REGIONAL STAKEHOLDERS' VALIDATION WORKSHOP &
ASERT-2030 DIALOGUE ON OFFSHORE WIND

Building an offshore wind energy market: considerations for the Caribbean region

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The Carbon Trust

29 November 2023

AGENDA

1. Introduction to the Carbon Trust
2. Overview of offshore wind energy markets
3. Key pillars for offshore wind market growth
4. Enabling factors for the Caribbean region

Building an offshore wind energy market

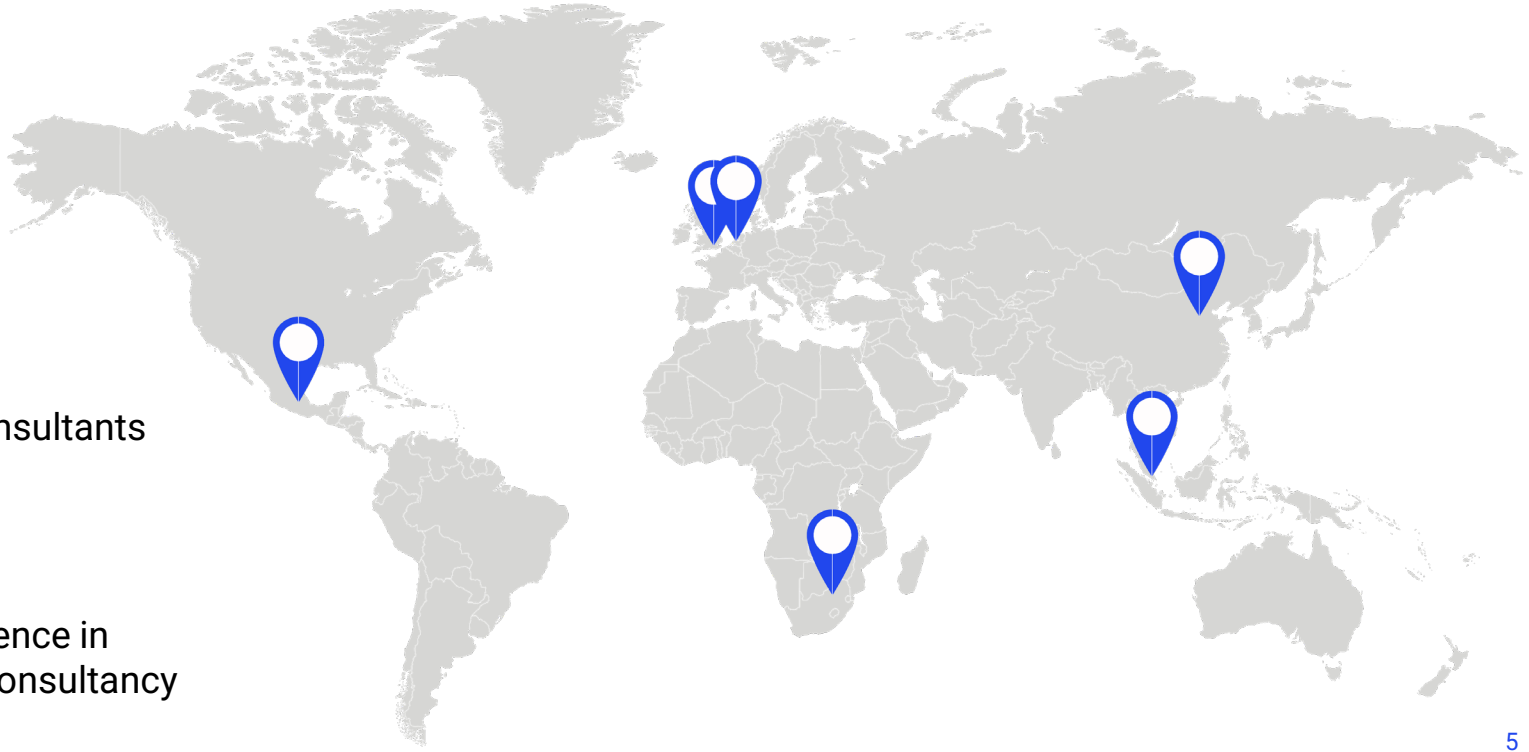
Introduction to the Carbon Trust

Our mission is to accelerate the move to a decarbonised future.

5
continents

450+
experts and consultants

20
years of experience in sustainability consultancy



Our Expertise

Focus Industries

- Offshore Wind - Fixed
- Offshore Wind - Floating
- Offshore Energy Integration
- Maritime Decarbonisation
- Marine Energy

Research & Insight

Over a decade of experience delivering market insights to international organisations to aid in their market & industry knowledge, analysis and feed into strategic expansion plans.

- Market Insight
- Policy, Technology, Strategy & Innovation Review
- Energy Systems & Future Energy Analysis
- Environmental & Social Analysis
- LCOE Modelling for Innovation
- Infrastructure and Logistical Reviews

Strategic Advice

We provide strategic policy and market support, cost reduction and economic development, and deliver insights into technology and industry progress to help understand market gaps and evaluate solutions.

- Innovation Needs Assessment
- Technology Guidance
- Policy Design & Recommendations
- Supply Chain Enablement
- Skills & Workforce Development Site Selection, Auction and Subsidy Support
- Scenario Planning

Collaboration

We are global leading experts in delivering large scale RD&D and collaboration programmes, with a track record of delivering real cost reductions .

- Programme Design & Set up
- Programme Management
- Stakeholder Mapping & Engagement
- Capacity Building and Knowledge Management

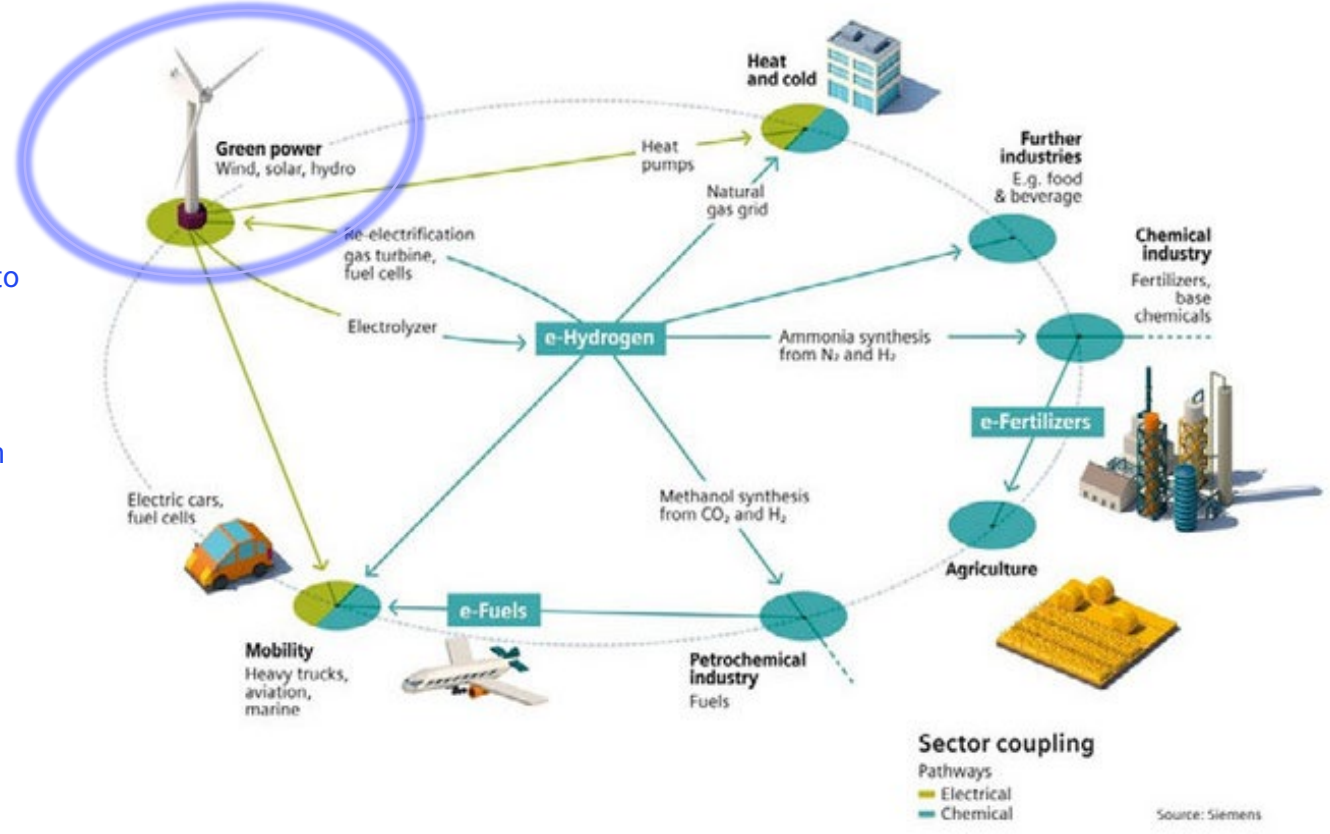
Building an offshore wind energy market

Overview of offshore wind energy markets

What do we mean by the offshore wind energy market?

Integrating new energy sources

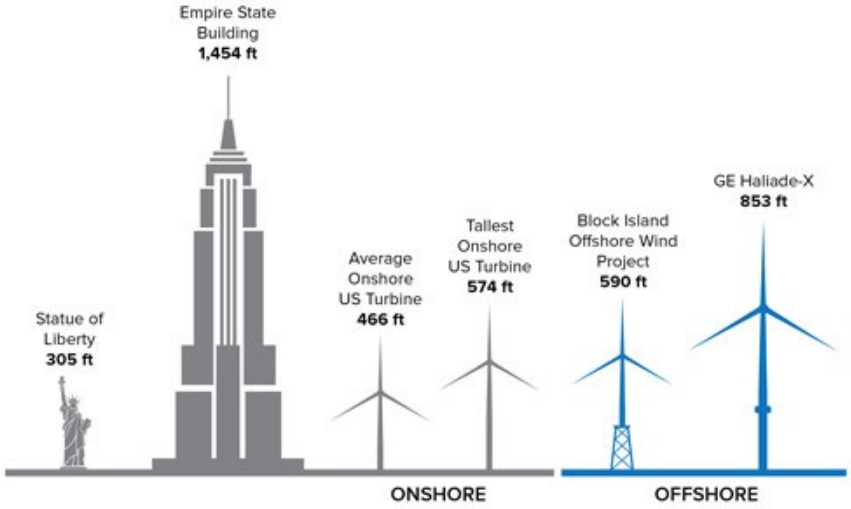
- A wider electricity/energy market is made up of buyers (users) and sellers (generators)
- Different technologies used to generate electricity/energy – increasingly, renewable technologies
- Typically, multiple generation projects needed to meet demand
- Technology-specific energy markets (e.g. offshore wind energy market made up of many projects over time) interact with wider electricity/energy market



Why offshore wind?

Efficiency, scale, space

- Offshore wind turbines are **more efficient** than onshore wind turbines. They generate much more energy because:
  - The wind speeds are greater, more consistent and less turbulent than on land;
  - More space for construction, with (generally) fewer restrictions.
- Offshore wind is a form of **large-scale renewable electricity**, which contributes to market decarbonisation.

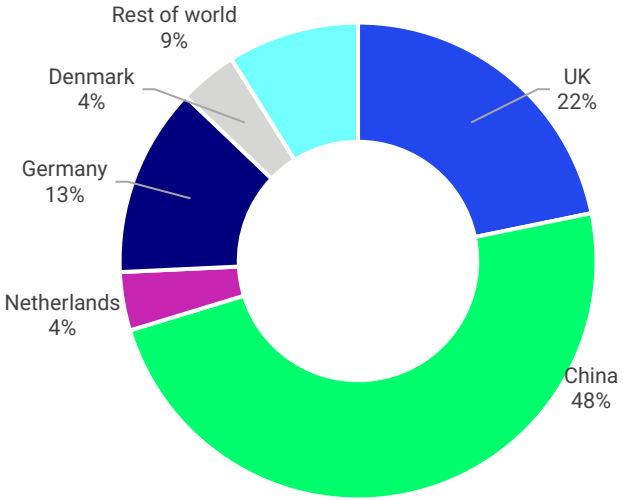


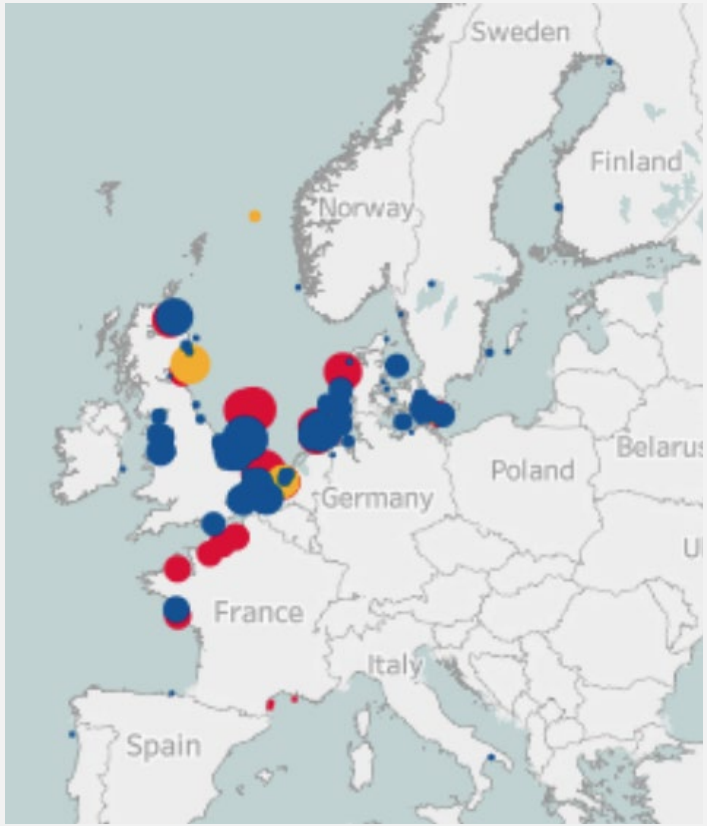
Offshore wind energy

The global OSW energy market

The installed offshore wind capacity was **64.3 GW globally at the end of 2022** and is anticipated to rise to 269 GW by 2030.

Total offshore wind installed capacity by country





Global Wind Energy Council (GWEC), 2023; European Offshore Wind Farms Map, 2023

Offshore wind opportunities

Focus on the UK OSW energy market

1 Cost reduction

- 2012-2019, a 67% reduction in LCOE of offshore wind
- OSW now cost-competitive with and sometimes cheaper than fossil fuels. In 2023, LCOE for Comb. Cycle Gas was £114/MWh, versus £44/MWh for OSW.

2 Innovation

- Innovations brought to market through UK-based R&D programmes include: novel foundations, floating wind moorings, installation methods, transfer vessels, cables, electrical systems, wind and wake modelling.

3 Jobs, supply chain

- Globally, industry employs >32k people; supply chain has potential to generate £92bn by 2040.
- UK jobs in development services, blade & cable manufacturing, electrical and offshore services, which are used globally

4 Energy security

- Domestically-produced electricity reduces reliance on imported fuels;
- National Grid recorded the highest penetration of offshore wind as 70% of the overall electricity mix

CONSIDER

What are your country's aspirations for decarbonisation, and what role could OSW play?

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What are your country's aspirations for decarbonisation, and what role could OSW play?

Which benefits of OSW are most important to explore, for your country, and for the Caribbean region more broadly?

Building an offshore wind energy market

Key policy pillars for offshore wind markets

Key policy pillars for an effective offshore wind market

1. Market scale and visibility
2. Site development
3. Grid integration
4. Incentive mechanisms
5. Supply chain development
6. Innovation support

Key policy pillars for an effective offshore wind market

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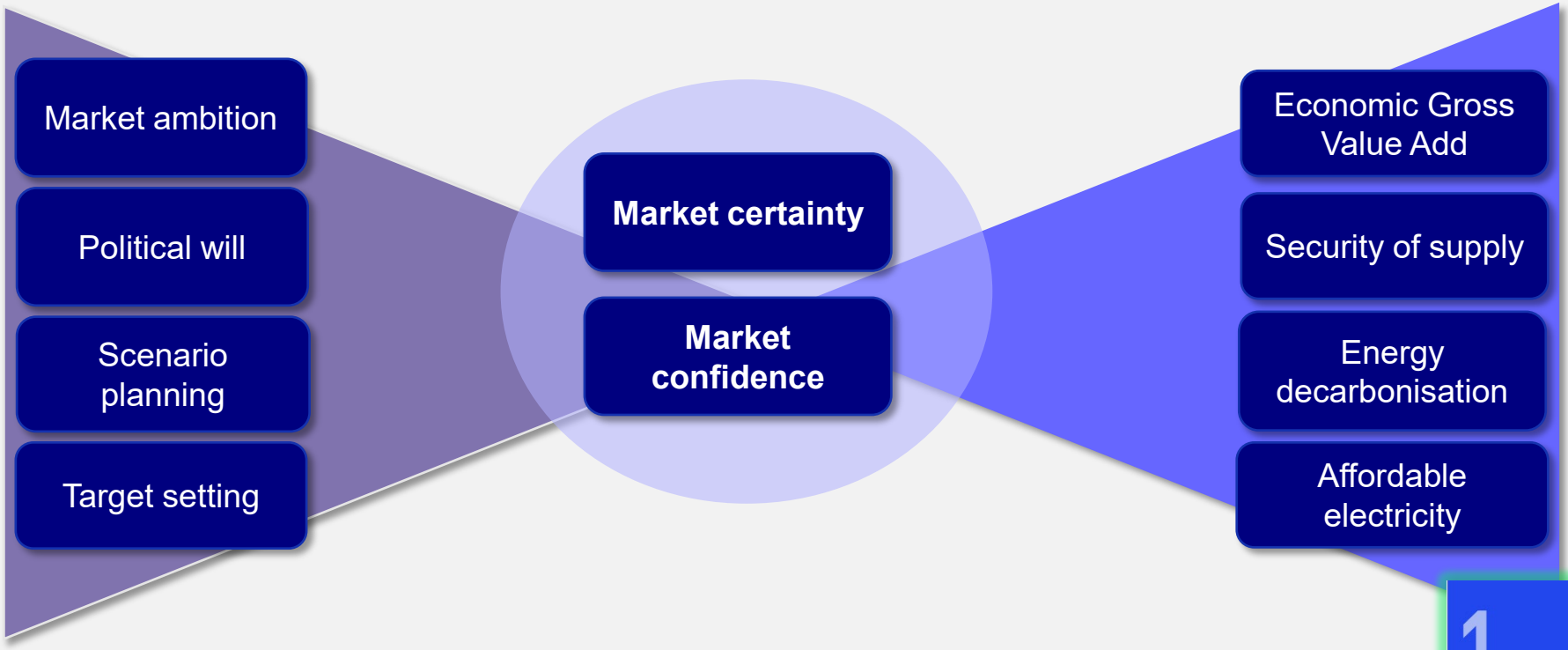
1 | Market scale and visibility



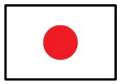
1 | Market scale and visibility

- Market ambition
- Political will
- Scenario planning
- **Target setting**

Targets and other strong market signals can encourage investment.

UK – Offshore Wind Sector Deal
50 GW by 2030; 5 GW Floating offshore wind by 2030

France – President Macron's Belfort speech
20 GW by 2030; 8 GW Floating offshore wind by 2030



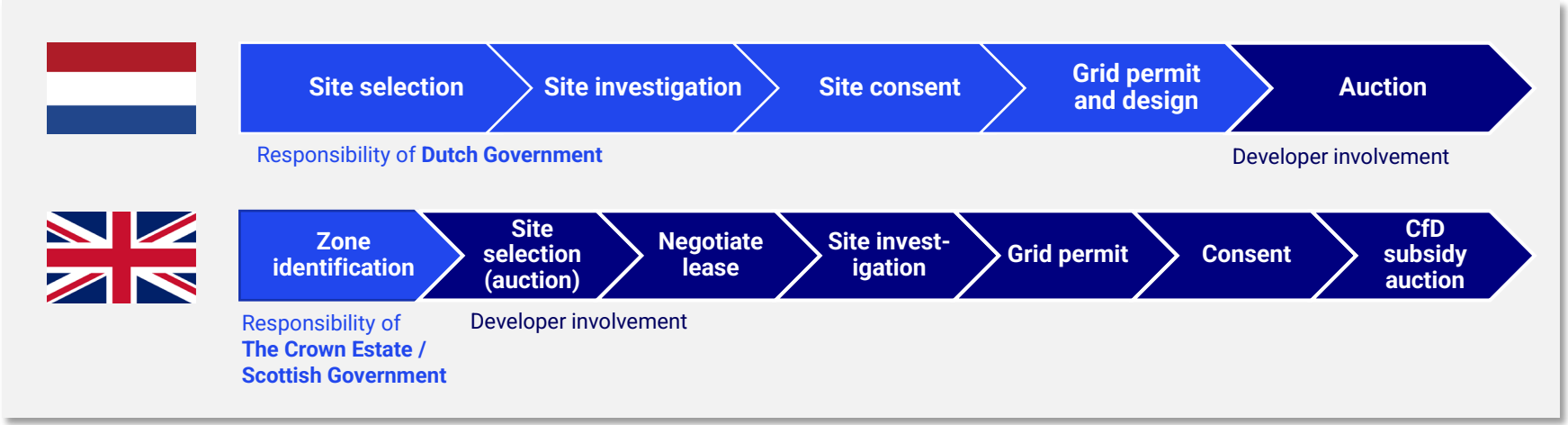
Japan – Strategic Energy Plan; Vision for Offshore Wind Power Industry;
10 GW by 2030

South Korea – Renewable Energy Implementation Plan
12 GW by 2030

China – Target setting by local provinces
~43 GW by 2030

USA – Executive branch targets; Floating Offshore Wind Shot
30 GW by 2030; 15 GW Floating offshore wind by 2030

2 | Site development



Development model – how much of the site assessment, development activities/risks are taken on by government or industry. Trade-offs for OSW deployment, govn't revenue generation, consumer costs, and other marine activities.

Marine spatial planning – Many marine activities and industries, plus need to consider grid integration Spatial analysis, stakeholder engagement, iteration

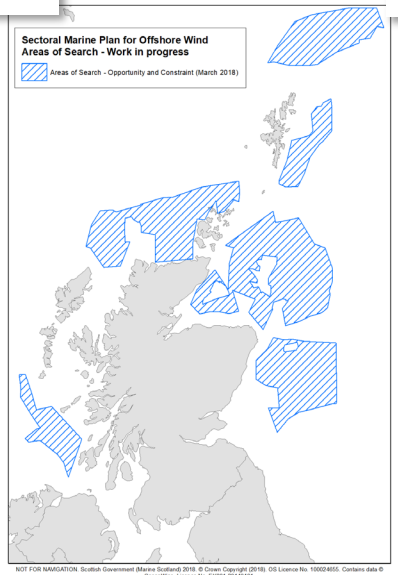
Leasing / auctions – Leasing / auctions allow governments to grant 'exclusivity' on certain sites to developers and guarantee access to the electricity market

Consenting – Processes to ensure that offshore wind development meets certain environmental, social requirements

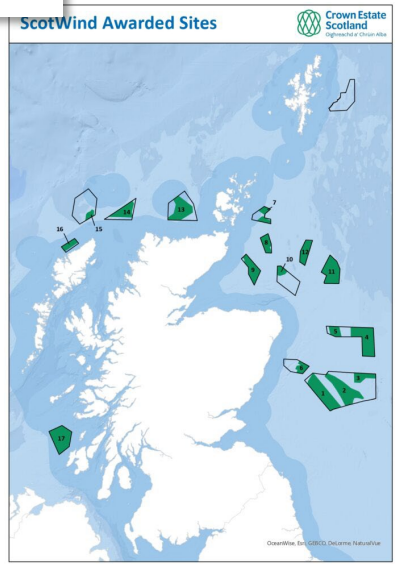
2
Site development

2 | Site development

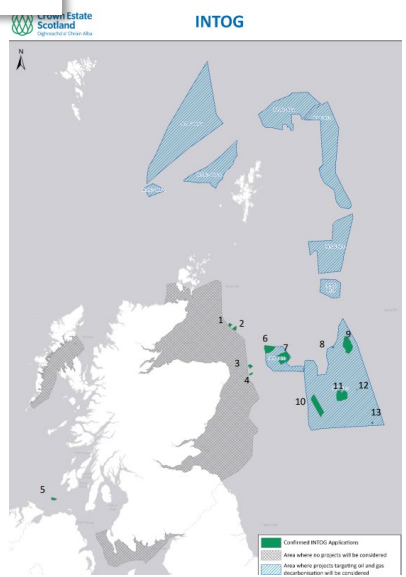
2018



2022



2023



Effective site allocation processes are crucial for reducing risk and delay and facilitating a pipeline of projects.

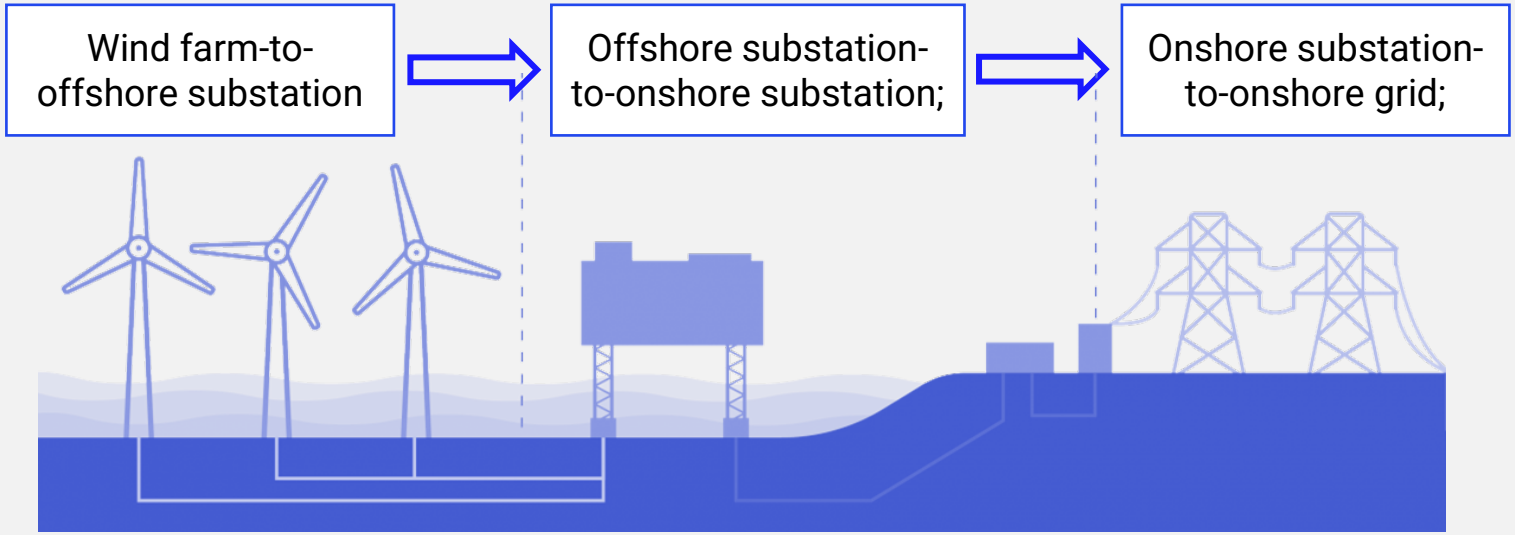
2 Site development

3 | Grid integration

The connection of the offshore wind farm to the onshore grid is a fundamental aspect of offshore wind integration. Grid connections happen in key nodes of any network and allow generator assets to feed electricity into the overall system.

Three primary transmission nodes are of importance when considering any regulatory and policy feasibility assessment.

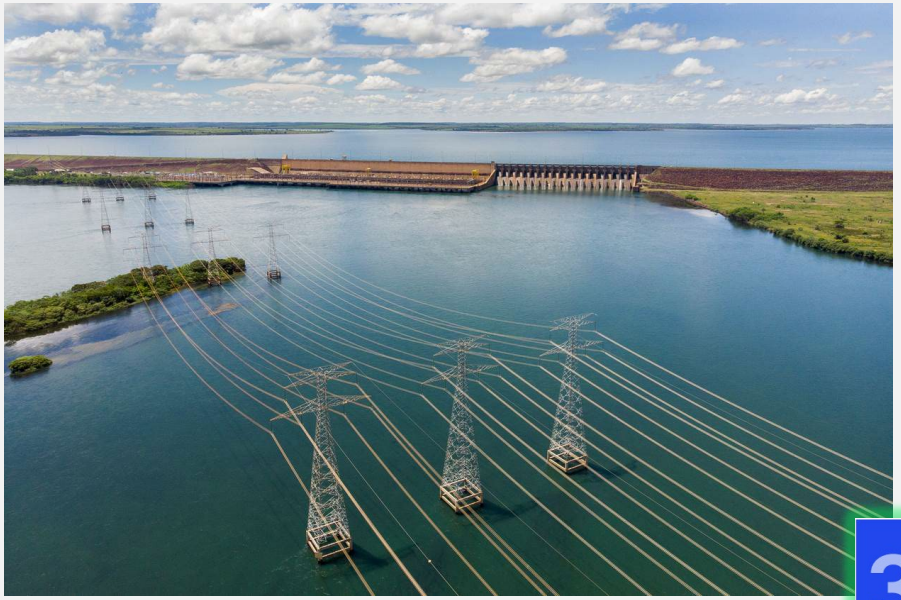
It is important to clearly define responsibility for construction, maintenance and funding at each stage.



3 | Grid integration

Governments, developers and power grid owners should plan how and where electricity will be transported before projects commence.

- Historically, offshore wind farms have been connected to the closest point on the shore (point-to-point connection).
- But electricity demand is often concentrated elsewhere.
- This can put pressure on the onshore transmission grid, especially as renewables are often deployed faster than transmission grids can be upgraded to accommodate them.
- As a solution, governments are exploring **meshed offshore grids.**



3
Grid integration

4 | Incentive mechanisms

If there is a strong incentive to participate in a market, offshore wind developers will come.

Incentives stimulate the OSW market as they reduce risk and cost for developers and investors.

Incentive mechanisms can be used to attract developers and investors to the market, who are willing to invest time and resources in building OSW.

Incentives can be awarded as:

1. **Direct incentives or subsidies** based on the amount of electricity generated. This provides the OSW developers with stable revenue which gives certainty through all or part of the project lifetime.

2. **Indirect incentives or subsidies** where the OSW developer receives benefits for renewable generation. This may be through tax benefits or carbon pricing mechanisms such as carbon credits.

Early-stage markets should focus on incentive mechanisms that de-risk and provide confidence to developers. These incentives may need to be more generous, as project risk is considered higher where there is no current OSW deployment.

4 | Incentive mechanisms

The UK Government adapted its incentive mechanisms as the has market developed.

2002 – 2019

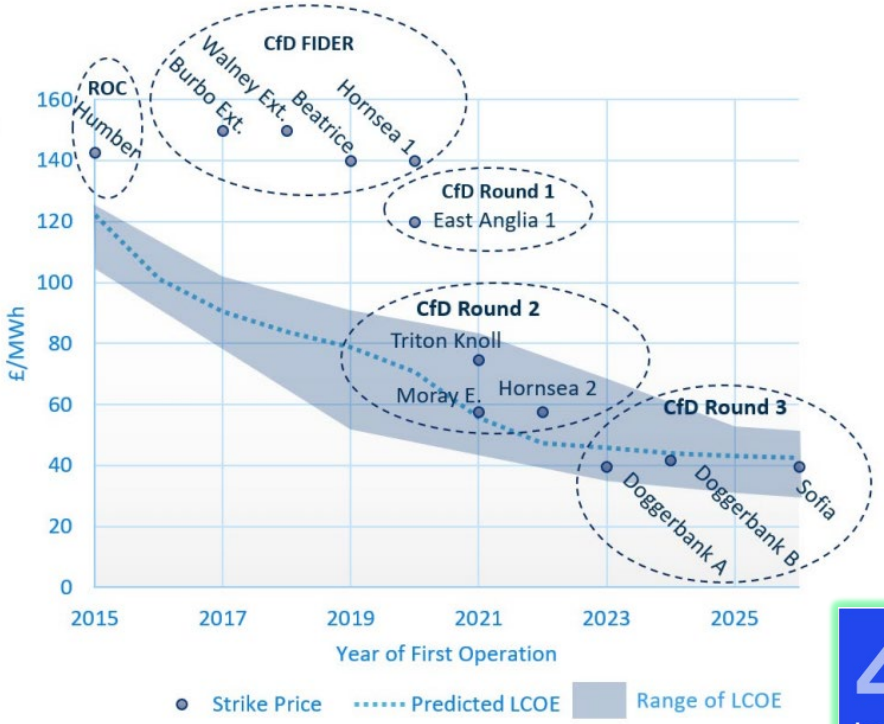
- The Renewable Obligation Certificate (ROC) helped to kick-start the market. This generous and stable income stream drove early investor confidence.

2013 – 2023

- Contracts for Difference (CfDs) were introduced in 2013 to replace the ROCs. The CfD was awarded during an auction which has led to drastic cost reduction since they were first introduced.

2023 – onwards

- Cost reduction has been so effective that developers are unable to deliver projects for their agreed price. What happens next?



4
Incentive mechanisms

Building an offshore wind energy market

Enabling factors for the Caribbean region

Establishing a successful OSW energy market

What enabling factors could the Caribbean region leverage to create an offshore wind energy market?

Establishing a successful OSW energy market

Enabling factors for the Caribbean region

Energy plans, policies and targets

National energy plans and policies provides a mechanism to introduce an action plan for including offshore wind or renewable generation. Existing renewable energy targets demonstrate confidence in the government to support the development of renewable energy.

Marine spatial planning

Any activity relating to marine spatial plans provides a good basis for further assessment Marine spatial plans will need to be adopted by the government to ensure offshore development is conscientious of all marine users.

Definition of roles and responsibilities

Governments who have clarity on roles and responsibilities for renewable energy development will easily be able to adopt offshore wind development into the responsibilities. This should include clarity for leasing the seabed, conducting initial surveys and issuing licenses throughout the wind farm lifecycle.

Renewable energy projects

Existing commercial-scale renewable energy projects are likely to have some agreement for grid connection of commercial generation. There may also be existing framework in place for subsidy linked to energy generation, which would be beneficial for OSW market development.

Offshore energy projects

Existing offshore energy projects such as Oil and Gas, will have frameworks in place to regulate and grant permits for offshore surveys, construction and operation. Similar procedures are essential for offshore wind energy, and the presence of clear existing processes can be advantageous for the development of offshore wind projects.

Grid connection planning

Any grid connection planning to include commercial-scale renewables is beneficial. There needs to be some understanding of how the infrastructure can handle the intermittent nature of renewable generation. This may include upgrades to the grid, where clarity on responsibilities for construction and maintenance of offshore grid is key.

Renewable energy targets

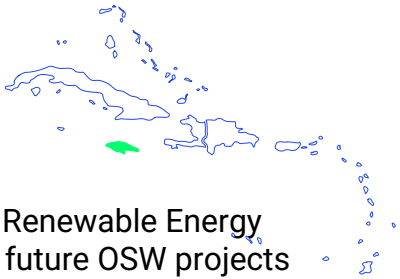
Case study: The Bahamas

- 2013 – Government of The Bahamas sets RE target of 30% renewable energy mix by 2030 in Bahamas National Energy Policy 2013-2033.
- 2023 – Government of The Bahamas publishes “Integrated Resource and Resilience Plan” (IRRP), reaffirming target
- Objective is to generate 30% of renewable energy from solar, wind and ocean sources.
- The Irena country profile from 2023 shows that the current renewable installed capacity of The Bahamas is less than 1%, which indicates significant effort is required over the next 6 years to reach this target.

Regional reflections & recommendations

- **Consistency in target setting** can help signal government commitment to wider industry, investors
- Caribbean governments that want to facilitate OSW development should consider amending RE targets to **include explicit reference to offshore wind capacity**
- Important to **establish RE targets that are both ambitious and feasible**
- OSW RE targets should **reflect anticipated electricity demand, potentially including power-to-X (export)**

Renewable energy projects



Case study: Jamaica

- Current 100 MW tender for the Renewable Energy Project in Jamaica relevant for future OSW projects
- Generation Procurement Entity (GPE) has mandate to develop, implement the process of new generating capacity via competitive bidding.
- Government of Jamaica introduced tax benefits relating to renewable components (general consumption exemption; income tax credit equivalent to 30% of the purchase cost for photovoltaic systems)
- Jamaica Public Service Company (JPS) acts as the exclusive distributor, transmitter and supplier of electricity; has long-term PPAs with 9 Independent Power Producers (IPPs) that collectively generate electricity.

Regional reflections & recommendations

- Jamaica has clearly established responsibilities for electricity generation and distribution
- The transparent tender process for smaller-scale, onshore renewable energy serves as a solid foundation for the development of offshore wind.
- Governments supporting OSW development should **clearly define how to incorporate new generation** capacities
- In the transition to including offshore wind, it is **essential to introduce supplementary incentives for developers**, given the higher LCOE.

Offshore energy projects

Case study: Trinidad and Tobago

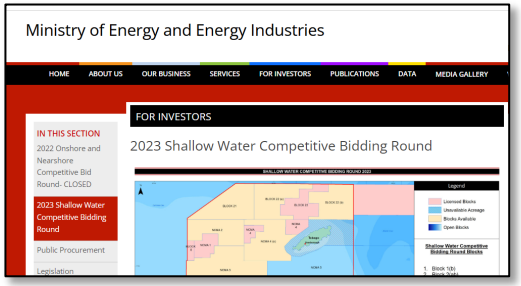
- Trinidad and Tobago has existing offshore O&G frameworks, including:
- National legislation that governs permitting and licensing of offshore exploration and production.
- Transparent, publicised process for competitive bidding rounds for offshore areas, including the presentation of available blocks.

Clearly defined roles and responsibilities

- E.g. the Environmental Management Authority plays a crucial role in the review/approval of the Environmental Impact Assessment and provides a Certificate of Environmental Clearance on exploration.

Regional reflections & recommendations

- Trinidad and Tobago's existing O&G frameworks for site development (planning, permitting) can be used as a foundation for OSW
- An in-depth review of existing O&G frameworks and legislation could **highlight necessary modifications or adaptations** to facilitate OSW development



Grid connection planning

Case study: Grenada

- ‘Grenada Vision 2030’ (published 2012) set ambitious target of 100% renewable energy by 2030. Currently, installed RE capacity is 6.5% of generating capacity.
- The Electricity Supply Act 1994 grants exclusive licence to Grenada Electricity Services Limited (GRENLEC) to generate, transmit, distribute and supply electricity until 2073.
- GRENLEC can authorise another entity to perform some or all of these functions, but there is no clarity on the conditions required for this.

Regional reflections & recommendations

- OSW developers will need to understand how grid connection works and must possess the authorization to generate electricity offshore and establish connections to the grid.
- Governments and transmission system actors should consider **mapping possibilities and processes to facilitate OSW grid connection** in the context of existing agreements and decarbonisation ambitions
- **Grid level planning would need to be undertaken** to understand how renewables (power electronics) could integrate into an existing grid system that relies on fossil fuel generation.
- Other electricity export opportunities could be explored.

Marine spatial planning

Case study: Antigua and Barbuda

- 2014 – Environmental Law Institute published review of marine laws, institutions to support ICZM in Barbuda

Clearly defined roles and responsibilities

- Antigua and Barbuda's marine area is delineated by the Maritime Areas Act (1982);
- Minister for External Affairs manages regulation on navigation; marine traffic; conservation; general use of internal and archipelagic waters and territorial seas;
- The Physical Planning Act (2003, amended 2007) allocates planning control to the Barbuda Planning Commission, which can prepare development plans (e.g. for offshore zones) and set procedures for public participation and permitting.

Regional reflections & recommendations

- Marine spatial planning can be a complex and comprehensive activity, but no Caribbean country has clear and replicable process for identifying offshore wind development areas
- In order to kick-start a Caribbean offshore wind market, recommend **a pilot marine spatial plan for offshore wind** is developed in one country with high offshore wind suitability and clear roles, responsibilities
- The framework and process could be **adopted and replicated across the Caribbean region**

CONSIDER

Are any of these enabling factors present in your country?

CONSIDER

Are any of these enabling factors present in your country?

If so, what would it take to leverage them to pursue offshore wind development?

Building an offshore wind energy market – in summary

Recommendations for the Caribbean region

- **There is no need to start from scratch.** There are opportunities to build and develop offshore wind regulatory frameworks across the Caribbean region.

- **Clarity is good, streamlining is even better**. Developers need to know roles, responsibilities, authorities, processes because OSW development takes time and money.

- **If there is a strong incentive to participate in a market, OSW developers will come**. Could that incentive come from a single country, or the wider Caribbean region?

- **Determine what could be gained from OSW development** and make a plan to get there. Take learnings from other markets around the world.

Thanks for listening