Technical Appendix 16.1: Carbon Calculator Input

CARBON CALCULATOR TOOL v1.6.1				Ref: 275Y-QVSG-CD62 (v4)
Input Data	**Expected Value**	**Minimum Value**	**Maximum Value**	**Source of Data**
Windfarm Characteristics				
Dimensions				
No. of turbines	13	13	13	Chapter 1: Introduction
Duration of consent (years)	35	35	35	Chapter 1: Introduction
Performance				
Power rating of 1 turbine (MW)	6.0	6.0	6.0	Chapter 1: Introduction
Capacity factor	40.5	39	42	Chapter 1: Introduction
Backup				
Fraction of output to backup (%)	5	4.5	5.5	Standard value recommended by the carbon calculator (Assumes more than 20% of national electricity is generated by wind energy)
Additional emissions due to reduced thermal efficiency of the reserve generation (%)	10	10	10	Fixed
Total CO_2 emission from turbine life (tCO_2 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	Chapter 10: Geology, Hydrogeology, Hydrology and Peat
Average annual air temperature at site (°C)	7.93	4.02	11.84	Met office climate station - Redesdale Camp: https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-climate-averages/gcy6s0k6r
Average depth of peat at site (m)	0.22	0	2.05	Chapter 10: Geology, Hydrogeology, Hydrology and Peat
Content of dry peat (% by weight)	20.3	19	28.7	Chapter 10: Geology, Hydrogeology, Hydrology and Peat
Average extent of drainage around drainage features at site (m)	0.75	0.5	1	Chapter 10: Geology, Hydrogeology, Hydrology and Peat
Average water table depth at site (m)	0.8	0.5	1	Chapter 10: Geology, Hydrogeology, Hydrology and Peat

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Input Data	**Expected Value**	**Minimum Value**	**Maximum Value**	**Source of Data**
Dry soil bulk density (g cm^{-3})	0.3	0.25	0.3	Chapter 10: Geology, Hydrogeology, Hydrology and Peat
Characteristics of Bog Plants				
Time required for regeneration of bog plants after restoration (years)	3	3	10	Chapter 10: Geology, Hydrogeology, Hydrology and Peat
Carbon accumulation due to C fixation by bog plants in undrained peats (tC ha^{-1} yr^{-1})	0.25	0.225	0.275	Chapter 10: Geology, Hydrogeology, Hydrology and Peat
Forestry Plantation Characteristics				
Area of forestry plantation to be felled (ha)	81.96	73.76	90.16	Chapter 17: Forestry
Average rate of carbon sequestration in timber (tC ha^{-1} yr^{-1})	3.6	2.4	4.4	Default value
Counterfactual Emission Factors				
Coal-fired plant emission factor (t CO_2 MWh^{-1})	0.92	0.92	0.92	Scottish Government Carbon Calculator
Grid-mix emission factor (t CO_2 MWh^{-1})	0.25358	0.25358	0.25358	Scottish Government Carbon Calculator
Fossil fuel-mix emission factor (t CO_2 MWh^{-1})	0.45	0.45	0.45	Scottish Government Carbon Calculator
Borrow Pits				
Number of borrow pits	3	3	3	Chapter 10: Geology, Hydrogeology, Hydrology and Peat
Average length of pits (m)	178	175	185	Chapter 10: Geology, Hydrogeology, Hydrology and Peat
Average width of pits (m)	107	104	114	Chapter 10: Geology, Hydrogeology, Hydrology and Peat
Average depth of peat removed from pit (m)	0.25	0	0.4	No peat present at any BP site
Foundations and Hard-Standing Area Associated with Each Turbine				
Average length of turbine foundations (m)	25	22.5	27.5	WTG foundations of up to 25m diameter (circular or octagonal)
Average width of turbine foundations (m)	25	22.5	27.5	WTG foundations of up to 25m diameter (circular or octagonal)

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Input Data	**Expected Value**	**Minimum Value**	**Maximum Value**	**Source of Data**
Average depth of peat removed from turbine foundations (m)	0.22	0	0.51	Chapter 10: Geology, Hydrogeology, Hydrology and Peat
Average length of hard-standing (m)	77	69.3	84.7	Main Hardstanding area including backfill around turbine and excluding road adjacent to hardstanding is 28m x 77m=2156m^2 (Infrastructure design and aggregate estimates)
Average width of hard-standing (m)	28	25.2	30.8	Main Hardstanding area including backfill around turbine and excluding road adjacent to hardstanding is 28m x 77m=2156m^2 (Infrastructure design and aggregate estimates)
Average depth of peat removed from hard-standing (m)	0.24	0	0.64	Chapter 10: Geology, Hydrogeology, Hydrology and Peat
Volume of concrete (m^3)	9,016	8,114	9,917	Infrastructure design and aggregate estimates
Access Tracks				
Total length of access track (m)	14,909	13418.8	16400.8	Infrastructure design and aggregate estimates
Existing track length (m)	11,012	9,910.9	12,113.4	Infrastructure design and aggregate estimates
Length of access track that is floating road (m)	0	0	0	Infrastructure design and aggregate estimates
Width of access track that is floating road (m)	5	5	5	Infrastructure design and aggregate estimates
Length of access track that is excavated road (m)	0	0	0	Infrastructure design and aggregate estimates
Excavated road width (m)	7.5	5.5	9.5	Infrastructure design and aggregate estimates
Average depth of peat excavated for road (m)	0.22	0	0.9	Infrastructure design and aggregate estimates
Length of access track that is rock filled road (m)	3,897	3,507.9	4,287.4	Infrastructure design and aggregate estimates
Rock filled road width (m)	7.5	5.5	9.5	Infrastructure design and aggregate estimates
Rock filled road depth (m)	0.65	0.5	0.75	Infrastructure design and aggregate estimates

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Input Data	**Expected Value**	**Minimum Value**	**Maximum Value**	**Source of Data**
Length of rock filled road that is drained (m)	3,897	3,507.9	4,287.4	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 (e.g., sand) (m)	0	0	0	Infrastructure design and aggregate estimates
Average depth of peat cut for cable trenches (m)	0	0	0	Chapter 10: Geology, Hydrogeology, Hydrology and Peat
Additional Peat Excavated (not already accounted for above)				
Volume of additional peat excavated (m^3)	0	0	0	Chapter 10: Geology, Hydrogeology, Hydrology and Peat
Area of additional peat excavated (m^2)	0	0	0	Chapter 10: Geology, Hydrogeology, Hydrology and Peat
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)	0	0	0	N/A - there are no suitable areas of degraded bog to reinstate, as there's so little peat on the site
Water table depth in degraded bog before improvement (m)	0	0	0	N/A - there are no suitable areas of degraded bog to reinstate, as there's so little peat on the site
Water table depth in degraded bog	0	0	0	N/A - there are no suitable areas of degraded bog to reinstate, as there's so little peat on the site

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Input Data	**Expected Value**	**Minimum Value**	**Maximum Value**	**Source of Data**
after improvement (m)				
Time required for hydrology and habitat of bog to return to its previous state on improvement (years)	2	2	35	Chapter 10: Geology, Hydrogeology, Hydrology and Peat
Period of time when effectiveness of the improvement in degraded bog can be guaranteed (years)	2	2	35	Chapter 10: Geology, Hydrogeology, Hydrology and Peat
Improvement of Felled Plantation Land				
Area of felled plantation to be improved (ha)	47.4	40.87	53.93	Chapter 17: Forestry
Water table depth in felled area before improvement (m)	0.8	0.5	1	Chapter 10: Geology, Hydrogeology, Hydrology and Peat
Water table depth in felled area after improvement (m)	0.79	0.49	0.9	Chapter 10: Geology, Hydrogeology, Hydrology and Peat
Time required for hydrology and habitat of felled plantation to return to its previous state on improvement (years)	8	5	12	Chapter 10: Geology, Hydrogeology, Hydrology and Peat
Period of time when effectiveness of the improvement in felled plantation can be guaranteed (years)	22	15	27	Chapter 10: Geology, Hydrogeology, Hydrology and Peat
Restoration of Peat Removed from Borrow Pits				
Area of borrow pits to be restored (ha)	5.8	5.8	5.8	Chapter 10: Geology, Hydrogeology, Hydrology and Peat

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Input Data	**Expected Value**	**Minimum Value**	**Maximum Value**	**Source of Data**
Depth of water table in borrow pit before restoration with respect to the restored surface (m)	1.2	0.8	2	Chapter 10: Geology, Hydrogeology, Hydrology and Peat
Depth of water table in borrow pit after restoration with respect to the restored surface (m)	0.8	0.5	1	Chapter 10: Geology, Hydrogeology, Hydrology and Peat
Time required for hydrology and habitat of borrow pit to return to its previous state on restoration (years)	10	5	15	Chapter 10: Geology, Hydrogeology, Hydrology and Peat
Period of time when effectiveness of the restoration of peat removed from borrow pits can be guaranteed (years)	20	15	25	Chapter 10: Geology, Hydrogeology, Hydrology and Peat
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: Geology, Hydrogeology, Hydrology and Peat
Water table depth around foundation and hard standing after restoration (m)	0.05	0	0.1	Chapter 10: Geology, Hydrogeology, Hydrology and Peat
Time to completion of backfilling, removal of any surface drains, and full restoration of hydrology (years)	5	2	5	Chapter 10: Geology, Hydrogeology, Hydrology and Peat
Early Removal of Drainage from Foundations and Hardstanding				
Will you attempt to block any gullies that	Yes	Yes	Yes	

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have formed due to the windfarm?				
Will you attempt to block all artificial ditches and facilitate rewetting?	No	No	No	
Will you control grazing on degraded areas?	No	No	No	
Will you manage areas to favour reintroduction of species	No	No	No	
Methodology				
Choice of methodology for calculating emission factors	Site specific (required for planning applications)			