North Sea Transition Authority

Norwegian Energy Partners

UK-Norway Offshore Decarbonisation Workshops

Output Report

Date of publication: 29 January 2025

The document can be found on the NSTA's website.

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Published by the North Sea Transition Authority

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Introduction

A range of technologies will be required to keep the UK and Norway's oil and gas industries bearing down on emissions, including platform electrification, while carbon capture and storage will help both nations achieve carbon neutrality. All approaches present challenges, but many cost-effective solutions already exist or are being developed by the world-class supply chains of the UK and Norway.

As neighbours with similar offshore basins, there are opportunities for the UK and Norway to learn from each other. Norway has electrified several platforms and banned routine flaring, while a number of CCS projects are already online. UK operators cut their production emissions by 28% between 2018 and 2023, and encouraging progress is being made on electrification and CCS projects, with the support of the North Sea Transition Authority (NSTA).

The NSTA and industry body Norwegian Energy Partners (NORWEP) hosted two brainstorming sessions to provide collaborative environments for suppliers and operators from both countries to share experience and insights and remove barriers to emissions reduction projects.

The first took place in Aberdeen in June 2024 and a reciprocal event was staged in Stavanger in October of the same year. The same format was adopted for both events. Operators provided updates on their energy transition projects and outlined the issues faced. Hackathon-style breakout sessions were then held, enabling suppliers to hold in-depth conversations with operators about ways to unlock electrification projects, incremental decarbonisation schemes, for example, flare gas recovery, and CCS.

In numbers

- 200-plus attendees across both events
- 22 operators and 56 supply chain companies represented[1]
- 26 presentations delivered by operators
- 25 individual hackathon breakout sessions

This report consolidates, and presents at a high level, the issues and opportunities to lower costs and tackle engineering challenges which were discussed at the two workshops.

Any opinions and concerns reported below were expressed by attendee operators and/or suppliers and should not be interpreted as a representation of the NSTA or NORWEP's view on any given subject.

[1] See Appendix for a full list of attendee companies.

Electrification and low-carbon power

As the majority of production emissions come from power generation, electrification or low-carbon power should play a significant role in reducing that volume, including in future developments.

Cable capacity, reliability, size and weight

Challenges:

- Dynamic cables to import power onto an FPSO are becoming available at the required voltage and power rating, but they are very new. Concerns exist about the reliability of these cables, based on a number of cable failures in static service on wind farms.
- Some UK offshore wind farms have experienced difficulties with connecting cables, resulting in downtime. The causes include design, manufacture, installation and operation. Attention is being focused on all these areas to enable better performance in future.

Opportunities:

- One UK supplier with manufacturing facilities in England is developing a 132KV next generation cable.
- Aluminium conductor cables, used instead of copper cores, introduce different material properties which can provide alternative power transmission options.
- Attendees were encouraged to obtain statistics from ORE Catapult for cables used on oil and gas electrification projects offshore Norway, which may dispel some concerns around reliability.

Equipment procurement/lead times

Challenges:

- High demand for cables is expected from 2026 onwards. Manufacturing slots will get booked up quickly, so operators might have to purchase before FID, which is challenging to authorise.
- For transformers, lead times range from 18 months for a small unit to 50 months for a large ATEX-rated unit (30 months for non-ATEX).

Opportunities:

- One UK cable manufacturer said they could still offer slots to deliver cables in the late 2020s, but they need commitment from clients soon. Operators need to provide visibility on timelines to the supply chain and place orders to get slots reserved.

Intermittency

Challenges:

- Operators are concerned that wind intermittency will result in installations rapidly losing power and having to shut down, in the worst-case scenario.

Opportunities:

- Developers should focus on extending the design life of industrial-scale batteries from 10 years to 15 years or more. Alternative methods of dealing with intermittency, such as hydrogen production, storage and consumption, during low/no wind times should also be explored.

Regulatory pathway/grid connections

Challenges:

- There are concerns the wait for a grid connection in the UK could stretch well into the 2030s. This uncertainty impacts investment decisions.
- In the UK, "islanded" wind farms (single turbines, or small wind farms, dedicated to decarbonising oil platforms) have no clear route to gaining approval outside of leasing rounds.

Opportunities:

- NSTA to continue playing its role as an integrating force, engaging with other regulators and mitigating barriers. NSTA supported the launch of the INTOG leasing round and the achievement of recent milestones on the Green Volt project and the Culzean floating wind scheme.

Space and weight

Challenges:

- Platforms are congested and have weight limits, complicated by the need to retain some turbines/generators for backup, to provide redundancy. Operators want smaller and lighter equipment.
- Transformers are very heavy and technology providers could not provide much comfort that the next generation of transformers will be lighter.

Opportunities:

- Solutions include removing existing equipment, reconfiguring the layout, replacing existing equipment with smaller and lighter units, or building new bridge-linked platforms (BLPs).
- New BLPs are very expensive with long lead times and greater environmental and regulatory considerations. It was suggested old, redundant jack up rigs could be used depending on water depth and remaining design life.

Shutdown time

Challenges:

- In some cases, lengthy shutdowns will be required to do the modification work required for electrification.
- Some FPSOs may have to come off station and go to a yard for upgrades, which is costly. To connect an FPSO to a subsea electrical cable from shore or an offshore wind farm, the vessel needs specific equipment (swivels and slip rings). If the FPSO doesn't already have the required equipment, it will need to be retrofitted.

Opportunities:

- One operator believed their platform could be electrified over the course of two 28-day shutdowns.
- To the surprise of a peer, one vessel owner said changing out the swivel and slip rings offshore, although challenging, was possible and noted that they had done it before.

Waste-heat replacement

Challenges:

- Currently, platforms use waste heat from the power generation gas turbines for process heating purposes. If these are switched off, then all the heating needs to come from electricity, leading to a significant increase in electrical power requirements.

Opportunities:

- Operators are looking for the "sweet spot" between brownfield modifications and emission reduction. One operator said there may be value in running existing gas turbine generators on low power to maintain process heat.
- One major UK operator is exploring whether industrial heat pumps, currently used at onshore plants, could be right-sized and installed offshore to provide replacement heat. The same operator said they had ruled out small modular nuclear reactors (SMRs) as the technology will not be ready until the mid-2030s. Marinising the SMRs, including handling nuclear fuel offshore, would present significant challenges. Geothermal was considered too expensive due to the number of wells and the drilling depths required. Power from the UK grid, while still expensive, is a cheaper option.

Incremental decarbonisation

In addition to electrification, other decarbonisation options should also be considered, such as fitting flare gas recovery systems and more fuel-efficient equipment, as well as adopting best practice.

Alternative fuels

Challenges:

- Hydro-treated vegetable oil (HVO) could be used as an alternative to gas or diesel for powering offshore equipment. However, HVO is not currently recognised from a carbon credits point of view, so using it would offer no benefit over the use of diesel (but at a higher cost and supply chain risk). Work is understood to be ongoing to explore the inclusion of HVO for carbon credits, but the status of progress was not known.
- Methanol was suggested as an alternative to HVO but several operators raised safety concerns around handling it in bulk. Although modest quantities of methanol are routinely transported to offshore installations in tanks for use in hydrate control, the amounts required to support power generation would be substantially higher.
- One operator's parent company produces biodiesel but there is no established supply chain for it in the North Sea region. Trials would also have to be carried out to understand the impact on engines. This issue is common to any alternative fuel usage in that the original equipment manufacturers are required to confirm that alternative fuel use will not adversely affect the operation, maintenance and lifespan of their equipment. Such assurances require extensive testing and involve cost and time commitments (per fuel).

Opportunities:

- Legislation could be changed to allow the recognition of HVO in reducing emissions. This fuel is already available in substantial quantities, albeit the price is higher.
- Novel solutions such as subsea storage could address the issue of handling methanol in bulk.
- In general, alternative fuels present an opportunity to establish and grow UK-based production/refining capacity and an associated supply chain. The source of the feedstock for any HVO production facility would be critical, avoiding competition with food supply and ensuring sustainability.

Emissions monitoring

Challenges:

- Monitoring and measuring emissions is a challenge for industry, which relies on a combination of metering equipment and modelling techniques to calculate volumes. Fugitive emissions are particularly difficult to measure, albeit they are believed to be very much smaller than other oil and gas related emission sources such as power generation, flaring and venting.

Opportunities:

- Several operators have used drones fitted with sensors to measure the combustion efficiency of their flares.
- A trial with relevant aviation regulators is under way which could result in permission for long-range drone flights from shore being quicker and easier to obtain.
- One operator has developed a drone-mounted gas analysis sensor which can detect methane and CO_2 emissions and identify the source, even in hard-to-reach places. The product is being marketed to other operators.

- In-situ sensors, satellites and handheld monitoring devices are also being used to provide live readings.

- The Emissions Measurement and Monitoring Technology Roadmap produced by the Net Zero Technology Centre and the NSTA highlights additional examples of devices and solutions.

Equipment rationalisation and standardisation

Challenges:

- Offshore installations use multiple gas or diesel turbines for power and as a result have high fuel demand.

- Declining production throughput means compressors are now larger than required and are using up a disproportionate amount of fuel.

- Due to the age of some of the installations, particularly those on the UKCS, equipment is old, out-dated and inefficient.

Opportunities:

- Combined cycle: Expanding/modifying gas turbines to become combined-cycle turbines can deliver 3.5MW of additional power per machine which could bring the capacity of a single turbine up to what the installation requires, enabling single turbine operation, with substantial associated GHG emission reductions.

- Compressor re-wheeling (replacing components in the compressor to right-size it and lower fuel consumption) and the use of variable frequency and/or variable speed drives have the potential to reduce overall power consumption, which in certain cases could reduce the number of gas turbines required to meet demand and hence reduce GHG emissions.

- Operators can reduce flaring associated with platform restarts by making changes to operating modes and improving procedures, for example, reinstating gas compression as the final step. Digital tools are available to help optimise restarts.

- Attendees also recommended the use of software designed to work out the energy profile of individual plant and whole systems. Data can provide a better understanding of energy consumption, enabling operators to focus on the right optimisation measures, for example, shutting down or reducing the utilisation of certain equipment.

- AI-enabled digital tools have been developed to provide real time monitoring and supporting data for economic analysis of investing in emissions reduction modification projects.

- Operators should continuously screen available technologies, instead of doing it periodically or not at all. Examples of ground-breaking technologies which have been successfully deployed offshore can be viewed in the NSTA's annual Technology Insights Report.

Lead times

Challenges:

- Lead times of a year or more have been stipulated for equipment needed for emissions reduction modifications, much longer than necessary, due to operators refusing suppliers' standard items. Operators state a desire to be nimble but rarely deliver on this.

Opportunities:

- Infrastructure owners could lower costs by accepting standard items instead of requesting tailor-made equipment. Suppliers could also push back more robustly, resulting in greater use of standard equipment with associated cost and schedule improvements.

Space and weight

Challenges:

- Due to limited space on existing platforms, operators require smaller equipment for flare gas recovery.

Opportunities:

- Weight and space requirements for eductors is substantially less than for compressors. Water injection systems could be used to drive eductors to recover flare gas. A tier one supplier spoke positively about this and has carried out some projects using this equipment.

Carbon capture, utilisation and storage

The oil and gas industry has much of the kit, capability and capital required to deliver carbon storage projects which are vital to the delivery of the UK and Norway's net zero targets.

Cost, resources and skills

Challenges:

- It was suggested that current cost estimates are conservative and may need to be increased. Also, CCS is a low margin industry compared to oil and gas. Low-cost solutions are needed. CCS uses largely the same supply chain as oil and gas. Rates are unsustainably high.
- CCS is currently a relatively small industry which is competing with renewables. There is a lack of capacity in both construction and operations phases.

Opportunities:

- Retraining the oil and gas workforce is crucial. Standardisation of CO_2 specifications for equipment would also help.
- Industry needs to adopt a "value chain" mindset to CCS projects and not approach them the same way as oil and gas projects.

CO_2 flow assurance

Challenges:

- CO_2 has different properties to oil and gas and impurities in the CO_2 could cause flow-assurance issues.

Opportunities:

- Operators are interested in knowing what modelling solutions are out there – some initial models and modelling tools have been developed.
- There is an opportunity to share technical knowledge and collaborate, but companies need to improve their understanding of what can be shared between operators without breaching competition law.
- Reuse of pipelines and wells is an option, but this will have an impact on the quality and makeup of the CO_2 which can be accepted.

Size and weight of equipment

Challenges:

- Reducing the size and weight of equipment needed to remove CO_2 from the exhaust gas of gas turbines is seen as a key challenge. Few in the supply chain are currently working on this.

Opportunities:

- Lessons could be learned from the floating LNG industry, where CO_2 is routinely removed from exhaust gas, stored, then unloaded. A carbon capture pilot plant is being installed on an FPSO destined for Angola.
- One supplier has installed trial scale equipment offshore to demonstrate CO_2 capture from a small slipstream of exhaust gas.

Summary

Across the two events, operators and suppliers engaged in quality conversations and came up with numerous solutions and approaches with the potential to get complex and costly energy transition projects up and running. They also struck up relationships which may, in some cases, lead to contracts and projects progressing.

For each technology theme, some common issues emerged, including supply chain capacity and bottlenecks, technology readiness, size and weight, material and equipment lead times, and, most of all, the need for commitment to ensure timely delivery of key components. Fortunately, the operator community already holds the keys to overcoming most of these challenges. They should make firm commitments to the supply chain in the shape of contract awards and provide a clear picture of upcoming activities, including through the NSTA's Energy Pathfinder. This will give the supply chain the revenues and confidence required to invest in capacity and new technologies. Operators could also be more accepting of standardised solutions and technologies.

Several eye-catching approaches and proposals emerged, including the consideration of industrial-scale heat pumps to provide heat to platforms once they are electrified, the use of low-carbon fuels such as hydro-treated vegetable oil and methanol, combined cycle turbines and drones fitted with methane and CO_2 monitoring sensors.

Feedback was positive, with supply chain companies greatly appreciative of the opportunity to attend events with multiple operators under the same roof.

Next steps

- Ongoing facilitation of communication between attendees.
- Build on the extensive networking at both sections.
- Email addresses of all participants shared.
- Obtain more detail about key technologies and approaches discussed at the event.
- Seek further clarity around lead times for equipment and schedules/timescales for projects.
- Support two multinational service companies on the delivery of their own technology workshops, aimed at providing operators with holistic approaches to unlock decarbonisation projects.

Feedback

This page contains a selection of anonymised feedback from operators and suppliers received post-event in Aberdeen in June 2024.

Operators:

- "Thank you for organising the Hackathon today. It was a useful and enlightening day. We took a lot from the conversations we have had and will follow up as appropriate and look forward to seeing any feedback from you."
- "I have already progressed a couple of meetings from contacts with suppliers on the day. So, the event has been of good use. Thanks for organising."

Suppliers:

- "This incredible event has started to prove significantly powerful, working with projects such as the decarbonisation event usually means there are layers within the supply chain which disengages the communications between the end user and the manufacturer. At times this mean we can't get a true grasp of what the real issues are. Hosting such an event enables us to get a deep understanding from the primary source of their significant issues."
- "It was great to hear the real challenges faced by each of the brownfield North Sea operators in general, and where they are in order to choose the right path for their assets."
- "To meet our emissions reduction goals, deeper and more meaningful collaboration across both operators and supply chain is needed, and this event definitely saw us taking steps in the right direction."
- "I think I can speak for us all that it was a very well put together and interesting event. In terms of the format, I think the breakouts worked well and gave that focus on each topic and lots of follow ups to be booked based on the discussions had."

Appendix: List of attendees

A

Anasuria

Apache

ABB

AJT Engineering

Aker Solutions

Amplus

Apollo

Aragon

B

Baker Hughes

BW Offshore

C

Centrica

CNOOC

Carbon Circle

Crondall

D

Dana Petroleum

Draeger

Dynamix Energy

E

Eni

EnQuest

Equinor

Elemental Energies

ERM

Ethos

F

Freudenberg

G

Goal 7

Genesis

Gexon

Global E&C (now Nexos)

H

Harbour Energy

Halliburton

Honeywell

Houlder

I

Ithaca Energy

J

JDR

K

Kongsberg Digital

L

Lattice International

M

Marine Low Carbon Power

Mocean

Moreld Minox

N

NEO

NOV

O

One-Dyas

Orcadian

Ocean Power

Odfjell

Oglaend System

OneSubsea

Otechos

P

Perenco

Paradigm

PD&MS

Petrofac

Powersim Software

Primus International

R

Repsol Resources

Resman

Rotork

S

Serica

Shell

Spirit Energy

Continued on page 14

Continued from page 13

Storegga

Scan Tech

Schlumberger

Siemens Energy

Subsea 7

T

TAQA

TotalEnergies

Technip

Three60 Energy

V

Vectur Energy Services

Verlume

W

Worley

Wood

X

Xodus

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