



TotalEnergies E&P North Sea UK Ltd

Culzean - Floating Offshore Wind Turbine Pilot Project Environmental Impact Assessment Report – Chapter 3 - Site Selection and Consideration of Alternatives

ASSIGNMENT A100811-S02
DOCUMENT GB-CZN-00-XODUS-000005



Aberdeen

The Capitol Building
431 Union Street . Aberdeen
AB11 6DA . UK

T +44 1224 219 955
E deborah.morgan@xodusgroup.com
www.xodusgroup.com

REVISIONS & APPROVALS

This report has been prepared by Xodus Group exclusively for the benefit and use of TotalEnergies E&P North Sea UK Ltd. Xodus Group expressly disclaims any and all liability to third parties (parties or persons other than TotalEnergies E&P North Sea UK Ltd) which may be based on this report.

The information contained in this report is strictly confidential and intended only for the use of TotalEnergies E&P North Sea UK Ltd. This report shall not be reproduced, distributed, quoted or made available – in whole or in part – to any third party other than for the purpose for which it was originally produced without the prior written consent of Xodus Group.

The authenticity, completeness and accuracy of any information provided to Xodus Group in relation to this report has not been independently verified. No representation or warranty express or implied, is or will be made in relation to, and no responsibility or liability will be accepted by Xodus Group as to or in relation to, the accuracy or completeness of this report. Xodus Group expressly disclaims any and all liability which may be based on such information, errors therein or omissions therefrom.

A01	21/02/24	Issued for Use	DM	NB	NB	TEPNSUK
R01	20/11/23	Issued for Review	DM	NB	NB	TEPNSUK

REV	DATE	DESCRIPTION	ISSUED	CHECKED	APPROVED	CLIENT
-----	------	-------------	--------	---------	----------	--------

CONTENTS

GLOSSARY	4
ACRONYMS AND ABBREVIATIONS	5
3 SITE SELECTION AND CONSIDERATION OF ALTERNATIVES	6
3.1 Introduction	6
3.2 The 'Do Nothing' Option.	6
3.3 Site Selection Process	8
3.3.1 Policy and Planning	8
3.3.2 TEPNSUK Rationale	9
3.4 Project Design Alternatives	11
REFERENCES	13

GLOSSARY

TERMINOLOGY	DESCRIPTION
Culzean Floating Offshore Wind Pilot Project (the 'Project')	The entire Development including all offshore components and all project phases from pre-construction to decommissioning.
Environmental Assessment (EIA)	Impact The procedure to predict, minimise, measure and, if necessary, correct and compensate the impacts produced by any human action.
EIA Regulations	The Marine Works (Environmental Impact Assessment) Regulations 2007 requires that certain types of projects with the potential to significantly affect the environment have an environmental impact assessment before a marine licence decision is made.
Habitats Regulations Assessment (HRA)	Under the Habitats Regulations, all competent authorities must consider whether any plan or project could affect a European site before it can be authorised or carried out. This includes considering whether it will have a 'Likely Significant Effect' (LSE) on a European site, and if so, they must carry out an 'appropriate assessment' (AA). This process is known as Habitats Regulations Appraisal (HRA)
Innovation and Targeted Oil and Gas (INTOG)	<p>The Initial Plan Framework Sectoral Marine Plan for Offshore Wind for INTOG encompasses spatial opportunities and a strategic framework for future offshore wind developments within sustainable and suitable locations that will help deliver the wider United Kingdom (UK) and Scottish Government Net Zero targets.</p> <p>The 'IN' component of INTOG consists of small-scale innovative projects of 100 Megawatts (MW) or less. The aim of the 'TOG' component is to supplying renewable electricity directly to oil and gas infrastructure. The Culzean Floating Wind Pilot Project falls under the TOG component of INTOG.</p>
Maximum Design Parameters	The maximum range of design parameters of all infrastructure.
Net Zero	Refers to a government commitment to ensure the UK reduces its greenhouse gas emissions by 100% from 1990 levels by 2050 and in Scotland, the same target is set for 2045. If met, this would mean the amount of greenhouse gas emissions produced by the UK would be equal to or less than the emissions removed by the UK from the environment.
Project Design Envelope	The maximum range of design parameters of all infrastructure assessed as part of the EIA.
Study Area	Receptor specific area used to characterise the baseline.
Project Area	The extent of the immediate area surrounding the floating Wind Turbine Generator (WTG) and cable route as characterised by the extent of the seabed environmental and habitat surveys. Also referred to as the Survey Area where specifically relating to survey activities.
Survey Area	The area surveyed during site-specific surveys.
Floating Wind Turbine Generator (WTG)	Device that converts the kinetic energy of wind into electrical energy. Can be functionally divided into four parts: wind turbine, tower and transition piece, floating foundation, and mooring system.

ACRONYMS AND ABBREVIATIONS

ACRONYM/ ABBREVIATION	DEFINITION
AA	Appropriate Assessment
ALARP	As Low As Reasonably Practicable
BEIS	Department for Business Energy and Industrial Strategy (now the DESNZ)
CES	Crown Estate Scotland
DESNZ	Department for Energy Security and Net Zero (formerly BEIS)
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
FSO	Floating Storage and Offloading
GW	Gigawatts
HRA	Habitats Regulations Appraisal
Hz	Hertz
INTOG	Innovation and Targeted Oil and Gas
IPF	Initial Plan Framework
kV	Kilovolt
LSE	Likely Significant Effect
MW	Megawatts
NSTD	North Sea Transition Deal
PDE	Project Design Envelope
Pre-FEED	preliminary-Front End Engineering Design
SMP	Sectoral Marine Plan
TEPNSUK	TotalEnergies Exploration and Production North Sea UK Limited
TOG	Targeted Oil and Gas (component of INTOG)
UK	United Kingdom
WTG	Wind Turbine Generator

3 SITE SELECTION AND CONSIDERATION OF ALTERNATIVES

3.1 Introduction

This chapter outlines the site selection process that has been undertaken when defining the Culzean Floating Offshore Wind Pilot Project (the 'Project'). It also outlines the alternatives to the Project that have been considered, both in terms of the different design options throughout the development process as well as the consideration of not developing the Project at all (the 'do nothing' approach).

As defined in Chapter 2: Legislation and Policy, the Environmental Impact Assessment (EIA) Regulations require that the Project's Environmental Impact Assessment Report (EIAR) includes 'a description of the reasonable alternatives (for example in terms of Project design, technology, location, size and scale) studied by the Developer, which are relevant to the proposed works and its specific characteristics and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects'. The Scoping Opinion also provides the advice in Table 3-1 for the selection of a suitable site and the consideration of any alternatives.

Table 3-1 Scoping Opinion responses relevant to site selection and consideration of alternatives

SCOPING OPINION REFERENCE	COMMENT	RESPONSE
Scottish Ministers (Via MD- LOT)	The EIA Regulations require that the EIA Report includes 'a description of the reasonable alternatives (for example in terms of project design, technology, location, size, and scale) studied by the Developer, which are relevant to the proposed works and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects'. The Scottish Ministers acknowledge section 3.1 of the Developer's Scoping Report setting out the parameters which were considered as part of the selection process for site location, however, note that alternative considerations were not discussed in detail.	This chapter has been included within this EIAR to provide a description of any reasonable alternatives. Further detail on Project design, technology, location, size, and scale and the approach to relative environmental impact is provided in Chapter 4: Project Description.
Scottish Ministers (via MD- LOT)	For the avoidance of doubt, the Scottish Ministers advise that the EIA Report must include an up-to-date consideration of the reasonable alternatives studied as the parameters of the Proposed Development have been refined. The Scottish Ministers expect this to comprise a discrete section in the EIAR that provides details of the reasonable alternatives studied across all aspects of the Proposed Development and the reasoning for the selection of the chosen option(s), including a comparison of the environmental effects.	

3.2 The 'Do Nothing' Option.

The 'do nothing' option is a consideration of what would happen if the Project did not go ahead. As presented in Section 2.2: Need for the Project, the Project will aim to achieve the following:

- Supply electricity generated from three Megawatts (MW) of wind energy to partially power an offshore oil and gas platform to fulfil the aims of the Targeted Oil and Gas (TOG) component of Innovation and Targeted Oil and Gas (INTOG);
- Provide unique opportunities to deliver a fast and effective *Just Transition*;
- To meet the requirements of the North Sea Transition Deal (NSTD) which includes a Net-Zero Asset Stewardship Expectation;
- To encourage emissions reductions from both existing and new oil and gas developments;
- Trial floating substructure technology in offshore (relatively extreme) metocean conditions compared to turbines closer to shore;
- Investigate the feasibility to scale up the electrification of the remainder of TotalEnergies offshore oil and gas assets on a global basis;
- Set an example for other oil and gas operators in the hybridisation of their assets;
- Support the transition to a net zero economy; and
- Contribute to Government commitments to climate change;

A 'do nothing' scenario would not meet any of the above Project aims and would require the use of alternative emissions intensive fuel on the Culzean platform and would delay the potential for emissions savings on a larger scale, also not achieving the requirements of the NSTD Net-Zero Asset Stewardship Expectation for offshore developers.

The Project location has been strategically identified through Initial Plan Framework (IPF) for the Scottish Government Sectoral Marine Plan (SMP) for Offshore Wind Energy for INTOG, which will help deliver smaller projects to meet wider net zero commitments and meet the following objectives for INTOG:

- Contribute to the attainment of net zero targets and a cleaner energy transition through targeted decarbonisation of offshore oil and gas assets from offshore wind;
- Minimise the potential adverse effects on other marine users, economic sectors and the environment resulting from further offshore wind development; and
- Maximise opportunities for economic development, investment and employment in Scotland, by identifying new sustainable opportunities for offshore wind development (Scottish Government, 2022).

If the Project does not proceed, the potential for hybridisation may not be realised in the near-term, if at all. This could result in ramifications for current and future applications. In recognition of the importance of reducing carbon emissions, the United Kingdom (UK) and Scottish Governments have committed to reduce emissions and increase the use of renewable energy.

In support of climate change legislation, the Draft Scottish Energy Strategy and Just Transition Plan was published in January 2023 (Scottish Government, 2023) and provides a roadmap of how net zero emissions by 2045 can be accomplished. The Project is also key to supporting the NSTD which sets out an ambitious plan to deliver a Just Transition and an investment of up to £14-£16 billion by 2030 in new energy technologies in the North Sea to support the drive towards net zero (BEIS, 2021). As a pilot project, the electrification of the Culzean platform provides a launchpad upon which future North Sea (and international) projects can be based, contributing to these strategies on a much wider scale.

The Scottish Government is committed to ensuring secure, reliable and affordable energy supplies (i.e. social and economic benefits), within the context of long-term decarbonisation of energy generation (i.e. environmental benefits). The continued growth of the renewable energy sector in Scotland is an essential feature of the future clean energy system and a key driver of economic growth (Scottish Government, 2020). Development of the Project will be an important step in the continued path towards net zero and for meeting the energy demand of offshore oil and gas infrastructure. Thus, 'doing nothing' (no Culzean Pilot Project Wind Turbine Generator (WTG)) would hinder decarbonisation and the Scottish Government's development of a SMP for Offshore Wind Energy for INTOG, which encompasses spatial opportunities and the strategic framework for future offshore wind deployment in sustainable and suitable locations, that will help deliver smaller projects to meet wider net zero commitments (Scottish Government, (2022)). It is not compatible with a climate emergency to 'do nothing'.

For all the above reasons, the "do nothing" option was discounted.

3.3 Site Selection Process

The site selection process for the Project has been guided and informed by key events including:

- Policy and planning framework including:
 - The implementation of the IPF for a Sectoral Marine Plan to cover INTOG decarbonisation;
 - The submission of a TOG lease application to the Crown Estate Scotland (CES) in 2022;
 - The release of the Draft Energy Strategy and Just Transition Plan (Scottish Government, 2023) in January 2023 which specifically mentions INTOG as one of the key leasing rounds supporting the scale up of offshore wind energy in Scotland; and
 - Award of an Exclusivity Agreement to TEPNSUK in March 2023.
- TEPNSUK consultation, and environmental and technical investigations which have enabled refinements to be made to the Project design and area within which Project infrastructure will be located.

3.3.1 Policy and Planning

It is widely recognised that in offshore Scottish waters, there exists the potential to extract significant energy resources in the form of offshore wind energy generation. Any expansion of offshore wind energy generation in Scottish waters requires the application of marine spatial planning, at a national, regional and local scale, to identify areas that may be suitable for the development of offshore wind projects. The development of technologies such as floating wind, offers the scope for development in deeper water and has significant potential to contribute offshore wind energy supply at increasingly affordable prices. Floating technology is particularly well suited to the deeper water abundant around Scotland and in the vicinity of oil and gas infrastructure.

Smaller-scale innovation scale projects (i.e. those below 100 MW) are not accounted for in the existing SMP for Offshore Wind Energy nor do they have a route to a seabed lease. The Scottish Government is now developing a SMP for INTOG, which encompasses spatial opportunities and the strategic framework for future offshore wind deployment in sustainable and suitable locations that will help deliver projects to meet the above goal and our wider net zero commitments.

For TOG decarbonisation projects such as Culzean, the IPF outlines the following considerations and requirements:

- Projects should have up to a total of four Gigawatts (GW) generating capacity;
- Projects should be located within the areas identified for TOG Decarbonisation projects;
- The project should deliver electricity to oil and gas assets; and
- Any project proceeding to the final Plan must have successfully progressed through CES lease application process and been awarded exclusivity.

To comply with the spatial parameters set out in the IPF, all TOG decarbonisation projects were required to be located within the blue areas shown in Figure 3-1. This Project falls within the eastern area E-a.

3.3.2 TEPNSUK Rationale

The rationale of the Project is to trial the new floater technology for hybridisation, using a readily available WTG design. The new floater technology can deliver opportunities for significant cost savings, industrialisation of larger projects, and provide TEPNSUK with valuable experience in the electrification of an oil and gas asset.

A total of four locations across the North Sea were assessed within the criteria and requirements of the IPF and with the potential for hybridisation. Two of the locations were in Norwegian waters where the opportunity for hybridisation trials is not available. These options were therefore quickly discounted.

The remaining locations were both in UK waters, where hybridisation options were available. The potential locations consisted of the Alwyn North platforms and the Culzean platforms. The Alwyn facilities commenced production in 1987 (TotalEnergies, 2021). Under current expectations of long-term oil and gas prices and indications, the infrastructure is expected to be operational until the late 2020s and therefore the lifespan of this facility was not deemed suitable to act as a basis for this pilot Project (TotalEnergies, 2023).

Production commenced on the Culzean facilities in 2018. Culzean is TotalEnergies' most advanced and forward-looking digital offshore facility and is the largest gas project developed in the UK in the last 25 years, which at peak production will supply 5% of the UK's gas demand. Hybridisation is therefore in-keeping with this forward-looking approach, whilst also providing a greater decarbonisation opportunity (and therefore greater emissions savings) compared to Alwyn, where production is in decline.

TEPNSUK has also selected the Culzean Field to pilot this floating technology as the water depth is circa 90 m, providing an ideal environment to trial the technology. Furthermore, TEPNSUK has extensive and recent knowledge of the platform site and the surrounding area, which will facilitate rapid deployment. Key technical parameters assessed to inform the selection of the Project site included WTG layout flexibility and the logistics (aviation and vessel routes) around the existing Culzean platform.

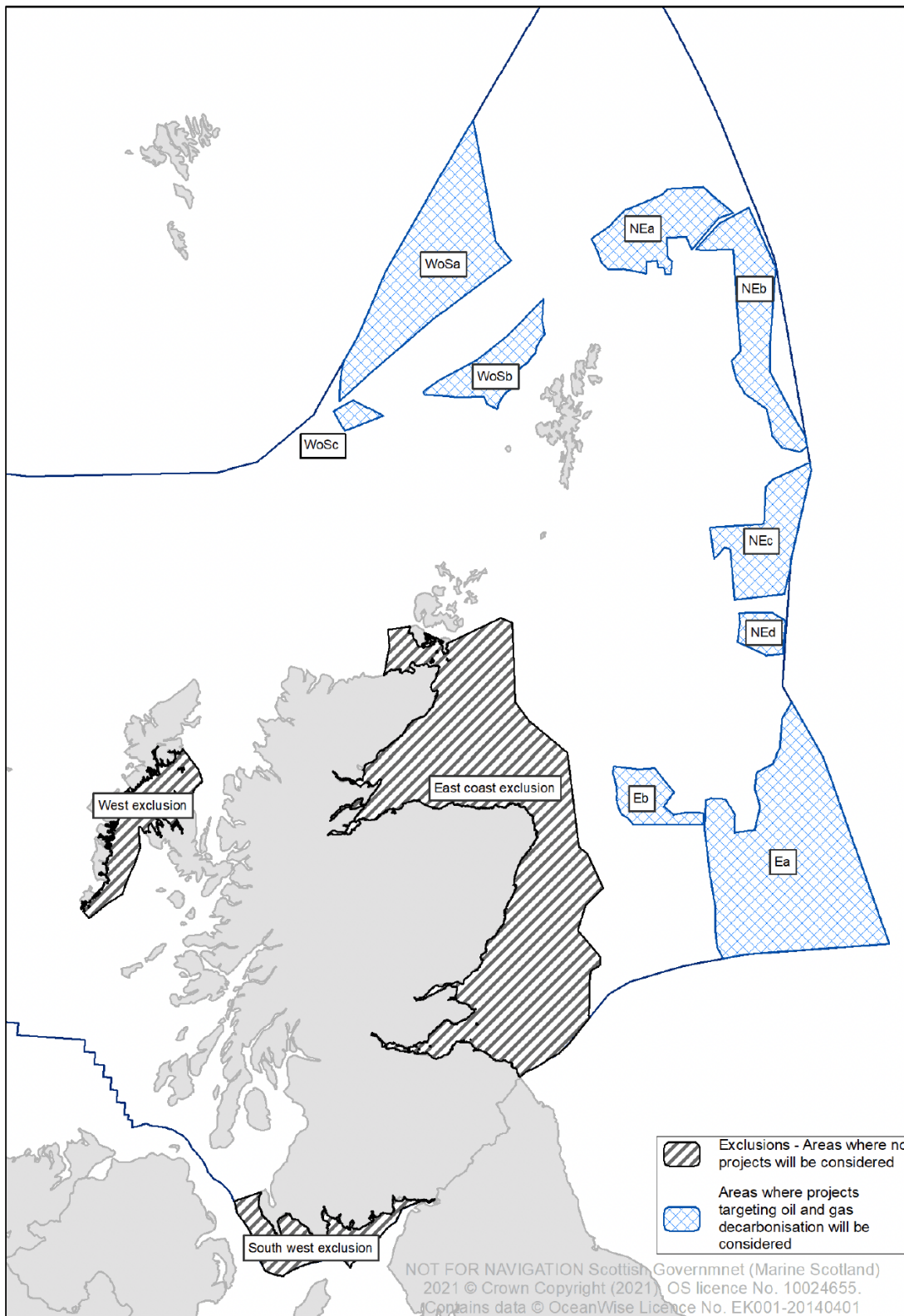


Figure 3-1 IPF TOG areas: Options and Exclusions (Marine Scotland, 2022)

3.4 Project Design Alternatives

A preliminary-Front End Engineering Design (pre-FEED) study for the integration works on the Culzean Facilities for the tie-in of the Project was undertaken. The selection of the Project location considered:

- Environmental impact of the potential Project seabed footprint;
- TEPNSUK’s knowledge of the seabed conditions around the Culzean platform;
- Logistics, in particular helicopter approaches and tanker operations, near the associated Ailsa Floating Storage and Offloading (FSO) vessel;
- Future seismic survey(s) requirements and future development(s);
- Platform approach (crossings); and
- Potential collision risk with the Culzean platform (e.g. drift of the floating WTG in case of a broken anchor).

The decision-making process around the selection of the WTG technology considered is outlined in Table 3-2.

Table 3-2 Technology selection: Decision-making process

ITEM	DECISION-MAKING PROCESS
WTG	<ul style="list-style-type: none"> • The WTG is provided by Vestas who are a key player of the floating wind market. • A refurbished V112 (with new blades, tower and substructure) is proposed by Vestas. • The V112 is a very well-established model from the industry largely installed onshore and offshore.
Floating substructure	<ul style="list-style-type: none"> • Ocergy was identified by TEPNSUK as a high potential technology for the future development of offshore wind / electrification projects. • The OCG wind model is based on a modular approach allowing flexibility in fabrication and maximising the use of the existing local supply chain, whilst reducing quayside and offshore operations to allow units to be installed. • The floater design was deemed to be optimal for the size of the WTG. • The ballast system that ensure a very low draft when along quayside and keep the platform horizontal during operations, allowing structural optimisations and improving the turbine energy yield.
Mooring lines	<ul style="list-style-type: none"> • A worst case of six mooring lines has been considered for the Project. • An initial catenary mooring system (three lines) was chosen as it is a field-proven technology and is designed to meet the requirements from codes & standards. This mooring system will be installed along with the WTG in 2025. • An additional taut or semi-taut mooring system (three lines) will be installed in 2026 at a 5° angle from the catenary lines. The aim of this is to trial new, innovative and low-impact mooring techniques with the aim to assess them for future electrification projects. • This mooring system approach is deemed to be sufficient to ensure a platform with a risk and environmental impact reduced to As Low As Reasonably Practicable (ALARP).
Anchors	<ul style="list-style-type: none"> • Drag embedment anchors have been selected for the catenary mooring system as they are the most effective anchoring technology with regards to Project sediment conditions. • Plate anchors (installed using a suction pile) may be used as a lower seabed impact alternative to drag anchors for the taut or semi-taut mooring options. • Pin-piling was discounted from consideration due to unsuitability of the ground conditions and the potential implications for the impacts of the associated installation noise on marine mammals and other megafauna and fish and shellfish.

ITEM	DECISION-MAKING PROCESS
Export cable	<ul style="list-style-type: none"> • An 11 kilovolt (kV) / 60 Hertz (hz) power cable was selected to deliver electrical power most efficiently from WTG to the Culzean platform. • Two-layer armour design chosen to enable dynamic configuration from floater to seabed. • Compatible with Culzean Platform which already has a J-tube installed for hook-up.
Export cable route	<ul style="list-style-type: none"> • The route was selected to optimise cable length away from other cables and pipe crossings associated with the export pipelines and the Ailsa FSO vessel to the south and southeast of the Culzean Platforms.
Cable installation method	<ul style="list-style-type: none"> • Trenching and burial of cable to account for lowering of risk to other sea users. • Burial (via jet trencher or non-displacement plough) is expected to be achievable within the seabed conditions. • Rock remediation to be limited to locations if burial depth cannot be achieved to avoid unnecessary environmental impact

Detailed engineering work and discussions have been ongoing throughout the EIA process to refine the design envelope wherever possible. Geophysical and geotechnical surveys were undertaken in 2023 to further help refine the engineering requirements and define the detailed design. The final Project Design Envelope (PDE) is presented in Chapter 4: Project Description.

REFERENCES

BEIS (Department for Business, Environment and Industrial Strategy; now known as The Department for Energy Security and Net Zero (DESNZ)) (2021) North Sea Transition Deal. Available online at: https://assets.publishing.service.gov.uk/media/605b148ce90e0724c7d30c2b/north-sea-transition-deal_A_FINAL.pdf. [Accessed 12/10/2023].

Scottish Government (2020). Offshore Wind Policy Statement. Available online at: <https://www.gov.scot/publications/offshore-wind-policy-statement/> [Accessed 12/10/2023].

Scottish Government (2022). Sectoral marine plan - offshore wind for innovation and targeted oil and gas decarbonisation: initial plan framework. Available online at <https://www.gov.scot/publications/initial-plan-framework-sectoral-marine-plan-offshore-wind-innovation-targeted-oil-gas-decarbonisation-intog/> [Accessed 12/10/2023].

Scottish Government (2023). Draft Energy Strategy and Just Transition Plan. Available online at: <https://www.gov.scot/binaries/content/documents/govscot/publications/strategy-plan/2023/01/draft-energy-strategy-transition-plan/documents/draft-energy-strategy-transition-plan/draft-energy-strategy-transition-plan/govscot%3Adocument/draft-energy-strategy-transition-plan.pdf> [Accessed 12/10/2023].

TotalEnergies (2021). Alwyn East Environmental Statement. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1028412/Alwyn_East_Environmental_Statement_D-4264-2021_Redacted.pdf [Accessed 15/11/2023]

TotalEnergies (2023). Alwyn Platform Description. Available online at: https://services.totalenergies.uk/system/files/atoms/files/northern_north_sea_-_icop_-_final_copy.pdf [Accessed 15/11/2023]