ESB Asset Development UK Limited

Chleansaid Wind Farm

Technical Appendix 16.1 – Carbon Calculator Input

662367

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RSK GENERAL NOTES

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Title: Chleansaid Wind Farm Environmental Impact Assessment Report, Technical Appendix 16.1 – Carbon Calculator Input

Client: ESB Asset Development UK Limited

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Table 16.1.1: Carbon Calculator Input

Input data	Expected value	Minimum value	Maximum value	Source of data
Windfarm Characteristics				
Dimensions				
No. of turbines	16	16	16	**Chapter 1: Introduction**
Duration of consent (years)	35	35	35	**Chapter 2: Proposed Development**
Performance				
Power rating of 1 turbine (MW)	6.0	6.0	6.0	**Chapter 2: Proposed Development**
Capacity factor	35	25	45	
Backup				
Fraction of output to backup (%)	5	5	5	Per Nayak et al (2008)
Additional emissions due to reduced thermal efficiency of the reserve generation (%)	10	10	10	Fixed
Total CO2 emission from turbine life (tCO2 MW^{-1}) (eg. manufacture, construction, decommissioning)	Calculate wrt installed capacity	Calculate wrt installed capacity	Calculate wrt installed capacity	Scottish Government Carbon Calculator
Characteristics of peatland before windfarm development				
Type of peatland	Acid bog	Acid bog	Acid bog	The calculator offers two options for this item: Fen or Acid Bog. Peatland present on this site is consistent with the Acid Bog option.
Average annual air temperature at site (°C)	7.65	6.885	8.415	Met Office Altnaharra weather station (2020).
Average depth of peat at site (m)	1.1	0.05	7.75	Chapter 10: Hydrology, hydrogeology, geology and soils
Content of dry peat (% by weight)	50.9	50.4	51.4	Chapter 10: Hydrology, hydrogeology, geology and soils
Average extent of drainage around drainage features at site (m)	0.75	0.5	1	Chapter 10: Hydrology, hydrogeology, geology and soils
Average water table depth at site (m)	0.1	0	0.3	Chapter 10: Hydrology, hydrogeology, geology and soils
Dry soil bulk density (g cm^{-3})	0.11	0.09	0.13	Chapter 10: Hydrology, hydrogeology, geology and soils
Characteristics of bog plants				
Time required for regeneration of bog plants after restoration (years)	3	3	10	**Chapter 8: Ecology**

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Input data	Expected value	Minimum value	Maximum value	Source of data
Carbon accumulation due to C fixation by bog plants in undrained peats (tC ha^{-1} yr^{-1})	0.25	0.225	0.275	**Chapter 8: Ecology**
Forestry Plantation Characteristics				
Area of forestry plantation to be felled (ha)	0	0	0	No trees to be felled
Average rate of carbon sequestration in timber (tC ha^{-1} yr^{-1})	N/A	N/A	N/A	N/A
Counterfactual emission factors				
Coal-fired plant emission factor (t CO2 MWh^{-1})	0.92	0.92	0.92	Scottish Government Carbon Calculator
Grid-mix emission factor (t CO2 MWh^{-1})	0.25358	0.25358	0.25358	Scottish Government Carbon Calculator
Fossil fuel-mix emission factor (t CO2 MWh^{-1})	0.45	0.45	0.45	Scottish Government Carbon Calculator
Borrow pits				
Number of borrow pits	2	2	2	**Chapter 2: Proposed Development**
Average length of pits (m)	425	382.5	467.5	**Technical Appendix 10:3: Borrow Pit Assessment**
Average width of pits (m)	151.5	136.35	166.65	**Technical Appendix 10:3: Borrow Pit Assessment**
Average depth of peat removed from pit (m)	0.6	0.1	1.2	From all survey locations within footprints
Foundations and hard-standing area associated with each turbine				
Average length of turbine foundations (m)	25	25	25	Infrastructure design and aggregate estimates
Average width of turbine foundations (m)	25	25	25	Infrastructure design and aggregate estimates
Average depth of peat removed from turbine foundations (m)	0.9	0.1	2.8	Infrastructure design and aggregate estimates
Average length of hard-standing (m)	77	77	77	Infrastructure design and aggregate estimates
Average width of hard-standing (m)	28	28	28	Infrastructure design and aggregate estimates
Average depth of peat removed from hard-standing (m)	0.7	0.1	2.8	Infrastructure design and aggregate estimates
Volume of concrete (m3)	9000	9000	9000	Infrastructure design and aggregate estimates
Access tracks				
Total length of access track (m)	17002	15889	18114.1	Infrastructure design and aggregate estimates

Input data	Expected value	Minimum value	Maximum value	Source of data
Existing track length (m)	5881	5881	5881	Infrastructure design and aggregate estimates
Length of access track that is floating road (m)	0	0	0	Infrastructure design and aggregate estimates
Length of access track that is excavated road (m)	5782.92	5204	6361.21	Infrastructure design and aggregate estimates
Excavated road width (m)	8.5	8	9	Infrastructure design and aggregate estimates
Average depth of peat excavated for road (m)	0.8	0.1	3	Infrastructure design and aggregate estimates
Length of access track that is rock filled road (m)	5338.08	4804	5871.89	
Rock filled road width (m)	8.5	8	9	
Rock filled road depth (m)	0.65	0.5	0.75	
Length of rock filled road that is drained (m)	5338.08	4804	5871.89	Infrastructure design and aggregate estimates
Average depth of drains associated with rock filled roads (m)	0.5	0.45	0.55	Infrastructure design and aggregate estimates
Cable trenches				
Length of any cable trench on peat that does not follow access tracks and is lined with a permeable medium (eg. sand) (m)	0	0	0	All cable routes follow access tracks
Average depth of peat cut for cable trenches (m)	0	0	0	All cable routes follow access tracks
Additional peat excavated (not already accounted for above)				
Volume of additional peat excavated (m^3)	2688	2419.2	2956.8	**Technical Appendix 10.2: Peat Management Plan**
Area of additional peat excavated (m^2)	7004	6303.6	7704.4	**Technical Appendix 10.2: Peat Management Plan**
Peat Landslide Hazard				
Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments	Negligible	Negligible	Negligible	Fixed
Improvement of C sequestration at site by blocking drains, restoration of habitat etc				
Improvement of degraded bog				
Area of degraded bog to be improved (ha)	78.7	70.83	86.57	**Chapter 8: Ecology and Biodiversity**

Input data	Expected value	Minimum value	Maximum value	Source of data
Water table depth in degraded bog before improvement (m)	0.3	0.2	0.5	**Chapter 10: Hydrology, hydrogeology, geology and soils**
Water table depth in degraded bog after improvement (m)	0.1	0	0.3	**Chapter 10: Hydrology, hydrogeology, geology and soils**
Time required for hydrology and habitat of bog to return to its previous state on improvement (years)	10	5	15	**Chapter 8: Ecology**
Period of time when effectiveness of the improvement in degraded bog can be guaranteed (years)	20	15	25	Duration of consent
Improvement of felled plantation land				
Area of felled plantation to be improved (ha)	N/A	N/A	N/A	No felling to be undertaken
Water table depth in felled area before improvement (m)	N/A	N/A	N/A	No felling to be undertaken
Water table depth in felled area after improvement (m)	N/A	N/A	N/A	No felling to be undertaken
Time required for hydrology and habitat of felled plantation to return to its previous state on improvement (years)	N/A	N/A	N/A	No felling to be undertaken
Period of time when effectiveness of the improvement in felled plantation can be guaranteed (years)	N/A	N/A	N/A	No felling to be undertaken
Restoration of peat removed from borrow pits				
Area of borrow pits to be restored (ha)	N/A	N/A	N/A	BPs won't be restored to peatland as the habitat is not suitable. Infrastructure design and aggregate estimates.
Depth of water table in borrow pit before restoration with respect to the restored surface (m)	N/A	N/A	N/A	BPs won't be restored to peatland as the habitat is not suitable. Infrastructure design and aggregate estimates.
Depth of water table in borrow pit after restoration with respect to the restored surface (m)	N/A	N/A	N/A	BPs won't be restored to peatland as the habitat is not suitable. Infrastructure design and aggregate estimates.
Time required for hydrology and habitat of borrow pit to return to its	N/A	N/A	N/A	BPs won't be restored to peatland as the habitat is not suitable.

Input data	Expected value	Minimum value	Maximum value	Source of data
previous state on restoration (years)				Infrastructure design and aggregate estimates.
Period of time when effectiveness of the restoration of peat removed from borrow pits can be guaranteed (years)	N/A	N/A	N/A	BPs won't be restored to peatland as the habitat is not suitable. Infrastructure design and aggregate estimates.
Early removal of drainage from foundations and hardstanding				
Water table depth around foundations and hard standing before restoration (m)	0.2	0.1	0.4	**Chapter 10: Hydrology, hydrogeology, geology and soils**
Water table depth around foundation and hard standing after restoration (m)	0.05	0	0.1	**Chapter 10: Hydrology, hydrogeology, geology and soils**
Time to completion of backfilling, removal of any surface drains, and full restoration of hydrology (years)	5	2	5	**Chapter 10: Hydrology, hydrogeology, geology and soils**
Early removal of drainage from foundations and hardstanding				
Will the hydrology of the site be restored on decommissioning?	Yes	Yes	Yes	**Chapter 8: Ecology**
Will you attempt to block any gullies that have formed due to the windfarm?	Yes	Yes	Yes	**Chapter 8: Ecology**
Will you attempt to block all artificial ditches and facilitate rewetting?	Yes	Yes	Yes	**Chapter 8: Ecology**
Will the habitat of the site be restored on decommissioning?	No	No	No	**Chapter 8: Ecology**
Will you control grazing on degraded areas?	No	No	No	**Chapter 8: Ecology**
Will you manage areas to favour reintroduction of species	No	No	No	**Chapter 8: Ecology**
Methodology				
Choice of methodology for calculating emission factors	Site specific (required for planning applications)			