Assessment of Potential Dogger Bank South Wake Impacts Rev 02

Dogger Bank A, B, and C

Energy Analytics Team

sse Renewables

Contents

Rev	Prepared by	Checked by	Approved by	Date of issue
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1. Introduction

1.1. About the Authors

This report sets out the Dogger Bank Projcos' assessment of the expected reduction in energy produced by the DBA, DBB and DBC projects because of DBS. In carrying out this modelling, the Projcos have relied on the SSE Renewables Energy Analytics (EA) team, which is comprised of wind energy analysts and wake modelling experts who are responsible for performing wind resource and energy yield assessments. Their track record covers offshore wind projects developed by the Projco shareholders, with previous experience working for independent consultancies, turbine manufacturers, and in research and development of wake modelling.

1.2. Background

In The Crown Estate (TCE) Leasing Round 4 seabed auction, RWE were successful in securing two 1500MW (Mega-Watt) wind farm sites in the Dogger Bank region. These sites are referred to collectively as Dogger Bank South (DBS) and individually as Dogger Bank South East (DBSE) and Dogger Bank South West (DBSW) in this document. RWE have submitted a Development Consent Order (DCO) application which, at the time of writing, is in the Examination phase. To help inform the Dogger Bank Projcos' position on the DCO application, the SSE Renewables Energy Analytics (EA) team has assessed the potential Annual Energy Production (AEP) wake losses on Dogger Bank A, B, and C (DBA, DBB, and DBC) wind farms, collectively referred to here as Dogger Bank Wind Farms (DBWF) due to the proposed developments at DBS.

The position of DBSW and DBSE are shown in relation to other wind farms in the Dogger Bank region in Figure 1.

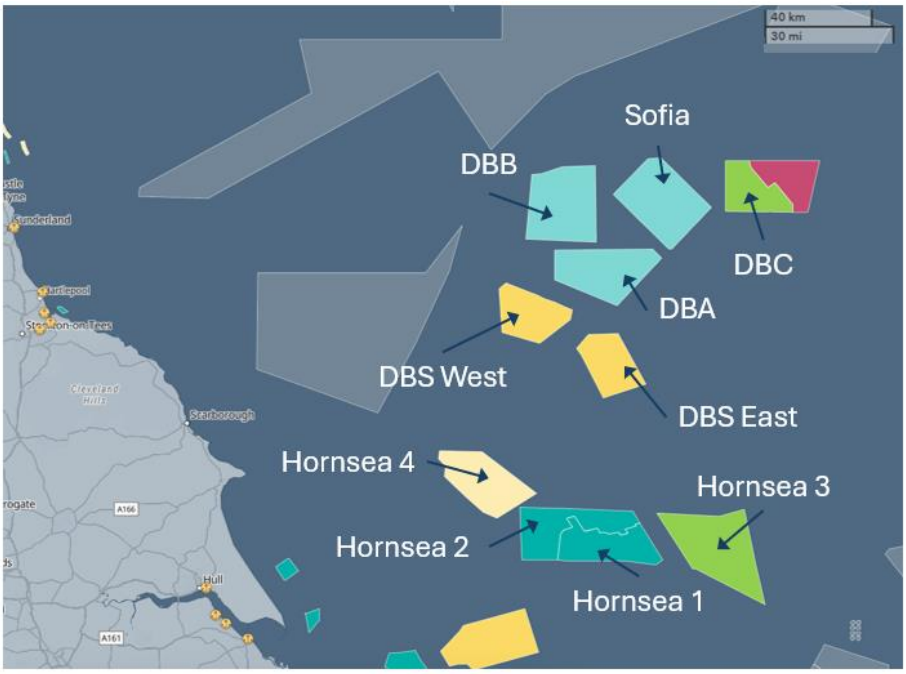

Figure 1: Arrangement of wind farms at different stages of development in the Dogger Bank region.

1.3. Objectives

The objectives of this study are to:

- Quantify the potential aerodynamic impact of proposed wind farms at DBSW and DBSE on the AEP of DBA, DBB, and DBC wind farms
- Assess the extent to which the impact on DBA, DBB, and DBC depends on the turbine size installed at DBSE and DBSW.
- Determine the indicative financial impact on DBA, DBB, and DBC including over project lifetime.

2. Methodology

2.1. Overview

Engineering models are used in this study to predict the changes in wind speed at DBA, DBB, and DBC due to the aerodynamic effects of the proposed DBS wind farms. These models solve a set of analytical equations that are tuned to real-world observations and consider key wind farm characteristics including turbine positions and the force exerted on the wind by each turbine. Changes in wind speed are converted into changes in energy production by means of the wind turbine power curves and considering the full range of wind speed and wind direction conditions expected at Dogger Bank on an annual basis. The impact of DBS wind farms is isolated by comparing the expected energy produced by DBA, DBB, and DBC projects under two scenarios: (1) with all wind farms excluding DBS; and (2) all wind farms including DBS.

2.2. Wind Farm Layouts

The wind farm layouts considered in this study are shown in Figure 2 and Figure 3, for scenarios where small (15 MW) and large (21 MW) turbines are installed at DBS sites, respectively.

All DB projects which have obtained planning consent are modelled as operational in a post-Contracts for Difference (CfD) regime. The confirmed layouts for DBA, DBB, DBC, and Sofia are used in this study as the projects are in construction these layouts are finalised. Sofia is included in this assessment given its proximity to DBC and likely wake impact. In addition, wake effects from the proposed wind farms at DBS may impact the wakes of Sofia on DBC.

Turbine specifications and layouts are not yet available for the DBS projects. As such, indicative layouts have been generated for the purposes of this study. These assumed layouts for DBS seek to respect the export capacity and site boundaries published at the time of writing in the DBS DCO documentation. Care has been taken to establish layouts for DBS which do not result in excessively large levels of internal wake loss.

Layout coordinates for DBS modelled in this study are presented in Appendix A of this report.

This revision 02 of the wake impact assessment includes the influence of the Hornsea 1, 2, 3, and 4 wind farms. Actual layouts were modelled for Hornsea 1 and 2 as these projects are fully commissioned. Given layouts for Hornsea 3 and 4 are not yet available, indicative layouts have been generated using a similar approach to that used to generate the DBS layouts.

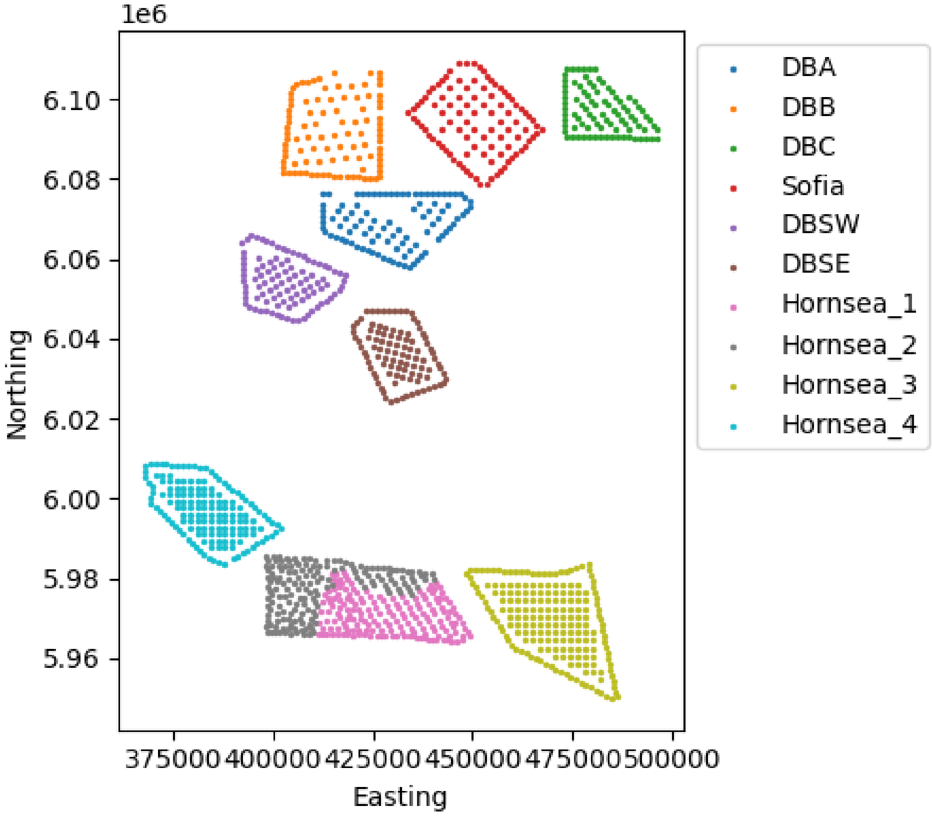

Figure 2: Turbine layouts modelled for small DBS turbine scenario.

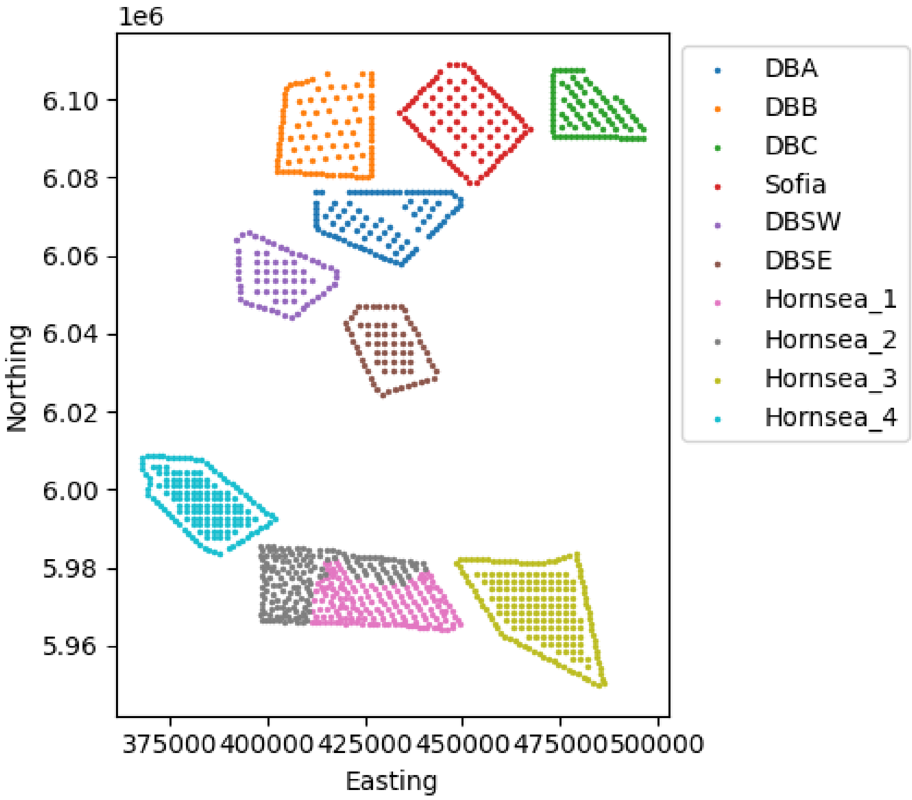

Figure 3: Turbine layouts modelled for large DBS turbine scenario.

2.3. Turbine Data

A summary of all turbine specifications modelled in this assessment is presented in Table 1.

The engineering wake models used in this study require inputs describing the characteristics and performance of the wind turbines, namely:

- **Power curves** quantify the relationship between wind speed and the expected power generated by a turbine (typically measured in Mega Watts (MW)). The capacity of a wind turbine refers to the maximum power it can generate. Power curves are necessary in this assessment to convert the reductions in wind speed into reductions in power generation at DBA, DBB, and DBC due to DBS. They are supplied by turbine manufacturers for each specific turbine model and are a key metric for quantifying the performance of individual turbine models and wind farms. As such, power curves for commercial turbine models are considered commercially sensitive.
- **Thrust curves** quantify the amount of force (or thrust) exerted on the wind by a wind turbine for its range of operating wind speeds. This relationship is used in the models to characterise the spatial extent and magnitude of the DBS wake effects. Thrust curves are supplied by turbine suppliers for specific turbine models and are similarly commercially sensitive.
- **Hub height and rotor diameter** are key dimensions of the turbine which influence the available wind speed and spatial evolution of the wake. They are explicitly included in the models.

Turbines at DBA, DBB, and DBC are modelled with the power and thrust curves, hub heights, and rotor diameter data provided to SSE Renewables by the Projco's turbine supplier. Due to commercial sensitivity restrictions, the power and thrust curves of these turbines cannot be made available publicly in this report.

The size and capacity of the DBS turbines are not known at this stage; however, in the DBS DCO application, it is stated the turbines selected for construction will lie within a range from 15MW to in excess of 20MW. In the absence of further information:

- A small turbine (15MW) scenario and a large turbine (21MW) scenario are modelled in this present study to assess the sensitivity of results to DBS turbine size. The layouts and turbine counts are adjusted accordingly between the small and large DBS turbine scenarios to not exceed an export capacity of 1,500MW per DBS project [1].
- DBS turbines are modelled with the theoretical power and thrust curves shown in Figure 4. The modelled rotor diameters and hub heights of the DBS turbines comply with the maximum rotor diameter of 344m and minimum tip clearance of 34m stated in the DBS DCO application.

Turbines at Hornsea projects are modelled using generic power and thrust curves. For Hornsea 1 and 2, these curves reflect the known turbine capacities and dimensions. However, as the turbine models to be installed at Hornsea 3 and 4 are not yet known, it is assumed that 15MW turbines will be installed.

Table 1: Wind farm turbine counts and capacities.

Wind Farm	Number of WTs	WTG Capacity (MW)	Wind Farm Capacity (MW)	Hub height (m)	Rotor diameter (m)
DBA	95	13.0	1235	140	220
DBB	95	13.0	1235	140	220
DBC	87	14.7	1278.9	140	220
Sofia	100	14.0	1400	140	222
Hornsea 1	174	7.0	1218	113	154
Hornsea 2	165	8.4	1386	121	167
Hornsea 3	197	15	2955	158	236
Hornsea 4	160	15	2400	158	236
DBS East (small WT)	100	15.0	1500	152	236
DBS West (small WT)	100	15.0	1500	152	236
DBS East (large WT)	71	21.0	1491	179	290
DBS West (large WT)	71	21.0	1491	179	290

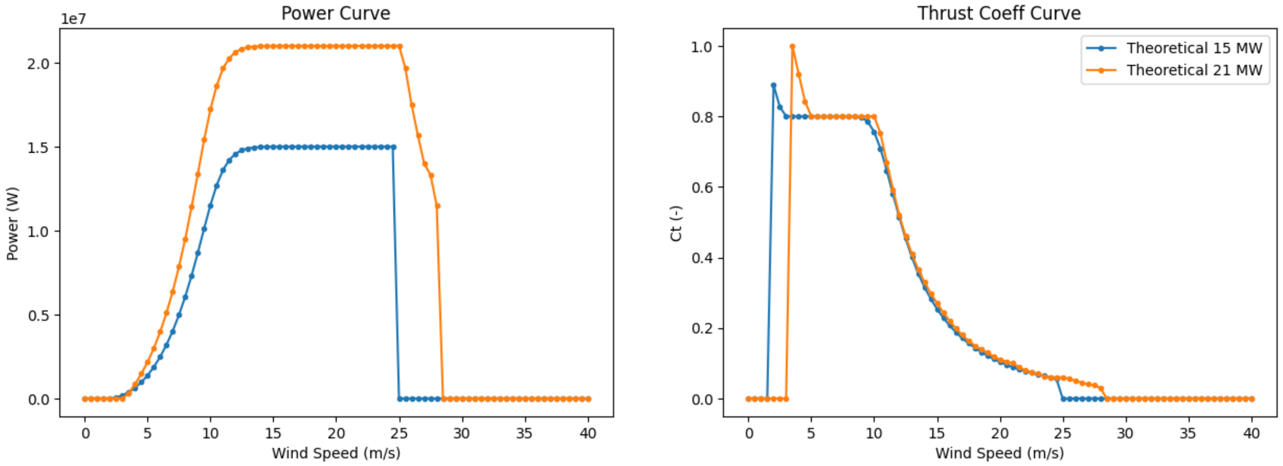

Figure 4: Theoretical power and thrust curves for DBS turbines in assessment.

2.4. Wakes and Blockage Models

Wakes and blockage losses were assessed in this study using a Turbulence Optimised Park (TurbOPark) wake model with gaussian velocity deficit profile coupled to the Rankine Half Body with Wake expansion (RHBW) blockage model [2, 3]. Ørsted developed and tuned the TurbOPark model to capture farm-to-farm wake effects as well as internal wake effects. Measurement evidence from Ørsted's own portfolio indicates that the TurbOPark wake model, coupled with Ørsted's blockage model, reproduces the impact of long-range wakes well up to 50km separation between wind farms [4, 5]. Whilst the evidence basis is still evolving, TurbOPark is considered a credible engineering model to model inter-array wake effects in this study. This was run using version 2.6.7 of PyWake and set up with a blockage model to replicate, in as far as practicable, the implementation as-validated by Ørsted and utilised by Frazer-Nash Consultancy [6].

Further to a review of our approach, we identified an issue whereby blockage deficits were being summed in quadrature in our model, instead of linearly as specified in the formulation of the RHBW blockage model [3]. This issue has been addressed in this revised assessment, and we note this has resulted in a reduction in average DBS wake impact of approximately 0.1% AEP across the DBA, DBB, and DBC projects.

2.5. Wind Resource

The wind resource is a key input to this study as it influences the frequency and spatial extent of the predicted wake effects generated by all wind farms at Dogger Bank including DBS. A wind resource representative of the Dogger Bank region has been used in this present assessment, including:

- Probability distributions of freestream wind speed and wind direction based on measurements made at the Dogger Bank West (DBW) and Dogger Bank East (DBE) measurement devices. The wind direction distributions are shown in Figure 5. The measurement period considered for DBW was from 26 September 2013 to 26 September 2017. The measurement period considered for the DBE data was from 16 March 2013 to 22 September 2017. Long-term adjustments were applied to both datasets to account for inter-annual variability. These data collection methods were established specifically to gather wind data for the DBA, DBB, DBC, and Sofia wind farms and hence are considered to provide the most representative data for wind conditions and wake effects expected at the sites. The Cavendish LIDAR (light detection and ranging device) measurement data was discounted for the purposes of this assessment due to its relative remoteness to the DBA, DBB, and DBC projects, as shown in Figure 6.
- Horizontal extrapolation using wind maps provided by Vortex.
- Turbulence intensity distributions with wind speed and wind direction based on measurements made at DBW and DBE.
- At DBA hub height, the modelled long-term mean wind speed is 10.53 m/s with a mean turbulence intensity of 5.13%.

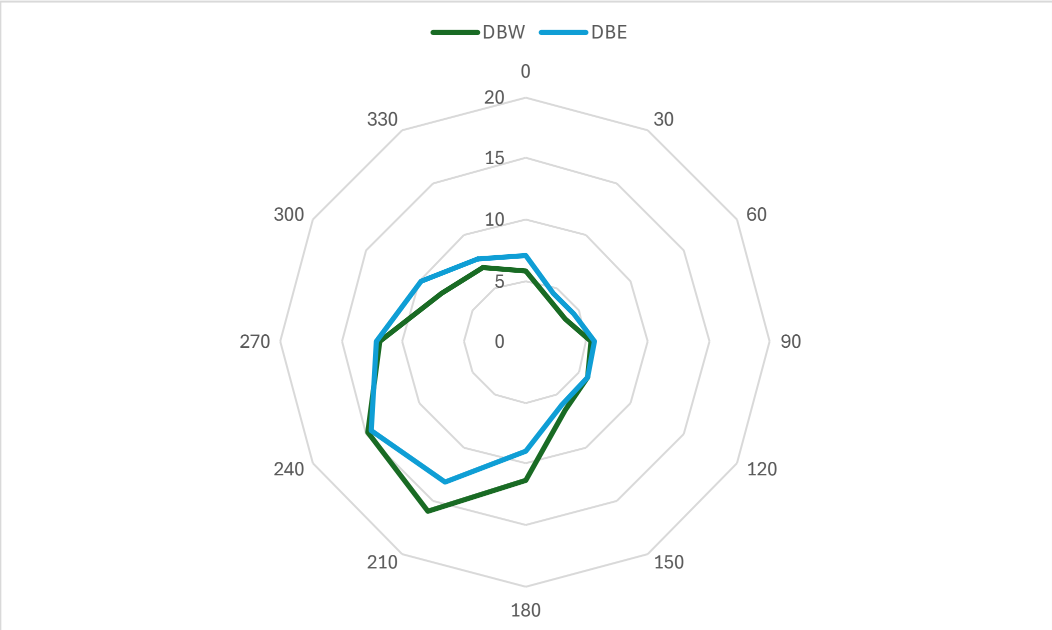

Figure 5: Wind direction probability distributions (%) at DBW and DBE met masts. Wake impacts at DBA and DBB were calculated using the DBW distribution, while wake impacts at DBC were calculated using the DBE distribution. The prevailing wind direction is from a south westerly direction.

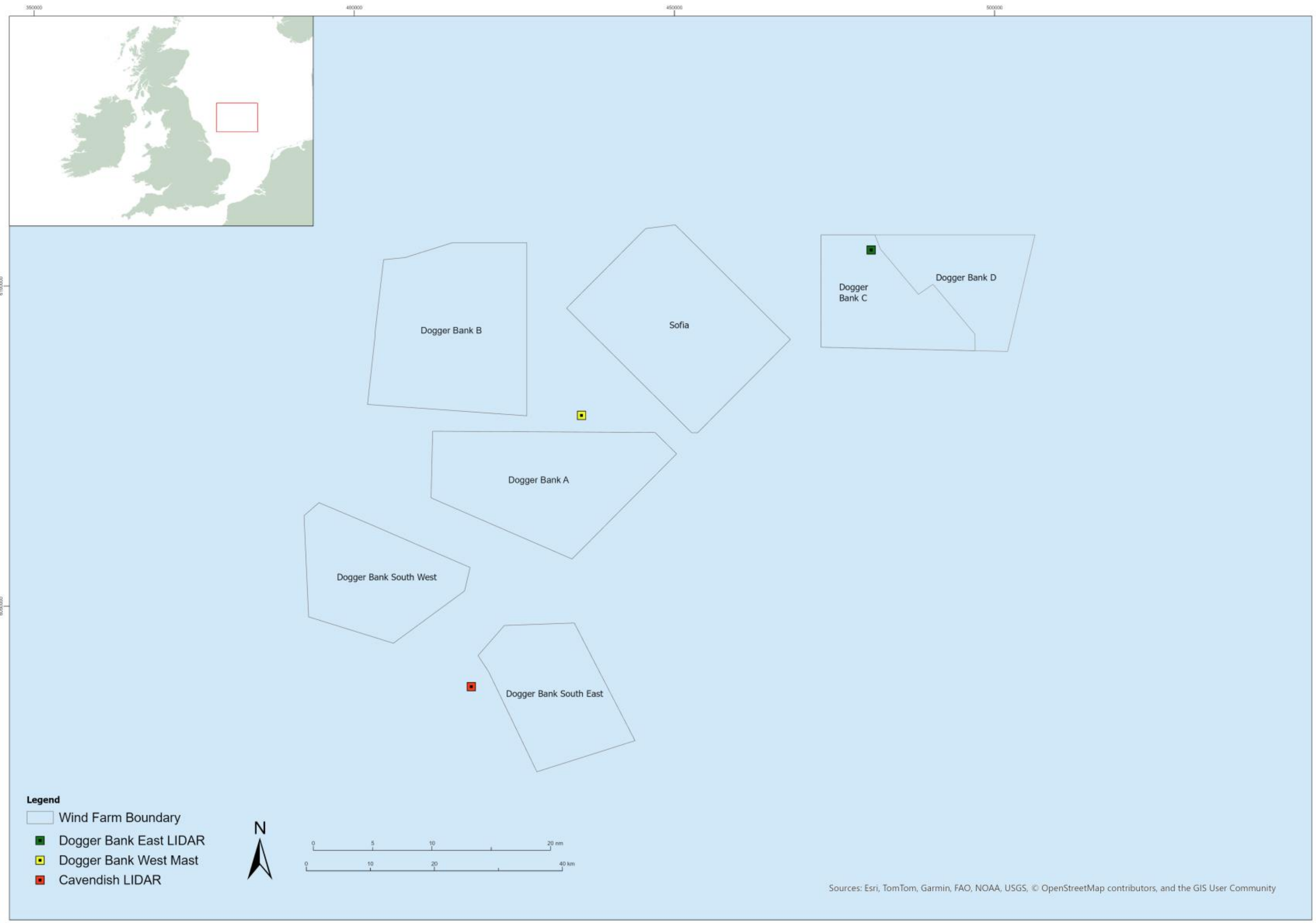

Figure 6: Offshore wind farm project areas and measurement devices in the Dogger Bank area.

3. Results

3.1. Impact on Annual Energy Production (AEP)

This section presents the AEP impact for both DBS turbine scenarios assessed. These are summarised in Table 2 and key findings are discussed in Section 4.

The wake impact of DBS was assessed by comparing the net AEP of DBA, DBB, and DBC, with and without the influence of DBS included. The reduction in net AEP due to DBA is expressed as a percentage of the net AEP without the wake impact of DBS in Table 2. Net AEP values only consider the influences of wind resource, wakes, and blockage losses.

Table 2: Expected AEP wakes and blockage loss on DBA, DBB, and DBC due to proposed DBS development.

Wind Farm	Net AEP change due to DBS (%)	
	Small DBS turbines (15MW)	Large DBS turbines (21MW)
DBA	-3.3%	-3.5%
DBB	-1.2%	-1.4%
DBC	-0.4%	-0.5%
Average	**-1.7%**	**-1.8%**

3.2. Lifetime and Financial Impacts

This section discusses how the wake impacts of DBS presented in section 3.1 (in percentage AEP terms) are converted into energy and financial terms for the large DBS turbine scenario. These results are presented on both an annual basis and for the anticipated lifetime of the DBA, DBB, and DBC projects, respectively. The calculation is performed as follows:

1. An indicative net AEP is computed for each of the DBA, DBB, and DBC projects using publicly available capacity factor data for the purpose of this analysis.
2. The indicative net AEP is multiplied by the wake losses due to DBS (discussed in section 3.1) to give an annual wake loss in energy terms (GWh) for each project. Collectively, the anticipated annual energy loss from DBA, DBB, and DBC due to DBS wakes is expected to be 312 GWh.
3. Annual energy losses due to DBS wakes are converted into indicative financial terms with assumptions on power price. The power generated by DBA, DBB, and DBC during the first 15 years from commissioning will be sold at the Contracts for Difference (CfD) strike price. However, the CfD contracts do not cover the whole period of overlap between DBWF and DBS operations, and during the post-CfD period the true power price may be higher or lower than the strike price. To consider the impact of this on lifetime financial losses, the following two scenarios are considered for post-CfD power price:
    a. Scenario 1: where the lost energy is sold at the CfD strike price for the DBA, DBB, and DBC projects.
    b. Scenario 2: where the lost energy is sold at the power price forecast by the Department for Energy Security and Net Zero (DESNZ) [7]. These forecast wholesale prices of £70-79/MWh (in 2023 prices) are materially higher than the Strike Prices assumed in Scenario 1. As DESNZ forecast prices are not available from 2051 until when DBA, DBB, and DBC are expected to be decommissioned, it is assumed that the forecast price for 2050 is applicable during this period.
4. To illustrate the financial impacts and simplify the analysis, all prices are presented in 2025 terms and without discounting for each scenario in Table 3. Calculation details for Scenario 1 and Scenario 2 are presented in Table 4 and Table 5, respectively.
5. Lifetime energy and financial losses are calculated for the whole period where DBA, DBB, and DBC operations are expected to overlap with those of DBS. The overlap period begins in the year after DBS is expected to be fully commissioned (2032) and ends when the DBA, DBB, and DBC projects are expected to be decommissioned. It is assumed that DBA, DBB, and DBC projects are subject to the anticipated DBS wakes for this entire period.

Table 3: Summary of annual and total financial impacts across DBA, DBB, and DBC due to DBS wake effects (assuming 21MW turbines are installed at DBS).

	Financial Impact (£m 2025 undiscounted)	
Power Price Scenario	**Annual**	**Total**
Scenario 1 (CfD Strike Price)	17	499
Scenario 2 (CfD Strike Price + Merchant Forecast)	23	669

Table 4: Summary of annual and lifetime energy and financial impacts of DBS wakes on DBA, DBB, and DBC wind farms for the large DBS turbine scenario. Power price scenario 1: CfD Strike Price for during and post-CfD.

	DBA	DBB	DBC	Total	Comment
Installed capacity (GW)	1.2	1.2	1.2	3.6	
Capacity Factor (CF)	0.55	0.55	0.55	0.55	based on publicly available CF: https://doggerbank.com/
Design life (yrs)	35	35	35	35	
Estimated commissioning year	2025	2026	2026		DB website
First full year of production	2026	2027	2027		year after estimated commissioning year
Estimated decommissioning year	2060	2061	2061		
First full year of production (DBS)	2032	2032	2032		year after expected commissioning year (2031)
Overlap with DBS (yrs)	29	30	30		
Wake loss due to DBS (% net AEP)	3.5%	1.4%	0.5%		
Net AEP (GWh/yr)	5785.6	5785.6	5785.6		
Average Power price (£/MWh)	£ 53.410	£ 56.250	£ 56.250		CfD strike price in 2025 prices
Annual					
Wake Loss (GWh)	202	81	29	312	
Wake Loss (£m)	11	5	2	**17**	£m in 2025 prices with no discounting
Lifetime					
Wake Loss (GWh)	5,872	2,430	868	9,170	
Wake Loss (£m)	314	137	49	**499**	£m in 2025 prices with no discounting

Table 5: Summary of annual and lifetime energy and financial impacts of DBS wakes on DBA, DBB, and DBC wind farms for the large DBS turbine scenario. Power price scenario 2: CfD Strike Price during CfD period and merchant forecast price post-CfD.

	DBA	DBB	DBC	Total	Comment
Installed capacity (GW)	1.2	1.2	1.2	3.6	
Capacity Factor (CF)	0.55	0.55	0.55	0.55	based on publicly available CF: https://doggerbank.com/
Design life (yrs)	35	35	35	35	
Estimated commissioning year	2025	2026	2026		DB website
First full year of production	2026	2027	2027		year after estimated commissioning year
Estimated decommissioning year	2060	2061	2061		
First full year of production (DBS)	2032	2032	2032		year after expected commissioning year (2031)
Overlap with DBS (yrs)	29	30	30		
Wake loss due to DBS (% net AEP)	3.5%	1.4%	0.5%		
Net AEP (GWh/yr)	5785.6	5785.6	5785.6		
Average Power price (£/MWh)	£ 72.837	£ 73.334	£ 72.598		CfD period: Strike price in 2025 prices
					Post CfD period: DESNZ merchant power price forecast in 2025 terms
Annual					
Wake Loss (GWh)	202	81	29	312	
Wake Loss (£m)	15	6	2	**23**	£m in 2025 prices with no discounting
Lifetime					
Wake Loss (GWh)	5,872	2,430	868	9,170	
Wake Loss (£m)	428	178	63	**669**	£m in 2025 prices with no discounting

4. Discussion

This section presents the key findings from the results: each of the objectives in section 1.3 is addressed in sections 4.1 – 4.3.

4.1. What is the AEP impact of DBS on DBA, DBB, and DBC?

DBS is expected to reduce the collective AEP of DBA, DBB, and DBC, by approximately 1.7 – 1.8%

Sites located closer to DBS are more greatly impacted by the wakes and blockage effects of DBS. DBA is the most impacted, with projected AEP losses of between 3.3% and 3.5% whilst AEP losses at the further-away DBC are projected to be between 0.4% and 0.5%, depending on turbine size and layouts installed at DBS. Overall, all of the individual losses on DBA, DBB, and DBC, are considered significant. At a minimum, it is recommended the impact of DBS is included in yield projections for these sites, should DBS be consented, constructed and operated as proposed by the current DCO application.

4.2. How sensitive are the findings to DBS turbine layout and size?

The AEP loss on DBA, DBB, and DBC is expected to increase by 0.1 – 0.2 percentage points if the turbines installed at DBS have a capacity of 21MW instead of 15MW.

This variation is less pronounced for sites further downstream of DBS – such as DBC – where contributions from individual DBS turbines to the wake are less distinct due to mixing of these with the background flow.

Overall, this variation is considered to be modest and wake losses on DBA, DBB, and DBC due to DBS are likely to remain significant irrespective of the final turbine size selected for construction at DBS.

4.3. What are the lifetime and financial impacts of DBS on DBA, DBB, and DBC?

Over the operational life of the DBA, DBB, and DBC projects, we expect wake effects from DBS to reduce the energy generation by 9,170 GWh in a scenario where large (21MW) DBS turbines are selected for construction. Indicatively, we expect this to result in lost revenue of approximately £669 million (2025 terms) over the lifetime of DBA, DBB, and DBC.

This figure excludes discounting and is based on CfD Strike Prices during the CfD terms and wholesale power prices thereafter using forecasts published by DESNZ [7].

5. Conclusions

This study was commissioned with the primary objective of quantifying potential wakes and blockage losses on DBA, DBB, and DBC wind farms in the Dogger Bank region due to the proposed development at Dogger Bank South (DBS).

In summary, based on the modelling performed in this study, we expect the proposed development at DBS to lead to a material reduction in the expected energy output of DBA, DBB, and DBC wind farms. We expect this reduction to be approximately 312 GWh and 9,170 GWh on an annual and lifetime basis, respectively. Indicatively, we expect this to result in financial losses of approximately £23m and £669m (in 2025 terms) on an annual average and lifetime basis, respectively.

Specifically, the wakes and blockage losses from DBS:

- Are expected to reduce the aggregate AEP of DBA, DBB, and DBC by 1.8% in a scenario where 21MW turbines are installed at DBS.
- Are expected to have the largest impact on the DBA wind farm due to its proximity to DBS, reducing the AEP of DBA by 3.5% in a scenario where 21MW turbines are installed at DBS sites.
- Show little sensitivity to assumed turbine size at DBS. AEP losses of DBA, DBB, and DBC are expected to increase by 0.1 – 0.2 percentage points if larger (21MW) turbines are installed at DBS compared to smaller (15MW) turbines. Wake losses on DBA, DBB, and DBC due to DBS are likely to remain significant irrespective of the final turbine size selected for construction at DBS.

References

[1] RWE Renewables UK Dogger Bank South (West) Limited, RWE Renewables UK Dogger Bank South (East) Limited,, "Environmental Statement, Volume 7, Chapter 5 - Project Description," Document Number: 004300145-02, June 2024.

[2] Ørsted, "TurbOPark code repository," on 12 December 2024, Accessed from: https://github.com/OrstedRD/TurbOPark.

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[6] Frazer-Nash Consultancy, "Offshore Wind Leasing Programme: Array Layout Yield Study," October 2023.

[7] DESNZ, "Energy and emissions projections: 2023 to 2050," Accessed on 23/05/2025 from: https://www.gov.uk/government/publications/energy-and-emissions-projections-2023-to-2050, December 2024.

A. DBS turbine coordinates

Table 6: DBS West small turbine (15MW) layout coordinates (EPSG:32631).

Name	Easting	Northing
WT1	392275.7	6064079.4
WT2	400732.8	6060466.4
WT3	393344.0	6065008.7
WT4	399097.8	6059522.4
WT5	394412.4	6065938.1
WT6	397462.7	6058578.4
WT7	395756.3	6065492.2
WT8	395827.7	6057634.4
WT9	397060.9	6064941.7
WT10	403406.3	6059611.9
WT11	398365.5	6064391.2
WT12	401771.2	6058667.9
WT13	399670.1	6063840.7
WT14	400136.2	6057723.9
WT15	400974.7	6063290.2
WT16	398501.1	6056779.9
WT17	402279.3	6062739.7
WT18	396866.1	6055835.9
WT19	403579.5	6062179.0
WT20	395231.0	6054891.9
WT21	404878.5	6061615.3
WT22	404444.7	6057813.3
WT23	406177.8	6061052.3
WT24	402809.6	6056869.3
WT25	407477.1	6060489.6
WT26	401174.6	6055925.3
WT27	408776.7	6059927.2
WT28	399539.5	6054981.3
WT29	410076.4	6059365.4
WT30	397904.5	6054037.3
WT31	411376.4	6058804.0
WT32	396269.4	6053093.3
WT33	412676.5	6058242.9
WT34	407118.2	6056958.7
WT35	413976.9	6057682.4
WT36	405483.1	6056014.7
WT37	415277.1	6057121.7
WT38	403848.0	6055070.7
WT39	416577.2	6056560.7
WT40	402213.0	6054126.7
WT41	417877.5	6056000.0

Name	Easting	Northing
WT42	400577.9	6053182.7
WT43	417627.5	6054606.2
WT44	398942.9	6052238.7
WT45	417304.9	6053227.4
WT46	397307.8	6051294.7
WT47	416556.2	6052025.6
WT48	395672.8	6050350.7
WT49	415415.2	6051187.1
WT50	409791.6	6056104.2
WT51	414274.2	6050348.5
WT52	408156.6	6055160.2
WT53	413133.1	6049510.0
WT54	406521.5	6054216.2
WT55	411992.1	6048671.5
WT56	404886.4	6053272.2
WT57	410851.1	6047832.9
WT58	403251.4	6052328.2
WT59	409710.0	6046994.4
WT60	401616.3	6051384.2
WT61	408569.0	6046155.9
WT62	399981.3	6050440.2
WT63	407428.0	6045317.4
WT64	398346.2	6049496.2
WT65	406287.0	6044478.9
WT66	412465.1	6055249.6
WT67	404889.4	6044706.4
WT68	410830.0	6054305.6
WT69	403537.3	6045126.9
WT70	409195.0	6053361.6
WT71	402185.3	6045547.4
WT72	407559.9	6052417.6
WT73	400833.1	6045967.9
WT74	405924.8	6051473.6
WT75	399481.0	6046388.5
WT76	404289.8	6050529.6
WT77	398128.9	6046809.0
WT78	402654.7	6049585.6
WT79	396776.9	6047229.5
WT80	401019.7	6048641.6
WT81	395424.8	6047650.0
WT82	413503.5	6053451.1
WT83	394072.7	6048070.5
WT84	411868.4	6052507.1
WT85	392957.5	6048943.2
WT86	410233.4	6051563.1
WT87	392893.8	6050357.7
WT88	408598.3	6050619.1

Name	Easting	Northing
WT89	392830.1	6051772.3
WT90	406963.2	6049675.1
WT91	392766.4	6053186.9
WT92	405328.2	6048731.1
WT93	392702.7	6054601.4
WT94	403693.1	6047787.1
WT95	392638.9	6056015.9
WT96	392575.2	6057430.5
WT97	392511.5	6058845.1
WT98	392447.8	6060259.6
WT99	392384.1	6061674.2
WT100	396424.3	6060377.0

Table 7: DBS East small turbine (15MW) layout coordinates (EPSG:32631).

Name	Easting	Northing
WT1	423494.0	6046863.1
WT2	424594.3	6043915.6
WT3	424909.1	6046913.7
WT4	424115.4	6042128.4
WT5	426324.2	6046964.2
WT6	423636.5	6040341.2
WT7	427739.3	6047014.7
WT8	426381.5	6043436.7
WT9	429154.4	6047065.3
WT10	425902.6	6041649.6
WT11	430569.4	6047115.8
WT12	425423.7	6039862.4
WT13	431984.6	6047166.4
WT14	424944.8	6038075.2
WT15	433399.7	6047216.9
WT16	428168.7	6042957.9
WT17	434646.6	6046546.0
WT18	427689.8	6041170.7
WT19	435296.2	6045287.8
WT20	427210.9	6039383.5
WT21	435945.8	6044029.6
WT22	426732.0	6037596.3
WT23	436595.4	6042771.4
WT24	426253.2	6035809.1
WT25	437245.0	6041513.2
WT26	429955.9	6042479.0
WT27	437894.6	6040255.0
WT28	429477.0	6040691.8
WT29	438544.2	6038996.8
WT30	428998.1	6038904.6
WT31	439193.8	6037738.6

Name	Easting	Northing
WT32	428519.2	6037117.4
WT33	439843.4	6036480.4
WT34	428040.3	6035330.2
WT35	440493.0	6035222.1
WT36	427561.5	6033543.0
WT37	441142.6	6033963.9
WT38	431743.1	6042000.1
WT39	441792.1	6032705.7
WT40	431264.2	6040212.9
WT41	442441.7	6031447.6
WT42	430785.3	6038425.7
WT43	443091.3	6030189.3
WT44	430306.4	6036638.5
WT45	442851.3	6028793.8
WT46	429827.5	6034851.3
WT47	441501.4	6028366.2
WT48	429348.7	6033064.1
WT49	440151.5	6027938.7
WT50	428869.8	6031276.9
WT51	438801.6	6027511.1
WT52	433530.2	6041521.2
WT53	437451.7	6027083.5
WT54	433051.4	6039734.0
WT55	436101.8	6026655.9
WT56	432572.5	6037946.9
WT57	434751.9	6026228.3
WT58	432093.6	6036159.7
WT59	433402.0	6025800.7
WT60	431614.7	6034372.5
WT61	432052.1	6025373.2
WT62	431135.9	6032585.3
WT63	430702.3	6024945.6
WT64	430657.0	6030798.1
WT65	429352.4	6024518.0
WT66	434838.6	6039255.2
WT67	428120.0	6025215.4
WT68	434359.7	6037468.0
WT69	427505.4	6026491.0
WT70	433880.8	6035680.8
WT71	426890.8	6027766.7
WT72	433401.9	6033893.6
WT73	426276.2	6029042.4
WT74	432923.1	6032106.4
WT75	425661.6	6030318.0
WT76	432444.2	6030319.2
WT77	425047.1	6031593.7
WT78	436146.9	6036989.1

Name	Easting	Northing
WT79	424432.5	6032869.4
WT80	435668.0	6035201.9
WT81	423817.9	6034145.1
WT82	435189.1	6033414.7
WT83	423203.3	6035420.7
WT84	434710.3	6031627.5
WT85	422588.7	6036696.4
WT86	434231.4	6029840.3
WT87	421974.1	6037972.1
WT88	437455.2	6034723.0
WT89	421359.5	6039247.7
WT90	436976.3	6032935.8
WT91	420652.4	6040474.5
WT92	436497.4	6031148.6
WT93	419877.0	6041659.4
WT94	436018.6	6029361.4
WT95	420155.2	6043047.8
WT96	438763.5	6032457.0
WT97	421087.7	6044113.4
WT98	438284.6	6030669.8
WT99	422020.2	6045179.0
WT100	430178.1	6029010.9

Table 8: DBS West large turbine (21MW) layout coordinates (EPSG:32631).

Name	Easting	Northing
WT1	392275.7	6064079.4
WT2	397049.3	6060580.0
WT3	393588.5	6065221.4
WT4	397049.3	6058187.5
WT5	395261.0	6065701.2
WT6	397049.3	6055795.0
WT7	396864.1	6065024.7
WT8	397049.3	6053402.5
WT9	398467.2	6064348.2
WT10	397049.3	6051010.0
WT11	400070.3	6063671.8
WT12	399441.8	6060580.0
WT13	401673.4	6062995.3
WT14	399441.8	6058187.5
WT15	403273.5	6062311.8
WT16	399441.8	6055795.0
WT17	404869.7	6061619.2
WT18	399441.8	6053402.5
WT19	406466.3	6060927.4
WT20	399441.8	6051010.0
WT21	408063.0	6060235.9

Name	Easting	Northing
WT22	401834.3	6058187.5
WT23	409660.1	6059545.4
WT24	401834.3	6055795.0
WT25	411257.5	6058855.4
WT26	401834.3	6053402.5
WT27	412855.1	6058166.0
WT28	401834.3	6051010.0
WT29	414453.0	6057477.3
WT30	404226.8	6058187.5
WT31	416050.6	6056787.9
WT32	404226.8	6055795.0
WT33	417648.3	6056098.8
WT34	404226.8	6053402.5
WT35	417570.1	6054360.5
WT36	404226.8	6051010.0
WT37	417173.6	6052666.3
WT38	404226.8	6048617.5
WT39	415866.0	6051518.3
WT40	406619.3	6055795.0
WT41	414463.9	6050488.0
WT42	406619.3	6053402.5
WT43	413061.8	6049457.6
WT44	406619.3	6051010.0
WT45	411659.7	6048427.2
WT46	406619.3	6048617.5
WT47	410257.6	6047396.8
WT48	409011.8	6055795.0
WT49	408855.5	6046366.4
WT50	409011.8	6053402.5
WT51	407453.4	6045336.0
WT52	409011.8	6051010.0
WT53	406015.5	6044356.1
WT54	411404.3	6053402.5
WT55	404354.0	6044872.9
WT56	402692.6	6045389.6
WT57	401031.1	6045906.4
WT58	399369.6	6046423.1
WT59	397708.1	6046939.9
WT60	396046.6	6047456.6
WT61	394385.2	6047973.3
WT62	392956.5	6048966.5
WT63	392878.2	6050704.7
WT64	392799.9	6052443.0
WT65	392721.6	6054181.2
WT66	392643.3	6055919.5
WT67	392565.0	6057657.7
WT68	392486.7	6059395.9

Name	Easting	Northing
WT69	392408.4	6061134.2
WT70	401834.3	6048617.5
WT71	406619.3	6058187.5

Table 9: DBS East large turbine (21MW) layout coordinates (EPSG:32631).

Name	Easting	Northing
WT1	423494.0	6046863.1
WT2	423587.5	6042380.3
WT3	425232.9	6046925.2
WT4	425762.5	6042380.3
WT5	426971.8	6046987.3
WT6	425762.5	6039987.8
WT7	428710.7	6047049.4
WT8	425762.5	6037595.3
WT9	430449.6	6047111.5
WT10	427937.5	6042380.3
WT11	432188.4	6047173.6
WT12	427937.5	6039987.8
WT13	433927.3	6047235.7
WT14	427937.5	6037595.3
WT15	434998.5	6045864.5
WT16	427937.5	6035202.8
WT17	435796.7	6044318.4
WT18	427937.5	6032810.3
WT19	436594.9	6042772.3
WT20	430112.5	6042380.3
WT21	437393.1	6041226.2
WT22	430112.5	6039987.8
WT23	438191.4	6039680.1
WT24	430112.5	6037595.3
WT25	438989.6	6038134.0
WT26	430112.5	6035202.8
WT27	439787.8	6036587.9
WT28	430112.5	6032810.3
WT29	440586.0	6035041.8
WT30	430112.5	6030417.8
WT31	441384.3	6033495.7
WT32	432287.5	6042380.3
WT33	442182.5	6031949.6
WT34	432287.5	6039987.8
WT35	442980.7	6030403.5
WT36	432287.5	6037595.3
WT37	442584.4	6028709.3
WT38	432287.5	6035202.8
WT39	440925.6	6028183.9
WT40	432287.5	6032810.3

Name	Easting	Northing
WT41	439266.9	6027658.4
WT42	432287.5	6030417.8
WT43	437608.1	6027133.0
WT44	434462.5	6039987.8
WT45	435949.3	6026607.6
WT46	434462.5	6037595.3
WT47	434290.6	6026082.2
WT48	434462.5	6035202.8
WT49	432631.8	6025556.8
WT50	434462.5	6032810.3
WT51	430973.1	6025031.4
WT52	434462.5	6030417.8
WT53	429314.3	6024505.9
WT54	436637.5	6035202.8
WT55	427944.7	6025579.2
WT56	436637.5	6032810.3
WT57	427189.5	6027146.7
WT58	436637.5	6030417.8
WT59	426434.3	6028714.3
WT60	425679.1	6030281.8
WT61	424923.9	6031849.4
WT62	424168.6	6033417.0
WT63	423413.4	6034984.5
WT64	422658.2	6036552.1
WT65	421903.0	6038119.7
WT66	421147.8	6039687.2
WT67	420209.0	6041152.2
WT68	420008.9	6042880.7
WT69	421154.8	6044190.1
WT70	422300.7	6045499.5
WT71	436637.5	6037595.3