Environmental Impact Assessment Report

Beinneun 2 Wind Farm

Volume 3

TA A10.1: Carbon Calculator Inputs

Document prepared by Envams Ltd for Beinneun 2 Ltd

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CARBON CALCULATOR INPUTS

Table 1: Wind Farm Characteristics

Input Data	Expected Value	Minimum Value	Maximum Value	Source of data
Dimensions				
No. of turbines	19	19	19	Expected: Minimum: Maximum:
Duration of consent (years)	40	40	40	Expected: Minimum: Maximum:
Performance				
Power rating of turbines (turbine capacity) (MW)	7.2	5.5	7.2	Expected: Manufacturer, maximum (design) value for the N173 turbine Minimum: Minimum value for a N163 turbine Maximum: Manufacturer, maximum (design) value for the N173 turbine
Capacity factor	32.0	28.0	36.0	Expected: Conservative estimation Minimum: Expected minus 4% Maximum: Expected plus 4%
Backup				
Extra capacity required for backup (%)	5	5	5	Calculating Potential Carbon Losses & Savings from Wind Farms on Scottish Peatlands, Technical Note, Version 2.10.0, Para 19.
Additional emissions due to reduced thermal efficiency of the reserve generation (%)	10	10	10	Fixed
Carbon dioxide emissions from turbine life - (eg. manufacture, construction, decommissioning)	Calculate wrt installed capacity	Calculate wrt installed capacity	Calculate wrt installed capacity	

Table 2: Characteristics of Peatland Before Wind Farm Development

Input Data	Expected Value	Minimum Value	Maximum Value	Source of data
Type of peatland	Acid Bog	Acid Bog	Acid Bog	Note - there is no bog habitat at the site.
Average annual air temperature at site (oC)	8.72	5.24	12.21	Taken from nearest met office weather station (Fort Augustus) 1991-2020
Average depth of peat at site (m)	0.59	0.29	1.18	Based on 1708 peat probes undertaken within the current site boundary, with a median of 0.40m bgl.
C Content of dry peat (% by weight)	55	49	62	Default value: An estimate of the range of %C in peat of between 49% and 62% is provided by Birnie et al. (1991).
Average extent of drainage around drainage features at site (m)	10.00	5.00	50.00	Generic precautionary values have been entered into the carbon calculator as follows: expected = 10m; minimum = 5m; and maximum = 50m as per Windfarm Carbon Calculator Web Tool User

Input Data	Expected Value	Minimum Value	Maximum Value	Source of data
				Guidance (SEPA, n.d)
Average water table depth at site (m)	0.30	0.10	0.50	The Carbon Calculator notes that water table depth should be measured on site. However, where site-specific values are not available, for degraded peat, reasonable estimated minimum, expected and maximum values are: 0.1 m, 0.3 m and 0.5 m, respectively.
Dry soil bulk density (g cm-3)	0.13	0.07	0.29	Scottish generic values for peat have been used: expected = 0.132 g/cm3; minimum = 0.072 g/cm3; and maximum = 0.293 g/cm3.

Table 3: Characteristics of Bog Plants

Input Data	Expected Value	Minimum Value	Maximum Value	Source of data
Time required for regeneration of bog plants after restoration (years)	10	5	15	Generic assumptions: "The physical and hydrological restoration of the site post construction, even if no wider site improvements and restoration are undertaken, should allow the vegetation to recover more rapidly than within 15 years. SEPA (n.d) Windfarm Carbon Calculator Web Tool User Guidance
Carbon accumulation due to C fixation by bog plants in undrained peats (tC ha-1 yr-1)	0.25	0.12	0.31	Carbon Calculator default value: Apparent C accumulation rate in peatland is 0.12 to 0.31 tC ha-1 yr-1 (Turunen et al., 2001; Botch et al., 1995). The SNH guidance uses a value of 0.25 tC ha-1 yr-1 .

Table 4: Forestry Plantation Characteristics

Input Data	Expected Value	Minimum Value	Maximum Value	Source of data
Method used to calculate CO2 loss from forest felling	Enter Simple Data	Enter Simple Data	Enter Simple Data	
Area of forestry plantation to be felled (ha)	0	0	0	No tree felling is proposed
Average rate of carbon sequestration in timber (tC ha-1 yr-1)	13.20	11.80	14.50	Values of 13.2 , 11.8, 14.5 for expected, minimum and maximum respectively taken from "Calculating potential carbon losses and savings from wind farms on Scottish peatlands Technical Note – Version 2.10.0"

Table 5: Counterfactual Emission Factors

Input Data	Expected Value	Minimum Value	Maximum Value	Source of data
Coal-fired plant emission factor (t CO2 MWh-1)	1.046	1.046	1.046	DUKES 2024, 5.14 data for 2023
Grid-mix emission factor (t CO2 MWh-1)	0.171	0.171	0.171	DUKES 2024, 5.14 data for 2023
Fossil fuel-mix emission factor (t CO2 MWh-1)	0.437	0.437	0.437	DUKES 2024, 5.14 data for 2023

Table 6: Borrow Pits

Input Data	Expected Value	Minimum Value	Maximum Value	Source of data
Number of borrow pits	4	4	4	This has assumed the worst case in that all potential borrow pit locations will be used to the full extent as covered in the borrow pit search locations shown in Figure 4.1.
Average length of pits (m)	128.9	128.9	128.9	
Average width of pits (m)	65.18	65.18	65.18	
Average depth of peat removed from pit (m)	0	0	0	Areas chosen for rock exposure, therefore anticipated no peat to be present here

Table 7: Foundations and Hardstanding Area Associated With Each Turbine

Input Data	Expected Value	Minimum Value	Maximum Value	Source of data
Method used to calculate CO_2 loss from foundations and hard-standing	Enter Detailed Information	Enter Detailed Information	Enter Detailed Information	
Average depth of peat removed from turbine foundations (m)	0.48	0.48	0.48	Site surveys - analysis of peat probing data. Turbine hardstands and foundations treated together.
Average depth of peat removed from hard-standing (m)	0.48	0.48	0.48	Site surveys - analysis of peat probing data. Turbine hardstands and foundations treated together.

Table 8: Access Tracks

Input Data	Expected Value	Minimum Value	Maximum Value	Source of data
Total length of access track (m)	17,500	17,500	17,500	Measured in GIS
Existing track length (m)	0	0	0	No tracks currently on site would be re-used
Length of access track that is floating road (m)	3,600	3,600	3,600	
Floating road width (m)	5	5	5	

Input Data	Expected Value	Minimum Value	Maximum Value	Source of data
Floating road depth (m)	0.00	0.00	0.00	
Length of floating road that is drained (m)	3,600	3,600	3,600	Worst-case assumption used
Average depth of drains associated with floating roads (m)	0.50	0.50	0.50	To be confirmed by detailed design. Assumption is that maximum extent is no greater than the base of the maximum peat along the road; i.e., an average of 0.50m
Length of access track that is excavated road (m)	4,900	4,900	4,900	
Excavated road width (m)	5	5	5	
Average depth of peat excavated for road (m)	0.44	0.44	0.44	The average depth of the peat excavated for an excavated road (cut access track) will be 0.44 m of anticipated overburden. The median is, however, 0.30 m of peaty soils
Length of access track that is rock filled road (m)	9,000	9,000	9,000	Shallow or no peat
Rock filled road width (m)	5	5	5	
Rock filled road depth (m)	0.94	0.94	0.94	The average depth was recorded to be 0.94m of peat, however, the median recorded 0.60m of peat
Length of rock filled road that is drained (m)	9,000	9,000	9,000	Worst-case assumption used
Average depth of drains associated with rock filled roads (m)	0.50	0.50	0.50	To be confirmed by detailed design. Assumption is that maximum extent is no greater than the base of the maximum peat along the road; i.e., an average of 0.50m

Table 9: Cable Trenches

Input Data	Expected Value	Minimum Value	Maximum Value	Source of data
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	All cables are expected to follow the tracks
Average depth of peat cut for cable trenches (m)	0.61	0.61	0.61	An average depth of 0.61m was recorded, but a median of 0.30m.

Table 10: Additional Peat Excavated (Not Already Accounted for Above)

Input Data	Expected Value	Minimum Value	Maximum Value	Source of data
Volume of additional peat excavated (m^3)	11,120	11,120	11,120	Average peat depth at each of the BESS, Substation, and construction compound was 0.4m in all probing - thus the min and max are the same as the average.
Area of additional peat excavated (m^2)	27,800	27,800	27,800	Substation (100x100m), BESS (100x100m) and construction compound (130 x 60m)

Table 11: Peat Landslide Hazard

Input Data	Expected Value	Minimum Value	Maximum Value	Source of data
Weblink: Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments	Negligible	Negligible	Negligible	As per the EIA Report, TA A12.2, Peat Landslide Hazard and Risk Assessment, mitigation of any material peat landslide risk is proposed, and hence, as per guidance on the Calculator spreadsheet, losses can be assumed to be negligible.

Table 12: Improvement of C sequestration at site by blocking drains, restoration of habitat etc.

Input Data	Expected Value	Minimum Value	Maximum Value	Source of data
Improvement of degraded bog				
Area of degraded bog to be improved (ha)	0	0	0	As there is uncertainty in this at this stage (subject to final HMP, post-consent), a worst case scenario of 0 ha has been assumed
Water table depth in degraded bog before improvement (m)	0.30	0.10	0.50	The Carbon Calculator notes that water table depth should be measured on site. However, where site-specific values are not available, for degraded peat, reasonable estimated minimum, expected and maximum values are: 0.1 m, 0.3 m and 0.5 m, respectively.
Water table depth in degraded bog after improvement (m)	0.10	0.05	0.30	The Carbon Calculator notes that water table depth should be measured on site. However, where site-specific values are not available, for intact peat, reasonable estimated minimum, expected and maximum values are: 0.05 m, 0.1 m and 0.3 m, respectively.
Time required for hydrology and habitat of bog to return to its previous state on improvement (years)	15	5	30	Carbon Calculator requires that a value between 2 and 30 is input. Values of 5, 15 and 30 used for min, max and expected to show worst case scenario
Period of time when effectiveness of the improvement in degraded bog can be guaranteed years)	30	30	30	

Input Data	Expected Value	Minimum Value	Maximum Value	Source of data
Improvement of felled plantation land				
Area of felled plantation to be improved (ha)	0	0	0	No felling is proposed.
Water table depth in felled area before improvement (m)	0.00	0.00	0.00	
Water table depth in felled area after improvement (m)	0	0	0	
Time required for hydrology and habitat of felled plantation to return to its previous state on improvement (years)	0	0	0	
Period of time when effectiveness of the improvement in felled plantation can be guaranteed (years)	0.00	0.00	0.00	
Restoration of peat removed from borrow pits				
Area of borrow pits to be restored (ha)	3.326	3.326	3.326	The full area
Depth of water table in borrow pit before restoration with respect to the restored surface (m)	0.10	0.10	0.10	Assumed value
Depth of water table in borrow pit after restoration with respect to the restored surface (m)	0.09	0.09	0.09	Assumed value
Time required for hydrology and habitat of borrow pit to return to its previous state on restoration (years)	10	10	10	
Period of time when effectiveness of the restoration of peat removed from borrow pits can be	30	30	30	

Input Data	Expected Value	Minimum Value	Maximum Value	Source of data
guaranteed (years)				
Early removal of drainage from foundations and hardstanding	0.0	0.0	0.0	
Water table depth around foundations and hardstanding before restoration (m)	0.00	0.00	0.00	N/A no early removal
Water table depth around foundations and hardstanding after restoration (m)	0.00	0.00	0.00	N/A no early removal
Time to completion of backfilling, removal of any surface drains, and full restoration of the hydrology (years)	0.00	0.00	0.00	N/A no early removal

Table 13: Restoration of Site After Decommissioning

Input Data	Expected Value	Minimum Value	Maximum Value	Source of data
Will you attempt to block any gullies that have formed due to the windfarm?	Yes	Yes	Yes	Normal site restoration likely to be required as part of a DEMP.
Will you attempt to block all artificial ditches and facilitate rewetting?	No	No	No	Worst-case assumption
Will you control grazing on degraded areas?	No	No	No	
Will you manage areas to favour reintroduction of species	No	No	No	

Table 14: Methodology

Input Data	Expected Value	Minimum Value	Maximum Value	Source of data
Choice of methodology for calculating emission factors	Site specific (required for planning applications)			