NORTH SEA

World's first net zero basin

The North Sea is well placed to become the world's first net zero basin, writes *Elaine Maslin*.

The global challenges we face today as a result of the climate emergency call for a diverse mix of energy supply and demand technologies. These include novel, disruptive technologies such as battery storage, smart networks and hydrogen; established forms of renewable energy like solar, wind and nuclear; and urgently needed technologies to target methane and carbon emissions at every point in the oil and gas lifecycle.

Oil and gas provide 54% of the world's energy today and this source cannot be expected to stop immediately. Investment in gas, in particular, is helping to reduce emissions by displacing heavily polluting coal in many parts of the world. However, alternatives for use in transport and chemicals are not yet readily available.

The question now being asked by oil and gas companies, governments, regulators, industry bodies and environmentalists is whether everything is being done to meet demand with the lowest possible greenhouse gas (GHG) footprint, to move more quickly to net zero by tackling fugitive methane emissions, bringing on vital carbon capture, use and storage (CCUS) schemes and accelerating the shift of business models to clean energy supply.

Europe is taking a lead on this and much is happening. New UK government policies and strategies are also in the pipeline.

UK drive to net zero

The UK's oil and gas sector will play a key role in the drive to net zero and the North Sea is well placed to become the first net zero basin. The change in the dialogue has been rapid, with many commitments to net zero goals already made. Operators are talking about platform electrification, integration with offshore wind, CCUS and even the creation of a North Sea hydrogen economy.

Last year, Oil & Gas UK (OGUK) launched its *Roadmap 2035: A blueprint for net zero*, which includes a goal to reduce UK Continental Shelf (UKCS) emissions from 14.6mn tonnes of CO_2 equivalent (tCO_2eq) – or 3.5% of the UK's total GHG emissions – to 0.5mn tCO_2eq. Meanwhile, the Oil & Gas Technology Centre (OGTC), a public-private funded technology accelerator, has set up a Net Zero Solutions Centre.

The UK's Oil & Gas Authority (OGA), which has called on the industry to act faster to reduce its carbon footprint, is studying how North Sea oil and gas infrastructure could support and accelerate low carbon initiatives through integration; with offshore wind, hydrogen production and CCS. It's also examining its own strategy towards net zero. Andy Samuel, OGA CEO, told delegates attending IP Week 2020 in February: 'We're completely redefining our fundamental strategy. Going forward, it will be very much in line with net zero and we are moving from "area plans" to "energy plans", because that is clearly the future.'

Key operators are onboard. Jean-Luc Guiziou, Managing Director, Total E&P UK, told IP Week delegates that he believed the North Sea could 'absolutely' be a net zero basin, perhaps the world's first. 'We used to shape our investment on two main pillars – safety and control of costs. Now there is a third requirement – the ability to reduce CO_2 emissions,' he said.

But this isn't just about emissions. According to Martyn Tulloch, Net Zero Solution Centre Manager, at the OGTC: 'It is an industrial opportunity larger than the current one by quite a margin.' An OGTC study estimates that the oil and gas industry, offshore wind, hydrogen production and CCUS industries could be worth a combined £49bn by 2050, compared with £26bn today.

Challenges ahead

So why now? Pressure on the industry to make more substantive changes has increased. It's coming from investors, society and government. The UK has a binding net zero GHG emissions target of 2050 (or 2045 in Scotland).

Equinor's Hywind Tampen project will see 88 MW of floating offshore wind displace carbon intensive power generation at the North Sea Gullfaks and Snorre facilities (see p3)
Photo: Equinor

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Andy Samuel, CEO, OGA, speaking to delegates attending IP Week 2020

Meanwhile, in December 2019, the Supreme Court of the Netherlands ordered its government to cut the nation's CO_2 emissions by 25% from 1990 levels, by the end of 2020. The Danish parliament set a target to reduce CO_2 emissions by 70% by 2030, compared with 1990. There's also a ticking clock – the North Sea Basin is mature and decommissioning is already underway.

Malcolm Forbes-Cable, Vice President, Upstream Consulting, at Wood Mackenzie, says European majors operating in the North Sea are sincere about their net zero commitments. 'It's a mature basin and that focuses minds,' he says. 'They [operators] don't have forever to play with this. They need to act fairly quickly. It's an interesting dynamic.' Or, as Total's Guiziou notes: 'As an industry, if we do not seize this opportunity, we will end up like the dinosaurs.'

There's a significant challenge. Installations across the UKCS currently consume some 2.1 GW of power and emit 46.4mn tonnes of CO_2 – more than any industrial sector onshore, says Tulloch. This is equivalent to 5% of UK power demand, accounting for about 10% of total 2018 power plant emissions, according to a Lloyds Register study. OGUK says 45% of emissions came from power generation, as facilities often use produced gas in open cycle gas turbines (OCGT). The other main source of emissions offshore is from flaring and methane from venting.

Some work is already ongoing and ramping up to decarbonise existing infrastructure; in the near-term by making it more efficient. Mid-term, electrification, using power from shore or offshore wind offers a big win. Then there's the potential for greater integration and creation of a hydrogen economy.

The UK offshore oil and gas industry has already cut its emissions intensity by 14% since 2014, reports OGA's Samuel, partly related to improvements in production efficiency. Repsol Sinopec Resources UK, for example, has reduced its emissions by 10%, targeting quick wins around flaring and venting, but also by switching from onboard power generation on one of its facilities to using power from a nearby platform. Since 2016, Shell says it has reduced its UK upstream emissions by 15% by improving plant efficiency and reducing flaring and venting.

Samuel believes more can be done. The OGA is undertaking a review of the UK North Sea flaring and venting regime, part of which will be the introduction of performance benchmarking. OGUK is due to publish an emissions strategy shortly, to better monitor and measure what's being emitted.

Electrification offers a big win

A big win could be through electrification. As highlighted by the OGA's *UK Continental Shelf (UKCS) energy integration: Interim findings* study, published in December 2019, alongside gas-to-wire, hydrogen and energy hubs. Electrification is already widely used in Norway, driven by government policy, carbon taxation and the availability of relatively low-cost clean electricity.

Power from OCGTs costs £100–200/MWh, according to Tulloch. 'If renewable energy was used instead, such as offshore wind power, at wholesale prices of £40/MWh, emissions and power costs could be dramatically reduced.' This approach is being considered by 75% of the main operators, says Tulloch. That includes BP, which is understood to have delayed the Clair South final investment decision (FID) while it assesses options, including power-from-shore. Jersey Oil & Gas, an independent, is also assessing a power-from-shore solution for its greenfield Greater Buchan Area project. Shell, BP and Total are also looking at electrification of the Elgin-Shearwater area. However, such a project requires co-operation between industry, regulators and governments, cautions Shell.

Efforts to shrink power equipment, from 400-tonnes to 40-tonnes, so that HVDC power can more easily be installed at brownfield sites, are also underway. This could see HVDC trunk lines supplying numerous sites, integration with offshore wind and exporting power back to shore, says Tulloch. Another concept is to reverse the flow of electrons, by producing power-from-gas at source and sending that generated electricity to shore, something TiGRE Group (formerly Indigo Power) and others are looking at.

Hydrogen prospects

Meanwhile, increasing focus is being put on hydrogen production, to balance wind energy but also for energy-intensive industries and the transportation sector. In the UK, £7.5mn has been awarded to the Gigastack project, which aims to convert energy, at an onshore site, from the massive Hornsea 2 wind farm into green hydrogen – initially in a 100 MW project that would test regulatory, commercial and technical challenges for industrial-scale applications. Another project, Hydrogen Offshore Production (HOP), run in partnership with the OGTC, is looking to trial green hydrogen technologies for potential use offshore.

In the Netherlands, Neptune Energy is set to host the first offshore green hydrogen production on its already electrified Q13a platform, as part of a project looking at synergies between existing infrastructure and clean energy production. A big role for hydrogen could be to balance out offshore wind, says Rene van der Meer, Neptune's Project Lead on the PosHYdon project, especially as more wind farms are built. Instead of curtailment, when supply outweighs demand, hydrogen could be produced and piped to shore, where it could be transported via existing networks. Shell has also pledged to build a huge wind-powered green hydrogen plant, named the NortH2, with Gasunie, initially targeting 3–4 GW capacity by 2030. Other significant projects are also being assessed.

Neptune, however, is not specifically interested in producing green hydrogen (from electrolysis using renewable energy). As a

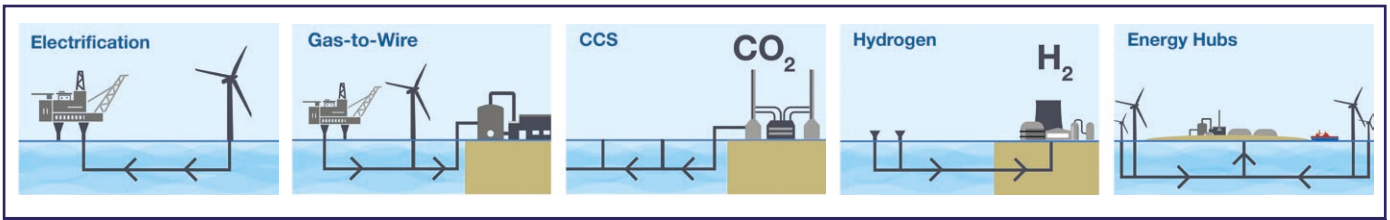

Figure 1: The OGA's Energy Integration project is looking at how different energies can interconnect in the North Sea *Source: OGA*

natural gas producer and pipeline infrastructure owner, Neptune suggests it could transport others' hydrogen and also supply its gas as a feedstock for blue hydrogen, currently mostly produced using steam reforming.

However, for blue hydrogen to work, and to aid net zero initiatives in other sectors, CCUS is needed. CCUS is not yet done at scale, but there are new projects hoping to change that. In Norway, Equinor is part of the Northern Lights project, which is targeting saline aquifers where CO_2 captured from industrial processes onshore can be stored offshore. In the UK, significant government and privately-supported initiatives including Net Zero Teesside and the Acorn project at St Fergus gas terminal, also aim to establish hydrogen production (see pp15–17).

Future offshore energy hubs

Getting these options right could pave the way for huge offshore energy hubs – comprising of large-scale electricity and hydrogen production from wind, combined with CCUS and energy storage. Industry leaders like OGA's Samuel see significant potential in energy hubs. A next phase of the UKCS Energy Integration project will see consultancy EY set out the economic feasibility for a major offshore energy hub and other integration schemes.

Neptune Energy is due to install a green hydrogen production plant on its Q13a platform in the Dutch North Sea, which runs on power-from-shore

Photo: Neptune Energy

A Dutch consortium, the North Sea Wind Power Hub (NSWPH), has been assessing options for a couple of years, albeit focused on offshore wind and green hydrogen. It says a gradual roll-out of 10–15 GW hubs is a logical step towards large offshore wind build-out. NSWPH says its first hub-and-spoke project would likely be electrically connected to shore, with green hydrogen to provide energy system flexibility, and could be operational in the 2030s.

'In many cases the technology feasibility is not the question,' says Carlo Procaccini, Head of Technology at the OGA. Instead, a focus on driving down cost and the policy to create clarity in the market is needed to move these types of projects forward. Samuel maintains that the regulatory and economic barriers – of which there are many – are being looked at, including carbon pricing. He says that carbon pricing and economic recovery in the North Sea shouldn't be inconsistent. However, that was before COVID-19 took a grip on the global economy and OPEC+'s initial failure to cut production sent oil prices below $30/b. The subsequent quota agreement in April 2020 failed to boost oil prices.

Paving the way

To pave the way for UK energy hubs, the OGA is due to launch a digital energy platform which will provide access to information about where wind farms and existing infrastructure are located, to help those involved join the dots. The timing will be challenging, as oil and gas facilities start to shut. Meanwhile, an Energy White Paper is due from the UK government (despite multiple delays) and is expected to set out legislative proposals in these areas. Many hopes are pinned on this, including support for CCUS, a hydrogen market design, and estimates of how much hydrogen can go into the grid (initially forecast to be around 20%).

Samuel thinks it's do-able. What's more, he says the North Sea could even achieve negative emissions if it gets combinations with CCS right. 'That's our real ace,' he says. 'It's what the Committee on Climate Change is looking for. The North Sea is their major contribution to help decarbonise other industries.' Nevertheless, failure to get these types of schemes right could see the UK fail to maximise its oil and gas resources and increase imports of carbon-intensive oil and gas, warns Colette Cohen, CEO at the OGTC. ●

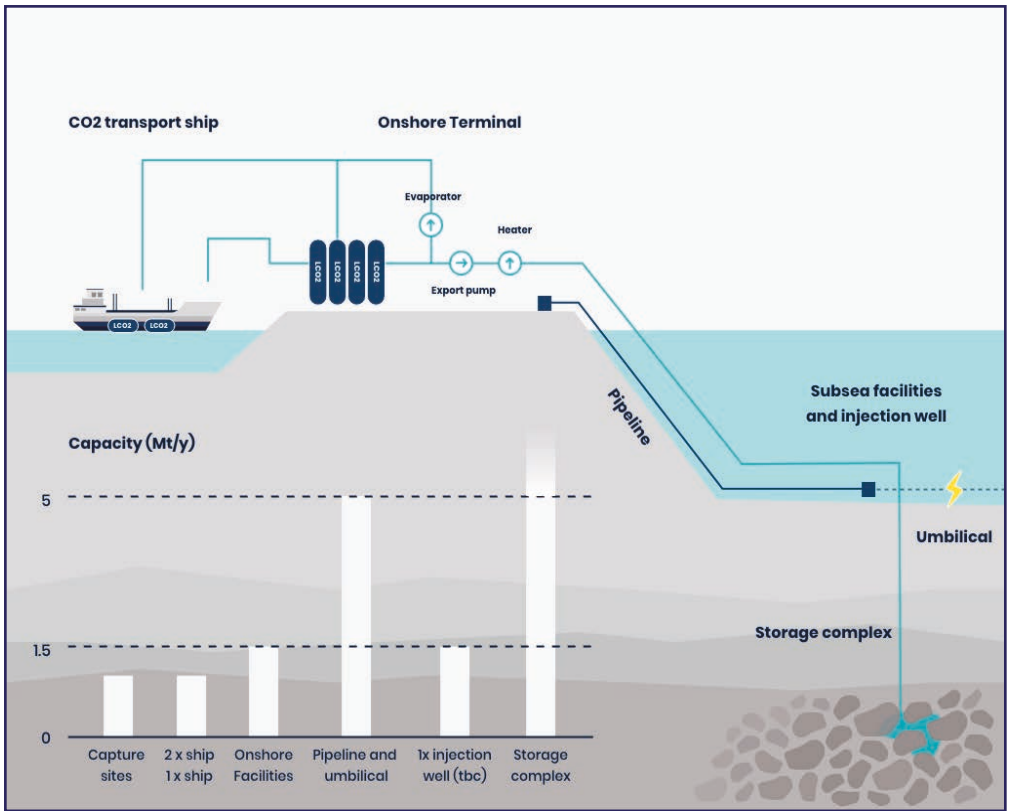

Figure 2: The Northern Lights project hopes to create offshore carbon sinks for CO_2 produced by onshore industrial processes *Source: Equinor*