DECOMMISSIONING INSIGHT 2023

OFFSHORE ENERGIES UK

The decommissioning outlook for the UK's offshore energy industry

OFFSHORE ENERGIES UK

An integrating offshore energy industry which safely provides cleaner fuel, power and products for everyone in the UK.

Working together, we are a driving force of the UK's energy security and net zero ambitions. Our innovative companies, people and communities add value to the UK economy.

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Front cover photograph courtesy of Harbour Energy

DECOMMISSIONING INSIGHT 2023

Contents

1. Foreword

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HSE & Operations Director
Offshore Energies UK

Welcome to *Decommissioning Insight 2023* – a flagship OEUK report and the most comprehensive outlook of North Sea decommissioning activity. It compares the actuals from 2022 with forecasts offering invaluable insights and trends for operators and the supply chain community.

Last year's report introduced data from the offshore wind sector to provide a detailed market overview for the decommissioning sector as a whole. The combined result illustrates the factors facing the UK supply chain working in the wind, oil and gas sectors.

The abundance of work forecast in the decommissioning sector is both an opportunity and a challenge. The key take-away from *Decommissioning Insight 2022* report was 'upsurge', with record spends predicted. Spending in 2022 fell short of the prediction by 18% but was still much higher.

This year's report shows that the coming ten years will see no reduction in spending. Last year, the UKCS clocked up a whopping £1.6bn and this year it is forecast to reach £2.2bn.

The remaining years face an almost flat spend profile, above £2bn/year. The decommissioning sector is executing more projects and spending more money than ever before. This report looks at each segment of decommissioning and puts a cost estimate on each.

It also looks at the wider North Sea so that there is basin-wide visibility of decommissioning. Offshore wind data is interpreted so that cross-sector knowledge and learnings might be shared.

The UK supply chain and operators have made big strides in re-using, recycling and repurposing end-of-life assets.

Better collaboration and visibility will continue to extract more value from decommissioning operations.

The UK decommissioning experience is a model that can be exported, along with its expertise.

The industry is operating in a challenging environment, particularly against the backdrop of Energy Profits Levy. Concerted action is needed.

Executing the decommissioning work will be difficult, given the sheer volume of macro-economic factors. The list includes inflationary pressures, supply chain availability and so on.

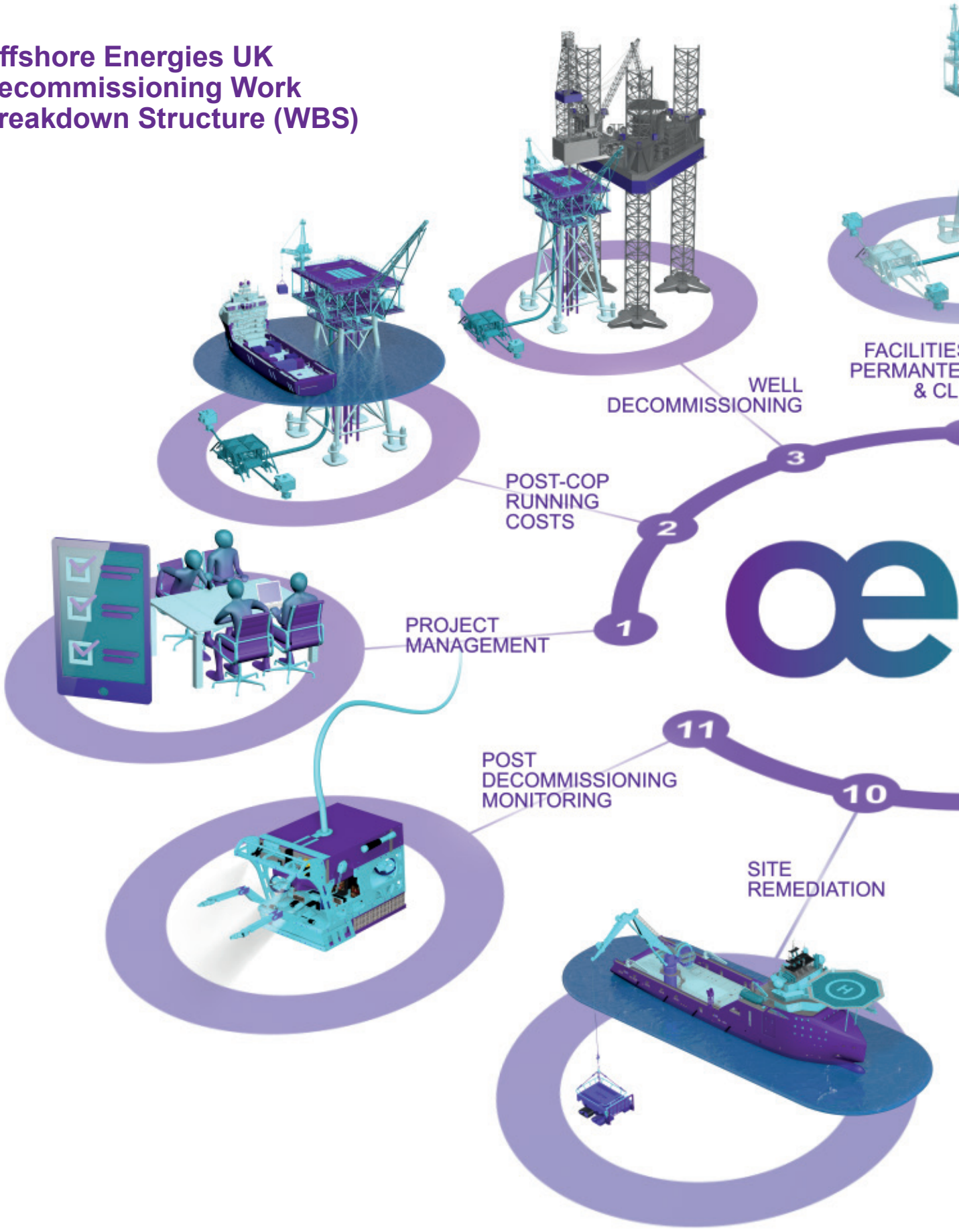
Dramatic growth needs careful management. Lessons learnt within the sector may have important implications for other sectors as the competition for resources and equipment intensifies. The UK supply chain will work more efficiently if it can accurately forecast demand for its services – not just in oil and gas, but in low carbon energy too.

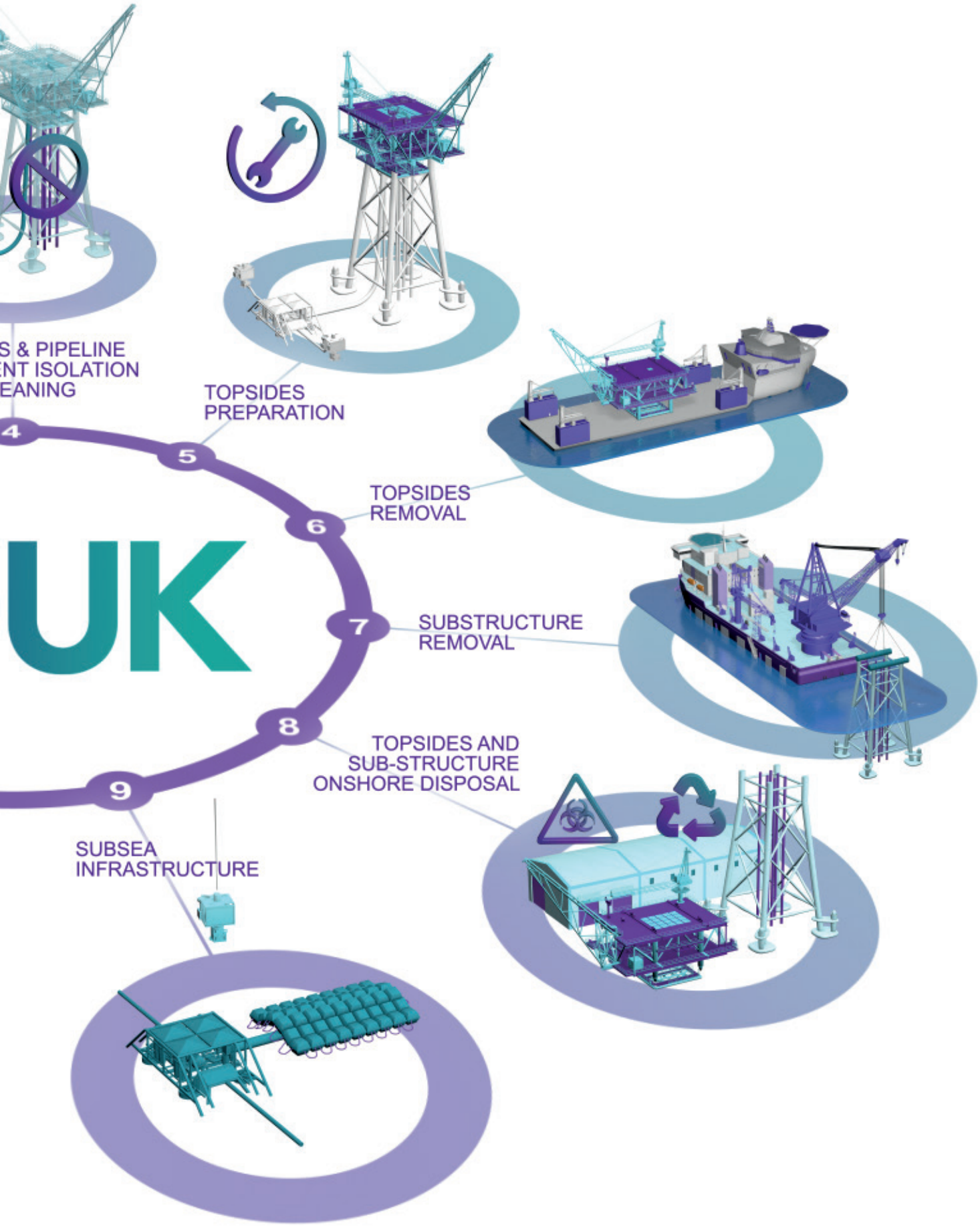
While new technology and collaboration must be wholeheartedly embraced, the cost savings they bring might do little more than offset inflation. Assessing the savings that new technology can bring will be complicated if the fiscal regime is unpredictable for the next few years.

Resilience and innovation are vital if the UK is to become the global centre of excellence for decommissioning.

As the rate of work is peaking, the right support from government is needed to retain the UK's involvement in the work. The sector needs a competitive environment to ensure that the decommissioning prize is captured. Thousands of jobs and contracts for billions of pounds' worth of highly skilled work are at stake.

Offshore Energies UK Decommissioning Work Breakdown Structure (WBS)

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NT ISOLATION
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Decommissioning Insight 2023

2. Key findings

£1.27bn
spent in 2021

£1.64bn
spend in 2022

28% Increase in annual spend*

28%
Increase

*Based on unrounded figures

60% Increase in well decommissioning forecasted for 2023

60%
Increase

Decommissioning	Actual 2022	Forecast 2023	Forecast 2024-31
Total expenditure (£bn)	1.6	2.2	18.4

2026 is forecast to see over 100,000 tonnes of topsides and substructures removed and 200 large scale wind turbines installed

100k
tonnes

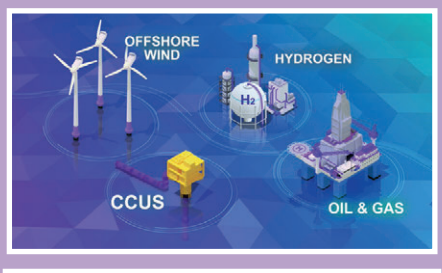
About 60% of the basin's topsides and subsea decommissioning will occur between 2026 and 2032. We need to prepare for this now

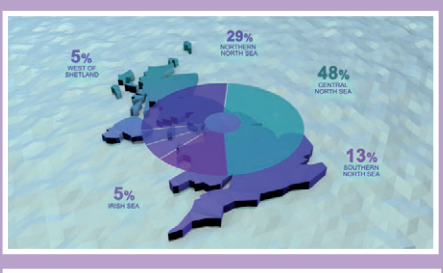
60%

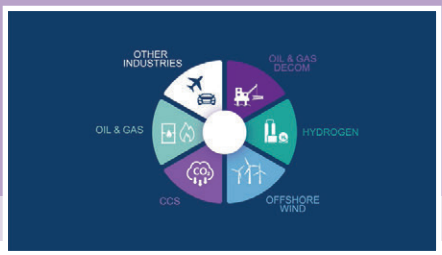
By 2031 the CNS could account for more than two-thirds of spend

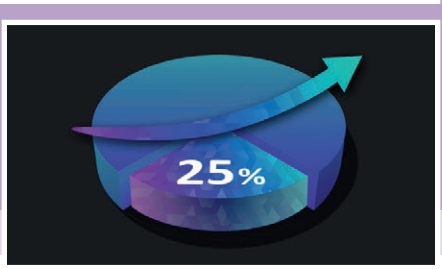
2031

Watch our decommissioning animation online at oeuk.org.uk/decommissioning









Spend in 2022

£1.6bn

- 139 wells
- 13 topsides
- 13 jackets/ substructures

139 wells

3 km of pipelines removed

3 km

60 km of pipelines decommissioned

60 km

932 tonnes of subsea infrastructure

932 tonnes

1,193 mattresses removed

1,193

The opportunity to plan for effective offshore wind decommissioning is now

Forecast spend in 2023

£2.2bn

- 210 wells
- 8 topsides
- 10 jackets/ substructures

210 wells

16.5 km of pipelines removed

16.5 km

253 km of pipelines decommissioned

253 km

8,208 tonnes of subsea infrastructure

8,208 tonnes

2,163 mattresses removed

2,163

Cost/well (£mn)	2020	2021	2022	2023
Platform	2.76	2.70	2.56	2.98
Subsea	7.96	7.81	7.89	7.92
Exploration & appraisal	4.01	4.36	4.42	5.33

Decommissioning upsurge

2020-2022: average decommissioning spend/year = £1.3bn

£1.3 bn

2023-26: average spend/year forecast = £2.1bn

£2.1 bn

% of oil and gas spend on decommissioning
2022: 12%
2023: 13%

13%

3. The UK's next decade of decommissioning

3.1 Short-term outlook

Decommissioning Insight 2022 predicted the start of an upsurge. And indeed, decommissioning expenditure has risen by a quarter in the last 12 months as the number of projects has gone up.

This year will show a similar picture before expenditure plateaus off at around £2bn/yr until 2032. Decommissioning accounted for 12% of total oil and gas expenditure in the UKCS in 2022 but this could increase to 25% in 2032, and average 17% across the 10-yr period. It will overtake capital expenditure by the end of this decade and potentially sooner.

This year's forecast sees the expenditure go up on almost every element of the decommissioning work break-down structure (WBS).

Wells once again dominate and continue to increase their share, accounting for 51% of the spend over the ten years.

Decommissioning activity	2022 (actuals)	2023 (forecast)
Wells 	139 wells	210 wells
	98 platform wells	109 platform wells
	30 subsea wells	62 subsea wells
	11 E&A	39 E&A
Topsides 	13 topsides	8 topsides
	63,082 tonnes	9,148 tonnes
Substructures 	13 jackets	10 jackets
	33,110 tonnes	13,225 tonnes
Subsea Infrastructure to be removed 	3 km of pipelines removed	16.5 km of pipelines to be removed
	932 tonnes	8,208 tonnes
	1,193 mattresses	2,163 mattresses
Overall tonnage of steel removed	97,124 tonnes	30,581 tonnes
% of infrastructure removed in 2022/2023 compared with following 10 years	6.1%	2.3%
Floating production, storage & offtake vessels to be removed (tonnes)	55,500	33,042

3.2 Decommissioning rising

2022 – A massive year for decommissioning

£1.6bn

2022 – **28% increase** in annual decommissioning spend

2023 – Forecast is **£2.2bn**

37% increase

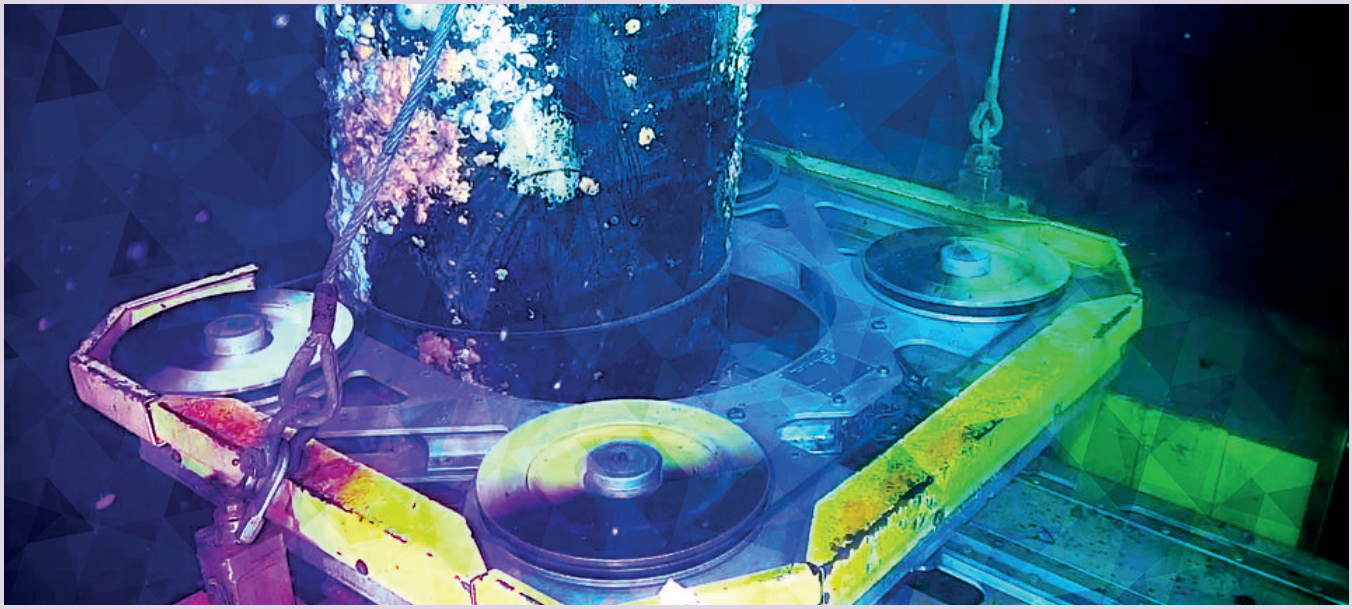
2023 – 2026 forecast

£2.1 bn/year

Significant rise in decommissioning activities in the next **3 years**

Higher average spend rate than forecast last year

16% increase



Photograph courtesy of Fairfield Energy

Figure 1
10-year cost forecast

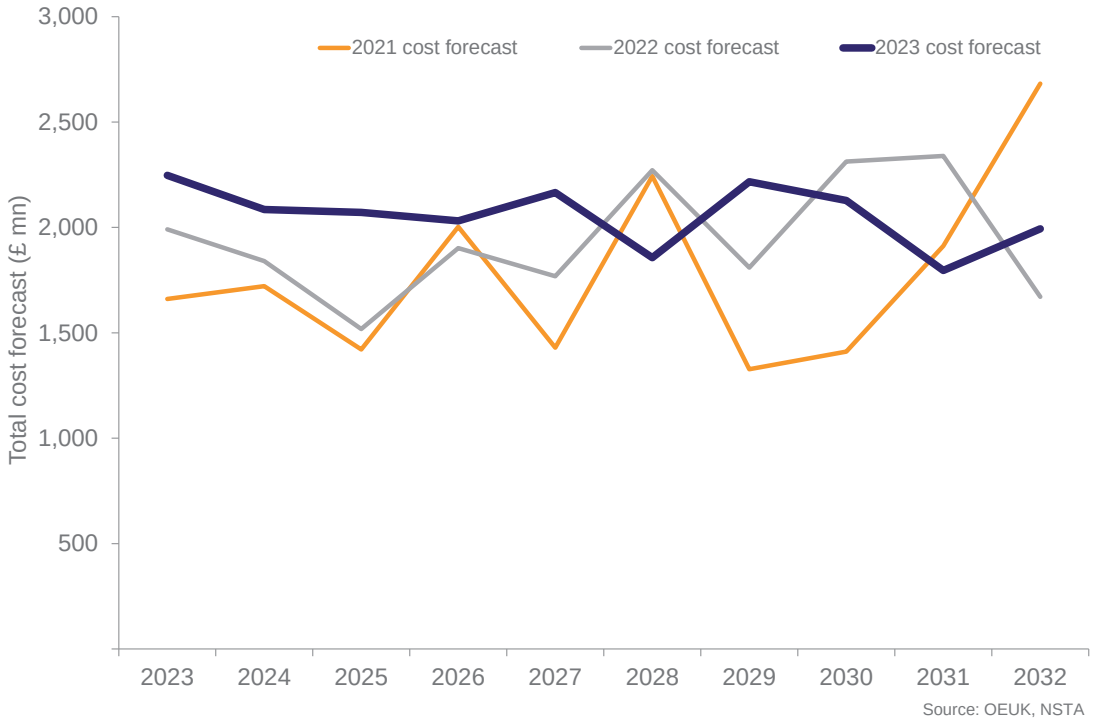
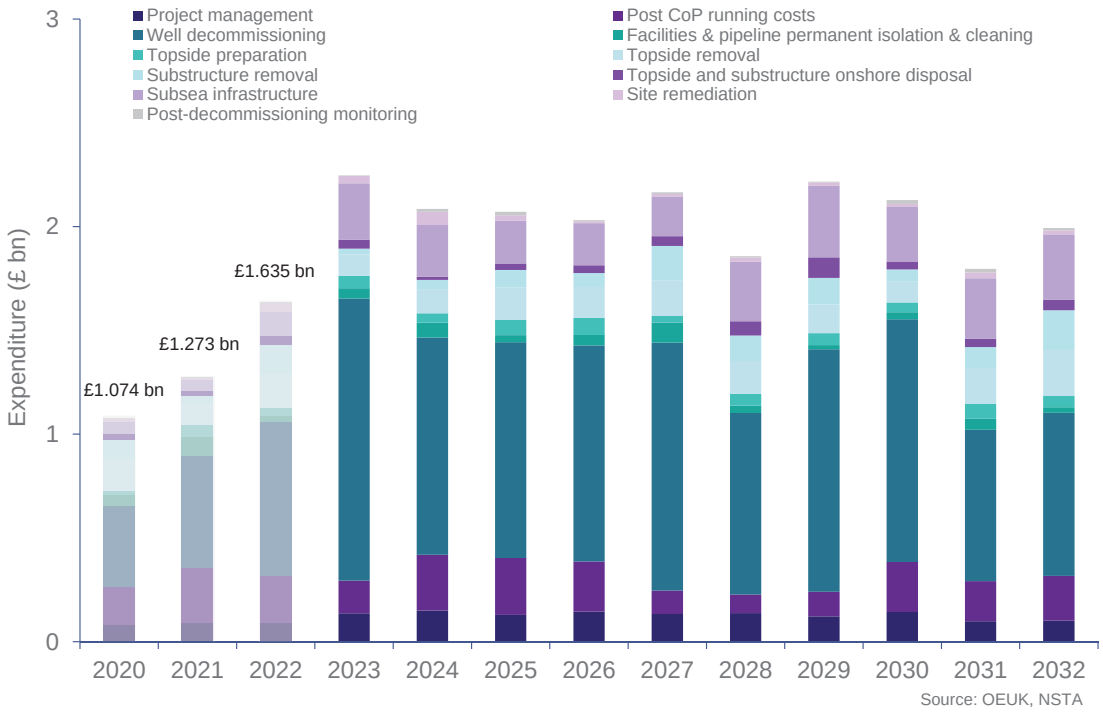
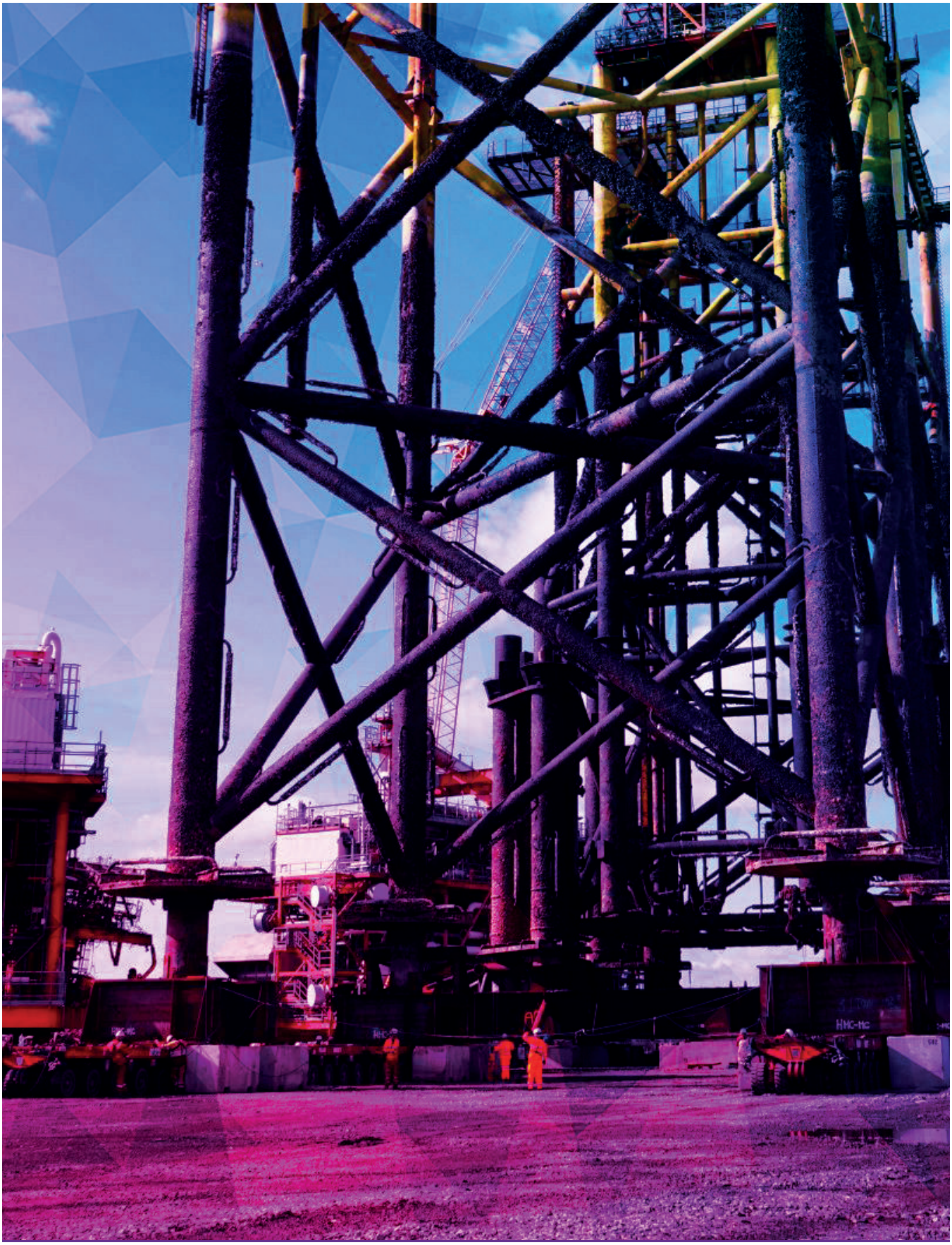


Figure 2
UKCS decommissioning expenditure by year

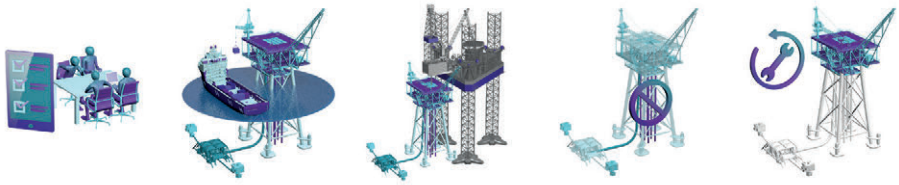




Photograph courtesy of Harbour Energy

3.3 UKCS decommissioning expenditure, by work break-down structure 2023-2032

Work break-down structure guidelines



1 Project management

2 Post-CoP running costs

3 Well decommissioning

4 Facilities & pipelines permanent isolation and cleaning

5 Topsides preparation

Expenditure (£mn)	6%	9%	51%	2%	3%	
CNS	£580	£1,054	£5,445	£155	£197	
NNS & WoS	£486	£703	£3,387	£241	£235	
SNS & IS	£233	£156	£1,576	£74	£146	
Total	**£1,299**	**£1,913**	**£10,408**	**£471**	**£578**	

6

Topsides removal

7

Substructure removal

8

Topsides and sub-structure onshore disposal

9

Subsea Infrastructure

10

Site Remediation

11

Post decommissioning monitoring

	7%	5%	2%	13%	1%	>1%	Total
	£623	£375	£195	£1,236	£72	£51	£9,983
	£443	£256	£186	£991	£72	£21	£7,022
	£424	£359	£91	£395	£101	£30	£3,585
	£1,490	**£990**	**£472**	**£2,622**	**£245**	**£120**	**£20,591**

3.4 Decommissioning cost by work break-down structure 2023-2032

Last year's 10-year decommissioning spend forecast added up to £19.7bn for the UKCS. This year's is higher, at £20.6bn. Here are some of the factors to consider when budgeting:

- General cost inflation
- Competition for resources
- Less new production for a variety of reasons
- More decommissioning activity
- Volatile commodity prices

The knock-on effects of the Energy Profits Levy are evident. It has created uncertainty around investment; the dates when a field's production will formally cease; and how decommissioning is to be funded. Along with inflationary pressures, this delays projects and may result in budgetary blow-outs.

Deep into the wells: The next five years of work on wells will see 12% more spending than the previous forecast. This years' forecast shows that in 2023, 50% more wells will be decommissioned compared with 2022. Activity is set to peak at 282 wells in 2030. The years 2023-2027 could see 1,154 wells being decommissioned. This is a step change in well activity and sends a clear message to the UK supply chain that the volume of work is rising fast. Even after the three-year surge to 2025, on average the UK will still decommission more than 200 wells/yr until 2032. This forecasted activity assumes that innovation races ahead in order to minimise the impact of higher costs.

The surge in subsea infrastructure removals means that careful preparation is vital: the table on p19 predicts a steady stream of work in this area over the next five years, which then becomes a steep climb towards 2032. This is broadly in line with previous reports. The UK supply chain must ensure that it is prepared.

After removal, the infrastructure will also have to be processed and disposed of onshore. Every opportunity to collaborate, charter vessels and book supply chain capacity must be taken, or the prize will be lost.

Squaring up for a peak: topsides and substructure removals are forecast to dip in 2023 before rising gradually to peak in 2027. About 60% of the basin's topsides and subsea decommissioning will occur between 2026 and 2032.

17% of overall basin spend will go on decommissioning in the next decade

17% basin cost

Photograph courtesy of Boskalis

Energy Profits Levy explained

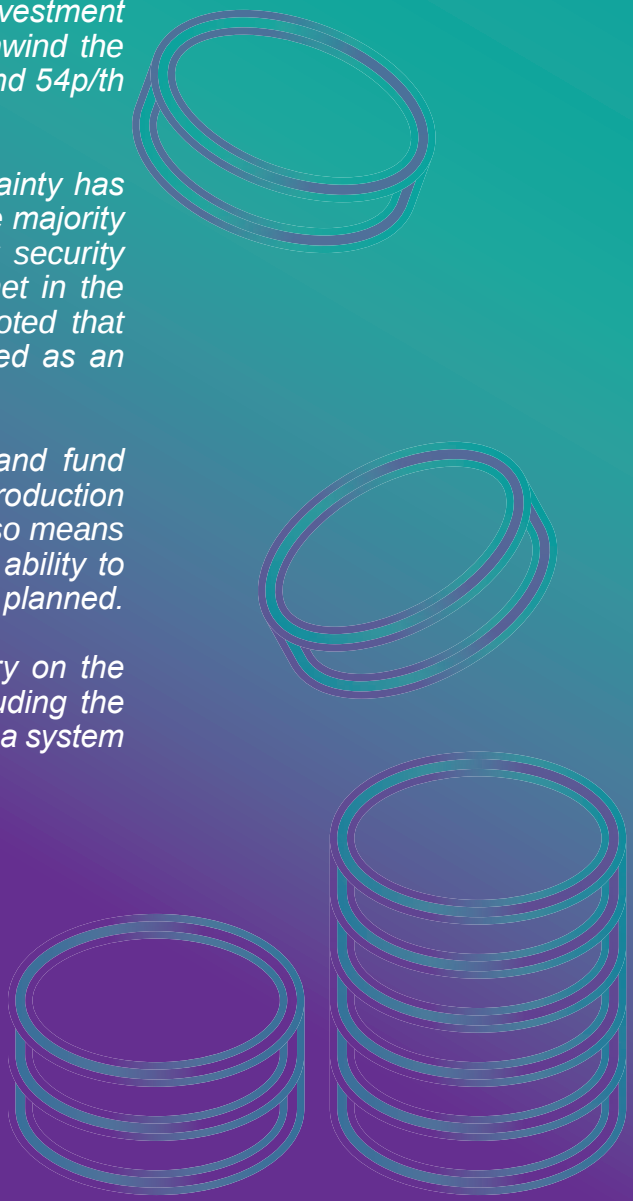
A competitive and predictable fiscal regime is fundamental for investors. But the May 2022 Energy Profits Levy (EPL) introduced changes that significantly damaged confidence in the UK and their ability to access finance. The tax rate on oil and gas production is now 75%.

An investment allowance is included in the levy. It allows companies to offset qualifying expenditure against tax payments. An 'energy security investment mechanism' has also been introduced to unwind the tax if oil and gas prices fall below $71.40/b and 54p/th respectively for six months.

But the damaging effect of long-term uncertainty has outweighed the benefits of allowances for the majority of companies. It is unlikely that the energy security investment mechanism price level will be met in the short to medium term. It should also be noted that decommissioning expenditure is not classified as an allowable expense.

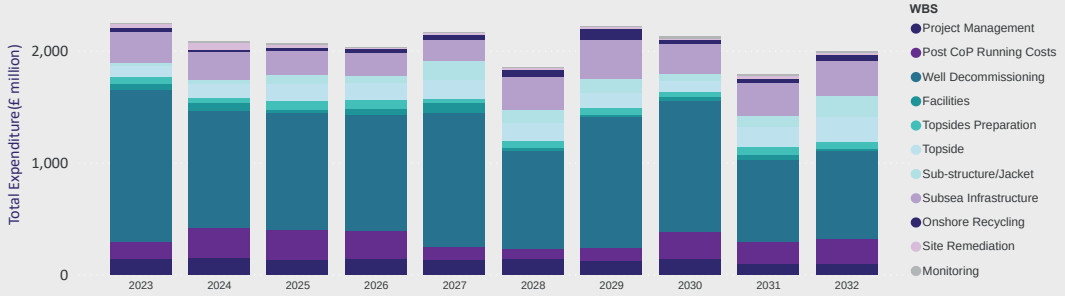
Companies are finding it harder to justify and fund investments in the UK, which impacts on production rates and cessation of production dates. It also means that cash generation is lower, meaning less ability to fund decommissioning projects as previously planned.

OEUK is actively engaged with HM Treasury on the future of the oil and gas fiscal regime, including the unwinding of the EPL and the development of a system which draws investment.



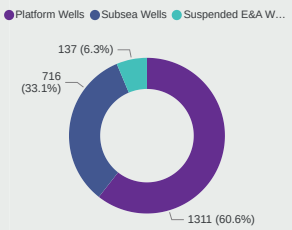
Decommissioning Insight 2023 Dashboard

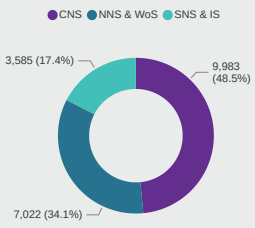
Work breakdown structure | Well decom & removals | Average well costs | Other



Over 2,100 wells are set to be decommissioned in the next 10 years.

60% of wells to be decommissioned are forecasted to be Platform Wells over the next 10 years.





Decommissioning spend in the North Sea set to top £20bn in the next 10 years

The Central North Sea and Northern North Sea are expected to continue to dominate spend in over the next 10 years.

For further insights see our OEUK Decommissioning insight dashboard

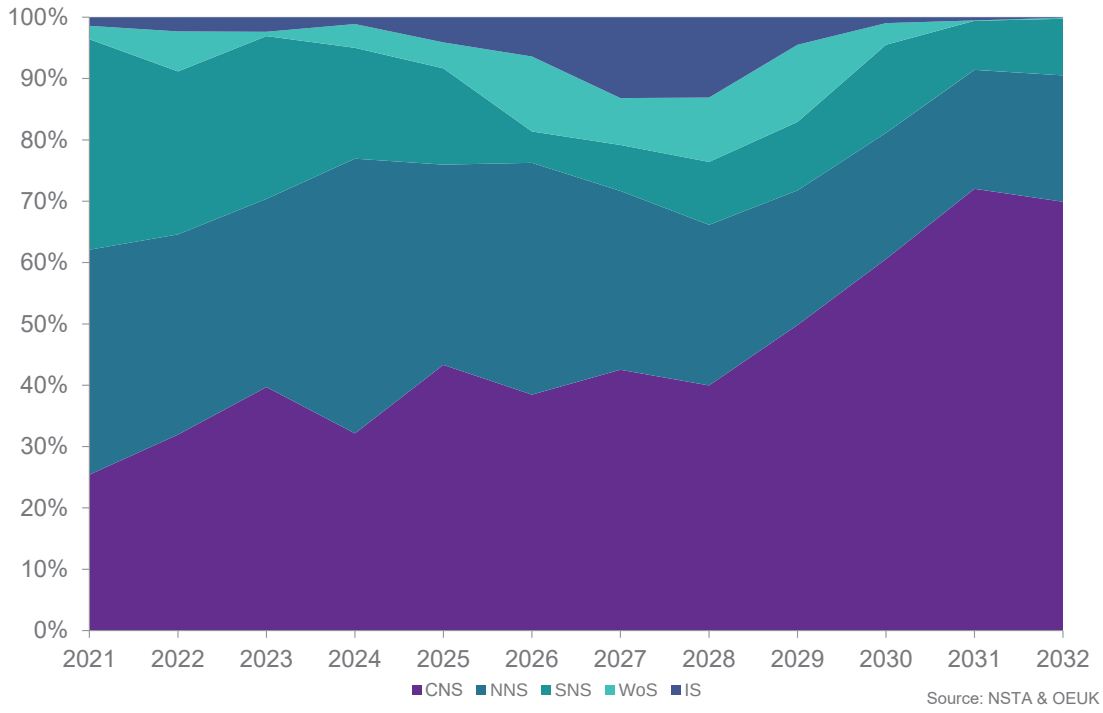
oeuk.org.uk/decommissioning/

3.5 Regional trends

Central & northern North Sea dominate: the central North Sea faces a steady flow of work between now and 2028 followed by a steep rise in activity until the early 2030s. By 2031 the CNS could account for more than two-thirds of spending, up from around one-third now. The northern North Sea follows the same trend which points at significant innovation and collaboration opportunities now and during the growth years from 2028.

The forecast for the West of Shetland is consistent with last year's report, showing a relatively steady supply of work over the next decade. This region has younger assets with more life left in them.

Figure 3
UKCS regional expenditure



Source: NSTA & OEUK

The rise of the southern North Sea & Irish Sea: activity in the southern North Sea (SNS) & Irish Sea (IS) is forecast to account for a quarter of this year's expenditure. Thereafter its share steadily declines until 2028, before rising again. Wells are the largest area of decommissioning spending in the SNS & IS, at £1.6bn or 44% of total spend in the region over the next 10 years. The pace of subsea removals has been quickening in recent years, catching up with the pre-pandemic numbers. Almost 1,000 tonnes of subsea infrastructure face removal in 2023, with subsea work to continue until 2029 at a regular rate. Likewise, the 10-year forecast for topside removals is set to return to pre-pandemic levels,

	Total subsea removals (tonnage)		
	CNS	NNS & WoS	SNS & IS
2022	785	82	65
2023	7,188	60	960
2024	2,830	6,264	356
2025	598	3,554	460
2026	1,690	2,210	402
2023-2026 Average	3,077	3,022	546

with over 170,000 tonnes recovered in the next 10 years, peaking at 34,500 tonnes in 2028. **Regional collaboration opportunities:** last year's *Insight* showed significant clusters of works being brought forward, thanks to collaborative campaigns particularly in wells and subsea. This year's report is similar. But unless there is more work done on collaboration, regional campaigns will fail to maintain a healthy supply chain, meaning a lost opportunity for the UK.

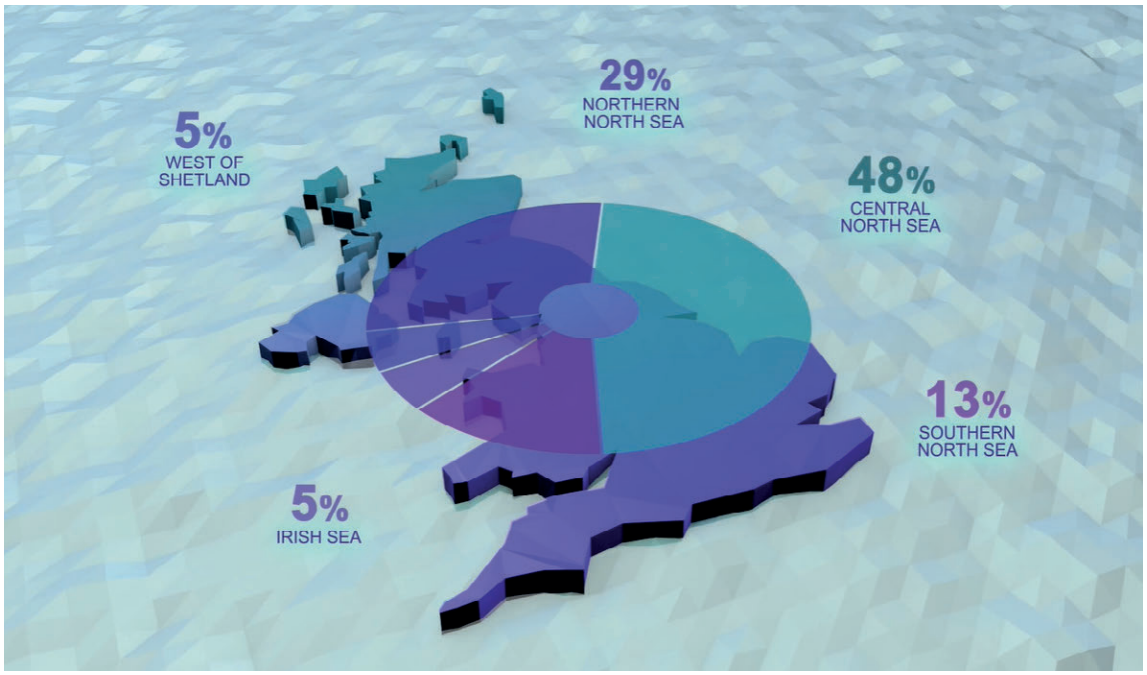
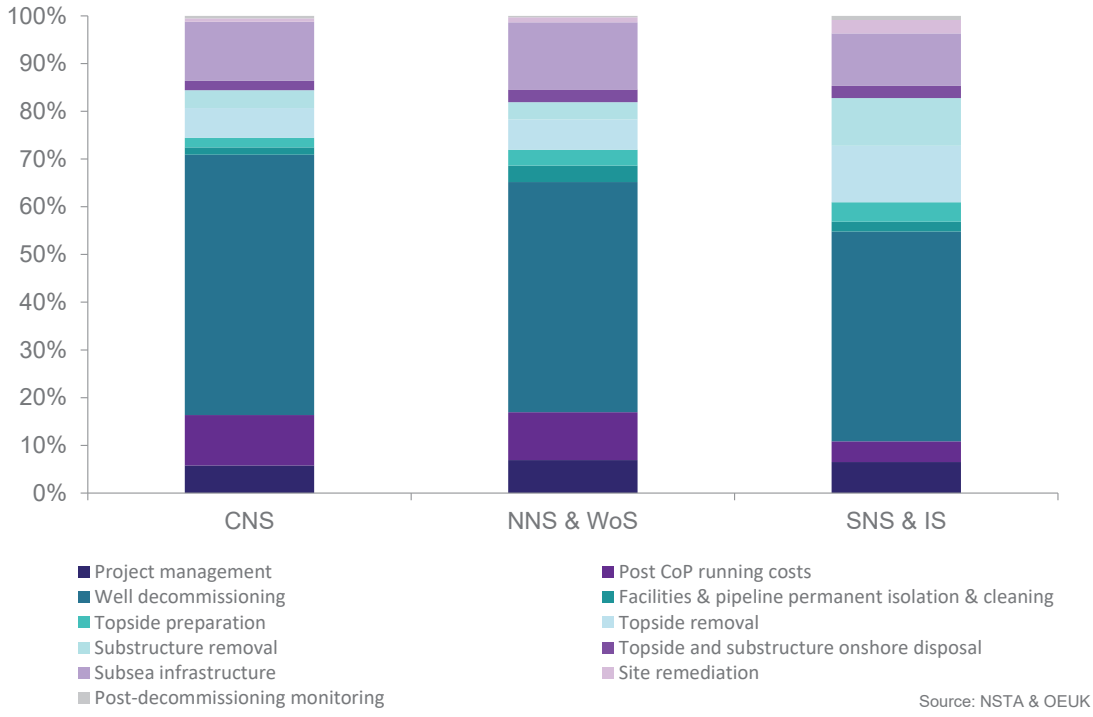


Figure 4
Work break-down structure by region



Source: NSTA & OEUK

Figure 5a
Northern North Sea & West of Shetland by work break-down structure

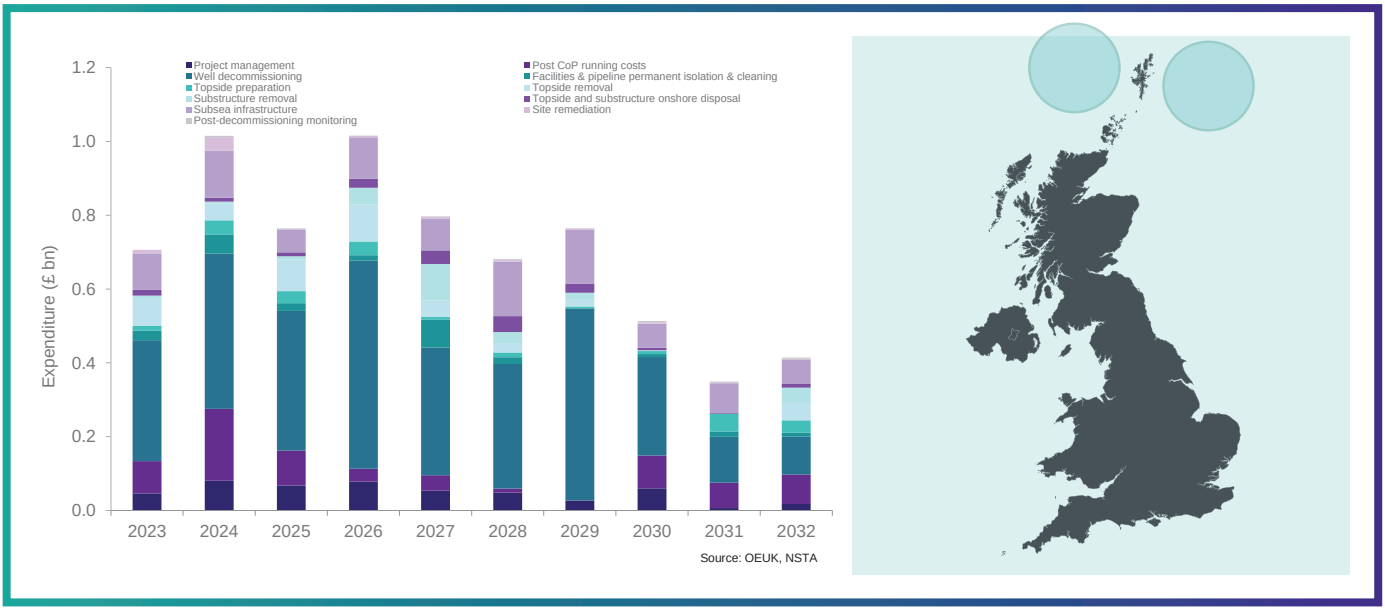
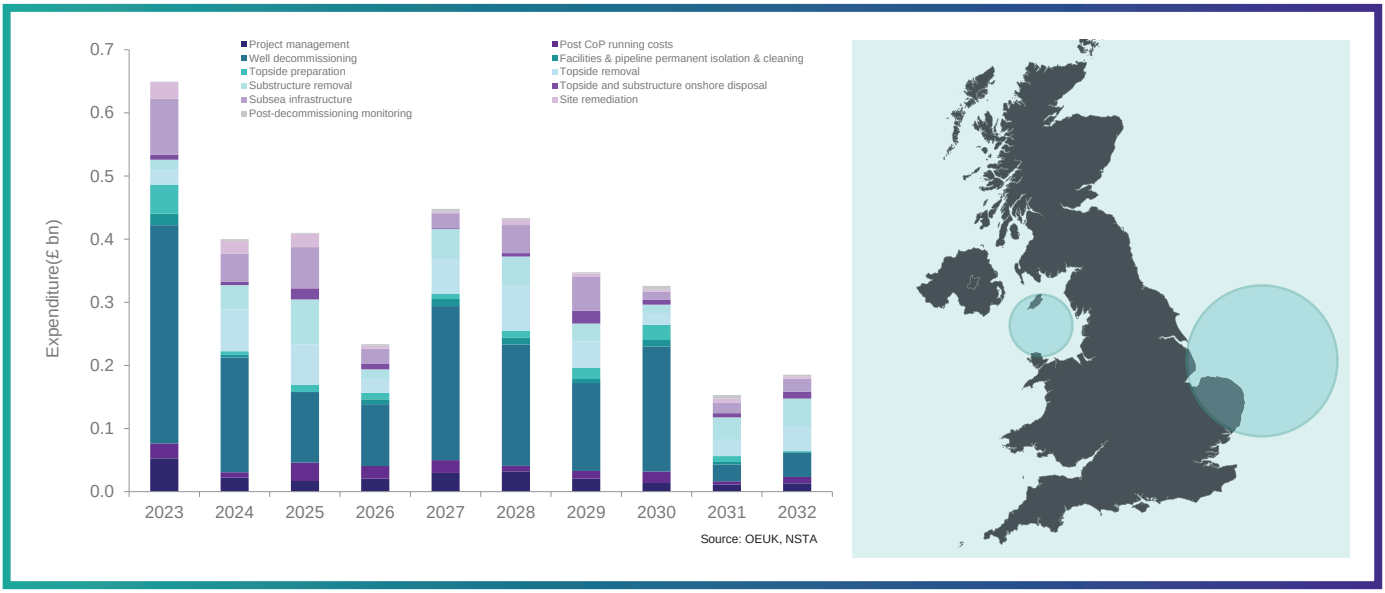


Figure 5b
Central North Sea by work break-down structure

Figure 5c
Southern North Sea & Irish Sea by work break-down structure



Case study: US Project Boomerang

Project Boomerang bundles scale, scope and duration for the decommissioning of 12 offshore platforms, 211 wells and 32 pipelines across seven worksites in shallow water Gulf of Mexico (GoM). bp selected Petrofac's 'integrated outsourced operator' project management, planning, engineering, procurement, and field execution solution. The project uses a "cost-plus" reimbursable model to execute work safely, efficiently and cost-effectively in accordance with local legislation.

This contract model effectively handles "discovery surprises" from these old assets with no risk premiums or contentious change orders. The scale of the scope offers many opportunities for continuous improvements through repetitive gains, lessons learned, performance benchmarking and risk reviews. "CostBusters" are continually sought and tracked daily, with 28 (>$16mn) captured to date. For example, before well-work commences, extensive diagnostic and wellhead maintenance work is done by smaller, lower cost crews. This enables better campaign planning, permitting and cost estimating.

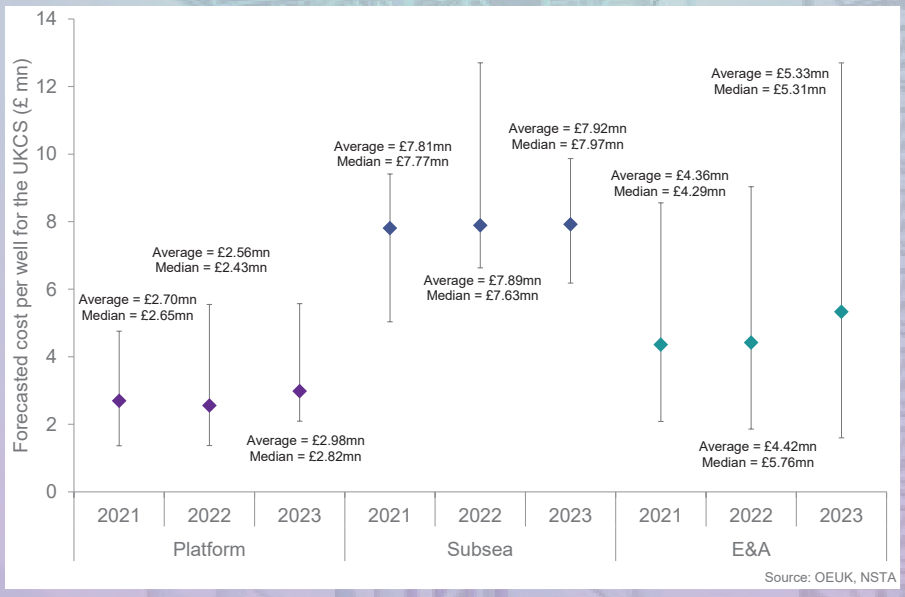
Project governance is via a rigorous Approval for Expenditure (AFE) process. This entails an AFE per activity including scopes of work, technical justifications, risk reviews, best available market pricing and detailed cost estimates. Once approved, each AFE is tracked and reported daily with full transparency.

Petrofac leverages its global decommissioning experience and GoM relationships with over 300 vendors to secure fit-for-purpose equipment, services and crews in a competitive market. The team mobilised in 30 days to take over the field, beginning with assessment and make-safe work. The project has now plugged 48 wells and is (October 2023) cutting and pulling conductors.

Collectively, the Petrofac team has decommissioned more than 2,500 wells, 250 platforms and 350 pipelines. It brings knowledge, experience, relationships and a passion for decommissioning. By removing this old oil and gas infrastructure, the project supports the energy transition and is delivering safe and assured decommissioning.

Figure 6
UKCS well decommissioning

Figure 7
Estimated costs



Planned, sealed, delivered: In 2022, 139 wells were decommissioned, comprising 98 platform wells, 30 subsea wells and 11 exploration and appraisal wells. This was a marked increase on 2021 and shows companies making up for time lost during the pandemic. This trend is expected to continue for 2023-2025 after which the forecast decommissioning work rises from 210 wells/year to 282 wells/year. Three quarters are expected to be in the CNS & NNS. By 2025, there could be an annual low of just 18 platform wells decommissioned in the southern North Sea. The number of wells set to be decommissioned in the next 10 years could be over 2,150.

Cost of subsea well decommissioning on the rise: this year's report forecasts an average annual cost of just under £8mn/well.

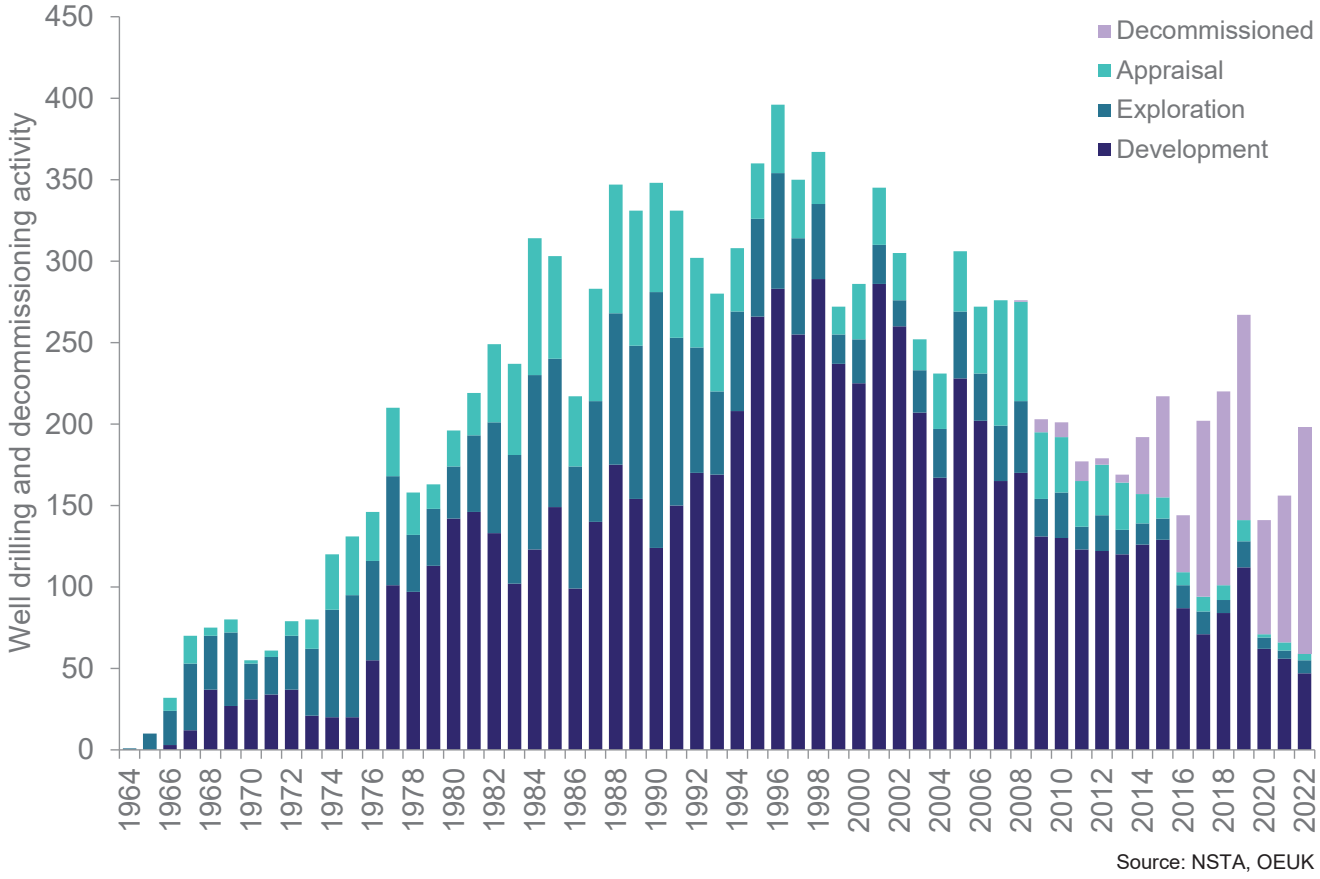
E&A wells have seen the largest jump in cost forecasts, up by around £0.9mn/well to £5.3mn. Platform well costs rose by about a sixth last year to around £3mn/well.

Innovation and new contracting models can help ensure efficiencies. A regulatory drive for shared campaigns alongside the industry's relentless push for new technology could keep the lid on costs in the coming years. But so far this initiative has not yielded any results.

Cost per well (£mn)	2020	2021	2022	2023
Platform	2.76	2.70	2.56	2.98
Subsea	7.96	7.81	7.89	7.92
E&A	4.01	4.36	4.42	5.33

P&A all the way: In 2022, well decommissioning activity was 135% higher than the potentially production-adding activity of exploration, appraisal, and development wells. The potential for activity that adds production has been affected by the impact of delayed exploration licence rounds, the introduction of the EPL and political uncertainty. This has resulted in a lower number of wells being drilled (*see Figure 8*). Conversely, if fields see an earlier cessation of production date because of the EPL, more wells might be decommissioned earlier in the coming decades.

Figure 8
Well drilling and decommissioning activity



Source: NSTA, OEUK

Well decommissioning activity is growing and accounting for an ever-increasing percentage of overall activity. However, the costs are not decreasing for plugging and abandonment and the industry needs to share more information and collaborate better to extract the needed efficiencies.

"There should be no competition in well decommissioning for operators. The more that knowledge is shared, the greater are the efficiency gains and the lower the costs."

Keith Wise
Operations Manager, Offshore Energies UK

51%

Wells decommissioning accounts for 51% of expenditure over the next decade

50%

Year-on-year increase is expected in number of wells to be decommissioned in 2023

Actual and forecast numbers of wells being decommissioned, by type		
2022 Actual	**2023 Forecast**	**Activity from 2024-2032**
139 wells, *of which:*	210 wells, *of which*:	1,954 wells, *of which:*
98 platform	109 platform	1,202 platform
30 subsea	62 subsea	654 subsea
11 E&A	39 E&A	98 E&A

Case study: North Sea 21-well decommissioning programme

Well-Safe Solutions successfully harnessed new technologies, batched operations and integrated natural salt barriers to plug and abandon 21 wells in the North Sea ahead of time and under budget.

The three-year campaign (interrupted by Covid-19) generated key performance data, with collaboration between Well-Safe Solutions, its client and the supply chain vital to successful completion.

This project gave Well-Safe Solutions the opportunity to realise efficiencies of scale for its client while safely decommissioning assets. This was of vital importance as the field has been earmarked for future carbon capture usage and storage (CCUS) development.

As part of Well-Safe's commitment to safe, smart and efficient well decommissioning operations, the company introduced and project-managed several new technologies at the same time to maximise efficiencies and increase operational safety.

A particularly effective partnership with a mechanical cutting services provider enabled repeated downhole, multi-string cuts to be completed, with an innovative conductor recovery tool reducing total operational time by 56 hours. Quick, effective annulus testing and dual casing milling was also achieved with a mechanical perforator.

The 'learning curve' of understanding and the deployment of these new technologies generated considerable savings of time and money.

The team took an innovative approach to well abandonment using salt formation as a barrier for zonal isolation. The salt verification process saw the team log 11-3/4in casing with USIT/CBL, before identifying probable halite squeeze locations onto the casing's overall diameter. The salt was then qualified as pressure-sealing, before an internal cement plug was placed.

Our drive to reduce costs and increase the efficiency of decommissioning operations saw two digital slickline units used to support simultaneous operations. This method sped up the execution phase by combining two services into one cable conveyance. Wellbore data was also enhanced by the digital slickline system's ability to provide real-time toolstring pressure and temperature data.

At well suspension (ABN0) stage, Well-Safe Solutions reduced the time required for wireline-based intervention from 30.3 days on Well 1 to only 5.6 days by Well 10. The conductor cutting and recovery (ABN3) phase also realised tangible savings, from 5.1 days on Well 1 to 0.8 days on Well 10.

With the successful decommissioning of all wells and no fewer than 41 permanent isolation barriers established, Well-Safe Solutions demonstrated the cumulative benefits of batched operations in campaigns and the introduction of new technology, all of which was executed to the satisfaction of the client.

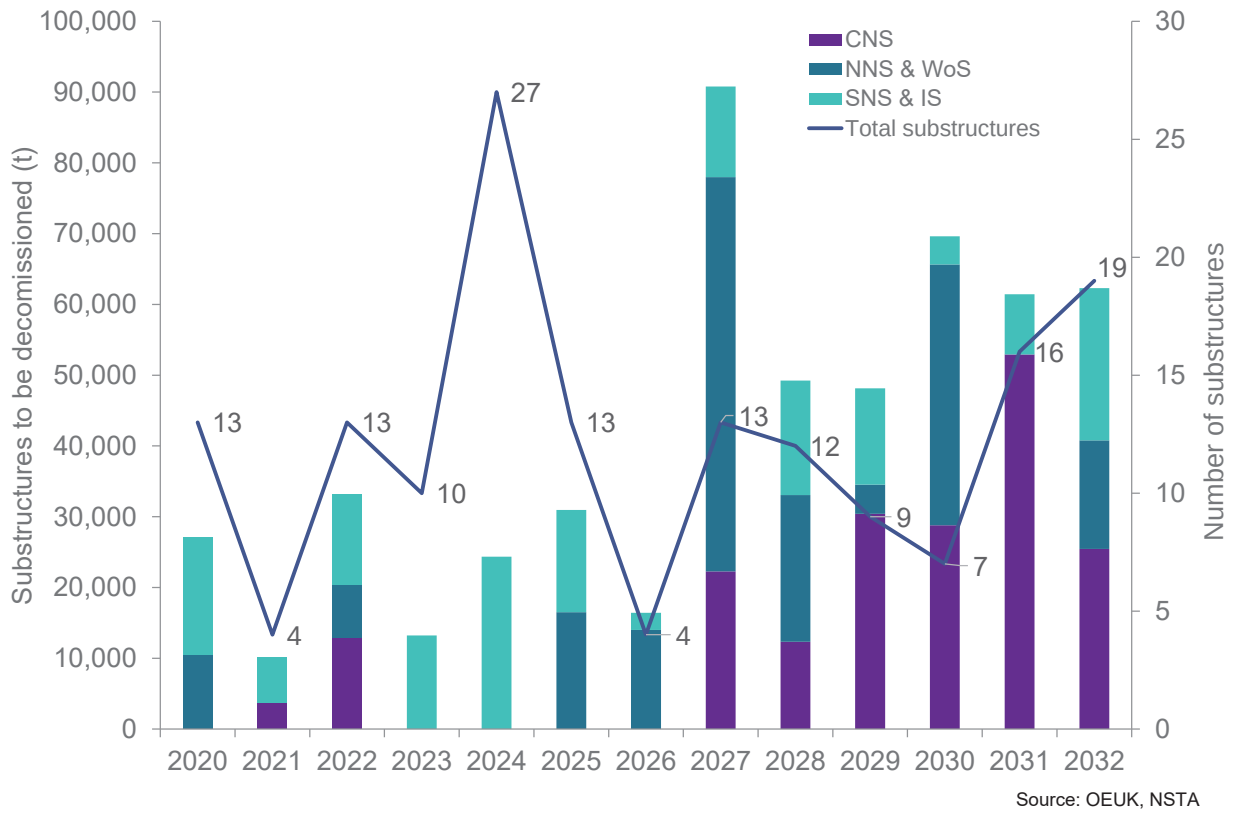
3.7 Removals

Substructure removals raise the stakes: 13 substructures weighing a total 30,000 tonnes were removed in 2022, divided between the SNS, CNS and IS. The SNS will see another steady year of substructure removals in 2023, before a hefty 27 SNS & IS substructures are forecast for removal in 2024. The SNS and IS see the most growth but the weight will stay under 30,000 tonnes until 2027 when some mammoth substructures from the NNS & WoS will be removed.

Uncertainty around market conditions, heavy lift vessel availability and unstable regulatory positioning around derogation decisions may result in further fluctuations in these forecasts.

2020s end with topsides removal push: the story for topsides removals is similar to that of substructures. Executing the combined body of work across substructure and topsides in the UKCS is going to need a colossal push from

Figure 9
Substructures to be decommissioned

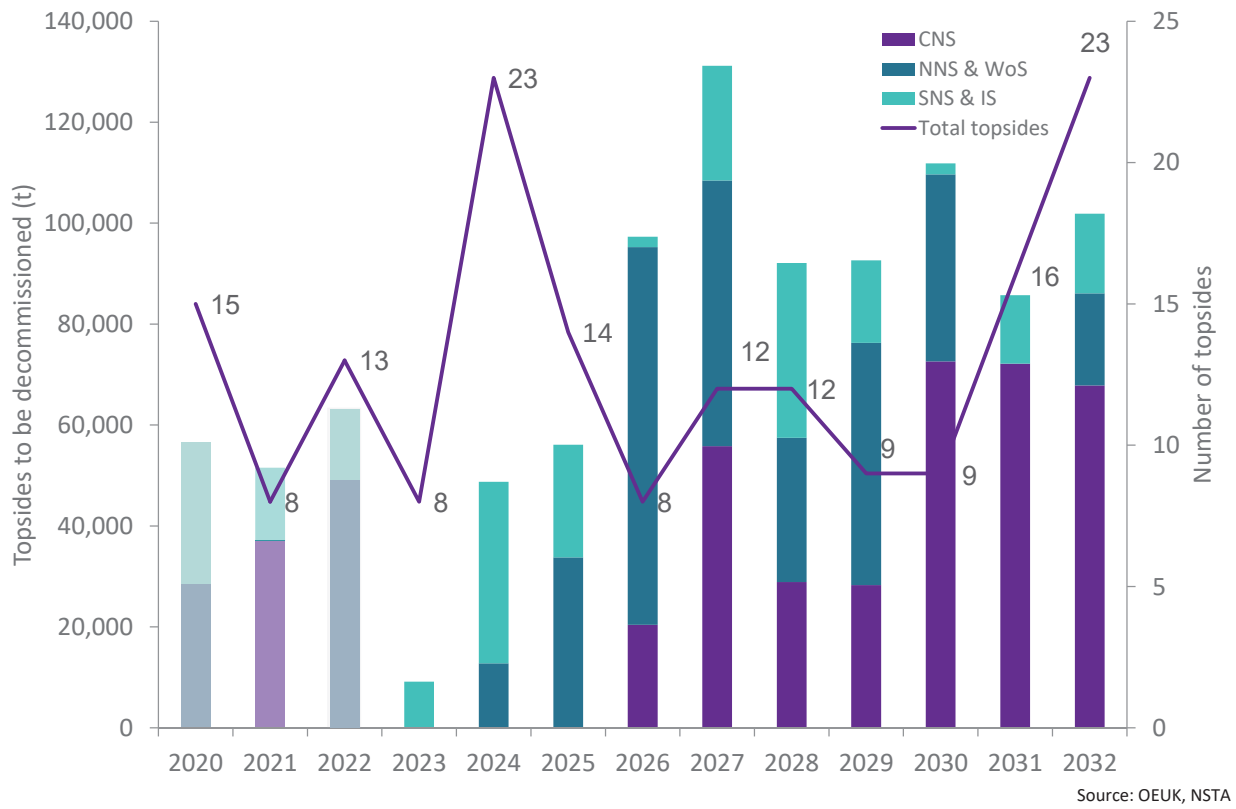


Source: OEUK, NSTA

the heavy-lift market. Clever scheduling and fresh contracting models may be the answer to delivering such an abundance of work.

In terms of heavy lifting, the larger structures will come away from 2027 onward, while most of the decommissioning of the smaller topsides will occur over the next few years. The SNS & IS will have a steady workload out to 2032, with an average forecast above 17,000 tonnes/yr. In the CNS, NNS and WoS there may be a window of opportunity for innovation in large topsides removal work, with the average forecast to be above 80,000 tonnes/yr from 2027-32.

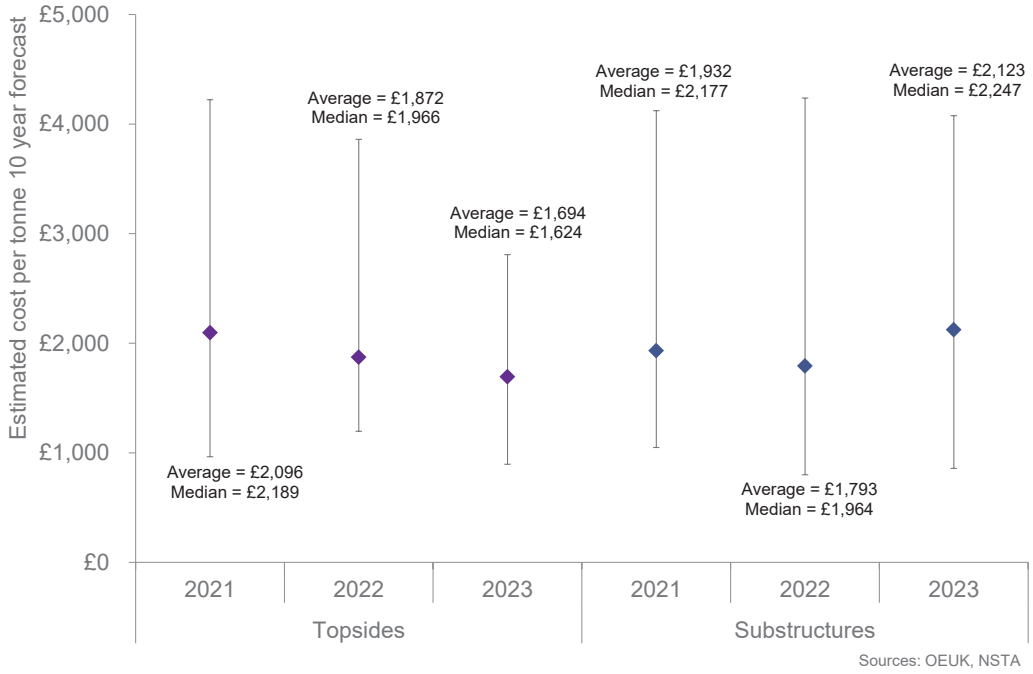
Figure 10
Topsides to be decommissioned



Source: OEUK, NSTA

2023 – 2032 Forecast	NNS & WoS	CNS	SNS & IS	Total UKCS
Topsides removal	15	26	93	134
Total weight (tonnes)	305,904	348,038	174,718	826,660
Substructure removal	11	20	99	130
Total weight (tonnes)	163,260	172,198	131,054	466,512

Figure 11
Estimated cost/tonne



Sources: OEUK, NSTA

Heavy lifters on point: the cost of removing a tonne of topsides has fallen by an average 10%. This reduction is forecast to be repeated again this year, based on cumulative improvements in technology and efficiency.

Substructure removal costs for 2023 could however go 10% above the forecast owing to difficult market conditions and scarce resources. This may be offset by the advances in lift and removal technologies seen in the past few years. These scopes will peak for the SNS & IS in 2024 and mainly reflect the fact that the structures are smaller.

Larger structure removals will take up the bulk of the workload from 2026 onwards. If there is sufficient investment and preparation, the UK supply chain could challenge continental Europe's market leaders in heavy lift technology.

Case study: Kishorn Port - *MV Kaami* and beyond

The vessel *MV Kaami* ran aground on rocks in The Minch between the islands of Harris and Skye in March 2020.She was declared a constructive loss by the insurers. KPL JV partners Fergusons Shipping & Transport were initially approached by the salvers, Resolve, to assist with cargo recovery.

Following subsequent discussions with the Salvage Company, SOREP and SEPA, it was agreed to bring *MV Kaami* to Kishorn Dry Dock for recycling in line with circular economy, re-use, and with minimum waste.

Although KPL at the time was not authorised to recycle shipping vessels, a special dispensation was granted to allow the vessel to be deconstructed and processed. KPL brought John Lawrie Metals 'on board' to undertake the downsizing and recycling. The vessel weighed 1,257 tonnes. Overall, it was a 13-week turnaround from initial consultation to delivering depolluted and fully recycled material to the steel mill. Working efficiently, safely and collaboratively with all parties enabled this quick completion, with the majority of the recycled materials leaving the site via sea which further reduced the carbon footprint.

KPL is now fully licensed and authorised by the UK and the EU to carry out ship recycling at the facility at Kishorn Port, in full compliance with the EU Ship Recycling Regulations and the Hong Kong Convention on Safe and Environmentally Sound Recycling of Vessels. Liberty Industrial is the principal contractor on the 10-month recycling plan for *Northern Producer*, which arrived at the dry dock October 2023.

Exciting times ahead for KPL

Kishorn Port and Dry Dock will look to continue to develop, increasing the dock's capacity to cater for vessels up to 250 m long, with plans to increase the lay-down area by a further 10 ha. It is building a deep-water heavy load-out quay up to 20 metres depth to suit all the energy sectors, ranging from oil and gas, decommissioning, offshore wind and the aquaculture sector.

3.8 Integrated energies

From 'Clash of the titans' to 'share and share alike': OEUK members have been active in offshore wind decommissioning, ensuring that industry shares the lessons learned.

OEUK is working on two sets of guidelines that apply the lessons from oil and gas decommissioning to offshore wind decommissioning.

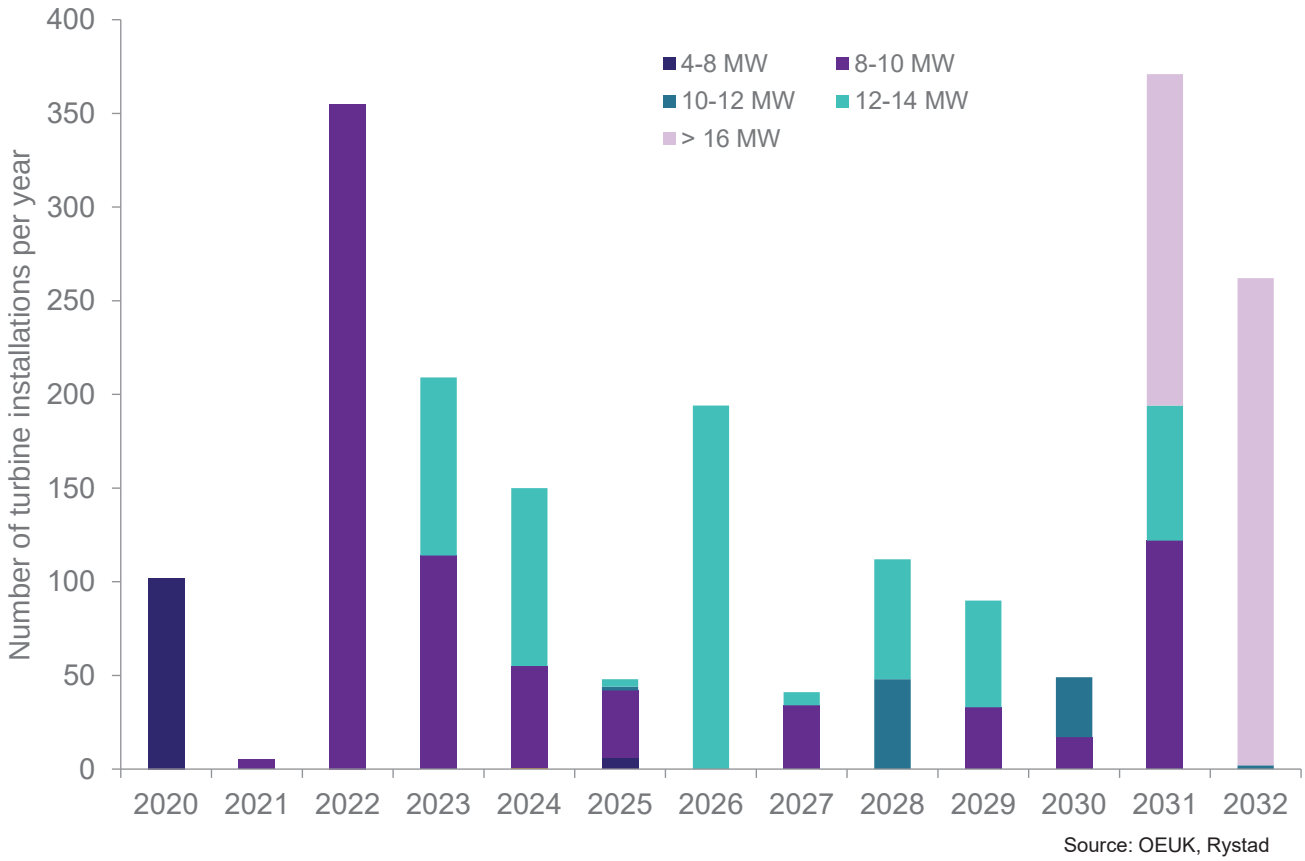
The two guidelines – 'Design for decommissioning offshore wind installations' and 'Offshore wind decommissioning WBS guidelines' – will be instructive from a technical, commercial and project management basis in the transition period.

Issues remain in terms of shared skills and assets for offshore wind installation and oil and gas removal works, as well as umbilical and pipeline installation and removal. 2026 sees over 100,000 tonnes of topsides and substructures removed and 200 large scale wind turbines installed.

An integrated offshore sector working together is needed to ensure collaboration, innovation and potentially infrastructure investment to enable these scopes.

Activities across these industries will be sharing the heavy lift space for the next decade, so co-operation and some new assets will be important.

Figure 12
Turbine additions (by capacity)



Source: OEUK, Rystad

Case study: RWE and Blyth Wind Farm

Blyth Offshore Wind Farm was the UK and RWE's first offshore wind farm. About 1 km off the Northumberland coast at Blyth, the site consisted of 2 Vestas V60 2-MW wind turbine generators (WTGs), a single array cable between the north and south turbine and a single export line from the north turbine to the shore at Cambois Beach.

Decommissioning took about a month and was successfully completed May 19, 2019 after a year of careful engineering and planning by principal contractor Fugro Geoservice. The main decommissioning works were completed using the *Fugro Excalibur*, which was also the vessel that had installed the wind farm almost 20 years earlier.

The works began with the dismantling of the WTGs, accomplished using a 6-lift reverse installation method. The WTG components were dismantled and lifted to the vessel deck within 12 hours before being transported back to the Port of Blyth where they were offloaded for reuse and recycling.

In order to minimise the impact of the decommissioning works, one of the WTGs was gifted to the Port of Blyth to support the training of future offshore personnel. The other was reused as spare parts into the RWE onshore portfolio.

The next step was the removal of the monopile foundations. The novel design of a drilled and grouted rock socket foundation was followed by an internal cut, removing the structure below the seabed in line with the decommissioning requirements. A specially designed ultra-high pressure abrasive water jet tool was developed for the project and was successful in cutting the 40-mm thick 3.5 m diameter monopile to enable successful removal.

The monopiles were transported back to the Port of Blyth where they were offloaded before being recycled as scrap steel.

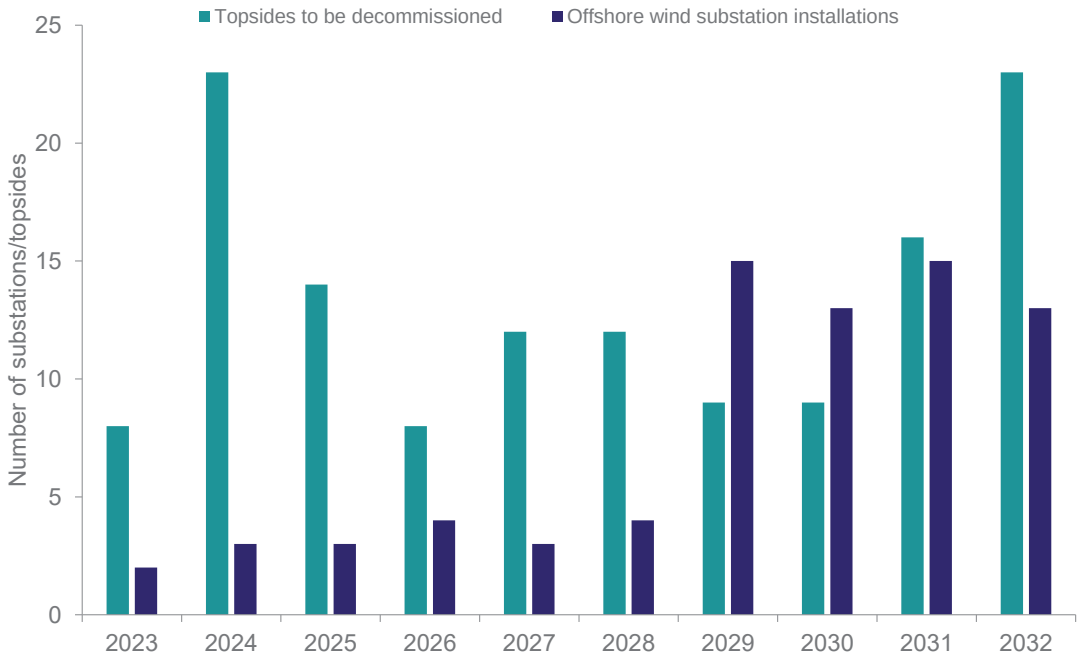
The learnings from this first decommissioning project are being used to support RWE with the planning and preparation for future full scale commercial offshore decommissioning activities.

Wind in the sails of the supply chain: offshore wind farm activity remains resilient and the installation of a steady stream of substations is planned over the next five years.

This could rise sharply towards the end of the decade and into the early 2030s. This would pose a direct challenge to the decommissioning supply chain as it tackles an abundance of topsides.

No more crossed wires: Over 3,000 km of pipelines are set to be decommissioned by 2030 while 5,000 km of subsea cable will be laid in the wind sector. This offers yet another opportunity to share assets and resources across sectors, along with all the knowledge that has been gained from oil and gas installation. A glut of projects within these spaces calls out for UK supply chain solutions.

Figure 13
Topside decommissioning vs offshore wind substation installations



Source: OEUK, Rystad

3.9 Subsea decommissioning

Figure 14
Subsea infrastructure removals

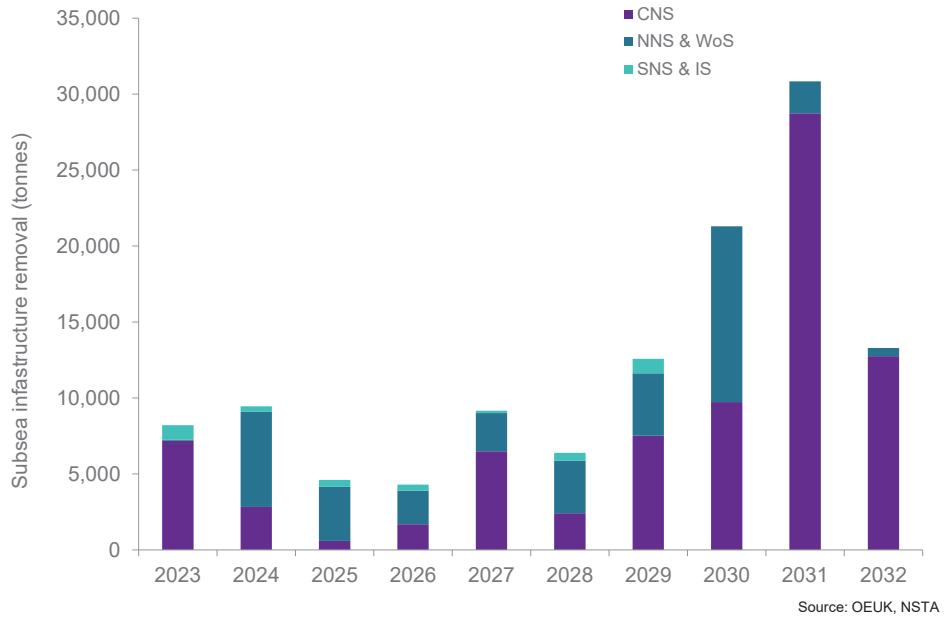
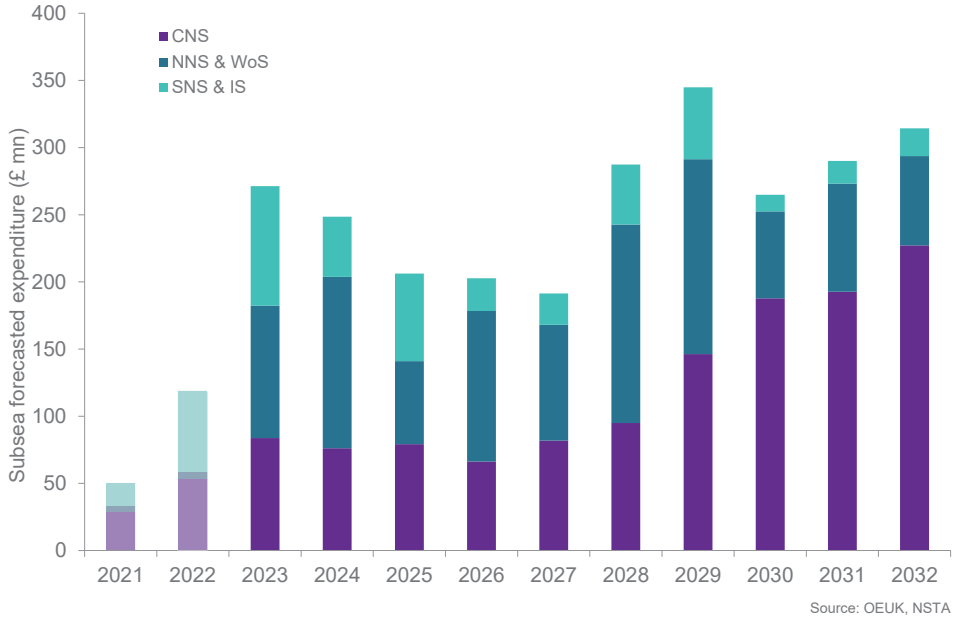


Figure 15
Forecast subsea expenditure



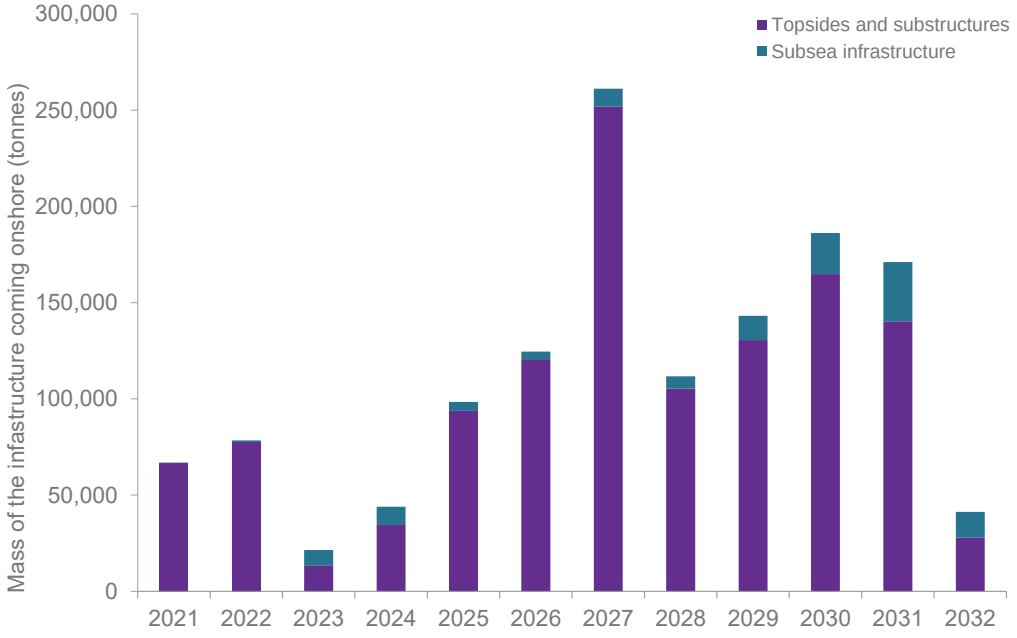
Subsea decommissioning is sharply rising, and forecast to reach 12% year on year. The period 2023-27 will see on average over £200mn/yr spent. This is just a taste of what 2028-2032 will bring: the basin will average over £300mn/yr.

The year 2031 shows a massive 30,000 tonnes of subsea infrastructure forecast to be removed, mostly in the CNS. Actual spending in 2022 exceeded £100mn on subsea infrastructure removals but this is set to be eclipsed by a forecast record year in 2023: removing 8,000 tonnes of subsea infrastructure will cost above £250mn. As with the substructure and topside removal space, subsea infrastructure decommissioning is a growth sector that will peak towards the end of the ten-year period. However, the upward climb began this year and will provide a stable decade of work. This is a colossal opportunity for the UK supply chain to use its historically strong subsea sector and win the bulk of the contracts.

2022 (Actual)	2023 (Forecast)	Activity from 2024-2032
3 km	16 km	348 km pipelines planned to be removed
932 tonnes	8,208 tonnes	111,918 tonnes of subsea structures to be removed
1,193 mattresses	2,163 mattresses	37,048 mattresses to be removed

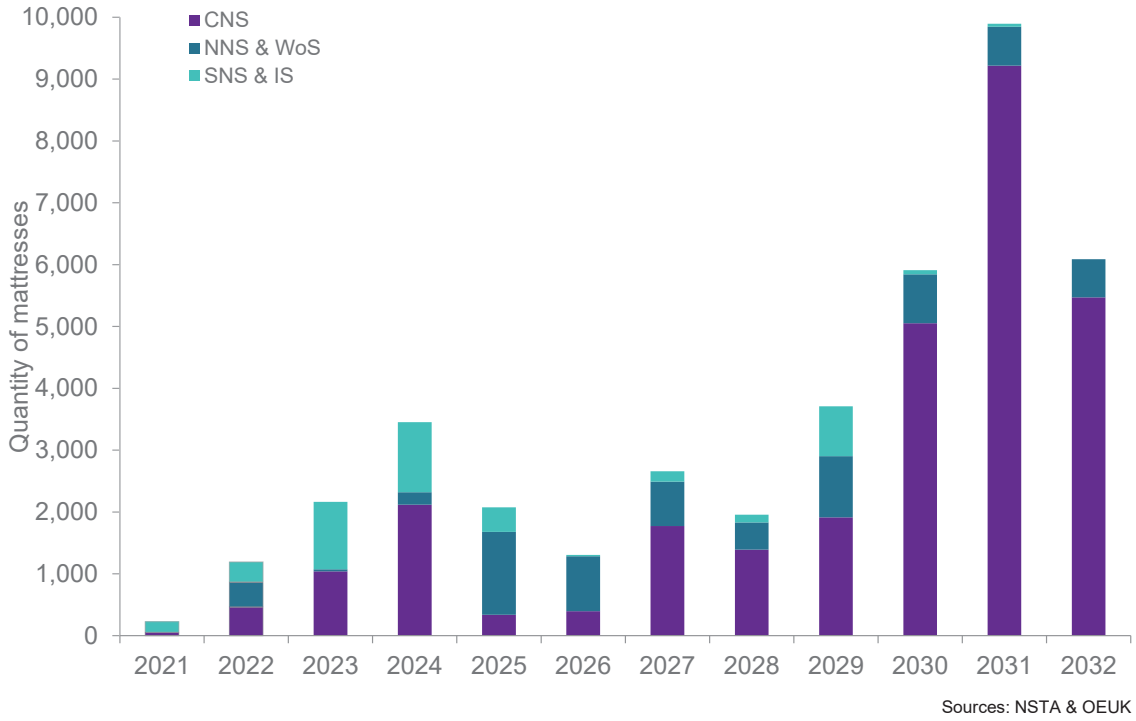
3.10 Onshore dismantling and re-use opportunities

Figure 16a
Mass of infrastructure coming ashore



Source: OEUK, NSTA

Figure 16b
Mattress removals



Sources: NSTA & OEUK

Opportunity knocks… onshore: last year's forecast of over 1.3mn tonnes of infrastructure to come onshore in the 10-year period for re-use or recycling is now firmed up. Although 2023 and 2024 show a dip, a steep rise in 2025 will continue until 2031 – a welcome boost to the UK onshore market.

The year 2027 once again stands out as the peak, with over 250,000 tonnes potentially hitting the UK shores. Ensuring that the UK supply chain is able to land this work is important: jobs and the wider economy need it. The industry has committed to at least 50% local content in decommissioning work, in the North Sea Transition Deal.

Topsides and substructures account for the majority of the tonnage which should pep up the growing UK onshore market. With this significant opportunity knocking, even more re-use and repurposing opportunities should arise. Last year there were significant advancements here, including ASCO's re-use of a 16-inch North Sea subsea isolation valve in a field in Africa.

The UK supply chain continues to work hard to ensure re-use across the sector. Innovative examples include the 'Legacy locker' from J+S Subsea, which helps industry to maintain production by providing a portal for new and refurbished equipment.

Concrete mattress removals on the rise: shared campaigns may bring some work forward to the mid-2020s, depending on market conditions and competition for resources. Repurposing concrete mattresses is an area rich in opportunities for growth.

While solutions within the construction and agricultural industry have been used in the past, other plans may await the 40,000 or more mattresses that are to be recovered by the end of the decade. The rate has been rising steadily since 2021.

OEUK's newly formed circular economy network aims to address the multitude of opportunities with this and indeed other spaces. OEUK's re-use and repurposing database will be of value here as it also encourages cross-sector collaboration.

Case study: Boskalis Subsea Services

Boskalis Subsea Services (BSSL) has been supporting a major operator for a number of years on its North Sea decommissioning programme, covering a range of assets and mainly providing diving support and subsea infrastructure removal. It has deployed its fleet of diving and construction support vessels. Since 2014, BSSL has delivered over 2,000 days offshore, working collaboratively with safety, trust and sustainability at the forefront.

Mattress recovery plays a huge role in the subsea infrastructure removal programme of many decommissioning projects. Between November 2022 and May 2023, BSSL was contracted to conduct the following works across the client's North Sea assets:

- Cutting and recovery of rigid spools, flexibles and control jumper removal
- Structure preparation works and recovery
- Blind flange installation and leak test
- Flexible and umbilical recovery - reverse reeling
- Well / XT preparation works
- Suction pile recovery
- Waste management plan

As part of this campaign, BSSL removed about 1,280 mattresses from multiple assets. These mattresses were retrieved using speed loaders to suit both 2 m and 3 m width, weighing between 2.75 tonnes and 4.7 tonnes respectively. Typically, these mattresses are returned to shore and broken down as aggregate. However, as part of the sustainability drive on this programme, the retrieved mattresses have been used as a stabilisation tool for a ground embankment at a soon-to-be constructed grain store, with a footprint of 15,000 ft².

Sustainability, re-use and repurposing is at the core of BSSL's ethos when conducting decommissioning activities. Every effort is made to repurpose all the recovered equipment in conjunction with our clients requirement, limiting waste. The repurposing of the concrete mattresses facilitated a structural cost saving initiative, which can be replicated in many types of ground works.

4 The wider North Sea

4.1 North Sea decommissioning 2023-32

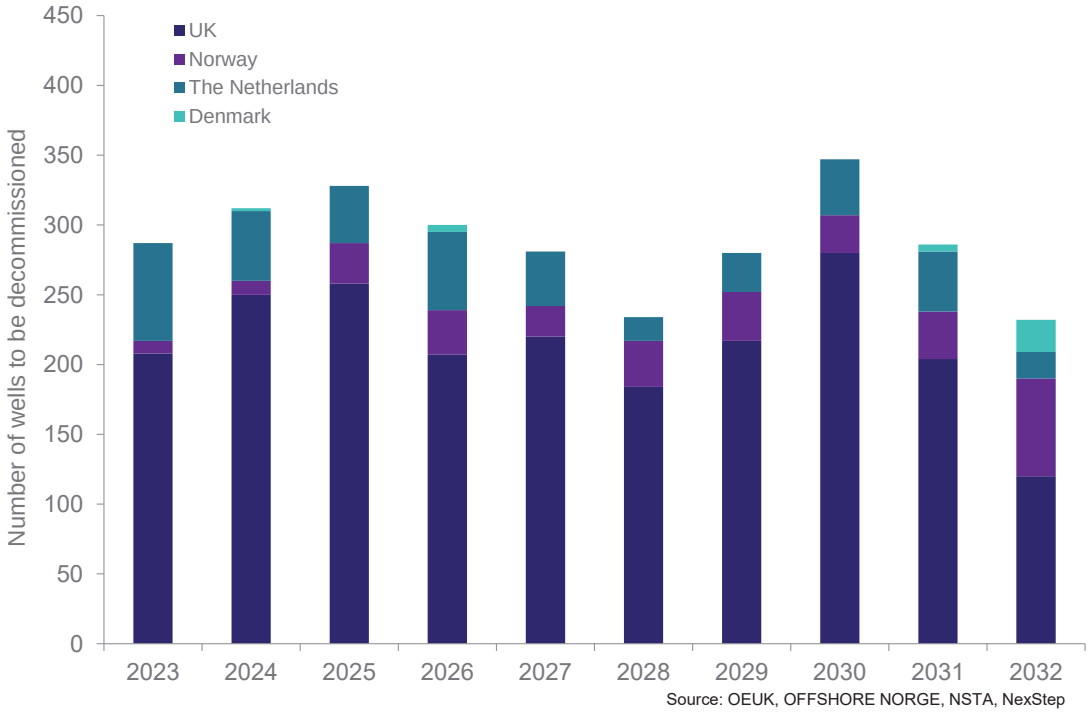
The UK accounts for almost three-quarters of the North Sea's decommissioning work in the period 2023-32, with 74% of the well decommissioning work, 74% of topsides tonnage and 75% of substructure tonnage all being handled within the UK.

The UK supply chain must be equipped to capture as much of this work as possible to UK shores. More work is needed in many areas of the supply chain to achieve this, including, heavy lift, subsea and onshore disposal. A competitive fiscal regime alongside sufficient regulatory allowances would provide a solid footing for the UK to capture the prize.

OEUK's equivalent trade associations in Norway and the Netherlands have kindly provided data to highlight the decommissioning opportunities across the North Sea. Data from Norway was collected by Offshore Norge while for the Netherlands, NexStep and the Dutch oil and gas industry represented by Element NL were the data-providers. OEUK also collected data directly from operators in Denmark in order to develop a wider picture of the North Sea.

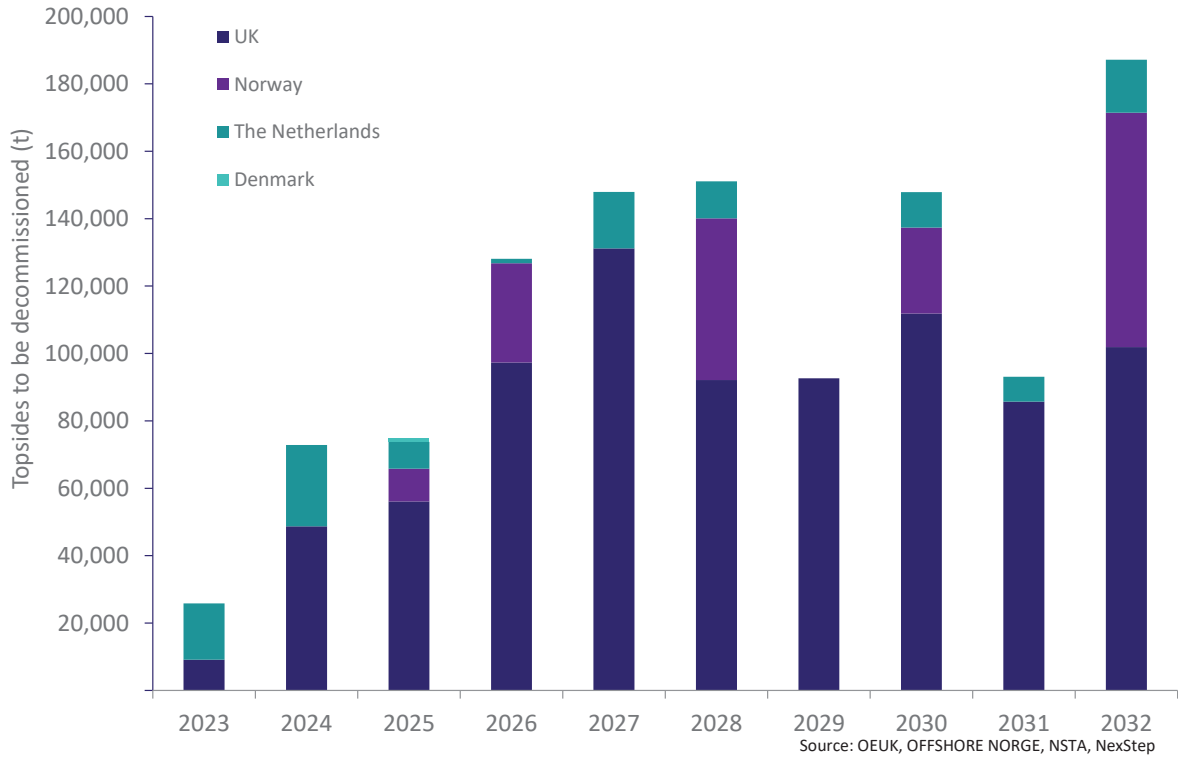
Country	Wells	Topsides	Substructures
UK	74%	74%	75%
The Netherlands	14%	10%	10%
Norway	10%	16%	15%
Denmark	1%	0%	0%

Figure 17a
Well decommissioning in the North Sea



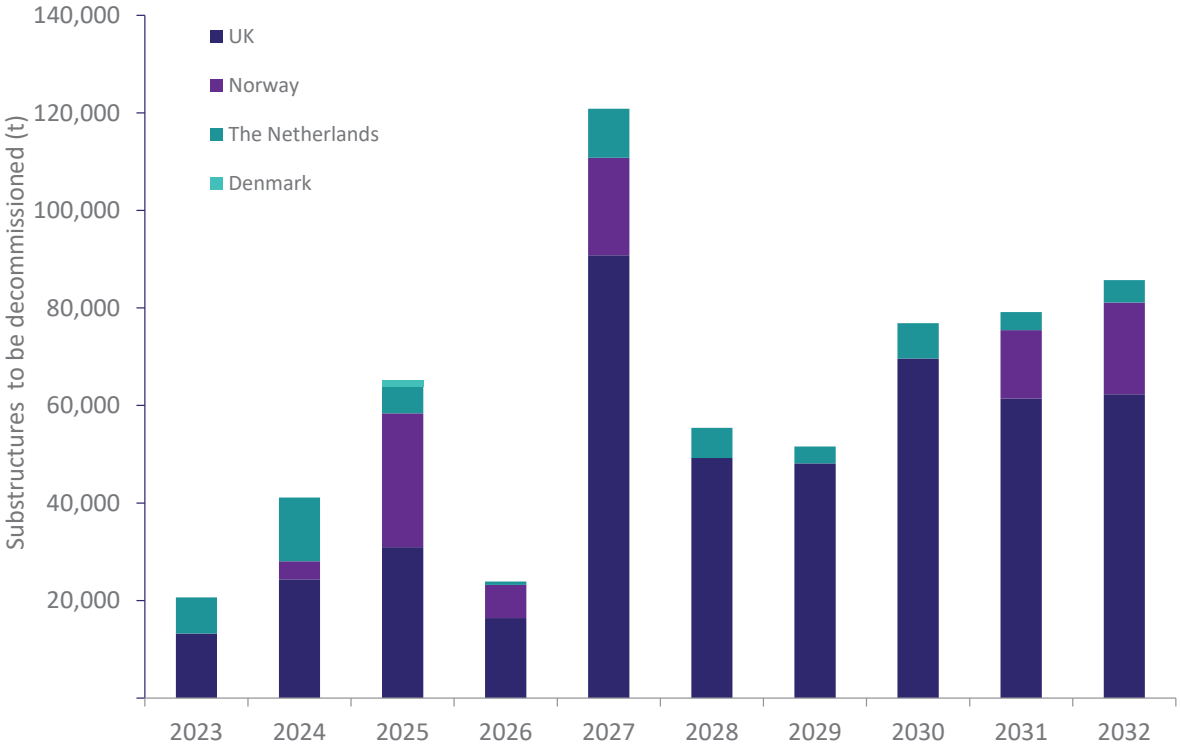
Source: OEUK, OFFSHORE NORGE, NSTA, NexStep

Figure 17b
Topsides mass decommissioning in the North Sea



Source: OEUK, OFFSHORE NORGE, NSTA, NexStep

Figure 17c
Substructure mass decommissioning in the North Sea



Source: OEUK, OFFSHORE NORGE, NSTA, NexStep

4.2 Norway's decommissioning plan

Number of wells to be decommissioned: 301 of which:
Platform wells: 242
Subsea wells: 50
Suspended E&A wells: 9

Topsides tonnage to be removed:
182,262

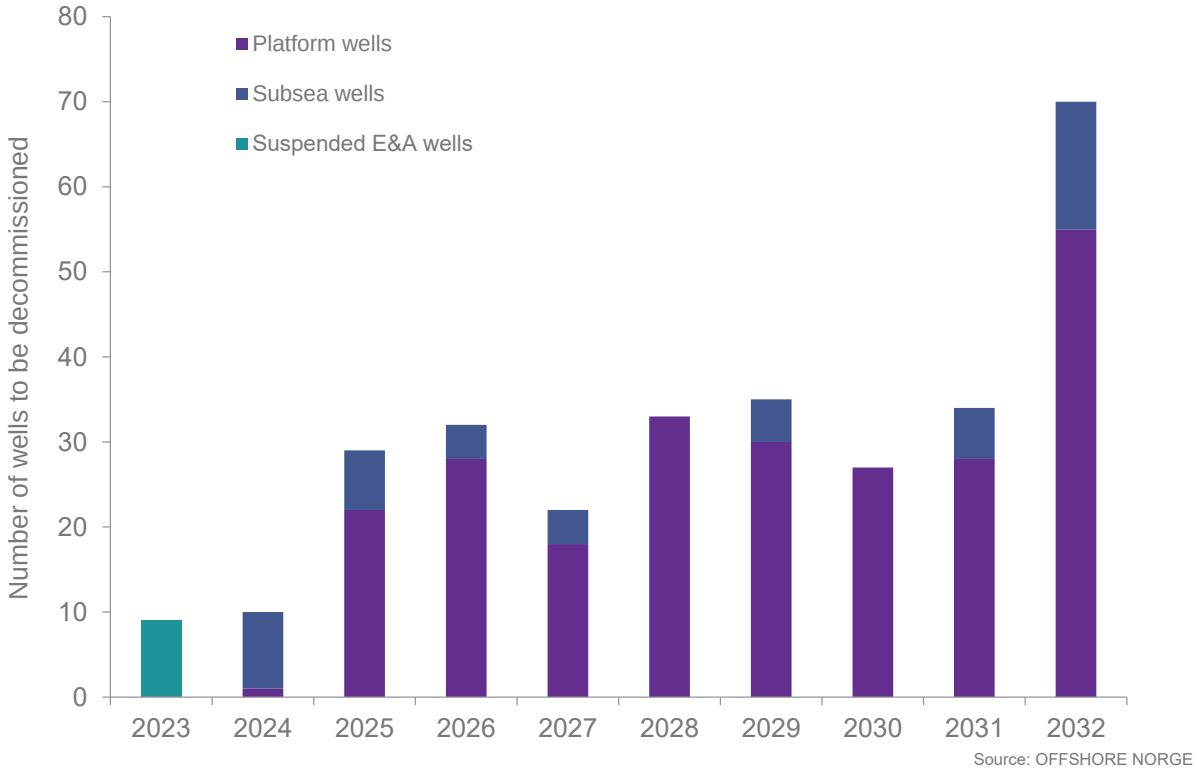
Substructure tonnage to be removed:
90,724

Pipelines to be decommissioned:
817 km

Umbilicals to be decommissioned:
178 km

Mattresses to be decommissioned:
932 tonnes

Figure 18
Norwegian wells



Source: OFFSHORE NORGE

4.3 The Netherlands decommissioning plan to 2032

Number of wells to be decommissioned: 403 of which:
Platform wells: 302
Subsea wells: 15
Suspended E&A wells: 86

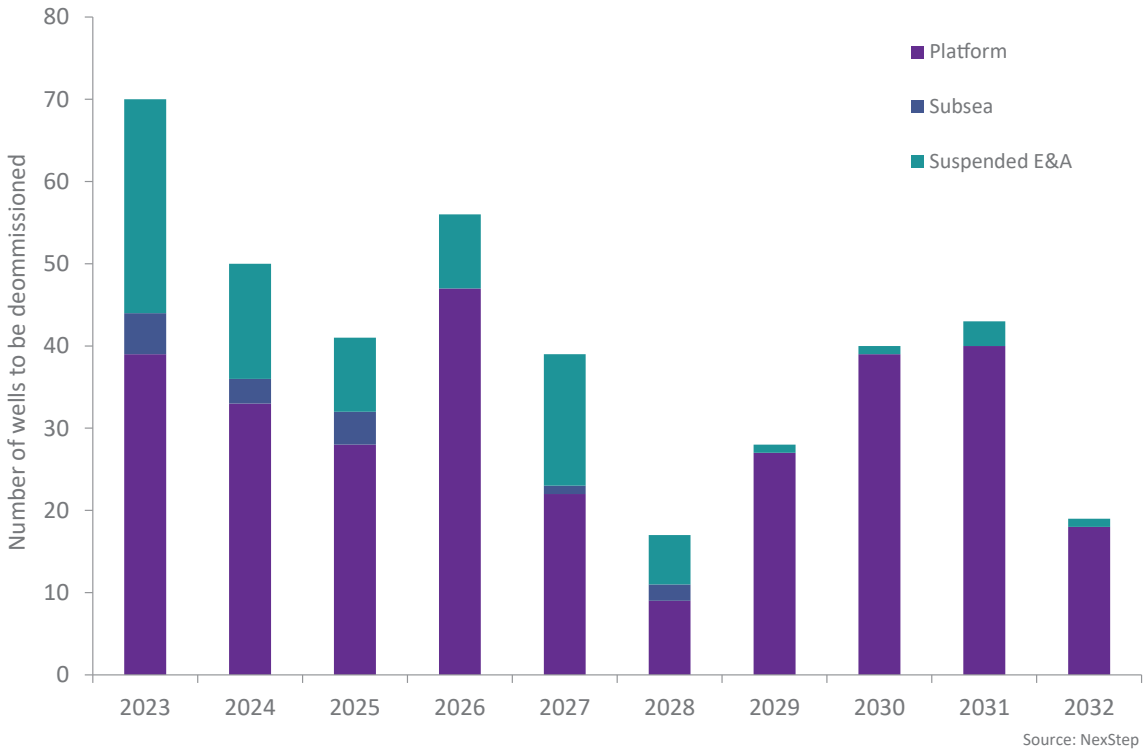
Topsides tonnage to be removed:
111,436

Substructure tonnage to be removed:
62,023

Pipelines to be decommissioned:
1,744 km

Umbilicals to be decommissioned:
179 km

Figure 19
The Netherlands' wells decommissioning plan



Source: NexStep

Case Study: Nexstep's wells campaign

Nexstep (National Platform for Re-use and Decommissioning in the Netherlands) initiated a joint campaign to decommission mudline suspended (MLS) wells, which was successfully completed in September 2023. This involved bringing together six major operators in the Netherlands who benefited from the optimised and integrated decommissioning approach that used vessels instead of a drilling rig.

In total 30 MLS wells were removed, including (if required) setting of cement plugs and removal of oil based mud (OBM) without any spills to the environment. Nexstep provided the joint campaign management and offshore supervision on behalf of the operators.

Oceaneering was selected in a tendering approach in 2021 following its experience as a lead contractor for multi-client decommissioning scopes (Rig Chase™). It provided a solution for zero-spill OBM removal from part of the wells using a mud containment system. A phased approach resulted in more economical and right-sized vessels to complete the specified wellhead removal work scopes per phase in a single campaign. This delivered multiple client benefits including:

- Avoiding OBM spills;
- Reducing environmental impacts from CO_2 by using vessels instead of a rig and avoiding NO_x deposition on Natura 2000 areas by using a selective catalytic reduction system on the vessels;
- Campaign scheduling and optimising done by contractor with limited operator involvement and time between phases allowing adjustments of plan based on new information (if applicable);
- Cost savings exceeding 30% were achieved by moving scope from rigs to vessels; sharing risks and costs between operators; and applying learnings.

The integrated approach, close co-operation of the six operators and aligning of documentation also facilitated:

- a more efficient approval process of well programmes with the regulator, the State Supervision of Mines;
- obtaining environmental permitting;
- sharing of campaign management and offshore supervision.

Learnings from this campaign will be used in the preparation of a second campaign for MLS wells which is expected to be a mix of vessel and rig-based approach.

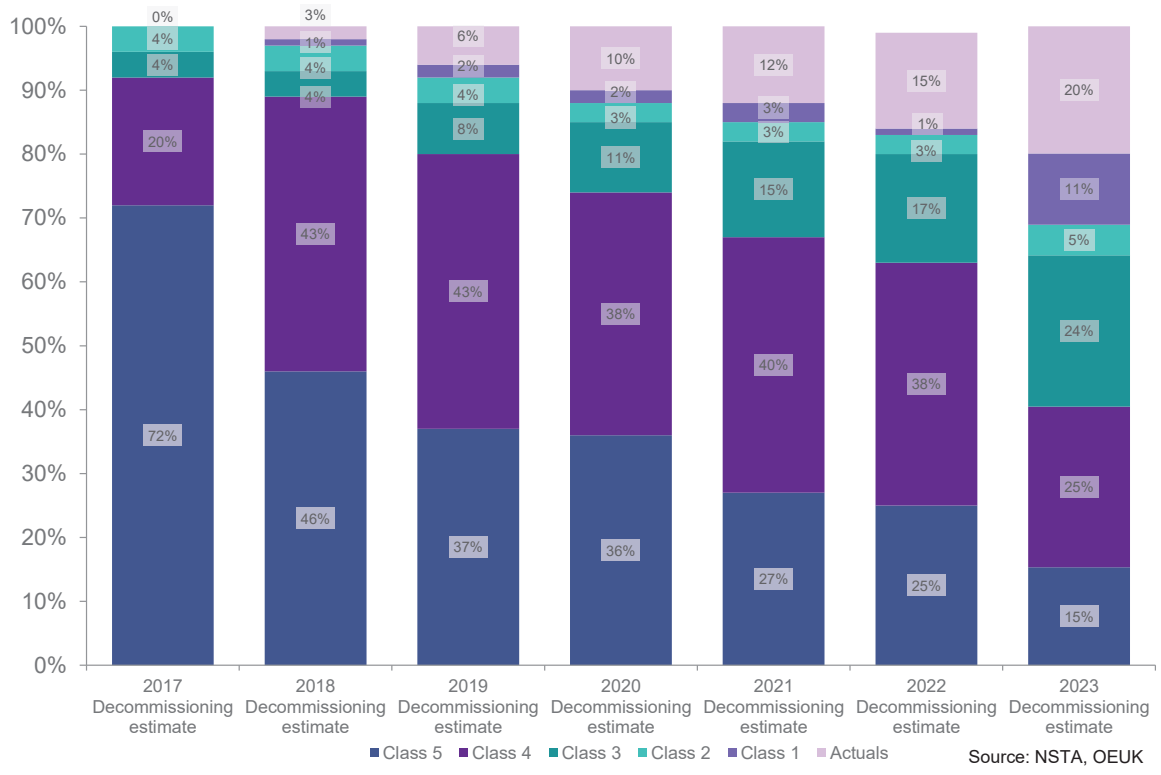
Appendices

5.1 Maturity of estimates

Each year UK operators provide the cost classification for each of their decommissioning projects using the Association for the Advancement of Cost engineering (AACE) classifications. These seek to define the stage of each project and indicate the degree of uncertainty in the estimates.

Class 4 or 5 estimates mean that the projects are in the early planning stages where the scope of work is still being defined and feasibility studies are being carried out. Class 5 estimates have an expected accuracy range of -20 to +100 percent. This range narrows over time as more work is done to increase the understanding of the work involved.

Class 2 estimates represent projects that are in the contracting stage with some activities already being executed. These have a higher degree of accuracy of between -5 and +20 percent.



5.2 Glossary

AACE	Association for the Advancement of Cost Engineering
Asset Stewardship Survey	A survey run by the NSTA which creates a single source of robust data. It is used to inform stewardship reviews and provide meaningful insights into current and forecast activity in the UKCS.
CCUS	Carbon Capture, Utilisation and Storage
CGBS	Concrete gravity-based structure
CNS	Central North Sea
Comparative Assessment	Used to compare options, examine differences and identify the 'most preferred' option in the development of decommissioning programmes for: a) All installations for which derogation is sought under OSPAR Decision 98/3; b) All pipelines being decommissioned under the Petroleum Act 1998; and c) All drill cuttings piles that are not screened out at Stage 1 of OSPAR
CoP	Cessation of production
COP26	The 2021 United Nations Climate Change Conference, more commonly referred to as COP26, was the 26th United Nations Climate Change conference, held in Glasgow 2021
Decommissioning Programme	The Petroleum Act 1998 requires owners to set out the measures to decommission disused installations and/or pipelines in a decommissioning programme. A decommissioning programme must identify all the items of equipment, infrastructure and materials that have been installed and describe the decommissioning solution for each.
Derogation	In the case of offshore installations, derogation is related to leaving a structure wholly or partially in place as an exemption to the OSPAR convention which prevents disposal of waste at sea.
DIT	Department for International Trade
EBN	Energie Beheer Nederland, state entity upstream
E&A	Exploration and appraisal
FPSO	Floating production, storage and offload vessel
HSE	Health & Safety Executive
IS	Irish Sea
Making safe	'Making safe' of facilities includes cleaning, freeing equipment of hydrocarbons, disconnection and physical isolation, and waste management. 'Making safe' of pipelines involves depressurising them and removing any hydrocarbons. Then the pipelines are cleaned and purged, in line with the cleaning programme based on the specific needs of the system.

Mattresses	A structure laid over or under a pipeline to provide protection, stabilisation or structural integrity.
NNS	Northern North Sea
NOGEPA	Netherlands Oil and Gas Exploration and Production Association
NZTC	Net Zero Technology Centre
OGA/NSTA	Oil & Gas Authority (now North Sea Transition Authority)
OPRED	Offshore Petroleum Regulator for Environment and Decommissioning
OSPAR	OSPAR is the mechanism by which 15 governments & the EU co-operate to protect the marine environment of the northeast Atlantic.
Post-CoP OPEX	Operational expenditure after production has ceased.
SNS	Southern North Sea
Topsides	The facilities which sit on top of an installation, typically including drilling, processing and living quarters.
Work Breakdown Structures (WBS)	The WBS shows all elements of a typical decommissioning project and forms the basis for calculating decommissioning expenditure during different stages of the process.
WDON	Well Decommissioning Operators Network
WG4	Work Group 4
WoS	West of Shetland

5.3 Forecast activity in the UKCS over the next decade in detail

		Northern North Sea & West of Shetland	Central North Sea	Southern North Sea and Irish Sea	Total UKCS
Number of wells to be decommissioned	Platform wells	398	461	452	**1,311**
	Subsea wells	243	415	58	**716**
	Suspended E&A wells	50	54	33	**1137**
	Total	**691**	**930**	**543**	**2,164**
Number of topsides to be removed		15	26	93	**134**
Total weight of topside to be removed (tonnes)		305,904	346,038	174,718	**826,660**
Number of substructures to be decommissioned		11	20	99	**130**
Total weight of substructures to be decommissioned (tonnes)		163,260	172,198	131,054	**466,512**
FPSO weight to be removed (tonnes)		98,730	181,250	20,576	**300,556**
Subsea structures to be removed (tonnes)		36,383	79,946	3,797	**120,126**
Number of mattresses for removal		6,646	28,707	3,858	**39,211**
Length of pipelines, umbilicals and cables to be decommissioned (km)		2,378	5,517	1,294	**9,189**

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