuels-and-technologies/oil

Denmark has been producing oil and gas since 1972 and the revenue from it has contributed significantly to the state's economy and the welfare of its citizens.[132] Denmark was a net exporter of oil and natural gas from 1997 to 2018. Denmark is now a net importer of oil and forecasts show that Denmark could continue as a net exporter of gas until the mid-2030s.[133] In 2021 more than 55 platforms in 21 different fields are producing oil and gas in the Danish part of the North Sea.

In an agreement between the government and five other parties in the Danish parliament, Folketinget, on 3 December 2020,[134] it was decided that Danish production of oil and gas must end by 2050. Even though the earliest oil and gas fields have been active for more than 50 years, no facilities have yet been decommissioned.

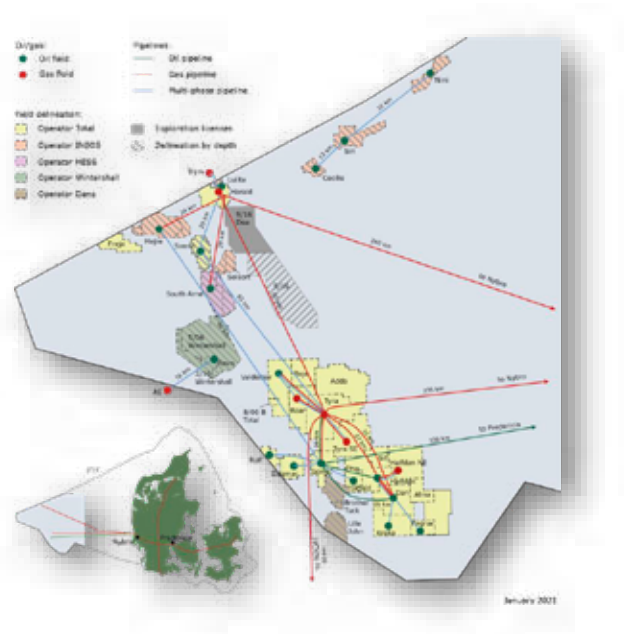
[131] World Atlas, The Top Oil Producing Nations In Europe, available at: https://www.worldatlas.com/articles/the-top-oil-producing-nations-in-europe.html.

[132] Danish Energy Agency, About oil and gas, available at: https://ens.dk/en/our-responsibilities/oil-gas/about-oil-and-gas.

[133] Danish Energy Agency, Om olie og gass, available at: https://ens.dk/ansvarsomraader/olie-gas/om-olie-og-gas.

[134] Aftale mellem regeringen (Socialdemokratiet),Venstre, Dansk Folkeparti, Radikale Venstre, Socialistisk Folkeparti og Det Konservative Folkepartiomfremtiden forolie-og gasindvinding i Nordsøen (3 December 2020), available at: https://kefm.dk/Media/0/3/Nords%C3%B8aftale%20(2).pdf.

Oil exploration and extraction have been regulated in Denmark since 1932.[135] Entities that wish to conduct hydrocarbon activity are required to have a licence from the Danish state. The licence grants a company or a group of companies the right to explore and extract oil and gas in a given area in the Danish subsoil. In practice, licensees operate on the basis of a Joint Operating Agreement (JOA) in which the Danish North Sea Fund will always be a part.[136]



Danish oil fields in the North Sea (January 2021) Source: *https://ens.dk/sites/ens.dk/files/OlieGas/anlaeg_felter_eft-tilladelser_i_nordsoen_2021_eng.png*

6.1.2 Governance of Decommissioning in Denmark

The decommissioning of the offshore oil and gas installations in Denmark is primarily regulated by the Act on the Use of the Danish Subsoil (Subsoil Act), last modified in 2019.[137] Other binding obligations related to decommissioning are found in the Model Licence and the applicable Joint Operating Agreement (JOA). Other Danish laws and regulations affect decommissioning, such as the Offshore Safety Act and Environment Protection of the Sea Act. Additionally, Denmark developed some Guidelines on Decommissioning Plans for Offshore Oil and Gas Facilities or Installations in 2018, published by the Danish Energy Agency (DEA).[138]

The Danish Ministry of Energy, Utilities and Climate is the regulator of offshore activities under Danish jurisdiction. The Subsoil Act authorizes the ministry to delegate its regulatory authority to the DEA, pursuant to §37 of the Subsoil Act. The DEA exercises most of the ministry's regulatory power, including the approval and oversight of decommissioning plans and activities.

The Danish system resorts to a default full removal obligation. This is established both in the Subsoil Act and the Model Licence as "*all facilities and installations, etc. comprised by the application*" must be removed.[139] Exceptions can be made if some of the "wells, pipelines or parts of processing plant are withdrawn from operation, but the primary function is continued".[140] Partial decommissioning is only

[135] Stanescu CG, 'Denmark' in Pereira; EG and others (eds), The Regulation of Decommissioning, Abandonment and Reuse Initiatives in the Oil and Gas Industry: From Obligation to Opportunities (Wolters Kluwer 2020), p. 319.
[136] Ibid.
[137] Bekendtgørelse af lov om anvendelse af Danmarks undergrund (Act on the Use of the Danish Subsoil), LBK nr 1533 af 16/12/2019, English translation available at: https://ens.dk/sites/ens.dk/files/OlieGas/consolidated_act_no._1190_of_21_september_2018_in_the_use_of_the_danish_subsoil.pdf
[138] Section 32a: Guidelines on decommissioning plans for offshore oil and gas facilities or installations (7 August 2018). English version available: https://ens.dk/sites/ens.dk/files/OlieGas/20180808_afviklingsvejledning_ss32_a_english.pdf
[139] The 8th license round Model License, section 37 (6).
[140] Section 32a: Guidelines on decommissioning plans for offshore oil and gas facilities or installations, p. 4.

accepted if the partial decommissioning plan is in accordance with the overall decommissioning plan for the entire development.[141]

In the Danish system, the licensees are the parties ultimately responsible for conducting the decommissioning of the installation, even if they are not the owners of it.[142] Furthermore, as licensees, they are obliged to provide security for the fulfilment of all the licence obligations,[143] including decommissioning, and be covered by adequate insurance.[144]

Health, safety and environmental aspects are taken into account in Danish decommissioning. The Offshore Safety Act §56 states that decommissioning a fixed installation, connected infrastructure or pipeline shall be planned and carried out to ensure that health and safety risks and risks of major environmental incidents connected with the work are identified, assessed and reduced to as low a level as reasonably practicable. The terms used in this section are vague and may be an indication of the case-by-case approach of the DEA when assessing decommissioning cases.[145]

The main requirements for the decommissioning of offshore oil and gas facilities are contained in §32a of the Subsoil Act. Pursuant to this provision, when applying for a licence to conduct oil and gas exploration and production activities, the parties must attach a plan for the decommissioning of all facilities and installations included in the application. The decommissioning plan must also include previous facilities and installations, etc., that were approved under the licence covered by the Subsoil Act that the application concerns.[146] As we shall discuss further, this first plan is subsequently followed by a 'final decommissioning plan' which has to be submitted to the DEA two years before the decommissioning starts.[147] Decommissioning plans are also expected to be updated during the lifetime of the installation.[148] As the plan is made so far in advance of its implementation, the Guidelines suggest making a distinction between early decommissioning plans (with decomissioning options described in as much detail as possible) and final decommissioning plans (with decommissioning methods selected based on completed technology and cost assessments, environmental assessments and sanctions licences). This means that the DEA expects the decommissioning plans to gradually get more detailed as the licence period progresses.[149]

Decommissioning must take place within a period of 50 years once the licence is granted, based on the maximum length of a petroleum licence.[150] Exceptions to this 50-year rule are possible pursuant to the Guidelines on a case-by-case assessment.

This requirement to include a decommissioning plan with the licence application for exploration and production activity was first introduced in an amendment to the Subsoil Act in 2015.[151] This requirement was applied retrospectively to licences granted before the inclusion of the requirement. Licensees were given three years to submit their decommissioning plan to the Ministry, from 19 July 2015.[152] As a consequence, all licensees should now have constructed and submitted a decommissioning

[141] Section 32a: Guidelines on decommissioning plans for offshore oil and gas facilities or installations, p. 5.
[142] Model license, s. 37 §6.
[143] Part 7a of the Subsoil Act 2019; Model license, s. 32.
[144] Part 7a §24(3) of the Subsoil Act 2019.
[145] Stanescu CG, 'Denmark' in Pereira; EG and others (eds), The Regulation of Decommissioning, Abandonment and Reuse Initiatives in the Oil and Gas Industry: From Obligation to Opportunities (Wolters Kluwer 2020), p. 325.
[146] The Subsoil Act 2019, section 32a.
[147] Section 32a: Guidelines on decommissioning plans for offshore oil and gas facilities or installations, p. 4 d)
[148] Ibid, p. 7.
[149] Ibid, p. 7.
[150] §6 of the Subsoil Act 2019; Section 32a: Guidelines on decommissioning plans for offshore oil and gas facilities or installations, p. 5 i). See also: Stanescu CG, 'Denmark' in Pereira; EG and others (eds), The Regulation of Decommissioning, Abandonment and Reuse Initiatives in the Oil and Gas Industry: From Obligation to Opportunities (Wolters Kluwer 2020), p. 324-325.
[151] The Subsoil Act 2019, section 32a.
[152] The Subsoil Act 2019, section 32a (4).

plan, giving the Danish authorities a clear insight into the decommissioning processes of all Danish offshore petroleum facilities.

The Decommissioning Guidelines from the DEA define the decommissioning timeline. No later than two years before the licensee starts to decommission the facilities and installations, a plan for the final decommissioning project must be submitted to the DEA, including a detailed description of what decommissioning method has been chosen and the associated environmental assessments.[153] After approving the decommissioning project, the licensee must start decommissioning before three years.[154] Installations must be decommissioned within three years from the termination of operations, whereas subsea installations must be decommissioned within five years.[155] The final decommissioning plan cannot begin until it has been approved by the DEA.

> According to §32a(2) of the Subsea Act, the "decommissioning plan shall include a calculation of the estimated expenses for implementing the decommissioning plan and a description of how security will be provided for availability of the funds necessary for implementing the decommissioning plan. The decommissioning plan shall be approved by the Minister for Climate, Energy and Utilities. The Minister may lay down terms and conditions for such approval."

In addition to these general requirements, pursuant to §32 of the Subsoil Act, the licensee must also provide an estimate of the expected costs of implementing the decommissioning plans. Furthermore, it must describe how and when they guarantee the necessary funds for implementing the decommissioning plan will be available.[156]

6.1.3 What needs to be decommissioned and how?

As previously mentioned, *all the facilities and installations included in the application,* both in the current application and any other previously approved, must be decommissioned.[157] The wording may suggest that every single installation that has ever been built *in situ* must be removed to the extent that the soil and subsoil are in their natural state. The same wording is used in the Model Licence.[158]

However, this is just a starting point and general default rule. The Decommissioning Guidelines lay down more detailed requirements for the decommissioning plans, stating more specifically what needs to be decommissioned and how, as we discuss below. According to the Guidelines, the DEA may require the licensee to remove all or part of any facility, etc. that the state does not wish to take over under subsections (1)–(5) in §37 of the Model Licence, irrespective of whether or not such facilities are the property of the licensee.[159]

Furthermore, the Guidelines require the decommissioning plans to be accompanied by a list of all the wells, pipelines and installations to be decommissioned. The list must include all installations previously or currently forming a part of the development in question. In addition, the lists must specify which installations, or parts of installations, are to be removed, converted to another use or to continue

[153] Section 32a: Guidelines on decommissioning plans for offshore oil and gas facilities or installations, p. 4 d)
[154] Ibid, p. 4 d)
[155] Ibid, p. 4 f)
[156] Ibid, p. 2.
[157] Subsoil Act section 32a (1).
[158] 8th license round Model License, section 37 (6).
[159] 8th license round Model License, section 37 (6) and Decommissioning Guidelines, p. 9

in operation as part of another installation. Finally, the list must give a description of the installations, or parts of installations, that are to be decommissioned *in situ* (meaning left in place).[160]

The lists of said installations must also contain additional information: the time of installation, the operating status until the date of decommissioning and any previous decommissioning method.[161] The lists must also specify the type of installation, material, surface treatment, weight, dimensions and geographical position of the various parts. Lastly, the decommissioning plan must include a layout plan showing the position of all installations.

The Guidelines insist on a principle of the application of best practices regarding the decommissioning options suggested by the licensee, based on the installations in existence at the current time (also including planned facilities), available technologies, prevailing market conditions and applicable legislation.[162] Plans must also describe the general decommissioning principles and concepts being followed and must as far as possible delimit the selected methods, estimating the costs based on this assessment.

The decommissioning plan must justify the choice of the decommissioning methods selected. This is required for pipelines and other types of installations listed in Annex I of the OSPAR Convention.[163] The various methods of decommissioning wells are described in the DEA Guidelines for Drilling. The Guidelines require wells that are to be closed permanently to be decommissioned within three years from the date of closure.[164] If this is not done the licensee must submit a reason for the postponement to the DEA. The DEA also requires the foundations, framework poles and wells to be removed or cut down below the seabed level.[165] There are no specific requirements as to the depth to which the licensee must remove installations. However, decommissioning plans must state the depth to which installations are to be removed and must take into account the precise state of the relevant seabed area, such as current conditions, erosion risks and free spans.

As previously discussed, the OSPAR Convention does not cover pipelines, which is remarked by the DEA in the Guidelines.[166] The DEA, therefore, assesses the need to remove them on a case-by-case basis by assessing the impact if they are left in place (*in-situ decommissioning*). The DEA requires any in-situ decommissioning of pipelines to be justified by a comparative assessment. Pursuant to the assessment it may request the pipelines to be removed if warranted by societal, environmental or economic considerations.

Additionally, all offshore in-situ decommissioning of installations must be justified based on a Comparative Assessment evaluating all available decommissioning methods with the one selected.[167] As mentioned, the comparison is done based on the criteria laid down in Annex II of the OSPAR Convention. The OSPAR Convention lists five main criteria, though these are not exhaustive according to the Guidelines[168]:

- Technical complexity
- Safety considerations

[160] The Decommissioning Guidelines defines in-situ decommissioning as "termination of operation of pipeline or an installation where the structure is emptied, cleaned, insulated and left to disintegrate. The OSPAR Convention restricts the installations that may be left in place offshore".
[161] Section 32a: Guidelines on decommissioning plans for offshore oil and gas facilities or installations, p. 9.
[162] Ibid, p. 6.
[163] Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) 1992, Annex I
[164] Section 32a: Guidelines on decommissioning plans for offshore oil and gas facilities or installations, p. 9.
[165] Ibid, p. 9.
[166] Ibid, p. 10.
[167] Ibid, p. 10.
[168] Ibid, p. 10.

- Environmental considerations
- Societal interest
- Economy.

6.1.4 Environmental and circular considerations

Before implementing decommissioning, the licensee must submit an Environmental Impact Assessment, and the DEA must approve the report. Until that point, decommissioning plans may be based on screening the environmental impact of the decommissioning options that are considered feasible or appropriate or on the environmental impact report available for the production or operation licence if such licence includes the decommissioning methods. The Environmental Impact Assessment Regulations set out the requirements for the Environmental Impact Assessment.[169]

Additionally, the Guidelines require the licensee to include the decommissioning procedures and a list of materials and chemicals to be re-used, recycled or disposed of, categorized under the Environmental Protection Agency's instructions for waste management. In addition, the plan must include an assessment of and information about the environmental and security consequences of the plan and a schedule for its implementation.

6.1.5 Liability

The model licence, which is the starting point for any licence granted for offshore petroleum activity in Denmark, contains provisions that regulate the licensee's liability for any damages and obligations to the state, such as financial coverage for decommissioning and insurance.

The licensee is liable for any obligations to the state under the licence, including decommissioning.[170] The obligations include "*any obligation to the State under this License*". If the licence is given to several parts jointly, they are jointly and severally liable.[171] In the model licence, the licensee also agrees to indemnify the Danish state against any claims that may be made by a third party against the state because of the licensee's activities.[172]

In order to ensure that the licensee complies with its obligations to the state, it is specified in §24f of the Subsoil Act) that provisions may be made in the licence for it to be mandatory for a licensee to provide security for the fulfilment of all obligations under the licence.[173] Such provisions are made in the Model Licence, stating that the *"[s]ecurity may be provided by way of a parent company guarantee, and the Danish Energy Agency may require the security to be changed or supplemented with 30 days' prior notice*".[174]

The DEA may at any time require the licensee to take the necessary actions to prevent any risk or inconvenience caused by the installations, etc.[175] If the licensee does not satisfy these requirements, the DEA has authority to demand measures to be taken at the licensee's expense and risk in every respect, without any notice. Should the removal or the implementation of preventive measures give rise to a claim for damages against the state by a third party, the licensee must indemnify the state.

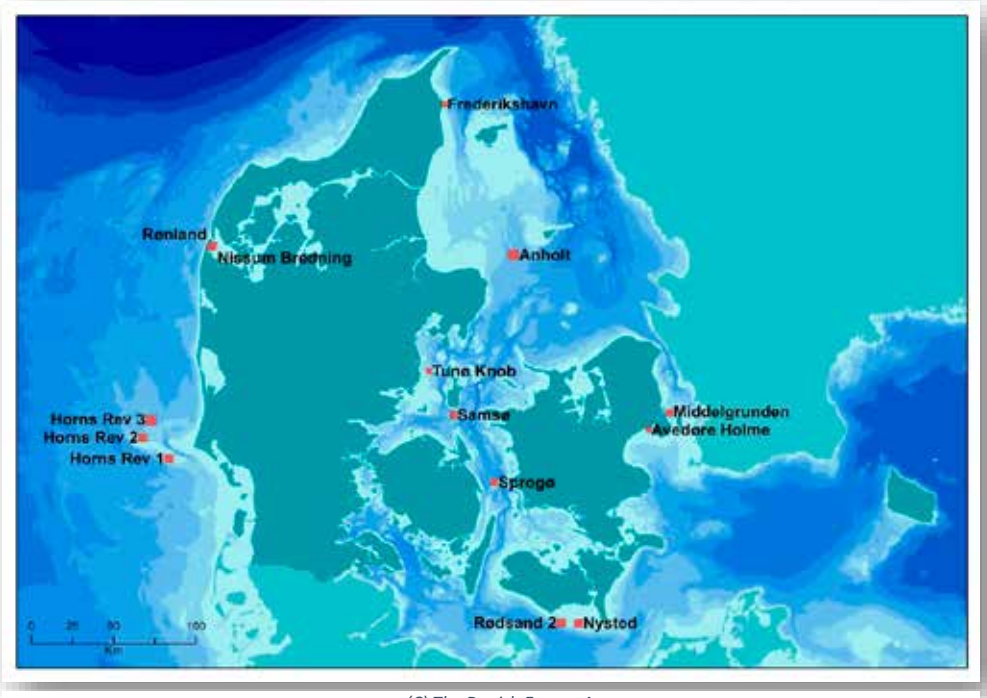
[169] Bekendtgørelse af lov om miljøvurdering af planer og programmer og af konkrete projekter (VVM) LBK nr 1225 af 25 Oct 2018 (EIA Regulations).
[170] 8th license round model license, section 31.
[171] Ibid, section 31.
[172] Ibid, section 38.
[173] The Subsoil Act, section 24 f).
[174] 8th license round model license, section 32.
[175] Ibid, section 37 (7).

Lastly, the Danish model has set up a system of residual liabilities as the securities demanded must cover all present or future liabilities, including those arising after the cessation of activities, replicating regimes existing in Norway and the UK.[176]

6.2 Decommissioning of offshore wind in Denmark

6.2.1 Introduction

Wind energy is one of the most widespread forms of renewable energy in Denmark. Currently, more than 40 % of the electricity produced in Denmark comes from wind turbines Furthermore, setting up new wind turbines on land is one of the cheapest ways to expand electricity production, and the cost of offshore wind is declining every year. Wind energy is playing a vital role in transforming the energy



(C) The Danish Energy Agency

system and helping to ensure that in 2050 Denmark will be independent of fossil fuels.[177]

There have been wind turbines on land in Denmark since the 1970s and offshore since the 1990s, and there has been a significant increase in both the number and capacity of turbines. Denmark and Danish companies are among the world leaders when it comes to the development, production and

[176] Stanescu CG, 'Denmark' in Pereira; EG and others (eds), The Regulation of Decommissioning, Abandonment and Reuse Initiatives in the Oil and Gas Industry: From Obligation to Opportunities (Wolters Kluwer 2020), p. 329-330.
[177] Danish Energy Agency, Facts about Wind Power: https://ens.dk/en/our-responsibilities/wind-power/facts-about-wind-power.

construction of wind turbines, and the export of wind turbines and the technology to produce wind energy makes a significant contribution to the Danish economy.

Denmark is a global leader in offshore wind energy and is in a unique position to expand its electricity production with even more offshore wind farms. Energy from offshore wind turbines will enable Denmark to meet its target of 55 % of the energy needs being produced by renewable energy in 2030.

Denmark currently has 14 established offshore wind farms, with a total capacity of 1,699 MW.

6.2.2 Decommissioning framework

Despite its success regarding the installation of offshore wind farms, Denmark has no specific offshore wind decommissioning rules.[178] Instead, the decommissioning of wind farms follows the same rules applicable to any renewable electricity production facility, pursuant to the Renewable Energy Act. Paragraph 25 of the Renewable Energy Act stipulates that:

> "(1) The establishment of electricity generation plants that utilize water and wind, with associated internal grid in the territorial sea and in the exclusive economic zone as well as significant changes in existing plants *can only be made with prior permission from the Minister of Climate, Energy and Utilities*.
>
> (…)
>
> (3) The Minister of Climate, Energy and Supply may make the approval of these facilities subject to conditions, including requirements for construction, layout, installations, erection, operation, *decommissioning and security for decommissioning of facilities*, as well as economic, technical, safety and environmental conditions in connection with establishment and operation, including residence and habitation", (emphasis added).

The same basic rules for the operation and decommissioning of electricity generation plants apply to wind farms as for the production of electricity in Denmark in general.[179] These are regulated in Section 12.2 of the Electricity Supply Act (*Elforsyningsloven*), which authorizes conditions for providing security for the decommissioning of facilities, and in the Act's Section 10, Subsection 7 which lays down the conditions for dismantling in the Power Plant Executive Order (Executive Order no. 493 of 12 June 2003 on conditions and procedures for granting a permit for the establishment of new electricity generation plants and significant changes to existing plants).

Furthermore, the Danish regime sets some basic rules concerning financial capabilities to conduct the decommissioning. Licensees must have a sufficient financial safety guarantee approved by the Danish Energy Agency for the decommissioning. The requirement is in accordance with the general requirement for the provision of security for the dismantling of electricity generation plants, which follows from Section 12, no. 2 of the Electricity Supply Act.

Decommissioning must take place in cases where the electricity production permit expires, the plant is not maintained or is destroyed, the plant is no longer used as a wind farm or the conditions for the permit are not met or complied with. The latter criterion applies to a situation where the permit is revoked due to default.

[178] Bech-Bruun, Law Firm, *Offshore Wind Law and Regulation in Denmark*. Available in: https://cms.law/en/int/expert-guides/cms-expert-guide-to-offshore-wind-in-northern-europe/denmark.
[179] Ibid.

A lack of detailed decommissioning rules and guidance on decommissioning for offshore wind farms has been justified on two grounds by the Danish Energy Agency.[180] First, internationally there is little experience regarding the decommissioning of offshore wind. Secondly, as yet there is little knowledge about the environmental impact of offshore wind installations. Consequently, it is thought that an assessment ought to be postponed until the decommissioning is about to take place.

However, this basic regulatory scheme is accompanied, usually in the licence documents, by a minimum standard required by the legislator concerning the state in which the area must be after the decommissioning has taken place.[181] Both for projects built following the government tenders and projects developed through the open-door procedure the concessionaire must "*re-establish the previous condition in the area at its own expense and decommission the plant according to a decommissioning plan approved by the Danish Energy Agency*".[182]

Furthermore, particular considerations regarding decommissioning securities and liabilities are often "regulated in the construction licence and in the electricity production authorisation issued by the Danish Energy Agency, as well as in the concession agreement".[183] To a certain extent, this complements the basic framework of the rules and addresses issues of liabilities, setting obligations and possibly setting performance standards.

6.2.3 Decommissioning of the Vindeby Farm

Denmark is the only country in our report that has actually decommissioned a fully operative wind farm. The farm in question was the Vindeby offshore wind farm, which was dismantled in 2017. Vindeby was the world's first offshore wind farm to be installed, it was built in 1991 and located two kilometres from the shore of the island of Lolland.

The Danish Energy Agency granted the Vindeby offshore wind farm permission to be dismantled on 10 January 2017, after it had been in operation for 25 years.[184] The wind farm was demolished in accordance with the decommissioning plan[185] and the Danish Energy Agency's permit to decommission the park.[186] An interesting and illustrative video of Vindeby's decommissioning is available online and published by Ørsted, the project developer and owner.[187]

[180] Bech-Bruun, Law Firm, *Offshore Wind Law and Regulation in Denmark*. Available in: https://cms.law/en/int/expert-guides/cms-expert-guide-to-offshore-wind-in-northern-europe/denmark.

[181] Ibid.

[182] Example Decision on license from 18. November 2008, http://www.hvidovrevindmollelaug.dk/Artikler/Etableringstilladelse%20PDF.pdf.

[183] Bech-Bruun, Law Firm, *Offshore Wind Law and Regulation in Denmark*. Available in: https://cms.law/en/int/expert-guides/cms-expert-guide-to-offshore-wind-in-northern-europe/denmark.

[184] On 10 January 2017, the Danish Energy Agency announced a permit for the decommissioning of Vindeby offshore wind farm. This permit was revoked due to legal deficiencies. A new permit for the decommissioning of Vindeby offshore wind farm was announced on 31 January 2017.

[185] DONG Energy, *Nedtagningsplan for Vindeby Havmøllepark* (2016), available at: https://ens.dk/sites/ens.dk/files/Vindenergi/nedtagningsplan_for_vindeby_havmoellepark_final_update_okt.pdf.

[186] Ibid.

[187] Ørsted, *Verdens første havmøllepark er nu taget ned* (2017). Available at: https://orsted.com/da/media/newsroom/news/2017/09/worlds-first-offshore-wind-farm-now-dismantled .

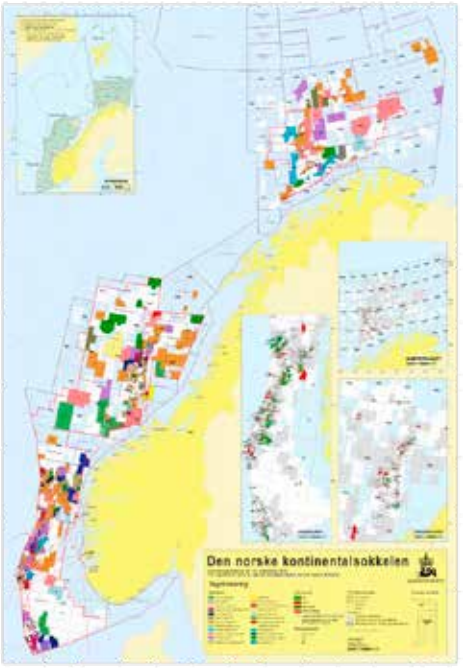
7. Norway

7.1 Oil and gas decommissioning

7.1.1 Introduction and background

All the hydrocarbon resources under Norwegian jurisdiction are located offshore,[188] in a wide variety of water depths.[189] The Norwegian Continental Shelf (NCS) stretches from the southern North Sea to the Arctic waters of the Barents Sea, an area almost six times bigger than Norway's land territory. Weather conditions can vary significantly in these different areas.

Norway's geographical location means that it is exposed to a lot of harsh weather, often caused by weather fronts coming from the Atlantic Ocean. This makes decommissioning in the NCS both technically challenging and expensive as the infrastructures have to be able to withstand a harsh environment and expertise is required when operating In bad weather.[190]



(C) Oil and Energy Ministry of Norway

There is a wide variety of offshore installations in the NCS. Jack–up rigs and jacket-based steel structure installations are common in the shallower waters of the southern North Sea. The deeper waters of the northern North Sea are home to large concrete installations, such as those used in the Statfjord, Gullfaks and Troll fields. Semi-submersible production units and floating production, storage and offloading vessels (FPSOs) are also employed in the deeper waters. In recent years subsea installations have become more common. These are typically used in smaller and less profitable fields but have also been used for larger fields such as Ormen Lange and Snøhvit. In addition to this, there is an extensive network of pipelines for transportation of oil and gas on the NCS, particularly in the North Sea.[191]

The level of awareness and enforcement of the rules on decommissioning remains high with regulators and relevant government entities. Decommissioning is subject to detailed legislation and is

[188] Bakken E, Kristensen M, Navestad KE, Norway, in Hammerson M, *Oil and Gas Decommissioning: Law, Policy and Comparative Practice* (2013). Globe Law And Business.
[189] Ibid; Norsk Petroleum, GYDA, available at: https://www.norskpetroleum.no/fakta/felt/gyda/; Wintershall Dea, Aasta Hansten, available at: https://wintershalldea.no/nb/hvor-vi-er/aasta-hansteen.
[190] Bakken E, Kristensen M, Navestad KE, Norway, in Hammerson M, *Oil and Gas Decommissioning: Law, Policy and Comparative Practice* (2013). Globe Law And Business.
[191] Ibid.

considered a significant liability among licensees, a factor which particularly affects licences and asset transactions.[192]

Many of the offshore oil and gas installations are nearing the end of their economic lifespan. The first decommissioning projects on the NCS were implemented as early as 1993 with Nordøst Frigg being the first to have its decommissioning plan approved in 1993, followed by the northeast Drigg and Odin satellite fields in 1996 and 1997 respectively.[193] It is expected that decommissioning activities on the NCS will increase significantly over the current and next decade. Industry estimates predict that nearly 199,100 tonnes of offshore infrastructure (of which just over 112,600 tonnes are topside from 14 platforms) will be decommissioned and brought onshore by 2025. All of the scheduled decommissioning activities involve facilities located in the Norwegian part of the North Sea, with no decommissioning expected in the relatively less mature fields in the Norwegian Sea and the Barents Sea that are on the NCS.

By 2020, there were 90 oil and gas fields In production in the NCS.

Furthermore, there are 12 concrete facilities (Heidrun A and Troll B are floating), 63 fixed steel facilities and 20 steel floating facilities in operation. In addition, there are nearly 400 subsea installations.

There are also 25 fields that have been cessated and decommissioned.

More specifically, 59 facilities, including 30 with a fixed jacket steel had been decommissioned In the NCS by 2018.

7.1.2 Decommissioning regulatory framework

The obligation to carry out decommissioning is an integral part of the Norwegian legal framework, with significant commitments and liabilities imposed on all licensees. This has been the case for some time, with rules governing decommissioning in the NCS since 1965.

Decommissioning has important economic and environmental implications, both licensees and the Norwegian State have incentives to ensure that the legal framework for such activities is as robust as possible. This includes rules concerning liabilities, claim for damages as well as the relations between the different operators/owners and licensees to a same field. Moreover, the global community has an interest in decommissioning, particularly those nations bordering the NCS. It is of importance for neighboring states that the decommissioning activities on the NCS are completed satisfactorily in order to avoid the possible negative environmental impact of decommissioning, to maintain a free passage and to safeguard their economic interest in their own marine spaces An important example of this is fish stocks.[194]

The cessation of petroleum activities is subject to comprehensive regulations. The main objective of the provisions for decommissioning is to ensure companies perform a thorough assessment of the disposal of productions facilities, and carry out decommissioning procedures accordingly.[195] This includes complying with both international rules and a detailed national framework.

The Norwegian framework regarding cessation of petroleum activities is based on several instruments. The main provisions are the Petroleum Act from 1996 and its chapter 5, the 1997

[192] Bakken E, Kristensen M, Navestad KE, Norway, in Hammerson M, *Oil and Gas Decommissioning: Law, Policy and Comparative Practice* (2013). Globe Law And Business.
[193] Norwegian Petroleum Directorate, Responsible removal of old facilities, available at: https://www.npd.no/en/facts/production/shutdown-and-removal/responsible-removal-of-old-facilities/.
[194] Bustnesli Y et alia. (2021) Oil and gas activitites in Norway. Oslo: Gyldendal, p. 121.
[195] Bakken E, Kristensen M, Navestad KE, Norway, in Hammerson M, *Oil and Gas Decommissioning: Law, Policy and Comparative Practice* (2013). Globe Law And Business.

Regulations to the Act relating to Petroleum and their §43–45 and the contractual obligations laid down in the licence agreement and the Joint Operation Agreement (JOA). In addition to the Norwegian legislation, the international conventions and soft law instruments discussed in Chapter 5 are of relevance to Norway.

The Norwegian law on decommissioning has three main components: a) international obligations (i.e. treaties entered into by the Norwegian State); b) applicable legislation; and c) contractual obligations between licensees (most notably under the JOA and/or unitization agreements, but decommissioning liabilities and obligations may also arise under transportation and/or processing agreements). All three components are integral parts of the same framework, and as such, they should not be considered in isolation.[196]

The Petroleum Act provides statutory requirements which apply to licensees in relation to cessation of petroleum activities, thereby implementing Norway's international obligations as discussed above.

Chapter 5 of the Petroleum Act regulates shutdown, decommissioning and disposal of offshore facilities on the NCS. The provisions of Chapter 5 impose comprehensive obligations on the licensees in the decommissioning phase. Thus, the award of a production licence implies a contingent obligation for the licensees to decommission any facilities subsequently installed. In addition, under the terms of the JOA the licensees are jointly responsible for costs, including decommissioning costs, on a joint and several basis, including those associated with decommissioning.[197] Owners and users of petroleum facilities that are not licensees are also subject to decommissioning obligations.

There are no default rules concerning decommissioning. Specific requirements must be determined on a case-by-case basis. However, full removal is the most frequent alternative but both practice and legislation leave room for partial removal or leave in place solutions, known as 'abandonment' in the Norwegian regulations.

The procedures to be used in the removal of pipelines and cables are set out in the guidelines laid down in the Norwegian Parliament White Paper No. 47 (1999–2000) *Decommissioning of Redundant Pipelines and Cables*.[198] As a general rule, pipelines and cables may be left in place provided they do not obstruct or present a safety risk for seabed fishing, with costs of burial, covering or removal taken into consideration.

The Ministry of Petroleum and Energy can also require, at any time, normally before the first licence award, that the licensee provide security for the fulfillment of their obligations before the Norwegian authorities, as well as for possible liability in connection with the petroleum activities.[199] This is normally done through a parent company guarantee. Any subsidiary company holding a production licence on the NCS must provide to the Ministry of Petroleum and Energy with a standard parent company guarantee covering its obligations relating to the petroleum activities in which it participates, according to Section 10-7 of the Petroleum Act. [200]

[196] Bustnesli Y et alia. (2021) Oil and gas activitites in Norway. Oslo: Gyldendal, p. 121.
[197] Bakken E, Kristensen M, Navestad KE, Norway, in Hammerson M, *Oil and Gas Decommissioning: Law, Policy and Comparative Practice* (2013). Globe Law And Business.
[198] Ministry of Petroleum and Energy (1999).Disposal ofdiscarded pipelines and cables on the Norwegian continental shelf.
[199] Bakken E, Kristensen M, Navestad KE, Norway, in Hammerson M, *Oil and Gas Decommissioning: Law, Policy and Comparative Practice* (2013). Globe Law And Business.
[200] Vareberg F, Willoch P. Parent company guarantee for NCS licensees: scope and third-party claims (2016).

7.1.3 Decommissioning plans

The Petroleum Act requires the licensees to submit a decommissioning plan to the Ministry of Petroleum 2–5 years before expiry or surrender of a production licence or a specific licence referring to installation and operation of facilities or alternatively before the use of a facility is permanently discontinued.[201] While the law does not define what constitutes a decommissioning plan, the preparatory work for the provision indicates that this document shall form the basis for the overall government processing of the question of the closure of production and disposition of the facilities. Consequently, the decommissioning plan has to include the necessary technical and financial information to conduct the activity.

The decommissioning plan consists of two main parts, a disposal plan and an impact assessment, according to the provisions set out in § 43–45 of the Petroleum Regulations. It is assessed by the Ministry of Petroleum and Energy and the Ministry of Labour and includes information relating to the safety of the decommissioning operation as well as the ways in which the materials will be disposed of.

The impact assessment provides an overview of the expected consequences of the disposal, such as the impact on the environment.[202] It also serves to encourage the reduction of discharges or emissions as well as to decide what remedies to apply in case of damage to the environment. The Ministry of Petroleum and Energy coordinates the public hearing of the impact assessment. It also prepares a draft Royal Decree, which is submitted to the government, based on the impact assessment and feedback from the public hearing, as well as on the disposal plan and its assessment. Applications for derogation from the OSPAR Decision 98/3 concerning disposal on land must be presented to the Norwegian Parliament.

A decommissioning plan must also cover aspects related to circular use and sustainability as the parties entrusted with decommissioning must ensure that the plan "shall contain proposals for continued production or shutdown of production and disposal of facilities. Such disposal may inter alia constitute further use in the petroleum activities, other uses, complete or part removal or abandonment."[203]

Once the plan has been submitted, the Ministriy for Petroleum and Energy assesses it and decides whether or not to approve it, based on the contents of it and the time limit for implementing the decommissioning plan. As in Denmark and Scotland, there is room for administrative discretion. The Ministry may approve it, reject it or require some amendments. However, the decision is based on technical, safety, environmental and economic procedures and consideration of other ocean users.[204]

The licensee then submits the final decommissioning or termination plan to the Ministry of Petroleum and Energy. It appears from the Petroleum Act's preparatory work that the Ministry of Petroleum and Energy coordinates the consideration of the decommissioning plan and obtains statements from the relevant bodies such as the Ministry of the Environment. After this consideration, the plan is sent to parliament with a recommendation as to whether or not it should be accepted.

The licensee will submit the final decommissioning or termination plan to the Ministry of Petroleum and Energy. It appears from the preparatory work that the Ministry of Petroleum and Energy coordinates the consideration of the decommissioning plan and obtains statements from the relevant

[201] Section 5-1 of the Norwegian Petroleum Act.
[202] Norsk olje og gass, the Norwegian Oil and Gas Association has issued a non-binding instrument called the “Handbook Impact assessment for offshore decommissioningDecommissioning and final disposal of redundant offshore oil andgas facilities” (2020). dealing with this part of the decommissionig plan. Available: https://www.norskoljeoggass.no/contentassets/d7bfa8b2f6874235a1e0dc0719b7250a/handbook-decom-ia-rev-1-2_final.pdf.
[203] Section 5-1 of the Norwegian Petroleum Act.
[204] Section 5-3 of the Norwegian Petroleum Act.

bodies such as the Ministry of the Environment. After this consideration, the plan is sent to parliament with a recommendation to accept it or not.

Under exceptional circumstances, the submission of a decommissioning plan may be waived.[205] A waiver can only be granted by the Ministry of Petroleum and Energy. However, a waiver will not be granted under any circumstances to large installations on the NCS, such as oil platforms. However, determine what counts as exceptional circumstances can often be challenging.

In 2008 the Ministry of Petroleum granted A/S Norske Shell an exception from the requirement regarding the removal of a loading buoy belonging to Draugen (Olje- og energidepartemenetet, 19 November 2008).

The Ministry of Petroleum stated on a general basis that they could grant exceptions from the decommissioning plan if the installations are small and the removal procedure is relatively easy. This statement is in accordance with the preparatory work (cf. Ot.prp.nr.43 (1995-96).

7.1.4 Liability considerations: responsible parties and Decommissioning Security Agreements

Norwegian regulation stipulates both who is responsible for conducting the decommissioning,[206] and who is "liable for damage or inconvenience caused wilfully or negligently in connection with disposal of the facility or other implementation of the decision".[207]

The default rule for determining who is responsible for the decommissioning is that the licensees and owners of the installation at the time the Ministry's decision relating to disposal are under an obligation to carry out the disposal. All current licensees and owners are jointly and severally liable.

If the parties obliged to conduct the decommissioning fail to do so, then "the Ministry may take necessary measures on behalf of the licensee or other responsible party, and for their account and risk. Costs of such measures are grounds for enforcement of distraint".[208]

Furthermore, the Ministry may also "stipulate a current fine for each day that passes after expiry of the time limit set for implementation" of the decommissioning activity.[209]

The rules concerning liability and decommissioning obligations were amended in 2010. According to the modification made to the Petroleum Act, the assignor of a participating interest in a license is alternatively liable for the financial obligations regarding disposal connected to the transferred participating interest.[210] Secondary liability extends to the associated and actual decommissioning costs. In other words, the system creates a secondary liability *after* the license has been transferred. The objective of the change seems to be to extend the liability to former owners and, in a way, prevent the issue of default by new owners/smaller firms taking over the structures near the end of their economic life.

The next point that needs clarification is how far existing licensees (that have not defaulted on payments) are required to go with regard to recovering the claim vis-à-vis the existing licensee (that

[205] Section 5-1 of the Norwegian Petroleum Act; see also: Bakken E, Kristensen M, Navestad KE, Norway, in Hammerson M, *Oil and Gas Decommissioning: Law, Policy and Comparative Practice* (2013). Globe Law And Business.

[206] Section 5-3 of the Norwegian Petroleum Act.

[207] Section 5-4 of the Norwegian Petroleum Act.

[208] Section 5-3 of the Norwegian Petroleum Act.

[209] Section 10-16 of the Norwegian Petroleum Act.

[210] "If a licence or participating interest in a licence has been transferred pursuant to Section 10-12 first paragraph, the assignor shall be alternatively liable for financial obligations toward the remaining licensees for the cost of carrying out the decision relating to disposal." Section 5-3 of the Norwegian Petroleum Act.

is defaulting on payment) before claims can be directed towards previous licensee(s). In other words, when does the previous licensee's alternative liability for financial obligations arise?

Just after the change in legislation in 2010, the Ministry drafted the following proposal to make the regulations more accurate:

> Under Section 5-3, third subsection of the Act, alternative liability for financial obligations means a liability that arises when a licensee, after receiving a written demand for payment, has defaulted on payment obligations according to the agreement relating to petroleum activities (the joint operating agreement) and the opportunities found in Article 9 of the joint operating agreement have been exhausted by the other licensees, or it must be clearly evident that the opportunities provided under Article 9 of the joint operating agreement, will not be able to give the other licensees full or partial coverage of the claim.
>
> When Section 5-3, third subsection, fourth sentence stipulates that requirements should first be directed at the company that last transferred the ownership interest, it should be understood such that, if an ownership interest in a licence has been transferred several times, the other licensees should always submit a written demand for payment to the assignors in successive order, so that claims are first directed to the company which last transferred the ownership to the interest, and then to the next company when the previous company has defaulted on its payment obligation.

The previous licensee is considered to have defaulted on their obligations if the obligations have not been covered within three months of the aforementioned written demand for payment being received.

In the recourse settlement, the defaulting licensee is the first liable party, followed by the licensee that last transferred the ownership interest and so on, in successive order for the entire defaulted obligation, if multiple previous licensees default on their obligations.

To mitigate the risk of secondary liability after the transfer of licences and, therefore, not limit such a possibility, the Norwegian hydrocarbon framework has developed the Decommissioninig Security Agreement. Entering such agreements between buyer and seller of the licence has become common practice since 2009. The Decommissioninig Security Agreement divides the responsibilities in case of a default, with the seller hoping to restrict their liability as much as possible. However, this agreement has force only between the parties and not with respect to the state or the other licensees. A recommended model agreement for decommissioning security has been developed by Norsk olje og gass.[211]

7.1.5 Residual liability

If there is a decision to leave the facility in place, abandonment, the Norwegian system sets up a rule concerning residual liability as it states that "the licensee or owner shall be liable for damage or inconvenience caused wilfully or inadvertently in connection with the abandoned facility, unless otherwise decided by the Ministry".[212] However, under the Norwegian system, it is also possible to terminate this residual liability and transfer it to the state. According to the Petroleum Act §5-4, the licensees and/or parties obliged to decommission the infrastructure, and the state may agree that "future maintenance, responsibility and liability shall be taken over by the State based on an agreed financial compensation". While not explicitly stated, these rules concerning residual liability also appear likely to be applicable to partial removal.

[211] Norsk olje og gass, Norwegian Oil and Gas Recommended Model Agreement for decommissioning security for removal obligations (2010).
[212] Section 5-4 of the Norwegian Petroleum Act.

In these cases of total, partial or leave in place decommissioning liabilities arising from damage caused to other parties the Norwegian system applies a system of joint and several liability among those that are required by law to conduct the decommissioning procedure.

7.1.6 Tax Considerations

In accordance with the applicable tax law regime for petroleum activities, the cost of decommissioning and plugging and abandonment as well as the cost of removal of installations are tax-deductible when the costs are incurred and the work is carried out.[213] As discussed in Chapter 4, the rationale behind this is to prevent the risk of default, on the basis that decommissioning has to be conducted when no income is being received from the installation.

Decommissioning costs will be deducted up to 78 % of the tax to be paid, based on the corporate tax rate in Norway, 22 %,[214] and the additional special tax applicable to oil and gas activities, 56 %.[215] This means that entities obliged to decommsission would cover only 22 % of the cost of the activity as such (decommissioning costs after the calculation of the tax deduction).

This principle is intended to moderate the cost of expected guarantees, to the benefit of both the state and the companies, and it is in line with the Ministry of Petroleum and Energy's intentions. Such post-tax limitation of seller's liability after a transaction requires coordination with the petroleum tax legislation which is currently not available. Sellers therefore normally require pre-tax security in the decommissioning security agreements relating to the NCS.

7.2 Offshore wind decommissioning

7.2.1 Introduction

The NCS has been an attractive area for extracting hydrocarbons for the last 50 years, starting with the Ecofisk field in 1969.[216] For the past decade, the NCS has also been considered as a production site for electricity from wind turbines, due to the strong winds. Offshore wind production on the NCS was first mentioned in a white paper by the Norwegian Parliament in 2006.[217]

Water depths on the NCS vary from shallow waters in the southern North Sea (from 60 metres) through deeper waters in the northern North Sea (up to 1,100 metres). This variation in depths means that different kinds of technologies are needed in the installations in different areas. In the shallow area in the southern North Sea installations are bottom-mounted. In the deeper waters further north floating wind turbines are required.[218]

On 12 June 2020, the Norwegian Government decided that it would open up Utsira Nord and Sørlige Nordsjø II for licence applications for the production of renewable energy at sea in those areas.[219] Utsira Nord comprises an area of 1,010 km^2 located west of Haugalandet approximately 22 kilometres

[213] Lov om skattlegging av undersjøiske petroleumsforekomster mv. (petroleumsskatteloven), LOV-1975-06-13-35.
[214] Norsk Petroleum, The Petroleum Tax System, available at: https://www.norskpetroleum.no/en/economy/petroleum-tax/.
[215] Lov om skattlegging av undersjøiske petroleumsforekomster mv. (petroleumsskatteloven), LOV-1975-06-13-35.
[216] Regjeringen (the Norwegian Government), Norsk oljehistorie på 5 minutter (2019).
[217] St.meld. nr. 34 (2006-2007), *Norsk klimapolitkk*, paras 7.1.1, 8.2 and 13.2.3.3, available at: https://www.regjeringen.no/no/dokumenter/Stmeld-nr-34-2006-2007-/id473411/?q=havvind&ch=2#kap7-1-1. See also: Noregs vassdrags- og energidirektorat (NVE), Havvind i Norge (2020), available at: https://www.nve.no/energiforsyning/kraftproduksjon/vindkraft/havvind-i-norge/.
[218] Fastsetjing av forskrift til havenergilova, Kgl.res 12. juni 2020 (20/88), p. 3 - 6.
[219] Regjeringen (the Norwegian Government), Opner områder for havvind i Noreg (12 June 2020).

from the coast. As there Is an average sea depth of 267 metres, the area is suitable for floating offshore wind turbines. The area of Sørlige Nordsjø II is 2,591 km^2 and borders the Danish economic zone in the south with an average sea depth of just 60 metres, which means the area is highly suitable for bottom-fixed facilities. The area is located approximately 140 kilometres from the coast, and the significant distance to land means that the authorities only expect developments of larger wind power plants in Sørlige Nordsjø II.

The Norwegian Government reiterated these ambitions and plans on 11 June 2021 and issued a white paper entitled "*Energi til arbeid – langsiktig verdiskaping fra norske energiressurser*", in which further plans and clarifications concering the deployment of offshore wind were made. Importantly, the Norwegian Government also issued a Guidance Notice related to the licensing process for offshore wind in which decommissioning is mentioned.[220]

(C) Equinor, Jan Arne Wold

7.2.2 Offshore wind regulation in a nutshell

The offshore energy production from wind turbines on the NCS is regulated in the Offshore Energy Act (OEA) (*Havenergiloven*) 2010.[221] The Act provides the framework for the production of renewable energy at sea and will only be applicable in Norwegian sea territory outside of the baselines, and on the continental shelf, according to para 1-2.

The main objective of the Act is to facilitate the utilization of renewable energy resources at sea in accordance with societal objectives, and for energy facilities to be planned, built and *disposed* of so that energy supply, the environment, safety, business and other interests are taken care of.[222]

The OEA states that the right to exploit the renewable energy resources at sea belongs to the state, cf. para 1-3. This paragraph stipulates that as a general rule such production can only take place after the

[220] Regjeringen (the Norwegian Government), Høring - Veileder for arealtildeling, konsesjonsprosess og søknader for vindkraft til havs, og forslag til endringer i havenergilova og havenergilovforskrifta (11 June 2021); Regjeringen (the Norwegian Government) Proposal for a Veileder for arealtildeling, konsesjonsprosess og søknader for vindkraft til havs, available at: https://www.regjeringen.no/contentassets/5a7268e3397b4f4ea6eb4fa84897808e/veileder-for-arealtildeling-konsesjonsprosess-og-soknader-for-vindkraft-til-havs-l1244319.pdf.

[221] Lov om fornybar energiproduksjon til havs (Offshore Energy Act), LOV-2010-06-04-21.

[222] Offshore Energy Act para 1-1.

state has opened the relevant area for licence applications (para 2-2). Currently, two areas have been opened for offshore energy production from windmills, Utsira Nord and Sørlige Nordsjø II.[223]

Production facilities may not be built, owned or operated without a licence from the Ministry, pursuant to the OEA § 3-1. The same applies to the rebuilding, repowering or expansion of existing facilities. The licensing processes are partly regulated in the OEA, and partly regulated in the Offshore Energy Administrative Regulation (*Havenergiforskrifta*) 2020.[224]

Both the OEA and the Offshore Energy Administrative Regulation include short provisions that regulate the decommissioning of the facilities. These are discussed in the next section.

7.2.3 Decommissioning framework

According to § 3-5 of the OEA a licence is given for 30 years. When the licence period is over, § 6-1 regulates the process of closing the facility. The paragraph merely states that the facility has to be removed. It does not specify what has to be removed and what can be left in place. However, based on the wording of the provision, it seems that a full removal would normally apply.

In the preparatory works, a very important source of law in Norway, it is stated that the paragraph must be interpreted in such a way as to be in accordance with obligations under international law, to avoid dumping and pollution of the sea.[225] The preparatory works also state that the paragraph allows the Ministry to accept partial removal of the facility, meaning that some parts of the installations may be left in place, as long as they do not violate international obligations and do not harm the environment, fishing activities or maritime shipping. Such a clear statement would, therefore, override a full removal obligation in all circumstances.

As the OEA does not specify what must be decommissioned, other regulatory measures in the offshore wind licensing process have to be considered.

Well in advance of the expiration of the licence, the licence holder must submit a closing plan. However, it is not specified exactly when that is to be done. The plan should contain a description of how the facility will be decommissioned, what will be left in place and how the decommissioned material will be treated afterwards.[226] Definitive requirements of the closing plan have not yet been adopted either by Parliament or the Ministry. The closing plan can be waived if the licence holder applies for an extension of the license, pursuant to the OEA § 6-1 para 2.

The Offshore Energy Administrative Regulation § 6-3 para 3 states that supplementary administrative regulations may be adopted by the Ministry of Petroleum and Energy. The supplementary regulations may impose requirements for the decommissioning process and the closing plan, such as specific information about the content of the plan and time limits, etc.[227] Currently, supplementary administrative regulations have not yet been adopted.

In the Offshore Energy Administrative Regulation's preparatory works, it is further stated that the decommissioning regulations can be supplemented by terms in the licence, provided they comply with Offshore Energy Administrative Regulation § 3-4. These terms must be read in the context of § 6-1 of the OEA and the licensing process.[228] In the licensing process, the applicant must submit a detailed plan for the development and operation of the installation to the Ministry. The detailed plan must address the

[223] Opning av områda Utsira Nord ogSørlige Nordsjø II for konsesjonshandsaming av søknader omfornybar energiproduksjon etter havenergilova, Kgl.Res. (12 June 2020), p. 6.
[224] Forskrift til havenergilova (havenergilovforskrifta - Offshore Energy Administrative Regulation), FOR-2020-06-12-1192.
[225] Forarbeid Ot.prp.nr.107 (2008-2009), p. 83.
[226] Ibid, p. 83.
[227] Forarbeid Ot.prp.nr.107 (2008-2009), p. 83.
[228] Ibid, p. 84.

technical, safety and environmental requirements and otherwise supplement the licence as far as has been determined. The Offshore Energy Administrative Regulation § 9 (2) litra d it states that the detailed plan must contain a "plan for closure and removal of the energy plant". The Offshore Energy Administrative Regulation does not contain further clarifications to what is required in the plan. These basic provisions about the requirement of a decommissioning plan have been reiterated by the proposed Guidance Notice for the licensing procedure of offshore wind farms.[229]

Furthermore, in the proposed Guidance Notice of June 2021, currently being reviewed by the Norwegian Parliament, decommissioning must be accounted for in several stages of the licensing process. First, in the tendering process, applicants in the pre-qualification phase must demonstrate their financial capacity to conduct decommissioning.[230] Later in the process, in the application for the approval of the final project proposal (the detailed project plan), a plan for the cessation and decommissioning of the facility must be included.[231]

Thus, it is clear that the OEA, the Offshore Energy Administrative Regulation, and the proposed licensing Guidance Notice contain some basic decommissioning requirements. However, the existing regime is underdeveloped in comparison to Denmark or Scotland or the oil and gas rules in Norway regarding decommissioning. The starting point in the law is that everything shall be removed (OEA § 6-1 (1)). Yet, the preparatory works indicate exceptions can be made to this starting point, allowing some parts of the installations to be left in place. It is not clear how the Ministry will decide what can be left in place. Consequently, the legal situation on decommissioning remains unclear.

[229] Regjeringen (the Norwegian Government), Høring - Veileder for arealtildeling, konsesjonsprosess og søknader for vindkraft til havs, og forslag til endringer i havenergilova og havenergilovforskrifta (11 June 2021).
[230] Regjeringen (the Norwegian Government) Proposal for a Veileder for arealtildeling, konsesjonsprosess og søknader for vindkraft til havs, p.7.
[231] Regjeringen (the Norwegian Government) Proposal for a Veileder for arealtildeling, konsesjonsprosess og søknader for vindkraft til havs, p.12.

8. United Kingdom and Scotland

8.1 Oil and gas decommissioning in Scotland

8.1.1 Introduction

This chapter introduces the framework for decommissioning oil and gas installations' in Scotland. Despite the fact that Scotland has its own jurisdiction on a number of aspects, the Scottish Parliament does not have the competence to legislate for the oil and gas regime in Scotland.[233] Therefore, to get an overview of decommissioning in Scotland it is necessary to review the governance and regulation of oil and gas in the UK.

The UK legislation sets the main governance framework for decommissioning which we discuss in this chapter.[234] This is then accompanied by different instruments, both in soft and hard law, applicable to decommissioning in Scotland. In this section, we include a general review of hard and soft law instruments related to the decommissioning process in the UK and Scotland. In particular, we analyse the system of notification, determining who is responsible for decommissioning, aspects related to financial issues and decommissioning liabilities.

The Country: The United Kingdom (UK Continental Shelf, UKCS)

500 installations have been emplaced since 1967, including 5,000 wells which have been drilled, of which 71 installations will be decommissioned between 2018 and 2027.[232]

8.1.2 Decommissioning framework in the UK

The UK enforces decommissioning by statute (i.e. and hard law and written rules) and soft law instruments.[235] It also adopts a governance scheme based on administrative functions, such as sending notices to the licensees and controlling and approving the decommissioning programmes.[236]

The Petroleum Act 1998[237] enacted by the UK Parliament regulates oil and gas activity in the UK as a whole and it is the primary legislation regarding the decommissioning of offshore oil and gas structures.[238] As in Norway and Denmark, offshore oil and gas activity in the UK is based on a licensing procedure,[239] licences are granted through 'competitive licensing rounds' held by the Oil & Gas Authority.[240] Unlike Denmark, in the UK there is no requirement for decommissioning plans to be not evaluated or submitted at the time of granting a licence. The Petroleum Act has been amended by the

[232] Gordon G, Paterson J, Decommissioning of Offshore Installations Upon the UK Continental Shelf in Roggenkamp M, Banet C, *European Energy Law Report XIII* (2020), p. 307.
[233] The Scottish Parliament, 'Part 1: Public bills and background to the legislative process'.
[234] According to the Scottish Government, the UK government is responsible of Oil and Gas regime; Scottish Government, 'Policies – Oil and Gas', available at: https://www.gov.scot/policies/oil-and-gas/.
[235] Hammerson M, *Oil and Gas decommissioning: Law, Policy and Comparative Practice* (Global Business Publishing Ltd, London, 2013) p. 21.
[236] Ibid, 22.
[237] Petroleum Act 1998 c. 17 [cit. the 1998 Act); Paterson J, United Kingdom in Pereira; EG and others (eds), The Regulation of Decommissioning, Abandonment and Reuse Initiatives in the Oil and Gas Industry: From Obligation to Opportunities (Wolters Kluwer 2020), p. 634.
[238] Hammerson M, *Oil and Gas decommissioning: Law, Policy and Comparative Practice* (Global Business Publishing Ltd, London, 2013) p. 21.
[239] Petroleum Act 1998, s 3.
[240] Oil and Gas Authority, 'Licence applications', available at: https://www.ogauthority.co.uk/licensing-consents/licensing-system/licence-applications/.

Energy Act 2008 and the Energy Act 2016.[241] The Energy Act 2008 strengthened the Secretary of State's powers in financial assurances.[242] In 2016 the amendment created the Oil & Gas Authority (OGA), an entity in charge of maximizing the economic recovery of offshore petroleum,[243] including the encouragement of efficient practice and cost reduction.[244] The Secretary of State is responsible for overseeing decommissioning,[245] but the OGA has to be consulted in the process.

The Petroleum Act implements the commitments created by international obligations.[246] The UK is a party to the UNCLOS Convention,[247] as well as the OSPAR Convention. As a party to the OSPAR Convention, the UK is also obliged to follow Decision 98/3 prohibiting the disposal of offshore installations in the marine environment.[248]

Despite the Petroleum Act being the main legal instrument regarding decommissioning, it does not include detailed regulation thereof. Instead, guidance notes complement it, as discussed below.[249] A detailed criterion to the Decommissioning Programmes is set by administrative soft law (a guidance) which is a supplement to the Act presented in section 6.[250] That said, the Petroleum Act contains provisions regarding decommissioning dealing with the following:

- Preparation of programmes[251]
- Persons who may be required to submit programmes[252]
- Approval of programmes[253]
- Failure to submit programmes[254]
- Reduction of costs of carrying out programmes[255]
- Default in carrying out programmes[256]
- Financial resources[257]
- Liability for an offence.[258]

Decommissioning activity is centred around the 'Decommissioning Programme', as prescribed by the Petroleum Act. This decommissioning programme must be approved before activity can start,[259] and,

[241] Department for Business, Energy & Industrial Strategy, 'Guidance Notes: Decommissioning of Offshore Oil and Gas Installations and Pipelines' (November 2018) [cit. Guidance Notes], 21.
[242] Ibid, 10.
[243] Ibid.
[244] Ibid.
[245] Paterson J, United Kingdom in Pereira; EG and others (eds), The Regulation of Decommissioning, Abandonment and Reuse Initiatives in the Oil and Gas Industry: From Obligation to Opportunities (Wolters Kluwer 2020), p. 634.
[246] Hammerson M, *Oil and Gas decommissioning: Law, Policy and Comparative Practice* (Global Business Publishing Ltd, London, 2013), p. 21. See the other international obligations adopted by the UK; Guidelines, 7.
[247] Guidance Notes, 7.
[248] Convention for the Protection of the Marine Environment of the North-East Atlantic; Hammerson M, *Oil and Gas decommissioning: Law, Policy and Comparative Practice* (Global Business Publishing Ltd, London, 2013), p. 18.
[249] Hammerson M, *Oil and Gas decommissioning: Law, Policy and Comparative Practice* (Global Business Publishing Ltd, London, 2013), p. 14.
[250] Paterson J, United Kingdom in Pereira; EG and others (eds), The Regulation of Decommissioning, Abandonment and Reuse Initiatives in the Oil and Gas Industry: From Obligation to Opportunities (Wolters Kluwer 2020), p. 635.
[251] The 1998 Act, s29.
[252] Ibid, s 30.
[253] Ibid, s 32.
[254] Ibid, s 33.
[255] Ibid, s 36A.
[256] Ibid, s 37.
[257] Ibid, s 38.
[258] Ibid, s 40-41.
[259] Paterson J, United Kingdom in Pereira; EG and others (eds), The Regulation of Decommissioning, Abandonment and Reuse Initiatives in the Oil and Gas Industry: From Obligation to Opportunities (Wolters Kluwer 2020), p. 635.

as in Denmark and Norway, the Act adopts a broad understanding of who is responsible for conducting it.[260] This is done to ensure that taxpayers are not ultimately liable for decommissioning costs.[261]

Details in the decommissioning programmes are agreed upon between the notice holders[262] and the government since every decommissioning process is designed on a case-by-case basis. The notice holders are persons who are obligated to submit a decommissioning programme to Secretary of State.[263] Including the details in the soft law contributes to take into account the specific circumstances of every installation.[264]

8.1.3 Governance in decommissioning: the Offshore Petroleum Regulator

8.1.4 for Environment & Decommissioning and Guidance Notes

As discussed above, the Secretary of State is entrusted with decommissioning regulation. This is done through the Offshore Petroleum Regulator for Environment and Decommissioning (OPRED).[265] OPRED has the authority to guarantee that the Petroleum Act and the international obligations are complied with.[266] OPRED is a national UK agency, having authority to govern decommissioning in Scotland.[267]

OPRED has general responsibility for ensuring that the statutory law and the international obligations concerning decommissioning are complied with in the UK. The authority regulates "environmental and decommissioning activity for offshore oil and gas operations in the UK".[268] In addition to this OPRED is a national authority with responsibility for the activities falling under the scope of OSPAR regulation.[269]

OPRED has created a framework to plan and complete the decommissioning programme which builds upon the framework laid out in the 1998 Act.[270] The "Offshore Oil and Gas Decommissioning Guidance Notes November 2018" (Guidance Notes) give advice to the persons involved in the decommissioning process.[271] The Guidance Notes are the core regulatory instrument related to decommissioning as they aim to provide guidance and clear criteria for those involved in decommissioning projects. The framework should be read in the light of the existing legislation and it can therefore be seen as a complement to the statutory law.[272]

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[260] Ibid.
[261] Ibid. Paterson J, United Kingdom in Pereira; EG and others (eds), The Regulation of Decommissioning, Abandonment and Reuse Initiatives in the Oil and Gas Industry: From Obligation to Opportunities (Wolters Kluwer 2020), p. 641; Guidance Notes, 6.
[262] The Petroleum Act 1998, s 29.
[263] Paterson J, United Kingdom in Pereira; EG and others (eds), The Regulation of Decommissioning, Abandonment and Reuse Initiatives in the Oil and Gas Industry: From Obligation to Opportunities (Wolters Kluwer 2020), p. 635; The Petroleum Act 1998, s29.
[264] Guidance Notes, 5.
[265] Ibid, 10.
[266] Ibid, 5.
[267] Scottish Government, 'Policies – Oil and gas', available at: https://www.gov.scot/policies/oil-and-gas/.
[268] Offshore Petroleum Regulator for Environment & Decommissioning, 'Latest from the Offshore Petroluem Regulator for Environement and Decommissioning, available at: https://www.gov.uk/government/organisations/offshore-petroleum-regulator-for-environment-and-decommissioning.
[269] Guidance Notes, 5.
[270] Ibid, 5.
[271] Offshore Petroleum Regulator for Environment & Decommissioning, 'Oil and gas: decommissioning of offshore installations and pipelines', available at: https://www.gov.uk/guidance/oil-and-gas-decommissioning-of-offshore-installations-and-pipelines#history.
[272] Ibid.

The Guidance Notes supplement the Petroleum Act. This instrument, however, has an unusual legal character as it is neither a piece of legislation nor a mere recommendation. The Guidance Notes specify the way that the governmental discretion regarding decommissioning is applied by the Secretary of State.[273] They help stakeholders by guiding them through the process and by giving some general advice regarding the decommissioning of an offshore installation.[274]

8.1.5 What needs to be decommissioned?

The Guidance Notes echo the OSPAR Convention and the OSPAR Decision 98/3. In this sense, they lay down a general obligation not to leave the whole or a part of a disused installation in the sea.[275] Thus, the main rule is the complete removal of the disused installations from the sea and to move them onshore for re-using, recycling or final disposal.[276]

The re-use of an installation is a preferred option according to Decision 98/3, something reiterated by OPRED with the aim to encourage cost-effectiveness.[277] To re-use the installation by leaving it in place offshore could contribute to new investments since there would already be the necessary infrastructure to conduct the activity.[278] Nonetheless, the obligation to decommission concerns all installations which consist of fixed steel or concrete (gravity). The floating and subsea installations must also be decommissioned according to the Guidance.[279]

Exceptions to full decommissioning are possible, subject to approval. Examples are "footings of large steel jackets weighing more than 10,000 tonnes in air" and concrete installations if they would be difficult to remove. Otherwise, all the fixed steel, concrete (gravity), floating and subsea offshore installations must be removed.[280] In order to obtain a derogation from the total removal of a footing weighing more than 10,000 tonnes "a significant reason" has to be given.[281] The operator must demonstrate why a derogation is a preferable option than the re-use, recycling or final disposal of the structure on land. To apply for permission to keep the whole or part of an installation in place, safety, environmental, technical, societal and economic consequences must be considered in the application. The permission to leave the structure in place will be approved or declined by the government. The same procedure concerns gravity-based concrete installations.[282] An abandoned installation above the surface of the sea must be maintained, and the safety of navigation must be ensured by "an unobstructed water column of at least 55 meters".[283] In addition to this, there must be a clear liability to meet possible claims for damages in the future.[284]

The topsides of installations must be decommissioned to re-use, recycle or move them for final disposal on land. The requirement to re-use, recycle or make a final disposal relates to all the other parts

[273] Gordon G, Paterson J, Decommissioning of Offshore Installations Upon the UK Continental Shelf in Roggenkamp M, Banet C, *European Energy Law Report XIII* (2020), p. 318.
[274] See Guidance Notes, 6.
[275] Guidance Notes, 33 ff.
[276] Ibid.
[277] Ibid, 27.
[278] Paterson J, United Kingdom in Pereira; EG and others (eds), The Regulation of Decommissioning, Abandonment and Reuse Initiatives in the Oil and Gas Industry: From Obligation to Opportunities (Wolters Kluwer 2020), p. 640.
[279] Guidance Notes, 33 f.
[280] Ibid.
[281] Ibid,35.
[282] Ibid.
[283] Ibid.
[284] Ibid.

of the installations as well as the topsides.[285] A derogation falling into the scope of Decision 98/3 is not possible since the removal would not endanger "the structural stability of the substructure".[286]

The applicable rules for the abandonment of subsea installations are slightly different as the structure is left in place. To obtain approval for such a derogation, the disposal must not disturb or interfere with other legitimate uses of the sea.[287] Furthermore, an exceptional circumstance may be a reason to leave an installation partially or wholly in place. Such a circumstance may be "structural damage or deterioration, or some other reason presenting a difficulty" to comply with the ordinary decommissioning procedure.

8.1.6 The Decommissioning Programme

The Petroleum Act gives a brief definition of the content required in the Decommissioning Programme. Section 29(4) sets out the content to be included in the Programme:

"An abandonment programme

(a) shall contain an estimate of the cost of the measures proposed in it;

(b) shall either specify the times at or within which the measures proposed in it are to be taken or make provision as to how those times are to be determined;

(c) if it proposes that an installation or pipeline be left in position or not wholly removed, shall include provision as to any continuing maintenance that may be necessary".

The hard law does not go into the specific content of the Programme. The soft law, the OPRED Guidance Notes, supplements the legislation by identifying the principles of what the document programme should include. The Guidance Notes emphasize the importance of *individual circumstances* meaning that the content of programmes may vary.[288] This is because derogation is granted on a case-by-case basis, which takes into account the materials, weight and state of the installation (e.g. if the installation has been damaged) and the environmental impact it would have if left in place.

The Guidance Notes define a set of principles that should be followed in a Decommissioning Programme, and it can be applied to the whole or parts of the installation to be decommissioned.[289]According to the Notes, a decommissioning programme should:

- Identify and describe all items of equipment, infrastructure and materials that have been installed or drilled. Installations, subsea equipment, wells, pipelines and accumulated drill cuttings at the site.
- Describe the decommissioning solution for each item explaining why the solution has been selected, providing appropriate supporting evidence. In doing this the programme must consider how the principles of the waste hierarchy will be met and show the extent to which the installation, including the topsides and the materials contained within the installation, will be re-used, recycled or disposed of on land.
- Clearly specify any equipment or remains which are to be considered for decommissioning in place/situ (with the exception of items left downhole).
- Be supported by an environmental appraisal. [290]

[285] Ibid, 33 ff.
[286] Ibid.
[287] Ibid, 37.
[288] Guidance Notes, 26.
[289] Ibid, §6.3, p. 26.
[290] Ibid, 26 f.

The Guidance Notes also give an indication of what specific issues should be included in the decommissioning programme. Among these are: description of items to be decommissioned, removal and disposal methods,[291] environmental appraisal,[292] list of wells related to the field and some brief details of their plugging and abandonment, interested party consultations[293] and detailed cost breakdown.[294]

The Guidance Notes emphasize the importance of consultations with stakeholders.[295] Consultations on a drafted Decommissioning Programme are a crucial part of the process. The process includes consultations with government departments and agencies as well as non-governmental agencies.[296] The process begins after the draft has been approved by OPRED. The process gives the stakeholders the opportunity to put forward their point of view about the decommissioning programme.[297] The OGA's role is to examine the cost of the decommissioning programme and to consider whether or not the costs could be reduced.[298] The comments on the draft should be reviewed and taken into account in the final draft.[299]

After finalizing the draft, the OPRED will give notification that the Programme has been submitted for approval.[300] The Secretary of State in turn informs the persons involved in the decommissioning of the approval. Possible changes to the Programme after approval must be discussed with the authority. This is also legislated in section 34 of the Petroleum Act.[301] The decommissioning process must begin as soon as the use of the installation or production comes to an end.[302]

8.1.7 When and who has to decommission?

In the UK the Petroleum Act does not include a timeline for when decommissioning must be conducted nor when the cessation process is to begin. Flexibility is the preferred choice. According to the OGA planning of the decommissioning process "should begin sufficiently before cessation of production to allow identification and generation of options that create best value for the stakeholders".[303]

The Petroleum Act determines when the planning for the imminent decommissioning must begin by sending a notice to the persons possessing the interest in the activity ("notice holders").[304] The framework authorizes OPRED to issue a notice to require a person to submit a decommissioning programme ("an abandonment programme").

The Petroleum Act does not determine when the notice should be served so the Guidance Notes cover this. The notice is to be issued as soon as construction of the installation has begun, and a Field

[291] Disposal methods like re-using, recycling or final disposal in land.
[292] To assess environmental impact and information on the energy balance and emissions.
[293] Assessment of public consultation to assess the interest from the Stakeholders.
[294] A reasonable cost estimate.
[295] Guidance Notes, 29.
[296] Ibid.
[297] Ibid.
[298] Gordon G, Paterson J, Decommissioning of Offshore Installations Upon the UK Continental Shelf in Roggenkamp M, Banet C, *European Energy Law Report XIII* (2020), p. 319.
[299] Guidance Notes, 29 f.
[300] Ibid 31.
[301] Ibid, 32.
[302] Ibid, 23.
[303] Oil and Gas Authority, 'Programmes & guidance', available at: https://www.ogauthority.co.uk/decommissioning/programmes-guidance/.
[304] Guidance Notes, 14.

Development Plan has been approved.[305] The same procedure will be applied to additional installations at a field. However, the provision does not define to whom the notice should be sent. Therefore, the recipient of notice must be assessed.

It has to be decided who the "person" referred in the Act should be as the person will be obligated to both submit the Decommissioning Programme and perform the activity. Section 30(1) determines to whom the notice is sent regarding the installation.[306] Possible parties to have a decommissioning obligation are defined in a very broad manner to ensure that the decommissioning is carried out,[307] and avoid any party defaulting on its liabilities. [308] In principle, this would be any person that possesses:

"a right to exploit or explore mineral resources in any area, to unload, store or recover gas in any area to convert any natural feature in any area for purpose of storing gas, or the person intends to carry on an activity mentioned in that subsection from by means of or on the installation or if he had such a right when any such activity was last so carried on".[309]

While from this it seems that the operator or owners of an oil and gas facility is the party to conduct the decommissioning, a person having an economic interest through a prospective purchase of an interest can also become a subject to receive a notice.[310] In addition to that anyone that has an interest in an installation through an exploring, exploiting or recovering activity may take on the responsibility.

The Guidance Notes regulate the notification procedure in a simpler way. The Guidance Notes list the following persons as being eligible to receive the notice concerning the installations (pipelines excluded):[311] the operator, the licensees, owners of the installations, including parties who own any interest in an installation; and parties to a JOA or a similar agreement.

According to the Guidelines "notices may not be served on persons who fall into the categories above but who are not and never have been entitled to derive a financial or other benefit in relation to the installation".[312] One could draw the conclusion that the interest means a financial or other type of benefit. One could also ask if there can be an interest without gaining some kind of benefit from the activity, which is confirmed by the Petroleum Act in its supplementary provisions.[313]

The Secretary of State may withdraw a notice before the decommissioning programme is submitted according to section 31(5) of the 1998 Act. Such a notice may serve to replace or supplement an earlier notice. A company is also able to request a withdrawal according to the Guidelines. A request

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[305] Guidance Notes, 15.

[306] "(1) A notice under section 29(1) **shall not be given** to a person in relation to the abandonment of an offshore installation **unless at the time** when the notice **is given he is within any of the following paragraphs**—

(a) the person having the management of the installation or of its main structure;

(b) a person to whom subsection (5) applies in relation to the installation;

(ba) a person to whom subsection (5)(a) and (b) applied in relation to the installation, but who—

(i) transferred the right mentioned in that subsection to another person, and

(ii) has not obtained a consent required under the licence in relation to the transfer;

(c) a person outside paragraphs (a) and (b) who is a party to a joint operating agreement or similar agreement relating to rights by virtue of which a person is within paragraph (b);

(d) a person outside paragraphs (a) to (c) who owns any interest in the installation otherwise than as security for a loan;

(e) a [body corporate] which is outside paragraphs (a) to (d) but is associated with a [body corporate][2] within any of those paragraphs." The Petroleum Act 1998, s 29 (2).

[307] Paterson J, United Kingdom in Pereira; EG and others (eds), The Regulation of Decommissioning, Abandonment and Reuse Initiatives in the Oil and Gas Industry: From Obligation to Opportunities (Wolters Kluwer 2020), p. 635.

[308] Ibid, p. 641.

[309] The Petroleum Act 1998, sub-s 5.

[310] Ibid.

[311] Guidance Notes, 14 f. See also The Petroleum Act 1998, s 30.

[312] Guidance Notes, 15.

[313] The Petroleum Act 1998, s 31 (A1).

of withdrawal may be made if, for example, the financial factors concerning the potential decommissioning costs have changed, or if there is another reason why the company believes the notice should be withdrawn, such as that there is an upcoming transfer of interest to the installation.[314]

8.1.8 Financial capabilities and liabilities

The UK Government requires there to be a definite financial capability to execute the decommissioning. The Petroleum Act authorizes the Secretary of State to judge if there are enough financial assets to perform the decommissioning.[315] Information about the financial affairs, such as date management accounts and information about financial capability may be required by a notice from the Secretary of State.[316] The same section enables the Secretary to request a financial security to cover the decommissioning costs.[317]OPRED is entitled to decide whether or not it is necessary to use this power.[318] However, the option to require a security is only used occasionally.[319]

The costs of decommissioning should be covered by the owner's cash flow.[320] However, it is more likely that parties to the JOA[321] enter into a Decommissioning Security Agreement (DSA).[322] The DSA is there to protect the UK Government (and the taxpayers) from being obligated to fund the activity.[323] An obligation to enter into such an agreement is included in most of the newer JOAs but not in the older ones.[324]

The UK Government has committed to tax relief for persons conducting activity on the UK Continental Shelf. The Government and the oil and gas industry have entered into 'Decommissioning Security Deeds' in order to maintain "the level of tax relief at the time of entering into the agreement".[325] The background to the Deeds is that the level of security the parties commit themselves to is high since they rely on tax reliefs remaining more or less untouched by the Government.[326]

Persons determined in section 29 of the 1998 Act or just the owners may be liable to meet claims of liability due to interest in or direct responsibility for the offshore installation. This section presents the criminal offences, the liability regarding an abandoned installation and the economical liability to decommission.

[314] Guidance Notes, 16 f.
[315] The Petroleum Act 1998, s 38; Guidance Notes, 17.
[316] The Petroleum Act 1998, ss 38 (1) and 38 (2); Guidance Notes, 18.
[317] The Petroleum Act 1998, d 38 (4).
[318] Guidance Notes, 18.
[319] Gordon G, Paterson J, Decommissioning of Offshore Installations Upon the UK Continental Shelf in Roggenkamp M, Banet C, *European Energy Law Report XIII* (2020), p. 321.
[320] Aldersy-Williams J, Decommissioning Security, OGEL 4 (2007), para I-13.2; Gordon G, Paterson J, Decommissioning of Offshore Installations Upon the UK Continental Shelf in Roggenkamp M, Banet C, *European Energy Law Report XIII* (2020), p. 321.
[321] The 1998 Act, s 29 (1) (c).
[322] Gordon G, Paterson J, Decommissioning of Offshore Installations Upon the UK Continental Shelf in Roggenkamp M, Banet C, *European Energy Law Report XIII* (2020), p. 322.
[323] Ibid.
[324] Ibid.
[325] Ibid, 323.
[326] Ibid, 322 f.

An executive or a company may be guilty of an offence if certain conditions are fulfilled.[327] The Petroleum Act regulates offences in Sections 40 and 41. A person can be convicted to an imprisonment or to a fine or both if they are guilty of one of the following offences[328]:

- The decommissioning is not started or continued without a reasonable excuse[329]
- The person does not give required information of other notice holders to the Secretary of State[330]
- The person fails to submit the Decommissioning Plan and the records and drawings are not submitted to the Secretary of State by its notice without a reasonable excuse[331]
- The person fails without a reasonable excuse to collaborate with other persons to perform the decommissioning or to make changes in the times of measures described in the Programme by a notice from the Secretary of State[332]
- The person fails to carry out the Decommissioning Programme and does not comply with a remedial action required by a notice.[333]
- The person fails to provide information of financial affairs required by a notice from the Secretary of State.[334]

The residual liability is based on the owner's responsibility for any residues and remains of installations, which have been left in place at the time of decommissioning.[335] The responsibility continues in perpetuity according to the Guidance Notes.[336] Case law[337] has created a test to assess a residual liability. The test determines that the residual liability arises due to damage or loss if the person has been negligent in their duty of care.[338] The loss should be foreseeable, and the assessment of the duty of care must be fair, just and reasonable. The doctrine states that a prudent owner would not have any problem in the English and Scottish courts when the negligence is assessed, but the outcome of a foreign court claiming residual liability based on an extra-territorial jurisdiction and application of strict liability is uncertain.[339]

The duty to perform and fund the decommissioning is joint and several according to the Guidance Notes. This means that in the case of another party's default, other parties involved in the decommissioning are responsible for performing the duty of the defaulting party.[340] There is a possibility, as the document discusses, that a single party may become responsible for the entire cost of completing the decommissioning.[341]

[327] Hammerson M, *Oil and Gas decommissioning: Law, Policy and Comparative Practice* (Global Business Publishing Ltd, London, 2013), p. 15.
[328] The Petroelum Act 1998, s 40 (A).
[329] Ibid, s 28 A (2).
[330] Ibid, s 30 (3)
[331] Ibid, s 33 (3).
[332] Ibid, s 36 A (7).
[333] Ibid, s 37 (2).
[334] Ibid, s 38 (3).
[335] Guidance Notes, 72.
[336] Ibid.
[337] Caparo Industries Ltd. V Dickman [1990] 2 AC 605.
[338] See more about this in Paterson J, United Kingdom in Pereira; EG and others (eds), The Regulation of Decommissioning, Abandonment and Reuse Initiatives in the Oil and Gas Industry: From Obligation to Opportunities (Wolters Kluwer 2020), p. 642-643.
[339] Ibid.
[340] Guidance Notes, 14.
[341] Ibid.

8.1.9 Environmental considerations

OPRED activity and policies are guided by recognized principles of environmental law: the precautionary principle and the polluter pays principle. A key principle concerning OPRED policies and practices is the precautionary principle.[342] This strong principle within both international law and national jurisdictions can be found at a general level both in the Rio Declaration[343] and soft law of the European Union.[344] The aim of the precautionary principle is to achieve a clear seabed. If an installation is not an object for decommissioning and will therefore remain in the seabed, a clear seabed will not be achieved.[345] However, the OPRED Guidelines make it clear that it is not always possible to achieve this as it may be necessary to leave the installation in place.[346]

Concerning the interest in the field, the Guidance Notes make it clear that the UK complies with the 'Polluter Pays Principle'.[347] The principle means that the producers of pollution must carry the cost to prevent environmental damages and damages to human health.[348] The principle applies to the responsibilities of those who benefit from exploitation or production in the UKCS. The benefits received from the activity come with a responsibility to carry out the decommissioning of an installation.

8.2 Offshore wind decommissioning in Scotland

8.2.1 Background to offshore wind licensing

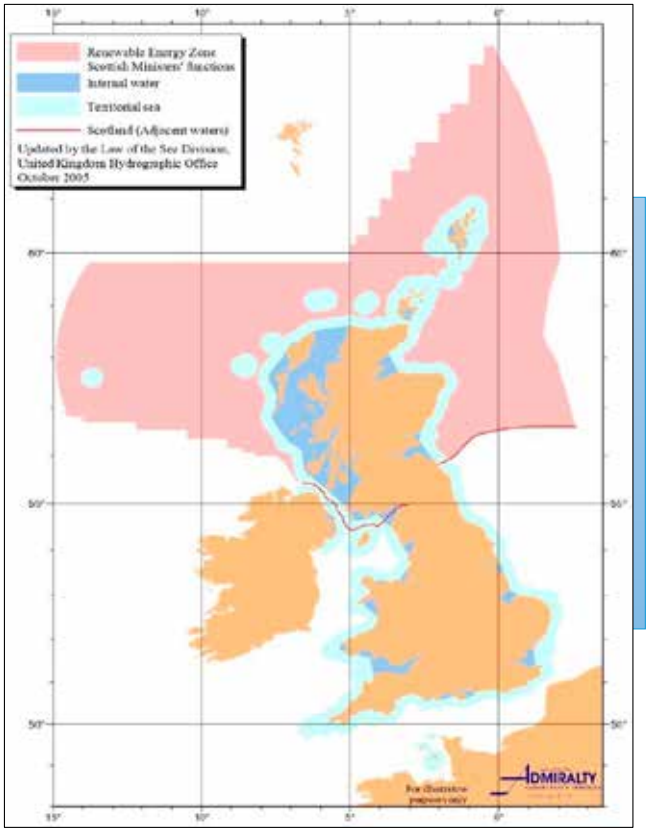
The main requirements for the decommissioning of offshore energy installations are contained in the Energy Act 2004, as amended by the Energy Act 2008 and the Scotland Act 2016.[349] The Act established provisions for the decommissioning of offshore installations (including offshore renewable energy installations) in sections 105–114, requiring a responsible person constructing/operating the installation to prepare a 'decommissioning programme'.[350]

As we discuss in further detail, the regulation of decommissioning by the Energy Act is complemented by a soft law instrument, the Guidance Notice issued in 2019 which gives thorough guidance on the process.[351] The Guidance Notice applies not only to wind farms but also to other offshore renewable energy technology.

[342] Guidance Notes, 6.
[343] United Nations, General Assembly, *Report of the United Nations Conference on Environment and Development: Rio Declaration on Environment and Development*, A/CONF.161/26 (12 August 1992), Principle 15.
[344] Communication, 'Communication from the Commission on the precautionary principle' COM (2000) 1 final.
[345] Guidance Notes, 37.
[346] Ibid, 6.
[347] Guidance Notes, 6.
[348] The London School of Economics and Political Science, 'What is the polluter pays principle?'.
[349] Decommissioning of Offshore Renewable Energy Installations in Scottish Waters or in the Scottish Part of the Renewable Energy Zone under the Energy Act 2004. Guidance notes for industry (in Scotland). Draft for Consultation November 2019.
[350] The Energy Act 2004, Chapter 3.
[351] Decommissioning of Offshore Renewable Energy Installations in Scottish Waters or in the Scottish Part of the Renewable Energy Zone under the Energy Act 2004. Guidance notes for industry (in Scotland). Draft for Consultation November 2019, available at: https://www.gov.scot/publications/decommissioning-offshore-renewable-energy-installations-scottish-waters-scottish-part-renewable-energy-zone-under-energy-act-2004-guidance-notes-industry-scotland/.

To help developers and owners understand the decommissioning obligations laid down in the Energy Act, the Scottish Ministers developed the Guidance on Decommissioning of Offshore Renewable Energy Installations in Scottish Waters or in the Scottish Part of the Renewable Energy Zone.[352] The Guidance covers many aspects of decommissioning, including the geographical scope, requirements for the decommissioning programmes and their content, decommissioning standards, liabilities, financial security, etc.

One of the rules for operating wind farms is the removal of offshore installations, it is also an activity covered by rules laid down by a Marine Licence to operate a wind farm. Licences for offshore wind farms are granted through a system regulated by Part 4 of the Marine (Scotland) Act 2010 (between 0 and 12 nautical miles), and Part 4 of the Marine and Coastal Access Act 2009 (between 12 and 200 nautical miles).[353] Marine Licences may be issued for the lifetime of a project – from the construction of an installation to its removal. The licence will therefore be valid during the operational and decommissioning stage of a project and the conditions contained will remain enforceable throughout its lifetime.[354]



Source: Explanatory Memorandum to the Renewable Energy Zone (Designation of Area) (Scottish Ministers) Order 2005.

Consents and licences establish certain conditions that the developer is bound to follow, including decommissioning. This implies that the decommissioning of an offshore wind farm is considered right from the time of the granting of the license to operate it. Section 71 of the Marine and Coastal Access Act 2009 prescribes that, having considered an application, the appropriate licensing authority may grant a licence subject to certain conditions including responsibility:

> "(d) for the removal, at the end of a specified period, of any object or works to which the licence relates;
>
> (e) for the carrying out, at the end of a specified period, of such works as may be specified for the remediation of the site or of any object or works to which the licence relates."

[352] Decommissioning of Offshore Renewable Energy Installations in Scottish Waters or in the Scottish Part of the Renewable Energy Zone under the Energy Act 2004. Guidance notes for industry (in Scotland). Draft for Consultation November 2019.
[353] Marine Scotland Consenting and Licensing Guidance for Offshore Wind, Wave and Tidal Energy Applications (2018).
[354] Marine Scotland. Guidance for Marine Licence Applicants Version 2 - June 2015.

8.2.2 Decommissioning under the 2004 Energy Act

Under the terms of the Energy Act, the appropriate Minister may by notice require a person who is proposing to construct, extend, operate or use an offshore renewable energy installation (or is already doing so) to submit a programme for decommissioning the relevant object.[355] For the purposes of the Energy Act, "relevant object" means the whole or any part of a renewable energy installation or a related electric line.[356]

The provisions on decommissioning in Scotland are applied to the offshore installations in Scottish territorial waters or in Scottish parts of a Renewable Energy Zone. Section 104 of the Energy Act defines Scottish Waters as:

(a) the internal waters of the United Kingdom that are in or are adjacent to Scotland; or

(b) so much of the territorial sea of the United Kingdom as is adjacent to Scotland.[357]

Regarding the Renewable Energy Zone, under section 84(4) a Renewable Energy Zone may be designated as the area within which the United Kingdom's rights to exploit areas for energy production are to be exercisable,[358] which is:

"(a) any area for the time being designated as exclusive economic zone, but

(b) if Her Majesty by Order in Council declares that the Renewable Energy Zone extends to such other area as may be specified in the Order, is the area resulting from the Order."[359]

The "Scottish part" of the Renewable Energy Zone means the part of the Renewable Energy Zone designated as an area in relation to which the Scottish Ministers are to have functions.[360]

Section 105 of the Energy Act requires the owner or operation of the installation to submit a programme for decommissioning the "relevant object", which means "the whole or any part of a renewable energy installation or a related electric line".[361] This is a broad definition that includes objects already constructed, in construction or in transit.

8.2.3 Authorities governing decommissioning

The Scotland Act 2016, amending the Energy Act 2004, authorized Scottish Ministers to act as the "appropriate Minister" from 1 April 2017 under provisions on decommissioning that are applied to the offshore installations in Scottish territorial waters or in Scottish parts of a Renewable Energy Zone, therefore replacing the UK Secretary of State for the Department for Business Energy and Industrial Strategy.[362]

[355] The Energy Act 2004, section 105(2)
[356] Ibid, section 105(10).
[357] Ibid, section 104(1).
[358] Explanatory Memorandum to the Renewable Energy Zone (Designation of Area) (Scottish Ministers) Order 2005, No 3153, para 4.1.
[359] The Energy Act 2004, section 84(4).
[360] Ibid, section 84(5).
[361] Ibid, section 105(10).
[362] Concordat between the UK Department for Business Energy and Industrial Strategy and Scottish Ministers on decommissioning renewable energy installations (2017) and The Energy Act 2004, section 105(1A).

In cases where the object is located in a cross-border site within the UK,[363] the responsibility for decommissioning will be divided between Scottish Ministers and the Secretary of State.[364]

In addition, the Scottish Ministers and the Crown Estate Scotland entered into a Memorandum of Understanding (MoU) regarding the decommissioning of offshore renewable energy installations. The MoU was necessary because of the transfer of the assets and functions in respect of the seabed to Crown Estate Scotland in accordance with the Crown Estate Transfer Scheme 2017 and amendments to the Energy Act 2004 by the Scotland Act 2016.[365] The MoU has the function of avoiding the duplication of the decommissioning requirements imposed on developers under the Energy Act, and also excessive paperwork and consultations.[366] The objective of the MoU was to ensure that the Scottish Ministers are able to provide a "one-stop-shop" in relation to decommissioning as far as possible.

8.2.4 What needs to be removed? Presumption of full removal

It is generally expected that all installations and structures will be fully removed at the end of the operational life of the wind farm. Such a request for full removal is also anticipated when the responsible parties design their decommissioning plans.

However, the system also allows for partial removal. When this is the case, the Guidance Notice for decommissioning of Scotland indicates that developers/owners should take into account the following points:

- considerations on the individual characteristics of the site
- the IMO "extreme cost" exception normally will not be accepted as the sole reason in favour of partial removal
- safety concerns should preferably be supported by written evidence of a third party (such as the Health and Safety Executive)
- a responsible person is encouraged to consider using the 'Comparative Assessment Framework' set out in the UK Government's decommissioning guidance for the Oil and Gas sector when determining their position on removal.[367]

Exceptions to full removal will be considered on a case-by-case basis and this must be put forward as part of the decommissioning programme, taking into consideration the environmental assessment, potential risks, cost and technological capabilities at the time of decommissioning.[368]

The Scottish decommissioning regime demands meeting the requirements of the IMO 1989 Guidelines and Standards for the Removal of Offshore Installations, even if these were not developed with offshore wind farms in mind. All derogations will be assessed in line with these standards if they are

[363] A site of an offshore renewable energy installation or its extension, straddles the marine border between Scottish Waters and other international waters of the UK or, in respect of a Renewable Energy Zone, the marine border between that part over which the Scottish Ministers have functions and the rest of the zone.
[364] Concordat between the UK Department for Business Energy and Industrial Strategy and Scottish Ministers on decommissioning renewable energy installations (2017), para 12.
[365] Memorandum of Understanding Between the Scottish Ministers and Crown Estate Scotland (Interim Management) with Respect to the Decommissioning of Offshore Renewable Energy Installations (2017).
[366] Decommissioning of Offshore Renewable Energy Installations in Scottish Waters or in the Scottish Part of the Renewable Energy Zone under the Energy Act 2004. Guidance notes for industry (in Scotland). Draft for Consultation November 2019, para 3.15.
[367] Ibid, para 7.8.
[368] Ibid, para 7.6.

based on the evidence that removal would create unacceptable risks to personnel or marine environment, be technically unfeasible or involve extreme costs. [369]

8.2.5 Decommissioning procedure: the Decommissioning Guidance

In 2019, the Marine Scotland Directorate and the Scottish Ministers issued a guidance note to outline the procedure that the government envisaged for decommissioning activity.[370] The Decommissioning Guidance is a soft law instrument that draws inspiration from oil and gas practices to orient the decommissioning process for wind farm operators and owners. This extensive and detailed document is discussed below.

Stage 1, Preliminary discussions. The decommissioning programme for an offshore wind farm in Scotland consists of several stages, the first being a preliminary discussion between the developer and the Scottish Ministers.[371] Developers are encouraged to start thinking about decommissioning from the moment they apply for the licence, to ensure that decommissioning costs are taken into account from the start.[372]

This concern is reflected in the timing of the submission of the decommissioning plans, in contrast to practices in oil and gas in some of the jurisdictions we have studied.[373] Final draft decommissioning programmes have to be submitted for approval no later than 6 months in advance of construction and the first drafts should be submitted about 18 months before construction.[374] In other words, decommissioning plans must be in place *before* the wind farm is constructed. Furthermore, a condition of granting a license to operate a wind farm is that construction cannot begin until a decommissioning programme has been submitted to and approved by Scottish Ministers.[375]

[369] Decommissioning of Offshore Renewable Energy Installations in Scottish Waters or in the Scottish Part of the Renewable Energy Zone under the Energy Act 2004. Guidance notes for industry (in Scotland). Draft for Consultation November 2019, para 7.5.

[370] Decommissioning of Offshore Renewable Energy Installations in Scottish Waters or in the Scottish Part of the Renewable Energy Zone under the Energy Act 2004. Guidance notes for industry (in Scotland). Draft for Consultation November 2019, available at: https://www.gov.scot/publications/decommissioning-offshore-renewable-energy-installations-scottish-waters-scottish-part-renewable-energy-zone-under-energy-act-2004-guidance-notes-industry-scotland/.

[371] Decommissioning of Offshore Renewable Energy Installations in Scottish Waters or in the Scottish Part of the Renewable Energy Zone under the Energy Act 2004. Guidance notes for industry (in Scotland). Draft for Consultation November 2019, para 5.5.

[372] Ibid, para 5.5.

[373] Department for Business, Energy & Industrial Strategy, "Guidance Notes: Decommissioning of Offshore Oil and Gas Installations and Pipelines", 2018, 21.

[374] Decommissioning of Offshore Renewable Energy Installations in Scottish Waters or in the Scottish Part of the Renewable Energy Zone under the Energy Act 2004. Guidance notes for industry (in Scotland). Draft for Consultation November 2019, para 5.6.

[375] Ibid, para 5.7.

Stage 2: Notice to submit a programme for decommissioning. Under section 105, the Scottish Ministers may by notice require the developer/owner to submit a decommissioning programme[376] normally after a consent or Marine Licence for the offshore installation has been granted.[377] When multiple persons are acting jointly, the notice may be given to one or more of them. In these cases, the requirement to submit a programme must be satisfied by all notified persons.[378]

(C) Equinor, photo Ole Jørgen Bratland 1

Stage 3: Drafting the decommissioning programme. Developers should prepare the draft decommissioning programme taking into account all the requirements discussed with the Scottish Ministers in Stage 1.

The decommissioning programme must include:

a) Measures to be taken to decommission the relevant object

b) An estimate of the expenditure likely to be incurred in carrying out those measures

c) Provision for determining the times at which, or the periods within which, those measures will have to be taken;

d) Provision for restoring that place to the condition that it was in prior to the construction of the object if the relevant object will be wholly or partly removed

e) Provision for whatever continuing monitoring and maintenance of the object will be necessary if the relevant object will be left in position or will not be wholly removed.[379]

The measures proposed in the decommissioning programme should also include environmental and safety considerations, cost estimates and financial security provisions.[380]

The measures proposed in the decommissioning programme should also include environmental and safety considerations, cost estimates and financial security provisions.[381]

Stage 4: Consultations. In parallel to the notice to submit the decommissioning programme, the Energy Act "may require the recipient of the notice to carry out the consultations specified in the notice before submitting the programme required of him".[382]

[376] The Energy Act 2004, section 105(2).
[377] Ibid, section 105(3).
[378] Ibid, section 105(4)
[379] Ibid, section 105(8).
[380] Decommissioning of Offshore Renewable Energy Installations in Scottish Waters or in the Scottish Part of the Renewable Energy Zone under the Energy Act 2004. Guidance notes for industry (in Scotland). Draft for Consultation November 2019, para 5.12.
[381] Ibid, para 5.12.
[382] The Energy Act 2004, section 105(7).

When drawing up the decommissioning programme the developer/owner should consult with key representatives of parties who may be affected by the decommissioning proposals, such as the fishing industry and other users of the sea. Moreover, the developer/owner should take into account the comments received during the consultations with the Scottish Ministers.[383] This will be reviewed and the Scottish Ministers will send their written comments on the programme, which should be again updated in line with the feedback received.[384]

Stage 5: Submission and approval of the decommissioning programme. The final plan is submitted to the Scottish Ministers,[385] no later than six months in advance of commencing construction.[386]

The Scottish Ministers may then either approve or reject a programme, more specifically they may:

a) Approve the submitted programme without modifications and unconditionally

b) Approve the programme with modifications and/or subject to conditions (after giving the person who submitted it an opportunity to make representations about the proposed modifications or conditions)

c) Reject the programme giving reasons and require a new one[387]

d) Prepare a decommissioning programme themselves, recovering the expenditure incurred and determining the interest rate on that sum.[388]

Stage 6: Reviews and revisions of decommissioning programmes. The UK and Scottish system is based on plans submitted many years ahead of the actual decommissioning. Because of this, the Energy Act requires the Scottish Ministers to conduct reviews of the approved decommissioning programme from time to time.[389]

The decommissioning framework empowers Scottish Ministers or the developer/owner to propose modifications to the plan.[390] These changes may reflect modifications prompted by:

- Information gathered during the course of construction and operation
- Changes in market conditions, international standards, the regulatory regime
- Knowledge of environmental impacts, including any sediment shift since the approval of the programme
- Construction or new species entering the area
- New technology
- Any relevant changes in nearby infrastructure/navigational routes
- The latest cost estimates and the robustness of the financial security arrangements.[391]

If the developer/owner decides to sell their assets wholly or partly, they may seek to transfer their obligations and liabilities under the decommissioning process to the new owner. The Scottish Ministers

[383] Decommissioning of Offshore Renewable Energy Installations in Scottish Waters or in the Scottish Part of the Renewable Energy Zone under the Energy Act 2004. Guidance notes for industry (in Scotland). Draft for Consultation November 2019, para 5.16.
[384] Ibid, para 5.17.
[385] Ibid, para 5.18.
[386] Ibid, para 5.6.
[387] The Energy Act 2004, section 106.
[388] Ibid, section 107.
[389] Ibid, section 108(1).
[390] Ibid, section 108(2).
[391] Decommissioning of Offshore Renewable Energy Installations in Scottish Waters or in the Scottish Part of the Renewable Energy Zone under the Energy Act 2004. Guidance notes for industry (in Scotland). Draft for Consultation November 2019, para 5.25.

would need to determine whether or not effect should be given to this proposal of transfer and give notice of their determination to all parties involved.[392]

Stage 7: Execution of decommissioning programmes. Once the installation stops operating, it is the duty of the responsible person to fulfil the removal obligation in its entirety, under the decommissioning programme.[393] It is an offence to deviate from the measures specified in the programme for decommissioning unless it is done with the agreement of the Scottish Ministers.[394]

Stage 8: Post-decommissioning report. Once operations have finished, the developer/owner must set in place arrangements for the monitoring, maintenance and management of the decommissioned site and any remains of installations or cables that may exist. Furthermore, a post-decommissioning report will be required as a condition of the Marine Licence that was granted.[395]

8.2.6 Financial security for decommissioning obligations

The Energy Act requires the person responsible for the wind farm decommissioning to provide financial security to guarantee the decommissioning costs right from the beginning of the lifetime of the wind farm.[396] The reason for this is to reduce the risk of liabilities falling on the public funds in the event of default by developers/owners by requiring and to ensure that appropriate securities are put in place.[397]

To ensure the performance of the decommissioning obligations, the Energy Act establishes a protective mechanism for the decommissioning funds under section 110A. It applies to any security that has been provided by a responsible person («security provider») in relation to carrying out an approved decommissioning programme.[398] This is designed to ensure that, in the event of insolvency of a person responsible for decommissioning an offshore renewable energy installation, the funds set aside for meeting those liabilities remain available for decommissioning and are not available to the general body of creditors.[399] Such protection will be available only if funds were set aside in a secured way (trust or other arrangements) for the implementation of the decommissioning programme.

Besides, section 110B is designated to ensure that creditors and potential future creditors of a person responsible for a decommissioning programme are aware of any decommissioning funds protected by section 110A. The Scottish Ministers may as well oblige the responsible person to publish any relevant information about the security arrangements, so his creditors and potential future creditors would be able to make an informed decision taking into account this information.[400]

[393] The Energy Act, section 109(1).
[394] Ibid, section 109(2).
[395] Decommissioning of Offshore Renewable Energy Installations in Scottish Waters or in the Scottish Part of the Renewable Energy Zone under the Energy Act 2004. Guidance notes for industry (in Scotland). Draft for Consultation November 2019, para 5.42.
[396] Ibid, para 9.1.
[397] Ibid, para 9.2.
[398] The Energy Act, section 110A.
[399] Decommissioning of Offshore Renewable Energy Installations in Scottish Waters or in the Scottish Part of the Renewable Energy Zone under the Energy Act 2004. Guidance notes for industry (in Scotland). Draft for Consultation November 2019, Annex A.
[400] Ibid, Annex A.

8.2.7 Liabilities

In case of non-compliance with decommissioning obligations, the Scottish Ministers may require the responsible person(s) to take remedial action within a specified period. If the requirement is not complied with, the Scottish Ministers may secure the remedial action themselves and recover the expenditure incurred, including any interest, from the person(s) concerned.[401] This solution is found in other jurisdictions, such as in Norway, in relation to oil and gas decommissioning.

In some instances, the Scottish Ministers may also place liability on an associated corporate body that has control of the 'main' developer/owner of the site in accordance with section 105(2b).[402] The understanding in the Energy Act is that one corporate body is associated with another if one of them controls the other or if a third body has corporate control over both of them.[403]

If the wind farm is left in place or partially removed the residual liability system is triggered. This eventuality must be incorporated in the approved decommissioning plan as provision for the management of the residual liabilities of developers/owners in the long-term must be included when the infrastructure is allowed to be left totally or partially in place. This may involve conducting surveys and monitoring or establishing legal arrangements between the developer/owner(s) and their landlord on post-decommissioning obligations.[404]

8.2.8 Decommissioning plans in action: the Hywind Scotland example

The Hywind Scotland Decommissioning Programme can be taken as an example of the decommissioning programme required by the Energy Act 2004. The document presents the Decommissioning Programme for the offshore elements of the wind farm Hywind Scotland (HYS), which consists of five floating turbines each of which is moored to the seabed by three anchors, four infield cables and one export cable connecting the wind farm to the shore. The wind farm has been operating since 2017 and has a design life of 20 years with the decommissioning therefore scheduled for 2037 and operations at site are expected to be done within a window of five months.

The programme consists of the following components:

1. Introduction
2. Background information (site layout and characteristics, adjacent facilities, etc.)
3. Description of items to be decommissioned (floating units, mooring lines and anchors, cables)
4. Description of decommissioning measures (decommissioning methods, what should be removed/left in place, reuse/recycling considerations)
5. Emergency response (overview of safety measures, notifications and reporting)
6. Environmental Impact Assessment (identification of the potential impacts)
7. Consultations with interested parties (list of the stakeholders involved in consultations)
8. Costs and financial security (confidential information)
9. Decommissioning schedule (only indicative schedule is provided)

[401] The Energy Act, section 110.
[402] Decommissioning of Offshore Renewable Energy Installations in Scottish Waters or in the Scottish Part of the Renewable Energy Zone under the Energy Act 2004. Guidance notes for industry (in Scotland). Draft for Consultation November 2019, para 5.11.
[403] The Energy Act 2004, section 105A(3).
[404] Decommissioning of Offshore Renewable Energy Installations in Scottish Waters or in the Scottish Part of the Renewable Energy Zone under the Energy Act 2004. Guidance notes for industry (in Scotland). Draft for Consultation November 2019, para 5.38.

10. Project management and verification (reviews with the regulatory authority)
11. Seabed clearance and restoration of the site commitments
12. Post-decommissioning monitoring, maintenance and management of the site (based on the scale of the remaining infrastructure).

The document constitutes the preliminary decommissioning programme for the offshore components of the project, which will be updated and further developed before the actual decommissioning takes place. The decommissioning procedure will also be subject to the award of a new Marine Licence by the Scottish Government. [405]

[405] Decommissioning Programme for Hywind Scotland Pilot Park (Doc. No. C178-HYS-Z-GA-00002 C178-HYS-Z-GA-00002). Valid from 2016-07-01. Rev. no. 03.

PART III

9. Conclusions and challenges ahead

9.1 Summarizing thoughts and paving the way ahead

"Understanding decommissioning of offshore infrastructures: A legal and economic appetizer" has been drafted to present an introductory one-stop-shop concerning the regulation of the decommissioning of offshore energy structures in the North Sea. Our aim has been to discuss the governance framework around the decommissioning activities of oil, gas and offshore wind structures from a comparative and interdisciplinary angle. We have done this by studying the regulatory aspects of decommissioning from a dual perspective. We have compared regulation in three different jurisdictions: Denmark, Norway and Scotland (in the wider context of the United Kingdom). Further, we have contrasted the regulation that applies to offshore wind with that applicable to the oil and gas industry. We have also discussed the economic and policy grounds for conducting decommissioning from an environmental economics perspective and given reasons for promoting circularity and strict environmental standards. This includes an analysis of the justification for leaving, partially removing or totally removing an offshore energy infrastructure, and the dynamic and static implications of these choices.

As discussed in this report decommissioning is the final stage in the life cycle of an offshore energy infrastructure. In this process, the oil, gas and wind turbines are either totally removed, partially removed or left in place (abandonment). This operation is conducted due to international and national obligations under which it is ultimately the responsibility of either the state or the energy companies to ensure: a) safe use of the sea by other users, this typically being maritime shipping; and b) minimal environmental impact and the restoration of the sea spaces and seabed to their original state as far as possible.

Decommissioning activities are not a new phenomenon in the oil and gas sector. Since the 1970s several thousand offshore oil and gas fields have been decommissioned across the globe, mostly in the Gulf of Mexico, which typically has smaller structures, and in the North Sea, where there are gigantic works of engineering. Experience of decommissioning offshore wind farms is much more recent and limited, only seven projects have been decommissioned worldwide so far. However, decommissioning activity is bound to increase in the near future as many oil and gas and wind farms are approaching the end of their lifecycle. There is substantial economic potential and many opportunities for decommissioning-related firms, including businesses located on the Norwegian west coast.

As complex as the engineering decommissioning process, we have highlighted the intricate aspects of the planning, governance and economics of it. Below are several key findings:

- The decommissioning of offshore oil and gas and that of offshore wind farms have to comply with the same legal parameters from a broad perspective. Public International Law does not distinguish between technological types at this stage.
- That said, both the hard law instruments and the soft law guidance that exists were drafted with oil and gas structures in mind but not offshore wind farms. As we discuss below, this is a matter still to be addressed.
- Both industries have a common starting point regarding the standard of removal set in the legislation. The main rule in the different regimes is a preference for full removal of the structures, with exceptions to leave some of them in place. These exceptions, so far, have only been granted regarding oil and gas projects.
- The decommissioning of cables and pipelines and objects under the seabed in general is subject to different criteria. Either these are not addressed by the rules or when they are,

the presumption is that they may remain in place. The decommissioning of offshore wind farms may bring changes regarding parts left In the seabed.

- Oil and gas decommissioning is thoroughly regulated in the North Sea. Denmark, Norway and the United Kingdom, and more specifically Scotland, have comprehensive, detailed and well-regarded regulatory frameworks. They are all quite similar as they combine some general requirements imposed by the law, often complemented by administrative regulations, with soft law instruments in the form of guidance notes or best practices developed by the state, often the respective Ministry or sectoral regulator. These general rules on decommissioning are concretized in a *decommissioning plan*, drafted by the entities under the obligation to conduct the operation, which needs to be approved by the regulator. The decommissioning plan is the project's decommissioning roadmap. These instruments contain the technical, structural, financial, environmental and legal considerations and actions that will be undertaken. Furthermore, the legal systems have developed comprehensive rules that address the risk of default in the decommissioning obligations. In the North Sea, this is done through a combination of a requirement of guarantees, insurance and funds reserved to conduct the activity. Furthermore, obligations and parties that are responsible for complying with them have also been extended through figures such as secondary liability or joint and several liability, in addition to the existence of residual liability rules.
- The decommissioning of offshore wind farms lags behind that of oil and gas regimes in terms of regulation. By and large, the rules are less developed, there are fewer or les thorough guidance notes and the regimes also appear less sophisticated. However, both Denmark and Scotland, particularly the latter, represent examples of a comprehensive regulatory framework and even some decommissioning activity. Norway, on the other hand, has barely any relevant rules for decommissioning. Interestingly, the source of inspiration for decommissioning rules for offshore wind farms appears to come from two different sources: oil and gas and electrical power plants. In Scotland, the influence of the offshore oil and gas decommissioning regime is palpable. In Denmark, the main influence appears to come from rules related to the decommissioning of *electricity generation plants*.
- Aspects related to sustainability and reutilization of the structures and their materials appear in the decommissioning frameworks. However, in the majority of cases, these are suggestions or requirements from the authorities that plans for reutilization be considered. Nonetheless, so far this seems to have proven successful as far as the rate of recycling materials is concerned, less so in the case of the repurposing or the reutilization of materials.
- Economics - and the economics of auction theory - can provide guidance to the regulation of decommissioning of ocean and seabed structures. First, theories from economics can be used to both understand incentives for agents involved in the industry, and how incentives change over the life of an asset. Second, auction theory can be used to understand how the process of decommissioning should be organised. That is, the interplay between industry agents - and potentially the introduction of governmental bodies - is readily analysed using game theory, and in particular so, auction theory.

In the remainder of this chapter we discuss three topics that deserve further consideration regarding the development of decommissioning regulatory frameworks: the need for more circularity and the reuse of the infrastructures and materials for a different purpose; the challenges to be faced by offshore wind decommissioning; and the location of onshore decommissioning activities and associated

conflicts. Our aim is to stimulate discussion about these important issues and highlight the way for needed future research.

9.2 Circularity and reuse: the market economy and its limitations

Traditional economic analyses have historically involved analyzing a linear economy. When designing a new product, a new process, or in our case a new energy asset to be deployed at sea, proper handling of waste from the assets must be given adequate considerations.

Analyses using a circular economy approach involve transforming the economic system from a linear one, into a circular economic system. Hence, resources historically extracted from the natural environment should be recycled and reused. Efforts concerning the reutilization of materials part of an offshore installation are not novel. Estimates indicate that about 80 % of the total weight of an offshore oil and gas platform is recycled. Two important materials used in the North Sea are steel and concrete; both with gains in terms of reuse, and potential regarding the value and reduced carbon intensity by avoiding steel being melted again. With concrete, its reuse value fairly limited, efforts being focused on methods and materials to recycle and repurpose.[406]

Metal-structures are highly recyclable, hence they are sold, but often not in ways maximizing value. In the oil and gas sector, concrete mattresses and anchors are recovered for reuse in offshore operations if possible, but the possibility of recycling these components presents technical and economic challenges. The separation of steel and concrete is difficult, and recycling of concrete in Norway has a low economic incentive for companies. In Norway, only 21 % of concrete from construction is reused,[407] and usually in low value for ditches, foundations or reinforcement layers.

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In economics, these aspects of reusability should be analysed using cost-benefit analysis. All monetary and non-monetary impacting affecting relevant stakeholders to (lack of) recycling of materials used in assets offshore. In other words, the applied policy of decommissioning could be guided by the theories from economics, both cost-benefit analyses and auction theory. In the discussion above, we have discussed two market failures, and how these may affect the circularity of offshore oil and gas, and offshore wind. We have illustrated that economic and

[406] The RSA Great Recovery & Zero Waste Scotland Programme (2015), North Sea Oil and Gas Rig Decommissioning & Re-use Opportunity Report; Bull AS, Love MS. Worldwide oil and gas platform decommissioning: a review of practises and reefing options. Ocean & coastal management. 2019 Feb 1;168:274-306.

[407] UiT (2019) "Millioner til gjenvinning av betong." Norges arktiske universitet and Forskning.no, https://uit.no/nyheter/artikkel?p_document_id=625603.

environmental aspects may impact both the desirability of decommissioning and the regulation/organization of decommissioning.

First, properly designed governance frameworks can give incentives to asset owners and operators to increase circularity; either by requiring secondary utilization of the materials or allowing for more efficient uses of the structures to maintain their value, such as repurposing or repowering.

Second, while the recycling of materials in decommissioning is quite successful, more value-enhancing uses of the resources are yet to be explored.[408] Large potential may lie in repurposing, examples being artificial reefs,[409] shell farms, energy hubs, or hydrogen platforms.[410] Additionally, the wind industry is resorting to repowering farms, expanding power output when fewer and larger turbines replace smaller ones.

Hence, the insights discussed in this report are not only relevant for already deployed assets. Rather, our discussion can be used to understand decommissioning of assets not yet deployed in the North Sea.

9.3 Offshore wind: uncharted territory

Our study shows that there is a lacuna of experience from an engineering and regulatory perspective when it comes to the decommissioning of offshore wind farms. This is probably due to the lack of decommissioning activity and comparative law experiences.

Only a handful of the more than 120 wind farms installed worldwide have been decommissioned, 4 in Europe and 7 in the world. Most of the wind farms that have been decommissioned so far were quite small. Of the countries in our study, only Denmark has had a fully functioning wind farm decommissioned. In Scotland, only a handful of testing turbines have been decommissioned. Moreover, these decommissioning experiences have all involved projects that were small both in the number of turbines and their size. New offshore wind projects will all have turbines that are the same size or bigger than the GE Renewable Energy 12MW Haliade-X prototype, which is already installed and producing power at Maasvlakte, in the Port of Rotterdam,[411] featuring a 220-metre rotor, a 107-metre blade and digital capabilities,[412] or the even larger SG 14-222 DD offshore Direct Drive wind turbine with 14-megawatt (MW) capacity by Siemens Gamesa, with a 222-metre diameter rotor, 108-metre long blades and a sweep are of 39,000 m^2 .[413] We simply do not know what the practical problem will be when it comes to decommissioning large offshore wind farms.

Similar comments may be made concerning the regulatory frameworks governing offshore decommissioning. Few jurisdictions in the world have rules for regulating offshore wind activity, much

[408] Nugraha, R. B. A., et al. (2019). "Rigs-To-Reef (R2R): A new initiative on re-utilization of abandoned offshore oil and gas platforms in Indonesia for marine and fisheries sectors." IOP Conference Series: Earth and Environmental Science. Vol. 241. No. 1. IOP Publishing

[409] Fowler, Ashley M, Anne-Mette Jørgensen, Jon C Svendsen, Peter I Macreadie, Daniel OB Jones, Arjen R Boon, David J Booth, m.fl." Environmental Benefits of Leaving Offshore Infrastructure in the Ocean". Frontiers in Ecology and the Environment 16, nr 10 (December 2018): 571–78.

[410] Oil and Gas Facilities, Offshore Infrastructure Reuse Can Contribute to Decarbonization, Journal of Petroleum Technology (2020).

[411] OE Offshore Engineer, GE's Haliade-X Produces First Power (2019), available at: https://www.oedigital.com/news/472669-ge-s-haliade-x-produces-first-power.

[412] GE Renewable Energy, An Industry First, Haliade-X offshore wind turbine, available at: https://www.ge.com/renewableenergy/wind-energy/offshore-wind/haliade-x-offshore-turbine.

[413] OE Offshore Engineer, Siemens Gamesa Launches 14MW Offshore Wind Turbine (2020), avaiable at: https://www.oedigital.com/news/478602-siemens-gamesa-launches-14mw-offshore-wind-turbine.

less the decommissioning of wind farms. In this report, we have analysed three jurisidictions in which there are rules on decommissioning but there is a huge variation in the amount of detail given in these rules. All of them, at least potentially, share the characteristic of being regulated through a hybrid model combining vague hard law requirements with more thorough soft law recommendations. They take common inspiration from previous decommissioning regimes.

Scotland appears to be the best in class with a thorough system modelled closely on the decommissioning rules for oil and gas applicable in the UK. The rules include a preference for full removal, have provisions dealing with issues regarding financial capability, considerations regarding environmental protection as well as liabilities. Importantly, decommissioning has to be considered from the very beginning of the project development, not just once the installation is approaching the end of its lifecycle. Norway, on the other hand, sits at the other end of the spectrum, with very basic provisions and lots of uncertainty.

Circularity aspects are also touched on in these regimes, although to a minimal extent. This is an area in which the regulatory framework could certainly do better. The difficulty of recycling wind turbine blades as composite materials, for example, is well known. Also, repurposing options, including repowering, might be suitable alternatives to achieve a more circular decommissioning of offshore wind farms.

Two other issues that offshore wind farms decommissioning will face should also be highlighted. First, the impact of the infrastructures on the seabed does not seem to be given adequate consideration. Both floating and bottom-fixed turbines are anchored to the seabed and cover immense areas, London Array, for example, covers 245 km^2, an area the size of Edinburgh, and hundreds of piles and foundations that are fixed into the seabed. Moreover, electricity cables – similar to gas pipelines – are buried in the seabed, but with a huge number of connecting points spread over a vast area in addition to which each turbine needs to be interconnected. The impact of the decommissioning on the seabed is an issue that has not yet been addressed by the regulation in any of the countries we have studied.

Secondly, due to their size – increasingly as they keep expanding – wind farms cause conflicts with other sea users. The risks associated with the partial removal of wind farms appear to be greater than those with oil and gas structures. As wind farms cover much larger areas, the risk of accidents involving maritime transport or naval activities is higher. These are risks that do not give rise to great concern when dismantling oil and gas structures in the North Sea due to their very large size but small surface area, added to which few of them are left in place.

These observations cause us to reflect on the need to consider a framework for offshore wind farm decommissioning that goes beyond mirroring the rules applied to oil and gas or electricity generators. This is certainly an area in which interdisciplinary research is needed.

9.4 Location of on-shore removal activities: opportunities and challenges

Discussions concerning offshore decommissioning focus on activities conducted at sea. Little, if anything, is said about the implications of onshore decommissioning. These implications are directly linked to the activities conducted on land once the structure has been removed or partly removed. These activities are typically conducted in ports where the infrastructure is received, processed and delivered to other onshore sites for further treatment. This may include onshore demolition, the recycling of these structures, their re-adaptation to be used as different pieces/products or their disposal. Onshore decommissioning activities are also a significant part of the total offshore energy structure

decommissioning costs. The Norwegian Petroleum Directorate estimates these activities to amount to between 5 and 15 % of the total decommissioning costs.[414]

A strong offshore energy decommissioning policy ought not to omit the associated onshore activities and to address some of the implications thereof. We have identified three key points, all of which demonstrate the need for the coordination and planning of land-sea decommissioning activities.

First, onshore bases that are suitable for conducting decommissioning operations are rare. Ports need specific infrastructure as well as geographical qualities to be suitable for carrying out decommissioning procedures. Appropriate land-sea combinations are scarce and rules concerning land planning and zoning may hinder incentives to develop further bases. For instance, having ultra-deep-water quays makes it possible for a port to accommodate vessels capable of heavy lifting.[415] Furthermore, decommissioning ports should ideally have full-scale facilities for platform dismantling and recycling and the relevant licences to do so.[416]

The North Sea is no stranger to this lack of port capacity. For instance, in Norway, there are five facilities that have permission to process decommissioned facilities for oil and gas: AF Miljøbase in Rogaland County, Aker Stord and Scandinavian Metal in Vetsland County, Lyngdal Recycling in Agder County and Lutelandet Offshore Vestland County.[417] When it comes to wind farms, other reports indicate that in Norway there are only three ports that are eligible to carry out this process: Stord Base, AF Decom and Sognefjørd.[418] In Scotland, in 2017, no port was fully licensed to conduct decommissioning, but plans were underway to upgrade ports on different parts of the East Coast as well as Shetland.[419] In Denmark, there has not yet been any decommissioning of oil and gas structures and only a small wind farm has been decommissioned to date. However, decommissioning is "imported" to facilities such as Frederikshavn for dismantling, as was announced on 8 June 2021 regarding the Balmoral platform.[420] Frederikshavn has been upgraded to be a decommissioning port and focuses on the recyclability and circularity aspects of the decommissioning obligation, a trend that is likely to be followed elsewhere.[421]

Secondly, and as a consequence of the above, the increase in decommissioning activity in the years to come will also lead to a need for further decommissioning port capacity. This represents an opportunity to develop new sites and create industrial possibilities. Norway with its engineering expertise and its geographical advantages is well suited to be a prime contestant for future decommissioning dominance in the North Sea. Clear government signals and targets, from both local and

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[414] Norwegian Petroleum Directorate, Decommissioning Costs, available at: https://www.npd.no/en/facts/publications/reports2/resource-report/resource-report-2017/cessation/decommissioning-costs/.

[415] Mark Lammey, Energy Voice, 'Industry will decide' best venues for North Sea decommissioning, Lerwick says (2018), available at: https://www.energyvoice.com/oilandgas/north-sea/163788/industry-will-decide-best-venues-north-sea-decommissioning/

[416] Offshore Magazine, Scottish ports compete for share of decommissioning rewards (2017), available at: https://www.offshore-mag.com/field-development/article/16755898/scottish-ports-compete-for-share-of-decommissioning-rewards.

[417] Norwegian Petroleum Directorate, Responsible removal of old facilities, https://www.npd.no/en/facts/production/shutdown-and-removal/responsible-removal-of-old-facilities/.

[418] DecomTools; and Kruse M, *Market Analysis - Decom Tools 2019* (2019), p. 36.

[419] Offshore Magazine, Scottish ports compete for share of decommissioning rewards (2017), available at: https://www.offshore-mag.com/field-development/article/16755898/scottish-ports-compete-for-share-of-decommissioning-rewards.

[420] Allister Thomas, Energy Voice, Harbour Energy sending Balmoral platform to Denmark for decommissioning (2021), available at: https://www.energyvoice.com/oilandgas/north-sea/decom/328783/harbour-energy-balmoral-platform-denmark-decommissioning/.

[421] NTU International, Recycling and Decommissioning the old ships in the port of Frederikshavn, Denmark, available at: https://www.ntu.eu/environment/recycling-and-decommissioning-the-old-ships-in-the-port-of-frederikshavn-denmark/; NIRAS, Europe's first specially designed recycling facility for ships and offshore structures has been established in a Danish harbour, available at: https://www.niras.com/projects/europe-s-first-specially-designed-recycling-facility/

national entities, suitable market conditions and appropriate land planning and construction rules are paramount for new port capacity to be successfully developed.

Thirdly, associated onshore decommissioning activities may lead to areal conflicts due to the nature of these activities. Activities conducted in onshore decommissioning ports and processing sites generate externalities (pollution, aesthetics) that can significantly affect other stakeholders and citizens living in their vicinity. These are problems not unfamiliar to energy developments. [422] Experience shows that failing to adequately consider the interests and concerns of other stakeholders may jeopardize projects, such as the construction of a new decommissioning port.

Thus, as offshore decommissioning is on the increase with aging infrastructure in the North Sea, it is of paramount importance to integrate associated onshore activities into the national decommissioning policy. Leaving these land-sea interaction issues unaddressed will probably lead to a lack of the necessary infrastructure or an increased regional conflict. Therefore planning and clear policies are key.

[422] See discussing these issues, in the offshore wind industry: Herrera Anchustegui I, 'Distributive Justice, Community Benefits and Renewable Energy: Offshore Wind Projects' in Ruven Fleming KH, and Leonie Reins (ed), Sustainable Energy Democracy and the Law vol 26 (Brill | Nijhoff 2021).

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Sea spaces have been vital for humankind. Thanks to technological development and ingenuity, we harvest, use, consume and exhaust resources located in the sea or the seabed. To do so, we make use of different man-made structures. These range from fish farms and simple buoys, to complex and large energy structures such as wind farms or oil and gas rigs, such as the Norwegian Troll A oil platform, the heaviest structure ever made at the time of its construction.

Oil and gas platforms and wind turbines have a finite life span. Their location at sea means that there is erosion, causing mechanical attrition and increasing the repair and maintenance costs. This makes wind farms become inefficient or no longer operative. The same applies to oil and gas platforms, with the added complication that as fields mature, fewer hydrocarbons remain, and they are either impossible to extract or it is not cost-effective to do so. In addition, there are structural factors that cause problems, such as the fact that offshore energy structures are typically built on the terms set by a government-granted license or permit. These authorizations are granted with time limits and upon their expiration, they request the operators and owners of the offshore structures to remove them from the sea. This process is known as decommissioning.

Our report takes a holistic approach to offshore energy decommissioning in the North Sea. We study the rules applicable to offshore oil and gas operations and offshore wind. This is a novel approach compared to that of existing literature. This will allow us to compare how decommissioning is conducted in different industries and answer whether oil and gas decommissioning rules can be readily applied to offshore wind. Furthermore, our research will identify challenges that these two sectors are facing in light of the need for further circularity and sustainability. Additionally, we adopt a legal and economic standpoint to study the governance of these activities in order to understand the incentives and challenges in decommissioning.

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