

Background Briefs on Offshore Installations and Decommissioning in the North Sea

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- Background Brief 1. Blue Growth and the Energy Transition: Unprecedented Industrialisation of the North Sea
- Background Brief 2. Technical Decommissioning options for offshore installations
- Background Brief 3. Current Regulatory Framework

Background Brief 1. Blue Growth and the Energy Transition: Unprecedented Industrialisation of the North Sea

As space and resources on shore become increasingly scarce, governments and business are increasingly looking to our oceans and seas as a place of new opportunities for mining resources, producing energy and food to meet the future needs of a growing population and growing economies. In the OSPAR region, the European Commission's Blue Growth strategy and the "Political Declaration on energy cooperation between the North Sea Countries" are characteristic for this development. The result is an **increasing industrialisation of the North Sea (and other seas), which presents us with new challenges in ensuring sustainable use of marine resources and in conserving important marine species and habitats**. This process does not only have an impact in terms of potential pollution, increasing pressure from fisheries and disturbance of valuable coastal and marine areas, but also through the placement of a huge number of offshore installations, made of various materials.

In the North Sea alone, there are now some 1,350 oil and gas installations, more than 27,000 shipwrecks and more than 2,300 offshore wind turbines. The number of wind turbines is growing with hundreds each year, forecasts predicting an additional 4,000-8,000 turbines by 2030 and up to 25,000 by 2050.¹ Eventually the result could be that almost 8% of the North Sea area (57,000km²) might be occupied by offshore energy installations by 2050 and that some 300-600 wind turbines would have to be built and decommissioned each year until 2050, while almost all oil and gas installations would have to be decommissioned within the same period of time.

Within the OSPAR area, more than 70 artificial reefs have been constructed since the early 1970's, for various purposes: creating opportunities for artisanal fishing, diving and surfing, protection from (illegal) trawling and restoration of reef habitats. Most of these reefs have been established after 1998, of which at least 7 in Denmark (own research and Tessier, A. et al 2015). In Denmark, especially active restoration of stone reefs has been successful adding biodiversity and biomass and in supporting species which are under pressure. Though most artificial reefs in the OSPAR region are built from natural stone or concrete, there are also several examples of reefs created from disused cleaned vessels or even military tanks. After 2000, the average deployment cost per m³ of artificial reef has been approximately €500 (Tessier et al, 2015). Presumably, these costs could be substantially reduced by reusing clean material from disused offshore installations or by considering the use of such installations as artificial reefs in their present location.

When looking at the map below (fig. 1), indicating the location of offshore installations and shipwrecks, the North Sea seems full of offshore installations and other forms of man-made items. In reality, all these man-made structures – oil and gas installations, offshore wind turbines and shipwrecks including surrounding safety zones – 'only' cover an area of 1000 - 1500km² or 0.13 – 0.2% of the total surface of the North Sea².

¹ www.ospar.org/work-areas/oic/installations,

<https://www.ewea.org/fileadmin/files/library/publications/reports/EWEA-Wind-energy-scenarios-2030.pdf>,

https://en.wikipedia.org/wiki/List_of_offshore_wind_farms_in_the_North_Sea

² This calculation is based on the following assumptions: 650 - 1300 O&G installations with each a safety zone of 500m = 510 - 1020km²; 30,000 shipwrecks with a mean surface of 1200m² = 36km²; 2400 wind turbines with an average safety zone of 0,22km = 550km². The safety zones of O&G installations are partially overlapping, but to exactly what extent is unknown. The wind turbine safety zones differ per country: in the Netherlands wind parks are closed for fishing and many other activities, but in the UK and Denmark, only limited areas (especially around cables) are closed.

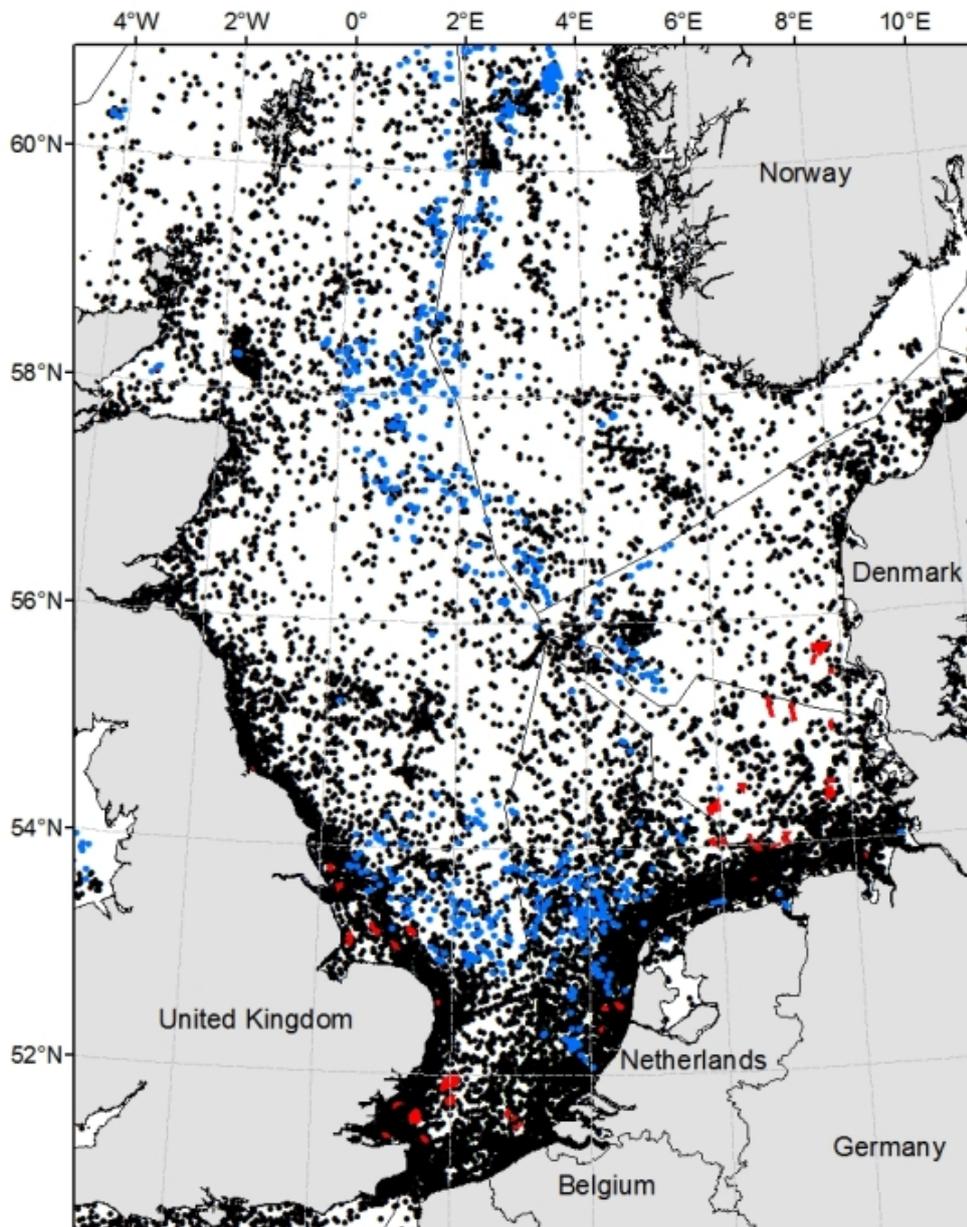


Figure 1. Map from Coolen JWP (2017) *North Sea Reefs: Benthic biodiversity of artificial and rocky reefs in the southern North Sea*. PhD-thesis Wageningen University & Research, 203p
Black dots = ship wrecks; **Blue** dots = oil & gas installations; **Red** dots = wind parks

With the growth in offshore wind farms, projected in the Energetic Odyssey scenario presented at the IABR in 2016 (see the fig. 2 below and video presentation on <https://vimeo.com/199825983>), however, this percentage may increase to some 7.5% of the North Sea ($\pm 57,000\text{km}^2$)³.

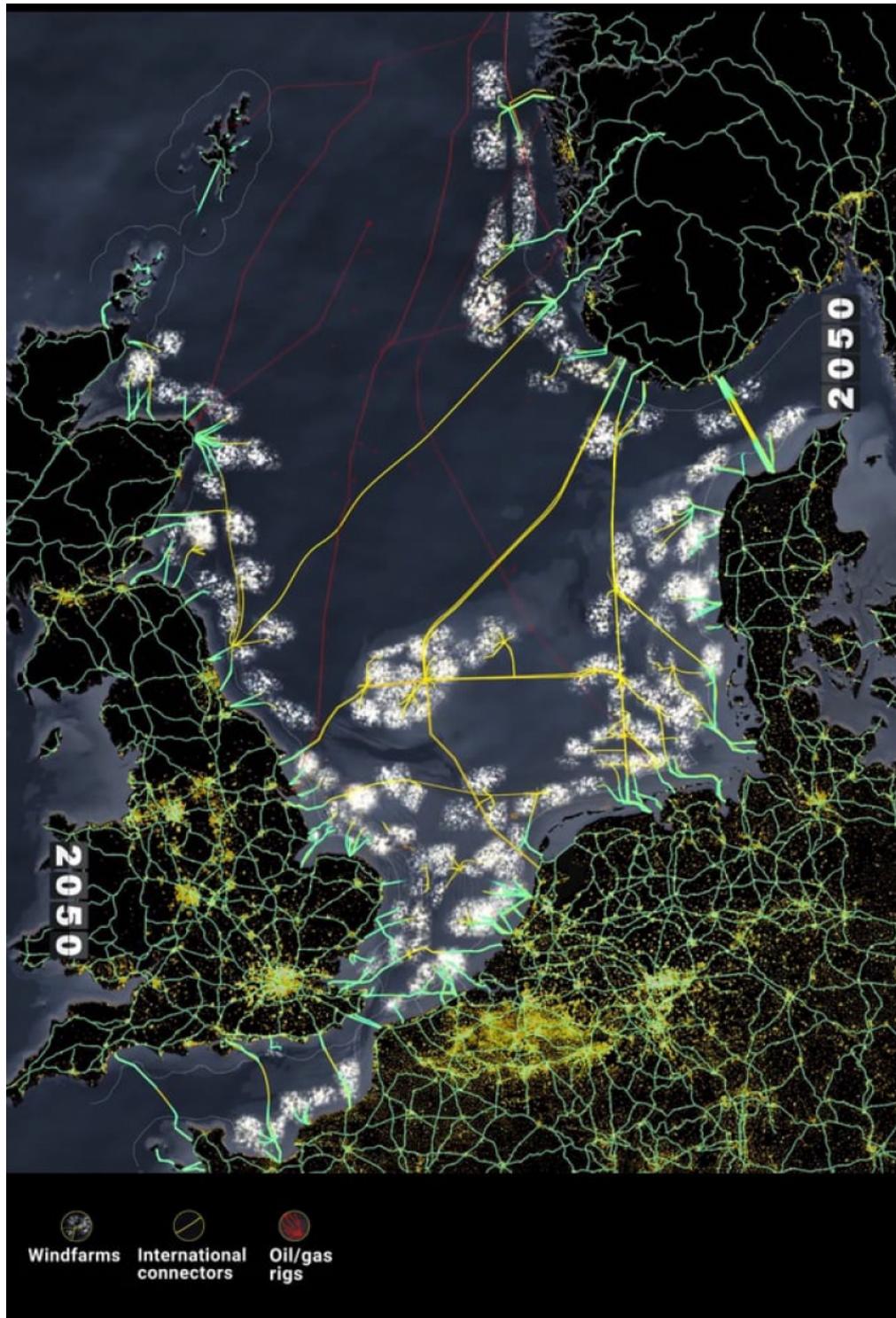


Figure 2. Map of offshore installations in 2050 Energetic Odyssey scenario

³ <https://www.natuurenmilieu.nl/wp-content/uploads/2016/04/20160713-IABR-Symposium-Outcomes.pdf>

Background Brief 2. (Theoretical) Decommissioning options for offshore installations

Before an installation is decommissioned, it may be transferred several times to new owners, who want to use the installation for the same or a different purpose (e.g. CO₂ storage, offshore diving hotel, aquaculture facility or an artificial reef), or it may be ‘mothballed’ – made/kept ready for future use - for several years by its original owners. If an installation is transferred to a new owner and reused on the spot, the new owners take over liabilities and the responsibility for decommissioning the installation at a later stage.

Mothballing is especially relevant for oil and gas installations, where a low oil price can make it attractive to cease production until an increase in oil price or technical developments make it profitable to start production again. Alternatively an installation can be mothballed to await a new function or simply because the equipment necessary to dismantle it, is not yet available. Independent of the type of lifetime extension, however, at some point in time the installation must be decommissioned.

Theoretically, there is a variety of options for how to decommission an offshore installation, depending primarily on the type and size of the installation and its location. However, all these options essentially form combinations and variations of three primary decommissioning options and three disposal options described in the table below.

Option	Description	Disposal/end-point
<i>Leave in place</i>	<i>For oil and gas installations:</i> The entire installation, with or without the topside, is left in place, standing with decks sticking out, toppled over or with the top part placed on the seabed next to the lower part. <i>For wind turbines:</i> The entire installation is left in place, with the tower either sticking out of the water (the turbines will be removed whatsoever) or toppled in place.	In situ (see fig 2 & 3)
<i>Partial removal</i>	This option involves removal of the topside (for oil & gas installations) or turbine and tower (for wind installations) and cutting of the substructure (jacket, tower or foundations) at a certain height: either to the footing/foundation or to a height that leaves at least a 25m or 55m clear water column above the structure. 25m is common in Rigs2Reef programmes; 55m is in line with the IMO guidelines for unobstructed passing of ships.	Substructure (fully or partially): In situ Topside/tower: onshore disposal with possible reuse offshore (artificial reef) (see fig. 2)
<i>Full removal</i>	This option involves removal of the topside or turbine and tower, of the jacket and conductors, and of the footing or foundation and scouring protection from the seabed. Parts of an installation that are under the seabed, pipelines and concrete anchor foundations that do not present an obstacle to fisheries do not always have to be removed, but in principle, as much as possible is removed and taken to shore. Sometimes a ‘trawl sweep’ follows full removal in order to check if the seabed is safe for bottom-trawlers.	Onshore disposal (all structures) with possible reuse offshore (artificial reef, see fig. 1)

Whatever the decommissioning option, for oil and gas installations, **wells** have to be ‘plugged and abandoned’. This involves plugging the wellbore with concrete (or in the future possibly with other, more modern and non-shrinking materials) to avoid future leaking of oil or gas. For all installations, **cables** will usually have to be removed and **pipelines** either removed or cleaned and made safe for future users. **Drill cutting piles**, which are sometimes present under and around oil and gas installations, are sometimes removed and sometimes left in place, depending on what is deemed technically and economically feasible and what is considered to be the safest option for the environment.

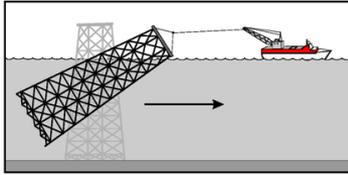


Fig. 1 Towing a jacket to a reef location elsewhere

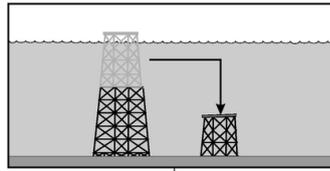


Fig 2. Top & placing top on seabed next to jacket

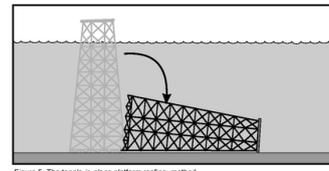
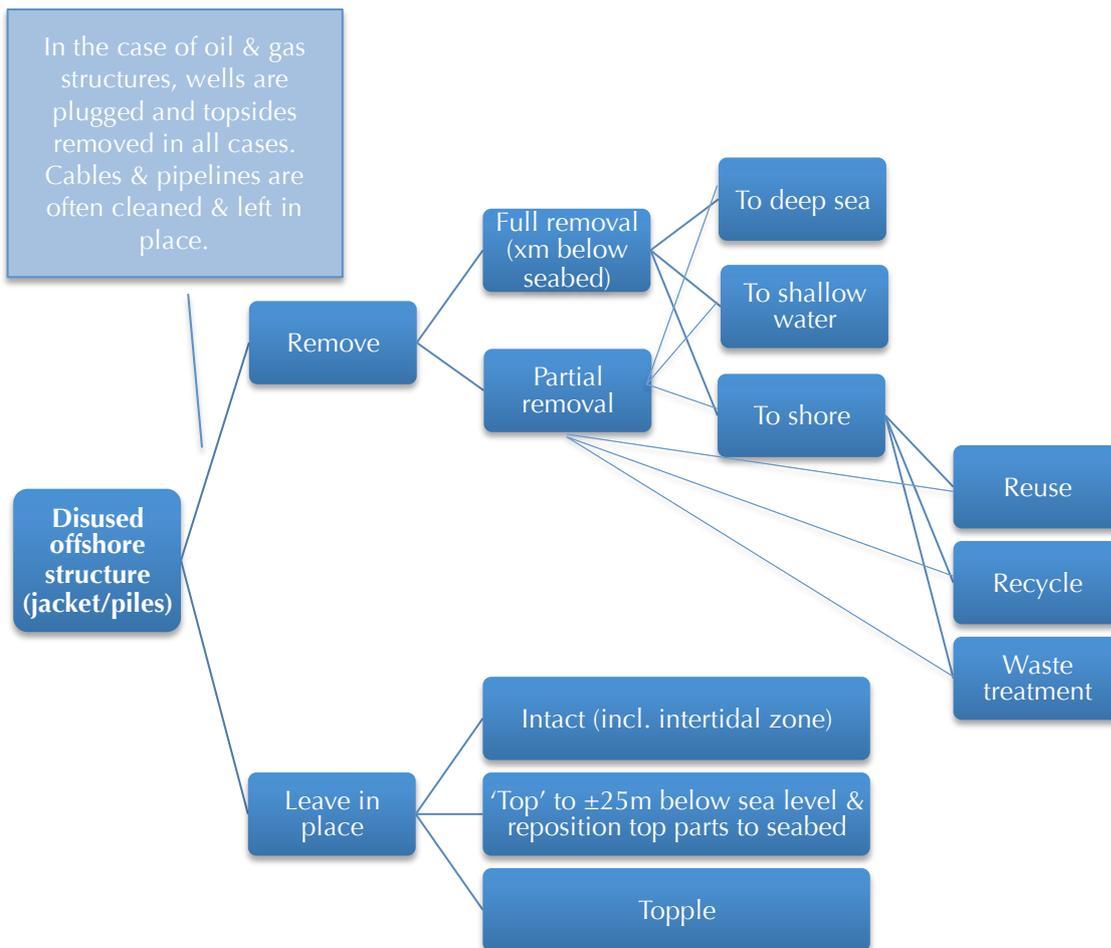


Fig 3. Toppling a jacket, leaving it in place

In the figure below, we provide a schematic overview of all decommissioning options and how they combine with disposal options.



Background Brief 3. Current Regulatory Framework

OSPAR Decision 98/3

In the North Sea and more widely in the OSPAR region, offshore installations may be placed on the seabed only with a specific, well-defined purpose such as energy production, aquaculture, recreation or nature creation (e.g. an artificial reef). When an installation is no longer needed for that particular purpose, OSPAR Decision 98/3, which has been implemented into national law, dictates that it may be rebuilt or repurposed into fulfilling another legitimate purpose and transferred to another owner. If that is not feasible, however, the “preferred option” is that disused installations are taken to shore for “reuse, recycling and final disposal on land”⁴. OSPAR refers to the precautionary principle and the polluter pays principle as being fundamental for any decommissioning policy or decision⁵.

In practise, this policy implies that all disused offshore installations in the North Sea and wider OSPAR region have to be removed to shore. There are a few exemptions (‘derogations’) to this general rule, which are based on technical rather than environmental considerations:

- The footings of steel installations placed in the maritime area before February 9 1999 and weighing more than 10,000 tonnes in the air.
- Gravity-based and floating concrete installations and concrete anchor-bases that do not interfere with other legitimate uses of the sea. In principle, this exception might apply to some scouring protection and concrete foundations of offshore wind turbines, but this is unclear.
- Other disused installations for which exceptional and unforeseen circumstances resulting from structural damage or deterioration, or from some other cause presenting equivalent difficulties, can be demonstrated.
- Pipelines and cables are **not covered by OSPAR Decision 98/3**, but are regulated at the national level. Most often, the smaller ones have to be removed, whereas the larger ones can be left in place on the condition that they are cleaned and burrowed or otherwise protected from moving around or being caught in trawling nets. Management of drill cutting piles is addressed under different measures within OSPAR (Decision 2000/3 and Recommendation 2006/5), which leave open various options, incl. onshore treatment as well as in situ disposal options.

Every five years (next in 2018), the room for derogations is being reviewed by OSPAR’s Offshore Industry Committee (OIC), on the basis of experiences with decommissioning up till then. The intention behind these reviews is that this room should be reduced as technical innovations make it feasible to safely remove ever-larger installations. Any request for derogations from the general rule has to be presented to the national government (‘competent

· This general rule is often referred to as the ‘clean seabed principle’, which refers to the principle that the sea (bed) should be accessible for all potential users – especially fisheries – and that therefore a piece of seabed is only temporarily being ‘given’ to a specific user, who then has the obligation to return the seabed to its original state, when he is done using it.

· In Article 2 of the OSPAR Convention these principles are defined as follows:

(a) the precautionary principle, by virtue of which preventive measures are to be taken when there are reasonable grounds for concern that substances or energy introduced, directly or indirectly, into the marine environment may bring about hazards to human health, harm living resources and marine ecosystems, damage amenities or interfere with other legitimate uses of the sea, even when there is no conclusive evidence of a causal relationship between the inputs and the effects; (b) the polluter pays principle, by virtue of which the costs of pollution prevention, control and reduction measures are to be borne by the polluter.

authority'), which is obliged to consult with the other OSPAR contracting parties before taking a final decision.

In Annex 2 to Decision 98/3, OSPAR has outlined a clear framework for the assessment of proposals for the disposal at sea of disused offshore installations, which includes technical, safety, environmental, economic, 'future use' and long-term management aspects.

In practise, OSPAR Decision 98/3's clear ban on disposal at sea sends a strong signal to owners of offshore installations and to competent authorities, making them automatically consider full removal to shore as the default option. Only in cases where installations clearly meet the derogation criteria, alternative options are being actively being explored. Therefore, limited information is available about how different decommissioning options actually compare in terms of environmental (and other) impacts for installations in the North Sea region. On a more general basis and for installations outside the OSPAR region, some comparative assessments have been made. Overall, these studies seem to agree that the outcome in terms of ecosystem impact is likely to be more certain (and neutral to positive) in cases where installations are partially left in place than in cases where they are fully removed and the seabed returned into its 'original state'. There is a large degree of uncertainty as to whether a cleaned seabed will actually restore to its original ecosystem value over time, whereas there is a large degree of certainty that ecosystems that have developed on and around an installation over 20-30 years will remain more or less unchanged for many years, if they are left undisturbed. Exactly which decommissioning option is the best environmental option differs per location and type of installation⁶.

Liability

OSPAR Decision 98/3 dictates the different options that are available to national governments to allow for certain decommissioning options, but they do not deal with issues pertaining to liability for any material left offshore, nor do they deal with the question of who is to pay for the costs of decommissioning if an owner of an installation are unable to do so. Liability and who pays what is regulated at the national level.

In practice, the so-called 'residual liability' (liability for plugged and abandoned wells and for any material left offshore) has turned out to be a highly relevant factor when companies decide which decommissioning strategy to pursue. North Sea countries have taken different approaches in regulating liability for disused offshore installations.

In the UK and Denmark, the final owner(s) of an installation before its abandonment remains liable in perpetuity. In cases of default, previous owners are alternatively liable. Only if all previous owners are unable to fulfil their responsibilities, liabilities may fall back on the state.

In the Netherlands, liability follows ownership of the installation, with no residual liability for previous owners. Since the Dutch State is always one of the owners, however, this means the costs will eventually have to be covered by the State if other owners fail to pay their part of the bill. In Norway, operators can transfer liability over abandoned assets to the State, if they provide sufficient compensation.

With the possible exception of Norway, current liability regimes provide a strong disincentive for considering decommissioning options where structures are (partially) left offshore.

⁶ See e.g. Fowler, A.M., et al (2014) "A Multi-criteria decision approach to decommissioning of offshore oil and gas infrastructure". *Ocean & Coastal Management*: 87:20-29. Smyth, K., et al (2015) "Renewables-to-reefs? Decommissioning options for the offshore wind power industry". *Marine Pollution Bulletin*: 90: 247-258. Cante, P., et al. "Evaluating Alternatives for Decommissioning California's Offshore Oil and Gas Platforms: A Technical Analysis to Inform State Policy."