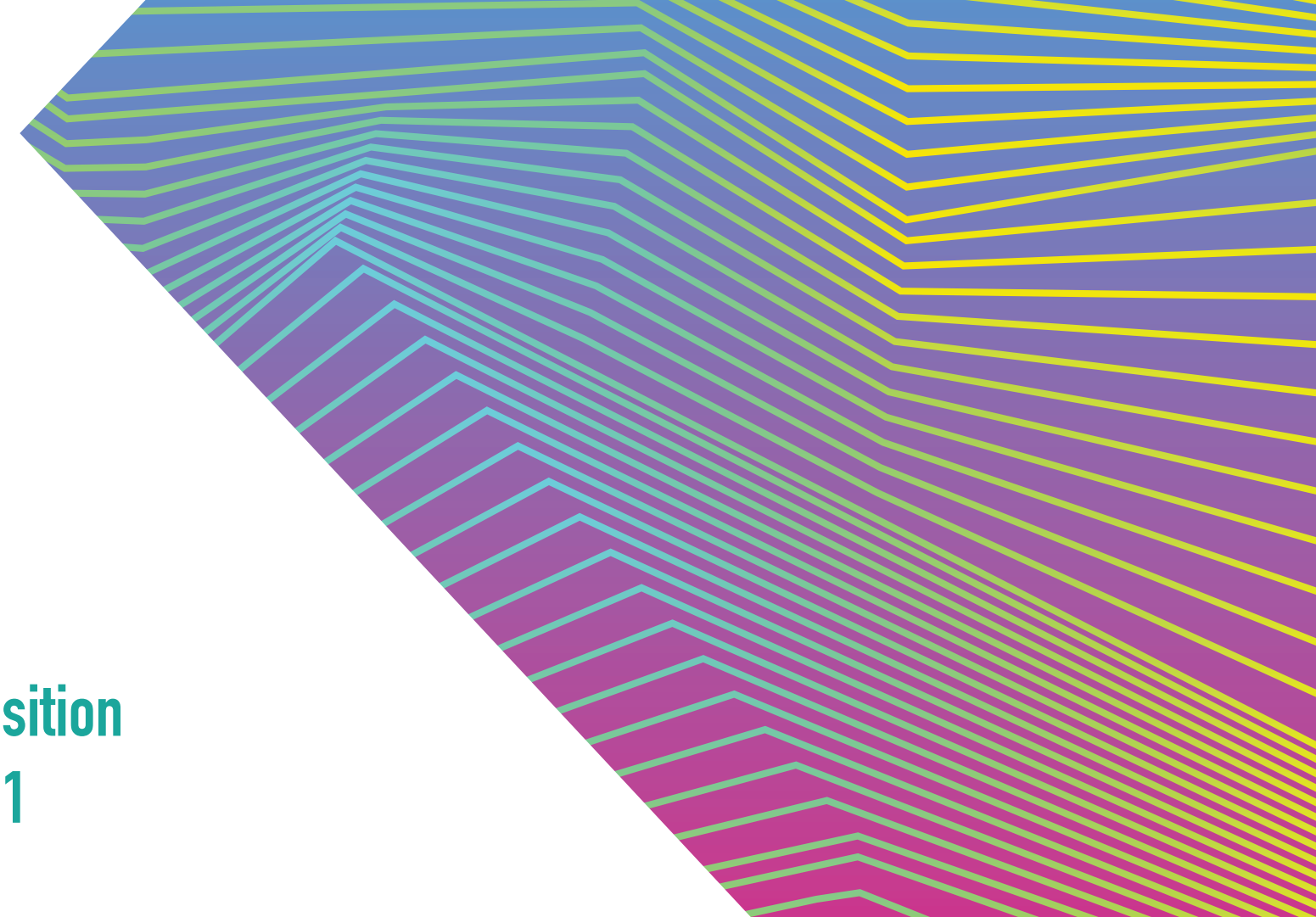
OGUK

Energy Transition Outlook 2021



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OGUK

Energy Transition Outlook 2021

Foreword

The Conference of Parties meeting (COP26) hosted by the UK in Glasgow begins in less than two weeks. Alongside our recent *Economic Report*, this latest edition of the OGUK *Energy Transition Outlook* reflects on the enormous changes in the energy economy over the last 18 months that form the background to the conference. The report also looks forward to some of the practical and policy steps needed to deliver a carbon neutral economy in the UK by 2050.

The objectives of the COP26 conference are to:

- Secure global net zero by mid-century and keep 1.5 degrees within reach
- Adapt to protect communities and natural habitats
- Mobilise finance to support delivery
- Work together to deliver the goals through collaboration between governments, businesses and civil society

The UK oil and gas sector is committed to all of these objectives. Through Roadmap 2035 and now, as part of the North Sea Transition Deal (NSTD) agreed with government in March 2021, there is a clear vision for the future.

The Deal will accelerate the energy transition towards new technologies, cutting emissions even as the sector to continues to supply ongoing oil and gas requirements. New activities will grow the supply chain and stimulate jobs and opportunities for communities across the UK. A specific objective is to maximise the contribution of the sector in getting carbon capture and hydrogen production up and running quickly. This will, in turn, support other UK industries as they transition to net zero.

By 2050 or sooner, households and businesses will have access to a mix of net zero energy sources to heat our homes, power our electricity and operate our industries. With the right support and careful planning, the engine driving all of this will be homegrown UK energy producers. It means that people from Liverpool to Hull and from Shetland to Southampton could see big benefits in achieving net zero, levelling up jobs and economic prosperity as well as successful delivery of our climate goals.

As we emerge from the COVID-19 pandemic, it is clear the challenges around climate change and energy policy remain. Global energy consumption fell during 2020 but, there has been a rebound in global energy demand in 2021 and global atmospheric concentrations of CO_2 continue to rise.

This does not mean that progress on transition has stalled. Indeed, significant advances have been made in terms of overall climate policies. The UK, European Union and other jurisdictions have now adopted target dates to reach a net-zero economy and interim objectives. This has also been reflected in business strategies, often in response to investor or wider societal demands. Where strategy and policy lead, investment should follow, especially as detailed regulatory and commercial structures are emerging to make large-scale projects financeable.

The recent global gas crisis has underlined how dependent the economy is on stable energy supplies. As well as implementing the energy transition, this again brings into focus the role of our sector in supporting diverse and competitive energy sources. In this respect the continuation of investment and development of new prospects is crucial. Increasing our reliance on imported oil and gas from sources that often have lower environmental standards undermines the UK's planned energy transition.

While industry is committed to a step change in action, governments and regulators should also recognise that a coordinated effort is required both in terms of policy support and practical action to deliver decarbonisation at the required pace. The remainder of 2021 and next year will see further significant policy developments and, in particular, the addressing of certain gaps as noted in the recent progress report by the Climate Change Committee. Policy development to unlock investment is essential.

The progressive greening of our energy consumption and supply will involve large-scale and complicated projects carried out by companies with access to the required financial capital. I firmly believe that our operators and supply chain are in prime position to make this change happen at pace and to the wider benefit of the UK economy and communities it supports.

Deirdre Michie OBE,
CEO, OGUK, October 2021

Executive Summary

Emissions reduction in action

- Direct emissions from the UK oil and gas sector are being driven down with a 2 million tonne cut in emissions during 2020, of which OGUK estimates that around half can be attributed to operators' actions.
- The UKCS is proactively reducing methane emissions. In 2019 these were 42,000 tonnes and close to 0.2 per cent of total natural gas production. OGUK members are aligned with the World Bank Zero Routine Flaring objective and OGUK has become a signatory of the global Methane Guiding Principles (see Appendix).
- Current volatile market conditions underline the need for diverse sources of oil and gas and ongoing development of indigenous resources. Without additional investment, the proportion of anticipated oil and gas demand supplied from local resources could fall to around one third by 2027.
- The landmark North Sea Transition Deal agreed with government in March 2021 is an important enabler for the Energy Transition and signals global leadership as well as being an opportunity for the oil and gas supply chain.
- UK oil and gas companies are now leading in renewable and alternative energy investment opportunities including offshore wind. Investor requirements with respect to Environment, Social and Governance (ESG) criteria are now being embedded in the sector and driving strategic change.

Policy Priorities

Significant progress has been made in policy development since OGUK's last policy review document, released in March 2021. Six months on from the Energy White Paper, many of the required changes are being delivered, including those agreed in the context of the North Sea Transition Deal. However, as the economy emerges from the pandemic, accelerating the next phase will be essential for the delivery of both the NSTD and the wider shift in energy and industrial policy to ensure success. This is also recognised in the government's recently published Net Zero Strategy – Build Back Greener.[1]

• The UK now has a robust economy-wide carbon price framework

£58/ tonne
UK CO_2 price: September 2021 average

The UK Emissions Trading Scheme (ETS) was launched in May 2021 and the price of certificates has tracked upwards throughout 2021. This is now providing a strong incentive for emission reduction throughout the economy and will help accelerate new technologies such as carbon capture and hydrogen.

Government has also updated its estimates of social cost of carbon for policy appraisal. As carbon prices increase so does the potential for carbon leakage, especially as the UK price has moved well above the European level in recent weeks. Linkage between schemes should be an important short term objective. A further missing element in the UK is the development of decarbonisation funds, using the receipts from auctioned allowances to support systemic change.

2020
17 Mt CO_2e
Direct emissions from UKCS

• A framework for emission reduction on the UKCS is emerging

The redrafting of the OGA Strategy, which has shifted regulatory policy towards the government net zero objective and in support of emission reduction, has been an important step.

[1] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1026655/net-zero-strategy.pdf

For its part, industry has now approved the Methane Action Plan and has signed up to the Methane Guiding Principles. Action is already resulting in emissions reduction in 2020 and in the OGUK near-term forecast. Under the NSTD, some progress is being made to support electrification of assets.

- **Government is making rapid progress in developing market structures for carbon capture and hydrogen market design**

5
Phase 1 cluster projects considered for approval

The concept of industrial clusters for both CCUS and hydrogen is now well established both in the UK and, increasingly, across the rest of the world. Government has also set out a process for allocating support to the initial phases via the CCUS Infrastructure Fund and has now decided on two "Track 1" clusters.

The economic regulation framework for CCUS and the development of business models for power generation, industrial capture and hydrogen are being clarified. Meanwhile the publication of the Hydrogen Strategy in September 2021 was a major milestone highlighting its potential to serve 20-35 percent of UK energy consumption.

- **Upscaling of investment is required across the whole energy sector to achieve net zero**

The Climate Change Committee estimates energy sector investment needs to increase substantially from current levels. Most of this consists of the additional investment required to simultaneously decarbonise the economy while also maintaining reliable supply.

£50 billion
Annual energy sector investment

The revision of the government Green Book with respect to policy appraisal should provide an impetus in this respect, along with the addition of a UK taxonomy.. Further amendment of the fiscal treatment of energy sector investment may also be helpful.

Investor requirements with respect to climate-related disclosures will also increasingly have an impact.

- **More work is needed to ensure the energy transition will support local economies and jobs**

Increased investment associated with the NSTD, and more widely across the energy sector, will have its greatest impact where it can make the most of the UK's existing supply chain. This means building on existing advantages and expertise derived from oil and gas projects and moving quickly to develop competences in new market segments as they emerge.

40,000 jobs
To be created via the NSTD

Progress against sector emission reduction objectives

Emissions in 2020 fell 10 per cent compared to the 2018 baseline

This report sees industry's first progress update following the launch of emissions reduction targets[2] in 2020, which set our commitment to achieving a net zero basin by 2050. OGUK first published emissions targets for the sector in June 2020, using data from 2018 as the baseline year. This report includes the first update by the sector against these targets. These show that industry has seen a 10 per cent emissions reduction from the restated 2018 baseline, falling from 18.88[3] Mt CO_2e to 17.06 Mt CO_2e in 2020.

Figure 1: 2018 – 2020 Scope 1 CO_2e Reported Emissions

The methodology used to derive these figures, using various databases from the offshore oil and gas industry's production operations, is set out in the attached Appendix. This year also sees the baseline for industry emissions and subsequent reported years move to *AR5 with Carbon Feedbacks*, and OGUK will continue to monitor the progress of the outcome of AR6 expected in 2022.

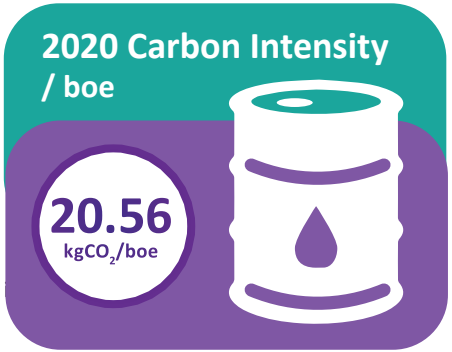
[2] https://oguk.org.uk/product/product-production-emissions-targets-report/

[3] Emissions baseline and subsequent emissions are reported using AR5 with carbon feedbacks using 100-year time horizon.

Assessment of 2020 emissions

While production in 2020 fell 5 per cent, predominantly due to the impacts of COVID-19 on production and activity, emissions fell by 10 per cent.

OGUK estimates that around half of the emissions decline is the result of reduced production and maintenance activity due to the pandemic. 2020 saw some of the lowest rates of drilling activity for the basin and, coupled with reduced aviation flights and less throughput to terminals, a proportion of the observed emissions reduction was expected. However, compared with previous years, emissions declined significantly further than would have been expected from the reduced activity and associated decline in production. There was also some evidence of this emerging in the 2019 figures in that, although emissions rose slightly, they were below the level of OGUK's previous forecast.



Evidence from an OGUK survey of operators also supports this conclusion. This revealed that they are beginning to realise near-term emissions reduction through continuous improvements. These measures include reduced flaring and venting, streamlining operations and investing in targeted plant modifications, all while maintaining and improving on an 80 per cent production efficiency target.[4] This means the UKCS emitting fewer GHG emissions per barrel of oil and gas produced. The average carbon intensity (expressed as total production divided by total carbon emissions) from 2014-19 was around 23 kg CO_2 per barrel of oil equivalent (boe) produced, and is now around 21 kg/boe in 2020.

[4] https://www.ogauthority.co.uk/data-centre/benchmarking/ukcs-production-efficiency-2020/

OGUK CO_2 installations short-term forecast (2021-25)

Industry's direct greenhouse gas emissions has a strong correlation to UK oil and gas production. OGUK analysis have projected CO_2 emissions from installations out to 2025, providing an indication of likely progress against the NSTD targets. CO_2 emissions from installations are around 70 per cent of the total covered by the industry target, which also includes terminals and methane emissions.

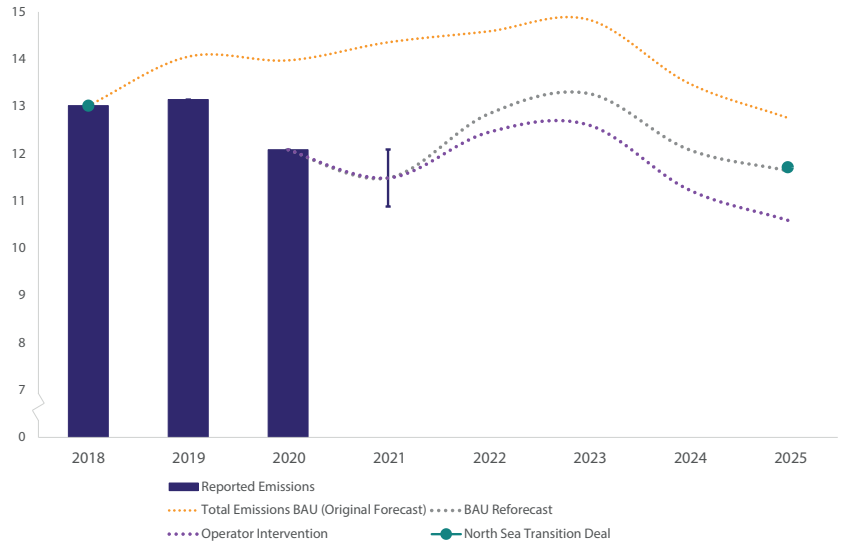
Based on a projection including both a high level of investment in new production and development, combined with continued intervention by operators to control emissions, it is concluded that industry has the potential to exceed near-term emissions reduction targets whilst avoiding steep declines in output, provided investment programmes recover.

OGUK's short-term forecasts for emissions apply a full investment production outlook against installation emissions and extrapolates them across the basin. This assumes that even when further development proposals which are currently under consideration are included, industry can meet its emissions reduction target. This is illustrated in Figure 2 which sets out:

- a high case, based on a reforecast of OGUK's previous BAU scenario
- a low case, which assumes more rapid progress by operators in addressing emissions

"reduced flaring and venting, streamlining operations and investing in targeted plant modifications, while maintaining and improving on an 80 per cent production efficiency target means the UKCS is emitting fewer GHG emissions per barrel of oil and gas produced"

Figure 2: Installations CO_2 Emissions (Reported and Forecast)



Source: OGUK

For the current year, 2021, both forecasts anticipate a 10 per cent reduction in oil and gas output as a result of outages that were postponed from 2020. The overall impact of this, combined with further reduced drilling activity, means that emissions for 2021 are likely to remain around same level as reported emissions in 2020. Some further improvement is possible depending on emission reduction activities in the remainder of the year. However, this will not be confirmed until full information from 2021 is available in next year's report.

Moving towards 2023, if all investment proposals are sanctioned from 2021-22, OGUK anticipates CO_2 emissions from installations could marginally increase and peak in 2023 before beginning to decline as a result of continuous operational improvements, maintenance and industry best practice. The range set out in Figure 2 is based on the assumptions below:

In a reforecast "BAU" emissions scenario: The same rate of continuous improvement is assumed going forward as has been seen over the last two years. At the same time, carbon intensity (CO_2kg/boe) is held constant, even as production increases in line with basin wide recovery plans. This assumption therefore includes new production from less carbon-intensive projects being brought online as older assets, which have a higher carbon intensity, are retired.

In a "Operator Intervention" emissions scenario: OGUK has modelled the likely outcome of all operators improving emissions performance in line with the best practice levels seen to date. In this scenario, while production and emissions increase to 2023, the increase is less pronounced than originally forecast due to alternations in performance of the assets. By 2025 this leads to a further reduction of emissions beyond the NSTD target. This outcome also factors in new production coming online and older assets coming offline. However, operator intervention assumes carbon intensity will improve across the board.

While the short-term challenge for the industry is to maintain emissions performance at a time where has the potential to increase from 2022-23, both scenarios demonstrate emissions reduction forecasts are likely to be sustained to meet the short-term targets.

Both scenarios include an expectation that around 30 installations and FPSO's are due to cease production between 2021-25. Of those assets due to come offline, four were commissioned before 1990. Natural decline of production from aging fields and assets and decommissioning older energy intensive installations during this period is anticipated in total to remove around 0.3 Mt/p.a. of CO_2 emissions.

During the same period, production will start up from three new platform and FPSO projects which have committed development plans in place, along with around 10 fields which will be tied into existing production infrastructure. There are further project opportunities under consideration, but not yet committed, for development which would likely see around 5 new platforms and FPSOs as well as new fields tying into already producing installations. These installations using latest technology, and in some instances unmanned installations will drive further improvement in emission intensity.

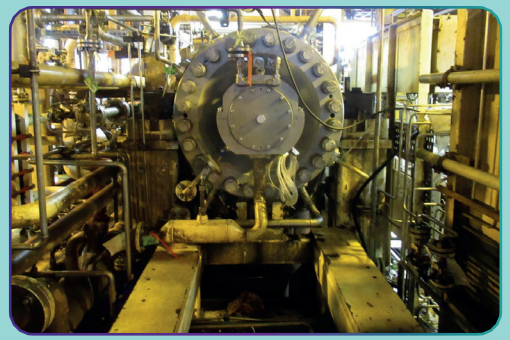
In conclusion, new production with improved emissions intensity can be brought online whilst maintaining industry's emissions reduction progress in line with the North Sea Transition Deal.

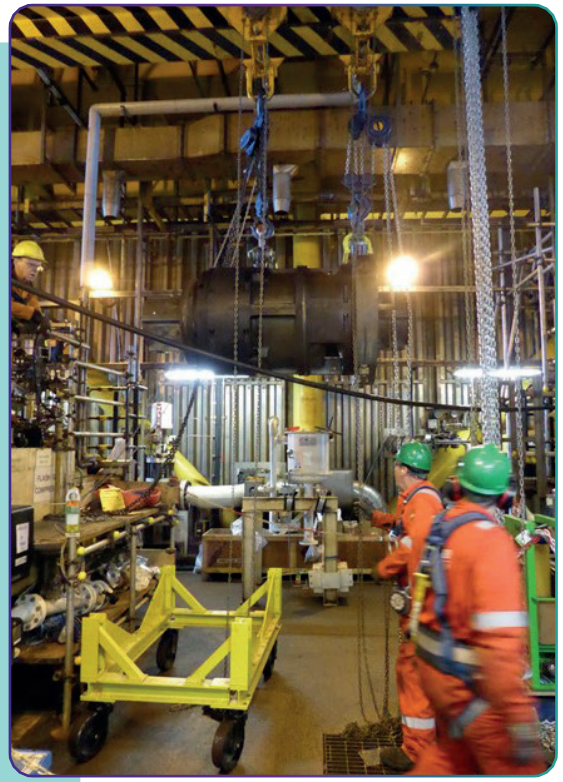
CASE STUDY: SHELL

Taking action today to reduce the carbon footprint of assets

The Gannet platform has been processing oil and gas via subsea tie-backs in the Central North Sea since 1993. Processing equipment on the platform, such as compressors and pumps, were designed for the initial operating conditions. Over time, as production has declined, the capacity of some equipment has become too big for current requirements. By re-wheeling machinery, Shell has been able to re-size equipment to ensure that only the energy that is required for today's operating conditions is used. There are added benefits in that surrounding equipment and piping can be retained, thus saving costs and downtime.

During the 2021 turnaround on Gannet two new compressor bundles were installed to great effect; reducing the power demand on their motor drives and in turn lowering the load requirement on the platform power generation packages. This reduces total platform CO_2 emissions by 25% - with potential to go further, and give significant savings through reduced fuel gas usage.

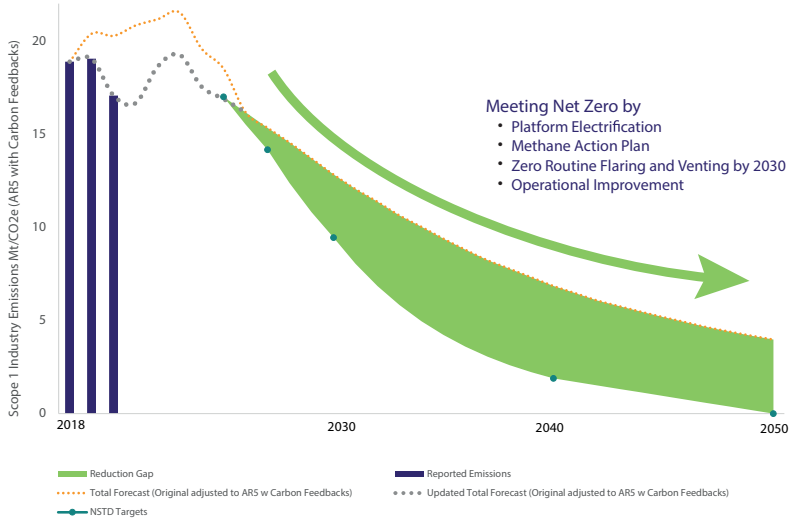




2025 and longer-term trends

Looking to the longer-term commitments, industry action today is driving and developing the strong foundations needed to support sustained emissions reduction and achieve net zero by 2050. In its long-term commitment to net zero, industry recognises it must go far beyond business-as-usual activity, and that absolute abatement will only be possible through further reductions in flaring and venting as well as step change in emissions reduction through new investment in areas such as the electrification of installations.

Figure 3: Long Term Scope 1 Emissions Forecast (BAU versus North Sea Transition Deal Targets)



As has been demonstrated, operational measures to reduce supply emissions are already having an impact, and they are being augmented by longer term measures which will collectively have a further significant impact on emissions reduction. These include:

(i) Investment and deployment of new technologies that allow for a step-change in emissions reductions, **in particular platform electrification** using renewable sources of electricity to replace on-platform, gas-fired power generation. Plans are underway which could lead to electrification of assets in the central North Sea, outer Moray Firth and west of Shetland. Offshore electrification is a complex technical and commercial activity which will need to make the most of synergies with wind farms, and electrical infrastructure, whilst addressing regulatory and operational issues and surmounting significant capital and operational costs.

(iI) Phasing out of routine flaring and venting aided by improving gas recovery and implementation of new flare management plans. Coupled with a UK industry commitment to support the World Bank Zero Routine Flaring by 2030 initiative, the OGA guidance on flaring and venting has set an objective of zero routine flaring and venting by 2030[5] which aligns with commitments within the NSTD.

(iii) Implementation of the Methane Action Plan[6] , incorporating enhanced quantification and measurement, followed by systematic program of reduction of platform and fugitive emissions.

(iv) Phasing out of high-emission assets that are unable to economically or technically reduce emissions at prevailing carbon and commodity prices.

However, just as industry is committed to step change in action; government, regulators

[5] https://www.ogauthority.co.uk/news-publications/publications/2021/flaring-and-venting-guidance/

[6] Methane Action Plan 2021 - OGUK

and stakeholders should also recognise that multi-stakeholder action is required both in term of policy support as well as practical action to deliver decarbonisation at the required pace. OGUK and members are committed to continued progress to reduce emissions, working closely with regulators such as the OGA which recently released its own monitoring report on emissions[7].

Summary of Methane Action Plan components

1. **50% methane emission reduction by 2030**
   Industry will halve methane emissions by 2030 (against a 2018 baseline) in accordance with overall emission reduction targets.
2. **UKCS methane intensity below 0.20% by 2025**
   Industry will adopt the 'stretch' OGCI methane intensity target of 0.20% by 2025 to drive short-term operational efficiency.
3. **Zero Routine Flaring before 2030**
   Industry will aim to meet the World Bank 'Zero Routine Flaring by 2030' initiative, with individual assets seeking to accelerate compliance where possible before 2030.
4. **Asset MAP**
   Operators will develop a Methane Action Plan for each individual asset by Q4 2022, including measurements and quantifications, flare and vent management plans, and abatement plans.
5. **Measuring methane**
   Operators will seek to validate methane quantification wherever practicable.
6. **International alignment**
   The industry will seek to align to international standards and reporting principles.

[7] https://www.ogauthority.co.uk/media/7809/emissions-report_141021.pdf

CASE STUDY: NEPTUNE ENERGY

Global independent E&P company, Neptune Energy, partnered with the Environmental Defense Fund (EDF) in September this year to test a first-of-its-kind approach to enhance methane emissions measurement and mitigation on an offshore platform.

Operators piloted a rotary drone fitted with methane sensing technology on the Neptune Energy-operated Cygnus Alpha gas platform in the UK southern North Sea. The drone measured emissions at key points on the platform, in coordination with an EDF representative.

To quantify total potential emissions, a fixed wing drone carried out measurements while circling above, around 250 metres from the platform.

The study provided the means to evaluate advanced methods for emissions' detection and measurement and reporting, and has the potential to establish a more scientific benchmark for the wider upstream industry, addressing potential over/under-reporting of emissions which are currently based on "desktop calculations".

Neptune already has one of the lowest methane intensities in the sector (0.01% in 2020). It is a member of the Oil and Gas Methane Partnership (OGMP) and a signatory to OGMP's new 2.0 framework which aims to improve accuracy and transparency of methane emissions reporting. The Cygnus study is a strong example of how Neptune – and the UK industry – is serious about tackling methane emissions.

Given the short lifespan of methane, action today can bring results in as little as nine years, which will be crucial in helping meet the Paris Agreement goals. Methane reduction programs can also enhance process safety, support operational excellence and process optimisation, as well as reducing maintenance costs and production losses. The results of the Cygnus study are due to be published in a scientific peer-reviewed paper in 2022.

The changing oil and gas sector

Global and national context

In the run up to COP26, there have been many modelling exercises to produce global forecasts and scenarios for how the energy sector may evolve out to 2050. Some of these are scenarios based around a specific target outcome (e.g. Paris compliant or Net Zero) while others are specific projections about what could happen based on e.g. current policy measures in place.

Most of these predictions begin with similar basic assumptions for example, global GDP is expected to more than double by 2050, supporting a global population of around 9.6 billion people. A number of conceivable pathways have then been set out depending on the forecast or scenario used. The section below reviews the IEA Net Zero Scenario[8], DNV GL Energy Transition Report 2021[9] and the Shell Sky 1.5 Scenario.[10]

These differ in their approach in that:

- the IEA report is a single projection of how net zero could be achieved at a global level by 2050
- Shell Sky 1.5 is a challenging yet technically possible approach to meeting the Paris objectives
- DNV projects the likely outcome by 2050 based on the current policies in place which only delivers a 45 per cent cut in global emissions by 2050

The overriding conclusion is that progression toward the Paris Agreement goals requires further global action. A comparison of each scenario is provided for energy demand, oil and gas demand, renewable growth and CCUS and hydrogen deployment. See Appendix for further assumptions applied.

[8] Net Zero by 2050 – Analysis - IEA
[9] Energy Transition Outlook 2021 | DNV
[10] Sky Scenario - Meeting the Goals of the Paris Agreement | Shell

IEA's most recent World Energy Outlook[11] suggests that, based on current policies, carbon emissions will only drop by 40 percent by 2050 with current reduction pledges. It notes that $4trn investment is needed globally over the next decade to reach net zero. It also concludes that the world is not investing enough to meet its future energy needs, and uncertainties over policies and demand trajectories create a strong risk of volatility.

Energy demand

Historically, global GDP and energy demand have been closely linked. However, the advancement of energy efficiencies, technological developments and behavioral changes are expected to result in differing trajectories from the current level of around 400 exajoules (EJ) per year.[12]

- The IEA Net Zero Scenario assumes that these progressive behavioural changes and energy efficiency will have a large impact resulting in global energy demand to be 8 per cent *lower* than today's levels in 2050, to a level of 370EJ/year
- The Shell Sky 1.5 scenario allows for larger increase to around 500EJ in 2050 and a further increase thereafter stabilising at 600EJ/year
- DNV expects that global energy demand will peak in 2035 at 466 EJ/year, an 8 per cent increase from today's level. After this peak, demand will then remain relatively stable towards 2050
- The key difference in these scenarios is in terms of the extent of energy efficiency and behavioural change expected or required.

[11] World Energy Outlook 2021 – Analysis - IEA
[12] UK final energy consumption is equivalent to roughly 6 exajoules per annum, 1.5% of the global total

Renewable expansion

All the above reports envisage that renewable energy sources will grow significantly, at least doubling over the next two decades. From 2040 onwards all three scenarios expect that the growth of solar and wind will increase to become the two largest energy supply sources. Renewables will be particularly notable within power generation. Overall, electricity demand is expected to more than double by 2050, and renewables will grow from a 10 per cent share today to more than 60 per cent in 2050.

CCUS and hydrogen deployment

All three analyses envisage the need for substantial CCUS implementation with over 10,000 million tonnes of capture required per annum at global level. Currently, the oil and gas sector is leading this development. The IEA highlights that almost 75 per cent of current captured CO_2 emissions are currently linked to oil and gas operations, although in future it is expected that stand-alone carbon capture industrial clusters will drive investment. Widely regarded as an industry that can implement CCUS as a viable business case, it is forecast that the oil and gas sector will have a prominent role in the development of CCUS technologies and deployment towards and beyond 2050.

However, owing to the lack of a policy framework in most jurisdictions, DNV's projection does not include significant CCUS development. **This is the main reason that the projected reductions in carbon emissions in its modelling are not sufficient to deliver an outcome consistent with the Paris agreement.**

All scenarios envisage the emergence of hydrogen, totalling about 10 per cent of global final energy consumption just before 2050. All three projections expect electrolysis to become the dominant method for hydrogen production by 2050. However, fossil fuels also have a prominent role in hydrogen production, whereby 40 per cent of production in 2050 will be from natural gas facilities equipped with CCUS.

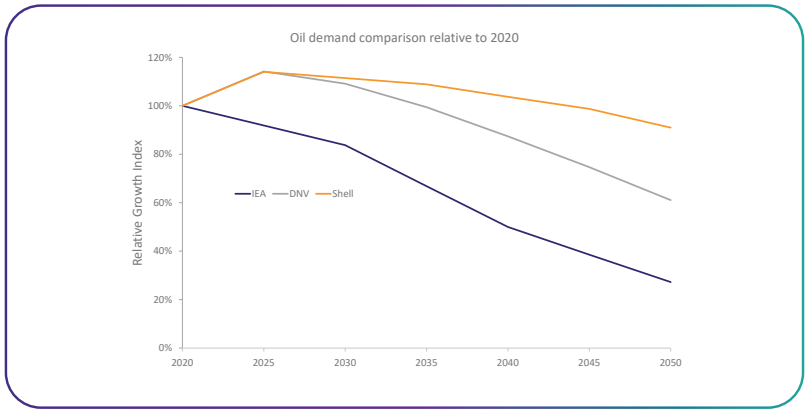
Oil and gas supply and demand

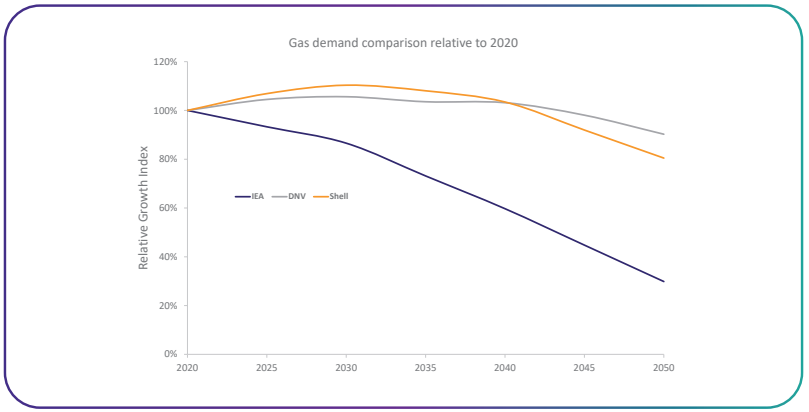
Within the IEA and DNV scenarios, the combination of relatively low growth in energy demand and rapid renewable increase leads to a fall in the use of fossil fuels in the global economy. Although fossil fuel reduction is seen in all scenarios, the reduction is particularly notable from 2030 onwards, but the extent of the decline is uncertain. The DNV forecast outlines that by 2050 global energy supply will be split roughly 50:50 between fossil and non-fossil fuels, comparative to today's current 80:20 split. However, according to the Sky 1.5 scenario, it is only after 2050 that renewable energy will eclipse fossil fuel supply.

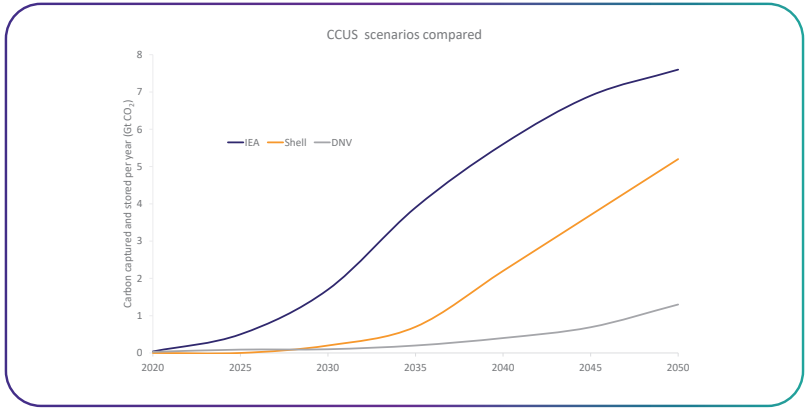
By contrast, the IEA net zero scenario projects that fossil fuels will only represent around 20 per cent of total energy supply and renewable sources two-thirds of supply in 2050.

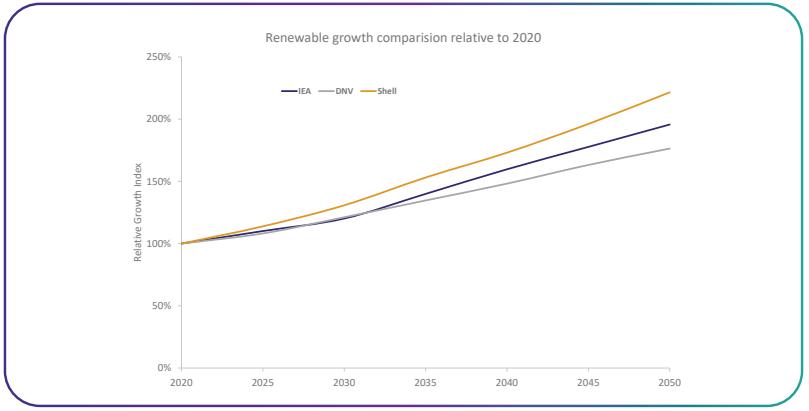
Although these figures differ in terms of the pace of change, it is clear in all outcomes that fossil fuels will remain an integral part of energy provision over the next 30 years.

Indeed, in DNV's forecast, oil demand could recover to pre-pandemic levels recorded in 2019 by mid-decade with demand for natural gas forecast to *grow* steadily towards 2030, a trend echoed by Shell. These plausible indicators of fossil fuel recovery following the COVID-19 pandemic demonstrate the current global importance of fossil fuels for immediate energy supply.







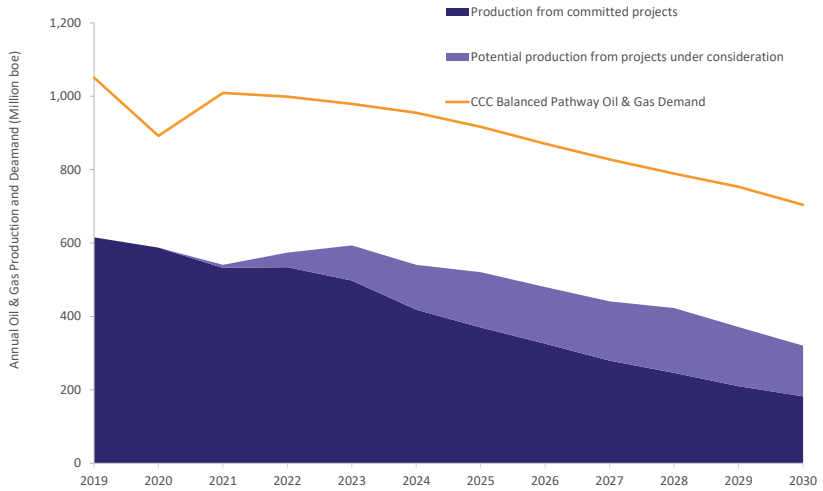


Source: IEA, DNV, Shell

UK oil and gas demand

The global projections discussed above are largely reflective of expectations for the UK energy sector. The use of oil and gas in the UK is still significant. Even in 2020 this exceeded 125 million tonnes of oil equivalent (mtoe) or 900 million barrels. As alternative energy technologies mature, the proportion of oil and gas within the energy mix is anticipated to fall significantly as the UK decarbonises its economy.

Figure 8: UK production and demand



Source: OGUK, OGA, CCC

As with global projections, the UK's Committee on Climate Change (CCC) [13] also envisages large reductions in oil and gas demand and overall energy efficiency improvement. For a net zero outcome by 2050 the CCC expect total energy demand in the UK would need to fall by around one-third, while more severe decreases in demand for oil (-80 per cent) and gas (-75 per cent) are forecast. The remaining use of oil and gas is seen mainly in sectors with few existing or potential alternative technologies. However, as shown in Figure 8, the decline in demand out to 2030 is less pronounced.

Furthermore, Figure 9 overleaf shows that may of the potential substitutes for oil and gas are not yet mature in terms of technology development or consumer uptake.

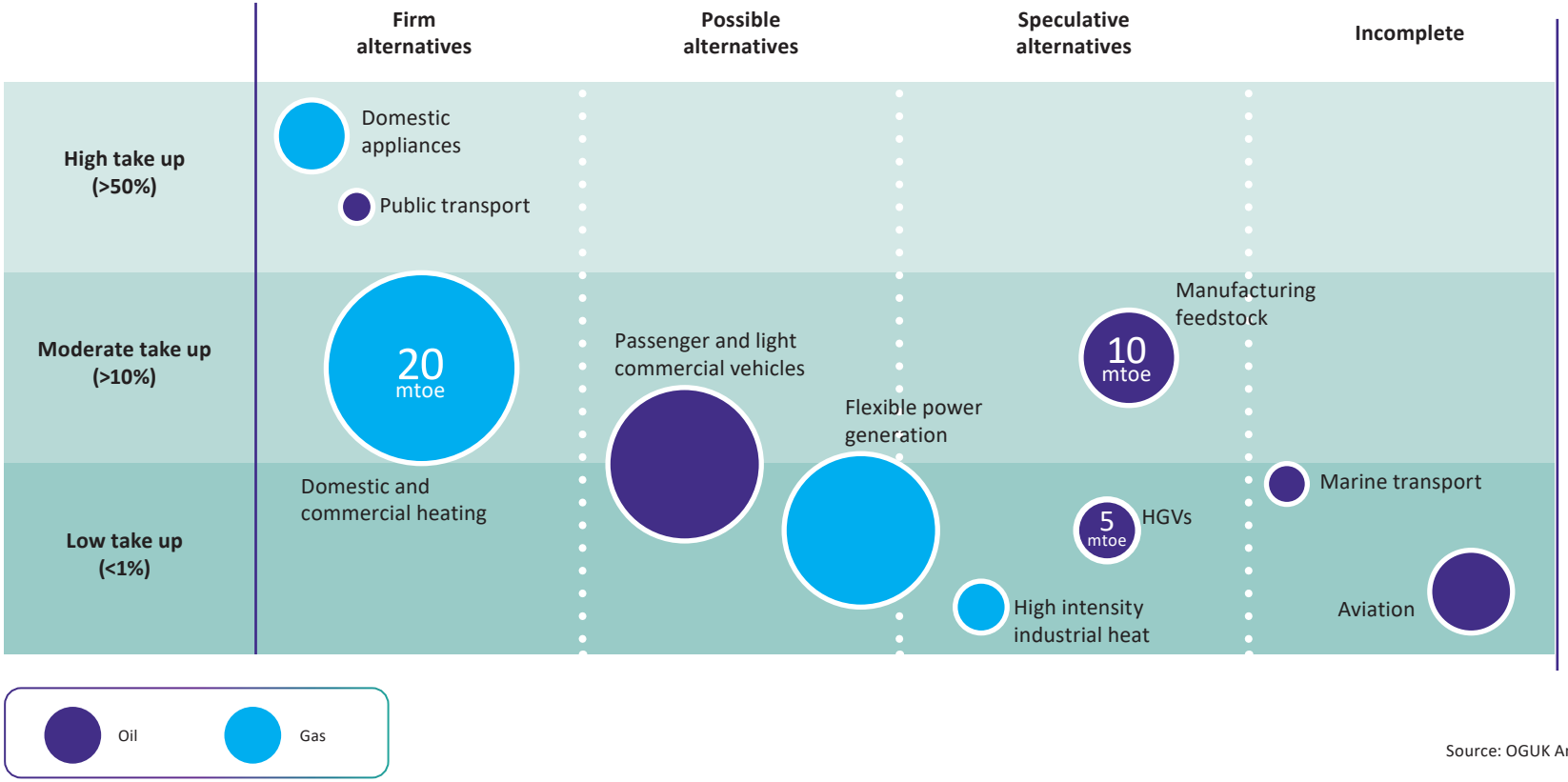
As outlined in OGUK's recent Economic Report, the ongoing demand for oil and gas requires continued investment in exploration and development of indigenous resources.

Investment in new field developments, along with opportunities within existing fields, provides the opportunity to maintain the positive contribution that domestic resources make to meeting the UKs oil and gas demand. Without these investments, the UK will become increasingly dependent on imported oil and gas, with less control over the environmental performance of the sector.

By unlocking the £14 billion worth of projects over the next four years already under consideration and not yet secured, the UKCS can continue to meet around half of our oil and gas needs over the next decade while meeting our emission reduction commitments. Failure to secure these opportunities mean that contribution to meeting oil and gas demand could fall to as low as a quarter by 2030.

[13] Sixth Carbon Budget - Climate Change Committee (theccc.org.uk)

Figure 9: Current status of alternatives to hydrocarbon-based fuels



Source: OGUK Analysis

Recent market developments

The UK National Balancing Point (NBP) gas market is currently experiencing unprecedented highs, following record lows last year. Current day-ahead prices throughout Q3 2021 have averaged around 120p/therm, the highest nominal quarterly average gas price on record in the UK. Equally, the forward gas price for Q1 2022 on the 30th September was 235p/therm, a five-fold increase on the quarter forward price set for Q1 2021 this time last year.

This abrupt increase in gas prices has led to several UK-based energy suppliers becoming insolvent in the run up to the release of this report. This has left around 2 million households having to be reallocated to alternative suppliers, often at higher prices.

The spike in UK (NBP) and continental (TTF) prices are largely being driven by supply-demand tensions and the increase in carbon prices. Balancing the reduced production on the UKCS with an upturn in demand as the economy reopens and less than favourable wind conditions for renewable generation, has led to an increase in gas imports.

In 2020, the UK already imported natural gas equivalent to just over half of demand, of which 55 per cent was imported from Norway via pipelines with the rest from deliveries of LNG. However during 2021, the consequence of reduced UK production and global competition, coupled with increased demand, are all being priced into the market meaning LNG now often sets the marginal price of gas for the whole of the EU.

Specifically, as reported in OGUK's *Economic Report*, EU and UK gas production in January to August 2021 declined by over 20 per cent, compared with the same period in 2019. This fall in UK production is in some part due to the delayed maintenance of the Forties pipeline shutdown for three weeks in May and June of this year, causing a reduction in supply. Whilst these outages have had a short-term impact on production, output is now recovering and there will be a limited impact on overall production levels in the remainder of this year and next year.

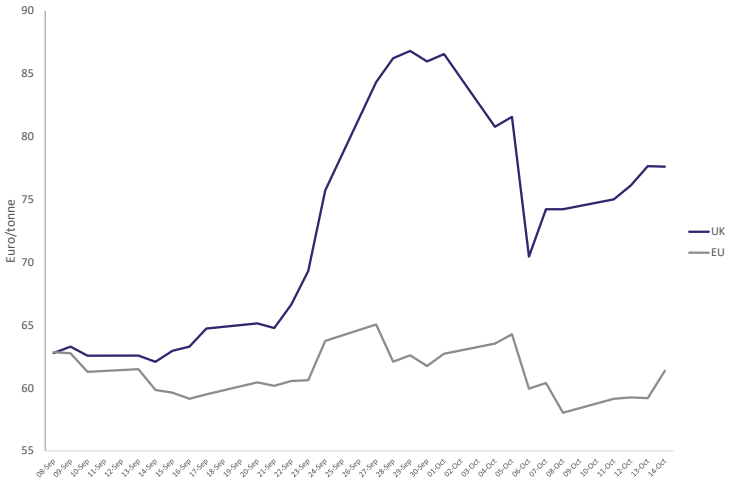
These conditions highlight the importance of diverse energy sources including domestic production. Over reliance on imports results in gas markets which are highly sensitive to global supply chain constraints and price volatility. By maintaining a strong domestic supply of gas, the UK is able to minimise its risk towards these global energy crises and price fluctuations.

The market for crude oil has also increased in recent months with prices exceeding $80/barrel. This again is largely down to supply-demand tensions as pandemic restrictions are lifted and the economy begins to reopen. Uncertainties in demand are affecting the recovery in supply along with some lack of investment in basins globally. It will be crucial for production to keep pace with demand to restore stability in the market.

Finally, carbon prices are now having a significant effect on the overall energy system since the UK ETS was launched in May 2021. Initially, UKETS prices tracked upward in parallel to the EU scheme. This was in anticipation of measures in both jurisdictions to reduce the quantity of allocations in line with the targets being set for 2030 for emission reduction. For example, the EU Commission proposed in July 2021 that the quantity of allowances available should be reduced by 4.2 per cent per annum (compared to the previous annual reduction of 2.2 per cent per annum). The UK Department for Business, Energy & Industrial Strategy (BEIS) has announced that it will also be consulting on setting a similar net zero consistent cap trajectory later in 2021. These measures saw carbon prices increase to around €50-60/tonne.

In recent weeks, however, (see Figure 10) the UK carbon market has diverged from the EU prices and is now trading at a premium of around €20/tonne to some £65/tonne (€75/tonne). This is partly due to the lower liquidity in the UK market meaning that even small volumes of trading can cause rapid shifts in prices.

Figure 10: Recent EUETS and UKETS trading prices



This market volatility underlines the importance of a continued government framework for a resilient and affordable energy system. This means ensuring reliability of the system and appropriate end-user costs whilst delivering on net-zero. As discussed in OGUK's *Economic Report*, a managed transition that retains security of supply and a strong domestic industry whilst delivering net-zero is critical.

Embracing diversification

The 2019 OGUK *Energy Transition Outlook*[14] set out a range of pathways that companies were likely to follow in terms of their approach to the transition.

[14] https://oguk.org.uk/product/energy-transition-outlook-report/

OGUK pathways to a low carbon industry

Two years on from the last *Energy Transition Outlook*, it is clear that strategic choices identified then are already being made and are beginning to have a significant effect on investment both in terms of scaling low-carbon technologies and decarbonising supply. As governments continue to progress on the path to net zero, it is anticipated that we will see a growing number of fiscal policy and market mechanisms be implemented to ensure the flow of capital to key areas. In this context, OGUK are pleased to see the publication of HMT's NZ Review, in particular the emphasis placed on the need to see large increases in investment across the UK economy to achieve net-zero. OGUK are clear there is a need to see new finance flows directed towards scaling low carbon technologies as outlined in both the review and the recently published Greening Finance Framework and look forward to seeing these policy areas progress.

A recent assessment carried by Capital Economics for CMS Cameron McKenna[15] demonstrated that capital allocation decisions can change rapidly across the energy sector. In many cases these can swing rapidly to renewable investment in terms of the share of capital expenditure. Overall, this trend is likely to increase, particularly for those companies active in the UKCS and which have recently made successful bids for acreage to develop offshore wind projects.

[15] Energy Transition: The evolving role of oil and gas companies in a net-zero future (cms-lawnow.com)

Snapshot of total capital investment in renewables as a share of capital expenditure % (Top 5 UK based operators)

	2018	2019
ENI	4.0	17.0
Total Energies	3.0	10.0
Shell	9.0	8.7
Equinor	5.0	7.5
BP	5.6	2.6

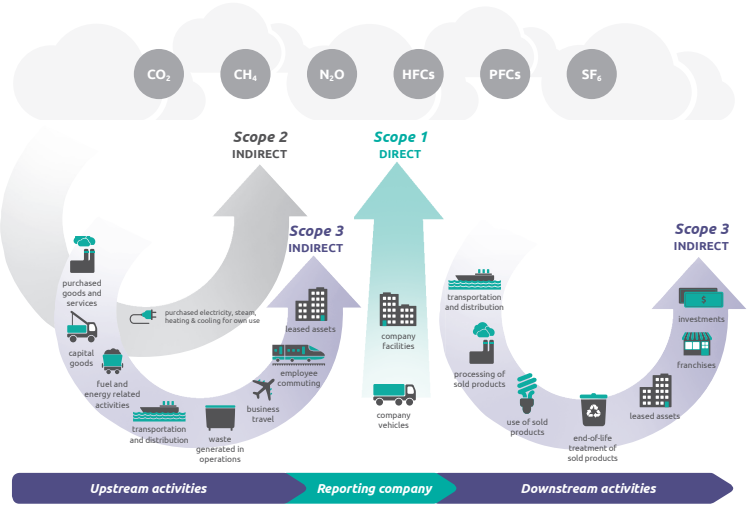
Source: Capital Economics for CMS Cameron McKenna

As discussed in OGUK's *Economic Report*, investors and stakeholders are increasingly looking at a far wider range of non-financial disclosures from businesses with respect to their alignment with environmental, social and governance (ESG) factors, in parallel with company profitability.

OGUK expects this trend to continue over the next decade as climate, environmental and social co-benefit policies are embedded into the market through initiatives including the Taskforce on Climate-Related Financial Disclosures (TCFD), Taskforce on Nature-based financial disclosures (TNFD), and Green Taxonomies. Recognising this, OGUK has established a new work stream to support industry in meeting appropriate ESG criteria. A key challenge to address will be to assimilate the reporting requirements placed on companies and across the value chain with regards to Scope 1–3 emissions.

As ESG becomes further embedded in the markets, there will be a need for some standardisation to ensure efficiency and the ability for benchmarking across not only the sector on a global level but other energy intensive industries. This will provide clarity and confidence to the market and OGUK acknowledges the work of the IIGCC Oil and Gas Net Zero[16] Standard as a prominent example supporting standardisation within the sector. Specifically, within this framework it notes the need for companies to retain flexibility. OGUK strongly believes that the value of ESG is achieved through standardised corporate reporting that allows companies to retain flexibility and own their strategic direction.

We look forward to engaging further with government following the publication of their Greening Finance; A roadmap to sustainable investing which outlines the next steps to delivering a UK wide taxonomy and sustainable disclosure requirements.



Source: GHG Protocol

[16] https://www.iigcc.org/download/iigcc-net-zero-standard-for-oil-and-gas/?wpdmdl=4866&refresh=6155d9cbb0ef31633016267

Net Zero Technology Centre
Technology Driving Transition

Since 2017, the Net Zero Technology Centre (NZTC) has fast-tracked technology investment within the oil and gas industry and is now acting to accelerate the role of technology in support of the transition to a net zero basin. Its focus is on reducing emissions from existing facilities, unlocking the full potential of an integrated energy system, driving the energy industry towards a digital, automated future and accelerating clean energy start-ups to build a thriving supply chain.[17]

Unlocking the full potential of technological capabilities will be a critical mechanism to support the basin to meet its net zero targets under the North Sea Transition Deal. Technology investment in emissions reduction, for example, will act to support industry's commitment to reduce operational emissions by half by 2030, and by 90% by 2040. New developments in areas such as methane leak detection are already supporting industry commitment to the methane action plan

By reshaping and refocusing, the Net Zero Technology Centre will also act to drive and unlock the full capabilities of what it calls 'Offshore Energy 4.0', which will focus on digitisation and automation, using real time data to support smart assets and real-time decision making.

Both of these pillars will be crucial as the UKCS transitions to become an energy highway, one which will see energy being produced in a decarbonised manner, using creative and innovative technology such as energy storage and network infrastructure, CCUS and hydrogen. In addition to these technologies offshore wind will play a significant role in unlocking and further harnessing the opportunity of electrification to drive down emissions. This will also enable the UKCS to lead as an example to other global basins; and just as the UK led the way in decommissioning, we will demonstrate how technology can support the transition to a net zero economy.

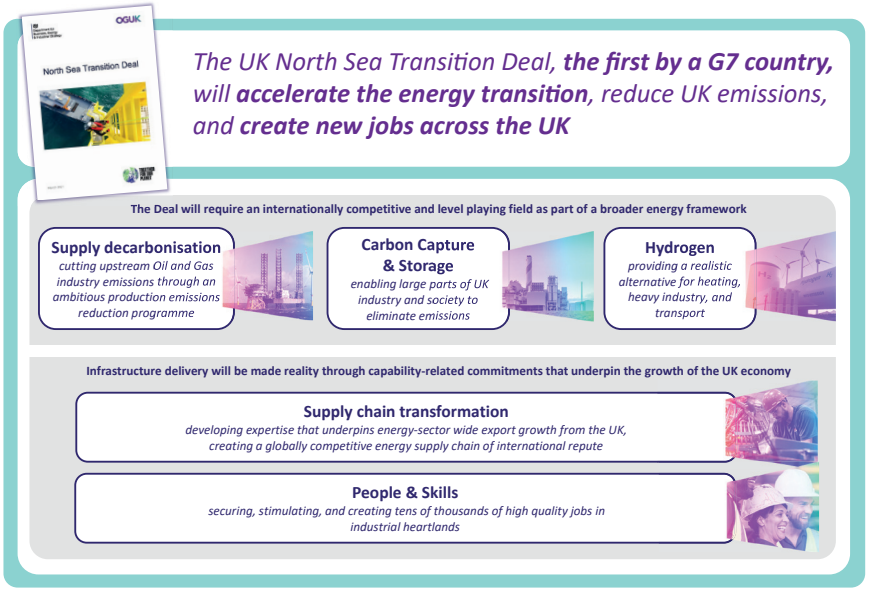
Looking ahead to 2022, OGUK, along with its members will continue to work closely with the Net Zero Technology Centre and welcomes the white papers by the Net Zero Technology Centre on venting and flaring, alternative fuel supply and energy as well as recommendations on technology to support well decommissioning.

[17] https://roadmaps.netzerotc.com/RoadmapVis.html

The North Sea Transition Deal

The UK North Sea Transition Deal (NSTD), the first by a G7 country, will accelerate the energy transition, reduce UK emissions, and create new jobs across the UK.

The Deal represents an agreement between government and industry to deliver a net zero future and to place the oil and gas sector at the centre of the transition to net zero. The NSTD will help maximise the energy potential of the North Sea, supporting a range of new energy opportunities and providing up to 60 per cent of the potential sources of emission reduction on the pathway to net zero.[18]



[18] OGA Energy Integration Report

As well as reducing emissions from production, the Deal sets out how the sector will contribute to decarbonisation of the wider economy, in particular through investments in CCUS infrastructure and in the production of hydrogen to substitute for some of the existing uses of oil and gas in the economy.

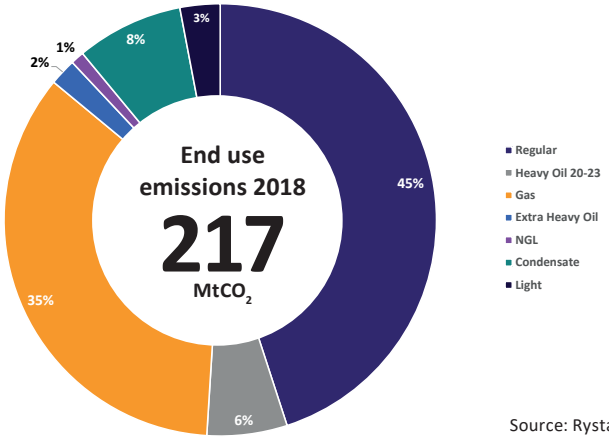
Over the period to 2030 the Deal is expected to deliver around £15 billion of additional investment into UKCS, on top of that required to contribute to meeting ongoing oil and gas demand. Around 40,000 incremental jobs will result from this investment. These jobs will be across construction, operation and the supply chain and there is an aspiration to achieve 50 per cent UK content over the lifecycle of all related new energy projects, including 30 per cent locally provided technology content.

The agreement of the NSTD provides for a stable future for the UKCS consistent with the net zero objectives of the government and wider society. This includes both diversification into important new activities offshore, including renewable and carbon capture and storage, and the ongoing production of oil and gas with consistently lower emissions from production.

The pathway to a zero-carbon basin

By 2050 the UK Continental Shelf is expected to be CO_2 negative in the sense that any emissions from production, processing and combustion of oil and gas will be more than offset by the opportunities for carbon capture. Currently Scope 1-3 emissions, which include those from the whole value chain are around 250 million tonnes p.a. with the majority of these from end use of oil and gas.

Figure 11: Emissions from UKCS oil and gas end use in 2018, Million Tonnes CO_2

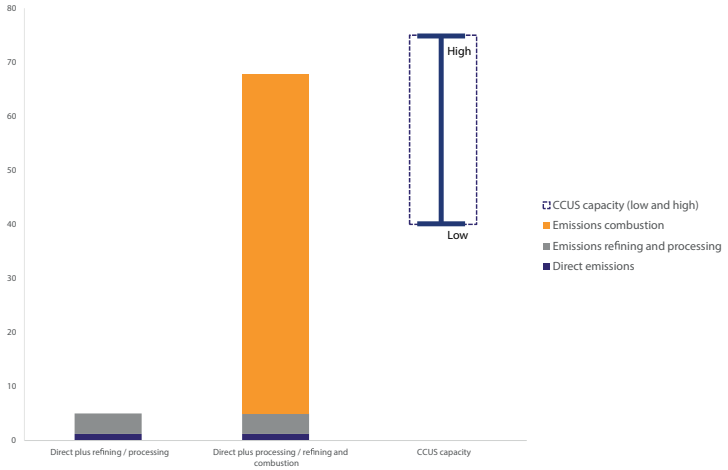


Source: Rystad Energy

By the mid-2030s, the expected roll out of carbon storage facilities would likely offset both direct emissions and those from processing and refining which would be in the range of 20-30 million tonnes. However, emissions from combustion of the oil and gas being produced would remain significantly higher.

By the mid-2040s however, the production and use of oil and gas in the economy will have fallen while carbon storage capacity increases. With a greater roll out of carbon storage capacity, this should more than offset the emissions, including those from the combustion of UK-produced oil and gas. Figure 12 below includes an assessment of the likely position by the mid-2040s in this respect. In considering this it should be noted that this is the likely outcome for UKCS only and not necessarily reflective of the entire UK consumption of oil and gas which will also include imports.

Figure 12: CCUS potential by mid-2040



Investments in carbon capture and hydrogen technologies therefore represent an important opportunity for the oil and gas sector to contribute to the objective of net zero, but continued progress is dependent on these projects being attractive to investors. These technologies will not have the same characteristics as oil and gas assets in terms of balance sheet impact, risk profile and return on capital.

The opportunity for the UK supply chain from carbon capture and storage (CCUS)

The future of CCUS

CCUS creates the opportunity to reduce carbon emissions entering the atmosphere through capturing and transporting CO_2 from industrial activity and power generation and storing it in deep, underground geological formations. CCUS technology is well established globally with the capacity of operational facilities and projects in development growing to 111 million tonnes p.a. in 2021.[19] The UK has a significant advantage in the deployment of CCUS, benefiting from the rich natural capital of geological formations the UK North Sea and East Irish Sea have to offer. The integration of CCUS with industrial processes will be key in decarbonising the UK economy, along with the deployment of other technologies such as direct air capture.

The recent CCC report, Energy White Paper and the IEA Net Zero Scenario all reaffirmed the importance of CCUS in the UK and its need to support the decarbonisation of our economy. This is an area projected to grow and create the opportunity for annual storage throughput of at least 100 million tonnes per annum by 2050. Such a level will require at least 5 gigatonnes of cumulative storage capacity to be developed from the total potential of 78Gt.[20] Scaling these technologies is therefore an important element of government strategy for achieving emission reduction targets with an initial target of 10 million tonnes per annum.

To continue to unlock the UK's CCUS potential, a clear policy framework and a secure pipeline of industrial carbon capture projects will continue to be needed to support investor confidence.

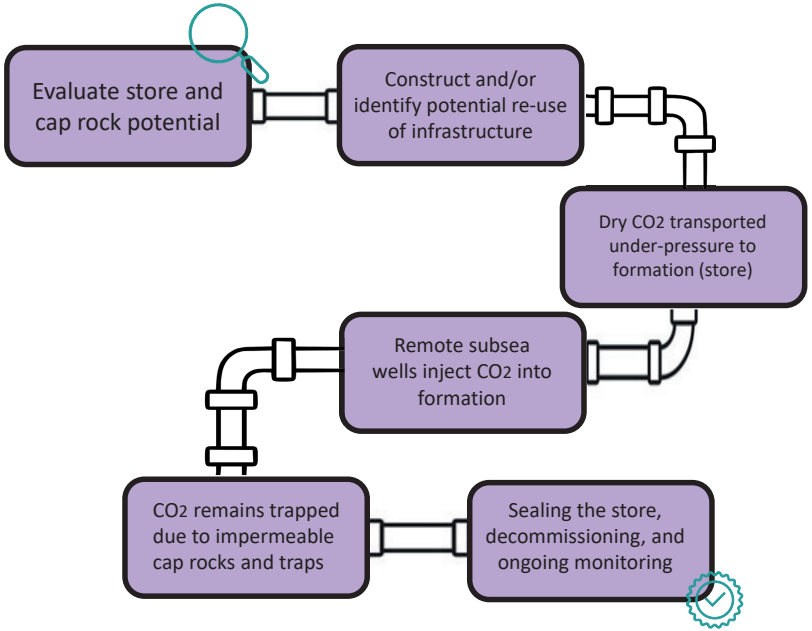
[19] Global Status Report - Global CCS Institute

[20] https://www.eti.co.uk/programmes/carbon-capture-storage/strategic-uk-ccs-storage-appraisal

CCUS and the upstream sector

The oil and gas sector has unique experience in implementing and operating large offshore infrastructure projects. This ability and understanding is key for the success of CCUS. Similarly, the experience of investing in shared offshore infrastructure solutions and a deep knowledge of subsurface technologies, geoscience, and reservoir management mean the sector is particularly suited to the development of transport and storage (T&S) facilities.

To provide a secure and reliable CCUS Transport and Storage network, the below steps must be taken:



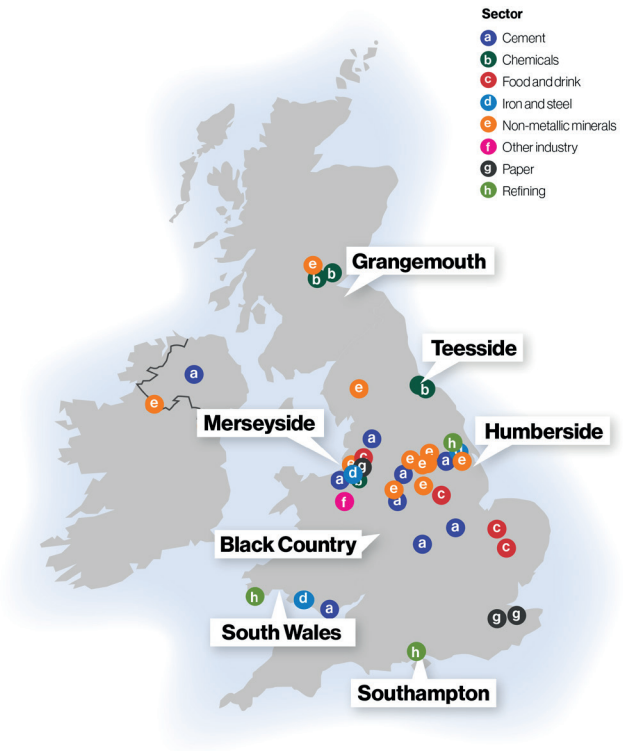
The UK's regulatory regime

It is expected that carbon T&S infrastructure will be an economically regulated asset and will form a critical UK future infrastructure network. As the business models are developed, it is important that appropriate regulation is devised to capitalise on oil and gas assets as part of the regulated asset value. This will be a key component in ensuring the net-positive-value of the project and attracting necessary investment into this space.

At present, there is no single CCUS regulator with oversight of the whole value chain, nor an independent economic regulator for the T&S model. It is now expected that BEIS will perform this role in the initial phase with an established regulator potentially taking on these responsibilities at a later date. Currently, the OGA is the licensing authority for such activity, with engagement from the Crown Estate where necessary. Once such a regime is in place, CCUS projects will develop in clusters through funding from both government and the private sector.

The UK has the ambition of expanding these clusters to begin to form a UK-wide carbon network as the projects become more economically viable. It is expected that as the current and future projects grow, there will be a decreasing need for government support as CCUS becomes commercially viable. To reach this point, overcoming market failures by progressing all cluster projects rapidly now is key. Delay will prejudice the UK's ability to decarbonise at the required pace to meet its net zero targets.

There is also a need to expand exploration and appraisal activity in order to look beyond the initial cluster areas. If CCUS is expected to reach 100-150million tonnes by 2050 this implies 5- 10 gigatonnes of capacity is likely to be required to meet such UK's long-term ambitions. Additional action is therefore required now to support the development of "bankable" storage locations.



Source: BEIS Industrial Decarb Strategy

The investment case for CCUS

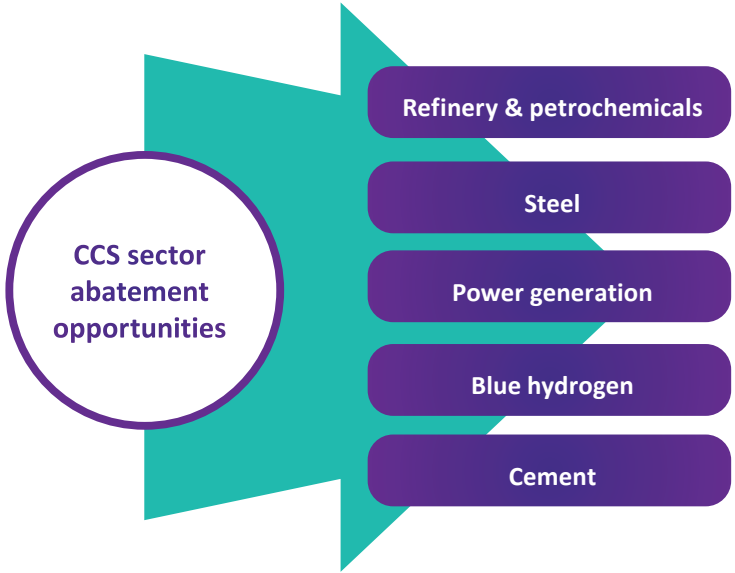
The volume of capital needed to flow into CCUS creates opportunities for a variety of funding mechanisms and business models to be implemented to suit investor risk appetite. As several first-of-a-kind projects are beginning to progress on a global scale, a better understanding of the cost for CCUS is emerging, along with an increased understanding of appropriate allocation of risk. This, coupled with the growing commitment from the UK in providing clarity over business models, will be key in growing investor confidence to commit to the scaling of CCUS.

The NSTD has modelled that the total transport and storage costs for a capacity of 10 million tonnes per annum could be between £2-3 billion. This will be partly financed from industry, alongside a contribution from the government CCUS Infrastructure Fund announced in the Budget in 2020.

The announcement by government of support for Hynet and the East Coast CCUS Clusters is welcomed. However, to achieve the net zero ambition all of the five projects identified as eligible for Phase 1, and additional projects, need to be progressed rapidly.

The capture process requires a range of different technologies and is as equally as important as the T&S side. The lead option for many proposed capture projects is amine processing, which involves passing flue gases through a solution that absorbs carbon dioxide. The costs associated with capture processes per tonne are estimated to be around three times that of the transport and storage element. Government is also working on business models that will support capture from industrial facilities and power generation.

CCUS and abatement for high-emitting sectors



In the UK, the initial focus will be on applying CCUS to power generation and industrial sectors. Power generation with CCUS will provide a flexible source to support the greater emphasis on electricity that will be required in a low carbon energy mix. The other main application will be in industrial sectors located at or close to cluster locations. Finally, CCUS will support the expansion of the hydrogen economy, in particular blue hydrogen.

CCUS and redefining the oil and gas supply chain

The oil and gas service sector is worth over £26 billion to the UK economy and will be key to realising the new industrial energy sectors such as floating wind, CCUS and hydrogen. Nearly half of the revenue to UK service companies comes from export markets.[21] Many of the disciplines required by these emerging sectors are similar to the competencies within our own supply chain, which sells these services in the UK and across the world. New energy systems have features that are familiar to oil and gas contractors, as well as new niche elements. Some value chains are not yet mature and more detailed mapping and analysis is needed to assess the key opportunities for the UK in terms of technologies and high-value jobs.

The traditional breakdown for oil and gas supply chain is understood in terms of the activities below. Expenditure is split relatively evenly between these categories and it estimated that together they provide over 100,000 jobs when support for other sectors is also included.

[21] https://assets.ey.com/content/dam/ey-sites/ey-com/en_uk/topics/energy-resources/how-accelerating-energy-transition-will-shape-the-industry/ey-uk-energy-services-overview.pdf

Traditional oil and gas supply chain

Reservoir and Wells
- Seismic data and processing
- Geoscience consulting
- Data analysis
- Seismic instruments
- Drilling contractors
- Well engineering services
- Drilling and well equipment
- Laboratory service

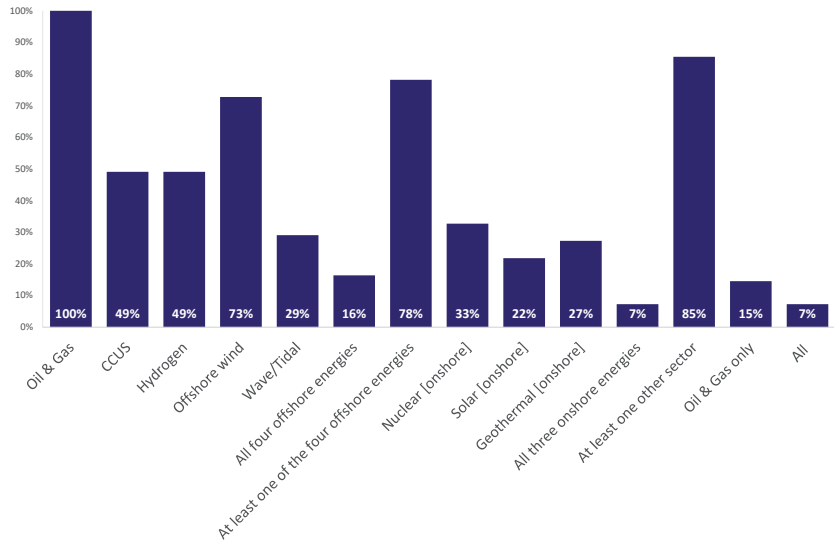
Facilities
- Equipment manufacture
- Topside design/fabrication
- Asset operations and maintenance
- Engineering support
- Specialist steel/tubular
- Specialist engineer (other)
- Inspection services

Marine and Subsea
- Heavy lift/pipe cable lay
- Floating production units
- Subsea manifold
- Marine/subsea equipment
- Inspection services

Support and Services
- Catering/facility management
- Sea/air transport
- Logistics
- Communications
- Recruitment/training
- Health/safety/environment
- Consultancy/legal
- IT

At present, OGUK represents over 300 businesses across the energy supply chain and who provide support across all these categories. The energy transition is creating numerous opportunities for growth across the sector. Many OGUK members, who have traditionally focused on the oil and gas industry, are already looking to diversify in pursuit of wider opportunities in the energy sector both in the UK and globally, building on their North Sea heritage. Based on a detailed survey of OGUK members, many have already started to re-orient their businesses around new opportunities as shown in Figure 13.

Figure 13: Supply Chain Capabilities



source: OGUK

It is therefore clear there is a strong alignment between the traditional activities of the oil and gas supply chain and the new skills and capabilities that will be implemented as we decarbonise the UK economy. The pioneering steps being taken by the UK to lead net zero is encouraging the growth of a unique and marketable skillset that will also allow the sector to drive new exports, building on their achievements in the domestic market.

Greater diversification of companies is also creating multiple skilled jobs in energy communities which are often in traditional industrial heartlands.

This surge in activity will be critical in achieving net zero ambitions. This is already being seen in the north east of England through Net-Zero Teesside, which is accelerating a first-of-its-kind CCUS and hydrogen project, and Humberside where offshore wind is creating new business opportunities for the supply chain sector.

This includes the manufacture of bulk materials such as steel pipeline, valves, plus process equipment, pumps, compressors and electrical equipment, suitable for use both on and offshore in the most demanding of environments. The supply chain has experience of safely managing operations and processes to the most exacting of standards. The expertise in transporting gases and liquids in high-pressure systems is the perfect backdrop for the needs of scaling of both CCUS and hydrogen technologies.

The oil and gas supply chain has the capacity to pivot to be the key driver in overcoming technology barriers for both crucial low carbon technologies.

Breaking down the CCUS value chain

The recent publication of the BEIS CCUS Supply Chain Roadmap[22] recognised the value of our UK supply chain and outlined a path to harness its power to maximise the potential for CCUS.

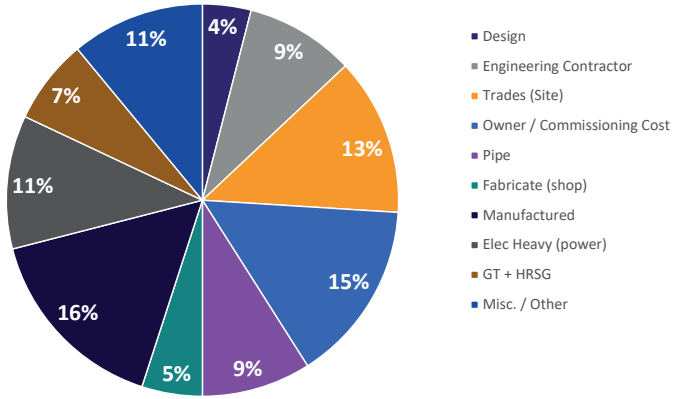
Success in scaling CCUS technologies through our highly skilled manufacturing and engineering firms will competitively position the UK to be a global leader across key elements of the energy value chain and offer exciting export opportunities. The expertise and opportunities available are as applicable onshore as offshore and the innovation and drive that have served the North Sea so far bode well for the whole of the CCS value chain.

[22] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/984308/ccus-supply-chains-roadmap.pdf

Whilst the NSTD concentrates on the transport and storage element of CCUS, the technologies needed for capture, and the transportation and compression requirements onshore are also key growth areas. The Carbon Capture and Storage Association (CCSA) estimates that there is likely to be more than £41 billion capex and £50 billion fixed opex needed across both CCUS and hydrogen during the period to 2035, with further expansion thereafter.[23] The objective of the NSTD is that a least half of this is served by the UK supply chain.

The CCSA estimates that the bulk of expenditure will be onshore, much of which will be close to existing oil and gas terminals and associated industrial areas. An estimated breakdown for capital expenditure across various types of *onshore* activity is provided below.

Figure 14: Onshore CCUS Expenditure Breakdown

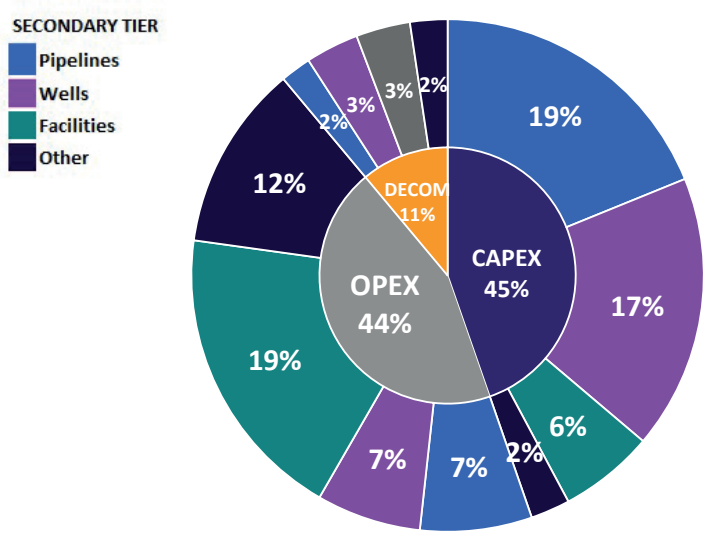


Source OGUK/CCSA analysis

[23] CCSA-report-Supply-Chain-Excellence-for-CCUS-22-July-2021-1.pdf (ccsassociation.org)

Likewise, although smaller in terms of overall investment, the offshore elements of CCUS projects will be significant. Expenditure for the carbon transport and storage element of CCUS is estimated in the NSTD at around £2-3 billion over the period to 2030, and £5 billion by 2035. It includes many activities directly related to oil and gas such as installation and management of pipeline equipment, offshore facilities and compression equipment. An initial estimated breakdown of *offshore* expenditure elements is set out in the chart below.

Figure 15: Expenditure for carbon transport and storage



Source OGUK/CCSA analysis

To achieve positive outcomes in terms of local content, further work is needed to identify, map and understand the CCUS supply chain, something which OGUK continues to work on with members and other organisations. It is clear from the offset however, that supply chain companies will have a role across the whole breadth of the value chain. This includes both active CCUS systems, related technologies and the monitoring and decommissioning of storage sites and infrastructure in the longer term.

The CCSA concluded that there were a range of possible activities that would help in terms of:

- securing a good environment for fabrication including building excellence in modularised construction
- strengthening trade skills across the whole energy sector which needs to be refreshed to attract a diverse new workforce in the medium and long term
- improving the prospects for UK content in steel and pipe spool manufacture (potentially the largest individual single spend element)
- although the UK lacks production of specialist rotating equipment, developing a segment of this market for particular attention e.g., high pressure hydrogen or CO_2 compression, may yield positive results

Hydrogen: a flexible and versatile energy resource

The hydrogen opportunity

Hydrogen is an important technology opportunity for the UK and is required at scale to achieve national decarbonisation objectives. It should not be seen as a "silver bullet" but as part of a range of technology options and complementary to the projected expansion of renewable electricity.

The growth of key energy sources, such as hydrogen, and the integration of this to compliment the energy system will ensure flexibility in the market and support for a wider range of sectors to decarbonise. The growth of both the hydrogen and CCUS sector allows the industry to maximise the potential of our existing skills, supply chain and gas networks and anchor them to the UK.

The development of these new industrial technologies provides an opportunity more widely for the UK to develop indigenous existing industry and jobs rather than these being displaced by more carbon-intensive imported products. Unlocking these technologies will create opportunities through the energy transition to realign the UK economy around low carbon manufacturing opportunities.

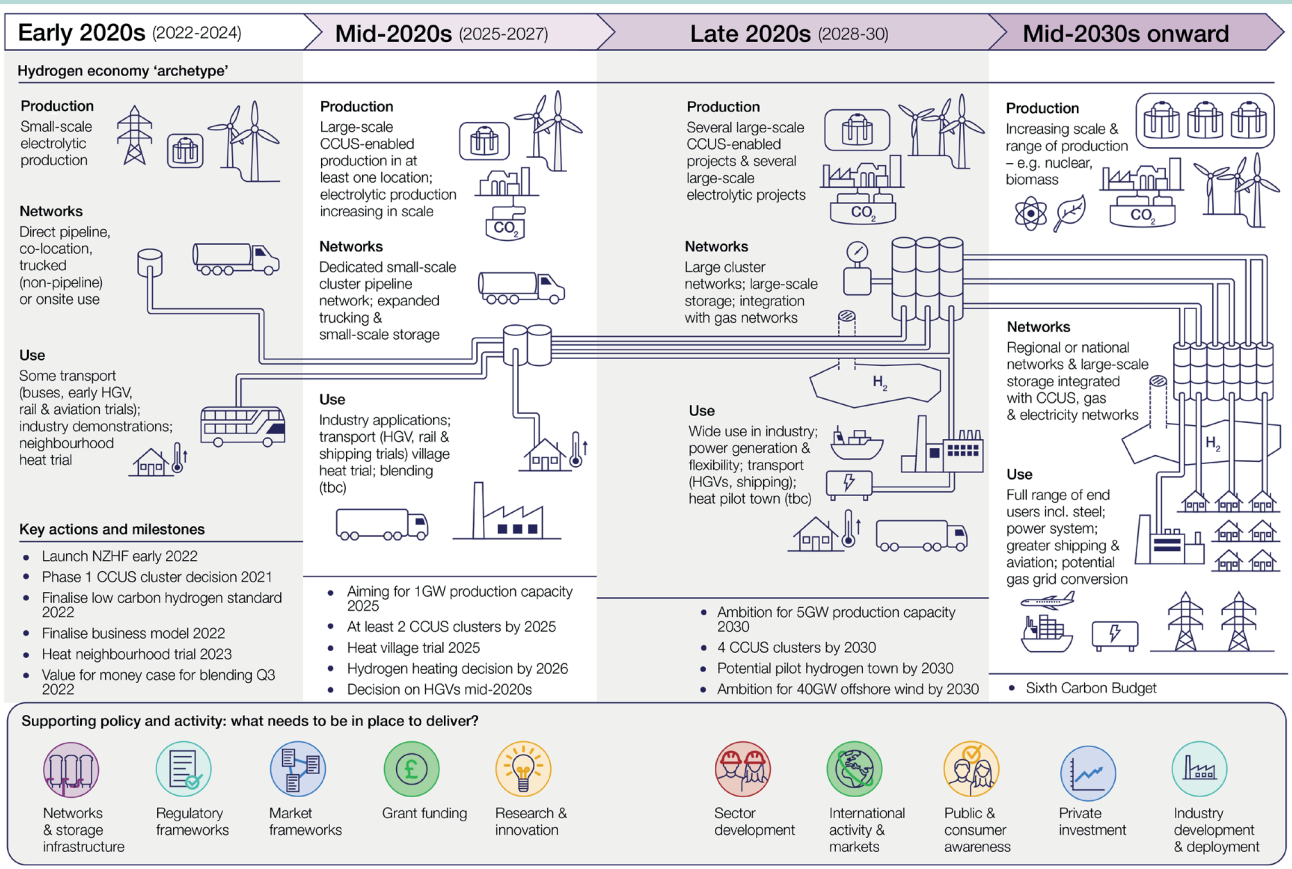
To effectively decarbonise, the economy needs to develop a wide range of technologies that can be implemented at scale, of which hydrogen is one. The current objective is to develop existing concepts at scale and to understand associated costs and challenges and address these. This is one of the elements of the NSTD and where our sector is contributing to the challenge of net zero.

The role of hydrogen:

Hydrogen has considerable potential as a flexible and versatile energy carrier. It can be combusted in the same way as natural gas, used in fuel cells, and in liquid synthetic fuels. A shift to hydrogen is therefore a natural evolution of the current energy market and would not significantly differ to natural gas in terms of consumer experience. The UK government Hydrogen Strategy[24] sets out a clear route to maximising the contribution of hydrogen and the main sectors where it will have a role, with industrial and freight transport as a priority. Looking beyond the next decade, BEIS analysis suggests around 250-460TWh of hydrogen could be needed in 2050, making up 20-35 per cent of UK final energy consumption.

Hydrogen has many positive attributes including a high energy content by weight. It also allows for rapid production of heat used in industrial processes and potentially in power generation. These properties also make it suitable for long distance and freight transport requirement. In addition, many of the technologies using hydrogen, such as fuel cells, are mature and can be put into effect quickly.

[24] Hydrogen strategy review: UK hydrogen strategy (accessible HTML version) - GOV.UK (www.gov.uk)



Source:
BEIS Hydrogen Strategy

At the same time, using and embedding hydrogen in our systems will require changes to asset configurations and safety processes. Work is already underway preparing gas pipe networks to accept hydrogen by replacement of iron mains with UPVC, but a key element of scaling hydrogen is how the transmission system can contribute in the UK and more widely in Europe. This is the source of several research and development projects that are ongoing.

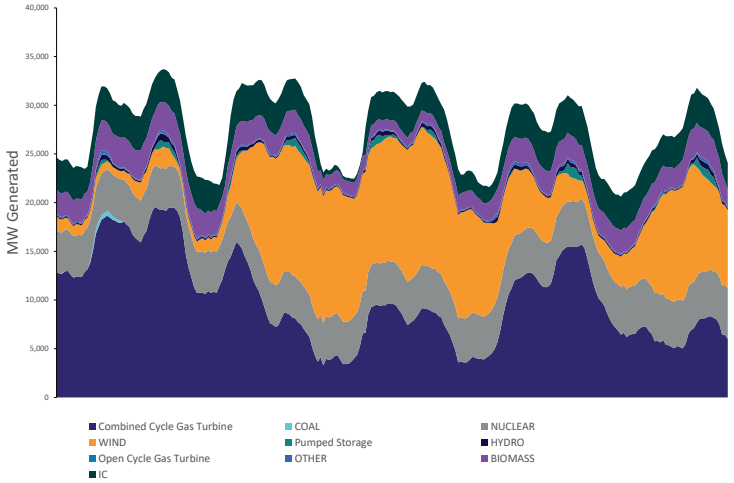
Hydrogen is made either through reformation of methane (with carbon capture), also known as 'blue' hydrogen, or through electrolysis, also known as 'green' hydrogen. Both processes result in the loss of some of the content of the original energy source (around 30 per cent in the former). This means that the benefits of hydrogen in terms of flexibility and energy/mass characteristics will need to offset these transformation losses.

Although blue and green are different technologies, they are compatible in the sense that each will support the developing demand for hydrogen as an energy alternative and, for example, spread the costs of distribution infrastructure. This is relevant regardless of the nature of the production technology. Most analyses consider that for the UK and other countries with a substantial natural gas sector blue hydrogen will initially develop more rapidly with green hydrogen expanding later as global markets develop based on the growth of renewable energy sources across the world.

Creating resilience in the energy system

As noted, one attribute of gaseous fuels is the resilience they add to the overall energy system. This is demonstrated in the chart showing the complementary nature of existing gas generation with renewables during the period 19-23 May 2021, when renewable generation reached record levels. This also highlights the intermittency of renewable energy, reinforcing a need to supplement these sources with other alternative energy sources.

Figure 16: Source of energy for electricity supply from 19 May to 23 May



Source: Elexon BM reports

The integration of hydrogen into the wider energy system serving heat and transport requirements, alongside electricity, therefore provides low carbon solutions to many areas where we currently use gases and liquids. The potential for Hydrogen also comes from the fact that energy has different values depending on when and where it is produced and available. So even though costs per unit may be higher in terms of the "levelised cost of energy", this may be more economic if it is available when needed.

For example, the UK has 22 million homes that are heated by gas. This means that the existing demand swing between summer and winter for natural gas is a ratio of 1:8. Shifting to an alternative source such as hydrogen potentially creates less challenge and disruption for consumers.

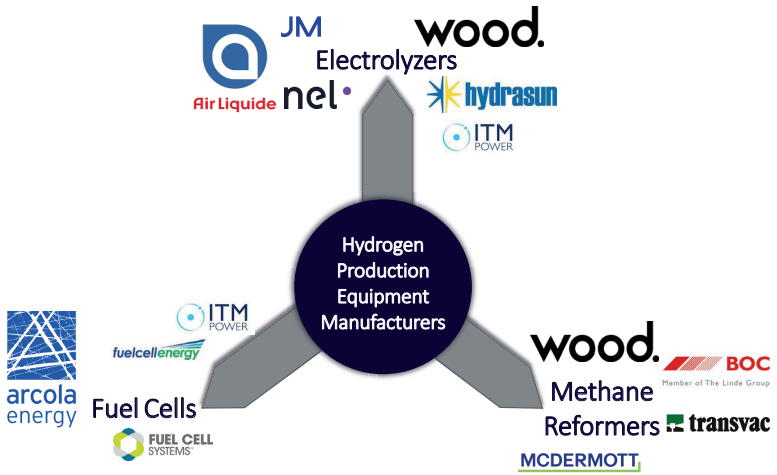
To be successful, hydrogen needs to be integrated into the wider energy system to compliment other growing low carbon technologies such as renewables. This would ensure that the system is not reliant on a single energy vector, and that the system remains as resilient as it is today. Continuing to meet individual requirements of users and consumers remains a critical objective of the energy system though, even in a low carbon future, and so ensuring flexibility in the market through energy sources is key.

Supply chain opportunities

In addition to CCUS, the supply chain has an important role to play in supporting the UK achieve its hydrogen potential. The NSTD envisages around £5 billion of investment spending on production facilities will be needed to meet the government's hydrogen target by 2030. Whilst this only covers the production element, there will also be significant expenditure requirements in the downstream parts of the business, including infrastructure and equipment and in the transporting of hydrogen. As with CCUS, the oil and gas supply chain is already active across all these areas.

A key element to unlocking the UK's hydrogen potential will be scaling up and overcoming technology barriers seen in the market today. There is already a mature and competitive market for hydrogen production equipment in terms of both methane reformers, fuel cells and electrolyser equipment. However, to satisfy the scale of the demand, innovation will need to increase. As noted below, several Western European companies are already leading the way in the market along with activity from China.

Figure 17: Hydrogen Equipment Manufacturers



Policy and certification

Successful integration and scaling of hydrogen in the energy system will be vital to the UK unlocking low-carbon energy sources. As policy is developed to support the supply and demand of hydrogen, we must also ensure the integration of appropriate standards and investable parameters. This includes the recently published consultation on low carbon hydrogen standard and its integration with the impending UK Green Taxonomy. Ensuring a progressive yet appropriate GHG emission threshold for low carbon hydrogen standard will allow early and critical investment into the UK's hydrogen market

To develop hydrogen demand, enabling the blending of limited amounts of hydrogen into existing gas networks and safety standards around the handling of hydrogen and development of appliances.

Further work is needed on the route to expanding these industries beyond the initial projects as well as the development of national and/or international traded hydrogen markets on the same basis as the gas market including certification of carbon content are also crucial.

Learn more about the North Sea Transition Deal and the work of OGUK

www.oguk.org.uk/nstd

Add yourself to our distribution list
email: NSTD@oguk.org.uk

Additional Member Content Available

Get involved

OGUK encourages all members to join the debate and support the industry's work in delivering on our climate ambitions.

To hear about our relevant forums and workgroups, and where your views can make a difference, visit our website:

oguk.org.uk

or email the team:
sustainability@oguk.org.uk

If you'd like to hear more about membership of OGUK, get in touch with our membership team:
membership@oguk.org.uk

Appendix: emission methodology

The below methodology sets out OGUK's preferred method for gathering and collating data which encompasses the totality of greenhouse gases (GHG) emissions from the upstream oil and gas sector, including those emitted from offshore oil and gas installations, onshore terminals processing oil and gas, offshore shipping supporting UK oil and gas production (logistics and drilling rigs) and aviation transportation (helicopter journeys). The targets cover the full scope of GHGs: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride gases.

For the purposes of evaluating the upstream oil and gas production industry as an entity, OGUK has broadly used the definition outlined in IPIECA's *'Petroleum industry guidelines for reporting greenhouse gas emissions'*. Scope 1 emissions are defined as UKCS oil and gas installations, onshore terminals processing UK oil and gas, offshore shipping supporting UK oil and gas production (logistics and drilling rigs) and aviation transportation (helicopter journeys).

OGUK continues to work with stakeholders to agree metrics for emissions reporting and, this year sees industry's emissions move to IPCC AR5 with Carbon Feedbacks applying a 100-year time horizon[25] using 34 $tCO_2e/tCH4$ and 298 $tCO_2e/tN2O$. As HFC's, PFC's and SF6's contributes negligible emissions, data is limited. In discussions, member and external stakeholder estimates have been applied.

[25] https://www.ipcc.ch/report/ar5/syr/

	EUETS	EEMS	National Inventory	NAEI	Stakeholder Estimates
Installations	CO_2	CO_2 [installations **not** covered under ETS] CH4 N20			HFC PFC's SF6
Terminals			CO_2 CH4 N20		
Logistics				CO_2 CH4 N20	
Exploration		CO_2 CH4 N20			
Aviation	CO_2				CH4 N20 HFC PFC's SF6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Demetrios Papathanasiou
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Washington, DC 20006

Dear Mr Papathanasiou

Letter of support for World Bank's Zero Routine Flaring by 2030 initiative

I am writing on behalf of OGUK and the UK's offshore oil and gas industry in support for the World Bank's Zero Routine Flaring by 2030 initiative.

The UK Oil and Gas Industry Association Limited, otherwise known as OGUK, is a not-for-profit organisation, first incorporated in 1973 and is the leading representative body for the UK's offshore oil and gas industry. Our membership includes over 400 companies and organisations with an interest in the UK's upstream oil and gas industry, and more widely across the energy sector. Its membership includes the Exploration and Production companies, ranging from super majors and international oil companies through to smaller local companies, operating assets on the UK Continental Shelf as well as supply chain companies supporting the sector and its energy transition in the UK.

Our industry in the UK is wholly committed to delivering Net Zero in the UK by 2050. We have made a ground-breaking commitment with the UK government to ambitiously to tackle the challenges of reaching net zero at pace through the North Sea Transition Deal[1], which was signed by ministers and representatives of the industry in March this year. The Deal includes specific demanding targets to reduce greenhouse gas emissions whilst helping companies and communities to embrace the energy transition, creating jobs, and driving investment in clean energy.

[1] North Sea Transition Deal - GOV.UK (www.gov.uk)

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Our industry in the UK is wholly committed to delivering Net Zero in the UK by 2050. We have made a ground-breaking commitment with the UK government to ambitiously to tackle the challenges of reaching net zero at pace through the North Sea Transition Deal , which was signed by ministers and representatives of the industry in March this year. The Deal includes specific demanding targets to reduce greenhouse gas emissions whilst helping companies and communities to embrace the energy transition, creating jobs, and driving investment in clean energy.

Within the deal, the industry has committed to support the World Bank's Zero Routine Flaring by 2030 initiative, as well as accelerate compliance, including phasing out routine flaring and venting with a reduction of 30% over and above natural decline. OGUK and industry regulators are monitoring performance and we have already seen meaningful improvements in 2020. The industry is also taking wider action to cut its methane emissions. As a result, OGUK launched a Methane Action Plan in June this year which includes commitments to meet the OGCI 2025 methane intensity targets and will see methane emissions by the industry halved by 2030. The plan again reiterates our commitment to the World Bank's Zero Routine Flaring by 2030 initiative.

Through this letter, we would like to acknowledge the contribution that the World Bank's Zero Routine Flaring by 2030 initiative will make, and we wish to put our support for the initiative on record. We will keep you and your team updated on progress.

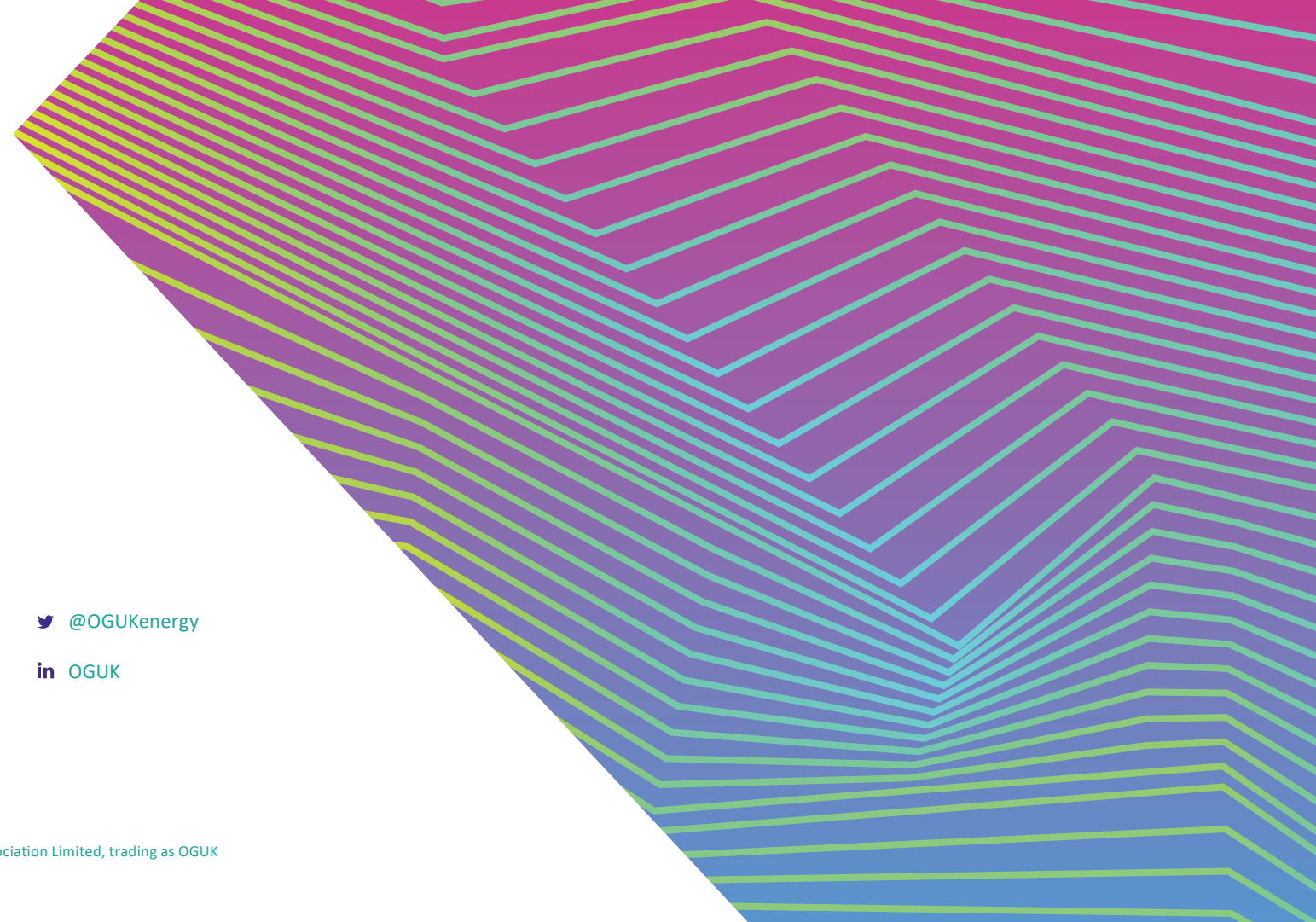
Yours sincerely

Deirdre Michie OBE
Chief Executive, OGUK.

Appendix: Summary of assumptions applied within IEA, DNV and Shell analysis

	IEA – Net Zero Scenario	DNV – Current Policy Forecast	Shell 1.5 Sky Scenario
CCUS and carbon removal	Around half of fossil fuel use in 2050 is in plants equipped with CCUS (around 3.5 Gt are captured from fossil fuels in 2050.) Brings opportunity to oil and gas sector with present technologies and expertise.	Uptake of CCS is too slow due to cost, today primarily only found in oil recovery. Existing and announced policies aren't enough. In 2040s the carbon price will approach the cost of CCS, only then will projects begin accumulating.	As well as substantial CCUS, the scenario also requires the plantation of 700 million hectares of trees. By 2040, carbon prices become more viable to which extensive policy development is vital.
Renewable Growth	Alternative fuel supply to come online. Low-emission liquid fuels account 20% of final energy 2050 (1% 2020.) Electricity consumption to double 2020 figures in 2050. Largest global investment is electricity generation. Almost half of emission reductions in 2050 depend on technologies that are currently under development Annual investment in clean energy infrastructure $880 billion 2030 ($290 billion over past 5 years.)	Renewable energy represents 15% of global energy supply. 45% in 2050 (+5% nuclear) representing a 50:50 split between fossil and non-fossil fuels. Electricity global demand is to double towards 2050. Cost reduction, government support and carbon pricing will improve renewable allocation of power generation.	Renewables required to scale up by as much as 10x in the next 30 years. Renewable fuels largely uncertain. The adoption of EVs as well as the successfulness of hydrogen presents uncertainty.

	IEA – Net Zero Scenario	DNV – Current Policy Forecast	Shell 1.5 Sky Scenario
Oil Demand	Demand dropped below 88 mb/d in 2020. Annual average decline of more than 4 % from 2020-2050. The electrification of transport is the primary reason for oil demand reductions.	2019 demand 88mb/d, 2025 could see similar levels showing initial recovery. New oil developments will continue to 2050. Growing population/economy alongside demand for transportation explains the growth in demand.	Demand to stay strong throughout 2020s peaking in 2025. Investment in producing oil alongside new fields is necessary. Current production will not meet long-term demand.
Gas Demand	Demand dropped to 3900 bcm in 2020. Annual average decline of more than 5% from 2020 to 2050. Large level of hydrogen and biomethane results in gas demand to decline less severely.	In 2050 around a 50:50 spilt of natural gas demand between final usage and being used in the production of other final uses (electricity, hydrogen etc.) Europe OECD Pacific are decarbonizing faster than others, demand will largely reduce to 2050.	Demand to stay strong throughout 2030s peaking in 2034. Readily available in power generation, investment increases.



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