MONA OFFSHORE WIND PROJECT

Technical Note: Calculation of the Net Effects on Greenhouse Gas Emissions

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Glossary

Term	Meaning
Climate change	A change in global or regional climate patterns, in particular a change apparent from the mid to late 20th century onwards and attributed largely to the increased levels of atmospheric carbon dioxide produced by the use of fossil fuels.
CO_2e	'carbon dioxide equivalent.' Used to measure and compare emissions from greenhouse gases based on how severely they contribute to global warming
Emissions	An amount of a substance that is produced and sent out into the air that is harmful to the environment, especially carbon dioxide.
Fossil fuel	A hydrocarbon-containing material formed naturally in the earth's crust from the remains of dead plants and animals.
Greenhouse Gas (GHG)	A gas that absorbs and emits radiant energy within the thermal infrared range, causing the greenhouse effect. Examples include carbon dioxide and methane.
Marginal generation source	Accounts for sustained changes in energy consumption for the purposes of cost-benefit analysis, including policy appraisal.
Maximum Design Scenario (MDS)	The scenario within the design envelope with the potential to result in the greatest impact on a particular topic receptor, and therefore the one that should be assessed for that topic receptor.
Renewable energy	Energy from a source that is not depleted when used, such as wind or solar power.
UK Grid Carbon Intensity	Carbon intensity is a measure of how clean UK Grid electricity is. It refers to how many grams of carbon dioxide (CO_2) are released to produce a kilowatt hour (kWh) of electricity.
Well-to-tank	Emissions associated with the production, transportation, transformation and distribution of fuels.

Acronyms

Acronym	Description
AEP	Annual energy production
BEIS	Department for Business, Energy and Industrial Strategy
CNP	Critical National Priority
DCO	Development Consent Order
DESNZ	Department for Energy Security and Net Zero
EIA	Environmental Impact Assessment
ExA	Examining Authority
ExQ	Examining Authority’s written questions
GHG	Greenhouse Gas
IP	Interested Party

Acronym	Description
IEMA	Institute of Environmental Management and Assessment
ISH	Issue Specific Hearing
MDS	Maximum Design Scenario
OFGEM	Office of Gas and Electricity Markets
OWF	Offshore Wind Farm
REGO	Renewable Energy Guarantees of Origin
WTG	Wind turbine generator

Units

Unit	Description
%	Percentage
CO_2e	Carbon dioxide equivalent
GW	Gigawatts
kg	Kilograms
$kgCO_2e$	Kilograms of carbon dioxide equivalent
km	Kilometres
km^2	Square kilometres
MW	Megawatts
MWh	Megawatt hours
MWh/yr	Megawatt hours per year
tCO_2e	Tonnes of carbon dioxide equivalent
t	Tonnes

1 EXECUTIVE SUMMARY

1.1.1.1 This technical note provides a calculation of the effects of the Mona Offshore Wind Project on greenhouse gas (GHG) emissions, taking into account the potential for wake effects (i.e. any energy production losses that result from changes in wind speed caused by the impact of wind turbine generators on each other) from the Mona Offshore Wind Project on existing Ørsted Interested Parties (IPs) operational offshore wind farms (OWF). The note has two purposes: firstly, to determine the net effect on GHG emissions relating to the potential wake values put forward by the Ørsted IPs in their Wake Impact Assessment Report (REP5-120); and secondly, to determine the effect of implementing potential mitigation on net GHG emissions. To address these, a scenario-based approach has been used to calculate the net GHG emissions for three cases:

a) **Business as usual**: present day baseline scenario with continued energy production from existing Ørsted IPs OWFs in the Irish Sea in the absence of the Mona Offshore Wind Project.

b) **Presence and operation of Mona Offshore Wind Project:** energy production from the Mona Offshore Wind Project, designed in accordance with the Maximum Design Scenario as set out in Volume 1, Chapter 3: Project Description (F1.3 F02), as well as energy production from existing Ørsted IPs OWFs in the Irish Sea, accounting for a potential reduction in energy production due to Ørsted IPs estimated wake effects.

c) **Presence and operation of Mona Offshore Wind Project with indicative mitigation for potential wake effects:** energy production from the Mona Offshore Wind Project, re-designed to incorporate example mitigation for potential wake losses, as well as energy production from existing Ørsted IPs OWFs in the Irish Sea, with a corresponding reduction in potential wake effects.

1.1.1.2 For each scenario, net effects are presented with regard to the avoided GHG emissions (presented in tonnes of carbon dioxide equivalent (tCO_2e)) due to overall renewable energy contribution to the UK electricity Grid. Two emissions factors have been used in the calculation of GHG emissions to estimate the potential avoided emissions as a result of each scenario, in line with the methodology detailed in Volume 4, Chapter 2: Climate change (F4.2 F02). These are the long-run marginal emissions factor (carbon intensity of long-run marginal electricity generation and supply) and ‘non-renewable fuels’ (current estimated intensity from electricity supplied for ‘all non-renewable fuels’).

1.1.1.3 This note has been prepared to address Action Point 10 arising from Issue Specific Hearing 6: Onshore and Offshore Environmental Matters and the DCO (ISH6). The calculations have applied the estimated wake effects on energy yield put forward by the Ørsted IPs (REP5-120), however the use of these figures does not in any way indicate the Applicant’s agreement with the Ørsted IPs wake assessment for the reasons set out in previous submissions on this topic (see REP6-130 and section 6 of REP6-083).

1.1.1.4 An assumption key to determining the outcomes of the assessment is the use of a conservative capacity factor to calculate the average energy production for the Mona Offshore Wind Project (presented in Volume 4, Chapter 2: Climate change (F4.2 F02)). The capacity factor used is based on historic capacity reported in UK offshore wind projects, and as such does not account for efficiency improvements associated with technological advances in wind turbine design and manufacture. It is likely that Mona Offshore Wind Project's capacity factor will be much improved. As such, it can be expected that Mona Offshore Wind Project's energy production potential, and therefore associated avoided emissions, would be greater in reality.

1.1.1.5 The assessment concludes the following:

- **'Scenario a' Net GHG emissions for business as usual:** the total avoided emissions associated with the present-day baseline scenario of operational Ørsted IPs projects in the absence of the Mona Offshore Wind Project are 2,886,965 tCO_2e (DESNZ long-run marginal) and 27,042,721 tCO_2e (DESNZ 'non-renewable fuels').
- **'Scenario b' Net GHG emissions associated with the Mona Offshore Wind Project accounting for the Ørsted IPs wake assessment (REP5-120):** the total lifetime avoided emissions associated with the Mona Offshore Wind Project alongside existing operational Ørsted IPs projects (accounting for a potential reduction in energy production due to Ørsted IPs estimated wake effects) would be 5,253,745 tCO_2e (DESNZ long-run marginal) and 79,111,940 tCO_2e (DESNZ 'non-renewable fuels'), demonstrating that the construction of the Mona Offshore Wind Project in line with the MDS would lead to an overall net benefit in terms of GHG emissions.

  The loss of avoided emissions by the Ørsted IPs projects as a result of the presence and operation of the Mona Offshore Wind Project is negligible when compared to the avoided emissions achieved by the Mona Offshore Wind Project. Under 'Scenario b' the Ørsted IPs projects result in a total loss of avoided emissions of 38,200 tCO_2e (DESNZ long-run marginal)/353,356 tCO_2e (DESNZ 'non-renewable fuels'), while the Mona Offshore Wind Project results in 2,404,980 tCO_2e (DESNZ long-run marginal)/52,422,575 tCO_2e (DESNZ 'non-renewable fuels'), thereby outweighing any loss (range presented using the long run marginal and non-renewable fuels emissions factors).

  The net change in avoided emissions which has been calculated for the Ørsted IPs projects based on the potential wake effects put forward by the Ørsted IPs (REP5-120) does not alter the conclusions of the climate change assessment as presented in Volume 4, Chapter 2: Climate change (F4.2 F02). This is because the assessment uses a conservative capacity factor for the Mona Offshore Wind Project. A range of factors have influenced project yields (on which the historic capacity factor is based) including wake effects, therefore the capacity factor used adequately factors in the potential for wake effects, as outlined in detail in the Applicant's response to ISH6 Action Point 10 at Deadline 6 (REP6-082).
- **'Scenario c' Change in net GHG emissions associated with example mitigation scenario:** The implementation of example mitigation by Mona Offshore Wind Project to reduce the potential wake effects on the Ørsted IPs projects would not result in a net benefit to GHG emissions reduction. The assessment demonstrated that under 'Scenario c' (where example mitigation has been applied to the Mona Offshore Wind Project and the suggested wake losses experienced by existing Ørsted offshore wind farms in the Irish Sea are reduced) there would be a reduction in net lifetime avoided emissions overall, meaning any mitigation would have a counterproductive effect in achieving its net goal. When compared with 'Scenario b', 'Scenario c' results in 97,468 tCO_2e (DESNZ long-

run marginal)/2,651,495 tCO_2e (DESNZ 'non-renewable fuels') fewer avoided emissions (range presented using the long run marginal and non-renewable fuels emissions factors).

This is because the suggested mitigation would result in increased wind turbine generator density within the Mona Array Area, leading to increased internal wake effects reducing Mona Offshore Wind Project's annual energy production. The corresponding reduction in potential wake effects on the Ørsted IPs OWFs associated with implementing such mitigation would be comparably small, which aligns with the general principle that wakes effects internal to a project are greater than effects on external projects at a distance. The net loss in avoided emissions, therefore, is due to the decrease in the AEP of Mona Offshore Wind Project resulting in a large loss of avoided emissions that outweigh those lost by the Ørsted IPs projects as a result of wake loss effects. This demonstrates that the implementation of mitigation does not support overall UK Government emissions reduction efforts.

1.1.1.6 The greatest benefit to national GHG emissions reduction, and UK renewable energy production, is achieved through the presence of the Mona Offshore Wind Project (without mitigation), despite any potential losses experienced by the Ørsted IPs OWFs.

2 INTRODUCTION

2.1.1.1 This technical note provides a calculation of the net effects of the Mona Offshore Wind Project on greenhouse gas (GHG) emissions, taking into account the potential for wake effects from the Mona Offshore Wind Project on existing operational offshore wind farms. The note has two purposes: firstly, to determine the net effect on GHG emissions relating to the potential wake values put forward by the Ørsted Interested Parties (IPs) in their Wake Impact Assessment Report (REP5-120); and secondly, to determine the effect of implementing potential mitigation on net GHG emissions. To address these objectives, a scenario-based approach has been used to calculate the net GHG emissions for three scenarios:

a) Business as usual: operational Ørsted IPs projects only, with no wake effects

b) Presence and operation of Mona Offshore Wind Project in line with the Maximum Design Scenario (MDS)

c) Presence and operation of Mona Offshore Wind Project with example mitigation for potential wake effects.

2.1.1.2 For each scenario, net effects are presented with regard to the lifetime avoided GHG emissions (presented in tonnes of carbon dioxide equivalent (tCO_2e)) due to renewable contribution to the UK electricity Grid.

2.1.1.3 This note has been prepared to address Action Point 10 arising from Issue Specific Hearing 6: Onshore and Offshore Environmental Matters and the DCO (ISH6). The calculations utilised estimated wake effects on energy yield put forward by the Ørsted IPs (REP5-120), however the use of these figures does not in any way indicate the Applicant’s agreement that there is a policy requirement to undertake an assessment or with the Ørsted IPs wake assessment.

3 BACKGROUND

3.1.1.1 The Ørsted IPs put forward, in their post-hearing submission at Deadline 4 (REP4-129), that preliminary results of modelling have indicated that the Mona Offshore Wind Project will have an impact on their existing operational developments of between 0.9 and 1.7% annual energy production (AEP), and, when considered cumulatively with the Morgan Generation Assets and the Morecambe Offshore Windfarm: Generation Assets, between 1.7 and 5.3%. A more detailed breakdown of the figures for each of the Ørsted IPs wind farms was provided by the Ørsted IPs in their Wake Impact Assessment Report at Deadline 5 (REP5-120). The Applicant in no way agrees that there is a policy requirement for such an assessment or with those figures (as set out in the Applicant's response to Q2.19.1 at Deadline 5 within REP5-080, and in the Applicant's response to Ørsted IPs Deadline 5 submissions at Deadline 6 (REP6-116 and REP6-117)). However, in response to the Examining Authority's written questions (ExQ2) Q2.19.5 (see below), the Applicant committed to review whether it would be possible to carry out an exercise utilising the figures provided by the Ørsted IPs to provide a calculation of the net effects on GHG emissions:

3.1.1.2 '*Do you accept, as a matter of principle, that wake loss can be of relevance to the EIA Regulations in terms of assessing the impact of a project on climate (such as contribution to the abatement of fossil fuel generation within the UK grid during the operational phase)? Explain your response*'.

3.1.1.3 The Applicant set out its position in its Responses to ExQ2 (REP5-080) and in further detail in its Responses to ISH6 Hearing Action Point 10 (REP6-082), as follows:

3.1.1.4 '*Volume 8, Annex 2.1: Greenhouse gas assessment technical report (APP-182) considers avoided emissions, the quantity of renewable energy use it enables by avoiding curtailment, the quantity of fossil fuel generation it displaces, and the associated Greenhouse Gas (GHG) impacts of both. The assessment makes a calculation of the project's GHG balance against the Department of Energy Security and Net Zero (DESNZ) long-run marginal, published by National Grid.*

3.1.1.5 *The marginal source of energy generation displaced by new renewable generation must be based on a prediction of the future long-term trends of generation type, which has inherent uncertainty built-in. Any assessment must be considered on the basis that the long-run marginal emission of future generation may at any point include more, or less, renewables generation from other generators than the long-run marginal data set assumes. In this regard at a high level possible reduction of generation by the Orsted IPs and replacement of generation by alternative generators, is already factored into the assessment. It is also noteworthy that as the UK moves towards its 2050 net zero carbon target, the marginal source of electricity generation will likely become a combination of renewables (predominately solar and wind) and storage. Therefore, from circa 2040 onwards, comparing the Mona Offshore Wind Project's GHG impacts with the marginal source of generation is akin to comparing it with itself and has limited value.*

3.1.1.6 *As noted in the IEMA EIA Guidance on Assessing GHG Emissions (IEMA, 2022) "the crux of significance therefore is not whether a project emits GHG emissions, nor even the magnitude of GHG emissions alone, but whether it contributes to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2050." The Applicant believes it is uncontentious that factoring in any potential change in the Ørsted IPs generation output, when viewed against the long term-*

marginal source of electricity that would replace that generation, would not change the outcome of the EIA assessment for GHG net effects (see section 2.10.8 of Volume 4, Chapter 2: Climate change (APP-076) [now F4.2 F02]*) as beneficial, and therefore of positive significance in EIA terms.*

3.1.1.7 *However, the Applicant considers it could be possible to utilise the figures provided by the Ørsted IPs, as referenced in ExA Q2.19.1, to provide a calculation of the effects of the project on climate, specifically the net effects on GHG emissions. This would in no way suggest agreement with those figures (as set out in the Applicant's response to Q2.19.1 above). The Applicant would need to be provided with a more detailed breakdown of the output of the figures, in particular which impacts the Ørsted IPs consider relate to which project*'.

3.1.1.8 Whilst the Applicant maintains that the above considerations remain pertinent, it has conducted additional review of the available information, and as a result has provided further analysis within this document.

4 METHODOLOGY

4.1 Scenarios

4.1.1.1 This assessment calculates the net effect on GHG emissions for four scenarios:

a) **Business as usual:** present day baseline scenario with continued energy production from existing Ørsted IPs OWFs in the Irish Sea in the absence of the Mona Offshore Wind Project

b) **Presence and operation of Mona Offshore Wind Project:** energy production from the Mona Offshore Wind Project, designed in accordance with the MDS as set out in Volume 1, Chapter 3: Project Description (F1.3 F02), as well as energy production from existing Ørsted IPs OWFs in the Irish Sea, accounting for a potential reduction in energy production due to Ørsted IPs estimated wake effects.

c) **Presence and operation of Mona Offshore Wind Project with example mitigation for potential wake effects**: energy production from the Mona Offshore Wind Project, re-designed to incorporate example mitigation for wake losses, as well as energy production from existing Ørsted IPs OWFs in the Irish Sea with a corresponding reduction in potential wake effects.

4.1.1.2 The example mitigation comprises increasing the separation distance between the Mona Offshore Wind Project and the Ørsted IPs projects, resulting in a shrinking of the Mona Array Area and a corresponding increase in the density of the wind turbine generator (WTG) layout. Further detail regarding this example mitigation is included at Section 4.2.4.

4.1.1.3 Cumulative assessment of the Mona Offshore Wind Project with the Morgan Generation Assets and the Morecambe Offshore Windfarm: Generation Assets has not been considered within this note (see paragraph 5.3.2.3 for further discussion).

4.1.1.4 For each scenario, the following methodology has been applied to determine the net effects on GHG emissions:

- Calculation of lifetime energy production:
  - Baseline energy production has been determined for operational Ørsted IPs OWFs in the absence of potential wake effects and for Mona Offshore Wind Project (detailed in Section 4.2.2).
  - For operational Ørsted IPs OWFs, baseline energy production has been adjusted for estimated wake losses associated with the Mona Offshore Wind Project, as provided by Ørsted IPs (REP5-120) (detailed in Section 4.2.3).
  - For the Mona Offshore Wind Project, baseline AEP has been adjusted for the reduction in energy production resulting from the implementation of mitigation for potential wake effects on existing offshore wind projects (detailed in Section 4.2.4).
- The resulting avoided GHG emissions (tCO_2e) associated with the energy production have been calculated for the above scenarios on a lifetime basis, as detailed in Section 4.3.

4.1.1.5 Data sources used in the assessment are detailed in Table 4.1 below.

Table 4.1: Data sources used in the assessment.

Dataset	Source
Operational offshore wind farm annual electricity generation	Renewable Energy Guarantees of Origin (REGO) certificate reporting by Office of Gas and Electricity Markets (OFGEM), 2024.
Operational offshore wind farm earliest decommissioning dates	Ørsted IPs earliest decommissioning dates for their Irish Sea projects from Table 1 of Ørsted IPs Deadline 4 Submission - Responses to ISH4 action points (REP4-130).
Wake losses for Ørsted IPs operational offshore wind farms	Estimated wake losses calculated by the Ørsted IPs for Mona Offshore Wind Project from scenario 1 in Table 5-4 of the Ørsted IPs Deadline 5 Submission - Wood Thilsted Wake Impact Assessment Report (REP5-120). The Applicant highlights that use of the Ørsted IPs estimated wake loss values does not in any way imply it is in agreement with these values (as set out in section 3 above).
Mona Offshore Wind Project AEP	Table 2.16 of Volume 4, Chapter 2: Climate change (F4.2 F02)
Mona Offshore Wind Project internal losses resulting from mitigation	Sensitivity study by the Mona Offshore Wind Project to assess the reduction in AEP which would result from increasing the distance between OWFs, as detailed in Section 4.2.4 below.

4.2 Energy generation methodology

4.2.1.1 The sections below detail the methodology undertaken to calculate the energy generation for each scenario, in order to inform the GHG assessment.

4.2.2 Scenario a) Business as usual

Ørsted IPs OWFs

4.2.2.1 An average AEP (MWh/yr) for each of the Ørsted IPs projects listed in Table 4.2 has been calculated based on the AEP since 2014 sourced from publicly available REGO certificate reporting provided by OFGEM (2024) in the absence of more detailed project-specific information on AEP being made available in the Ørsted IPs Wake Impact Assessment Report (REP5-120).

4.2.2.2 Lifetime energy production has been calculated based on the earliest decommissioning dates for each project, as set out in Table 4.2, based on information provided by the Ørsted IPs in REP4-130. This is consistent with the approach for Mona Offshore Wind Project which has assumed a 35-year life as the earliest decommissioning date.

Table 4.2: Ørsted IP's relevant projects with decommissioning dates.

Ørsted IPs developments		Earliest decommissioning date	Remaining lifetime (months)*
Burbo Bank 1		December 2031	23
Burbo Bank 2 (extension)		May 2041	136
Barrow		September 2030	8
Walney	Walney 1	July 2035	66

Ørsted IPs developments		Earliest decommissioning date	Remaining lifetime (months)*
Walney Extension	Walney 2	June 2036	77
	Walney 3	May 2042	148
	Walney 4	May 2042	148
West of Duddon Sands		October 2038	105

*Remaining lifetime of each project from the operation of Mona Offshore Wind Project (2030) to each project's earliest decommissioning date.

4.2.2.3 When calculating the lifetime production (MWh) of each Ørsted IPs project, the average historic production (as informed by OFGEM, 2024) has been scaled for each Ørsted IPs project over its remaining lifetime. Such average production figures do not account for any fluctuations in energy production due to factors such as major component replacement and technological upgrades, and changing wind resource, nor potential wake loss benefits as a result of the decommissioning of neighbouring wind projects. Likewise, when calculating lifetime production for the Mona Offshore Wind Project, the same factors have not been accounted for.

4.2.2.4 In order to define a timeframe over which to undertake the assessment, the Ørsted IPs earliest decommissioning dates have been used alongside the expected lifetime of the Mona Offshore Wind Project (35 years). The AEP and associated avoided emissions have been scaled by the remaining lifetime of the Ørsted IP project (earliest point of decommissioning Table 4.2) from the first year of operation of the Mona Offshore Wind Project (2030). Scenarios where projects (i.e. Mona Offshore Wind Project and/or Ørsted IPs projects) extend beyond these lifetimes have not been considered.

4.2.3 Scenario b) Presence and operation of Mona Offshore Wind Project

Mona Offshore Wind Project

4.2.3.1 Annual and lifetime energy generation for the Mona Offshore Wind Project have been extracted from Volume 4, Chapter 2: Climate change (F4.2 F02). The climate change assessment took a maximum design scenario approach and assumed a conservative worst case.

4.2.3.2 The average energy production (MWh) calculated for Mona Offshore Wind Project presented in Volume 4, Chapter 2: Climate change (F4.2 F02) uses a conservative capacity factor based on historic capacity reported in UK offshore wind projects, and as such does not account for efficiency improvements associated with technological advances in wind turbine design and manufacture. This capacity factor was used in order to present a conservative assessment when final design information was not available to refine assumptions. It is likely that Mona Offshore Wind Project's capacity factor will be much improved. As such, it can be expected that any reported losses in Mona Offshore Wind Project's AEP potential and associated avoided emissions would be greater in reality. Therefore, this note presents a conservative comparison to the Ørsted IPs project losses, and underplays the benefits of the Mona Offshore Wind Project due to that conservatism.

Ørsted IPs OWFs

4.2.3.3 The Ørsted IPs Wake Impact Assessment Report: Irish Sea Cluster (REP5-120) details the extent to which Ørsted IPs consider that the Mona Offshore Wind Project may result in additional wake effects on the future operational energy production of the Ørsted IPs projects. Ørsted's report has assessed the energy yield and subsequent impact of the potential wakes produced by individual wind farms using WindFarmer: Analyst software.

4.2.3.4 The potential wake loss values provided by the Ørsted IPs for the Mona Offshore Wind Project only scenario (as summarised within Table 4.3) have been used to scale the Ørsted IPs project parameters (as detailed at Section 4.2) to calculate an updated AEP.

4.2.3.5 The Applicant highlights that use of the Ørsted IPs estimated wake loss values does not in any way imply it is in agreement with these values (as set out in section 3 above).

4.2.3.6 The Applicant notes that the Ørsted IPs Wake Impact Assessment Report: Irish Sea Cluster (REP5-120) considers the potential for wake effects on projects operated by Ørsted IPs only and does not present potential wake values for other projects within the Irish Sea. As a result of this limitation, an assessment of potential wake losses for operational offshore wind farms in the Irish Sea which are not operated by the Ørsted IPs has not been included in the assessment since the Applicant is not able to undertake its own wake modelling and thus has no estimated values for potential wake effects on energy production for these projects. The assessment is therefore limited to those projects for which potential wake losses have been estimated within the Ørsted IPs wake impact assessment report (REP5-120) only.

Table 4.3: Ørsted IPs projects additional potential wake losses as a result of Mona Offshore Wind Project only as provided by Ørsted IPs (REP5-120).

	Burbo Bank 1	Burbo Bank 2	Barrow	Walney 1	Walney 2	Walney Extension[1]	West Duddon Sands	Total
Mona Offshore Wind Project only	-0.96%	-1.22%	-1.55%	-1.67%	-1.22%	-1.21%	-1.57%	-1.38%

[1]Average case for Walney Extension 3 and Walney Extension 4 presented here.

4.2.4 Scenario c) Presence and operation of Mona Offshore Wind Project with example mitigation for potential wake effects

4.2.4.1 To estimate the potential mitigation effect of increasing the distance between the Mona Offshore Wind Project and the Ørsted IPs projects, thereby reducing wake effects on the Ørsted IPs projects, the Applicant has performed a simple sensitivity study based on a generic model of two interacting wind farms, to provide an indication of how the potential wake impacts may be reduced by increasing their separation distance. This exercise does not seek to accurately replicate or reflect the real-world situation in the Irish Sea, as, for reasons explained in previous submissions (see REP6-130 and section 6 of REP6-083) the Applicant does not have a number of key pieces of information needed to undertake this. Instead, it seeks to demonstrate principles of effect on the respective wind farms when applying spatial mitigation.

4.2.4.2 Further, the exercise presents a hypothetical indicative scenario to test the theory of potential mitigation, and does not present mitigation that could be accommodated by the Mona Offshore Wind Project given constraints and commitments regarding WTG layout and the consent envelope of the Array Area.

4.2.4.3 All calculations were performed in Openwind software with the wake model TurbOPark developed by Ørsted. The chosen wind resource and thus wind direction and wind speed were based on the Applicant's data for the Mona Offshore Wind Project and are therefore representative of the meteorological conditions on site.

4.2.4.4 The generic model is detailed in Figure 4.1 below. The impacted 'OWF1' is assumed to have 1.4 GW installed capacity with 200 generic WTG (7.0 MW, hub height 105 m). The proposed 'OWF2' is assumed to have 1.5 GW installed capacity with 70 generic WTG (21.5 MW, hub height 170 m).

4.2.4.5 Two array boundary scenarios were investigated for the proposed 'OWF2':

- A 300 km^2 array boundary with a gridded layout, at a distance of 28 km from 'OWF1'
- A reduction in the array boundary area by 50% to 150 km^2, and increase in the distance of 'OWF2' to 'OWF1' to 35 km. This reduction results in an increase of the capacity density of 'OWF2' from 5 MW/km^2 to 10 MW/km^2, with correspondingly reduced turbine separation distances.

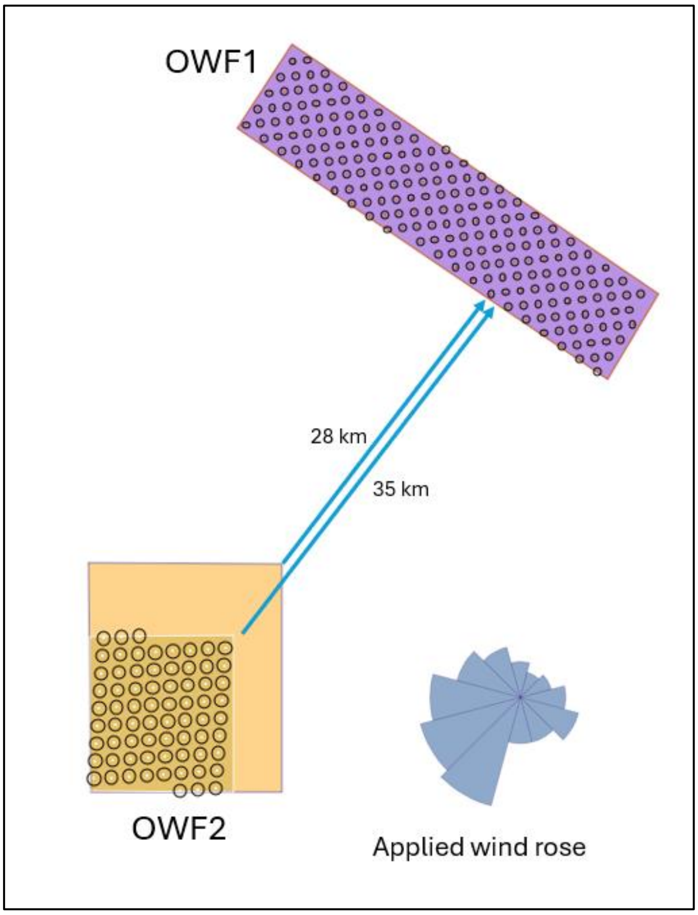

Figure 4.1: Sensitivity study array boundary options.

4.2.4.6 The 50% reduction in array boundary area reduces the potential wake impact on 'OWF1' by 0.15% (from 0.86% to 0.71% - an improvement of 0.15%, translating to ~80% of the reported wake effects still occurring). The corresponding increase in the internal wake loss for 'OWF2' was >4% (from 10.0% to 14.4%). It is noted that a 50% reduction in the proposed 'OWF2' array boundary is not a realistic mitigation scenario without adapting the installed capacity. This scale of reduction was selected in order to achieve a meaningful modelled change in the potential wake impact on 'OWF1'. This first-principles study reflects the Applicant's experience of layout design.

Mona Offshore Wind Project

4.2.4.7 The above sensitivity study has been applied to the Mona Offshore Wind Project to indicate the impact on Mona Offshore Wind Project and the Ørsted IPs projects under a mitigation scenario, whereby 'OWF2' is considered to represent the Mona Offshore Wind Farm.

4.2.4.8 Given that the Mona Array Area is limited to the Order Limits specified within the DCO application, to implement such mitigation without reducing the wind farm capacity would necessitate reducing the spatial coverage of the Mona Array Area, thereby increasing the density of the WTG layout. This would have a corresponding negative effect on internal wake losses, reducing the wind farm's capacity factor, leading to an overall reduction in the Mona Offshore Wind Project AEP.

4.2.4.9 As stated at paragraph 4.2.4.6, for the purpose of providing an estimate of potential loss associated with a reduction in the array boundary, the increase in internal wake loss on the Mona Offshore Wind Project as a result of the change in array boundaries was conservatively considered to be 4%, based on the sensitivity study.

Ørsted IPs OWFs

4.2.4.10 As detailed above, the results of the sensitivity analysis has been applied to the likely impact of the Mona Offshore Wind Project's mitigation options on the Ørsted IPs projects. The potential wake losses detailed within the Ørsted IPs Wake Impact Assessment Report (REP5-120) have been assumed to improve by only 0.15% as a result of changes to the Mona Array Area considered in the sensitivity study (see paragraph 4.2.4.6). This translates to ~80% of the reported wake effects still occurring despite the significant (unrealistically so, at 50% area reduction) amendments to the Mona Array Area.

4.2.4.11 The revised potential wake loss effects for each of the Ørsted IPs projects are presented in Table 4.4, alongside those presented in Table 4.3 and informed by Ørsted IPs wake impact assessment report (REP5-120).

Table 4.4: Ørsted IPs projects revised potential wake losses as a result of Mona Offshore Wind Project mitigation options.

	Burbo Bank 1	Burbo Bank 2	Barrow	Walney 1	Walney 2	Walney Extension[1]	West Duddon Sands	Total
Scenario b potential wake losses	-0.96%	-1.22%	-1.55%	-1.67%	-1.22%	-1.21%	-1.57%	-1.38%
Scenario c potential wake losses	-0.77%	-0.98%	-1.24%	-1.34%	-0.98%	-0.96%	-1.26%	-1.10%

4.3 Greenhouse gas assessment methodology

4.3.1.1 The lifetime production for the Ørsted IP projects and Mona Offshore Wind Project under each scenario, as relevant, have been scaled by emissions factors to calculate the avoided emissions resultant from each scenario. The following emissions factors have been used, and are further detailed below:

- Electricity supplied by all non-renewable fuels
- Long run marginal electricity generation.

4.3.1.2 This methodology is consistent with that undertaken within Volume 4, Chapter 2: Climate change (F4.2 F02).

4.3.1.3 The renewable generation assets will likely contribute to the abatement of the amount of fossil fuel generation within the UK Grid (i.e. UK Grid carbon intensity). As such, the current baseline (at the time of the application submission) with regard to UK Grid-average emission factor for electricity generation is 252.974 $kgCO_2e/MWh$ (including well-to-tank, excluding transmission and distribution losses) (DESNZ and Defra, 2023) and current estimated intensity from electricity supplied for 'all non-renewable fuels' (424 $kgCO_2e/MWh$) (intensity currently provisional) (DESNZ, 2023a). These figures were accurate at the time of submission of the Mona Offshore Wind Project DCO application. As such, these static emission factors have been considered in this report. It should be noted that the figure for fossil fuel generation only is considered to be the higher avoided emission scenario, and as such is the static figure presented in the assessment below to detail the greatest potential avoided emissions. The methodology to present the lowest potential avoided emissions is summarised below.

4.3.1.4 The future baseline for electricity generation that would be displaced by the Mona Offshore Wind Project depends broadly on future energy and climate policy in the UK, and more specifically (with regards to day-to-day emissions) on the demand for the operation of the Mona Offshore Wind Project, compared to other generation sources available; this will be influenced by commercial factors and National Grid's needs.

4.3.1.5 The carbon intensity of baseline electricity generation is projected to reduce over time and so too would the intensity of the marginal generation source, displaced at a given time.

4.3.1.6 The Department for Energy Security and Net Zero (DESNZ (formerly BEIS)) publishes projections of the carbon intensity of long-run marginal electricity generation and supply that would be affected by small (on a national scale) sustained changes in generation or demand (DESNZ, 2023b). DESNZ projections over the operating lifetime of the Mona Offshore Wind Project (as outlined in Table 5.2) are used to estimate the potential avoided emissions as a result of the Mona Offshore Wind Project.

4.3.1.7 The net lifetime reduction in avoided emissions associated with each scenario is presented, alongside their resultant total avoided emissions accounting for potential wake loss. When considering the net impact of the Mona Offshore Wind Project on the Ørsted IPs projects, the reduction in energy production (MWh) and associated avoided emissions (tCO_2e) are provided to the earliest decommissioning dates detailed in Table 4.2.

5 RESULTS

5.1.1.1 The following sections detail the energy generation values for each scenario and the subsequent net avoided GHG emissions associated with the Ørsted IP projects and Mona Offshore Wind Project under each scenario.

5.2 Energy generation results

5.2.1.1 Each section below details energy generation as relevant for each scenario, in order to inform the results of the GHG assessment detailed at Section 5.

5.2.2 Scenario a) Business as usual

Ørsted IPs OWFs

5.2.2.1 AEP (MWh/yr) by the Ørsted IPs projects since 2014 has been presented in Table 5.1. Data is presented for whole year only energy production; where projects are operational for part of a year, this year has not been included as part of this assessment as this would likely skew the averages.

5.2.2.2 An average production[1] and average operational capacity factor[2] have been calculated and presented for each Ørsted IPs project (Table 5.1). This forms the baseline for the operational energy production of the existing Ørsted IPs projects whereby an assessment of net effects can be completed.

[1] Average of historic production output for each of Ørsted IPs projects.

[2] Calculated by scaling the installed capacity (MW) by the number of hours in a year (8,766 hours, to account for leap years) to reach the installed energy capacity (MWh). The average production (MWh) was then divided by this installed energy capacity (MWh) to reach the implied capacity factor.

Table 5.1: Historic energy production for Ørsted IPs projects sourced from OFGEM (2024).

Parameter	Year	Burbo Bank 1	Burbo Bank 2	Barrow	Walney 1	Walney 2	Walney Extension	West Duddon Sands
Historic AEP (MWh)	FY14/15	284,724	-	288,248	636,173	758,729	-	1,207,406
	FY15/16	312,474	-	307,971	679,323	501,578	-	1,449,863
	FY16/17	243,971	-	273,157	601,247	713,332	-	1,476,641
	FY17/18	227,429	936,208	302,012	727,680	845,893	-	1,686,408
	FY18/19	246,936	841,960	265,885	578,479	699,586	2,604,710	1,462,783
	FY19/20	269,645	993,919	284,915	658,513	800,215	2,904,033	1,571,852
	FY20/21	273,558	945,299	258,393	634,192	731,267	2,688,669	1,542,449
	FY21/22	206,807	803,587	236,987	552,230	634,615	2,178,171	1,334,335
	FY22/23	240,878	833,763	255,103	596,599	712,188	2,669,112	1,514,781
	FY23/24	213,113	918,643	246,913	599,660	692,184	2,542,900	1,522,975
Average AEP (MWh)		**251,954**	**896,197**	**271,958**	**626,410**	**708,959**	**2,597,933**	**1,476,949**
Predicted lifetime production (MWh)*		**482,912**	**10,156,899**	**181,305**	**3,445,255**	**4,549,154**	**32,041,174**	**12,923,304**
Installed capacity (MW)		90	258	90	183.6	183.6	659	389
Implied capacity factor		32%	40%	34%	39%	44%	45%	43%

*Remaining lifetime of each project from the operation of Mona Offshore Wind Project (2030) to each project's earliest decommissioning date as stated in Table 4.2.

5.2.3 Scenario b) Presence and operation of Mona Offshore Wind Project

Mona Offshore Wind Project

5.2.3.1 Key energy generation parameters for the Mona Offshore Wind Project from Volume 4, Chapter 2: Climate change (F4.2 F02) are presented in Table 5.2.

Table 5.2: Mona Offshore Wind Project parameters.

Parameter	Value
Input parameter - rated power (based on current estimates) MW	1,500
Capacity factor %	34.9
Output parameter – Annual Energy Production MWh	4,585,860
Lifetime output MWh	160,505,100
Operation Commencement Date	2030
Earliest Decommissioning Date	2065

Ørsted IPs OWFs

5.2.3.2 The generation losses presented within Table 4.3 have been applied to the average AEP from each Ørsted IPs project (displayed within Table 5.1) to calculate revised electricity production, accounting for potential wake effects from Mona Offshore Wind Project as presented by the Ørsted IPs in REP5-120. Results are presented in Table 5.3.

5.2.3.3 Additionally, the AEP and energy loss has been scaled by the remaining lifetime of the Ørsted IPs project (earliest point of decommissioning Table 4.2) from the first year of operation of the Mona Offshore Wind Project (2030) to provide the lifetime energy production for the Ørsted IPs projects.

5.2.3.4 It should be noted that the total lifetime production loss of Ørsted IPs projects (833,338 MWh), as informed by Ørsted IPs estimate of wake effects presented in REP5-120, is significantly outweighed by one year of operation by the Mona Offshore Wind Project (4,585,860 MWh).

Table 5.3: Scenario b) Revised Ørsted IPs projects output parameters.

	Burbo Bank 1	Burbo Bank 2	Barrow	Walney 1	Walney 2	Walney Extension	West Duddon Sands	Total
Average AEP (MWh) (OFGEM)	251,954	896,197	271,958	626,410	708,959	2,597,933	1,476,949	6,830,360
AEP loss (MWh)	-2,419	-10,934	-4,215	-10,461	-8,649	-31,305	-23,188	-91,171
Revised AEP (MWh)	249,535	885,263	267,743	615,949	700,310	2,566,628	1,453,761	6,739,189
Predicted lifetime production (MWh) (OFGEM)	482,912	10,156,899	181,305	3,445,255	4,549,154	32,041,174	12,923,304	63,780,003
Lifetime production loss (MWh)	**-4,636**	**-123,914**	**-2,810**	**-57,536**	**-55,500**	**-386,096**	**-202,896**	**-833,388**
Revised lifetime production (MWh) [3]	**478,276**	**10,032,985**	**178,495**	**3,387,719**	**4,493,654**	**31,655,078**	**12,720,408**	**62,946,615**

[3] From 1st year of Mona Offshore Wind Project up to earliest decommissioning date.

5.2.4 Scenario c) Presence and operation of Mona Offshore Wind Project with example mitigation for potential wake effects

Mona Offshore Wind Project

5.2.4.1 The internal wake losses on the Mona Offshore Wind Project under the mitigation scenario (-4%) were applied to the baseline AEP for the Mona Offshore Wind Project (see Table 5.2) to reach amended AEP and lifetime production for scenario c. This is presented in Table 5.4.

Table 5.4: Scenario c) Mona Offshore Wind Project revised project parameters.

Parameter	Mona Offshore Wind Project
Capacity factor change	-4%
Revised AEP (MWh)	4,442,363
Loss of AEP (MWh)	-143,497
Revised lifetime production (MWh)	**155,482,704**
Loss of lifetime production (MWh)	**-5,022,396**

Ørsted IPs OWFs

5.2.4.2 As detailed at Section 4.2.4, high level assessment by the Applicant has identified that as a result of mitigation for potential wake effects by Mona Offshore Wind Project, potential wake effects impacting the Ørsted IPs projects would be reduced to 80% of those detailed within Ørsted's Wake Impact Assessment Report (REP5-120).

5.2.4.3 Revised potential wake losses presented in Table 4.4 have been applied to the baseline values presented in Table 5.1 to calculate revised AEP and lifetime production associated with the Ørsted IPs projects under the mitigation scenario, presented in Table 5.5.

Table 5.5: Scenario c) Revised Ørsted IPs projects output parameters.

Parameter	Ørsted IPs projects
Revised AEP (MWh)	6,757,423
AEP loss (MWh)	-72,937
Revised lifetime production (MWh)[4]	63,113,292
Lifetime production loss (MWh)	**-666,710**

[4] from 1st year of Mona Offshore Wind Project and Morgan Generation Assets up to earliest decommissioning date

5.3 Greenhouse gas emissions results

5.3.1 Scenario a) Business as usual

5.3.1.1 The baseline avoided emissions for the Ørsted IPs projects has been calculated by scaling the predicted lifetime production (detailed in Table 5.1) by the relevant emissions factors as described in Section 4.3. The resultant lifetime avoided emissions arising from the electricity generated by the Ørsted IPs projects is detailed in Table 5.6.

Table 5.6: Scenario a) Ørsted IPs projects lifetime avoided emissions.

	DESNZ long-run marginal	DESNZ 'non-renewable fuels'
Ørsted IPs projects baseline lifetime avoided emissions (tCO_2e)	2,886,965	27,042,721

5.3.2 Scenario b) Presence and operation of Mona Offshore Wind Project

5.3.2.1 The avoided emissions associated with the Ørsted IPs projects, accounting for the potential wake loss effects provided by Ørsted IPs in REP5-120 as a result of the Mona Offshore Wind Project (assuming no mitigation has been implemented), have been calculated by scaling the revised lifetime production (detailed in Table 5.3) by the relevant emissions factors as described in Section 4.3. The resultant lifetime avoided emissions arising from the electricity generated by the Ørsted IPs projects is detailed in Table 5.7, alongside the avoided emissions resultant from the energy generated by the Mona Offshore Wind Project (sourced directly from Volume 4, Chapter 2: Climate Change (F4.2 F02)).

Table 5.7: Scenario b) Ørsted IPs projects and Mona Offshore Wind Project lifetime avoided emissions.

		DESNZ long-run marginal	DESNZ 'non-renewable fuels'
Ørsted IPs projects	Baseline lifetime avoided emissions (tCO_2e)	2,886,965	27,042,721
	Total loss of avoided emissions associated with Mona Offshore Wind Project (tCO_2e)	-38,200	-353,356
	Revised lifetime avoided emissions (tCO_2e)	2,848,765	26,689,365
Mona Offshore Wind Project	Lifetime avoided emissions (tCO_2e)	2,404,980	52,422,575
Total avoided emissions (tCO_2e)		5,253,745	79,111,940

5.3.2.2 As a result of the potential wake effects from Mona Offshore Wind Project, as provided by the Ørsted IPs calculation of potential wake loss effects in REP5-120, it is estimated that the Ørsted IPs projects may result in between 38,200 tCO_2e (DESNZ long-run marginal) and 353,356 tCO_2e (DESNZ 'non-renewable fuels') of avoided emissions no longer achieved. When compared to the total avoided emissions resulting from the electricity generated by the Mona Offshore Wind Project (sourced directly from Volume 4, Chapter 2: Climate Change (F4.2 F02)), it is considered that such a loss is negligible.

5.3.2.3 Whilst this calculation has not considered cumulative scenarios of the Mona Offshore Wind Project with the Morgan Generation Assets and the Morecambe Offshore Windfarm: Generation Assets, it is anticipated that similar principles would apply in a cumulative scenario, whereby the cumulate net GHG benefit resulting from these projects would significantly outweigh a small reduction in avoided emissions for the Ørsted IPs projects.

5.3.3 Scenario c) Presence and operation of Mona Offshore Wind Project with example mitigation for potential wake effects

5.3.3.1 As detailed at paragraph 4.2.4.6, example mitigation considered for the Mona Offshore Wind Project results in a 4% reduction in Mona Offshore Wind Project's capacity factor as a result of internal wake loss effects. Alongside this, the potential wake loss effects on the Ørsted IPs projects, as provided by the Ørsted IPs in REP5-120 are anticipated to reduce by only 0.15% (or 80% of the unmitigated losses presented in Table 4.3 remain).

5.3.3.2 The avoided emissions associated with the Ørsted IPs projects, accounting for reduced potential wake loss effects as a result of the mitigation of the Mona Offshore Wind Project, have been calculated by scaling the total loss of avoided emissions associated with the Mona Offshore Wind Project (as presented within Table 5.7) by 80% to reach a revised lifetime loss, as presented in Table 5.8.

5.3.3.3 The avoided emissions associated with the Mona Offshore Wind Project, accounting for internal wake loss effects as a result of the mitigation, have been calculated by scaling the revised lifetime production (detailed in Table 5.4) by the relevant emissions factors as described in Section 4.3.

5.3.3.4 Revised avoided emissions arising from both the Ørsted IPs projects and Mona Offshore Wind Project are summarised in Table 5.8.

Table 5.8: Scenario c) Ørsted IPs projects and Mona Offshore Wind Project lifetime avoided emissions.

		DESNZ long-run marginal	DESNZ 'non-renewable fuels'
Ørsted IPs projects	Baseline lifetime avoided emissions (tCO_2e)	2,886,965	27,042,721
	Total loss of avoided emissions associated with Mona Offshore Wind Project (tCO_2e)	-30,560	-282,685
	Revised lifetime avoided emissions (tCO_2e)	2,856,405	26,760,036
Mona Offshore Wind Project	Baseline lifetime avoided emissions (tCO_2e)	2,404,980	52,422,575
	Total loss of avoided emissions associated with mitigation (tCO_2e)	-105,108	-2,722,166
	Revised lifetime avoided emissions (tCO_2e)	2,299,872	49,700,409
Net emissions (tCO_2e)		5,156,277	76,460,444
Net change in avoided emissions from scenario b		-97,468	-2,651,495

5.3.3.5 When comparing the net emissions associated with 'Scenario c' (where example wake loss mitigation has been implemented for the Mona Offshore Wind Project) to those associated with 'Scenario b' (where no example wake loss mitigation has been implemented for the Mona Offshore Wind Project), it can be concluded that the mitigation results in a net loss of avoided emissions. This net loss is due to the decrease in the AEP of Mona Offshore Wind Project resulting in a large loss of avoided emissions that outweigh those loss by the Ørsted IPs projects as a result of wake loss effects.

6 SUMMARY AND CONCLUSIONS

6.1.1.1 Table 6.1 summarises the associated net avoided GHG lifetime emissions for the three scenarios considered in this note. Each indicative Scenario is compared to ‘Scenario b’ (presence and operation of Mona Offshore Wind Project designed in accordance with Volume 1, Chapter 3: Project Description (F1.3 F02)).

6.1.1.2 It is demonstrated that under ‘Scenario b’, as a result of the operation of the Mona Offshore Wind Project, net lifetime avoided GHG emissions greatly exceed those associated with ‘Scenario a’ (business as usual without Mona Offshore Wind Project).

6.1.1.3 The loss of avoided emissions by the Ørsted IPs projects as a result of the presence and operation of the Mona Offshore Wind Project is negligible when compared to the avoided emissions achieved by the Mona Offshore Wind Project. Under ‘Scenario b’ the Ørsted IPs projects result in a total loss of avoided emissions between 38,200 tCO_2e (DESNZ long-run marginal) and 353,356 tCO_2e (DESNZ ‘non-renewable fuels’), while the Mona Offshore Wind Project results in between 2,404,980 tCO_2e (DESNZ long-run marginal) and 52,422,575 tCO_2e (DESNZ ‘non-renewable fuels’). This demonstrates that the avoided emissions arising from the operation of the Mona Offshore Wind Project greatly exceed any loss in avoided emissions by Ørsted IPs projects resulting from potential wake effects. It should also be noted that lifetime production loss of (833,338 MWh) is outweighed by one year of operation by the Mona Offshore Wind Project (4,585,860 MWh).

6.1.1.4 In order to assess whether mitigation by the Mona Offshore Wind Project would result in a net improvement in avoided emissions (compared to ‘Scenario b’), an example mitigation scenario was considered, which reviewed the impact of increasing the distance between OWFs. As shown in Table 6.1, the scenario results in reduced net avoided emissions, demonstrating that the implementation of mitigation by Mona Offshore Wind Project to reduce the potential wake effects on the Ørsted IPs projects would not result in a net benefit in terms of emissions. This is because the suggested mitigation would result in increased wind turbine generator density within the Mona Array Area, leading to increased internal wake effects reducing Mona Offshore Wind Project’s annual energy production. The corresponding reduction in potential wake effects on the Ørsted IPs OWFs associated with implementing such mitigation would be comparably small, which aligns with the general principle that the greatest wake effects are within wind farms. This net loss of avoided emissions is due to the decrease in the AEP of Mona Offshore Wind Project resulting in a large loss of avoided emissions that outweigh those lost by the Ørsted IPs projects as a result of wake loss effects.

6.1.1.5 National Policy Statement EN-1 confirms the urgent need for <u>new</u> (emphasis added) electricity infrastructure to be brought forward as soon as possible to meet the Government’s commitment to reducing GHG emissions by 78% by 2035 under carbon budget 6 (see paras 3.3.5 and 3.3.58). New offshore wind capacity is also considered to be critical national priority (CNP) infrastructure (para 3.3.63) and the deployment of new offshore wind capacity is a key element of the recently published Clean Energy Strategy 2030 which states at page 74:

6.1.1.6 *Renewable technologies will form the foundation of our clean power system, and we need to see very significant deployment to make this a reality. Meeting the renewable capacities set out in the DESNZ ‘Clean Power Capacity Range’ is achievable, but will* *require deployment at a sharply accelerated scale and pace. This can only be delivered by unblocking delivery challenges throughout the development lifecycle*.

6.1.1.7 The greatest benefit to national GHG emissions reduction, and UK renewable energy production, is achieved through the presence of the Mona Offshore Wind Project (without mitigation), despite any potential losses experienced by the Ørsted IPs OWFs.

Table 6.1: Summary of net GHG avoided emissions.

Project	Parameter	Scenario		
		A: Business as usual (no Mona)	B: Unmitigated scenario (with Mona)	C: Example mitigation
Mona Offshore Wind Project	DESNZ 'non-renewable fuels' avoided emissions (tCO_2e)	0	52,422,575	49,700,409
	DESNZ long-run marginal avoided emissions (tCO_2e)	0	2,404,980	2,299,872
Ørsted IPs Projects	DESNZ 'non-renewable fuels' avoided emissions (tCO_2e)	27,042,721[1]	26,689,365[2]	26,760,036[3]
	DESNZ long-run marginal avoided emissions (tCO_2e)	2,886,965[1]	2,848,765[2]	2,856,405[3]
Net emissions	**DESNZ 'non-renewable fuels' avoided emissions (tCO_2e)**	**27,042,721**	**79,111,940**	**76,460,444**
	DESNZ long-run marginal avoided emissions (tCO_2e)	**2,886,965**	**5,253,745**	**5,156,277**
Net change in emissions from Scenario B	**DESNZ 'non-renewable fuels' avoided emissions (tCO_2e)**	n/a	**0**	**-2,651,495**
	DESNZ long-run marginal avoided emissions (tCO_2e)	n/a	**0**	**-97,468**

[1] Informed by baseline OFGEM reporting, not accounting for potential wake loss associated with the Mona Offshore Wind Project.

[2] Accounting for potential wake loss resulting from the Mona Offshore Wind Project, as calculated by Ørsted IPs in REP5-120.

[3] Accounting for a reduction in potential wake loss resulting from Mona, as calculated by Mona Offshore Wind Limited.

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