



EIA: Supplementary Environmental Information

Sandy Knowe Wind Farm Extension

Appendix 2-1: Carbon Calculator (2023 Update)

Sandy Knowe Wind Farm Limited



October 2023



Contents

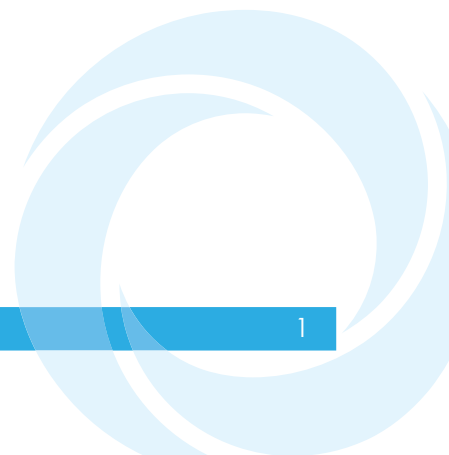
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This report is supported by the following Figures associated with this SEI:	
SEI Figure 3-3: Drain Blocking Proposals	
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Glossary of Terms

Term	Definition
The Applicant	Sandy Knowe Wind Farm Limited
The Agent	ERG Holding UK Limited
Environmental Advisors and Planning Consultants	Atmos Consulting Limited
Environmental Impact Assessment	Environmental Impact Assessment (EIA) is a means of carrying out, in a systematic way, an assessment of the likely significant environmental effects from a development.
Environmental Impact Assessment Regulations	The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (EIA Regulations)
Environmental Impact Assessment Report	A document reporting the findings of the EIA and produced in accordance with the EIA Regulations
The Proposed Development	The Sandy Knowe Wind Farm Extension
The Proposed Development Footprint	The area within which the Proposed Development will be located
The Proposed Development Site	The full application boundary including Sandy Knowe Wind Farm and Sandy Knowe Wind Farm Extension

List of Abbreviations

Abbreviation	Description
BEIS	Department for Business, Energy & Industrial Strategy
CO ₂	Carbon Dioxide
DUKES	Digest of UK Energy Statistics
ECU	Energy Consents Unit
EIA	Environmental Impact Assessment
NTS	Non-Technical Summary
SEI	Supplementary Environmental Information



Carbon Calculator Outputs

This Appendix presents the revised findings of the Carbon Calculations prepared for the Proposed Development and should be read in conjunction with SEI Chapter 2 Project Description Update.

As stated in SEI Chapter 2 the Applicant has both recalculated carbon calculator outputs for the EIA design of the 2022 Proposed Development and the 2023 SEI revisions to the Proposed Development by using an average load factor of the BEIS Digest of UK Energy Statistics (DUKES) (BEIS, 2023) for onshore wind generation from 2018-2022, 26.4%.

Revisions to the following the input data have also been made with the rationale explaining each revision stated in Table 2-1-2:

- Counterfactual emission factors:
 - Coal-red plant emission factor (t CO₂ MWh⁻¹);
 - Grid-mix emission factor (t CO₂ MWh⁻¹);
 - Fossil fuel-mix emission factor (t CO₂ MWh⁻¹);
- Access tracks:
 - Floating road: Length of access track (m);
 - Excavated road: Length of access track (m);
- Improvement of C sequestration at site by blocking drains, restoration of habitat, etc:
 - Area of degraded bog to be improved (ha);
 - Area of borrow pits to be restored (ha);
- Will you attempt to block all artificial ditches and facilitate rewetting?; and
- Will you manage areas to favour reintroduction of species?

The Scottish Government's Online Carbon Calculator v1.7.1 (updated in November 2022) was used to calculate the carbon cost and payback period of the Proposed Development.

The Carbon Calculator results of the SEI 2023 design are shown in Table 2-1-1 (Reference **GFB5-9F1O-THPY v7**).

The recalculated Carbon Calculator results using the capacity factor of 26.4% for the 2022 EIA design of the Proposed Development are presented in Table 1 (Reference **GFB5-9F1O-THPY v8**).

The changes in input data used to carry out the Carbon Calculator for both the SEI 2023 and EIA 2022 are presented in Table 2-1-2.

This data is presented with 'Expected' values – the best estimate of the anticipated value, based on the current understanding of the Proposed Development – along with 'minimum' and 'maximum' values to give a range of possible outputs, dependant on the variables within the model.

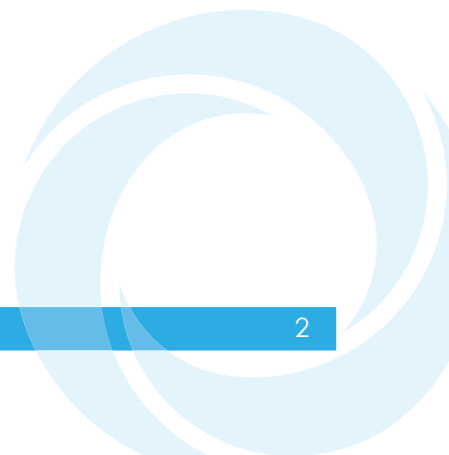


Table 2-1-1: Payback time and CO₂ emissions

	Design Iteration	Expected	Minimum	Maximum
1: Wind farm CO₂ Emission Saving over (tonnes CO₂ eq.):				
Coal Fired electricity Generation	SEI 2023	50,053	44,934	55,058
	EIA 2022	50,053	44,934	55,058
Grid mix of electricity generation	SEI 2023	9,660	8,672	10,626
	EIA 2022	9,660	8,672	10,626
Fossil fuel mix of electricity generation	SEI 2023	21,580	19,373	23,738
	EIA 2022	21,580	19,373	23,738
Energy output from windfarm over lifetime (40 years) (MWh)	SEI 2023	1,998,121	1,793,768	2,197,933
	EIA 2022	1,998,121	1,793,768	2,197,933
Total CO₂ losses due to wind farm (tCO₂ eq.)				
losses due to turbine life (e.g. manufacture, construction, decommissioning)	SEI 2023	20,932	20,932	20,932
	EIA 2022	20,932	20,932	20,932
Losses due to backup	SEI 2023	16,348	16,348	16,348
	EIA 2022	16,348	16,348	16,348
losses due to reduced carbon fixing potential	SEI 2023	592	169	3,299
	EIA 2022	638	184	3,511
losses from soil organic matter	SEI 2023	3,870	47	15,100
	EIA 2022	4,647	383	16,804
losses due to DOC & POC leaching	SEI 2023	694	16	7,453
	EIA 2022	802	23	8,140
losses due to felling forestry	SEI 2023	0	0	0
	EIA 2022	0	0	0
Total losses of Carbon dioxide	SEI 2023	42,436	37,512	63,132
	EIA 2022	43,366	37,870	65,735
Total CO₂ gain due to improvement of site (tCO₂ eq.)				
gains due to improvement of degraded bogs	SEI 2023	0	0	0
	EIA 2022	0	0	0
gains due to improvement of felled forestry	SEI 2023	0	0	0
	EIA 2022	0	0	0
gains due to restoration of peat from borrow pits	SEI 2023	430	0	483
	EIA 2022	382	0	429
gains due to removal of drainage from foundations and hardstandings	SEI 2023	0	0	0
	EIA 2022	0	0	0
Total gains	SEI 2023	430	0	483
	EIA 2022	382	0	429
Results: Carbon Payback Time				
Net emissions of carbon dioxide (t CO ₂ eq.)	SEI 2023	42,866	37,955	63,132
	EIA 2022	43,748	38,299	65,735
Coal Fired electricity Generation (years)	SEI 2023	0.9	0.7	1.4
	EIA 2022	0.9	0.7	1.5
Grid mix of electricity generation (years)	SEI 2023	4.4	3.6	7.3
	EIA 2022	4.5	3.6	7.6

	Design Iteration	Expected	Minimum	Maximum
Fossil fuel mix of electricity generation (years)	SEI 2023	2.0	1.6	3.3
	EIA 2022	2.0	1.6	3.4
Carbon Intensity (kgCO ₂ e/kWh)	SEI 2023	0.02145	0.01729	0.03519
	EIA 2022	0.02189	0.01743	0.03665

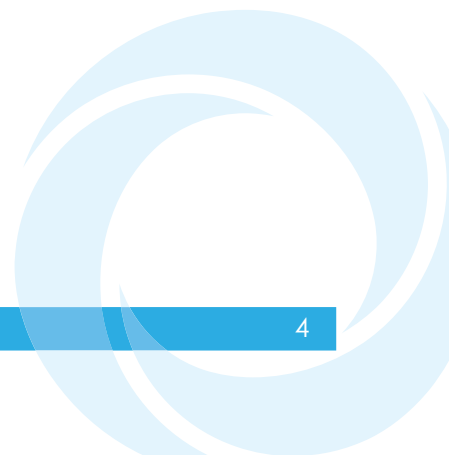


Table 2-1-2: Revised Inputs to the Scottish Government Carbon Calculator

Input data	Expected value		Minimum value		Maximum value		Source of Data and Rational for amendments
	2023 SEI	2022 EIA	2023 SEI	2022 EIA	2023 SEI	2022 EIA	
Performance							
Capacity factor	26.4	26.4	23.7	23.7	29.04	29.04	As set out in Digest of UK Energy Statistics (DUKES) produced by the Department for Energy Security & Net Zero (DESNZ) an average of the load factors for onshore wind generation from 2018-2022 has been used as the expected value (BEIS, 2023). The minimum and maximum values at +/- 10% of the expected value.
Counterfactual emission factors							
Coal-fired plant emission factor (t CO ₂ MWh ⁻¹)	1.002	1.002	1.002	1.002	1.002	1.002	Fixed. Automatically updated when using Carbon Calculator v1.7.0.
Grid-mix emission factor (t CO ₂ MWh ⁻¹)	0.19338	0.19338	0.19338	0.19338	0.19338	0.19338	Fixed. Automatically updated when using Carbon Calculator v1.7.0.
Fossil fuel-mix emission factor (t CO ₂ MWh ⁻¹)	0.432	0.432	0.432	0.432	0.432	0.432	Fixed. Automatically updated when using Carbon Calculator v1.7.0.
Access tracks							
Floating road: Length of access track (m)	600		540		660		See SEI Chapter 3 Revised PMP. +/- 10% provided for minimum and maximum value presented. No change was made to the EIA 2022 input values.
Excavated road: Length of access track (m)	2500		2250		2750		Approximately 2.5km of new excavated track is proposed. See SEI Chapter 2 Project Description Update. +/- 10% of values presented. No change was made to the EIA 2022 input values.
Improvement of C sequestration at site by blocking drains, restoration of habitat, etc							
Area of degraded bog to be improved (ha)	22.8		20.52		25.08		SEI Chapter 3 Revised PMP Section 3.4.3. No change was made to the EIA 2022 input values.
Area of borrow pits to be restored (ha)	1.985		1.985		1.985		No new borrow pits are proposed. Use of an existing borrow pit for the excavation of on-site aggregate to be used in the construction of the Proposed Development and for peat reinstatement. With additional working (for example, reopening of the northwest corner of the pit subsequent to material stripping), the maximum available area would be c. 19,850 m ² with a 2 m reinstatement depth and indicative accommodation space of c. 30,580 m ³ as detailed in SEI Chapter 4 Outline Borrow Pit

Input data	Expected value		Minimum value		Maximum value		Source of Data and Rational for amendments
							Restoration Plan. No change was made to the EIA 2022 input values.
Will you attempt to block all artificial ditches and facilitate rewetting?	Yes	Yes	Yes	Yes	Yes	Yes	Rewetting will take place in all the areas shown in SEI Figure 3-3 as detailed in SEI Chapter 3 Revised PMP. Both the EIA 2022 and SEI 2023 values have been amended to reflect the habitat management plan (2022 EIA, Volume 2 Technical Appendix 14-2 Outline Habitat Management Plan).
Will you manage areas to favour reintroduction of species?	Yes	Yes	Yes	Yes	Yes	Yes	Both the EIA 2022 and SEI 2023 values have been amended to reflect the habitat management plan (2022 EIA, Volume 2 Technical Appendix 14-2 Outline Habitat Management Plan).

References

BEIS (2023). Digest of United Kingdom Energy Statistics (DUKES) 2022. Available at: <https://www.gov.uk/government/statistics/renewable-sources-of-energy-chapter-6-digest-of-united-kingdom-energy-statistics-dukes> Load factors for renewable electricity generation. [Accessed on 20/10/2023]

