OIL & GAS

A green use for old drilling platforms?

As the world gradually moves away from fossil fuels, the question arises – what do we do with the thousands of offshore oil and gas platforms that are reaching the end of their productive lives? *Elliot Tawney* reports.

According to consultancy Wood Mackenzie, end-of-life rigs are 'quickly becoming one of the biggest issues in the global oil and gas industry' – and deciding what to do with them won't be cheap. Oil & Gas UK predicts that the cost of decommissioning will total around £15bn over the next decade on the UK Continental Shelf alone.

As the energy sector faces the challenges of decarbonisation and decommissioning simultaneously, one solution could be to use one problem to help solve the other – rather than removing oil and gas infrastructure, perhaps some of it could be repurposed in the service of renewable energy.

'Electrification of platforms, CO2 injection and power-to-gas... are very dependent on the availability of the oil and gas infrastructure at the right time and at the right location.'

Rene Peters, TNO Energy

Kinsale, Ireland

Since becoming Ireland's first commercial gas field in 1978, Kinsale Head has been a backbone of the nation's energy industry. Located 50 km off the coast of County Cork in 90 m deep waters, the operation is centred around two platforms, Alpha and Bravo, with satellite gas fields at Ballycotton, Southwest Kinsale and Seven Heads.

However, over 40 years since gas production began, Kinsale will soon become uneconomical. Petronas-owned PSE Kinsale Energy, the field's operator, has already received approval for decommissioning plans, with the aim of initiating the process in 2020. The operation would likely see 19 sub-sea wells plugged and the infrastructure abandoned.

Meanwhile, CONSUB, a project management and engineering company, envisions a new lease of life for the field. Speaking at Renewable UK's offshore wind conference held in London in June, Sonia Chapman, CONSUB's Senior Project Manager provided details of a study into the feasibility of repurposing the Alpha and Bravo platforms for use as electrical substations for a floating offshore wind farm.

The company selected 10 MW floating offshore turbines – which it sees as a viable future technology – as the basis for the study, as Kinsale's environment is too deep for fixed offshore turbines.

The platforms themselves, although old, are still able to support up to 2,500 tonnes when wear and tear are accounted for, meaning they can each accommodate 500 MW substations to collect and export the power generated by the floating turbines. AC power cables would export electricity to the shore, potentially exploiting the existing gas pipeline as a conduit for the cabling closer to the East Cork landfall site.

Four scenarios were considered for the potential project – three involving re-using the gas platforms and one to build the wind farm from scratch. CONSUB found that in three scenarios where the Alpha and Bravo platform jackets were repurposed, savings could be made in the manufacture and installation of the substations. This helped to reduce the predicted levelised cost of energy estimates for a floating wind farm nearby slightly, from €114 per MWh, if built from scratch, to €111, when the jackets were repurposed.

Kinsale Energy has carried out technical studies which indicate that the main Kinsale Head reservoir, facilities and export pipeline may be suitable for CO2 transportation and storage inside the depleted field

North Sea

There are similar aspirations in the North Sea, where the increase in offshore wind generating capacity will correspond with decommissioning operations. The Dutch oil and gas industry, in collaboration with Dutch state energy company EBN, established the Nexstep initiative in 2017 to coordinate and accelerate the agenda for the re-use and decommissioning of oil and gas infrastructure in the Netherlands.

Nexstep's *Re-use and Decommissioning Report* explores the feasibility of repurposing opportunities such as offshore electrification, CO2 storage in depleted gas fields, and hydrogen production – see **Figure 1**.

Nexstep predicts that two-thirds of the North Sea's approximately 150 platforms, 3,000 km of pipeline and 700 wells

Electrification

An interim step for rig repurposing could be electrification. Oil and gas rigs are typically powered by diesel engines located on the platforms, which can use 20 m^3 to 30 m^3 of diesel per day. Finding ways to electrify rigs and power them with renewable energy would not only reduce emissions during a platform's traditional lifecycle, but would also provide clean power for future re-use, such as CO2 storage and hydrogen production, according to Nexstep.

Progress is already underway. The UK's Oil and Gas Authority (OGA) is currently conducting an investigation into ways to connect offshore oil and gas platforms to alternative power sources, such as offshore wind farms. Meanwhile, Equinor's Hywind Tampen project, consisting of eleven 8 MW floating wind turbines, will help power five nearby oil and gas platforms, with the aim of reducing CO2 emissions by 200,000 tonnes per year.

As North Sea Energy points out in its *Hybrid Offshore Energy Transition Options* report, high levels of offshore wind deployment in the coming decade, coupled with a limited supply of landing points, will lead to grid congestion in periods of high wind electricity production. Electrifying platforms and repurposing for offshore energy conversion and storage (such as via power-to-hydrogen) could help alleviate this situation.

Repurposing for offshore hydrogen production currently remains an elusive option due to high costs and weight restrictions on old platforms, but pilot schemes are active. Neptune Energy was recently selected by TNO to place a 1 MW electrolyser on its Q13a platform: the first in the Dutch North Sea to be fully electrified. The electrolyser will convert electricity to hydrogen gas, which will be transported to a second platform via an existing pipeline.

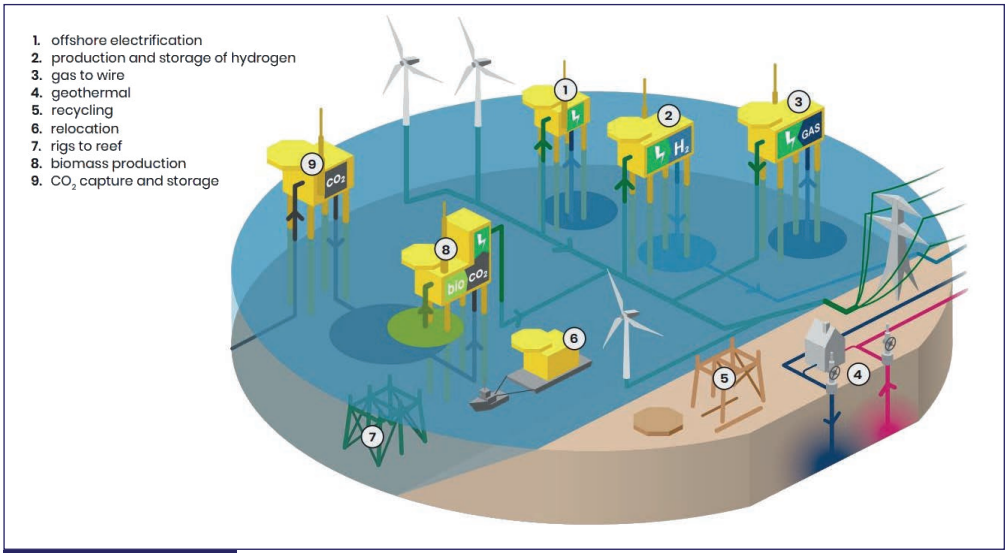

Figure 1. Diagram of the repurposing options explored by Nexstep
Source: Nexstep

are set to be decommissioned by 2027. It also found between 30 and 50 of the North Sea's platforms and underground reservoirs are suitable for CO2 storage, with the potential to store over 1,600mn tonnes of CO2 – enough to meet the Dutch government's ambitions for the next 80 years. The initiative sees carbon capture and storage (CCS) as a key component in the reduction of CO2 emissions from industry, the electricity sector, and waste incineration.

North Sea Energy – a consortium of gas and wind operators, including TNO – investigated transforming platforms to allow for CO2 to be pumped offshore and stored in former reservoirs. In scenarios where platforms were electrified, and where there were strong CO2 reduction incentives, and service fees of at least €8 per tonne of CO2 paid to operators for transporting and storing, storage proved a sound business opportunity for the three operating platforms tested.

Barriers

However, the road to widespread repurposing is far from straightforward. For a start, integrating offshore renewables with the oil and gas systems is 'best to be visualised by an already difficult 4D puzzle that has shifting puzzle pieces,' said North Sea Energy in its report. René Peters, Director of Gas Technology for TNO Energy, agreed: 'Electrification of platforms, CO2 injection and power-to-gas... are very dependent on the availability of the oil and gas infrastructure at the right time and at the right location.'

Additionally, as North Sea Energy's report shows, repurposing requires a robust and supportive regulatory framework to make projects such as CO2 storage viable. Currently, policy fails to provide guidance on reusing assets, and in many ways inhibits it. In the Dutch case, current laws block system integration between platforms and the offshore electricity network.

At present, the oil and gas repurposing movement is still in its infancy – with a handful of studies conducted and several small-scale pilots under way. However, the energy sector could start making unified decisions about how to deal with end-of-life offshore oil production facilities. Ultimately, progress will have to be made rapidly if re-use is to coincide with the approaching wave of decommissioning.