Sofia Offshore Wind Farm: Offshore Ornithology

Updated impact assessment for increased wind turbine blade diameter

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Revisions

Revision 1
Stakeholder Consultation Draft

Revision 2
Minor clarifications

Executive Summary

This report provides a review of the original offshore ornithology impact assessment for the Teesside B Offshore Wind Farm and assesses the effect on the impacts resulting from a change in turbine parameters. The Development Consent Order (DCO) for this project includes a limit on the number of turbines which may be installed (200) and a limit on the total rotor swept area (4.35km^2). As a consequence of these conditions the total number of turbines which can be installed must be calculated using the rotor diameter for any given candidate model of turbine. Calculating the total rotor swept area for the turbines currently under consideration generates reductions in the number of turbines, to between 66 and 114, compared with the consented maximum of 200, although it is not anticipated that the area to be developed will decrease.

The displacement, collision risk, barrier and indirect effects predicted in the project assessment have been reviewed. The proposed reduction in the number of turbines will be expected to reduce the impact magnitudes of all of these to some extent and hence impacts are assessed as the lower than those in the Environmental Statement (ES). To determine the magnitude of reduction for collision risk, collision mortalities have been recalculated using the new data on turbine specifications, providing a quantitative assessment of the change in collision risk.

The predicted collision risks for the four bird species which had mortality predictions in the ES which were greater than 1 per year (gannet, kittiwake, great black-backed gull, lesser black-backed gull) are reduced by up to 50% when the revised turbine parameters are used in place of those on which consent was awarded. Thus, the original conclusions of the Habitats Regulation Assessment prepared by the Department of Energy and Climate Change (DECC) and the Environmental Statement with respect to Adverse Effects on the Integrity of designated sites and the significance of the project alone and cumulatively are unaffected and no further assessment is required for offshore ornithology with respect to the proposed turbine changes.

1 Introduction

This document has been prepared by MacArthur Green. It provides a review of the consented wind farm design for the Teesside B Offshore Wind Farm, now renamed as the Sofia Offshore Wind Farm (SOWF), and how proposed amendments to wind turbine parameters will affect the results of ornithological impacts assessed in the Habitats Regulations Assessment prepared by the Department of Energy and Climate Change (DECC)[1] and Environmental Statement submitted with the DCO application and subsequent information provided during the DCO examination.

To minimise repetition of the original documents, the initial section of this report provides a high-level screening of the offshore ornithological impacts assessed and identifies those for which the proposed design changes have the potential to result in a quantifiable effect on the original conclusions. For the avoidance of doubt, unless an aspect has been included in this report it should be assumed that the original assessment is unaffected.

1.1 WTG parameters allowed under the Development Consent Order

The Development Consent Order (DCO) for the Dogger Bank Teesside A and B Offshore Wind Farm [1] states that:

> *3.(1) No wind turbine generator may –*
> *(a) exceed a height of 315 metres when measured from HAT to the tip of the vertical blade;*
> *(b) have a rotor diameter exceeding 215 metres;*
> *(c) be less than a multiple of 6 times the rotor diameter from the nearest wind turbine generator in any direction being not less than 750 metres measured between wind turbine generators;*
> *(d) have a distance of less than 26 metres between the lowest point of the rotating blade of the wind turbine generator and HAT.*

And,

> *3.(3) The total rotor-swept area within Work No. 1B must not exceed 4.35 square kilometres.*

2 Design revisions

In order to accommodate potential changes to wind turbine technology in the future Sofia Offshore Wind Farm Ltd (SOFWL) has submitted a non material amendment to the DCO to allow for an increase in the blade diameter allowed under the DCO from 215 metres to 288 metres. None of the other DCO parameters relating to wind turbines are changed by the non material amendment application, i.e. highest and lowest rotor tip heights, distance to other turbines and total rotor swept area will all be subject to the existing limits set out in the DCO.

A number of alternative scenarios have been modelled to test the results of the increase blade diameter on birds. The parameters used to model the alternative scenarios are set out in Table 1 along with the consented turbine parameters for the worst case scenario (WCS; Table 4.17 [2]).

[1] All subsequent references to Habitats Regulations Assessment and HRA in this document refer to the DECC assessment.

Table 1. Turbine parameters for the consented SOWF and proposed alternatives.

Parameter	Consented value (WCS)	Alternative turbine 1	Alternative turbine 2	Alternative turbine 3
Rotor diameter (m)	167*	220	250	288
Max. blade width (m)	5.5	7.2	8.2	9.5
Mean RPM	8.84	8.7	7.6	6.6
Mean blade pitch (°)	10	10	10	10
Hub height (m above HAT)	109.5	136	151	170
Minimum draft height (m HAT)	26	26	26	26
No. turbines (max.)	200	114	88	66
Total rotor swept area (km^2)	4.34	4.33	4.32	4.30

*Note that although 215m blade diameter was consented the worst case scenario had a blade diameter of 167m.

3 Review of consented assessment

Offshore wind farm ornithological impact assessments consider four potential impacts:

- Disturbance and displacement,
- Collision risk,
- Barrier effects, and
- Indirect effects.

The potential for the proposed revisions to affect the original impact assessment conclusions for each of these topics is considered below.

3.1 Disturbance and displacement

Disturbance and displacement are assessed in relation to construction/decommissioning and operational phases.

3.1.1 Construction/decommissioning

The potential for seabirds to be disturbed and displaced during construction (and to a similar but lesser extent during decommissioning) is related to vessel movements and construction activities and the number of simultaneous operations. As can be seen in Table 1, a non material amendment to the DCO to allow larger turbine blades will not result in any increase in the number of turbines allowed. If the largest turbine allowed under the amended DCO is installed then a maximum of 66 turbines will be allowed, much lower than the consented 200 turbines. Consequently, for the purposes of the current assessment it has been assumed that the potential magnitude of construction effects will be at worst the same and in practice almost certainly smaller than that originally assessed. Consequently, this potential impact has been screened out of the need for further assessment.

3.1.2 Operation

The potential for operational disturbance and displacement of seabirds from offshore wind farms is determined on the basis of the total area containing wind turbines. Thus, the original assessment presented the potential impacts with displacement assumed to occur across the entire Sofia Offshore Wind Farm lease area. While the revised turbines under consideration may cover a smaller area than that originally assessed, for the current assessment revision it has been assumed that the complete lease area will be developed. Consequently, the conclusions of the original assessment are unaffected.

3.2 Collision Risk

Collision mortality is assessed using a more quantitative approach than used for other potential impacts and the predictions are not a simple function of the number of turbines or area covered (c.f. displacement for example). Collision mortality is estimated using the Band (2012) collision risk model (CRM). This model uses three suites of data as input parameters:

- Site specific seabird activity (densities and, depending on the CRM version, flight heights),
- Seabird biometrics (standard values for wing span, flight speed, etc.), and
- Turbine dimensions.

There are currently two main variants of the Band CRM. The first, also known as the 'basic' model, assumes a uniform distribution of birds within the range of rotor swept heights. The proportion of birds at collision height (PCH) is either derived from site specific estimates obtained during surveys (Band CRM Option 1) or using published estimates [3][4] produced from analysis of data across many sites (Band CRM Option 2). The second variant, known as the 'extended' model, uses additional data on the variable overlap between rotor swept heights and seabird flight heights to obtain more realistic collision estimates. As for the basic model, the seabird flight height data can either be site specific (Band CRM Option 4) or from published data [3][4] (Band CRM Option 3). See Table 2 for a summary of these main differences.

The Environmental Statement (ES) for Dogger Bank Teesside A and B [5] presented collision impacts derived using both the basic and extended versions of the Band CRM, but based the impact assessment on the collision predictions obtained using the option 3 model. The statutory advisor for the project, Natural England (NE), stated in their response to the ES [6] and during the project examination that they did not support the use of the extended Band model and preferred the results obtained from the basic (option 1 or 2) model. As a consequence, NE used the collision results obtained using option 2 in their appraisal of the projects' potential impacts on seabirds (NB. this advice remains unchanged). Therefore, to understand how turbine revisions will affect collision predictions it is necessary to re-calculate mortality using the updated turbine parameters. Consequently, collision impacts have been screened in for reassessment.

Table 2. Differences between Band Collision Risk Model variants in seabird flight height parameters.

Band model variant	Type	Flight height distribution within rotor swept area	Flight height data source	Comments
Option 1	Basic	Uniform	Site-based	Accepted by Natural England when robust site-based sample size available (e.g. >100 height estimates)
Option 2	Basic	Uniform	Generic	Accepted by Natural England when small site-based sample size (e.g. <100 height estimates)
Option 3	Extended	Heterogeneous	Generic	Not currently accepted by Natural England due to concerns about flight height data reliability.
Option 4	Extended	Heterogeneous	Site-based	Not currently accepted by Natural England due to concerns about robustly estimating flight heights during surveys.

3.3 Barrier effects

Seabirds may experience barrier effects due to the presence of offshore wind farms at two different scales, either daily (e.g. if the wind farm is located between a colony and a foraging location) or seasonally (e.g. if the wind farm lies on a migration route). With regards to the proposed turbine revisions, the potential for either of these potential barrier effects to differ from those originally assessed is considered to be negligible. Consequently, the conclusions of the original assessment are unaffected and this potential impact has been screened out for further revision.

3.4 Indirect effects

Seabirds are typically considered to be at risk of indirect effects due to offshore wind farms if construction or operation affects their prey species. With regards to the proposed turbine revisions, the potential for either of these effects to differ from those originally assessed is considered to be negligible. Consequently, the conclusions of the original assessment are unaffected and this potential impact has been screened out for further assessment.

4 Summary of consented assessment subject to revision

As noted above, the only impact for which it is considered necessary to undertake reassessment is collision risk. Also, as discussed in section 3.2, there are different versions of the Band CRM and offshore wind farm ESs often include outputs derived from more than one of these. Furthermore, following ES submission, collision predictions are often subject to revisions and the presentation of results from alternative models. These updates are not always applied to all species, but are often focussed on those of highest concern.

Hence, the collision estimates on which a wind farm obtains consent may not be the same as those presented and assessed in the ES. In addition, impacts are often presented at different scales, reflecting both the total project impacts (e.g. for EIA) and also impacts apportioned to sub-populations (e.g. for HRA).

Collision risks presented in the Dogger Bank Teesside A and B ES were for 11 species which were present on the wind farm in sufficient numbers [5]:

- Fulmar
- Gannet
- Arctic skua
- Great skua
- Kittiwake
- Lesser black-backed gull
- Great black-backed gull
- Guillemot
- Razorbill
- Little auk, and
- Puffin

Of this list, the mortality predictions for fulmar, Arctic skua, great skua, guillemot, razorbill, little auk and puffin were very low (<1 individual per year) and NE agreed there would be no significant impacts due to collisions [6]. There is therefore no requirement to recalculate collision risks for these species.

Gannet, kittiwake, lesser black-backed gull and great black-backed gull were identified by NE as species for which the predicted levels of mortality raised concern, the first two species for both EIA and HRA, the two gull species for EIA only [6]. During the project examination, discussions with NE and additional submissions by the developer led to the resolution of all but one of NE's concerns, as recorded at Deadline 5 [7], or Deadline 6 [8], as indicated in Table 2. The only aspect which remained outstanding was for cumulative gannet collisions; Natural England's final position on this was that 'a significant impact due to cumulative collision mortality cannot be excluded'.

Table 2. Stages during the Dogger Bank Teesside A and B examination at which Natural England concluded collision mortality would result in non-significant impacts.

Species	EIA		Flamborough and Filey Coast pSPA		Farne Islands SPA	
	Project alone	Cumulative	Project alone	In-combination	Project alone	In-combination
Gannet	Deadline V ([7], Table 1 pg. 34)[7]	Significant impact could not be excluded[1] ([7], para 4.39 pg. 24)	Deadline V ([7], para 4.33 pg. 24)	Deadline V ([7], para 4.33 pg. 24)	N/A	N/A
Kittiwake	Deadline V ([7], Table 1 pg. 33)	Deadline V ([7], Table 1 pg. 33)	Deadline V ([7], para 4.42 pg. 25)	Deadline V ([7], para 4.42 pg. 25)	Deadline V ([7], Table 1 pg. 32)	Deadline V ([7], Table 1 pg. 32)
Lesser black-backed gull	Deadline V ([7], Table 1 pg. 29)	Deadline VI ([8], para 2.27 pg. 12)	N/A	N/A	N/A	N/A
Great black-	Deadline V	Deadline VI	N/A	N/A	N/A	N/A

Species	EIA	Flamborough and Filey Coast pSPA	Farne Islands SPA
backed gull	([7], Table 1 pg. 29)	([8], para 2.22 pg. 11)	

1. While NE could not exclude the potential for a significant cumulative impact for gannet it was noted by NE that the addition to the cumulative total from Teesside A and B was very small and that the potential for a significant cumulative impact was present irrespective of the inclusion of this project .

As can be seen in Table 2, no project alone collision impacts were considered to give rise to significant impacts for either EIA or HRA. The only impact for which a significant impact could not be ruled out was cumulative gannet collisions. However, NE acknowledged that this conclusion was based on a precautionary approach and that the contribution from Dogger Bank Teesside A & B was insufficient to affect this conclusion (i.e. the risk existed even without mortality at these wind farms). In their recommendations to the Secretary of State [9], the examining authority panel made no reference to this remaining concern, but instead focussed on the absence of predicted AEoI for all SPAs.

In reaching their conclusions on impacts, NE reviewed the figures provided by the applicant and in some cases applied their own precautionary adjustments to these figures (to test the sensitivity of the outcomes to assumptions made by the applicant). Following this assessment, with the exception of the gannet cumulative impact, NE were satisfied that all of the impacts remained below levels at which concerns would have been raised and no other significant impacts were identified. As a consequence of the NE approach (undertaking their own adjustments), it is not always apparent which collision predictions NE used to reach their final position. Therefore, the revised estimates presented here have used the final figures presented by the applicant. While these may have been slightly lower than the NE estimates, the key aspect for the current assessment review is to understand how the impacts change with the proposed turbine changes. Since the proportional magnitude of change will be consistent, changes to the applicant's figures would equally apply to those estimated by NE.

During the project examination NE accepted collision estimates using an avoidance rate of 99% for gannet and kittiwake and 99.5% for the large gull species (when used with the basic Band model [7]) following the recommendations in a report for Marine Scotland [11]). However, following the examination a joint SNCB note was produced [12] which advised that the avoidance rate for gannet and kittiwake should be reduced slightly to 98.9% (and this remains the recommended rate for these species).

5 Method for assessment revision

The collision estimates have been recalculated for the proposed alternative turbines using Band CRM option 2 and the parameter values extracted from the original assessment (Tables 3, 4 and 5). The final estimate of the proportion of flights at collision height used with option 2 was not reported. Therefore, this was obtained by calculating the value which gave the reported collision estimates using the consented turbine design for input (this estimated PCH is referred to as 'Derived (>26m)' in Table 4).

Table 3. Monthly mean density of birds in flight used in the CRM (birds/km^2; taken from ES Chapter 11 Appendix A Tables 4.15a-c [2])

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Gannet	0.04	0.10	0.38	0.13	0.17	0.10	0.09	0.11	0.16	0.31	0.09	0.08
Kittiwake	0.82	1.75	3.33	1.12	1.17	0.87	0.57	0.33	0.33	0.62	0.51	0.83
Lesser black-backed gull	0.01	0.01	0.02	0.04	0.06	0.05	0.05	0.01	0.00	0.00	0.00	0.00
Great black-backed gull	0.07	0.07	0.07	0.04	0.03	0.01	0.01	0.01	0.02	0.03	0.03	0.08

Table 4. Bird biometric parameters (taken from ES Chapter 11 Appendix A Table 4.16 [2])

Species	Body length (m)	Wingspan (m)	Flight speed (ms^{-1})	Nocturnal activity (%)	Proportion at collision height			
					Site (>20m)	Generic (>20m)	Generic (>26m)	Derived (>26m)*
Gannet	0.94	1.72	14.9	25	0.16	0.10	0.03	0.02
Kittiwake	0.39	1.08	13.1	50	0.2	0.16	0.06	0.05
Lesser black-backed gull	0.58	1.42	9.95	50	0.36	0.28	0.18	0.14
Great black-backed gull	0.71	1.58	13.0	50	0.32	0.34	0.24	0.19

* Note these estimates were not provided in the submitted documents and have been calculated as the values which produce the published mortalities.

Table 5. Monthly percentage of time wind turbines are operational (taken from ES Chapter 11 Appendix A Table 4.18 [2]).

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
97	97	97	94	93	92	92	92	95	96	97	96

6 Results of impact assessment revision

The final monthly estimates provided during the examination only presented figures for both Teesside A and Sofia Offshore Wind Farm combined. Therefore, to calculate the monthly estimates for Sofia Offshore Wind Farm (SOWF, Table 6) alone it was necessary to use the input data presented in the above tables. The annual figures were presented separately for each wind farm and the Sofia Offshore Wind Farm annual totals ([10] Table 3) are the same as those in Table 6.

Table 6. Monthly mean collision predictions for the (non amended) consented wind farm, using Band CRM option 2 for 200 turbines (using turbine parameter values in Table 1).

Species	AR (%)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
Gannet	99	0	1	4	1	2	1	1	1	2	3	1	1	18
Kittiwake	99	15	31	69	23	26	19	13	7	7	12	9	15	245
Lesser black-backed gull	99.5	0	0	0	1	2	1	1	0	0	0	0	0	6
Great black-backed gull	99.5	3	3	3	2	1	1	0	0	1	1	1	3	19

Revised collision estimates for the alternative turbines for gannet and kittiwake have been calculated using avoidance rates of both 99% and 98.9%. Use of the former rate ensures consistency with the consented estimates and use of the latter updates the estimates in line with current guidance [12].

Using the alternative turbine parameters (Table 1) and the bird parameters (Tables 3 to 5), the mean annual collision mortalities for the alternative turbines have been calculated (Table 7). The annual consented estimates for Teesside A and B (combined) and for SOWF alone (Teesside B) are included for comparison.

Table 7. Consented and revised total annual collision mortalities for Teesside A and B and SOWF, calculated using the basic Band model (option 2).

Species	Avoidance rate (%)	Consented (WCS)		Alternative turbine 1, SOWF	Alternative turbine 2, SOWF	Alternative turbine 3, SOWF
		Teesside A & B [10]	Teesside B [10] (SOWF)			
Gannet	99	33	18	13	11	9
	98.9	N/A	N/A	14	12	10
Kittiwake	99	404	245	181	154	129
	98.9	N/A	N/A	199	169	142
Lesser black-backed gull	99.5	12	6	5	4	3
Great black-backed gull	99.5	37	19	14	12	10

The calculated collision mortalities for the alternative turbines are all lower than those for the consented turbines, with declines of between 19% and 50% when compared to the consented totals (including allowance for the slightly lower avoidance rate now recommended for gannet and kittiwake).

Using estimates of the gannet and kittiwake populations with connectivity to the North Sea [13] and published foraging ranges [14] the proportions of annual collisions on North Sea wind farms which

could be apportioned to the Flamborough and Filey Coast (FFC) pSPA (gannet and kittiwake) and the Farne Islands SPA (kittiwake) were estimated [15][16].

While initial submissions presented separate estimates for Teesside A and B (e.g. Table 9.20d, ES Chapter 11 Appendix A [2]), subsequent revisions to these numbers were only provided for both Teesside A and B together. Therefore, to obtain revised estimates for SOWF alone it was necessary to follow the apportioning methods set out in MacArthur Green (2014a,b). Table 8 provides the resulting collision mortalities for SOWF, apportioned to the FFC pSPA and the Farne Islands SPA, using both the consented and alternative turbines. Note that there are no gannets breeding at Farne Islands SPA.

Table 8. Consented and revised annual collision mortalities for SOWF apportioned to FFC pSPA and Farne Islands SPA, calculated using the basic Band model (option 2) and 98.9% avoidance rate.

Species	Designated site	Consented value (WCS)	Alternative turbine 1	Alternative turbine 2	Alternative turbine 3
Gannet	FFC pSPA	4	3.1	2.7	2.2
Kittiwake	FFC pSPA	26.2	21.2	18.0	15.1
Kittiwake	Farne Islands	1.9	1.5	1.3	1.1

As for the project totals, the collisions apportioned to designated sites with connectivity are all reduced for the alternative turbines.

7 Discussion of changes

Offshore wind farm impact assessments use detailed project information to predict the magnitude and significance of potential effects. The two primary effects assessed are displacement and collision risk. Displacement is estimated on the basis of the area of the wind farm and the density of birds present to estimate the number of birds potentially affected. The Teesside wind farms (A and B) were assessed on the basis that development would cover the entire lease area. The amendment to increase the blade diameter will not change the previously assessed displacement impacts considered by the Examining Authority and SoS in granting the DCO and no further reassessment is required. The same conclusion applies to barrier and indirect effects, since the reduction in the number of turbines and change in turbine dimensions will not affect the magnitude or significance of these impacts.

Collision mortality is calculated using the summed turbine parameters for the entire wind farm. Changing the size and number of turbines therefore changes the mortality predictions. To understand how the proposed changes would affect the collision mortality the original assessments have been reviewed and the relevant data extracted. Using these data revised collision estimates have been calculated for comparison with the consented estimates. All three turbines under consideration result in reduced predictions of collision mortality when compared with those used in the project consent. The reductions vary depending on the turbine model, with the greatest reduction obtained for the largest rotor diameter under consideration (288m).

As the proposed revisions reduce the magnitude of collision impact and do not affect the other offshore ornithology impacts, no further assessment is required for offshore ornithology.

8 Summary

The proposed turbine revisions for the SOWF have been assessed for the potential to alter the conclusions of the project impact assessment for offshore ornithology. All impacts will be either unchanged or reduced (collision risk), therefore the recommendations of the Examining Authority [9] and the decision of the SoS [17] are unaffected.

9 References

[1]. The Dogger Bank Teesside A and B Offshore Wind Farm Order 2015 (DECC 2015)

[2]. Dogger Bank Teesside A & B. Environmental Statement Chapter 11 Appendix A Ornithology Technical Report, March 2014. Appl. Ref. 6.11.1

[3]. Johnston, A., Cook, A.S.C.P., Wright, L.J., Humphreys, E.M. and Burton, E.H.K. 2014a. Modelling flight heights of marine birds to more accurately assess collision risk with offshore wind turbines. Journal of Applied Ecology 51: 31-41.

[4]. Johnston, A., Cook, A.S.C.P., Wright, L.J., Humphreys, E.M. and Burton, N.H.K. 2014b. corrigendum. Journal of Applied Ecology, 51, doi: 10.1111/1365-2664.12260.

[5]. Dogger Bank Teesside A & B. Environmental Statement Chapter 11 Marine and Coastal Ornithology, March 2014, Appl. Ref. 6.11

[6]. Natural England 2014a. Dogger Bank – Dogger Bank Teesside A & B Application Written Representations of Natural England. 3rd Sept 2014.

[7]. Natural England 2014b. Interested parties D. V submission, 23rd October 2014.

[8]. Natural England 2014d. Interested parties D. VI submission, 20th November 2014.

[9]. PINS 2015. Dogger Bank Teesside A and B Offshore Wind Farms Examining Authority's Report of Findings and Conclusions and Recommendation to the Secretary of State for Energy and Climate Change. 5th May 2015.

[10]. Dogger Bank Teesside A and B. Statement of Common Ground between Forewind and Natural England (offshore). Appendix 3 – Option 2 collision risk numbers. August 2014.

[11]. Cook, A.S.C.P., Humphries, E.M., Masden, E.A., and Burton, N.H.K. 2014. The avoidance rates of collision between birds and offshore turbines. BTO research Report No 656 to Marine Scotland Science

[12]. JNCC, NE, NIEA, NRW, SNH 2014. Joint Response from the Statutory Nature Conservation Bodies to the Marine Scotland Science Avoidance Rate Review

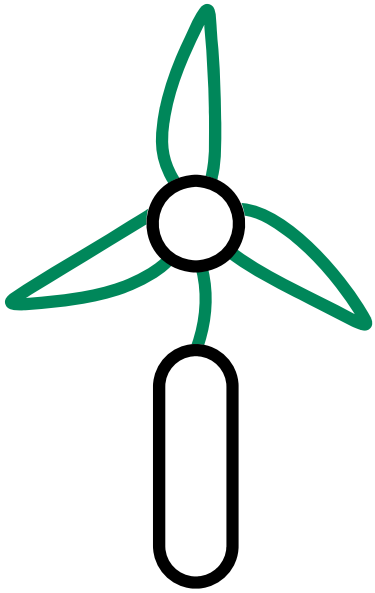
[13]. Furness, R.W. 2015. Non-breeding season populations of seabirds in UK waters: Population sizes for Biologically Defined Minimum Population Scales (BDMPS). Natural England Commissioned Report Number 164. 389 pp.

[14]. Thaxter, C.B., Lascelles, B., Sugar, K., Cook, A.S.C.P., Roos, S., Bolton, M., Langston, R.H.W. and Burton, N.H.K. 2012. Seabird foraging ranges as a preliminary tool for identifying Marine Protected Areas. Biological Conservation 156: 53-61.

[15]. Dogger Bank Teesside A and B. Deadline VI - Apportioning of the Flamborough and Filey Coast pSPA Gannet Population - BDMPS Update. November 2014.

[16]. Dogger Bank Teesside A and B. Deadline VI - Flamborough and Filey Coast pSPA and Farne Islands Kittiwake Populations - BDMPS Update. November 2014.

[17]. DECC 2015. Application for the Dogger Bank Teesside A and B Offshore Wind Farm Order.



Innogy Renewables UK Limited
Windmill Hill Business Park
Whitehill Way
Swindon
Wiltshire SN5 6PB
T: +44 (0)8456 720 090
www.innogy.com

Registered office:
Innogy Renewables UK Limited
Windmill Hill Business Park
Whitehill Way
Swindon
Wiltshire SN5 6PB
Registered in England and Wales no: 02550622

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