

Appendix 14.1 Carbon Calculator Inputs

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Carbon Calculator v1.6.1

Bhlaraidh Wind Farm Extension Location: 57.223023 -4.668792

SSE Renewables

Core input data

Input data	Expected value	Minimum value	Maximum value	Source of data
Windfarm characteristics				
Dimensions				
No. of turbines	18	18	18	EIA Chapter 2
Duration of consent (years)	50	50	50	EIA Chapter 2
Performance				
Power rating of 1 turbine (MW)	5.6	5.5	6.6	Candidate turbine model
Capacity factor	26.62	23.96	29.28	BEIS Onshore Wind Statistic (2020)
Backup				
Fraction of output to backup (%)	5	5	5	Standard Value
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	
Characteristics of peatland before windfarm development				
Type of peatland	Acid bog	Acid bog	Acid bog	Assumed type based on Chapter 5 Ecology
Average annual air temperature at site (°C)	8.5	5	11.9	Fort Augustus Met Office Climate Station Annual Data
Average depth of peat at site (m)	0.22	0	3.3	Average peat depth from site survey data
C Content of dry peat (% by weight)	55.5	49	62	Default assumed value
Average extent of drainage around drainage features at site (m)	10	9	11	Assumed standard value
Average water table depth at site (m)	0.2	0.05	0.3	Site data from Operational Development application.
Dry soil bulk density (g cm ⁻³)	0.25	0.2	0.3	Default assumed value
Characteristics of bog plants				
Time required for regeneration of bog plants after restoration (years)	10	5	15	Standard value
Carbon accumulation due to C fixation by bog plants in	0.25	0.12	0.31	NatureScot guidance value

Input data	Expected value	Minimum value	Maximum value	Source of data
undrained peats (tC ha ⁻¹ yr ⁻¹)				
Forestry Plantation Characteristics				
Area of forestry plantation to be felled (ha)	0	0	0	N/A
Average rate of carbon sequestration in timber (tC ha ⁻¹ yr ⁻¹)	3.6	3.55	3.65	NatureScot guidance value
Counterfactual emission factors				
Coal-fired plant emission factor (t CO ₂ MWh ⁻¹)	0.92	0.92	0.92	
Grid-mix emission factor (t CO ₂ MWh ⁻¹)	0.25358	0.25358	0.25358	
Fossil fuel-mix emission factor (t CO ₂ MWh ⁻¹)	0.45	0.45	0.45	
Borrow pits				
Number of borrow pits	6	5	8	EIA Chapter 2 - 8 proposed search areas, however expected to only require 6
Average length of pits (m)	147.5	132.75	162.25	Borrow Pit Assessment Report - average length of borrow pits
Average width of pits (m)	68.7	61.83	75.57	Borrow Pit Assessment Report - average width of borrow pits
Average depth of peat removed from pit (m)	0.27	0.243	0.297	Peat Management Plan - average depth of peat at borrow pits
Foundations and hard-standing area associated with each turbine				
Average length of turbine foundations (m)	0	0	0	
Average width of turbine foundations (m)	0	0	0	
Average depth of peat removed from turbine foundations(m)	0	0	0	
Average length of hard-standing (m)	0	0	0	
Average width of hard-standing (m)	0	0	0	
Average depth of peat removed from hard-standing (m)	0	0	0	
Volume of concrete used in construction of the ENTIRE windfarm				
Volume of concrete (m ³)	0	0	0	
Access tracks				
Total length of access track (m)	23900	22880	24920	Sum of existing road and excavated road.
Existing track length (m)	13700	13700	13700	EIAR Chapter 2

Input data	Expected value	Minimum value	Maximum value	Source of data
Length of access track that is floating road (m)	0	0	0	N/A no floating road proposed
Floating road width (m)	5	5	5	N/A (value cannot be 0)
Floating road depth (m)	0	0	0	N/A
Length of floating road that is drained (m)	0	0	0	N/A
Average depth of drains associated with floating roads (m)	0	0	0	N/A
Length of access track that is excavated road (m)	10200	9180	11220	EIAR Chapter 2
Excavated road width (m)	5.5	5	6	EIAR Chapter 2
Average depth of peat excavated for road (m)	0.82	0.738	0.902	Peat Management Plan - average peat depth based on peat volumes
Length of access track that is rock filled road (m)	0	0	0	N/A
Rock filled road width (m)	5	5	5	N/A - value cannot be 0
Rock filled road depth (m)	0	0	0	N/A
Length of rock filled road that is drained (m)	0	0	0	N/A
Average depth of drains associated with rock filled roads (m)	0	0	0	N/A
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)	1143	0	1143	Length of cross country cables
Average depth of peat cut for cable trenches (m)	0	0	0	N/A temporary disturbance only
Additional peat excavated (not already accounted for above)				
Volume of additional peat excavated (m ³)	77800	70092	85668	Peat Management Plan - hardstandings, substation, batching plant and compounds etc.
Area of additional peat excavated (m ²)	77785	70006.5	85563.5	Proposed Development detailed dimensions of hardstandings, substation, batching plant and compounds.
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				

Input data	Expected value	Minimum value	Maximum value	Source of data
Area of degraded bog to be improved (ha)	6.93	6.93	6.93	EIAR Chapter 5 Ecology
Water table depth in degraded bog before improvement (m)	0.1	0.1	0.1	Assumed value
Water table depth in degraded bog after improvement (m)	0.09	0.085	0.095	Assumed value
Time required for hydrology and habitat of bog to return to its previous state on improvement (years)	10	5	15	Standard value
Period of time when effectiveness of the improvement in degraded bog can be guaranteed (years)	40	40	40	Proposed Development lifespan less time required to return to natural state (50-10 years)
Improvement of felled plantation land				
Area of felled plantation to be improved (ha)	0	0	0	N/A
Water table depth in felled area before improvement (m)	0	0	0	N/A
Water table depth in felled area after improvement (m)	0	0	0	N/A
Time required for hydrology and habitat of felled plantation to return to its previous state on improvement (years)	10	10	10	N/A -value cannot be 0
Period of time when effectiveness of the improvement in felled plantation can be guaranteed (years)	40	40	40	N/A - value cannot be 0
Restoration of peat removed from borrow pits				
Area of borrow pits to be restored (ha)	6	5.4	6	Borrow Pit Assessment Report - total area of borrow pits
Depth of water table in borrow pit before restoration with respect to the restored surface (m)	0.1	0.1	0.1	Assumed value
Depth of water table in borrow pit after restoration with respect to the restored surface (m)	0.09	0.085	0.095	Assumed value
Time required for hydrology and habitat of borrow pit to return to its previous state on restoration (years)	10	5	15	Standard value
Period of time when effectiveness of the restoration of peat removed from borrow pits can be guaranteed (years)	40	40	40	Proposed Development lifespan less time required to return to natural state (50-10 years)

Input data	Expected value	Minimum value	Maximum value	Source of data
Early removal of drainage from foundations and hardstanding				
Water table depth around foundations and hardstanding before restoration (m)	0	0	0	N/A no early removal
Water table depth around foundations and hardstanding after restoration (m)	0	0	0	N/A
Time to completion of backfilling, removal of any surface drains, and full restoration of the hydrology (years)	2	2	2	N/A (value cannot be 0)
Restoration of site after decommissioning				
Will the hydrology of the site be restored on decommissioning?	No	No	No	
Will you attempt to block any gullies that have formed due to the windfarm?	No	No	No	No commitment to this
Will you attempt to block all artificial ditches and facilitate rewetting?	Yes	Yes	Yes	Habitat Management Plan
Will the habitat of the site be restored on decommissioning?	Yes	Yes	Yes	
Will you control grazing on degraded areas?	Yes	Yes	Yes	Habitat Management Plan
Will you manage areas to favour reintroduction of species	Yes	Yes	Yes	Habitat Management Plan
Methodology				
Choice of methodology for calculating emission factors	IPCC default			

Forestry input data

N/A

Construction input data

Input data	Expected value	Minimum value	Maximum value	Source of data
Bhlaraidh Wind Farm Extension				
Number of turbines in this area	18	18	18	EIA Chapter 2
Turbine foundations				
Depth of hole dug when constructing foundations (m)	0.25	0.225	0.275	Peat Management Plan - average peat depth at turbines

Input data	Expected value	Minimum value	Maximum value	Source of data
Bhlaraidh Wind Farm Extension				
Aproximate geometric shape of whole dug when constructing foundations	Circular	Circular	Circular	EIA Chapter 2
Diameter at bottom	25	25	25	
Diameter at surface	25	25	25	
Hardstanding				
Depth of hole dug when constructing hardstanding (m)	0.5	0.45	0.55	Peat Management Plan - peat depth at hardstandings
Aproximate geometric shape of whole dug when constructing hardstanding	Rectangular	Rectangular	Rectangular	Generic geometric shape for calculation. dimensions based on area of 1875m ²
Length at surface	50	50	50	
Width at surface	37.5	37.5	37.5	
Length at bottom	50	50	50	
Width at bottom	37.5	37.5	37.5	
Piling				
Is piling used?	No	No	No	Assumed
Volume of Concrete				
Volume of concrete used (m ³) in the entire area	12474	11226.6	13721.4	detailed project calculations based on 18 turbines

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