

Hornsea Project Four

Totality of impact of Protective Provisions on Hornsea Project Four Request for Further Information Date: 31 March 2023 Document Reference: G11.4 Revision: 01

PreparedMairi Dudley, Orsted, March 2023CheckedNicola Allan, Orsted, March 2023AcceptedFrancesca De Vita, Orsted, March 2023ApprovedJamie Baldwin, Orsted, March 2023





Document Properties				
Author	Mairi Dudley, Orsted, March 2023			
Checked by	Nicola Allan, Orsted, March 2023			
Approved by	Jamie Baldwin, Orsted, March 2023			
Title	G11.4 Totality of Protective Provisions			

Version History					
Date	Version	Status	Description / Changes		
31.03.2023	А	-	Submitted 31.03.2023		





Table of Contents

1	Introduction	4
2	Totality of Impact	5
2	rotatty of impact	
3	Potential Impact to Hornsea Project Four	7
3.1	Impact 1: Increased wake losses	7
3.2	Impact 2: Increased construction complexity	7
3.3	Impact 3: Substantial reduction in wind farm capacity	7
3.4	Impact 4: Project likely to be unviable	8
4	Summary of Individual Protective Provision impacts	8
5	Conclusion	9

List of Tables

Table 1: Impact of	f each set of protective	provisions and cumulative	impacts6
--------------------	--------------------------	---------------------------	----------

List of Figures

No table of figures entries found.

Appendices

Appendix A – Maps Appendix B – Water Depths



1 Introduction

- 1.1 The Secretary of State (SoS) for Energy Security and Net Zero issued a Request For Information (RFI) Letter made available via the Planning Inspectorate on 03 March 2023. Within the letter the SoS requests that the Applicant provides further information on the totality of impact of protective provisions on Hornsea Project Four.
- 1.2 The maps shown in Appendix A: Maps show the impact that the protective provisions proposed by and applied for the benefit of bp, NEO, Bridge and Harbour Energy could have on the layout of the proposed array and the number of turbines impacted. This is shown for each set of protective provisions alone and in combination to demonstrate the cumulative impact of the protective provisions. The results are summarised in Table 1.
- 1.3 Any protective provisions that have been proposed by and are applied for the benefit of, bp, NEO, Bridge or Harbour Energy would significantly compromise the flexibility the Applicant has to deliver an essential and substantial near-term contribution to the UK's decarbonisation and security of supply objectives, at the lowest possible cost to the consumer. In certain scenarios, the cumulative impact of the protective provisions would make the project completely unviable.
- 1.4 This document should be read with reference to the updated Volume F1.6 Statement of Need (REP7-053) and Table 10.3 Core Project Objectives for Hornsea Four of the B2.5 Without Prejudice Derogation Case (APP-182)
- 1.5 The updated draft National Policy Statement EN-3 requires that applicants should undertake an assessment of the potential effect of the proposed development on existing offshore infrastructure or activities. This was undertaken and the assessment is at Volume A2, Chapter 11 Infrastructure and Other Uses of the ES (APP-023). The Applicants proposed protective provisions as set out in the Baseline Scenario ensures the relevant stakeholders can continue their activities safely. The SoS can be confident therefore that the Applicants approach to other offshore operations is in accordance with relevant policies. This document focusses upon the commercial impacts upon Hornsea Project Four of the proposed protective provisions by third parties.





2 Totality of Impact

- 2.1 **Table 1** shows the impact of each set of protective provisions alone and also shows the cumulative impacts of any potential combination of protective provisions.
- 2.2 As shown in **Table 1**, there are four main impacts on the proposed Hornsea Four project should the SoS apply some, or all, of the protective provisions proposed by third parties. These impacts are further described in 3.1 3.4.
 - Impact 1: Increased wake losses
 - Impact 2: Increased construction complexity
 - Impact 3: Substantial reduction in wind farm capacity
 - Impact 4: Project likely to be unviable
- 2.3 It should be noted that each impacted wind turbine position is not worth the same as another. Different areas of seabed are valued differently depending on the seabed characteristics, wake effects, wind speeds and other factors. Therefore, the value of one turbine impacted by one stakeholder cannot be directly compared to the value of another turbine impacted by another stakeholder.



Scenario	Description	Turbine	Area Lost	% of	Impact on Hornsea Project Four			
		positions	(km2)	area	1. Increased wake	2. Increased	3. Substantial	4. Project likely to
		impacted		lost	losses	construction	reduction in wind	be unviable
						complexity	farm capacity	
Baseline	Baseline Scenario							
1	BP	53	108.0	29.6	×		x	
2	NEO PPs	4	5.0	1.4	x	x		
3	Bridge PPs	7	9.2	2.5	×			
4	Harbour PPs (Examination)	9	11.7	3.2	×	×		
5	Harbour Dec RFI solution d, ii	26	41.4	11.4	×	х	x	
6	Harbour Dec RFI solution d, i	30	48.6	13.3	×	×	x	
7	Harbour Dec RFI solution b	30	48.6	13.3	×	x	x	
8	Harbour Dec RFI solution a	44	84.3	23.1	×	х	x	
9	NEO + BP + Bridge + Harbour (Examination)	72	133.6	36.6	x	x	x	
10	NEO + BP + Bridge + Harbour (RFI solution d, ii)	86	159.4	43.7	×	x	×	х
11	NEO + BP + Bridge + Harbour (RFI solution d, i)	90	166.6	45.7	x	x	x	х
12	NEO + BP + Bridge + Harbour (RFI solution b)	90	166.6	45.7	x	x	x	x
13	NEO + BP + Bridge + Harbour (RFI solution a)	103	201.5	55.2	x	x	x	х

Table 1: Impact of each set of protective provisions and cumulative impacts



3 Potential Impact to Hornsea Project Four

3.1 Impact 1: Increased wake losses

- 3.1.1 If the Secretary of State were to apply some, or all, of the protective provisions proposed by bp, NEO, Bridge and Harbour Energy, the developable area would be significantly reduced. The Applicant would initially try to maintain the proposed installed capacity of 2.6GW, in line with the secured grid capacity, by relocating turbine positions within the smaller developable area.
- 3.1.2 However, a smaller developable area would mean the turbines are more closely packed together (greater turbine density). This would increase the wake losses (lost efficiency due to drag effect) within the wind farm layout which would have a significant negative effect on the amount of electricity produced.

3.2 Impact 2: Increased construction complexity

- 3.2.1 In addition to increased wake losses, a smaller developable area and re-location of turbine positions would also result in changes being required to foundation type assumptions and installation methodologies for each turbine. This is due to differing water depths and seabed characteristics in the array. In many circumstances, this would result in assumed monopile positions (generally lowest cost to construct and suitable in shallower waters) having to change to suction bucket jacket or gravity base positions (generally with a higher cost to construct and more suitable for deeper waters) (see Appendix B: Water Depths).
- 3.2.2 Both Impact 1 and Impact 2 will negatively impact the business case for the project and result in a higher cost to the consumer under a best realistic scenario. In a worst realistic scenario, the project would be unable to proceed at all as it fails to win in the highly competitive Contract for Difference auction round model.

3.3 Impact 3: Substantial reduction in wind farm capacity

- 3.3.1 If the Secretary of State were to apply some, or all, of the protective provisions proposed by bp, NEO, Bridge and Harbour Energy, the Applicant would likely need to substantially reduce the overall wind farm capacity to avoid an inefficiently designed wind farm with high wake losses and higher cost to construct (as covered by Impact 1 and Impact 2).
- 3.3.2 The number of individual impacted turbine positions <u>does not directly correlate</u> with a corresponding capacity reduction (i.e., a reduction of 10 x 15MW turbine positions does not simply mean a reduction of the overall wind farm capacity of 150MW).
- 3.3.3 The optimal wind farm design is dependent on many individual factors considered cumulatively, such as wake loss effect, water depths, seabed geology and, most relevant, transmission system and associated electrical infrastructure.
- 3.3.4 For instance, a relatively small reduction of wind turbine positions may result in the removal of a full electrical circuit from the design in order to maintain both a technically and commercially efficient electrical system.
- 3.3.5 For an Alternating Current (AC) electricity transmission system, a relatively small number of turbines (10-30) is likely to reduce the total wind farm capacity by approximately





500MW. For a Direct Current (DC) system, this could lead to a disproportionately significant reduction in the region of 1.2-1.3GW.

- 3.3.6 Any reduction in wind farm capacity from the proposed installed capacity of 2.6GW would reduce the ability of the project to benefit from economies of scale; this would have a detrimental impact on the overall business case for the project and ultimately would increase the cost to the consumer.
- 3.3.7 The full array area that the Applicant has applied for allows for a competitive project to be delivered which would provide an essential and substantial near-term contribution to the UK's decarbonisation objectives and security of supply at the lower possible cost to the consumer. <u>A significant reduction in the proposed installed capacity of 2.6GW would be to the detriment of the Government's 2030 offshore wind target.</u>

3.4 Impact 4: Project likely to be unviable

3.4.1 In the event the number of impacted turbine positions is so significant, such as in Scenarios 10 to 13, <u>it is highly likely that Hornsea Project Four would become unviable.</u>

4 Summary of Individual Protective Provision Impacts

- 4.1 Appendix A: Maps shows the impact that the protective provisions proposed by and applied for the benefit of bp, NEO, Bridge and Harbour Energy could have on the layout of the proposed array and the number of turbines impacted. This is shown for each set of protective provisions alone and in combination to demonstrate the cumulative impact of the protective provisions.
- 4.1.1 Scenario 1 (BP) shows that 53 turbine positions are impacted by the protective provisions proposed for the benefit of bp. If the Secretary of State applies these protective provisions it is likely to result in a substantial reduction to the overall capacity of around 500MW.
- 4.1.2 It would likely be possible to relocate some, but not all, of the impacted wind turbines but this would result in increased wake losses. The water depths in the area relating to the bp protective provisions already result in high construction complexity (see Appendix B: Water Depths).
- 4.1.3 Scenario 2 (NEO) shows that 4 turbine positions are impacted by the protective provisions proposed by NEO. Whilst this is unlikely to lead to a significant overall drop in capacity it will lead to increased wake losses as well as higher construction complexity due to the inability to take advantage of the shallower water depths around NEO's Babbage platform.
- 4.1.4 Scenario 3 (Bridge) shows that 7 turbines are impacted by the two 1nm exclusion zones proposed by Bridge in their response to the first Request for Information dated 13th January 2023. This is unlikely to lead to a significant overall drop in capacity but will result in increased wake losses.
- 4.1.5 Scenarios 4 to 8 (Harbour) show the impact of Protective Provisions provided by Harbour at DL8 of the Examination, plus four of the five suggested alternatives in Harbour's response



to the first Request for Information dated 13th January 2023. Alternative 'c' proposed by Harbour has not been modelled as it relates to time rather than a spatial restriction.

- 4.1.6 Scenario 4 shows that up to 9 turbine positions are impacted. Whilst this is unlikely to lead to a substantial reduction in capacity it will result in increased wake losses as well as increased construction complexity due to the inability to take advantage of the shallower water depths around the Harbour wellheads (see Appendix B: Water Depths).
- 4.1.7 Scenarios 5 to 8 impact between 26 and 44 wind turbine positions and are likely to result in a substantial reduction to the overall capacity of around 500MW. For clarity, this is in addition to the 500MW reduction referred to in Scenario 1 in relation to bp's protective provisions. Furthermore, as stated above, these scenarios will significantly add to construction complexity due to the inability to take advantage of the shallower depths around the Harbour wellheads (see Appendix B: Water Depths).

5 Conclusion

- 5.1 The Applicants proposed protective provisions for each stakeholder are in compliance with relevant policies more specifically draft NPS EN-3 issued for consultation on 30th March 2023 avoiding or minimising disruption or economic loss or any adverse effect on safety to the relevant stakeholders. What the Applicant has applied for is a reasonable position in which concessions have already been made based on industry safety standards, expert advice and to ensure safe co-existence.
- 5.2 Any protective provisions applied as proposed by bp, NEO, Bridge or Harbour Energy will significantly compromise the flexibility the Applicant has to deliver a large capacity wind farm providing an essential and substantial near-term contribution to the UK's decarbonisation and security of supply objectives, at the lowest possible cost to the consumer. In the worst case it may result in the project not being able to proceed at all.





Appendix A – Maps

































Appendix B – Water Depths

