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The world must rethink plans for ageing oil and gas platforms

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Rethink plans for the world's ageing oil and gas platforms

Earth's oceans are awash with ageing energy infrastructure. A change in the law is needed to ensure that it is decommissioned in ways that maximise environmental and societal benefits.

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The world's largest oil platform, the North Sea's Gullfaks C, has foundations constructed from 246,000 cubic metres of reinforced concrete, penetrating 22 metres into the seabed and smothering about 16,000 square metres of seafloor. The platform's installation in 1989 was a feat of human engineering. Now, Gullfaks C has exceeded its expected 30-year lifespan and is due for decommissioning in 2036. How can this gargantuan structure, and others like it, be taken out of action in a safe, cost-effective and environmentally beneficial way?

With many of the world's 12,000 oil and gas platforms nearing the end of their lives, the issue is pressing. The average age of the 1,684 platforms and installations in the North Sea is 25 years. In the Gulf of Mexico, more than 1,500 production platforms are over 30 years old. In the Asia-Pacific region, over 4,000 structures need to be decommissioned in the next 10 years. According to IHS Markit's proprietary Petrodata FieldsBase, nearly 2,800 fixed platforms (33% of the global total), 18,500 wellheads, nearly 3,000 subsea trees, and >80,000 km of offhshore pipelines are scheduled for decommissioning by 2030.

And the problem won't go away. Even when the world transitions to greener energy, infrastructure such as offshore wind turbines and wave-energy devices will one day need to be taken out of service.

There are several ways to handle platforms that have reached the end of their lives. For instance, they can be completely or partly removed from the ocean. They can be toppled, left on the sea floor. They can be moved elsewhere, and abandoned in the deep sea. But there's little empirical evidence of the environmental and societal costs and benefits for each course of action — how it will alter marine ecosystems, for instance, or the risk of pollution associated with moving or abandoning oil-containing structures.

As such, politics — rather than science — has been the driving force in decisions about decommissioning to date. For instance, it was not scientific evidence, but public opposition to disposing of a floating oil-storage platform called Brent Spar in the deep sea that led to strict legislation being imposed in the northeast Atlantic in the 1990s. Now, there is a legal requirement to completely remove decommissioned energy infrastructure in this region from the ocean. By contrast, in the Gulf of Mexico the idea of converting defunct rigs into ‘artificial reefs’ holds sway despite a lack of evidence for environmental benefits, because the reefs are popular as sites for recreational fishing.

A review of decommissioning strategies is urgently needed to ensure that governments make scientifically motivated decisions about the fate of oil rigs in their regions, rather than sleepwalking into default strategies that could harm the environment. We propose that local governments should each rigorously assess the best way to handle decommissioning of rigs in their region and have produced a framework to assist them in their assessment. Legislation for the Northeast Atlantic region should be rewritten to allow governments to consider a range of decommissioning options. Similar assessments should be used to inform the decommissioning of offshore wind infrastructure.

Challenges of removing oil and gas rigs

In the countries around the the northeast Atlantic, leaving oil platforms in place at end-of-life is an emotive issue, as well as a legal one. Anything other than complete removal is considered by environmental campaigners, much of the public, and some scientists to be littering by oil and gas companies[21]. But whether rig removal is the best approach to decommissioning — environmentally or societally — is questionable.

There has been little research into the enviornmental impacts of platform removal, largely due to lack of foresight[9]. But it’s known that oil and gas rigs can provide habitats for marine life such as sponges, corals, fish, seals and whales[4], both during and after operation. Organisms like mussels that attach to structures can provide food for fish — these might be lost, if rigs are removed[5]. Structures left in place act as *de facto* Marine Protected Areas (MPAs); areas that restrict other human activities around them because they are a navigational hazard, can protect marine life[6]. And there is concern that heavy metals in seafloor sediments around platforms might become resuspended in the ocean when foundations are removed[8], harming marine life.

Removing rigs is also a formidable logistical challenge, because of their enormous size. The topside of an oil or gas platform, home to the facilities for oil or gas production, can weigh more than 40,000 tonnes. And the underwater substructure — the platform’s foundation and the surrounding fuel-storage facilities — can be even bigger. In the North Sea, substructures are typically made of concrete to withstand the harsh environmental conditions, and can displace more than 1 million tonnes of water. In regions such as the Gulf of Mexico where conditions are less extreme, substructures can be lighter, built from steel tubes. But they still weigh more than 45,000 tonnes, and are anchored to the seafloor using two-metre-wide concrete pilings.

Huge forces are required to break these massive structures free from the ocean floor. Some experts even suggest that removal of the heaviest platforms is currently technically impossible[12].

And the costs are astronomical. The final cost of removing the Brent Delta oil platform alone was estimated at between £60 – 100 million and the underwater substructure, which includes 900,000 tonnes of concrete, 17,000 tonnes of steel, 103 kilometres of pipeline and 140 wells, remains to be tackled. The decommissioning cost of the entire Brent oil field is estimated to be in the single digit billions of pounds. By contrast, it’s estimated that disposing of the platform at sea would have cost around half the price[10].

Indeed, the cost to decommission and remove all oil and gas infrastructure from UK territorial waters alone is estimated to exceed £53 billion (US$67 billion)

Mixed evidence for reefing as an alternative

In the US, attitudes to platform removal are very different. There, a common approach is to remove the topside, then abandon part or all of the substructure in such a way that it doesn’t pose a hazard to marine vessels. The abandoned “reefed” structures can be used for watersports such as recreational fishing and diving.

This ‘rigs-to-reefs’ (RtR) approach was first pioneered in the Gulf of Mexico in the 1980s. Since its launch, the programme has repurposed around 600 rigs (10% of all the platforms built in the Gulf), and has been adopted in Brunei, Malaysia and Thailand.

RtR is reported to produce seven times less air-polluting emissions than complete rig removal[14], and to cost 50% less. Because the structures provide new habitat for marine life, [6], proponents argue that they act as artificial reefs and increase the biomass in the ocean[15]. In the Gulf of California, for instance, increases in endangered cowcod and commercially valuable rockfish have been reported in the waters around oil platforms[16].

But there is limited evidence that the reefed structures actually increase biomass. Opponents argue that they simply attract fish from elsewhere[18] and leave harmful chemicals in the ocean[19]. And as the hard surface of rigs is very different to the soft sediments of the seafloor, reefed structures attract species that would not normally live in the area, destabilizing marine ecosystems[20].

Evidence from experts

With little consensus about whether complete removal, reefing or another decommissioning strategy is best, decommissioning policy cannot evolve. More empirical evidence about the environmental and societal costs and benefits of the various options is needed.

To begin to address the knowledge gap, we gathered the opinions of 39 academic and government experts across three continents[22,23]. We asked how 12 decommissioning options, ranging from the complete removal of single structures to the abandonment of all structures, might impact marine life and contribute to international high-level environmental targets. To supplement the scant scientific evidence available, our panel of experts also used local knowledge, professional expertise and industry data.

The panel assessed the pressures that structures exert on their environment — factors such as chemical contamination and change in food availability — and how those pressures affect marine ecosystems, for instance by altering biodiversity, animal behaviour or pollution levels. Nearly all pressures exerted by leaving rigs in place were considered bad for the environment. But some produced effects that were considered beneficial for humans — creating habitats for commercially valuable species, for instance. Nonetheless, most of the panel preferred, on balance, to see infrastructure removed from the marine environment at end-of-life.

But the panel also found that abandoning or reefing structures was the best way to help the world meet 37 global environmental targets listed in three international treaties[23]. This might seem counterintuitive, but many of the environmental targets are written from a ‘what does the environment do for humans’ perspective, rather than being focussed on the environment alone.

Importantly, the panel noted that not all ecosystems respond in the same way to the presence of rig infrastructure. The changes to marine life brought about by leaving rigs intact in the

North Sea will differ from the those brought about by abandoning rigs off the coast of Thailand. Whether these changes are beneficial enough to warrant alternatives to removal depends on the priorities of stakeholders in the region — the desire to protect cowcod is a strong priority in the US, for instance, whereas in the North Sea, a more important consideration is X ***<please add an example]***. This demonstrates that management of rig decommissioning should be undertaken on a local, case-by-case basis, rather than using a one-size fits all approach.

Legal hurdles in the Northeast Atlantic

But to allow a case-by-case application of different decommissioning options in the Northeast Atlantic, policy change is needed.

Current legislation is multi-layered. At the global level, the United Nations Convention on the Law of the Sea (UNCLOS; 1982) states that no unused structures can present navigational hazards or cause damage to flora and fauna. Countries that have implemented RtRs comply with this legislation by ensuring that structures sit far enough under the sea surface, and point to biodiversity benefits.

But the Northeast Atlantic is subject to stricter rules, under the Oslo-Paris (OSPAR) Convention — a legally binding agreement between 15 governments and the EU on how best to protect marine life in the region (https://bit.ly/48yxqfD) that was signed in the face of public opposition to sinking Brent Spar. The convention includes Decision 98/3, which stipulates complete removal of oil and gas infrastructure as the default legal position, returning the seafloor to its original state. This legislation is designed to stop the offshore energy industry from polluting the sea by dumping installations *en masse*.

Under OSPAR Decision 98/3, RtR is prohibited. Exceptions to complete removal (referred to as derogations) are occasionally allowed, but only where there are exceptional concerns related to one of: safety; environmental or societal harms; cost; or technical feasibility. Of the 170 structures decommissioned in the region to date, just 10 have been granted derogations,. In those cases, the concrete foundations of the platform have been left in place, but the top part of the substructure removed.

Make change to enable local decision-making

The flexibility of UNCLOS is a more-pragmatic approach to decommissioning than the stringent removal policy stipulated in OSPAR Decision 98/3. Currently, there must be one outstanding reason to approve a derogation under OSPAR — but a process mose closely aligned with UNCLOS could allow smaller benefits and harms to both the environment and society to be weighed up. This approach would ensure that each decision about a rig was made using all the scientific evidence available.

We propose that although the OSPAR Decision 98/3 baseline position should remain the same — complete removal as the default, the derogation process should change to allow alternative options, such as reefing, if a net benefit to the environment and society can be demonstrated. OSPAR regulations should align with UNCLOS Article 216, which requires "prevention, reduction and control of pollution of the marine environment by dumping…", and Articles 266, which requires "conservation, protection and preservation of the marine environment".

The burden should be placed on industry to clearly demonstrate why an alternative to complete removal should not be considered as littering, but as contributing to the conservation of marine ecosystems based on the best available scientific evidence. Our expert elicitation gathered evidence on a global scale — the same framework can be used to gather and assess local evidence for the pros and cons of each decommissioning option. We suggest that collated evidence be assessed by a panel that has not only scientists, but also legal, environmental, societal, cultural and economic perspectives. Regions outside of the Northeast Atlantic should follow the same rigorous assessment process, regardless of whether they are already legally allowed to consider alternative options.

For successful change, governments and legislators must consider two key factors.

OSPAR's 16 signatories are responsible for changing its legislation but it will be essential to get buy-in for the more flexible approach from OSPAR's 22 intergovernmental and 40 non-governmental observer organisations (https://www.ospar.org/organisation/observers). These observers, which include Greenpeace, actively contribute to OSPAR's work and policy development, and help implement its convention. Public opinion in turn will be shaped by non-governmental organizations[24] — Greenpeace was instrumental in raising public awareness about the plan to sink Brent Spar in the sea, for instance.

Transparency about the decision-making process will be key to building confidence among skeptical observers. Oil and gas companies must maintain an open dialogue with relevant government bodies about plans for decommissioning. Governments must, in turn, make clear what standards they will require to justify an alternative to removal. This includes specifying what scientific evidence should be collated, by whom. All evidence about the pros and cons of each decommissioning option should be made readily available to all.

Oil and gas companies should identify and involve appropriate stakeholders in decision-making from the earliest stages of planning. This includes consulting a wide cross section of stakeholder groups including regulators, statutory consultees, trade unions, non-governmental organisations, business groups, local councils and community groups, and academics/researchers to ensure that diverse views and opinions are considered.

Conflict between stakeholders, as occurred around Brent Spar, should be anticipated. But this can be overcome through frameworks similar to those between trade unions and employers that help to establish dialogue between the parties[24].

The same principle of transparency should also be applied to other world regions. If rigourous local assessment reveals reefing not to be a good option for some rigs in the Gulf of Mexico, for instance, it will be important to get stakeholder buy-in for a change from the status quo.

Future-proofing

OSPAR and UNCLOS legislation applies not only to oil and gas platforms, but also to renewable energy infrastructure. To avoid a repeat of the challenges currently being faced by the oil and gas industry, decommissioning strategies for renewables must be established before they are built, not as an afterthought. Structures must be designed to be cheaply and easily removed and place fewer pressures on the environment and society. They should be readily recycled, or reused or repurposed easily.

If developers fail to design infrastructure that can be removed in an environmentally sound and cost-effective way, governments should require them to ensure that structures provide added environmental and societal benefits. This could be achieved retrospectively for existing infrastructure, taking inspiration from biodiversity-boosting panels that have been fitted to the side of concrete coastal defences to create habitats for marine life (https://www.livingseawalls.com.au).

Governments should also require industry to invest in research and development of greener designs. On land, constraints are now being placed on new developments to protect biodiversity — bricks that provide habitats for bees must be part of new building in Brighton, UK, for instance (https://www.dezeen.com/2022/01/24/bee-bricks-planning-requirement-brighton/). Structures in the sea should not be treated differently.

Designed properly, the marine infrastructure that is needed as the world moves towards renewable energy could benefit the environment — both during and after its operational life. Without this investment, the world could find itself facing a decommissioning crisis once again, as renewables infrastructure ages.

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