Offshore Colocation Forum

Offshore Wind and CCUS Colocation Forum

Plenary #12 – October 2024

THE CROWN ESTATE

Agenda

1. **Matters Arising** – Chair – 10mins
2. **Project Colocate** – Prof John Underhill – 20mins
3. **Project Anemone** – Philippa Parmiter, NECCUS – 15mins
4. **Non-technical workstreams** – Chair – 15mins
5. **Marine Delivery Routemap** – Will Steggals 25mins
6. **Future of Offshore Wind Report –** Jonny Boston 25mins
7. **AOB** – Secretariat – 5 mins

Matters Arising

Matters Arising

Action	Owner	Status
Project Colocate Advisory Group Meeting	Project Colocate advisory group members	Meeting took place on 25.09. Key actions of the meeting to be discussed in Plenary #12
Consider establishing a cross-industry liabilities / risk assurance workstream	TCE	Update in Plenary #12 – risk assurance event
Forum terms of reference	TCE	Reissue for feedback at plenary #13

Action	Owner	Status
RUK / TCE webinar	RUK / TCE	OWIC has begun engagement with membership around awareness of colocation ahead of webinar.
Explore how the Forum can quantify / categorise decarbonisation contribution of colocation	TCE	To be discussed

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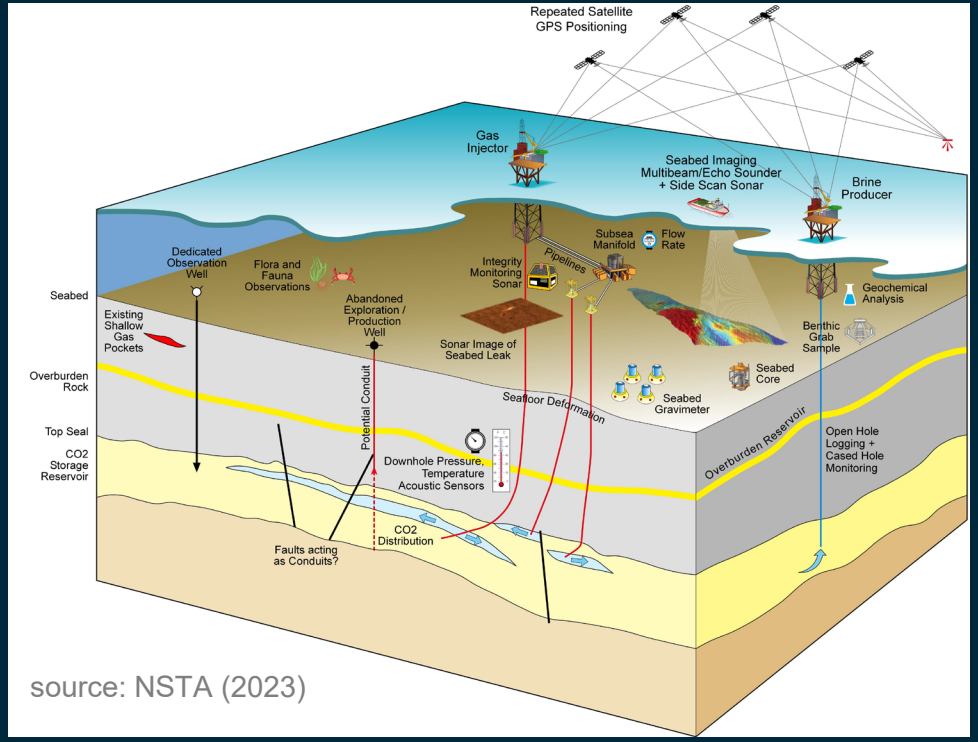
Project CoLocate

Update from Professor John Underhill

University Director for Energy Transition and Professor of Geoscience at University of Aberdeen



source: NSTA (2023)

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GO BEYOND BOUNDARIES

Project CoLocate

Undertaken at the Interdisciplinary Centre for Energy Transition, **University of Aberdeen**
Prof. John Underhill, Principal Investigator

To inform the **Offshore Wind and CCUS Colocation Forum (OCF)**

Two-year project

1. East Irish Sea

Dr Sam Head, Research Fellow

2. Outer Moray Firth

Dr Nigel Platt, Research Fellow

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Project CoLocate Objectives

Project Objectives

- Focus areas are future OW and CS targets within the East Irish Sea Basin (under the jurisdiction of The Crown Estate) and the Central North Sea (the area that falls under the jurisdiction of Crown Estate Scotland). Target areas on the UKCS may be **currently or imminently licensed** for one of the above defined uses.
- Undertake a systematic, technically informed consideration of the types of **carbon storage project and the monitoring requirements relative to other seabed constraints (notably OW) to delineate the areas where CS projects can coexist** with other seabed use.
- Integrate the results of the assessment to **produce a series of scenarios where multiple sector, potential future use is possible**.
- Develop a deep understanding of the **location, status and integrity of legacy wellbores** and their likely impact on future development.
- Make use of the outputs of the NSTA's MMV seismic work for the Colocation Forum, and the NSTA's National Data Repository (NDR) to inform thinking.
- Primary outcome: make use of technical data to **define, evaluate, and rank specific proposals for types of projects** aimed to persuade stakeholders that colocation is feasible.

Project CoLocate Aims & Objectives

***(1)** Define potential areas for OW and CS*	• **Identify areas of colocation** with offshore seabed and subsurface users, highlighting areas of multiple potential future uses in prospective areas
***(2)** Design colocation monitoring plans*	• **Storage risk assessment**, including **integrity of legacy boreholes** and other infrastructure - **"What monitoring data is required?"**
***(3)** Explore the viability of colocation projects*	• **produce a series of scenarios** where multiple sector future use is possible • **Evaluate and rank** specific proposals

Seek input from wider stakeholders with offshore interests

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EIS: Key Risks to Containment & Conformance

Some key risks differ between the Keys Basin and EIS margins, but mostly similar

EISB Geological Risk		
Risk	**Threats**	**Region**
Containment	Abandoned wells: Well integrity, vintage and density	Regional, particularly depleted fields
	Abandoned wells: Reservoir communication and brine expulsion	Possibly regional excluding the Keys Basin
	Injection wells: Poor completion or equipment failure, wellbore stability issues due to drilling challenges	Regional
	Faults: vertically extensive and densely spaced	Regional, particularly southern basin
	Faults: Reverse faults in the overburden	Parts of the Keys Basin
	Caprock: geomechanical or membrane failure of the mudstone-dominated caprock	Basin margins and south
Conformance; Containment	Unexpected lateral migration: depositional permeability heterogeneity, mudstone barrier and aeolian facies	Regional
	Unexpected lateral migration: diagenetic barrier, platy-illite cement	Keys Basin and parts of the South Morecambe field, possibly saline closures

East Irish Sea: MMV Colocation Challenges

Conformance assurance: CO_2 migration mapping, update dynamic models, verify capacity

Risk to CO_2 storage	- **Pressure baffles** (*igneous dykes, mudstone interbeds, and illite cement*) reduce reservoir connectivity and, possibly, limit injectivity and capacity
MMV techniques for <u>conformance</u> assurance	- Surface seismic (detectability?) - Borehole seismic (lateral resolution?) - Microseismicity (resolution?) - Micro gravity (sufficient vertical res.?) - Downhole press. & temp. gauges
Contingency requirements	- Rig (vessel and heliop) access for a new well (in the event of capacity or injectivity not being achieved in the first place)
Colocation conflicts	- Rig (vessel and heliop) access for drilling secondary wells - Limited area for secondary well location - Surface seismic acquisition (if conventional)
Possible solutions to Colocation conflicts	- Different surface seismic acquisition methods (OBN, DAS) - CO_2 detectability and seismic resolution is too poor - Rig access corridors to contingency well locations

Project CoLocate: East Irish Sea Summary

- Completed 12-month study
- Literature review - defined colocation issues
- Identified colocation sites, current and prospective
- Regional CS risks assessed – site-specific and CRS elements
- Legacy well abandonment information limited – remaining uncertainty (verification tests & annular cement)
- Recommended MMV techniques evaluated and alternatives assessed
- EIS-specific colocation risks & opportunities evaluated
- Scenarios created – where colocation is feasible / avoided / compromise
- Wide stakeholder engagement (more from OW?)

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Project CoLocate: East Irish Sea Conclusions

- Geological risks vary regionally but not hugely – similar MV techniques recommended
- Many recommended MMV technologies are well-based or require surveying vessels – colocation problems

- Alternative technologies - Nothing quite as good as 3D seismic (where it is well suited)
  - But seismic costly in a marginal industry, not always geologically suitable, and not feasible with OW

- ROV acquisition methods – vessel still required
- AUV/MASS technological and cost developments needed
- Other geophysical technologies have applications (where detectable) but have limitations (gravity, OBS, Spotlight?)
  - may be used to *complement, support and verify each other and create a comprehensive portfolio*

- *Colocation problems with drilling-rig access and Well-based MMV/contingencies are more difficult to solve without OW compromise & planning, - need to cater for wells (injection, monitoring, legacy risk)*
  - *reduce area (through-going access corridors)*
  - *Widen turbine spacing (how wide?)*
  - *Accept risks and liabilities? (Morecambe wind?)*

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Case-by-case basis / site-specific (Risks, MMV suitability, colocation problems & solutions)
no simple solution but collaboration (everyone) & compromise (at least one party)

Next Steps: Seismic forward modelling

Existing studies to determine CO2 detectability in depleted fields in the East Irish Sea:

- **Lennox**: Integrate Ikon study on behalf of the NSTA? (NSTA, 2023)
- **Hamilton**: WP5C Hamilton Storage Development Plan (PBD, 2016)
- **South Morecambe**: SLB study on behalf of Spirit Energy (Harrington et al. 2023)

Depleted fields: detectability too low for conformance,

- Low pressure depleted field - gas phase CO2,
- mix with residual methane (low density contrast)
- Stiff rock.

Saline closures: Seismic viability unknown.

- Shallow depth – CO2 gas phase (high density contrast?).

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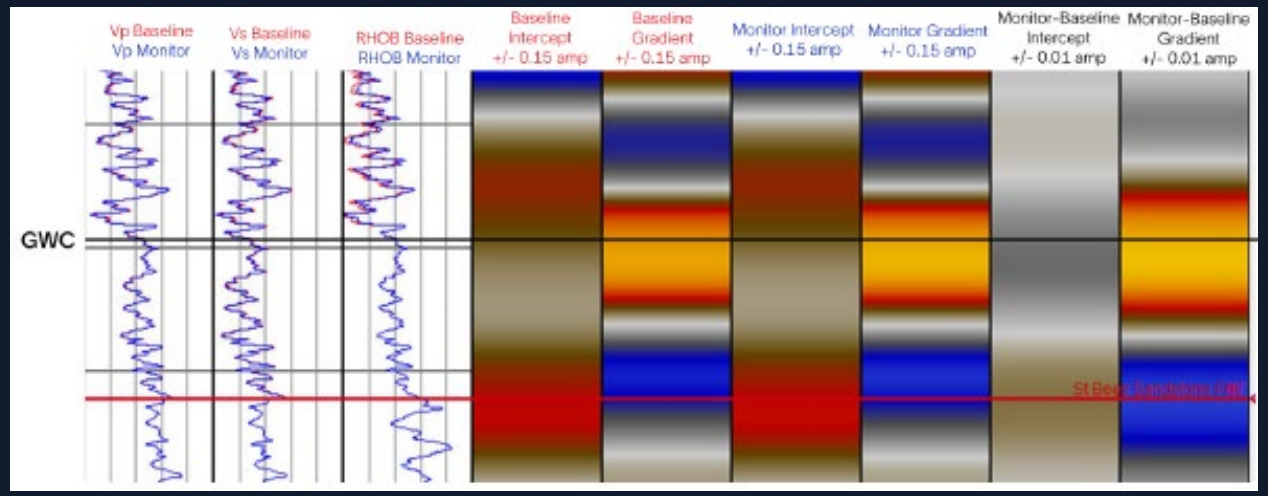
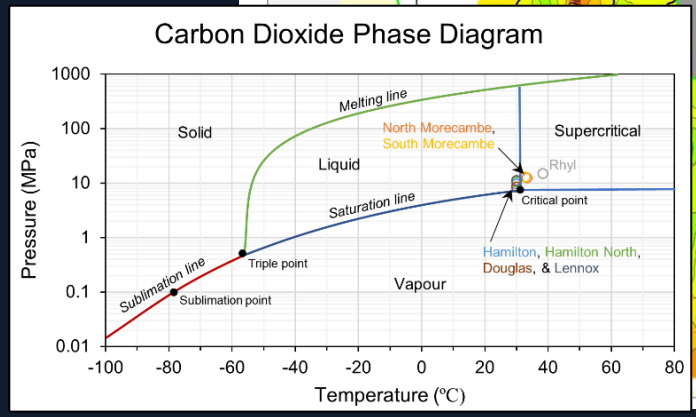
East Irish Sea: Next Steps

Identify co-location risks, opportunities, and <u>solutions</u>

- Where will subsurface CO_2 be seismically detectable in the reservoir and overburden for conformance and containment assurance?
- Partially fluid phase dependent, surface and subsurface conditions (velocity, frequency, porosity)



Harrington et al. (2023)



Project CoLocate

Centre for Energy Transition, **University of Aberdeen**

Prof. John Underhill, Principal Investigator john.underhill@abdn.ac.uk

Dr Sam Head, Research Assistant samuel.head@abdn.ac.uk

Dr Nigel Platt, Research Fellow nigel.platt@abdn.ac.uk

1. East Irish Sea

2. Outer Moray Firth

Project Anemone

Update from Philippa Parmiter

CEO at NECCUS

Source: Freepik

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Project Anemone – Objectives

Providing developers with a best-practice guidance for simultaneous operations that will help guide future projects and provide a baseline for developers to build on.

Help wider marine stakeholders understand the risks and mitigations associated with simultaneous operations.

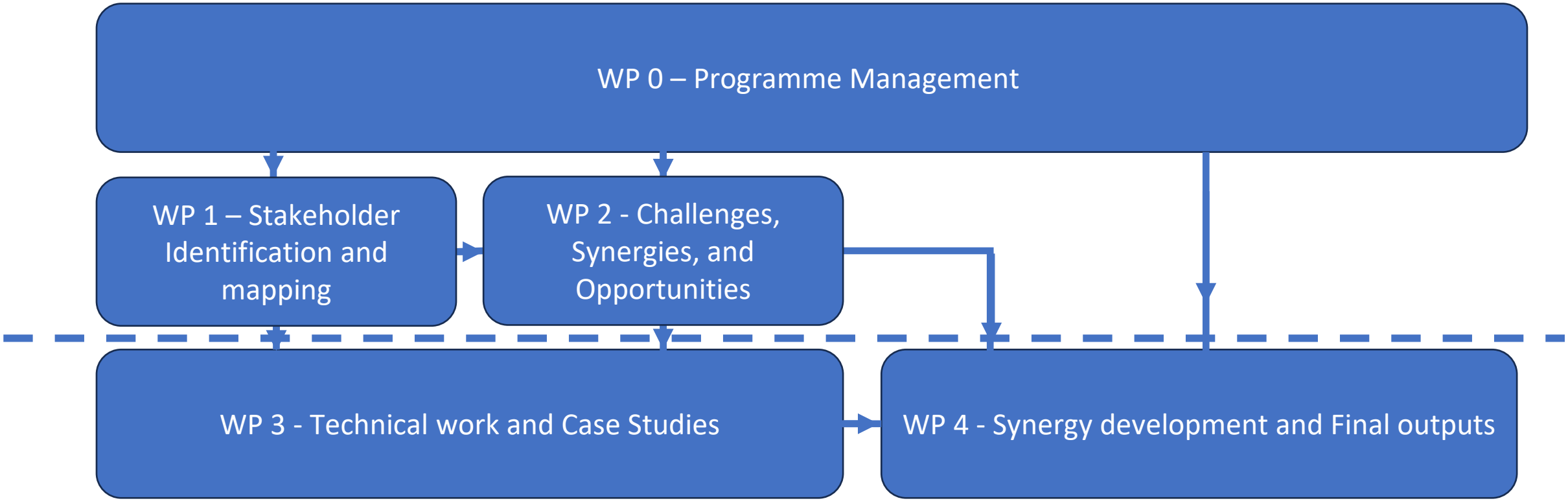
Project Anemone engagement with developers

NECCUS engaged OW and CCS developers around Project Anemone, sharing Project aims and objectives and key timelines:

- Understanding of key marine stakeholders associated with the challenges and mitigations of colocation
- Develop good practice guidance for simultaneous operations for offshore wind and CO_2 storage developers
- Influence policy and regulation to enable colocation of OW and CO_2 storage

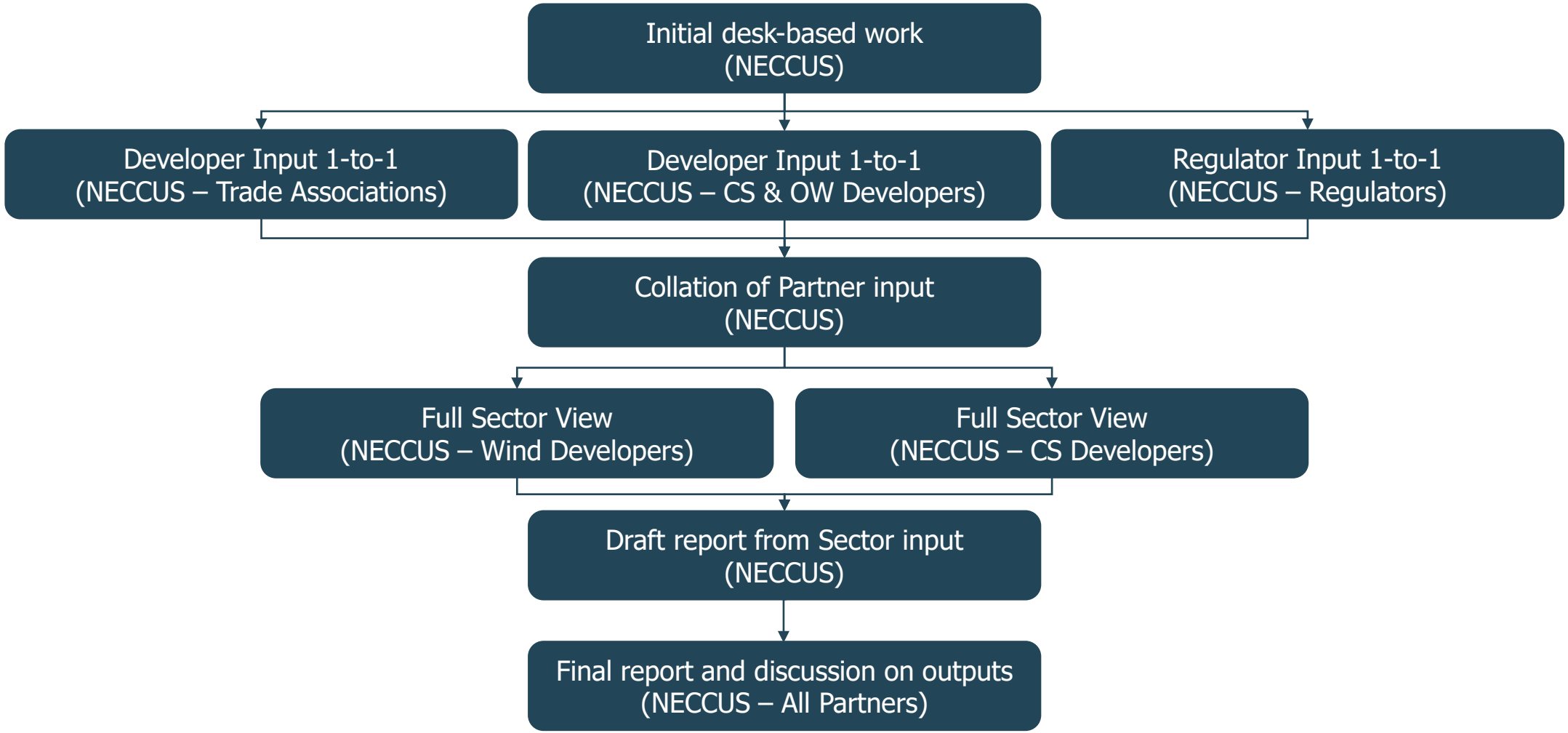
Project Anemone structure & management

Phase 1

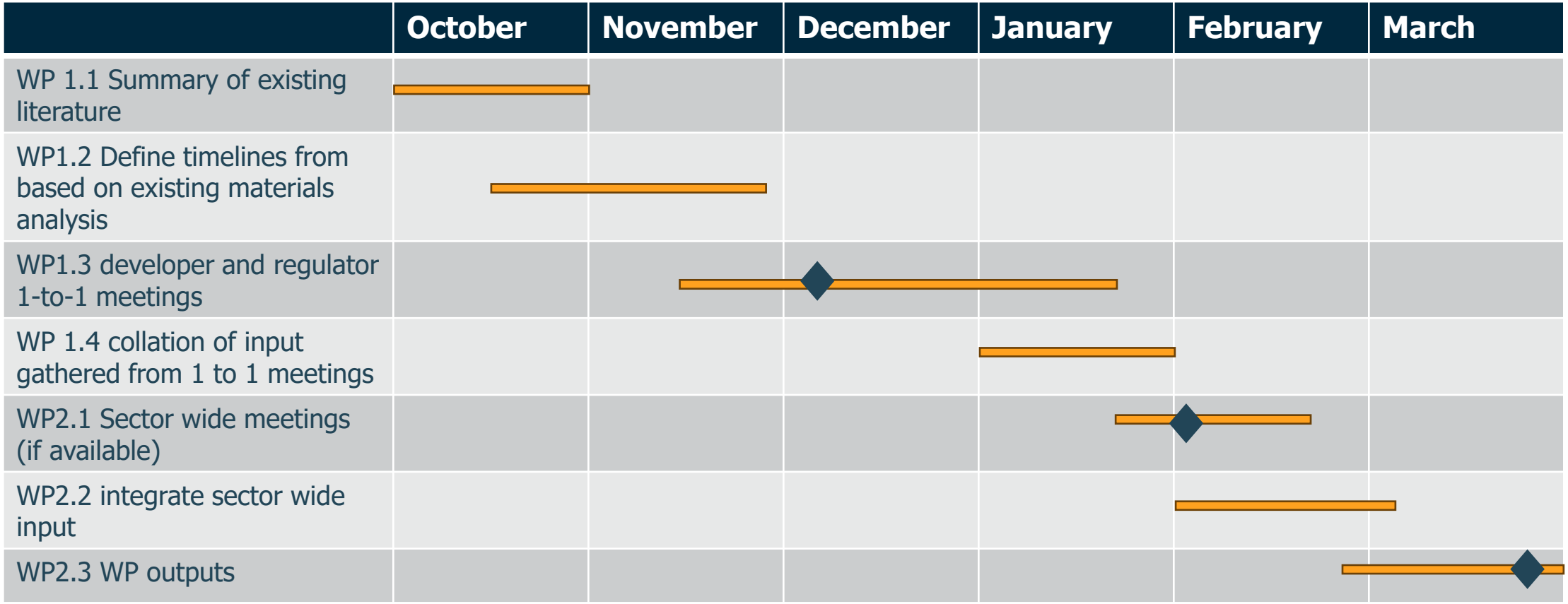


Phase 2

Project Map (Phase 1)



Project timeline (Phase 1)



Where are we Now

Background research has started – bulk of this is public documents from existing projects, previous relevant studies, including building out on the CCUS & Offshore Wind Overlap Study Report 1 to map stakeholder interactions across the various project phases (OW and CS).

Initial Emails to stakeholders are set to be sent – these emails outline the engagement that we will be commencing with the developers and who in the organisations that we would like to speak with.

Full launch of activities is awaiting full signoff from The Crown Estate and Crown Estate Scotland – the final reduced project brief was submitted to them on Friday 11th October.

Next Steps

Over the next few months, the aim is to be fully prepared for the first round of discussions with stakeholders the steps required for this are to:

- **Complete background research**
- **Draft Questions for stakeholders**
- **Schedule initial meetings with stakeholders**

Non-technical workstreams

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Non-technical Forum workstream

Colocation Forum raised queries regarding the non-technical challenges that the colocation of OW & CCS present.

Forum agreed to explore the topic of colocation risk assurance & insurance in **two phases**:

- **Phase 1:** Developer survey to gather views on the key risks to collocated and sector specific projects and share the findings with Insurers;
- **Phase 2:** Arrange workshop for Insurers to address the key points and questions raised by survey.

Key objectives include:

- Define potential for insurance solutions around colocation risks;
- Facilitate engagement between the insurance industry and developers;
- Broaden awareness of colocation insurance products.

Marine Delivery Routemap Report

Update from Will Steggals, Head of Strategic Delivery, Marine

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With growing demands for space, we need long-term coordinated action to deliver cross-sector system change

SHARED PRIORITIES

CATALYSE THE UK TOWARDS A NET ZERO AND ENERGY SECURE FUTURE

Marine-based energy infra (e.g. Offshore Wind, CCS, H2, interconnectors) and blue carbon critical to Net Zero by 2050

OPTIMISE BROAD VALUE CREATION FROM THE SEABED

Marine space needs to support many sectors critical to the economy and communities (e.g. minerals, telecoms, aquaculture)

DELIVER A THRIVING MARINE ENVIRONMENT

Marine ecosystems are in decline and urgent action is needed to protect and restore biodiversity as the seabed becomes more crowded

Delivery against these priorities requires coordinated action on:

- **'what'** the seabed should be used for (sector, technology, nature)?
- **'where'** are the best locations for each use?
- **'when'** should development and enabling infra be built and **'how'** it should be coordinated?

LONG-TERM COORDINATED ACTION

Governments across the UK are responsible for setting policies and priorities (e.g. MSPri)

In support of policy and to drive coordinated delivery TCE is:

- Mapping demands for seabed space across sectors - through the Whole of Seabed evidence base
- Co-developing forward delivery plans via the 2050 Marine Delivery Routemap

The benefits derived from long term coordinated action:

- ✓ **Consistent decisions** across sectors, agencies and wider
- ✓ **Optimising the use of marine space** to secure best value for the economy, the environment and society
- ✓ **Provide visibility and predictability** to sectors to unlock investment and speed up deployment
- ✓ **Supporting local development** by identifying the enabling investments needs (e.g. ports, supply chain).

Marine Delivery Routemap

Marine Delivery Routemap

A long-term strategy for the marine space to meet net zero and nature recovery goals, delivering a thriving marine economy and supporting communities

Our Shared Context

- Increasing demand for marine space
- Biodiversity loss and nature recovery
- Supporting growth and unlocking bottlenecks

Evidence Base

Robust evidence to underpin decision-making

Whole of Seabed and partner evidence
Digitally mapping the seabed resources and running scenarios on future demands from all sectors, sea users and nature

Data and evidence
Identifying in advance the data and evidence needs across sectors and how we can address these through research, shared forums and collaborations (e.g. OWEC)

Marine Delivery Routemap

Unlocking delivery of net zero and nature recovery goals, delivering a thriving marine economy and supporting communities

Spatial pathways
Identifying best use of marine space to deliver on biodiversity and policy goals and seabed user needs across sectors (giving context for sector plans such as the SSEP)

Forward management of seabed and coast
These pathways inform delivery plans for marine sectors and nature (e.g. The Crown Estate forward leasing plans)

Enabling and de-risking investment
Providing forward visibility on where and when key enabling investments are needed (e.g. ports, supply chain, grid, nature) and the opportunities these can create for onshore communities

Outcomes

Achieving shared objectives through partnerships

- Catalyse the UK towards a net zero and energy secure future
- Deliver a thriving marine environment and nature recovery
- Optimise value for the economy and coastal communities

Engagement and partnership — Continued engagement and a series of reports to share, test and receive feedback on our emerging thinking for sectors and nature

Spatial prioritisation: offshore and onshore systems issues

REGIONAL DEVELOPMENT

Provide visibility of the linked onshore and regional opportunities/needs from offshore development (e.g. ports, grid, supply chain, research hubs, nature)

EMERGING TECHNOLOGIES (e,g. HYDROGEN)

Identifying areas of opportunity and allocating space for market-led projects

TIDAL STREAM & RANGE

Building understanding of system value and environmental impacts

FISHING

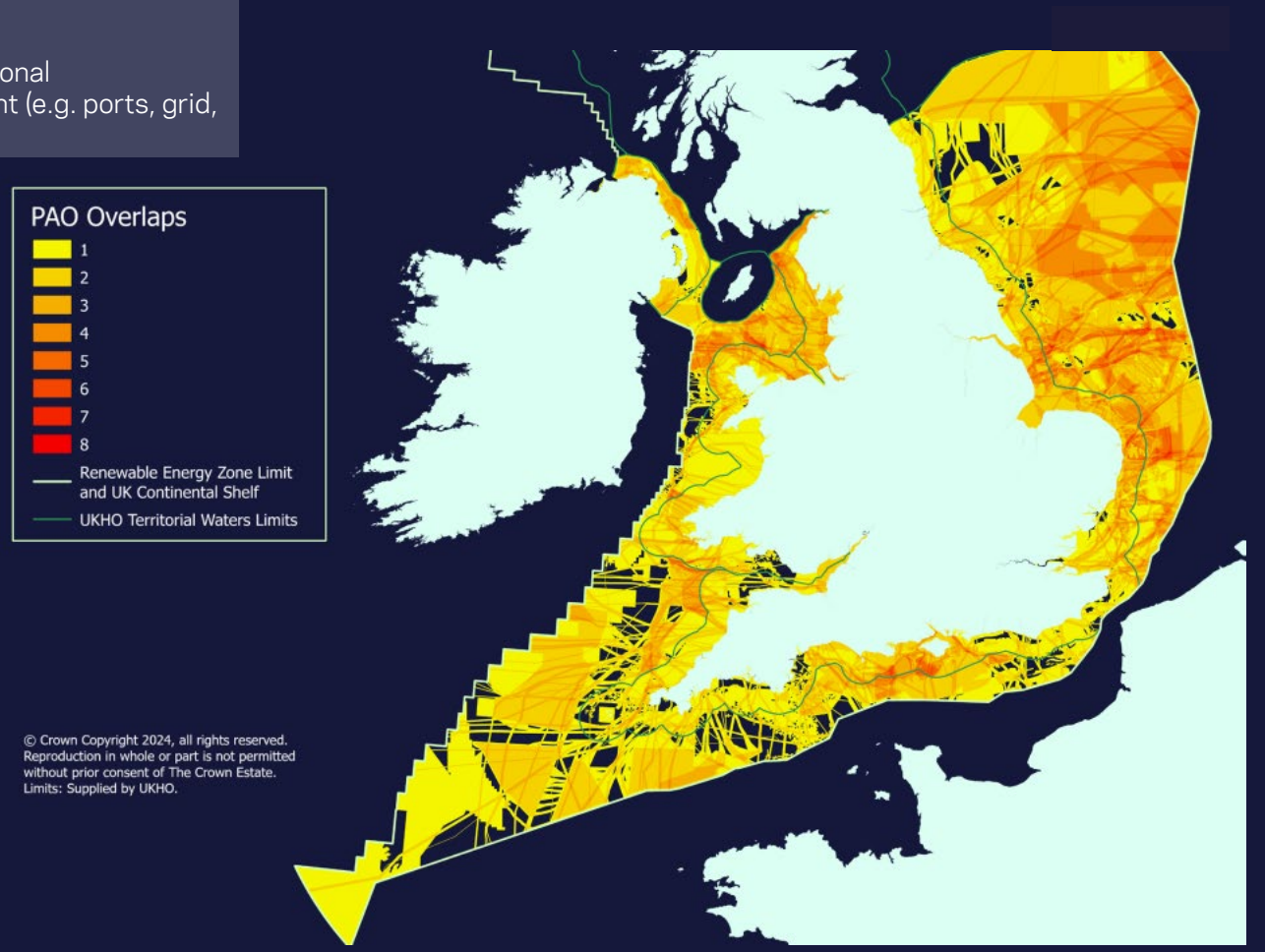
Using evidence and engagement to limit displacement and provide industry visibility

DEFENCE

Avoid known dangers and provide foresight of future activities for proactive review

NATURE

Understand how we best avoid and mitigate impacts to marine and coastal environment from development – while mapping opportunities for recovery and resilience



TELECOMS

Exploring benefits of more strategically-planned, spatially-defined cable corridors. Engaging with industry to understand demand growth and decommissioning potential

COASTAL

Mapping the opportunities, needs and impacts at the land-sea interface (e.g. nature recovery, grid connections)

AGGREGATES

Identifying future areas of opportunity and promoting sustainability (on carbon and nature)

OFFSHORE WIND

Mapping and forward planning of the most attractive sites (costs, system value) factoring in impacts/interaction with other sectors

TRANSMISSION & INTERCONNECTION

Spatial planning of generation & network design (with NESO) to coordinate offshore grid, reduce cost and reduce impact/cost of onshore landings

CCS

Mapping future areas of opportunity (with NSTA). Understand and promote co-location potential with other sectors (e.g. Wind)

OIL & GAS EXTRACTION

Identify future locations and support co-location

SHIPPING

Use high quality data to maintain safety at sea

Future of Offshore Wind Report

Update from Jonny Boston, Leasing and Business Development Director – Offshore Wind

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Looking to the future for Offshore Wind

As the first in a series of reports, we have set out our early thinking on the future growth of offshore wind in the period to 2040 for England and Wales* in a report on behalf of Great British Energy : The Crown Estate.

We have set out our early thinking to help maintain momentum to net zero by 2050 and provide necessary confidence to meet likely deployment ambitions for the mid-2030s and beyond. This report As part of a continuing dialogue, we are ensuring we provide an opportunity to receive detailed feedback on our early thoughts.

Key topics

- ***Whole of Seabed and Marine Delivery Routemap;*** setting out our approach to the future of offshore wind in the context of the Whole of Seabed Programme and Marine Delivery Routemap.

- ***Evolving approach;*** outlining how we are seeking to tackle some of the systems level issues ahead of leasing – notably in relation to planning, transmission and supply chain. As well as opportunity to create broad value from our management of the seabed.

- ***Future leasing;*** identifying our approach to future offshore wind leasing including key questions of scale, timing, scope, frequency and location of future leasing rounds.

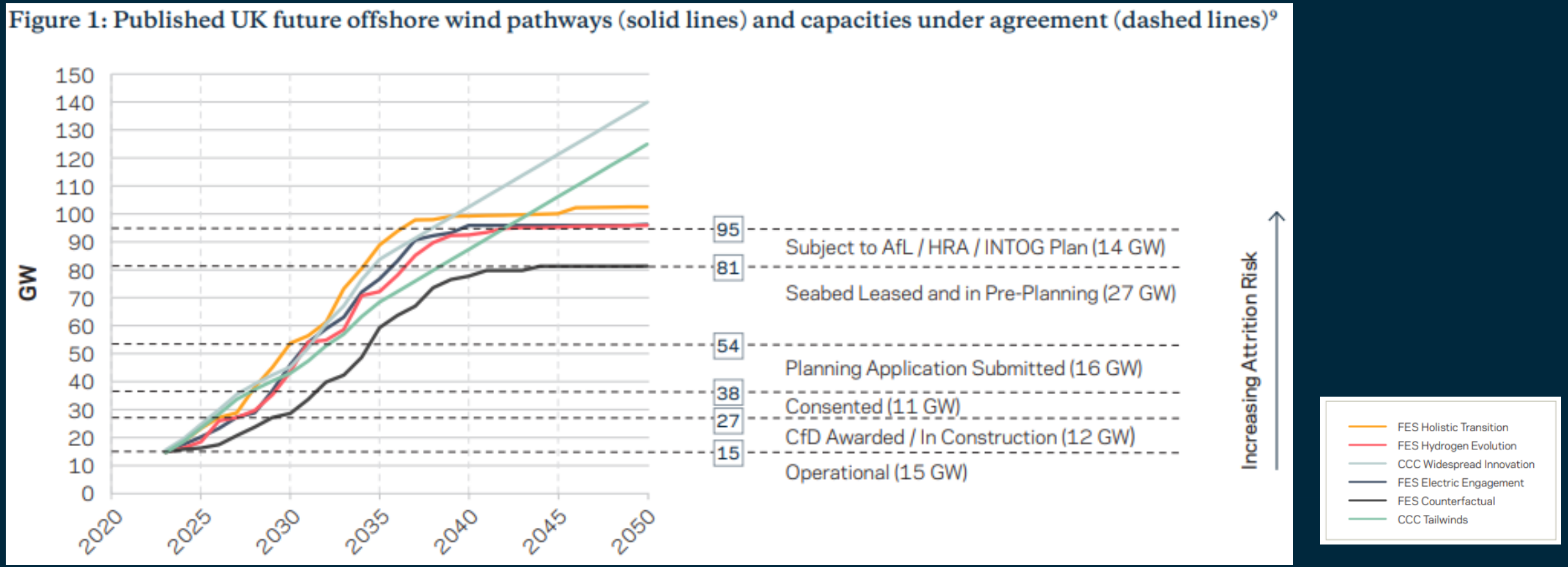
* Leasing in Northern Ireland is being considered in parallel through the work under the Offshore Renewable Energy Action Plan.

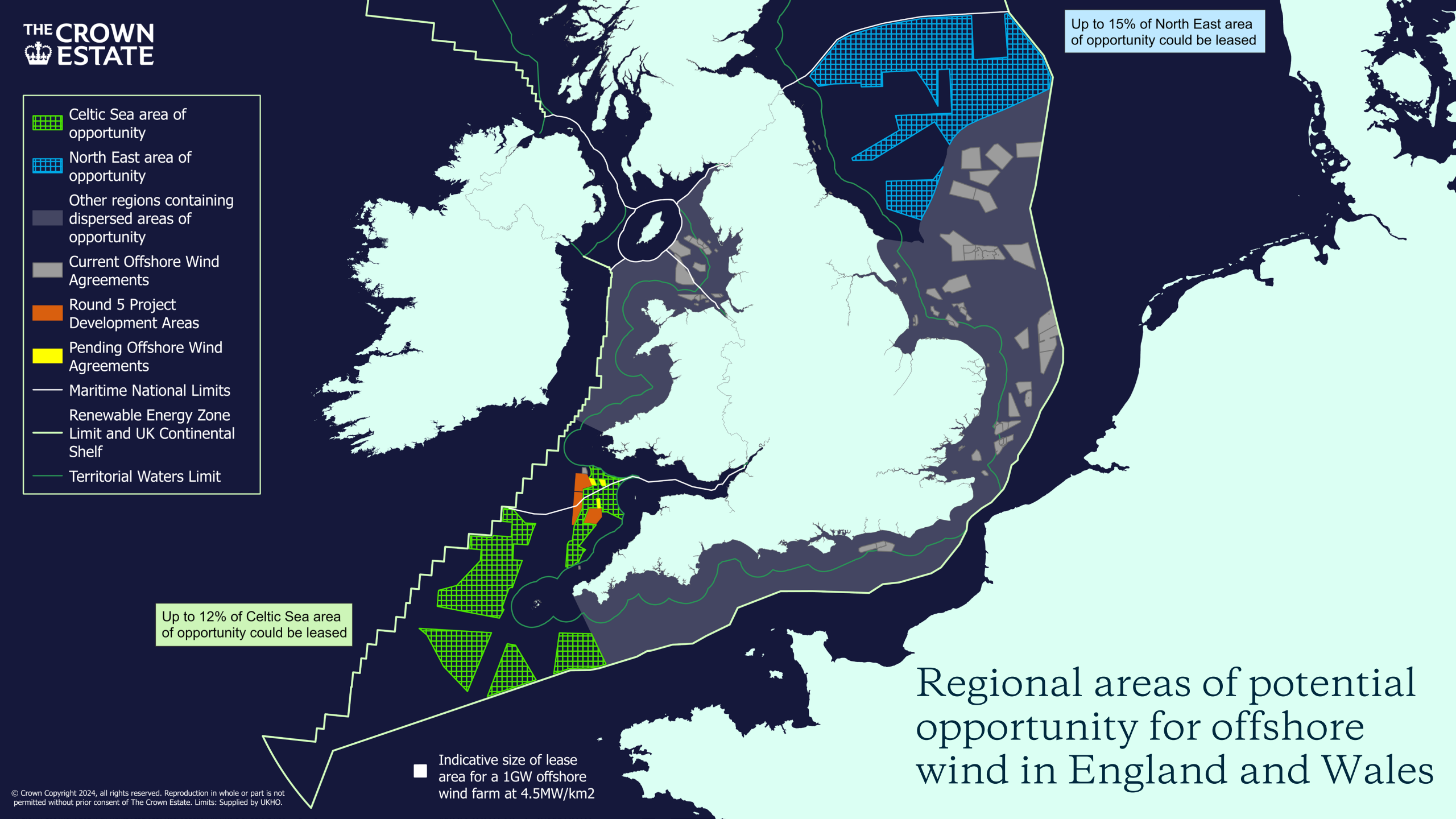
Future offshore wind

In order to maintain momentum to net zero by 2050 and provide necessary confidence to meet likely deployment ambitions for the mid-2030s and beyond, we have been considering plans for future offshore wind development. Our long-term planning is based on external forecasts from organisations such as NESO and the Climate Change Committee. We have used a mixture of these forecasts in our long term planning to ensure that leasing acts as an enabler for the sector to meet policy and demand targets.

Based on these pathways, and assessment of risk in the existing pipeline, it is our assessment that approximately 20-30GW of new rights should be brought to market by 2030 to enable sustainable growth of offshore wind. This is proposed to be across successive leasing rounds.

Figure 1: Published UK future offshore wind pathways (solid lines) and capacities under agreement (dashed lines)[9]





As well as setting out our broader thinking, we are seeking views on a number of topics including:

Cross System Coordination	Forward delivery planning which works across all key marine sectors and nature for the marine space.
Future Demand	Bring to market between 20-30GW of new offshore wind seabed rights in the waters off England and Wales by 2030, for delivery out to 2040*
Leasing Rounds	Successive leasing rounds in the period out to 2030 (timing, numbers, scale – TBC)
Locations	Anticipating key multi-gigawatt (GW) opportunities for new leasing by 2030 (subject to further evaluation): • Celtic Sea (off the south-western coasts of England and Wales) – spatial potential for circa 4-10GW, as part of 12GW long term potential • North Sea (off the north-east coast of England) – spatial potential for circa 10-16GW • Additional, more dispersed GW scale resource in other regions – spatial potential for circa 2-8GW
Co-Location	Given an increasingly busy marine space, our view is that it is important to enable co-location in Areas of Opportunity through leasing design.

* Leasing in Northern Ireland is being considered in parallel through the work under the Offshore Renewable Energy Action Plan.

As well as setting out our broader thinking, we are seeking views on a number of topics including:

De-Risking & Accelerating	By bringing sites to market with a greater level of assurance, we can reduce potential stumbling blocks upfront and reduce the risk of attrition and delays in later development stages.
Grid Connections	A systems-led approach can provide more coordination between seabed development and transmission design and delivery, aligned with strategic planning processes for the energy sector.
Broad Value	Harness the opportunities created by the delivery of offshore wind to enable net zero commitments, steward flourishing biodiversity and marine environments, create thriving communities and support economic growth.
Technologies	Future offshore wind leasing will include a mix of sites that accommodate the development of fixed, deep-water fixed and floating sub-structures.
Hydrogen	Offshore green hydrogen has significant potential - unlikely to be an immediate need for spatial design and leasing focus - open to developers having the option to incorporate the production of green hydrogen in their development plans (where market arrangements and system plans align)

Photo credit: The Crown Estate/Ben Barden Photography Ltd

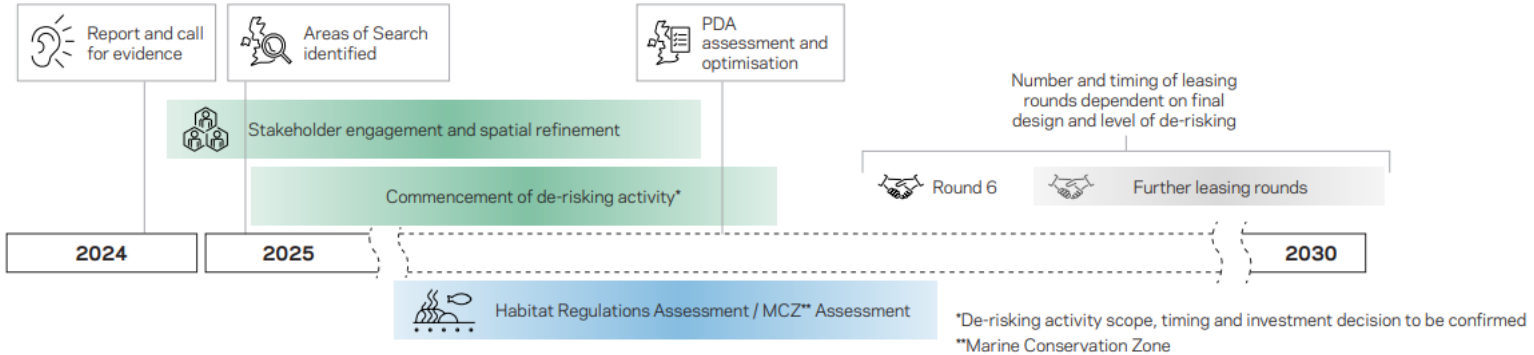
Next Steps

The views of our customers and stakeholders are critical to our approach and to inform our next steps.

Co-Location; As part of our early thinking on leasing design we are considering how we best enable opportunities for co-location of offshore wind with other uses of the seabed, such as nature restoration and CCS.

Co-Location remains a vital consideration and opportunity to be able to meet our shared goals.

Figure 6: Illustrative timelines, including potential de-risking activities



We will also continue to build on our existing work in close partnership with key government bodies and delivery agency partners as part of our Whole of Seabed work and the Marine Delivery Routemap.

AOB