



OffshoreWind

Introduction



Gus Jaspert
Managing Director, Marine

I'm delighted to share the 2023 UK Offshore Wind Report. Delivering this holistic view of the UK offshore wind industry is of great importance to us. The Crown Estate's purpose is to deliver lasting and shared prosperity for the nation, using the land and seabed we manage to help catalyse Net Zero, restore nature, create thriving communities and deliver national value. When it comes to our work managing the seabed, this means taking a strategic and long-term view of this vital resource.

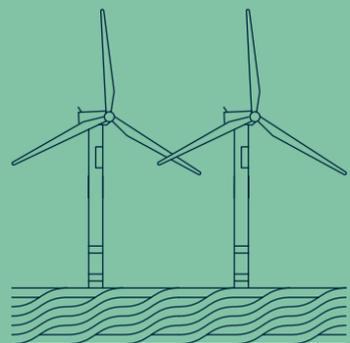
The UK's ability to rise to these challenges is directly linked to the growth and success of our offshore wind industry. Reading this report, it's extraordinary to see how far we've come in the almost 25 years since the first turbines were installed, collectively building a world-leading offshore wind market capable of powering 14.2m homes, drastically reducing our reliance on fossil fuels.

But as we look ahead we face new challenges which require new approaches. We need to achieve more in the next decade than we have in the last 25 years, accelerating the growth of the sector to maximise its contribution to Net Zero ambitions and unlock the jobs and prosperity it can bring. Yet at the same time our seas are under mounting pressure, supporting a growing number of livelihoods, industries and natural habitats. Growth must be achieved in a responsible way which allows all these other interests to thrive.

Achieving that means taking a more strategic, holistic and data-led approach than ever before to ensure we make the most of this vital resource so that it can contribute to the needs of our country and nature.

2023 saw many examples of new ways of thinking and new approaches being realised. Through our Whole of Seabed Programme we are digitally mapping the seabed space needed to meet future demand for a wide range of industries, infrastructure, and habitats out to 2050. This work will support the development of a pioneering Marine Delivery Routemap enabling partners and us to forward plan how we use the seabed in the future, which recognises the hat-trick of priorities we must consider - nature recovery, jobs and regeneration, and achieving Net Zero.

We are increasing collaboration with systems operators, governments and the sector to take a more strategic approach to resolve system issues, de-risk and accelerate the leasing process and put social value at the heart of decision-making. This includes working with the Electricity System Operator (ESO) and others to develop a Strategic Spatial Energy Plan; planning ahead for grid connections; the development of an Industrial Growth Plan (IGP) that could support long-term growth of the UK offshore wind sector and boost the UK's economy by up to £25bn and support over 10,000 jobs; and preparing to launch a pilot £10million Supply Chain Accelerator fund



2,766

operational offshore
wind turbines in
the UK

to support supply chain opportunities created through the Celtic Sea Leasing Round 5, with a further £40 million earmarked for offshore wind. For Offshore Wind Leasing Round 5 we set clear expectations on the commitments developers will need to make when it comes to delivering broader social, environmental and economic benefits arising from their projects.

We have been able to move faster than ever before between leasing rounds, bringing the 4.5GW Offshore Wind Leasing Round 5 opportunity to market within a year of signing Round 4 Agreements for Lease, whilst welcoming the Government's intention to work towards a further pipeline of up to 12GW. This acceleration is not just about faster leasing, but also about faster deployment of offshore wind - in part, thanks to up-front Habitats Regulations Assessments, planning together for grid connections and investing millions in surveys to inform site selection. We also announced a process to consider requests for increases in capacity on several projects already in agreement to ensure that we are maximising the potential from existing wind farm areas.

Deeper collaboration, enhancing evidence and data, forward planning together, resolving system issues, all increasing our pace: this is the shift in mentality we will need to take into the future if we are to meet the UK's critical Net Zero ambitions and ensure the social and economic benefits of the offshore wind sector are felt across the country.

We've come a long way, and built a solid base from which, together, we can accelerate the energy transition, support nature recovery and grow the

supply chain. But we want, and need, to do even more. That's why we welcomed the UK Government's commitment to bring forward legislation that will modernise our investment powers, in particular our ability to borrow. This would allow us to invest significantly more, to have a greater impact and accelerate the sustainable deployment of offshore wind for the benefit of the country and the environment.

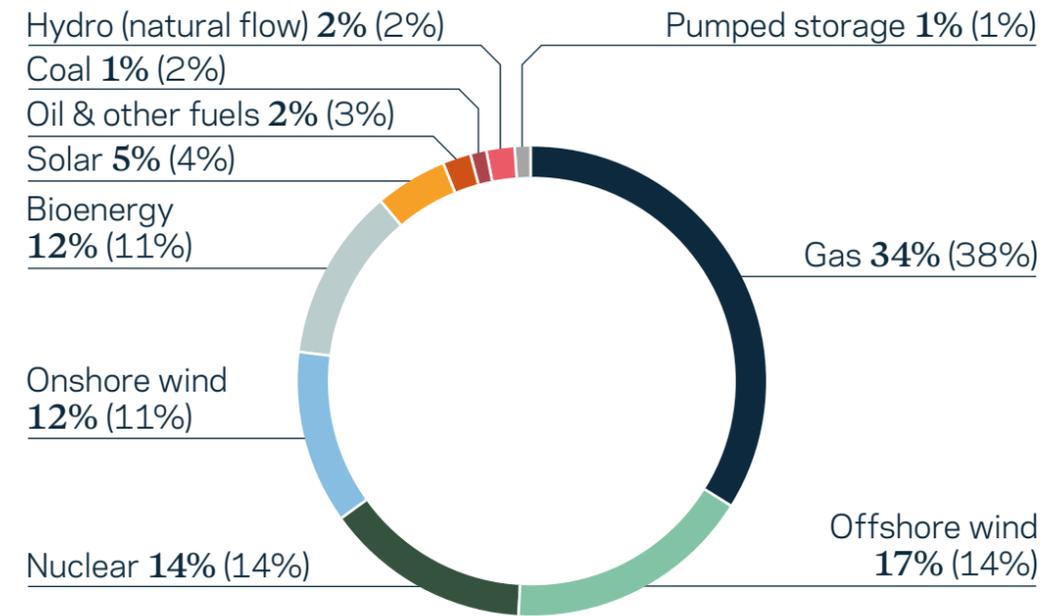
The one constant we can rely on is increasing volatility, whether that's geopolitical, economic or environmental. However, this report paints a picture of a robust industry which is able to overcome challenges and continue to grow. That's in no small part thanks to a commitment to work together, which will be a powerful force as we take on the challenge to do more, and do things differently, to ensure the continued success of the UK offshore wind industry.

I would like to thank all those who have contributed to this report and shared data, particularly Crown Estate Scotland, allowing us to present a holistic view of the UK offshore wind industry. I hope you enjoy reading this report and reflecting on yet another extraordinary year for the UK offshore wind industry.



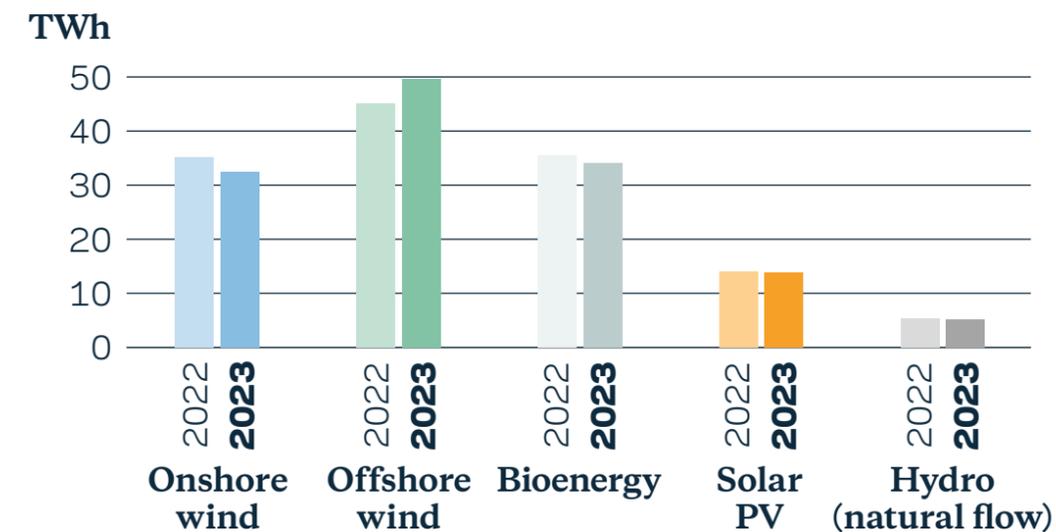
Gus Jaspert
Managing Director, Marine

Figure 1: UK electricity generation mix 2023 (2022 comparison)¹



¹ Source: Department for Energy Security and Net Zero (DESNZ).

Figure 2: Renewable energy generated by fuel type²



² Source: Department for Energy Security and Net Zero (DESNZ).

49TWh

Amount of electricity produced by UK offshore wind in 2023

50%

UK offshore wind generated enough electricity in 2023 to supply the needs of 50% (14.2m) of UK homes

17%

Proportion of total UK electricity generated by offshore wind in 2023³

18.5m tonnes⁴

CO₂ displaced through use of renewable energy⁵

³ Source: DESNZ Energy Trends publication March 2024

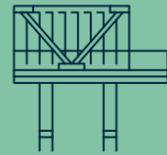
⁴ Rounded up from 18.49m

⁵ How this is calculated can be found at the [end of the report](#).



49TWh

UK offshore wind electricity produced in 2023



26

Offshore Transmission Owners



15GW

Operational offshore wind capacity



52

Offshore wind farms in the UK



43%

Of European offshore wind capacity hosted within UK waters

Marine Data Exchange



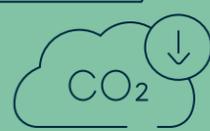
10 years

Since The Crown Estate established The Marine Data Exchange



50%

UK offshore wind supplied the equivalent electricity needs of 50% of UK households in 2023¹



18.5m

Tonnes CO₂ displaced by use of offshore wind energy



30k+

Total offshore wind workforce, growing to c.100,000 by 2030²



96.5%

Performance Index, technical availability of the wind farm fleet in England and Wales



41%

Reduction in Lost Time Injury Frequency (LTIF) in the UK³



Offshore Wind 2023 highlights

Looking forward: A strong pipeline of offshore wind capacity

50GW

UK Government offshore wind capacity target for 2030



93GW

Pipeline of offshore wind capacity in the UK including operational, committed, under development / preplanning and current potential⁴

4GW

Of additional capacity through potential capacity increases⁵

4.5GW

Capacity of floating offshore wind to come from Leasing Round 5⁶

c.268,000km²

Of seabed under management, equating to approximately twice the land area of England, Wales & Northern Ireland and included in the 2050 Marine Delivery Routemap

1 49TWh of power generated is the equivalent of the annual electricity needs of 50% of UK homes.

2 OWIC - Offshore Wind Skills Intelligence Report June 2023.

3 LTIF tracks fatalities and lost work day injuries per million hours worked. Reduction is based on latest data available, 2022 v 2021.

4 See page 36 of this report for more detailed explanation on the offshore wind development pipeline.

5 Up to 4GW, subject to assessments and approvals. Part of the overall 93GW pipeline.

6 Part of the overall 93GW pipeline.

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Data & evidence

This report is produced annually by The Crown Estate to provide a picture of the UK offshore wind industry, using our own and publicly available data.



We work across communities, cities, countryside, coast and the seabed with a responsibility – and opportunity – to play our part for the benefit of the nation, its finances and its future.

At the heart of our business lies a set of core duties to grow both the value of the portfolio into perpetuity and the income we return to the Treasury. Established through an Act of Parliament, we operate independently and commercially, occupying a space between the public and private sectors. Today, we express this through our purpose: to create lasting and shared prosperity for the nation.

Across our £16 billion portfolio, we are acting in the national interest for today and for future generations. Our strategy focuses on the nation’s long-term challenges where we are best placed to make a difference. We aim to:

- be a leader in supporting the UK towards a net zero and energy-secure future;
- take a leading role in stewarding the UK’s natural environment and biodiversity;
- support thriving inclusive communities and economic growth; and
- responsibly generate value and financial returns for the country.

A company for the country, all our net revenue profit goes to the Treasury for the benefit of the nation’s finances. This has totalled more than £3.2 billion over the last ten years.



Crown Estate Scotland is a public corporation which manages a range of property, including the seabed, to deliver lasting, valuable benefits to Scotland and its people. Our revenue profits are paid to the Scottish Government for use in public spending. Part of our role is awarding the rights to build and operate renewable energy projects in Scottish waters, and we are committed both to supporting the development of Scotland’s blue economy and the Scottish Government’s target of reaching net zero emissions by 2045. To learn more about the work we do and the causes we support, visit [crownestatescotland.com](https://www.crownestatescotland.com)



Acknowledgements

In order to provide a UK-wide picture of offshore wind, Crown Estate Scotland has provided statistics for this report and there are features on the performance and development of the Scottish offshore wind portfolio.

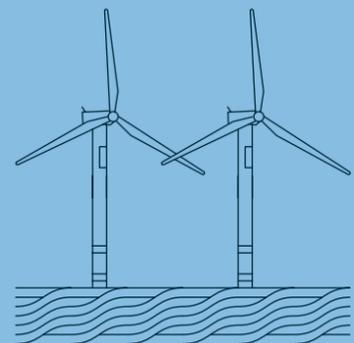
Our thanks to all those who have provided content, in particular:

Balfour Beatty; Ben Barden Photography; Dan Bolt; Diamond Transmission Partners; Dogger Bank Wind Farm; Equitix; Frontier Power; Global Energy Group; Jason Hawkes; Kate Harvey (G+); Lewis Jeffries; Monty Rakusen; Offshore Wind Industry Council (OWIC); Ofgem; Ørsted; Scott Young (Renewable UK / OWIC); Valery Joncheray; World Forum Offshore Wind.

Offshore wind farm overview

It has been 20 years since The Crown Estate awarded its first commercial offshore wind lease and since then the UK market has grown rapidly. It now hosts 43% of all European offshore wind capacity, and generates enough electricity to supply the needs of 50% of UK homes.

In this section we take a look at some of the key statistics in the UK and global offshore wind markets, some of the milestones achieved by UK offshore wind farms in 2023, and developments in the wider market to support the industry to continue to thrive.



52

The number of wind farms in UK waters (operating and under construction)

Siemens Gamesa offshore wind turbine blade factory, Hull



2023 was a year in which the industry set more records. Offshore, a record 49TWh of green electricity was produced during 2023, and on the morning of 21 December, wind power, including onshore, produced a record 56% of Britain’s electricity.¹

Total offshore wind operational capacity in the UK now stands at 14.7GW, generated by 45 offshore wind farms comprising 2,766 turbines.

In 2023 the under-construction pipeline continued to grow despite challenging economic conditions, from 6.7GW in 2022 to 7.8GW in 2023, equivalent to a 50% increase on the operational fleet.

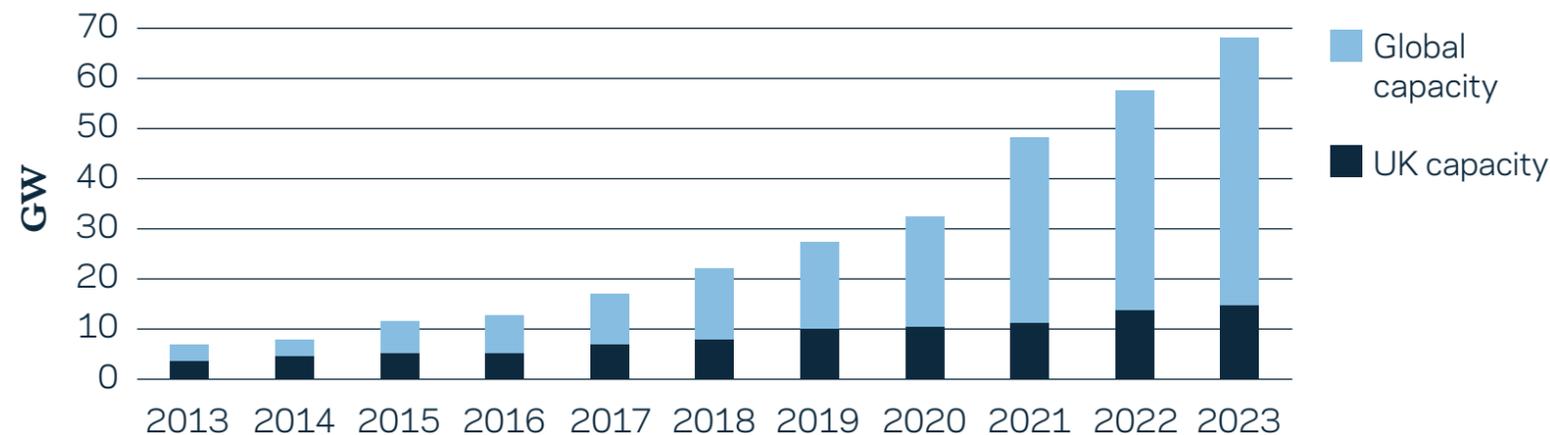
Other milestones in the year included the UK Secretary of State for Energy Security and Net Zero granting development consent to Ørsted’s Hornsea 4 project, Scotland’s largest wind farm,

Seagreen Phase 1 becoming fully operational, and construction beginning for RWE’s 1.4GW Sofia offshore wind farm. The world’s largest offshore wind farm under construction, Dogger Bank, started producing electricity for the first time. It was the first commercial deployment globally of the GE Vernova’s ground-breaking Haliade-X 13MW turbines. At over 130km from shore, the site showcases the shallow waters and windy conditions afforded by the UK market.

Meanwhile, London Array celebrated ten years in operation. When the 630MW wind farm became operational in 2013, it was the largest offshore wind farm in the world and remained so until 2018. The size and scale of more recent projects is a reminder of how rapidly the UK industry has grown in recent years, in part as a consequence of The Crown Estate’s approach to Offshore Wind Leasing Round 3.

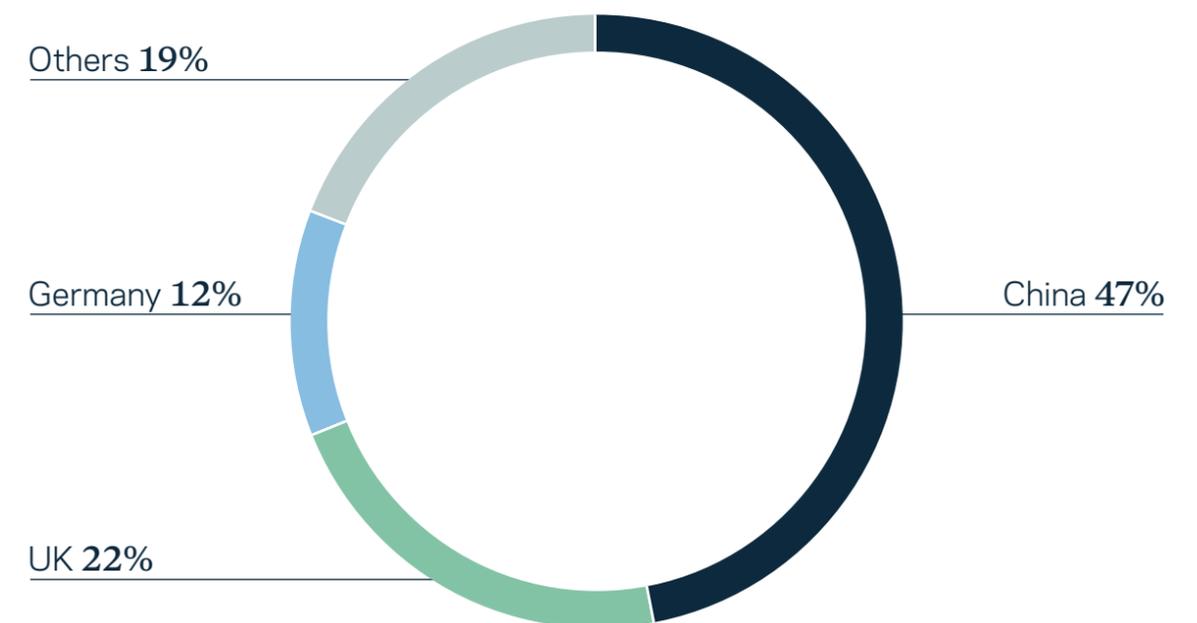
¹ Source: [ESO - Britain’s Electricity Explained: 2023 Review](#) (excludes N Ireland whose system operator is SONI).

Figure 3: Increase in global offshore wind operating capacity



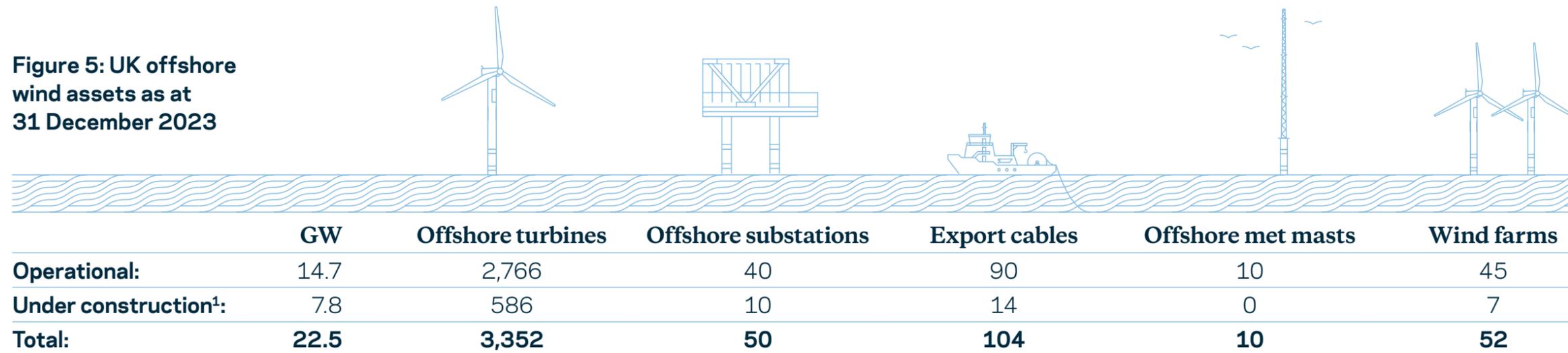
Gwynt y Môr offshore wind farm array.

Figure 4: Global offshore wind operating capacity in 2023

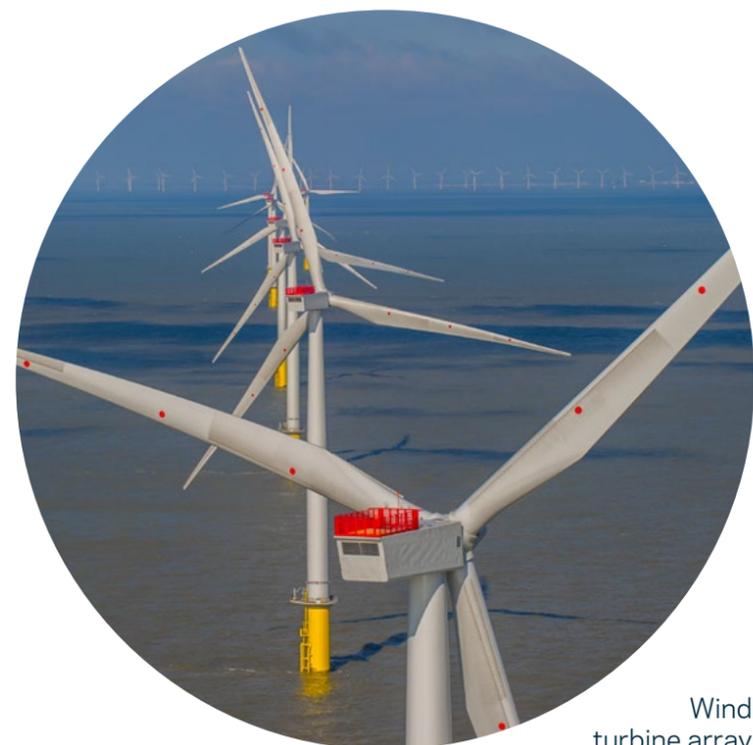


Offshore wind assets, activity and ten year grid connected trends

Figure 5: UK offshore wind assets as at 31 December 2023

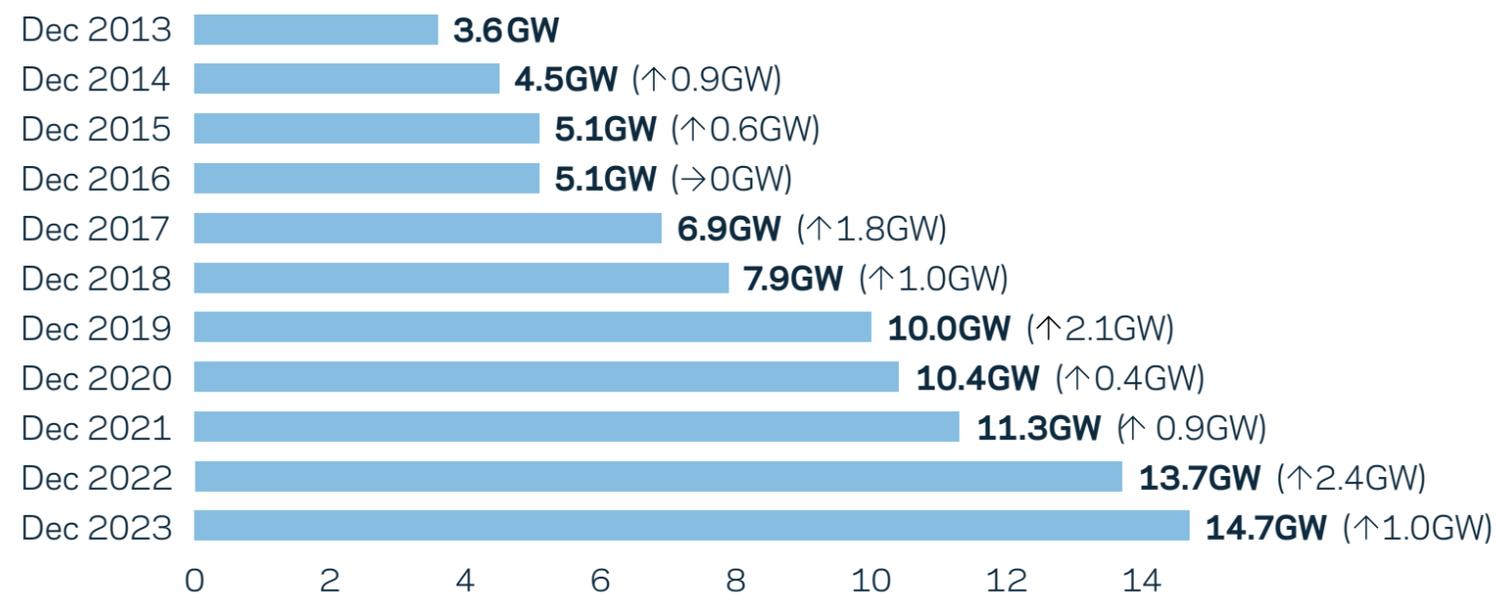


1 Sites under construction, including where first power is achieved, but not yet fully operational.



Wind turbine array

Figure 6: UK offshore wind grid connected² (change from previous year)



2 Grid connected capacity stated refers to the capacity connected to the grid from fully operational and partially operating sites (those under construction but already exporting power at December 2023).

Figure 7: Asset activity in 2023

Wind farms achieving Final Investment Decision

East Anglia THREE

Hornsea 3

Moray West

Wind farms starting offshore construction

Dogger Bank B

Dogger Bank C

Moray West

Sofia

Wind farms under construction

Dogger Bank A

Dogger Bank B

Dogger Bank C

East Anglia THREE

Moray West

Neart na Gaoithe

Sofia

Wind farms achieving first power

Dogger Bank A

Wind farms becoming fully operational

Seagreen Phase 1

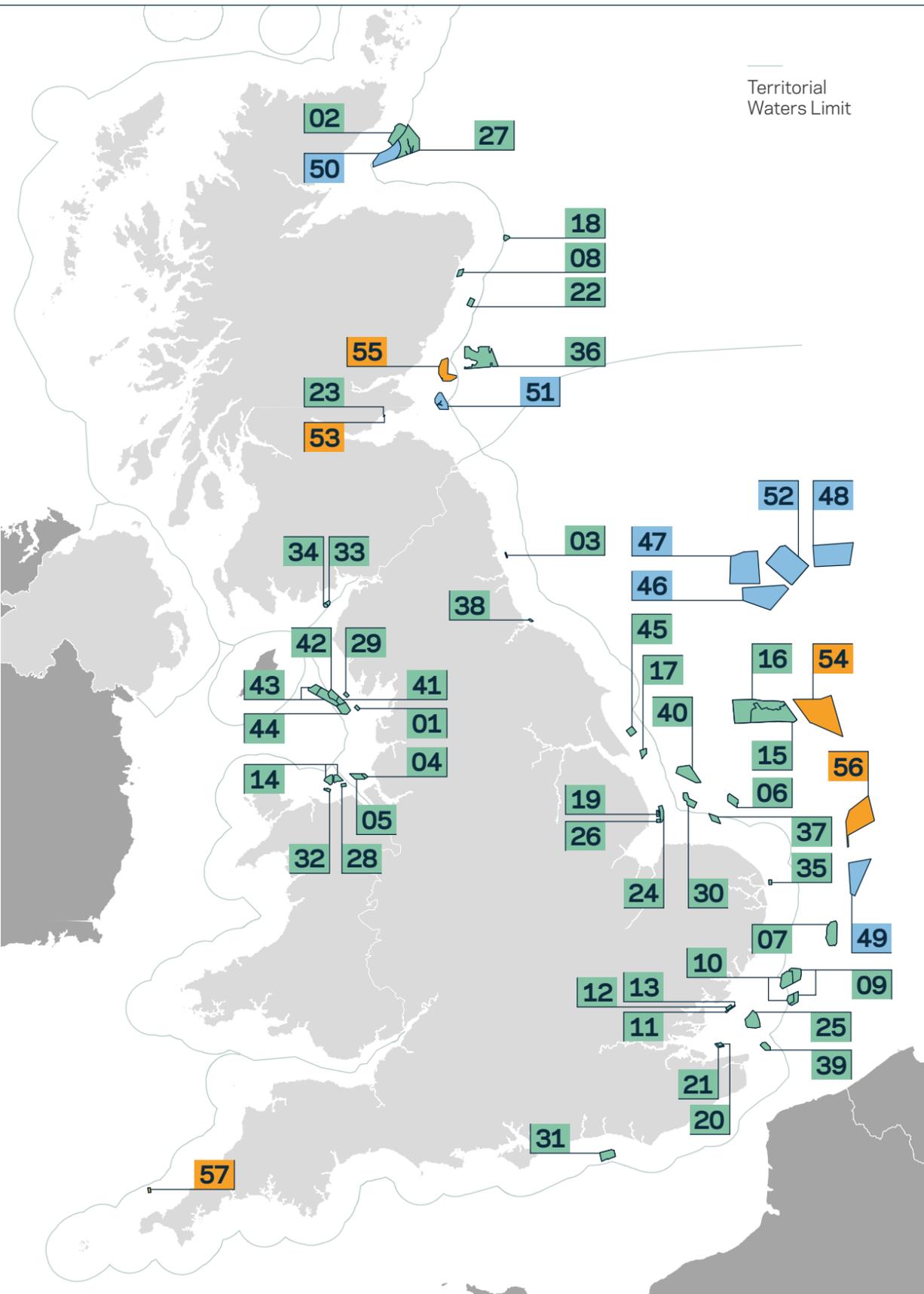


Figure 8: UK offshore wind project pipeline as at 31 December 2023

Operational: Total capacity of wind farms that have been fully commissioned.

	Capacity MW ¹		Capacity MW ¹		
01	Barrow	90	23	Levenmouth Demonstration ²	7
02	Beatrice ²	588	24	Lincs	270
03	Blyth Demonstration Phase 1	42	25	London Array	630
04	Burbo Bank	90	26	Lynn	97
05	Burbo Bank Extension	259	27	Moray East ²	953
06	Dudgeon	402	28	North Hoyle	60
07	East Anglia ONE	714	29	Ormonde	150
08	European Offshore Wind Deployment Centre ²	97	30	Race Bank	573
09	Galloper	353	31	Rampion	400
10	Greater Gabbard	504	32	Rhyl Flats	90
11	Gunfleet Sands Demonstration	12	33	Robin Rigg East ²	84
12	Gunfleet Sands I	108	34	Robin Rigg West ²	90
13	Gunfleet Sands II	65	35	Scroby Sands	60
14	Gwynt y Môr	576	36	Seagreen Phase 1 ²	1,075
15	Hornsea 1	1,218	37	Sheringham Shoal	317
16	Hornsea 2	1,386	38	Teesside	62
17	Humber Gateway	219	39	Thanet	300
18	Hywind Scotland ²	30	40	Triton Knoll	857
19	Inner Dowsing	97	41	Walney 1	184
20	Kentish Flats	90	42	Walney 2	184
21	Kentish Flats Extension	50	43	Walney Extension	659
22	Kincardine ²	50	44	West of Duddon Sands	389
			45	Westermost Rough	210
			Total	14,741	

Under construction: Total capacity of wind farms that have commenced construction but are not yet fully operational.

	Up to capacity MW ¹	
46	Dogger Bank A	1,235
47	Dogger Bank B	1,235
48	Dogger Bank C	1,200
49	East Anglia THREE	1,397
50	Moray West ²	882
51	Neart na Gaoithe ²	448
52	Sofia	1,400
Total	7,797	

Government support on offer: Total capacity of wind farms that have secured a Contract for Difference.

	Up to capacity MW ¹	
53	Forthwind ²	12
54	Hornsea 3	3,000
55	Inch Cape ²	1,080
56	Norfolk Boreas	1,400
57	Wave Hub	30
Total	5,522	

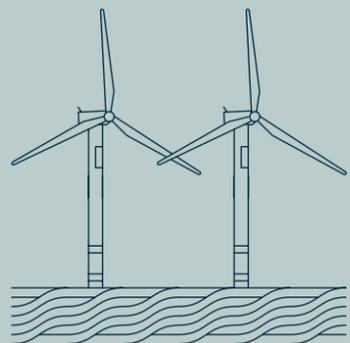
To find out where future development sites are – please see figure 38 on page 39.

1 Capacities noted are rounded to the nearest whole MW. 2 Asset managed by Crown Estate Scotland.

Offshore wind farm performance

The performance of UK offshore wind farms, and how fully plant capacity is used, is a vital indicator of the health and efficiency of the fleet. In this section we look at the performance of offshore wind farms, including capacity factor, power output and the impact of wind speed variation.

We cover performance across England and Wales which is under the remit of The Crown Estate, and Scotland, managed by Crown Estate Scotland.



96.5%

Performance Index
– indicating the
technical availability
of the wind farm fleet
in England and Wales



Walney Offshore Wind farm array

England and Wales Fleet Performance Index

Figure 9: Fleet Performance Index - England and Wales



The Crown Estate's Fleet Performance Index compares metered electricity output against the expected output adjusted for actual wind speed during that period. It gives a direct measure of the performance of the offshore wind farm fleet in England and Wales, without any adjustment for outages and operational events.

The analysis only includes fully operational wind farms excluding the construction period. The analysis includes the whole system of the wind farm and its associated transmission/export of electricity back to shore.

The expected power output is derived from satellite measurements and theoretical power curves. This indirect calculation carries a notable uncertainty, but gives an indication of the technical availability of offshore wind farms.

In 2023 the Fleet Performance Index was 96.5%, down from 97.4% in 2022, with a 10 year weighted average of 97.6%. Events that have had a noticeable impact include Distribution Network Operator (DNO) outages, substation maintenance and turbine main component exchanges.

England and Wales capacity factor

The capacity factor indicates how fully a plant's capacity is used, and varies year on year depending on the wind conditions.

Figure 10 shows the average capacity factor and the power output across all offshore wind farms in England and Wales between 2005 and 2023.

The fleet continues to improve its performance and in 2023 power output across the fleet in

England and Wales reached an all-time high of 42.8TWh, giving a fleet capacity factor of 41%.

This upward trend reflects the continued improvement in turbine technology and the ability of newer wind farms to take advantage of more favourable wind conditions further out to sea.

Details on capacity factors and wind variability in Scotland can be found on [page 14](#).

Figure 10: Capacity factor - England and Wales

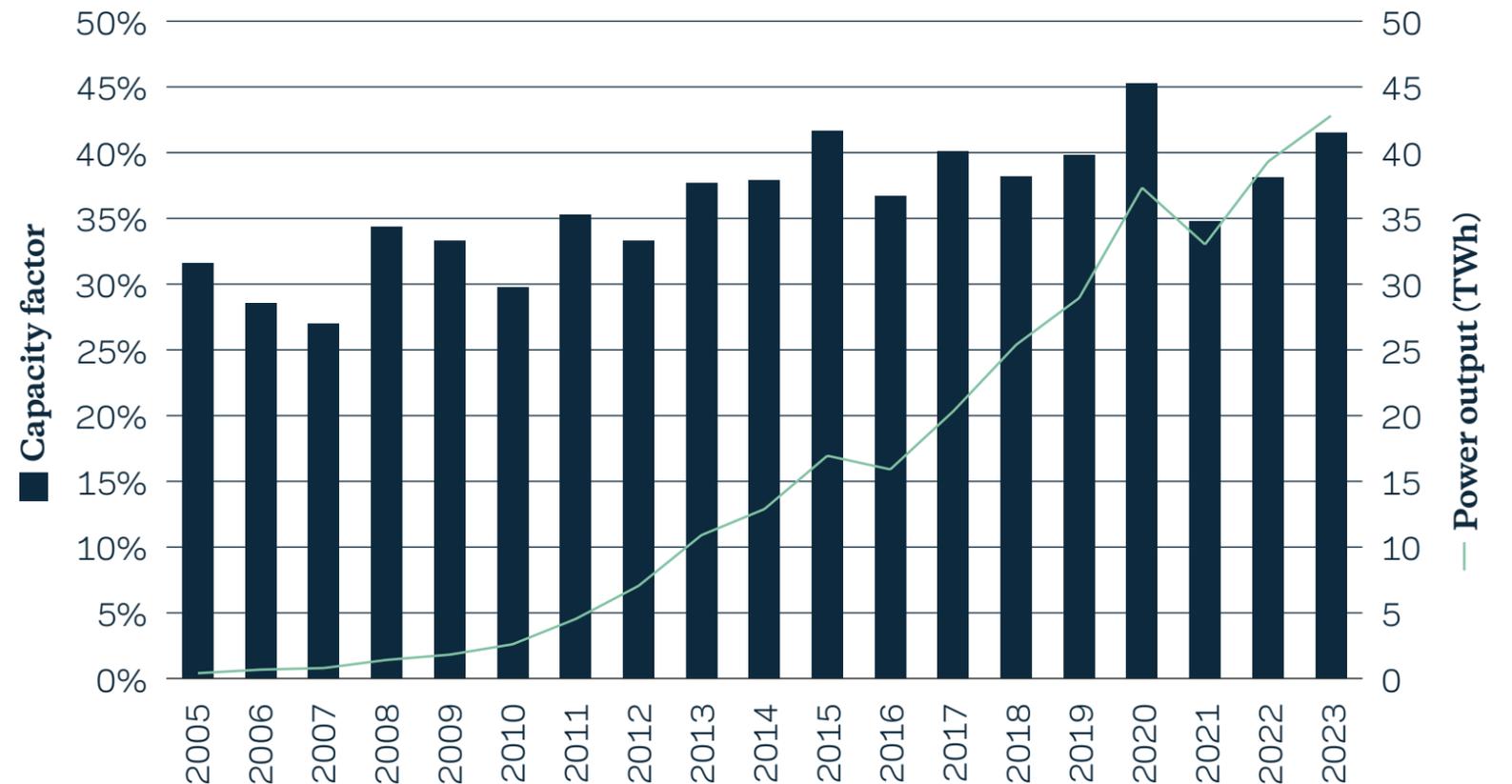
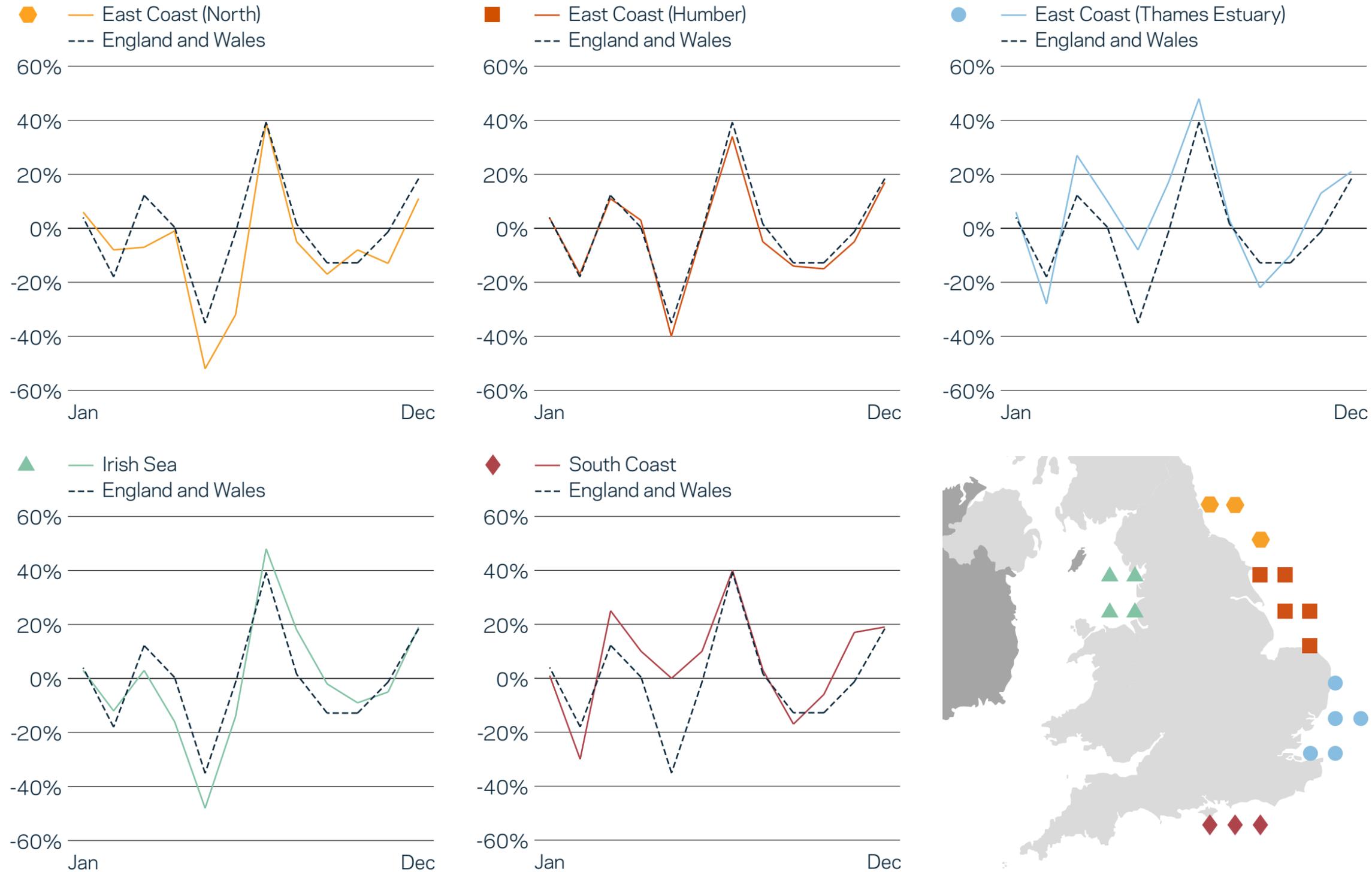


Figure 11: Monthly energy deviation due to wind speed in 2023 (zero on each graph represents the long-term average for each month)



England and Wales wind variability

Figure 11 shows the impact on energy production due to monthly wind speed variation in England and Wales.

The overall energy deviation at the end of 2023 was in line with the long-term average (LTA). February and May were significantly below the LTA with offshore wind production down by 18% and 35% respectively. Conversely, July proved to be an exceptionally strong month, with production 39% above average. This will have presented challenges to planning and carrying out summer construction and maintenance campaigns, aiming to take advantage of ordinarily less energetic months of the year.

The charts demonstrate the benefits of having an offshore wind fleet spread around the coastline, able to take advantage of different wind speed conditions in different locations. For example, the South Coast performed in line with the LTA in May, compared to every other area which saw production drop significantly.

Adding capacity in the Celtic Sea, starting with Offshore Wind Leasing Round 5, is expected to slightly increase resilience of the UK's renewable electricity production. For more information, see Offshore Wind Leasing Round 5 - floating wind in the Celtic Sea on [page 38](#).

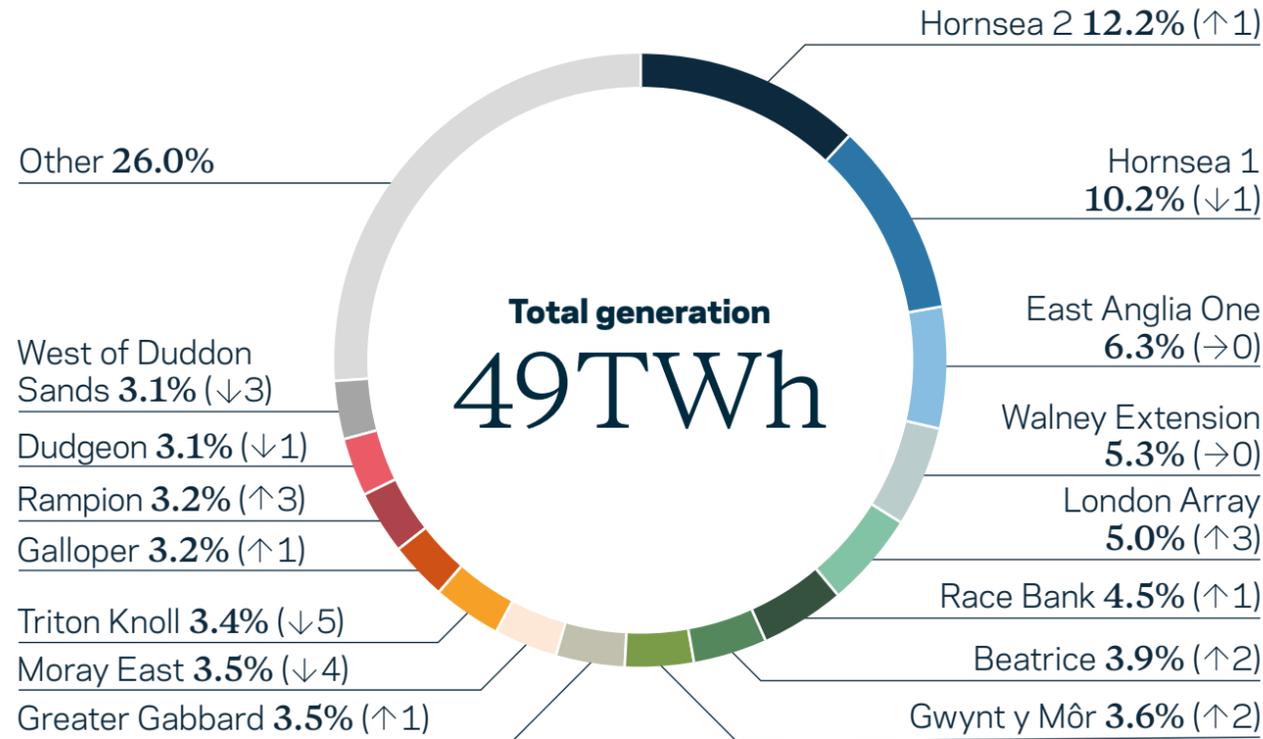
Offshore wind generated electricity

Figure 12 compares the output of the biggest producing wind farms in the UK in 2023 compared to production in 2022.

The UK fleet generated 49TWh in 2023, a 9% increase on output in 2022. That is enough to supply the electricity needs of 14.2million homes (see figure 13) and marks another record high for the sector.

The UK is home to seven of the world’s largest operational wind farms. In 2023 Hornsea 2 overtook Hornsea 1 as the world’s largest operational offshore wind farm. Collectively the two sites generated over a fifth of the UK’s offshore wind generation (22.4%), reflecting the increasing size and capabilities of new offshore wind farms.

Figure 12: Percentage of total 2023 offshore wind electricity, generated by asset (position change from 2022)



Performance in Scotland Portfolio managed by Crown Estate Scotland

The Seagreen Phase 1 project completed commissioning works in October 2023, with all 114 turbines successfully installed and generating. This wind farm is the largest in Scotland, with an installed capacity of 1,075MW, and is currently the world’s deepest fixed bottom offshore wind farm with the deepest foundation installed at 58.6m below sea level. The port of Montrose hosts the operations and maintenance base for the wind farm and in 2023 it began use of the state-of-the-art Edda Brint service operation vessel which has been prepared for future zero-emission usage due to its hybrid hydrogen power capability.

Construction of Neart na Gaoithe offshore wind farm continued throughout 2023, with over 30 turbines now installed. First power is currently expected during 2024, with the project ramping up throughout the next year.

Construction on Moray West offshore wind farm commenced during 2023, with first power generation estimated to arrive in summer 2024. Once all 60 turbines have been installed, Moray West will have a generating capacity of 882MW. Full operation of the wind farm is anticipated to begin in early 2025.

At the end of 2023, 2,973MW of capacity was fully operational with a further 1,330MW in construction. 2023 saw the Scottish fleet generate in excess of 6.2TWh of electricity.

Grid capacity continues to be a significant challenge for the Scottish portfolio with further curtailment constraining the wind energy produced as more wind farms move into operation. In 2023 the offshore wind portfolio was also challenged with lower wind yield and unplanned maintenance on some of the assets.

Figure 13: Percentage of UK homes’ annual electricity needs that can be supplied by offshore wind



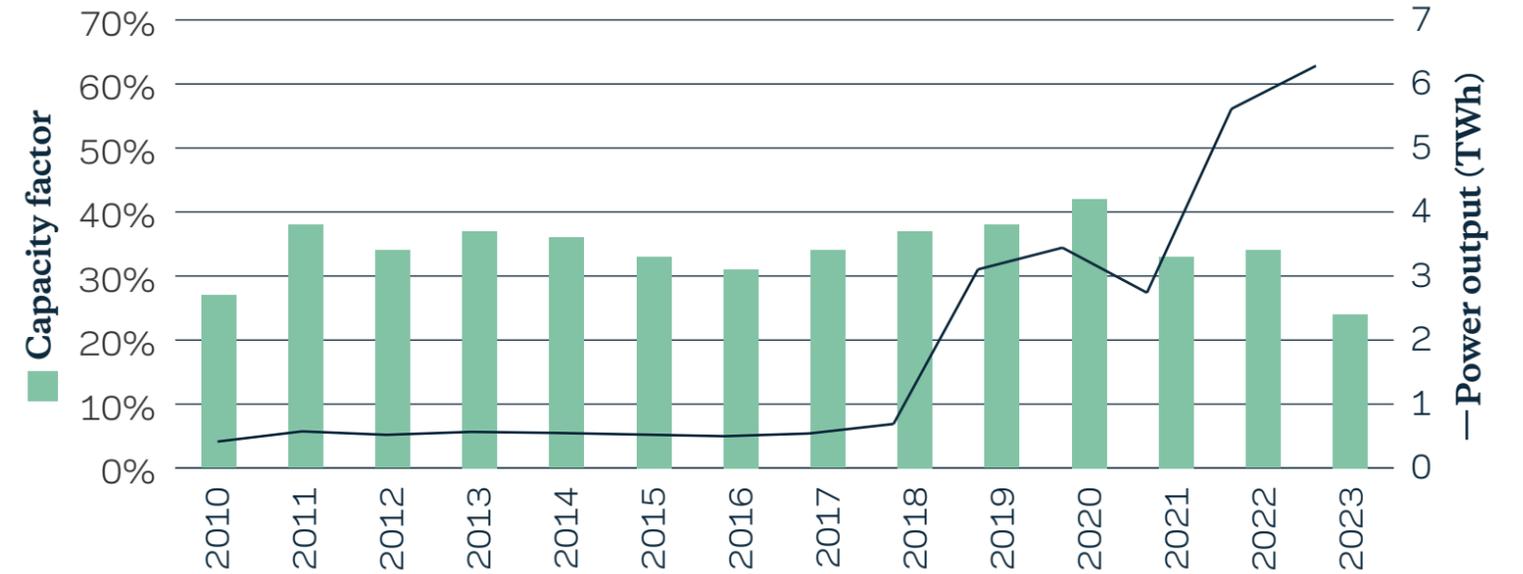
UK offshore wind generated **49.0TWh** last year. That’s enough to supply the electricity needs of **half of all UK homes**.

Capacity factor - Scotland

Figure 14 provides a picture of the capacity factor and power output of Scottish offshore wind farms between 2010 and 2023, as the operational fleet has grown. When Beatrice wind farm became fully operational in 2019, Scotland's offshore wind capacity increased markedly. There were further increases due to the performance of Hywind Scotland in 2020, setting a record for the highest annual average capacity factor for a UK offshore wind farm at 57.1%. Through 2021, wind speed decreased impacting the capacity factor, to then increase in 2022, in addition to Moray East wind farm becoming operational.

During 2023, wind speed dropped back from the average last three years and this was compounded by grid challenges as Seagreen become operational and cable outages at Moray East impacted the potential for generation. Capacity factor was disproportionately impacted by generation potential being lost at the two largest wind farms in the fleet leading to an historically low capacity factor of 24%. The average capacity factor over the last five years in Scotland was 34%.

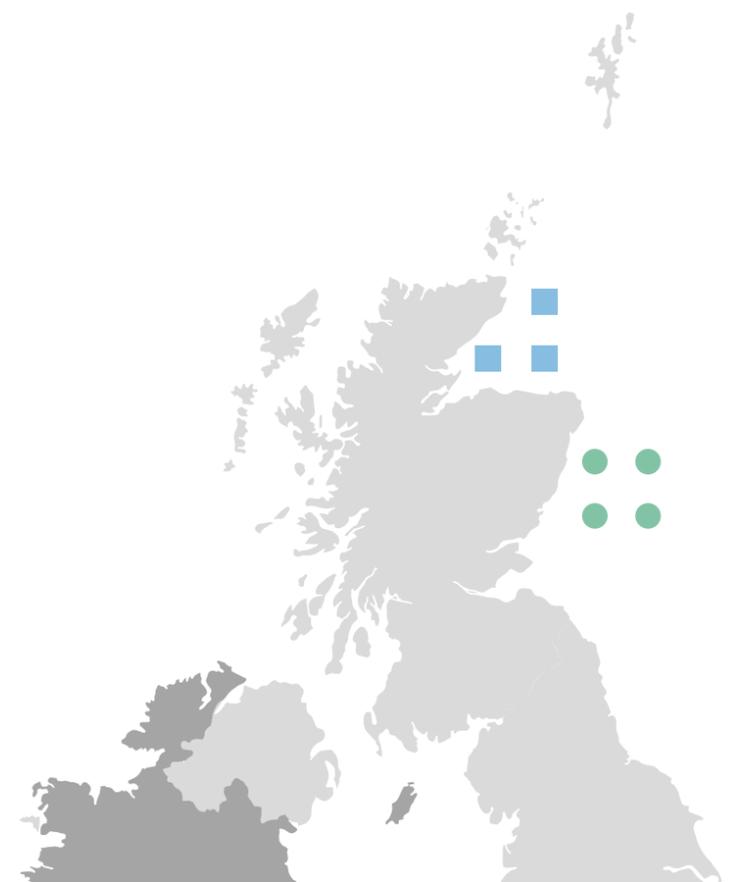
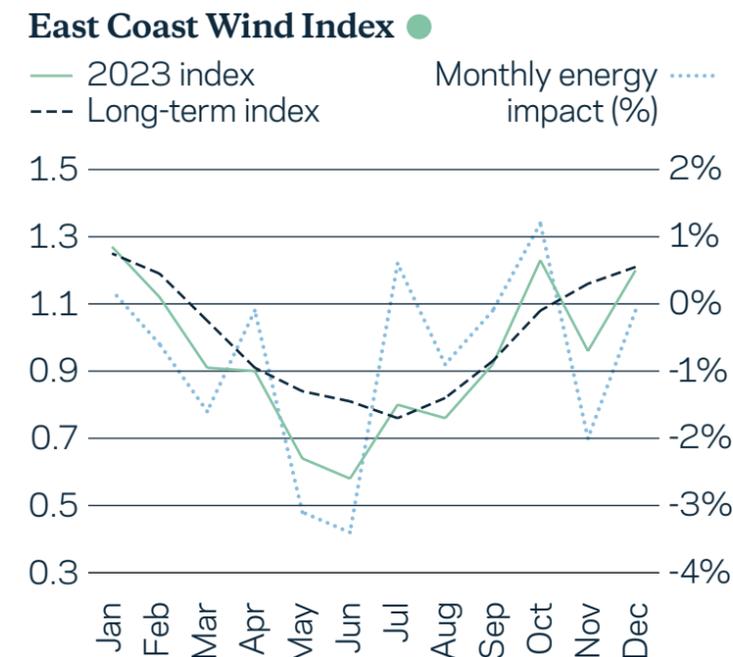
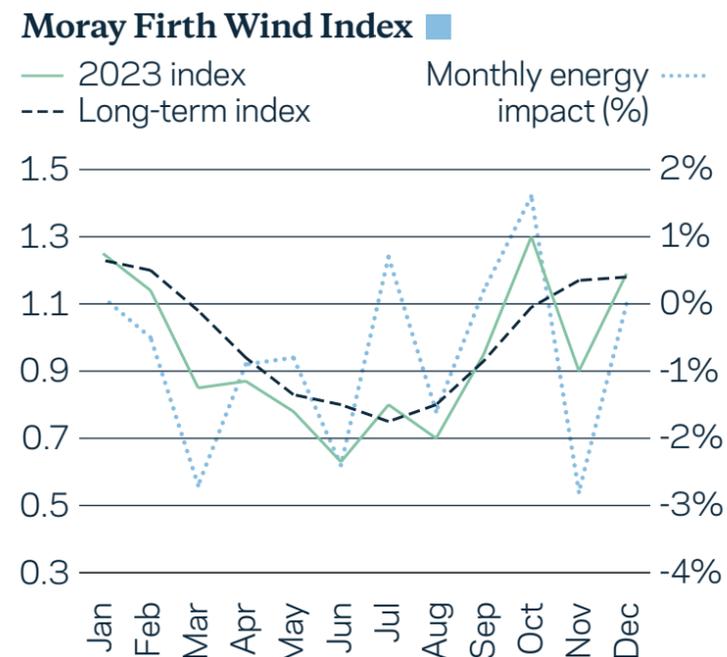
Figure 14: Capacity factor - Scotland



Wind variability - Scotland

Figure 15 illustrates Scotland's monthly wind speed indices based on the average of two regions, East Coast and Moray Firth. Wind speed trends for 2023 were similar for both regions, with the overall 2023 wind index in Scotland 5.4% below the long-term average. The cumulative total annual energy deviation associated with this decreased wind speed is 9.9% below the long-term average. This is a very different outcome compared to 2022 where wind speeds exceeded the long-term average for most of the year. The graphs illustrate consistency of wind resource being down on average across the UK. Similar to the rest of UK waters, wind speed was down against the long-term average for most of 2023.

Figure 15: Monthly wind speed index in 2023



Offshore Transmission Owner (OFTO) performance

The strength of the UK market doesn't rest on offshore wind farms alone. The performance of Offshore Transmission Owners (OFTO), which provide the transmission connection to the onshore electricity network, is a key indicator of a healthy, efficient industry. In this section we take a look at how these assets have performed.



99.4%

The average OFTO
availability for
2022/23



Gwynt y Môr offshore wind farm array and substation. Vessel in the background.

By the end of 2023, the OFTO network comprised 26 licensed OFTOs¹, up from 24 in 2022, supporting over 11.8GW of generating capacity. The number of export cable circuits which make up the network also increased from 47 in 2022 to 52.

OFTOs interface with either National Grid’s National Electricity Transmission System (NETS), or the lower voltage distribution networks owned and operated by Distribution Network Operators (DNO), ensuring that electricity generated can get to consumers. Transmission system availability figures, summarised in this section, are taken from the annual NETS performance report

1 Hornsea 2 OFTO licence granted July 2023 and Triton Knoll OFTO licence granted December 2023. However, these are not included in the performance statistics in this section of the report.

produced by National Grid covering April 2022 – March 2023. The full report can be found [here](#).

Over the year, the average availability was 99.42%, the highest level since 2018-19 (99.5%) and significantly above the 98% minimum level of availability target set through the regulatory framework. This increased the five year average for availability, which now stands at 99.18%.

Figure 17 shows the breakdown of OFTO unavailability, with planned and unplanned outages making up 73% of system unavailability, a 2% increase on 2021-22.

Figure 17: 2022-23 OFTO system unavailability

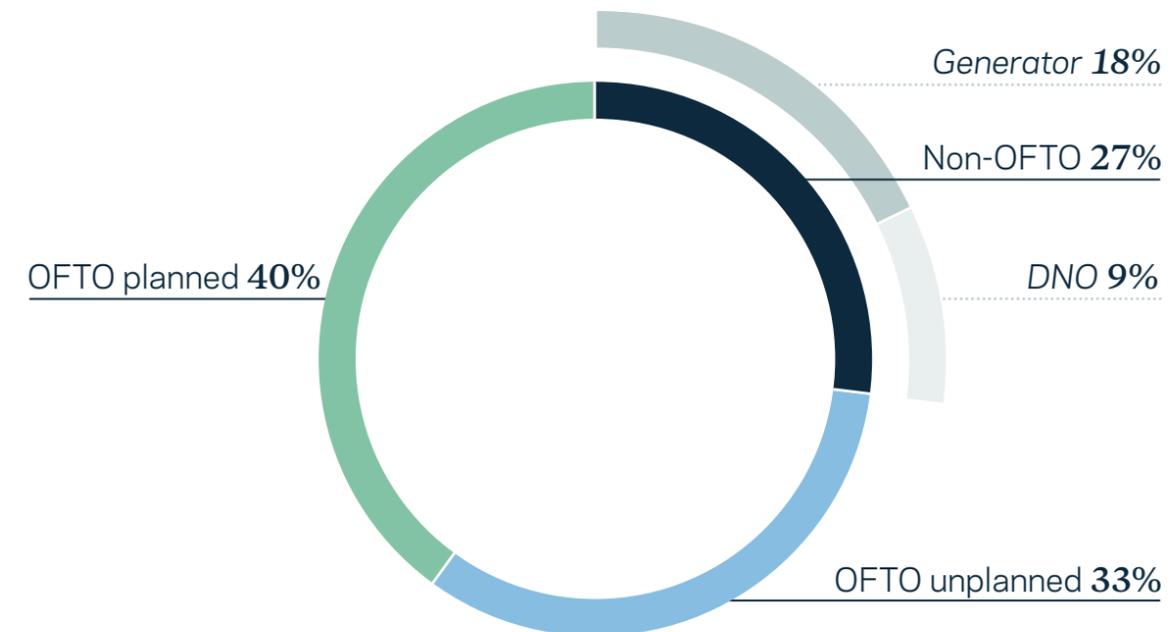


Figure 16: OFTO availability trend



Planned outages were the main cause of system unavailability with most taking place over the summer months. The number of these events decreased 38% over the year. However, unplanned outages increased, a situation usually caused by plant or equipment failure, such as circuit trips/faults, or outages requested by the DNO. In January 2024 Ofgem updated its 2014 guidance on ‘Exceptional Events’, providing greater clarity on circumstances under which OFTOs are not deemed responsible for system unavailability.

Reducing unexpected failures, particularly in the current market with long lead-times for replacement parts and vessels, is a key consideration as we accelerate towards net

zero. On pages [21-24](#) we look at the work in place to maintain system availability, particularly when assets in this maturing market are reaching the end of their original design life.

Figure 18 on [page 17](#) shows annual availability data for each OFTO, including all outages that originate on an OFTO’s system but excluding outages that originate elsewhere, for example on a wind farm generator or DNO system. The OFTO availability incentive then adjusts the reported outage data to calculate incentivised performance for each OFTO.

OFTO ownership details can be found on The Crown Estate’s [website](#).



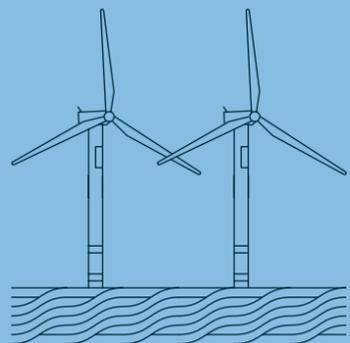
Figure 18: Offshore Transmission Networks % annual system availability

OFTO	2018-19	2019-20	2020-21	2021-22	2022-23
Barrow	100	100	100	100	100
Beatrice	N/A	N/A	N/A	99.16	99.32
Burbo Bank Extension	98.15	99.67	99.99	100	100
Dudgeon	100	99.31	99.83	99.92	99.95
East Anglia One	N/A	N/A	N/A	N/A	100
Galloper	N/A	100	99.95	100	99.97
Greater Gabbard	99.82	99.78	99.78	99.98	94.74
Gunfleet Sands	99.97	100	99.66	100	100
Gwynt y Môr	99.93 ¹	96.10	86.31	99.21 ¹	99.9
Hornsea One	N/A	N/A	100	99.93	99.57
Humber Gateway	100	99.83	99.76	98.73	99.72
Lincs	100	99.56	99.44	99.98	96.63
London Array	99.94	99.95 ¹	99.77	99.82	99.92
Ormonde	100	100	100	99.93	99.38
Race Bank	N/A	100	99.26	100	99.93
Rampion	N/A	N/A	N/A	100	99.56
Robin Rigg	100	99.87	99.95	100	100
Sheringham Shoal	99.40	100	100	99.69	99.61
Thanet	100	100	99.84	100	99.72
Walney 1	100	99.95	100	98.9	100
Walney 2	91.42	100	100	100	100
Walney Extension	N/A	N/A	99.97	100	100
West of Duddon Sands	100	100 ¹	99.50	99.19	99.09
Westernmost Rough	99.73	100	100	99.93	100

1. Figure has been updated as an exceptional event with agreement from OFGEM.

Health, safety & wellbeing

With new technologies being introduced, new waters being explored, new jobs being created, some assets nearing end of life, and the scale of development ever-increasing, the industry's commitment to health, safety and wellbeing is paramount.



41%

Reduction in Lost Time Injury Frequency (LTIF) in the UK (2022 data)



Wind farm technician at work

The Crown Estate's Safety First strategy puts health, safety and wellbeing at the centre of our decision-making and we are committed to thinking ambitiously about how we support health and safety resiliency in offshore wind.

We appreciate the need for a step change in our culture and capability. Moving forward, as the industry accelerates and continues to evolve and develop new technology in higher risk environments we are transforming our approach and strategy to surpass our previous achievements and build pace.

In 2023 we continued to strengthen and leverage our wide-ranging relationships with governments, international bodies and organisations including Trinity House, G+, and the Maritime and Coastguard Agency; and were pleased to become an Associate Member of the International Marine Contractors Association (IMCA).

We continue to work closely with the Health and Safety Executive HSE and support its strategic objectives of protecting people and places, especially fostering better health and mental health, and in 2023 welcomed the opportunity to take part in its Chairs Forum, to discuss the safe transition towards Net Zero. We built our incident handling capabilities by holding a crisis simulation exercise based on an offshore incident scenario, allowing the team to understand how to support customers and suppliers in the event of an incident. We also spent a day on board survey vessels with the teams conducting surveys for The Crown Estate in the Celtic Sea, sharing best practice and health and safety expectations with

one another before work commenced. This is a practice we intend to replicate in the future as we continually look for ways to improve how we care for our people, our customers and our suppliers.

The importance of actively promoting industry sharing is highlighted in the figures in this section. Whilst we are seeing a downward trend in reducing the number of incidents, it is vital that this momentum is maintained and we work together to build a safer and healthier future.

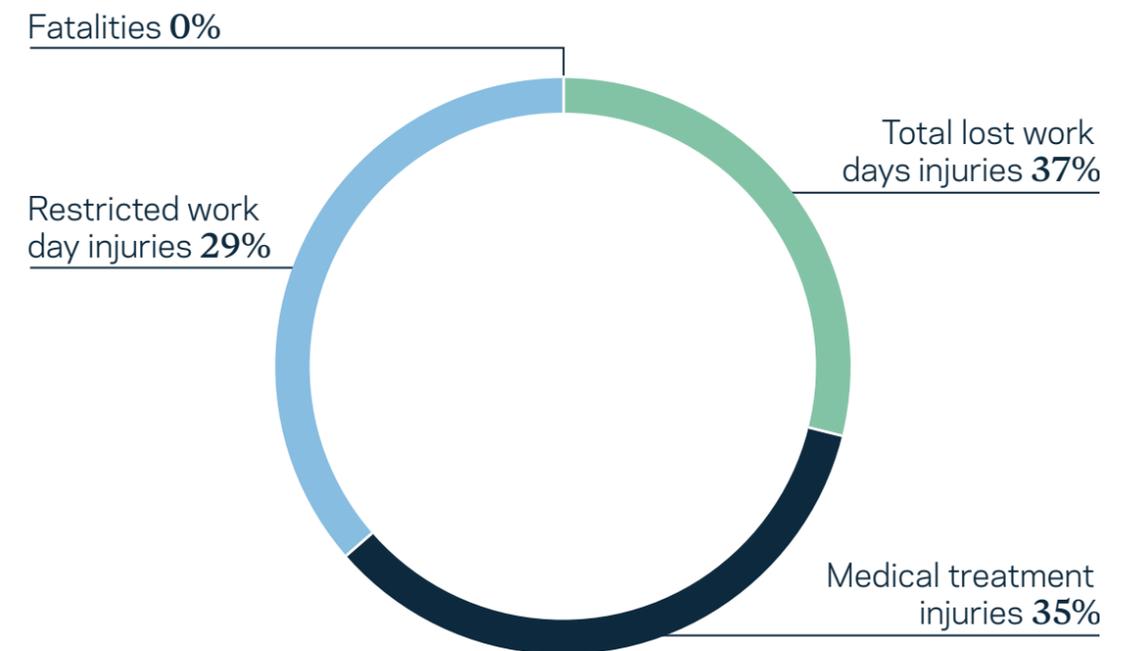
G+ update and data

The Crown Estate remains committed to working closely with G+, the global health and safety organisation for the offshore wind industry, to share information on an international level and seek best practice from across the globe. We welcome the commitments made by David Griffiths, the new chairperson of G+, to expand the reputation and reach of the organisation in North America and Asia Pacific regions. These commitments include initiating new workstreams into welfare in the offshore wind industry, severe weather preparedness, health and safety considerations around the use of surveying buoys, and the safe transit of vessels around offshore wind farms.



Technicians ascending a wind turbine to conduct inspections

Figure 19: Global offshore wind industry recordable injuries 2022¹



1. Source: G+ 2022 Incident data report (2023 data expected June 2024) - see [G+ website](#)

G+ update and data (continued)

Here we highlight data as published in the G+ 2022 incident data report, accessible by visiting the [G+ website](#). The data for 2023 is due to be published in summer 2024.

Lost Time Injury Frequency (LTIF)¹ and Total Recordable Injury Rate (TRIR)² are key indicators of the effectiveness of health and safety procedures and figure 20 shows progress in 2022 across both categories. Globally, LTIF reduced 34% in 2022 compared to 2021, and TRIR reduced 16%. This trend was mirrored in the UK with both scores reducing, bringing the UK figures lower than the global average. This is despite the number of hours worked increasing by 38% globally and by 6% in the UK. There were no fatalities in 2022, an indication that there is a strong adherence to process and procedure across the sector.

1 The number of fatalities and lost work day injuries per million hours worked.

2 The number of fatalities, lost work day injuries, restricted work day injuries and medical treatment injuries per million hours worked.

Figure 20: 2022 and 2021 LTIF & TRIR values for UK and rest of world

	LTIF		TRIR	
	2022	2021	2022	2021
UK	1	1.7	2.7	3.79
Global	1.03	1.55	2.82	3.28

In the UK, 'Near Miss' and 'First Aid Injury' continued to make up the majority of incidents (figure 22) with 75% (260) of all incident types occurring on operation sites (figure 23). Promisingly, the number of incidents fell significantly across all site locations, by 64% on construction sites, by 36% on development sites. UK incidents on operation sites are at 18%, higher than the rest of the world so require continued focus.

Figure 21 shows the UK top three work processes causing most incidents in 2022. 'Lifting Operations' remains the process causing most incidents (13%), followed by 'Access/ Egress' (10%) and 'Routine maintenance' (8%). However, Lifting Operations and Routine Maintenance have reduced from 15% and 11% respectively in 2021. Good progress was also made in the year on reducing the number of incidents caused by 'Dropped objects', falling by 71%, from 94 incidents to 27.

Figure 21: UK top three work processes causing most incidents in 2022

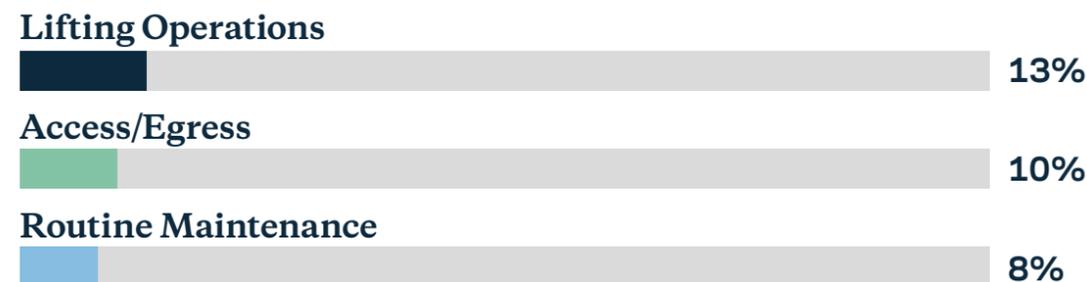


Figure 22: UK incident consequence profile 2022

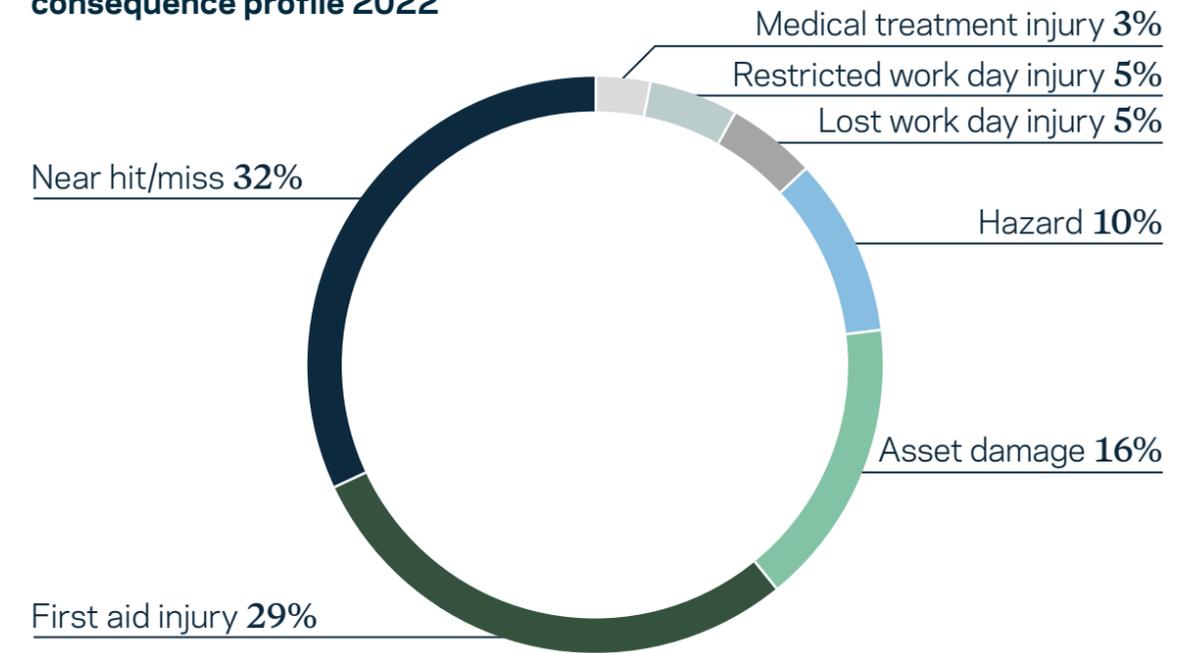
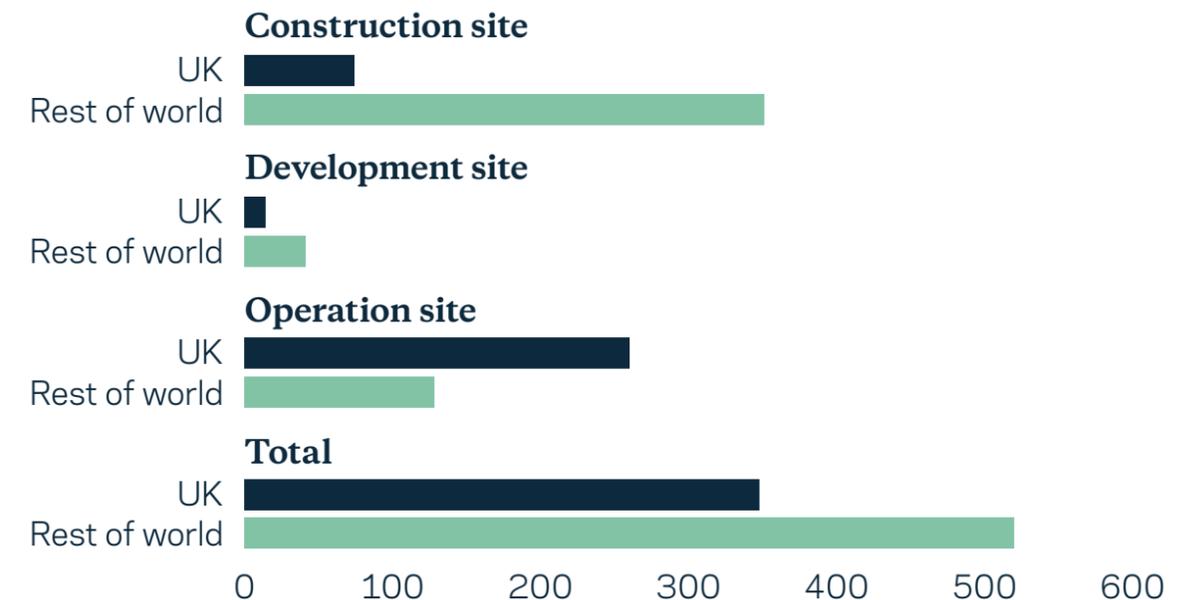


Figure 23: Incidents by site type in 2022 - UK v rest of world



Keeping the turbines spinning – the life extension opportunity

2023 marked a significant milestone for the UK offshore wind industry. The first commercial offshore wind farms, which were commissioned in 2003, reached their original expected 20 year design life. Following closely behind, in 2027 the first Renewables Obligation Certificates (ROCs) – a form of government subsidy for offshore wind farm operators – are due to expire, and in 2030 the first OFTO tender revenue stream will come to an end.

These milestone moments illustrate a challenge which must be factored in to considering how 50GW by 2030, and c.95GW by 2050, can be achieved.



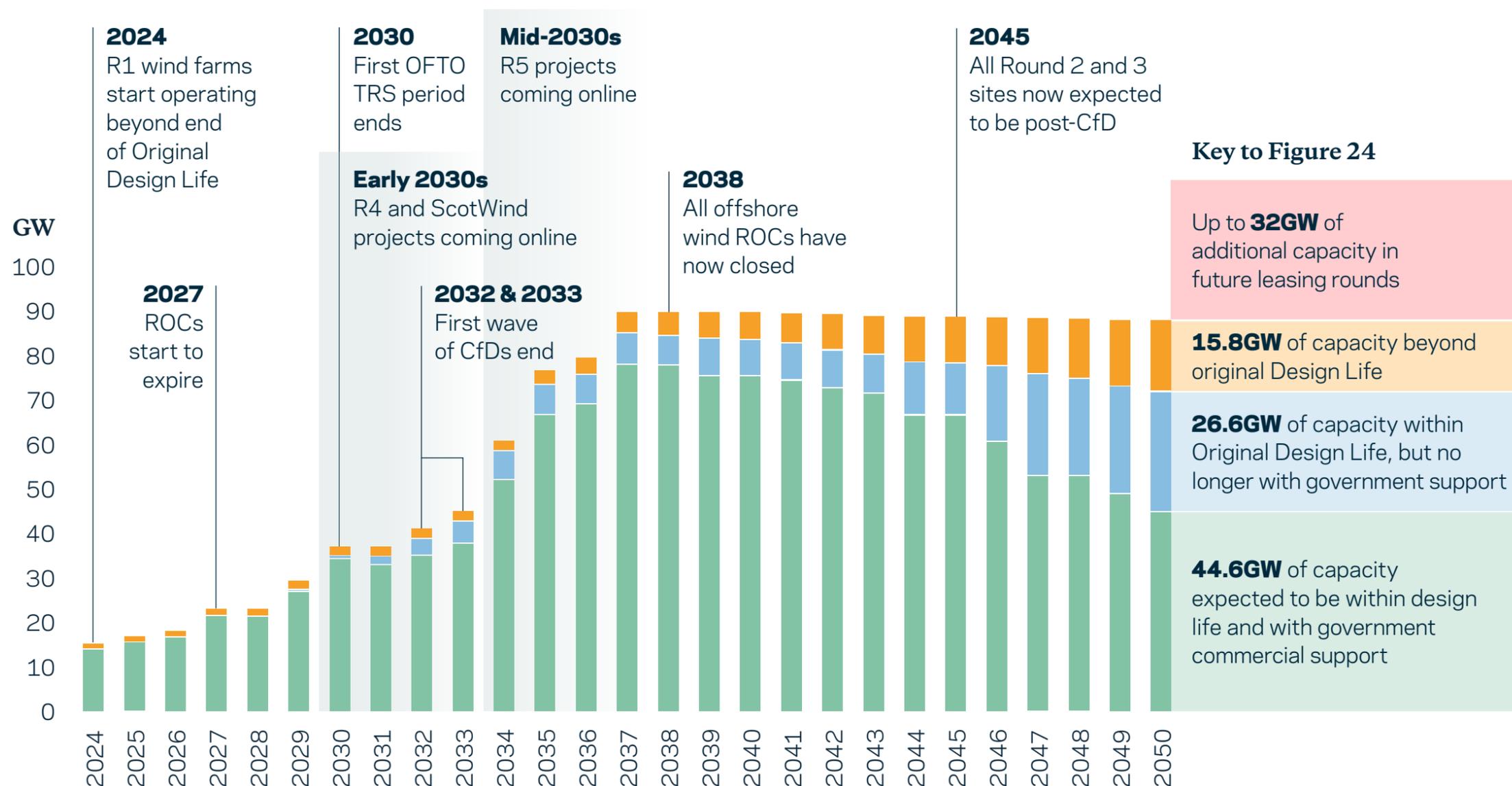
Figure 24: Capacity with increasing risk exposure

Figure 24 illustrates the offshore wind capacity that becomes more exposed to major events and economic changes, either due to potential expiry of government support in the form of subsidies, or through reaching end of expected lifetime.

Capacity is categorised in terms of:

- Original Design Life - usually 20-25 years
- Subsidy / Support Scheme - 15 years (CfD) or 20 years Renewable Obligation Certificates (ROC)

This profile considers the capacity in the operational and under construction UK fleet (figure 5 on [page 8](#)) and the capacity identified in the future development pipeline (figure 38 on [page 39](#)). Future timings are based on typical expected lead times for completion of project stages.



It is expected that a combination of new offshore wind developments, and repowering and extending the life of existing offshore wind farms (see figure 25 below) will be needed to maintain and grow a healthy offshore wind pipeline that supports 2050 targets.

New projects and technologies can generate more electricity from the same space. But in an increasingly busy seabed, repowering and extending the life of existing offshore wind makes efficient use of space, supports the network of jobs and supply chain benefits built up over time, and makes use of existing infrastructure which has long-since offset the carbon impact of the development phase.

Figure 25: Options for growing and sustaining offshore wind capacity

New development

New capacity obtained through future leasing rounds and capacity increases.



Repower/replant

New capacity utilising existing wind farm spaces.



Life extension

Prolonging and maintaining the existing fleet.



Offshore transmission asset lifespan

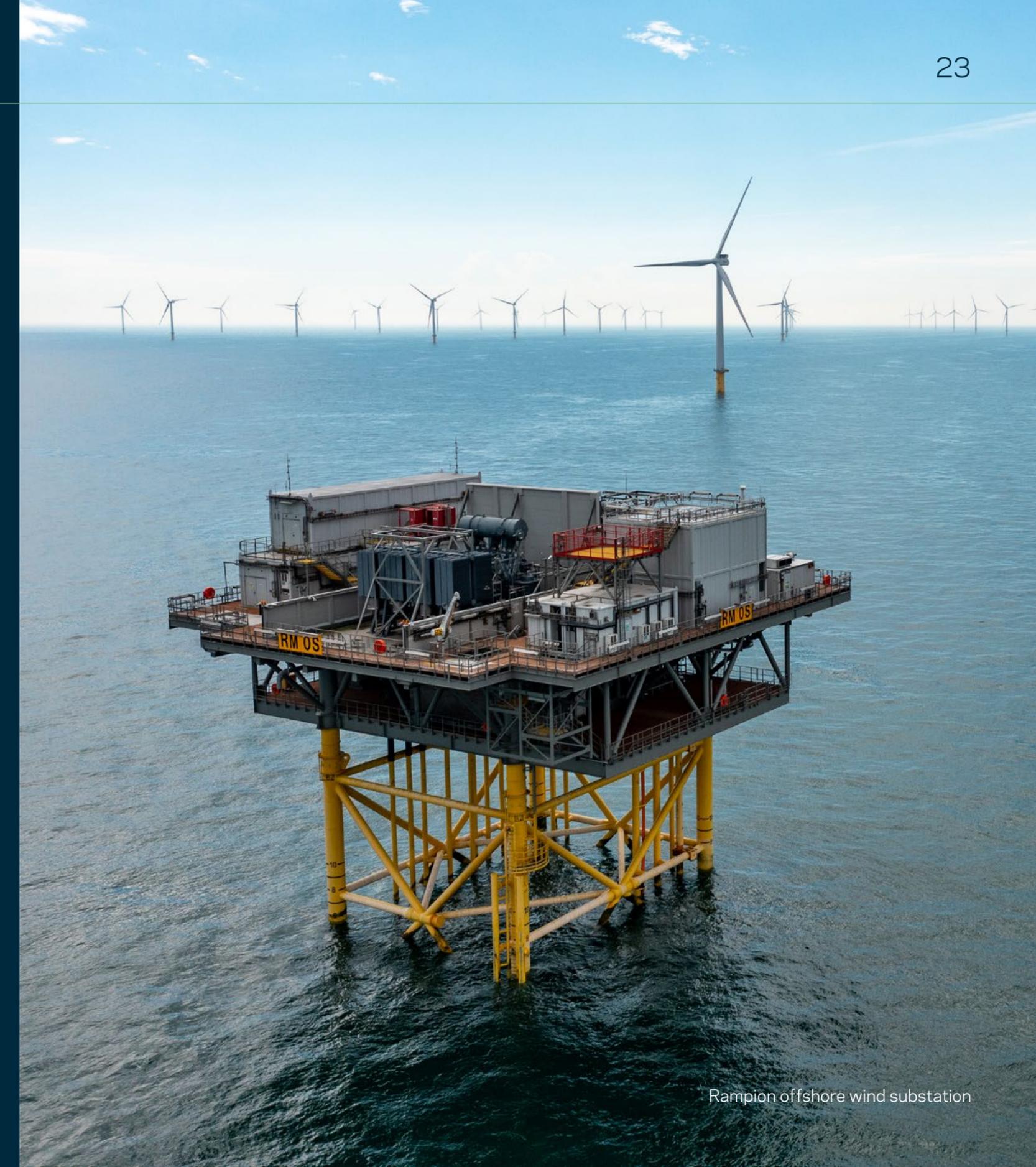
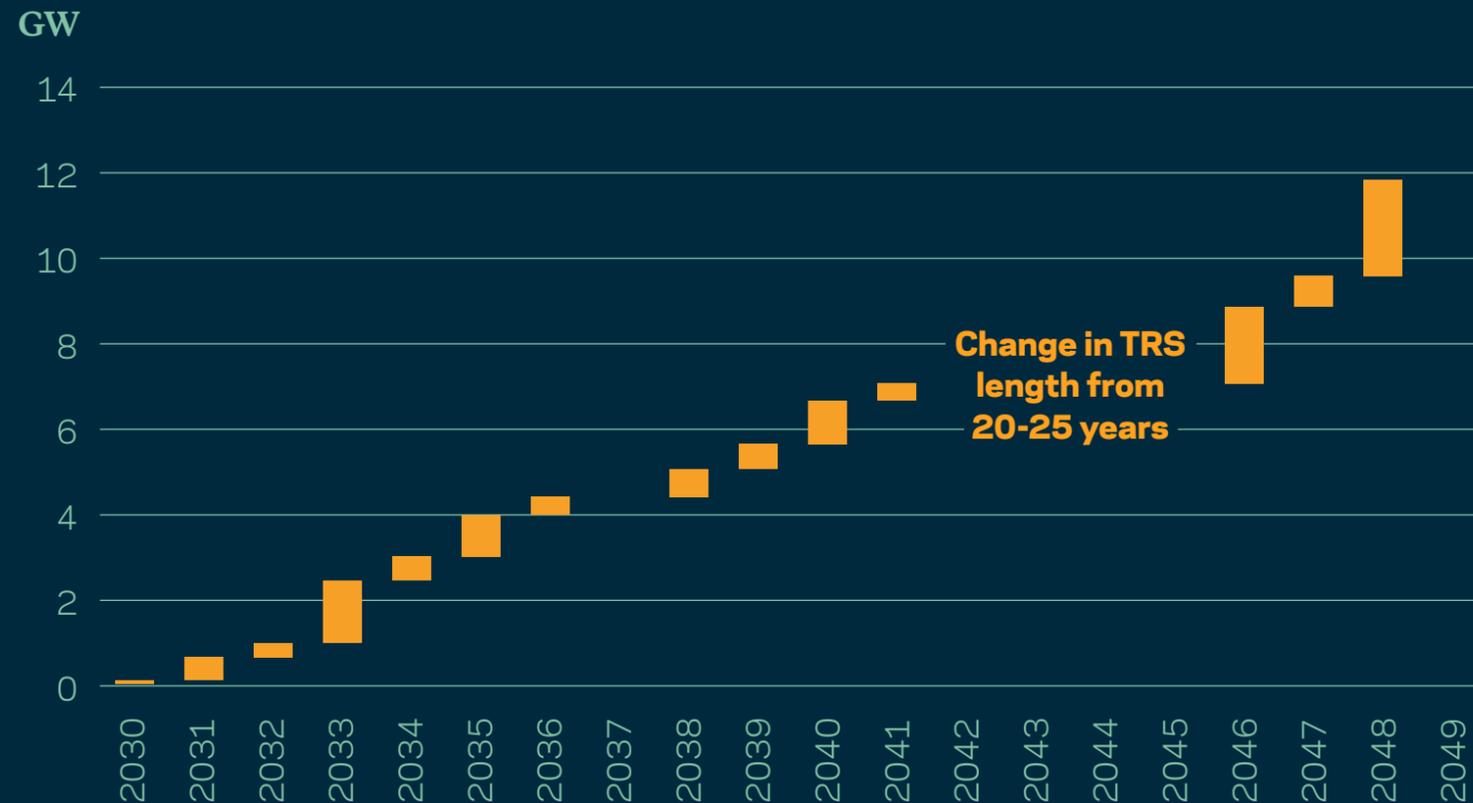
The maintenance and performance of offshore transmission assets is fundamental to the strength of the offshore wind system. A key driver for maintenance of these assets is the financial certainty which comes with the OFTO tender revenue streams (TRS), which supports a strong business case for investment.

Figure 26 reveals that by 2040, under current arrangements, the TRS would have ended for around 7GW of generating capacity. Consideration must be given to

if and how the scheme continues to support and incentivise these assets to operate beyond their original design life, at the most efficient cost to the consumer.

Since 2020, The Crown Estate has been working with both generators and OFTO operators through dedicated engagement sessions and surveys to gain combined insights into risks and issues around the extension of the transmission assets.

Figure 26: Capacity connected by OFTO post end of tender revenue stream



Rampion offshore wind substation

The benefits of life extension

In 2023 The Crown Estate commissioned a report to examine the comparative social and environmental value of life extension of offshore wind farms. Figure 27 shows the relative scoring of typical new build, repowered and life extended projects against a range of value factors.

While new developments contribute highly to security of affordable energy, a life extended project scores much higher in terms of the efficiency of materials and space, and minimising environmental impact.



A typical life extended project could...



Avoid an additional 136 tonnes steel, 8 tonnes glass and 4 tonnes polymer per MW



Continue 150 operational jobs with c.95% based directly in the project region

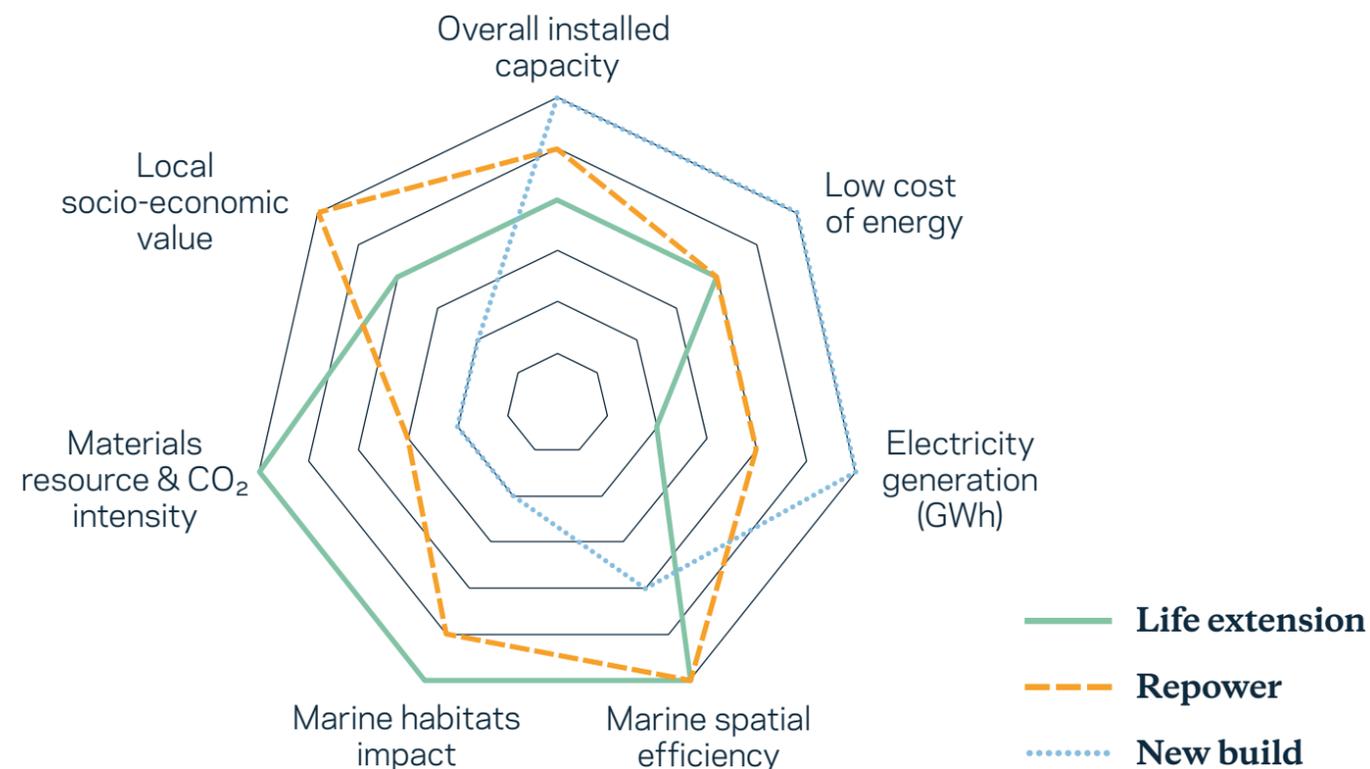


Avoid an additional 470 tonnes CO₂ per MW



Have negligible marine environment impact to benthic habitats, fish and shellfish, and marine mammals

Figure 27: Comparative value scoring of offshore wind project types



Addressing the challenge

Work is well underway to address the 15.8GW of post-design life capacity identified in [figure 24](#) and to mobilise the life extension opportunity.

The Crown Estate is working closely with customers, industry, Ofgem and government bodies about future approaches, with the aim of creating an environment that encourages a holistic approach to offshore wind life extension.

We're collectively building more evidence too. Our own research is contributing to our understanding of the environmental and social value of wind farm life extension. Elsewhere Crown Estate Scotland, Ofgem, the UK Government, developers and many others are building evidence to support our understanding, covering areas such as the financial value of wind farm life extension, innovations to repower maturing wind farms, and how subsidy schemes can incentivise and support extending the life of wind farms and transmission assets.

As the challenge moves ever closer, the key now is to share the emerging body of evidence and work together to establish a joined-up approach to maintaining maturing assets. Over the coming months we will be working closely with industry, governments and wider stakeholders, with an ambition to build a life extension roadmap – a coordinated approach to address this challenge in a way which continues to support net zero and deliver social and environmental benefits for the country.

Diversity & skills

As the offshore wind industry grows, so too does the number of job opportunities, bringing economic and social benefits across the UK. In June 2023, a report by the Offshore Wind Industry Council (OWIC) estimated that the number of jobs in the UK's offshore wind sector by 2030 will exceed 100,000 for the first time.

A diverse and skilled workforce will be critical to meeting this growth and ensuring the long-term resilience of the sector; delivering a wider talent pool to draw from in the places they are most needed, and the diversity of thinking required to meet the challenges of tomorrow.

Several announcements in 2023 signalled new supply chain opportunity in the UK. SeAH Wind secured a deal to supply Norfolk Vanguard's Monopile Foundations, which will be built in [Teesside](#); ORE Catapult opened '[Launch Academy East of England](#)', an extension of its existing technology accelerator to support the commercialisation of UK-based small and medium-sized enterprises to develop innovative new products and services; Siemens Gamesa commenced [blade production in Hull](#); and Ørsted launched its [UK and Ireland Innovation Hub](#) to engage with start-ups and smaller businesses in the area of renewable energy.

Technician replacing sensor in the nacelle hub



Focus on: East Coast opportunity

Progress was made towards ensuring future jobs can be filled by a skilled, diverse workforce. Here we highlight three landmark initiatives The Crown Estate supported during the year to unlock the jobs and skills opportunity offered by the thriving offshore wind industry off the east coast.

Upskilling work coaches

Working with the Department of Work and Pensions (DWP), The Crown Estate built a pilot programme designed to help work coaches in East Anglia and Lincolnshire better understand the career opportunities offered by offshore wind development in the region. The ambition is to give them the knowledge to signpost job seekers to the diverse range of careers offered by the sector, helping tackle regional inequalities, highlight career prospects and help address labour shortages facing the industry. Workshops for DWP work coaches and a careers fair will be rolled out in 2024.

Projekt Renewable Grimsby

This educational and cultural hub opened its doors in Grimsby in 2023. Its aim is to inspire the next generation of renewable energy experts through a ‘destination’ of immersive experiences which showcase the benefits of renewable energy and educate and influence future talent and the local community. In support of this initiative, The Crown Estate has invested an initial £50,000 and opened a bespoke space within the hub as part of our drive to build social, as well as economic and environmental value, from this rapidly growing sector.

East Coast internships

The Crown Estate works in collaboration with organisations in the marine sector to offer full-time, paid internships to young people interested in a career in the marine environment, helping to nurture the diverse, skilled workforce needed by the marine industry to achieve a sustainable future. In 2023 we funded a new ‘Marine Futures North East Internship Programme’, as part of a joint collaboration with Lincolnshire Wildlife Trust, Ørsted and Natural England. The six month internship offers two graduates the chance to gain work experience and build relationships in renewable energy, marine ecology and community engagement, and conduct marine research projects in and around the east coast area, further supporting the development of skills and research in this region. This programme complements our existing programmes in the North West and Kent.



Photo: Monty Rakusen

Technician on a vessel next to an offshore wind turbine.

Building the future workforce

Three other announcements during the year demonstrate the commitment to inspire and upskill a diverse and resilient future workforce across the country. In collaboration with **Microsoft UK**, The Crown Estate launched a new **Minecraft Education world** called ‘**Offshore Wind Power Challenge**’¹ to inspire 7-14 year olds to learn more about the challenges of planning offshore wind farms and protecting the marine environment, through immersive and interactive game-based learning.

Dogger Bank Wind Farm’s Scholarship Fund

opened its third round of scholarship applications for local students, with a total of 62 scholarships being awarded during the wind farm’s construction phase to help young people prepare for working life in a net zero world.

Finally, operations and maintenance (O&M) consultants, **Generating Better**, launched **The Offshore Wind O&M Management Programme**, a training programme to help address the skills gap, upskill in the face of a challenging commercial environment and build a support network of people with an interest in O&M management. With a number of free and subsidised places available for under-represented groups, the programme also aims to make a practical contribution to improving diversity in offshore wind and O&M.



Screenshot of Minecraft game in progress

The Crown Estate is committed to building a truly diverse, collaborative and inclusive culture and we closely monitor our progress in this area. Growth in the Marine Team in 2023 led to changes in colleague representation across several demographics. The percentage of people with a disability or long-term condition rose from 11.8% to 17.6%; we maintained a broadly equal balance between male/ female colleagues (52% vs 48% respectively); and the percentage of colleagues representing ‘Black/ Black British’, ‘Asian/ Asian British’ and ‘Other’ ethnicity groups all rose. The percentage of those identifying as ‘White’ and ‘Mixed/ Multiple’ ethnic group decreased slightly. The data shows some promising improvements but we remain focussed on using our reach and alliances to increase diversity, equity and inclusion across our business and the industry as a whole.

1 [Minecraft Education | The Crown Estate](#)

OWIC People and Skills Plan

To maximise the social and economic benefits of the anticipated growth in labour demand up to 2030, which is expected to more than treble from the current 30,000, the Offshore Wind Industry Council (OWIC) has published a **People and Skills Plan**. It sets out a vision for the sector to be “among the most attractive, equitable, diverse and inclusive sectors...in the UK economy.” The plan, developed with industry, identifies four cross-cutting themes and priorities for focus, as shown in Figure 28 below.

Working across the sector, including supply chain and developers, apprenticeships will represent 5% of the workforce by 2030 (a doubling of the 2019 Sector Deal target) and industry will work collaboratively to tackle barriers to employment and progression faced by women and under-represented groups. Occupational pathways and job profiles, and a shared industry value

proposition, will support attraction and retention, including from support workers coming into the sector from other industries. Partnerships will enable increased capacity to create training and qualification standards and solutions.

As interest in skills rises up the agenda, OWIC will also enhance its approach to labour forecasting to provide industry with the data it needs. This means the **OWIC Skills Intelligence Report**, which monitors progress against Sector Deal targets and provides workforce estimates, will be published every two years rather than annually, with the next instalment expected in 2025.

Whilst this means there are no updated workforce statistics to report on this year, we have included the 2022 data in Figure 29, to maintain focus on the Sector Deal workforce gender and ethnicity targets, and progress against them.

Figure 28: Offshore Wind Industry Council People and Skills Plan



Technicians loading equipment in preparation for nacelle maintenance

Figure 29: Offshore Wind Sector Deal workforce targets and progress against them up to 2022¹

Female employees

16%
Baseline (2019)

33%
Target (2030)
(40% if feasible)

20.6%
Progress (2022)

Black, Asian and minority ethnic employees

3.7%
Baseline (2019)²

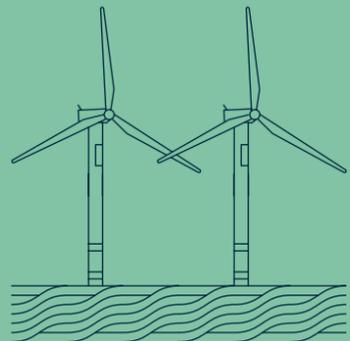
9%
Target (2030)
(12% if feasible)

7%
Progress (2022)

¹ Updated figures expected in 2025.
² 2019 figure re-baselined in 2021 because of increased accuracy in data collection.

Offshore wind farm ownership

We track UK offshore wind farm ownership to identify key companies, industries and trends in offshore wind investment.



62%

UK offshore wind capacity owned by utility companies

Gwynt y Môr offshore wind farm array and crew transfer vessel



Figure 30 shows companies with the greatest share of operating and under-construction offshore wind farms in 2023, and figure 31 summarises ownership by investor category. Utility companies increased overall share of ownership from 59% to 62%. Whilst the chart indicates a decrease in the percentage share of ownership by financial investors and oil and gas companies, this is a function of all three types of investor increasing capacity ownership in actual terms, leading to minor adjustments in overall percentage ownership. This reflects the progression of two wind farms owned by utilities to the under-construction category, East Anglia THREE owned by Iberdrola (Scottish Power), and Moray West owned by Ocean Winds, a joint venture between EDP Renewables and ENGIE, and minority shareholder Ignitis.

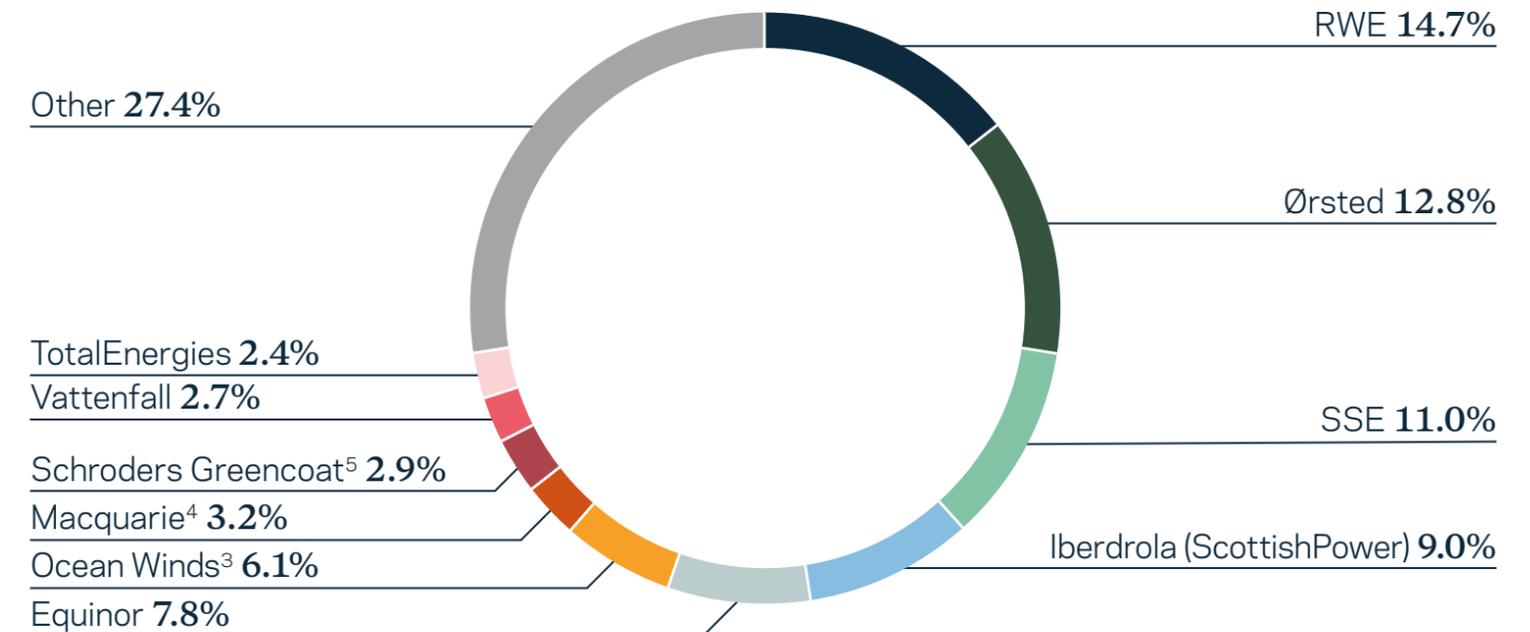
1 Source Bain: [Looking Back at M&A in 2023: Who Wins in a Down Year?](#)

In 2023, relatively little operational and under-construction capacity changed hands – 0.5GW in 2023, compared with 2.3GW in 2022 – in line with a broader M&A trend underpinned by gaps in valuations, high interest rates, mixed macroeconomic signals and geopolitical risks¹. Significant transactions included the sale of Ørsted’s 25% share in London Array to Schroders Greencoat, and 16.7% of Moray East sold by Mitsubishi Corporation to Japanese oil and gas major INPEX, through European subsidiaries.

There was notably more capacity changing hands at the development stage, which we cover on [page 30](#).

A full breakdown of offshore wind farm ownership for operating and under-construction sites can be found on The Crown Estate’s [website](#).

Figure 30: Operational and under-construction wind farm ownership as a % of total capacity in 2023 by company



3 Joint venture between EDP Renewables and ENGIE.

4 Green Investment Group (GIG), GIG Renewable Energy Fund, Macquarie European Infrastructure Fund, Macquarie Infrastructure and Real Assets.

5 Greencoat UK Wind, Greencoat Renewable Income LP, other Schroders Greencoat Funds.

Figure 31: Operational and under construction wind farm ownership as a % of total capacity in 2023 (and 2023 vs 2022) by category²



2 Percentages rounded.

Figure 32 shows ownership of projects at both the operational and development stage by investor category. This has remained relatively static since 2022 and indicates financial investors are coming in at the later stages of development, with the supply chain investing at the earlier stages. In 2023 ownership by utility companies was bolstered by the sale of nearly 25% of Leasing Round 4 project Outer Dowsing, to Gulf Energy Development by Macquarie's Green Investment Group.

Shares in several ScotWind projects changed hands in 2023, including 24.5% of Havbredey and Spiorad na Mara in the Outer Hebrides, purchased by Irish energy company ESB from Northland Power. 50% of shares in Arven South

transferred to Mainstream Renewable Power from Ocean Winds, as Mainstream, EDP Renewables and ENGIE teamed up to develop both Arven wind farm sites to the east of Shetland.

Figure 33 breaks down the financial investor category by type and digs deeper into the 22% of operating and under construction capacity held by financial investors. Whilst renewable energy and infrastructure funds still hold half of the operating and under-construction wind farm capacity, the proportion of investment funds with more diversified interests has increased slightly from 16% in 2022 to 17% in 2023.

Figure 33: Financial investor capacity ownership (operational and under construction wind farms)

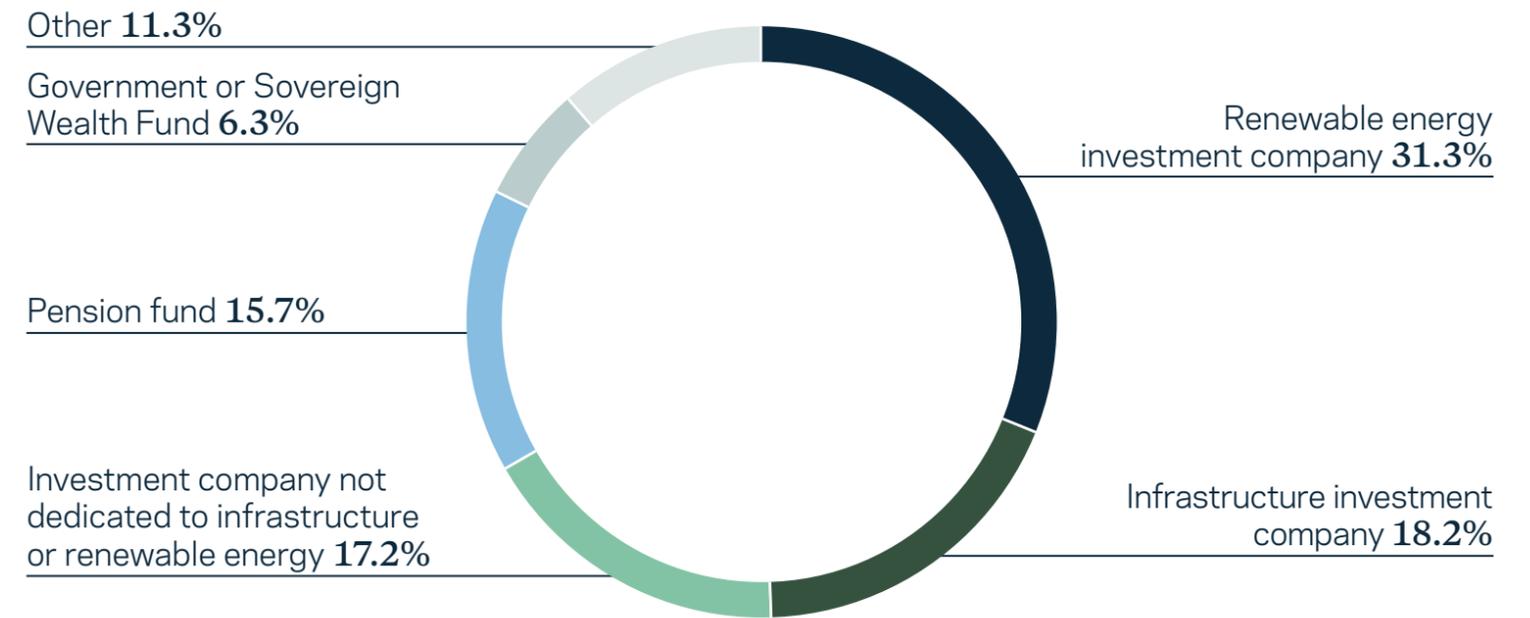
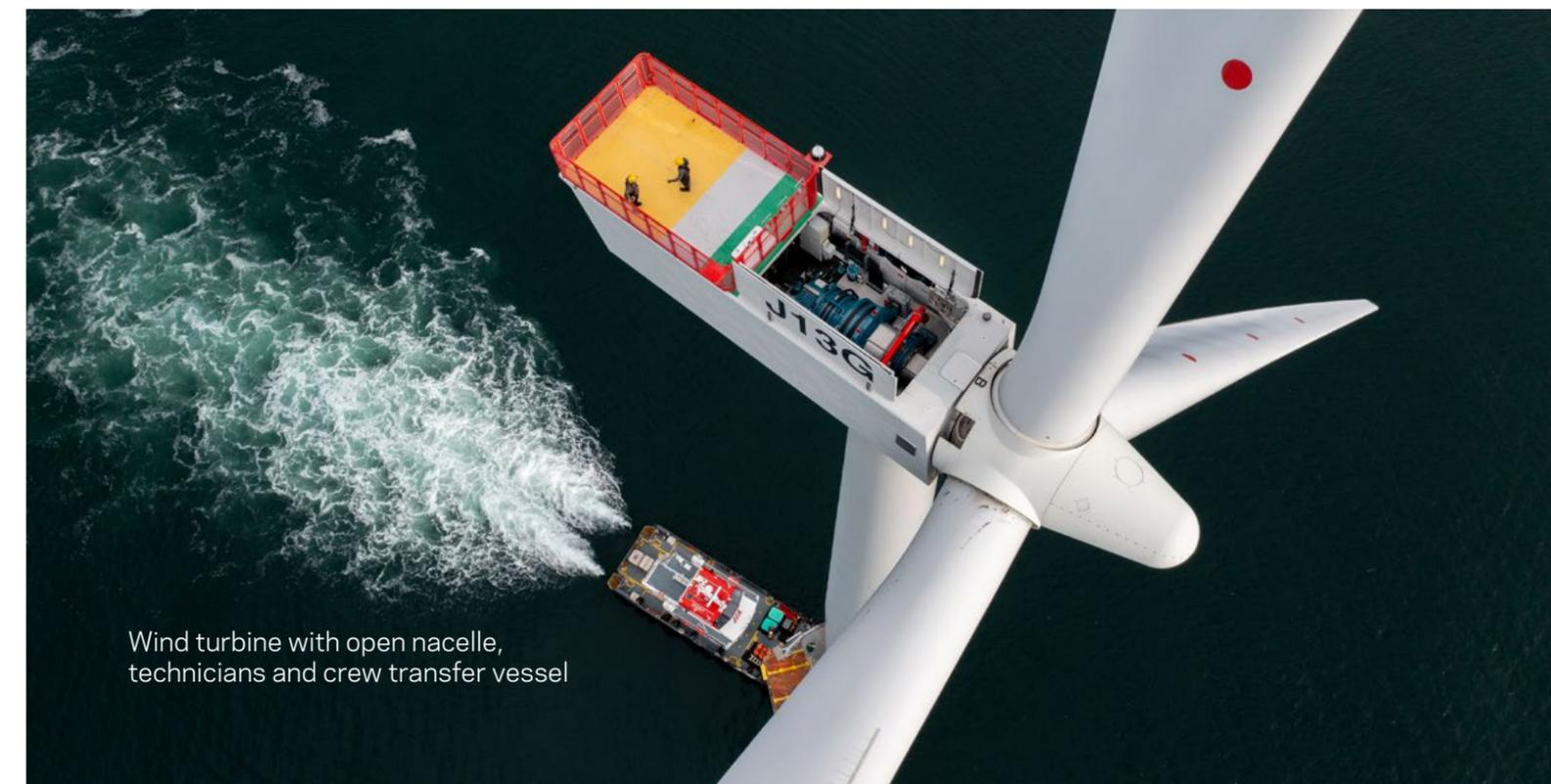
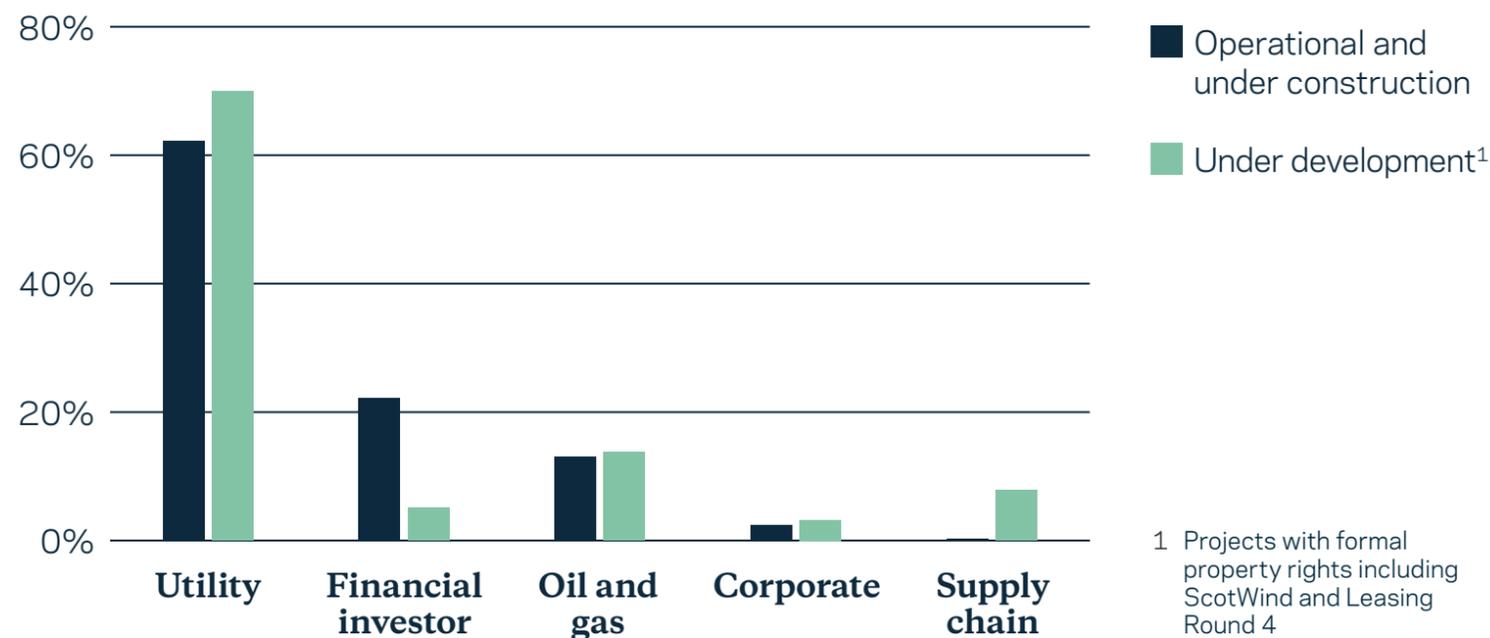


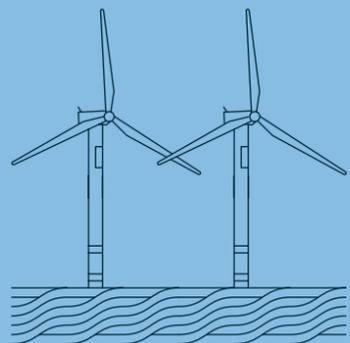
Figure 32: Capacity ownership by category and lifecycle stage in 2023



Investment & market

Floating offshore wind – a new frontier
of opportunity and investment

Photo: Courtesy of BW Ideol and Valery Joncheray



£50m

Total investment
earmarked by
The Crown Estate
to accelerate
offshore wind
supply chain projects



Key transactions in 2023 are listed in figure 34. Approximately 2GW of UK offshore wind capacity changed hands (vs c.20GW globally), with the majority (approximately 1.5GW) relating to projects at the development stage.

Notable transactions are described in the offshore wind farm ownership section on [page 29-30](#).

Significant transactions announced in 2023, but not completed by year end, included the sale of

Norfolk Boreas, Vanguard West and Vanguard East by Vattenfall to RWE, and Masdar's proposed purchase of 49% stakes in Dogger Bank South (East and West) Round 4 projects from RWE.

Although few assets changed hands over the course of the year, debt markets were more active. Numerous assets secured financing packages including Moray West (£1.9bn development finance), Kincardine (£408m refinancing) and East Anglia Three (€500m

development and construction finance).

2023 saw developers continue to explore alternative routes to market through Corporate Power Purchase Agreements (CPPAs), a long-term contract under which a business agrees to buy some or all of its electricity directly from a renewable energy generator. At least 223MW of capacity was signed to a CPPA in 2023, bringing the total offtake covered under a CPPA to 1GW – representing c.7% of all operational capacity.

Figure 34: Transaction activities completed in 2023 in date order

Asset	Lifecycle stage	Seller (share in the project before transaction)	Buyer (share in the project after transaction)	Approximate value (£m)	Indicative timing
Moray East	Operational	Mitsubishi Corporation (16.7%)	INPEX Renewable Energy Europe (16.7%)	Unknown	Mar-23
Outer Dowsing	Under development	Green Investment Group (50%)	Gulf Energy Development (24.99%)	Unknown	Mar-23
Westermost Rough	Operational	Macquarie European Infrastructure Fund (12.5%)	Equitix (12.5%)	Unknown	Apr-23
Rampion	Operational	Macquarie European Infrastructure Fund (12.5%)	Equitix (12.5%)	Unknown	Apr-23
Galloper	Operational	Macquarie European Infrastructure Fund (12.5%)	Equitix (12.5%)	Unknown	Apr-23
Havbredey	Under development	Northland Power (100%)	ESB (24.5%)	Unknown	May-23
Spiorad na Mara	Under development	Northland Power (100%)	ESB (24.5%)	Unknown	May-23
Hornsea 2 OFTO	Operational	Ørsted (50%), AXA IM Alts (25%), Crédit Agricole Assurances (25%)	HICL Infrastructure (75%), Diamond Transmission UK (25%)	£1,141m	Jul-23
Arven South	Under development	Ocean Winds (100%)	Mainstream Renewable Power (50%)	Unknown	Aug-23
London Array	Operational	Ørsted (25%)	Funds managed by Schrodgers Greencoat (25%)	£717m	Aug-23
Triton Knoll OFTO	Operational	RWE (59%), J-POWER (25%), Kansai Electric Power (16%)	Equitix (80%), TEPCO Power Grid (20%)	£573m	Dec-23

13MW GE Vernova Haliade-X turbine

Photo: Courtesy of Dogger Bank Wind Farm

2023 marked a year of rising interest rates and supply chain cost inflation which hit the offshore wind industry around the world. In the US over 12GW of offshore wind projects sought to change or cancel their subsidy contracts. In the UK, Vattenfall announced it had decided to stop the development of Norfolk Boreas in its current form, highlighting the vulnerability of the supply chain and cost increases up to 40%.¹ However, its subsequent sale to RWE² has led to an anticipated revival of the project.

These cost issues were highlighted in September's fifth Contracts for Difference allocation round (AR5) where, for the first time, there were no bids from fixed or floating offshore wind projects. This contributed to the UK falling three places to seventh place in the EY Renewables Attractiveness Index. However, for offshore wind specifically, the UK increased its Index score in the second half of the year, from 52.5 in June to 57.6 in November.

Despite the challenges, the offshore wind sector remains set for considerable growth globally and domestically, with governments continuing to see the technology as key for meeting long-term climate goals. In the UK, the Government's 2030 target of 50GW of offshore wind capacity continues to underpin confidence in the market. Its decision to increase the price cap - by 66% for fixed and 52% for floating - for the sixth Contracts for Difference allocation round (AR6) in 2024, came alongside a total funding commitment of £800million, the largest budget so far.

A series of initiatives were announced in 2023, designed to help mitigate rising costs, maintain confidence in the UK market and support the accelerated growth of the industry. They included:

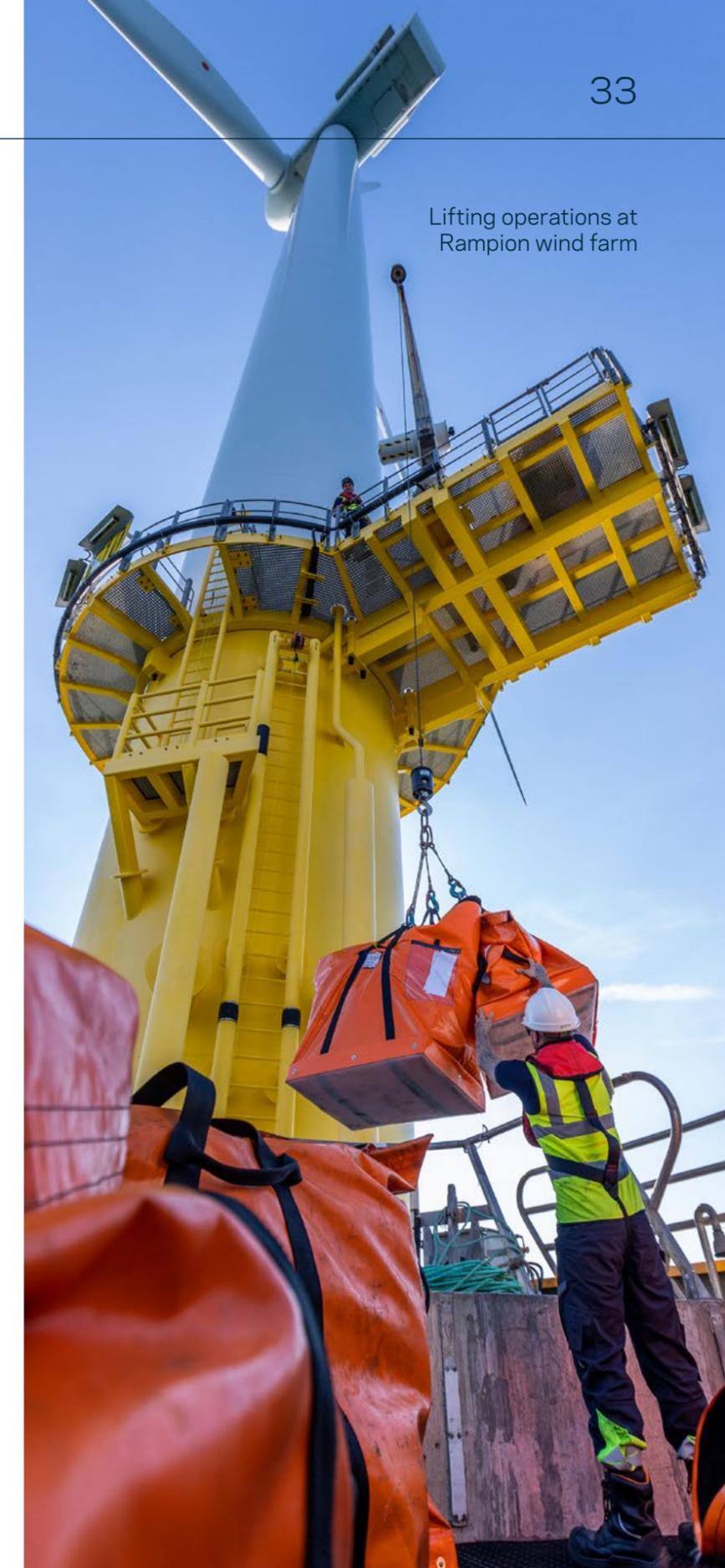
- The UK Government's £960million Green Industries Growth Accelerator (GIGA) to support capacity developments across multiple green industries, and its £1billion Net Zero Innovation Portfolio fund to support the development of low carbon technologies and systems. Both of which include a focus on offshore wind
- The £160million Floating Offshore Wind Manufacturing Investment Scheme (FLOWMIS) launched by the UK Government to support the delivery of port infrastructure to facilitate floating offshore wind
- The Crown Estate's intention to launch a pilot £10million Supply Chain Accelerator fund (see [page 40](#)) in 2024 to accelerate and derisk supply chain development projects, with a further £40million earmarked which could be deployed over time
- Up to £500million announced by the Scottish Government to support supply chain development
- The impact of Ofgem's Accelerated Strategic Transmission Investment (ASTI) regulatory approval and funding framework, which aims

to unlock c.£20billion of investment in transmission projects required to deliver the Government's 2030 ambitions for offshore wind

- Various funding opportunities through Innovate UK with £25million of loans for innovation, £25million in Smart Grants and other funding opportunities for research.

The UK Government is also consulting on **changes to future CfD rounds** post AR6, in addition to proposing the introduction of a new CfD Sustainable Industry Reward. The aim is to accelerate the deployment of low carbon electricity generation, specifically offshore wind and floating offshore wind.

Lifting operations at Rampion wind farm



1 Vattenfall 20 July 2023: [First six months 2023: A positive development for the customer business and challenges in offshore wind power - Vattenfall](#)

2 Vattenfall 27 March 2024: [Vattenfall and RWE conclude sale of Norfolk Offshore Wind Zone - Vattenfall](#)

Offshore Transmission Owner (OFTO) ownership

Offshore wind
transmission substation at
Gwynt y Môr wind farm

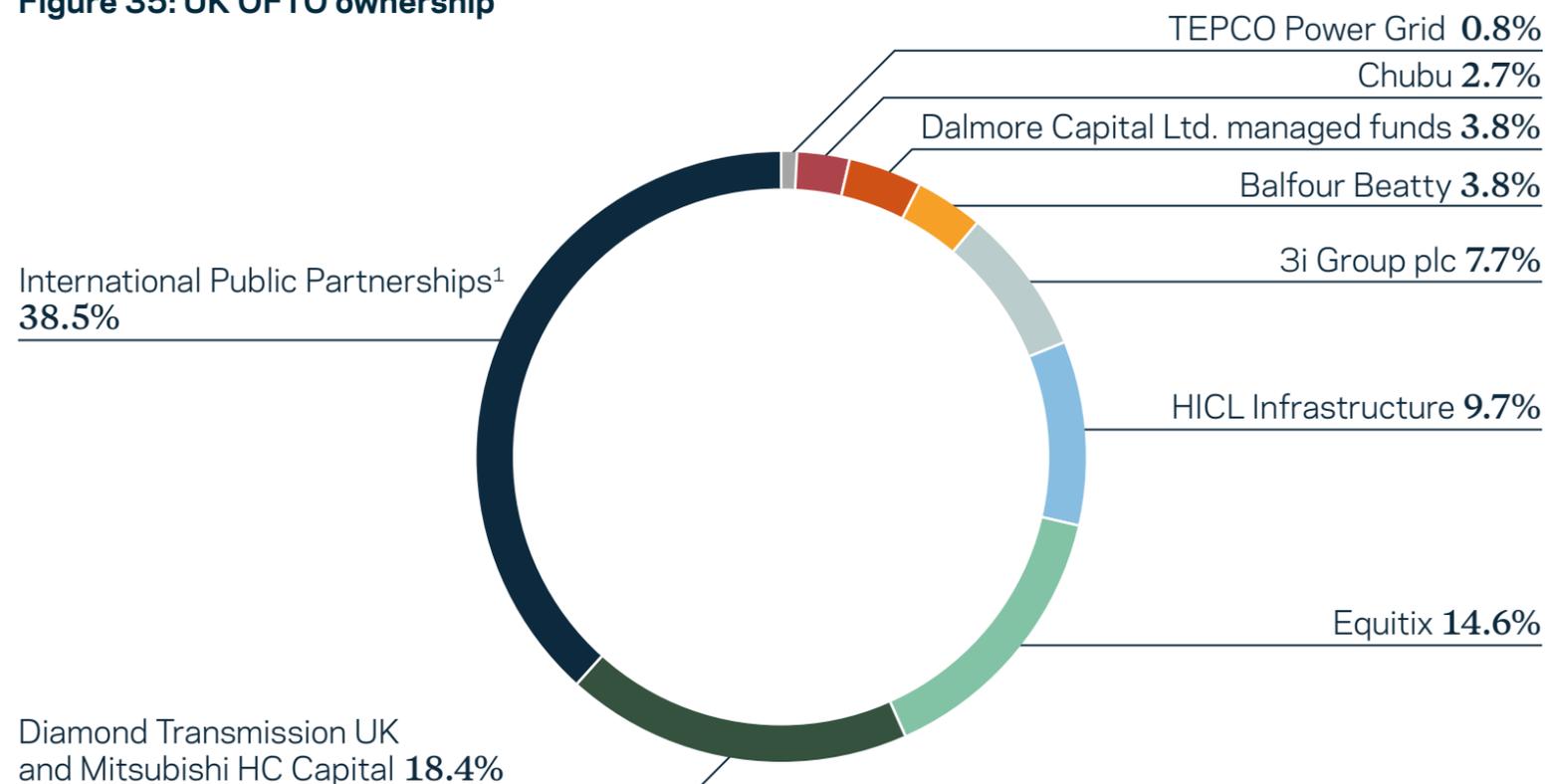


In 2023 Ofgem awarded two OFTO licences. The licence for Hornsea 2 was awarded to established OFTO owners Diamond Transmission Partners Hornsea Two Limited, a partnership between Diamond Transmission Corporation and HICL Infrastructure PLC. The licence for Triton Knoll was awarded in December to Triton Knoll OFTO Ltd, an Equitix Limited and TEPCO Power Grid incorporated consortium, bringing TEPCO Power Grid into the OFTO ownership table for the first time (see figure 35).

During the year Ofgem shortlisted four potential operators for the next OFTO tender round (TR10), including a new entrant to the market, a consortium led by Gravis Capital Partners. New entrants to the market could indicate the growing opportunity in this field for investors as the market expands to meet the UK Government target of 50GW by 2030.

OFTO ownership details can be found on The Crown Estate’s [website](#).

Figure 35: UK OFTO ownership



1. OFTOs operated by Transmission Capital Partners.

Figure 36: Offshore transmission tenders

Ofgem is responsible for managing the competitive tender process through which offshore transmission licences are granted. The tenders listed below are currently in progress.

<p>Tender Round 7 Launched November 2020</p>	<p>Licences granted 2023 Triton Knoll December 2023</p> <p>Licences granted 2024 Moray East February 2024</p>
<p>Tender Round 8 Launched July 2021</p>	<p>Licences granted 2023 Hornsea 2 July 2023</p>
<p>Tender Round 9 Launched January 2022</p>	<p>Preferred Bidder to be appointed 2023 Seagreen Phase 1 ITT stage commenced January 2023</p>
<p>Tender Round 10 Launched January 2023</p>	<p>EPQ stage commenced 2023 Dogger Bank A ITT stage commenced 2023</p> <p>Neart na Gaoithe ITT stage to commence Q4 2023</p> <p>Moray West ITT stage to commence Q2 2024</p>
<p>Tender Round 11</p>	<p>EPQ stage commenced 2024 Dogger Bank B</p>

For more details on the tender rounds, projects and publications relating to the tender processes, please visit Ofgem’s [website](#).

Offshore wind development

2023 was another busy year with projects progressing in England, Wales, and Scotland, and momentum maintained for converting pipeline potential into operational reality.

Here we look at some of The Crown Estate's highlights from the year. We also reference the latest updates from Crown Estate Scotland's development pipeline, and look ahead to consider some of the activity expected in 2024.



93GW

pipeline of UK offshore wind capacity

Artificial nesting structures for Kittiwake, related to Hornsea 3 wind farm

Photo: Courtesy of Ørsted



Development portfolio

The portfolio of offshore wind farms in development comprises projects under Agreement for Lease (AfL), where an option over an area of seabed has been granted for offshore wind development.

Figure 37 shows the UK offshore wind development pipeline. Operational capacity increased from 14GW to 15GW as Seagreen Phase 1, Scotland’s largest offshore wind farm, became fully operational. At the other end of the pipeline, potential capacity (opportunity announced but not yet under AfL) increased significantly from 4GW to 14GW. This is due to the potential from current leasing rounds and requests for increases in capacity being considered on several projects already in agreement.

Projects update

At the beginning of the year, The Crown Estate awarded landmark Agreements for Lease with developers of the six Offshore Wind Leasing Round 4 projects totalling c.8GW. The projects have the potential to generate enough green electricity to power seven million homes, targeting operation by 2030.

In England and Wales, projects obtain planning consent through a Development Consent Order (DCO) from the Secretary of State. In 2023 all Round 4 projects undertook pre-application statutory consultation on their proposed projects. Hornsea 4 and Awel y Môr were granted consent and Rampion 2 submitted its consent application. Offshore construction started in September 2023 at the 1.4GW Sofia project. The joint DCO application for

Sheringham Shoal and Dudgeon Extensions finished examination in July. Consent for this was granted on **17 April 2024**.

During the year momentum gathered for floating offshore wind development in the UK. Consent was granted for Wales’ first floating wind farm, Erebus, and the White Cross floating wind test and demonstration project submitted applications for consent. On **page 38** we look in more detail at The Crown Estate’s 4.5GW Offshore Wind Leasing Round 5, which launched in early 2024.

In November, following engagement with offshore wind farm developers, The Crown Estate announced the potential for additional capacity to be generated from array areas for which developers hold existing rights. The process

for considering these is underway.¹ If approved, the requests will enable generation of up to an additional 4GW across seven projects.

Ørsted reached a significant milestone this year as construction of three nearshore artificial nesting structures completed. These structures are to compensate for potential impacts of the Hornsea 3 wind farm to Kittiwake, a vulnerable species of seabird, and are the first of their kind. Ongoing monitoring will demonstrate the effectiveness of these structures and provide valuable insights, helping to inform future compensation projects.

You can read about progress in Scotland on **page 41**.

¹ The Crown Estate sets out plan to unlock enough new offshore wind capacity to power up to four million homes.

Figure 37: UK offshore wind development pipeline waterfall (GW rounded)



² Projects under construction or projects that have government support on offer.

³ Potential from current leasing rounds and additional capacity requests, including Innovation and Targeted Oil & Gas (INTOG) and Leasing Round 5.

⁴ UK Government Offshore wind net zero investment roadmap.

Offshore Wind Leasing Round 5 – floating wind in the Celtic Sea

2023 was a significant year for the future deployment of floating offshore wind in the UK, with The Crown Estate taking a number of key steps towards a leasing round for this new technology in the Celtic Sea, off the coast of Wales and South West England. The new leasing round is known as Leasing Round 5 and began in February 2024. It is expected to be the first phase of commercial development in the Celtic Sea.

Floating offshore wind is set to be a critical new frontier in the global move away from fossil fuels, with some estimates suggesting it will ultimately account for 80% of global offshore wind potential. To date, operational capacity is modest, with a number of test and demonstration (T&D) projects around the world, including the 50MW Kincardine wind farm off Aberdeen and the 30MW Hywind Scotland project off the coast of Peterhead.

In the Celtic Sea, The Crown Estate is supporting up to five T&D scale floating wind projects, with a combined potential capacity of up to 450MW. Notably, in March 2023, the 100MW Erebus project off the coast of Pembrokeshire attained its full consents – a first for any floating wind project in Wales. These T&D projects can be key enablers of the successful commercialisation of floating offshore wind in the region.

However, both the technology and industry ambition for commercial scale projects have continued to develop, and in 2023 we further refined our proposition for the Celtic Sea. A key focus was work on the spatial design of Leasing

Round 5, including supporting the UK Government as it sought to resolve a number of competing demands and policy drivers in the Celtic Sea.

After seeking market feedback in July 2023 on an initial, ‘minded-to’ detailed spatial design, we confirmed in October 2023 a final design of three Project Development Areas (PDAs) of equal size, each with a potential capacity of up to 1.5GW. In its Autumn Statement in November 2023, the UK Government subsequently confirmed its intention to work towards unlocking space for a further 12GW of capacity in the Celtic Sea.

Alongside work on the spatial design for Leasing Round 5, we continued to progress a number of workstreams to help de-risk projects for developers and accelerate the deployment of floating offshore wind. In July 2023 the first survey vessel set sail from Swansea as part of a multi-million-pound programme of surveys to better understand the physical and environmental properties of the PDAs. We also continued work with the Electricity System Operator (ESO) to support a coordinated grid design for Leasing Round 5, while also carrying out a plan-level Habitats Regulations Assessment ahead of the award of Agreements for Lease (AfLs).

This culminated in the publication of an Information Memorandum (IM) in December 2023 which set out the Leasing Round 5 offer in more detail. This included more information on how we intend to maximise the broader social, environmental and economic opportunities arising

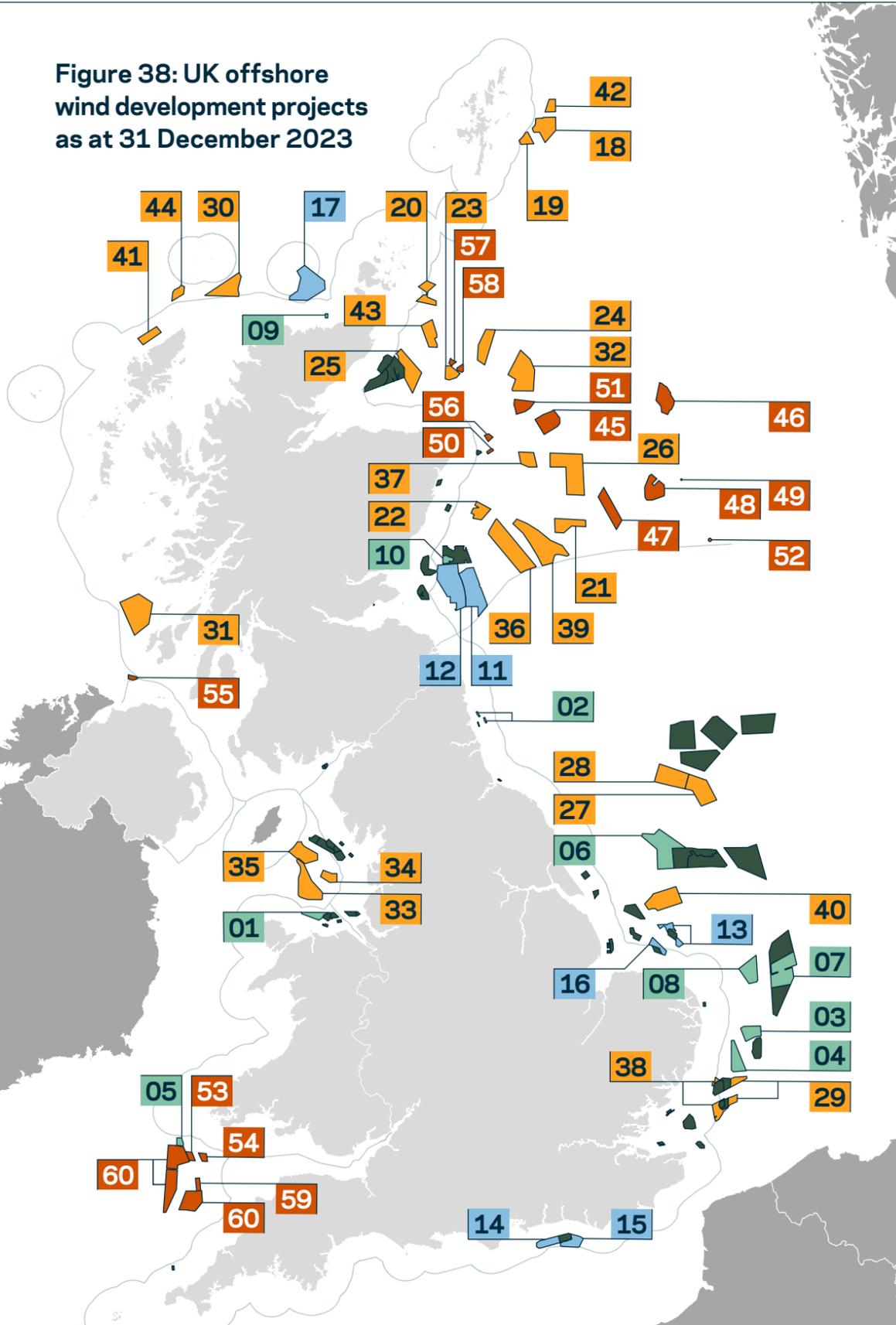


from Leasing Round 5 projects. In recognition of the nascent nature of floating wind technology and the lack of a mature supply chain, the IM also included plans for a 50% reduction in option fees if project consenting leads to undue delays in development.

At an event for potential bidders held in Swansea in January 2024, we set out an updated schedule for Leasing Round 5, saving up to six months off the overall process, with AfLs now expected by July 2025. The tender process for Leasing Round 5 formally began with the publication of a Concession Notice and Pre-Qualification Questionnaire in February 2024.

Colleagues from The Crown Estate alongside the vessel used by Fugro for the 2023 geophysical survey

Figure 38: UK offshore wind development projects as at 31 December 2023



Territorial Waters Limit

- Ext 2017 Extensions Round project.
- IN Innovation project, INTOG Leasing Round.
- R3 Leasing Round 3 project.
- R4 Leasing Round 4 project.
- SW ScotWind project (and plan area).
- T&D Test & Demonstration scale floating wind project.
- TOG Targeted Oil & Gas project, INTOG Leasing Round.

- 1 Capacities noted are rounded to the nearest whole MW.
- 2 Managed by Crown Estate Scotland.
- 3 Under construction or government support on offer.

Consented: Wind farms that have received consent but not yet secured a Contract for Difference.

Up to capacity MW ¹		
01	Awel y Môr ^{Ext}	576
02	Blyth Demonstration Phases 2&3 ^{T&D}	58
03	East Anglia ONE NORTH ^{R3}	950
04	East Anglia TWO ^{R3}	980
05	Erebus ^{T&D}	100
06	Hornsea 4 ^{R3}	2,700
07	Norfolk Vanguard East ^{R3}	1,400
08	Norfolk Vanguard West ^{R3}	1,400
09	Pentland ^{T&D, 2}	100
10	Seagreen Phase 1a ^{R3, 2}	500
Total		8,764

In planning: Wind farms for which a consent application has been submitted.

Up to capacity MW ¹		
11	Berwick Bank ^{R3, 2}	4,100
12	Marr Bank ^{R3, 2}	400
13	Dudgeon Extension ^{Ext}	400
14	Rampion 2 (Rampion Extension) ^{Ext}	400
15	Rampion 2 (Zone 6) ^{R3}	800
16	Sheringham Shoal Extension ^{Ext}	317
17	West of Orkney (N1) ^{SW, 2}	2,000
Total		8,019

Pre-planning: Wind farms for which a consent application has not yet been submitted.

Up to capacity MW ¹		
18	Arven (NE1) ^{SW, 2}	1,800
19	Arven South (NE1) ^{SW, 2}	500
20	Ayre (NE2) ^{SW, 2}	1,008
21	Bellrock (E1-3) ^{SW, 2}	1,200
22	Bowdun (E3) ^{SW, 2}	1,008
23	Broadshore (NE6) ^{SW, 2}	500
24	Buchan (NE8) ^{SW, 2}	960
25	Caledonia (NE4) ^{SW, 2}	1,000
26	CampionWind (E2-2) ^{SW, 2}	2,000
27	Dogger Bank South (East) ^{R4}	1,500
28	Dogger Bank South (West) ^{R4}	1,500
29	Five Estuaries ^{Ext}	353
30	Havbredey (N2) ^{SW, 2}	1,500
31	MachairWind (W1) ^{SW, 2}	2,000
32	MarramWind (NE7) ^{SW, 2}	3,000
33	Mona ^{R4}	1,500
34	Morecambe ^{R4}	480
35	Morgan ^{R4}	1,500
36	Morven (E1-2) ^{SW, 2}	2,907
37	Muir Mhòr (E2-1) ^{SW, 2}	798
38	North Falls ^{Ext}	504
39	Ossian (E1-1) ^{SW, 2}	2,610
40	Outer Dowsing ^{R4}	1,500
41	Spiorad na Mara (N4) ^{SW, 2}	840
42	Stoura (NE1) ^{SW, 2}	500
43	Stromar (NE3) ^{SW, 2}	1,000
44	Talisk (N3) ^{SW, 2}	495
Total		34,463

Future potential: Projects, leasing rounds and additional capacity subject to AfL and plan-level Habitats Regulations Assessment (HRA) or INTOG Sectoral Marine Plan.

Up to capacity MW ¹		
45	Aspen ^{TOG, 2}	1,008
46	Beech ^{TOG, 2}	1,008
47	Cedar ^{TOG, 2}	1,008
48	Cenos ^{TOG, 2}	1,350
49	Culzean ^{TOG, 2}	3
50	Flora ^{IN, 2}	50
51	Green Volt ^{TOG, 2}	560
52	Judy ^{TOG, 2}	15
53	Llŷr 1 ^{T&D}	100
54	Llŷr 2 ^{T&D}	100
55	Malin Sea Wind ^{IN, 2}	100
56	Salamander ^{IN, 2}	100
57	Scaraben ^{IN, 2, 3}	99
58	Sinclair ^{IN, 2}	99
59	White Cross ^{T&D}	100
60	Leasing Round 5	4,500
	Additional capacity requests ^{Ext/R3}	4,000
Total		14,200

Projects in operation or committed³ (see page 9)

Looking to the future

Figure 38 shows that the UK offshore wind development pipeline remains healthy and continues to grow. However, the pipeline also signals the need to continue to accelerate offshore wind development in order to meet 2050 net zero targets.

In Spring 2024, The Crown Estate intends to outline our initial thinking in relation to future offshore wind leasing as part of our ongoing engagement, seeking the views of our stakeholders and calling for feedback on our proposed approach.

With a sector set to grow radically in the coming years, a vastly more coordinated approach to seabed leasing and the delivery of transmission infrastructure is needed to realise the UK's clean energy potential, navigate emerging challenges while considering other seabed users and the natural environment.

2023 was a strong year for action to address this need. Three seminal reports were published which galvanized governments, industry and wider stakeholders to co-ordinate activity and collaborate on solutions: the UK Government's Offshore Transmission Network Review, a report by the UK's Offshore Wind Champion, Tim Pick, on how to accelerate the deployment of offshore wind farms in the UK, and a report by the UK's Electricity Networks Commissioner, Nick Winser,

on how to accelerate the deployment of electricity transmission infrastructure.

This led to a commitment from The Crown Estate and the Electricity System Operator (ESO) to work together with others to develop a Strategic Spatial Energy Plan (SSEP) and a Marine Delivery Routemap to ensure that there is a holistic plan for future offshore wind and transmission network needs which takes into account the many other demands on the marine environment, including nature and biodiversity.

It is widely acknowledged that action is needed now to develop the supply chain capability and skills needed to establish and support a rapidly growing sector. The panel on the right summarises recent research by The Crown Estate into the supply chain capacity needed to deliver Leasing Round 5 projects.

In progressing the activity to identify the supply chain capacity required to deliver the portfolio, and secure the economic benefits for the UK, the Offshore Wind Industry Council (OWIC) and OWGP released the **Supply Chain Capability Analysis**, evidencing the Offshore Wind supply chain has £92billion potential for the UK economy by 2040.

It also led to RenewableUK, OWIC, The Crown Estate and Crown Estate Scotland developing

a new Industrial Growth Plan to boost long-term growth of the UK offshore wind sector, published on 17 April¹.

The Crown Estate continues to support the draft Offshore Renewable Energy Action Plan, which is expected to put in place the policy and legislative frameworks to support future offshore wind leasing in Northern Ireland. As part of that, in January 2023, The Crown Estate and the Northern Ireland Executive's Department for the Economy developed a Statement of Intent, outlining the ways in which they will work together to enable leasing for offshore wind in the Northern Ireland marine area.

Internationally, The Ostend Declaration in 2023 saw energy ministers from nine European countries, including the UK, committing to more than doubling the planned 120GW capacity of North Sea offshore wind to at least 300GW by 2050. Additional announcements from the UK Government demonstrated a commitment to collaborating with European neighbours including Ireland, Germany, Denmark and the North Seas Energy Cooperation (NSEC) to support offshore renewable energy and increase interconnectivity, including the development of the world's largest-of-its-kind subsea power line between UK and Netherlands.

Capturing future opportunity

As part of a suite of measures to de-risk and accelerate deployment, we commissioned an independent study, '**The Celtic Sea Blueprint**'. This study looked at the minimum supply chain capacity needed to deliver the three projects expected to emerge from Leasing Round 5 and examined the gaps, such as ports deep enough for handling the giant turbines, vessels to service the sites, and export cables to transport electricity to land.

It estimates that 5,300 new jobs and up to £1.4billion could be generated for the UK economy by galvanising the supply chain and infrastructure opportunities arising from the development of new floating wind farms. It also highlights the opportunity for Wales and the South West to be at the forefront of driving this development, building on existing expertise in the region.

In responding to the challenge laid out by the Celtic Sea Blueprint, The Crown Estate is exploring investment options to enable and accelerate the establishment of the supply chain. This includes the launch of a pilot £10m Supply Chain Accelerator fund in 2024 to support early stage supply chain development projects. A further £40million has been earmarked to extend this in the context of the Industrial Growth Plan.



¹ [Offshore wind industry unveils Industrial Growth Plan to create jobs, tripling supply chain manufacturing and boosting UK economy by £25 billion](#) | The Crown Estate

Crown Estate Scotland development

Crown Estate Scotland has 26 option agreements for offshore wind farms in Scottish waters.

Of these projects, the largest is Berwick Bank, at an expected 4.1GW of generation capacity; Berwick Bank applied for consent in 2023 and will be expecting a determination in 2024.

At the other end of the development scale, in 2023 the Pentland Floating Offshore Wind demonstrator project – which will provide up to 100MW of generation capacity – successfully secured consent for its innovative project off the coast of Dounreay in Caithness.

A further 12 projects have secured exclusivity agreements from the INTOG leasing round.

ScotWind leasing round

Progress on the 20 projects which emerged from ScotWind has continued at pace, with most having undertaken site investigation surveys in 2023.

All of them have submitted the first updates to their Supply Chain Development Statements and we were pleased to see no softening in the strong commitments and ambitions for investment in Scotland; many have now established their own head offices and are building delivery teams. Projects are beginning to develop strong identities in their communities.

There has been notable collaboration between projects on matters including supply chain, surveys, ornithology, and cable landing.

The 2GW West of Orkney project was the first of the ScotWind cohort to submit its consent application to the Marine Directorate of the Scottish Government. More are expected to follow in 2024.

Innovation and Targeted Oil & Gas (INTOG)

The INTOG leasing round offered an opportunity for offshore wind farms to help maximise value from commercial scale deployment via small innovation projects, and to reduce the carbon emissions from North Sea Oil and Gas production via electrification.

After initial offers were made in March 2023, 12 projects – five innovation and seven targeted oil-and-gas projects – entered exclusivity agreements with Crown Estate Scotland.

Development outlook

Crown Estate Scotland continues to support the strategic infrastructure planning, and socioeconomic development necessary to help Scotland maximise the benefits of offshore wind development.

Notably the Strategic Investment Model (SIM) process is helping deliver transformational supply chain growth in Scotland through collaboration between offshore wind developers, the Scottish Government, enterprise agencies, and Crown Estate Scotland to unlock infrastructure investment. A total of 38 projects with a combined potential capital value of £6.5bn completed SIM stage 1. A number of these will move into stage 2 in 2024 where a full commercial business proposition and investment proposal will be developed.

Investments in energy ports are a key focus for Crown Estate Scotland, as they will help to unlock solutions for our other central priorities:

- Grid and hydrogen development for power export
- Delivering floating wind at gigawatt scale
- Pioneering models for supply chain collaboration
- Supporting Scotland's projects to be world-leading examples.



Moray West transition pieces arriving at Port of Nigg

Data & evidence

Demands on the seabed continue to intensify. Alongside offshore wind, space is needed for a diverse range of industries and uses.

To enable these multiple priorities to prosper in a sustainable way, The Crown Estate invests tens of millions of pounds to build world-class data, evidence and cutting-edge digital tools to inform how the seabed can sustain a wide variety of industries, livelihoods and natural habitats for the long-term benefit of the nation.

We work closely with the brightest and best minds to collect data and evidence and fill critical knowledge gaps to help speed up the consenting process. We do this by reducing uncertainties, encouraging innovative design measures to enhance biodiversity, and providing a better understanding of the spatial needs of user groups.

The level of commitment from industry, governments, the environmental sector, organisations representing other users of the seabed and academia to work collaboratively to find a sustainable way forward puts the UK at the forefront of this world-leading work and helps to de-risk and accelerate nature-positive offshore development.

Cold water divers at Drawna Rock, Cornwall, admiring the vibrant sealife

Photo: Lewis Jeffries, finalist, Underwater Photographer of the Year 2024



Delivering with the power of data and evidence: a pioneering approach

In 2023 we launched our pioneering 'Whole of Seabed Programme', using innovative technology to digitally map the seabed space needed to meet future demand for a wide range of industries, infrastructure, and habitats out to 2050. This will allow us to identify optimal sites for future offshore wind leasing, designing out spatial challenges from the start, where we can, and building a holistic view of how other industries and natural habitats can co-exist offshore. This modelling capability represents the most comprehensive and sophisticated approach to spatial mapping in our history, and it will play a vital role in de-risking future site selection.

Figure 39 illustrates the Whole of Seabed mapping process which starts with a wide range of datasets and demand profiles for the spatial needs of different sectors and, stage by stage, refines the optimal seabed area for each sector's requirements. By using a unique set of digital tools, we process and weigh up hundreds of spatial datasets which are structured and prioritised to ensure all environmental, social and cultural interests are fairly represented in line with stakeholder views. This allows us to identify prime areas of opportunity that are technically viable and optimise the cost, location and impact of development in more detail than ever before.

These areas are then added to a digital grid of the seabed which is made up of c.250,000 cells. Using this grid, we can run multi-sector spatial scenarios out to 2050, which demonstrate the different ways in which the seabed could develop and what that might mean for the activities and livelihoods that depend upon the space.

This work will play a key role in a '2050 Marine Delivery Routemap', developed in collaboration with government bodies, delivery agencies and in coordination with international neighbours. The Routemap will support the co-ordination of multi-agency, cross-sector action needed

to deliver net zero, nature recovery and support communities and a thriving marine economy.

Evidence gathered through the Whole of Seabed Programme will also contribute to existing work in this space. This includes the cross-government Marine Spatial Prioritisation work led by the Department for Environment, Food and Rural Affairs (DEFRA) in collaboration with the Marine Management Organisation (MMO) and relevant marine planning work within the devolved nations, such as the Welsh National Marine Plan and Northern Ireland's Strategic Environmental Assessment.

Figure 39: Whole of Seabed Programme

A holistic and cross-sectoral spatial evidence base required to meet a range of future sectoral demands out to 2050

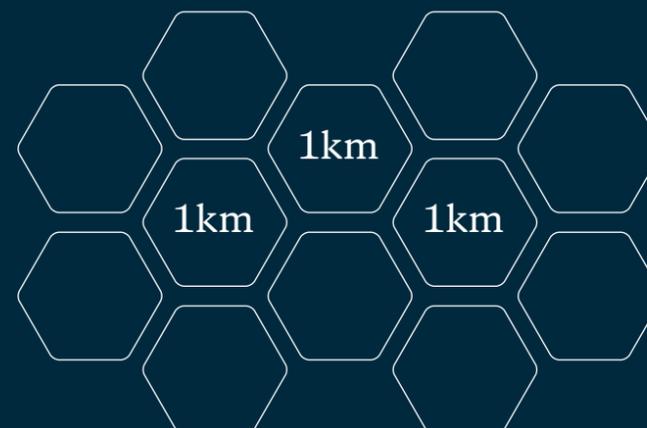
Modelling utilises a wide range of data feeds and demand profiles, across sectors to show spatial needs:

- 6** Key sectors covered in Phase 1
- 12** Sectors by Q1 2024, and >20 in long term
- 250+** Datasets used ranging from birds to sediments
- >15** Years of spatial modelling capability and evidence development

Analysing this data, we are able to refine Key Resource Areas into Prime Areas of Opportunity (PAO) for each sector.



We understand the seabed by attributing sector PAOs and all other datasets (e.g. water depth) to each of our c.250,000 hex grid cells.



From this, we run multi-sector spatial scenarios to 2050 in 5-year intervals, based on:

- 1.** Different objectives on spatial prioritisation between and within sectors (e.g. minimise costs, minimise impact on other users, maximise co-location).
- 2.** Different sector demand profiles to capture the uncertainty (e.g. GWs of offshore wind needed by 2050 for net zero).



World-class data resources

In 2023 The Crown Estate’s Marine Data Exchange (MDE) – the world-leading collection of free-to-access offshore marine industry data and evidence – reached its 10th anniversary. This marked a decade of invaluable data gathering and sharing, helping the UK offshore wind market learn from over twenty years of research, and grow in an informed and evidence-based way. The MDE also became the single portal for sharing offshore data relating to the whole of the UK’s seabed, thanks to a new agreement with Crown Estate Scotland to include data covering Scottish waters. The MDE supports a thriving UK market, through collaboration and open and accessible data sharing. Find out more about the MDE by reading the [MDE Impact Report](#) and [MDE Data Valuation Report](#). Figure 41 illustrates the scale and value of this data, whilst figure 40 splits data by type.

2023 was also the launch year for the [Offshore Wind Evidence and Knowledge Hub](#) (OWEKH). Funded through The Crown Estate’s £50million Offshore Wind Evidence and Change programme, OWEKH is an online knowledge centre to enable developers, regulators, marine specialists and other offshore wind professionals to access information that accelerates high-quality consenting around offshore wind development. The best practice guidance delivered by the Hub holds the potential to drive efficiencies for all stakeholders involved in the consenting process.



Figure 40: Data holding by theme

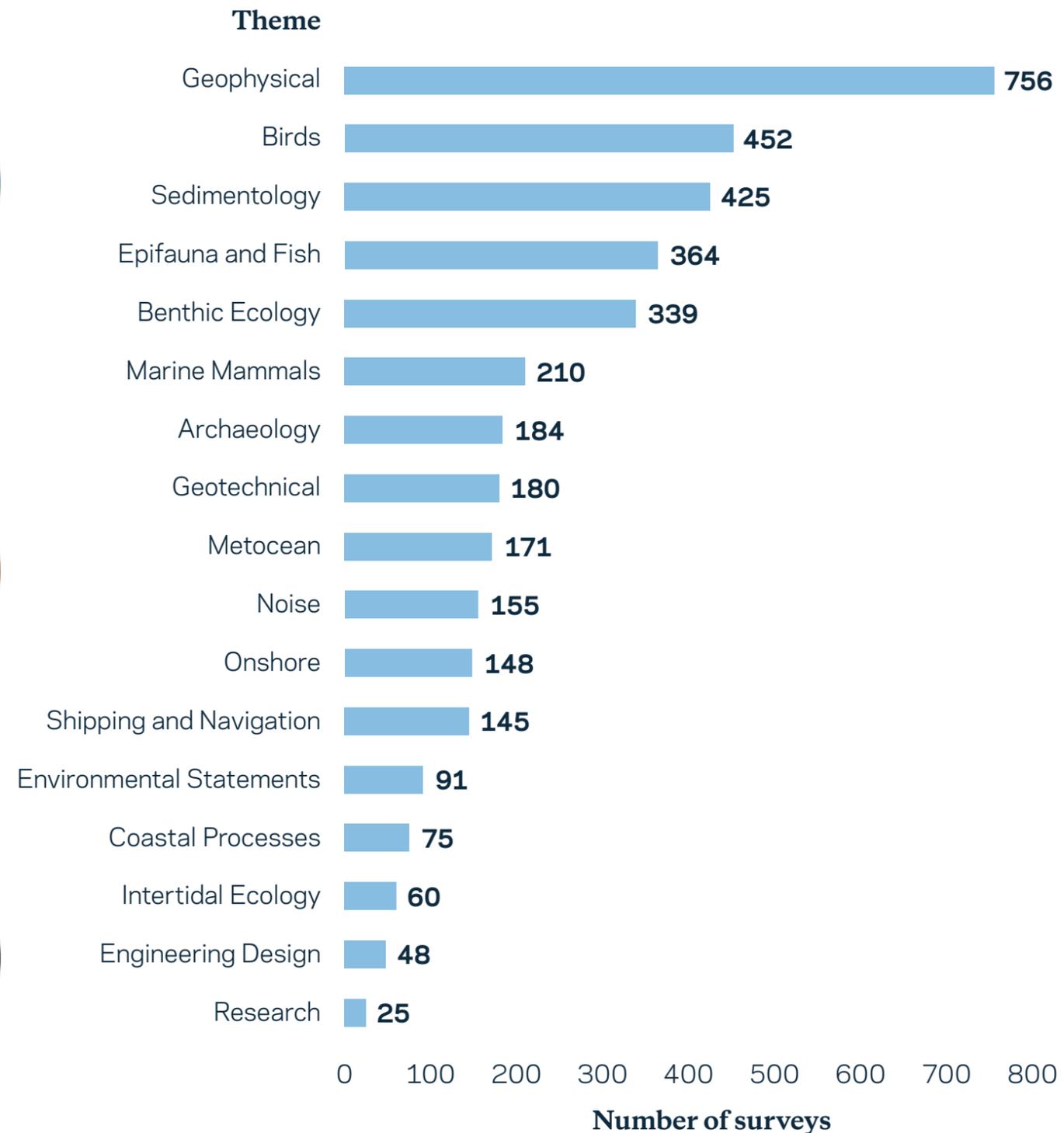


Figure 41: MDE in numbers

268TB

of data

20

years of data

3,000

surveys

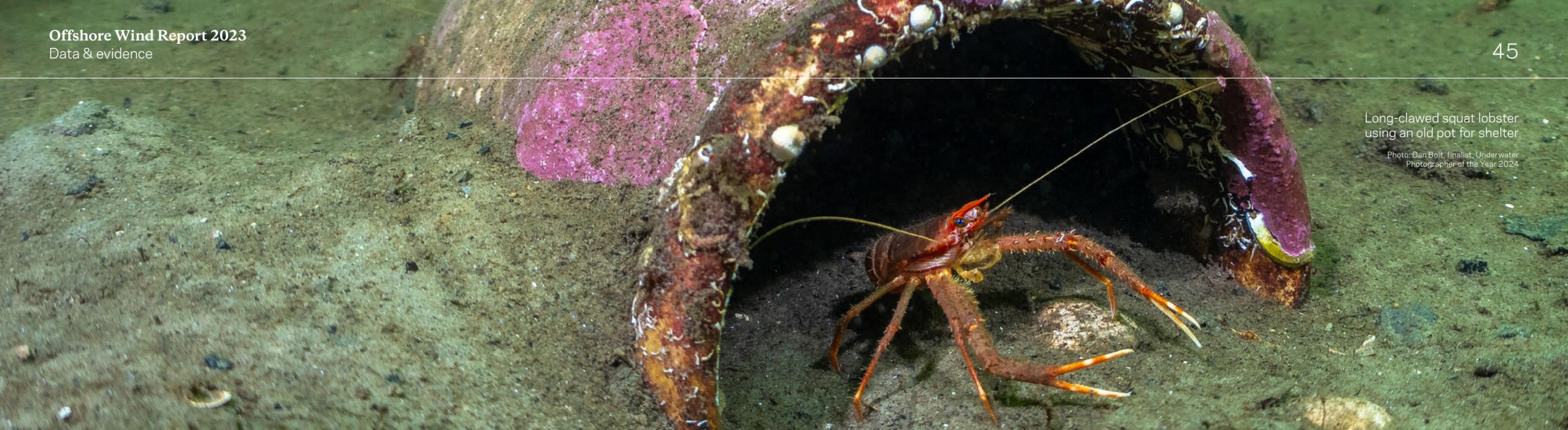
£1.54bn

value of data

5,000

users accessed marine data in 2023





Long-clawed squat lobster using an old pot for shelter

Photo: Dan Bolt, finalist, Underwater Photographer of the Year 2024

Figure 42: MDE history

Marine Data Exchange

2003 2013 2015 2021 2023

Data clause introduced

To support the growth of the offshore wind sector, The Crown Estate pioneered the inclusion of a data clause that would require offshore wind projects to deliver their survey data to The Crown Estate throughout the lifetime of the projects. This data clause has since been rolled out to all seabed leasing agreements which means it is a contractual requirement for our customers to share their survey data with us.

MDE established

In response to the large volumes of survey data being collected and delivered by our customers, we built a bespoke data management system, the Marine Data Exchange. The MDE not only provides a portal for data submission and an audit of the data management process, it also provides a public platform from where data is made publicly and freely available.

MDE moved to the cloud

The MDE data holding surpassed 100TB.

Rather than developing internal infrastructure to accommodate a rapidly growing database, we decided to move the MDE into the cloud. This paved the way for other systems at The Crown Estate to utilise the cloud platform.

New-look MDE launched

In 2021, following feedback from our customers, users and stakeholders, we re-designed the MDE and launched a new version of the site.

The new site is design-led and user-driven. We take an agile approach in rolling out improvements, responding and testing user requirements every step of the way.

10 year anniversary

The MDE celebrated its 10 year anniversary in 2023.

Take a look at the facts, case studies and events that celebrated this milestone.



Gwynt y Môr offshore wind farm array with Snowdonia in the background

Offshore Wind Evidence and Change programme

Despite the game-changing contribution that offshore wind can make to delivering a net zero future, it cannot be developed in isolation. New development, particularly on the scale required to achieve net zero, must sit comfortably alongside other users of the busy marine space, and – crucially – we need to be reducing the pressure on nature and proactively restoring the marine environment.

At its heart, robust and accessible data will help speed up the consenting process by reducing

uncertainties, encouraging innovative design measures to enhance biodiversity, and providing a better understanding of the spatial needs of user groups.

Investing in evidence, research and data is therefore vital to our future and no one organisation can do this on its own. The Crown Estate’s £50 million investment in the Offshore Wind Evidence and Change programme (OWEC), launched in 2021, brings together 26 member organisations to collect, analyse and share data

and evidence that will help to paint an ever-fuller picture of the whole of the seabed and its many interdependencies. Over the past year the programme has funded a broad range of pioneering new research projects on subjects such as consideration of subsea cabling and how to improve the evidence base for the coexistence of offshore wind farms and commercial fishing; and what kind of impacts floating offshore wind will have on the marine environment. For more information about the work of OWEC in 2023, read the annual report [here](#).



**Offshore
Wind Evidence
+ Change
Programme**

Carbon dioxide displacement due to renewable energy

Displaced CO₂: Represents the carbon dioxide that would have been emitted by traditional power stations to generate electricity, in the absence of renewable energy.

A study of greenhouse gas emissions of the UK electricity system by R.C. Thomson (2014)¹ demonstrated that wind power displaces coal - and gas-fired power stations, and that partial loading of fossil-fuelled power stations has an efficiency penalty of 11%.

The CO₂ displaced by offshore wind can be calculated by using DESNZ emissions statistics for “all fossil fuels” and subtracting 11% to account for the induced efficiency penalty.

The Crown Estate uses this method to measure the benefit of offshore wind.

Displaced CO₂ in 2023: 18,491,935 tonnes.²

¹ Carbon and Energy Payback of Variable Renewable Generation, Rachel Camilla Thomson (2014).

² Figure based on 2022 emissions data published on 27 July 2023 by DESNZ.

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