Technical Appendix 14.1 – Carbon Calculator Inputs

Giants Burn Wind Farm

Client: Statkraft
Reference: C5826-1442
Version 1.0

July 2025

14.1 Carbon Calculator Inputs

This assessment uses the Version 2.14.1 spreadsheet carbon calculator which mirrors the Scottish Government's Carbon Calculator Tool (version 1.8.1), which is based upon the work of Nayak et al. (2008, 2010) and Smith et al. (2011). It adopts a lifecycle methodology approach to estimate the Greenhouse House Gas emissions and savings associated with onshore wind farms situated on Scottish peatlands.

Different data sources have been used to collect the data required for the Scottish Government Carbon Calculator tool. Wind farm and site-specific data has been utilised wherever appropriate however where data was not available, default data or estimates have been applied. Inputs and their sources are noted in the below table. Where minimum and maximum values cannot be estimated a range of +/- 10% has been applied to some categories.

Table 14.1 – Carbon Calculator Inputs

Input data	Expected value	Minimum value	Maximum value	Source of data
Windfarm characteristics				
Dimensions				
No. of turbines	7	7	7	EIA Report Chapter 3: Description of Proposed Development
Duration of consent (years)	50	50	50	EIA Report Chapter 3: Description of Proposed Development
Performance				
Power rating of 1 turbine (MW)	7.2	7.2	7.2	EIA Report Chapter 3: Description of Proposed Development
Capacity factor	40.8	36.7	44.8	Estimation based on Statkraft Wind Yield assessments.
Backup				
Fraction of output to backup (%)	5	5	5	Scottish Government Carbon Calculator Guidance
Additional emissions due to reduced thermal efficiency of the reserve generation (%)	10	10	10	Fixed
Total CO_2 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

Input data	Expected value	Minimum value	Maximum value	Source of data
Characteristics of peatland before windfarm development				
Type of peatland	Acid bog	Acid bog	Acid bog	**Appendix 8.1 – Outline Peat Management Plan**
Average annual air temperature at site (°C)	9.65	6.54	12.75	Met Office – Bute: Rothesay UK Climate Station (1991-2020). Location-specific long-term averages
Average depth of peat at site (m)	1.58	0	5.5	Raw data grom peat probing datasets. **Appendix 8.1 – Outline Peat Management Plan**
C Content of dry peat (% by weight)	55	49	62	Scottish Government Carbon Calculator Guidance
Average extent of drainage around drainage features at site (m)	10	5	15	Smith et al (2011) Worst case Scenario
Average water table depth at site (m)	0.3	0.1	0.5	Guidance from 'Calculating Potential Carbon Losses & Savings from Wind Farms on Scottish Peatlands'
Dry soil bulk density (g cm^{-3})	0.132	0.072	0.293	Assumed decomposed peat value, National Soil Inventory of Scotland
Characteristics of bog plants				
Time required for regeneration of bog plants after restoration (years)	15	10	20	Site specific values are not available. Conservative estimates have been used. Professional Judgement.
Carbon accumulation due to C fixation by bog plants in undrained peats (tC ha^{-1} yr^{-1})	0.25	0.12	0.31	NatureScot recommended value, Calculating carbon savings from wind farms on Scottish peat lands: a new approach.
Forestry Plantation Characteristics				
Area of forestry plantation to be felled (ha)	3.85	3.47	4.23	**EIA Report Chapter 12 – Forestry**
Average rate of carbon sequestration in timber (tC ha^{-1} yr^{-1})	3.6	3.2	4.0	NatureScot recommended value for Sikta category - Calculating carbon savings from wind farms on Scottish peat lands: a new approach.

Input data	Expected value	Minimum value	Maximum value	Source of data
Counterfactual emission factors				
Coal-fired plant emission factor (t CO2 MWh^{-1})	0.945	0.945	0.945	Fixed
Grid-mix emission factor (t CO2 MWh^{-1})	0.207	0.207	0.207	Fixed[1]
Fossil fuel-mix emission factor (t CO2 MWh^{-1})	0.424	0.424	0.424	Fixed
Borrow pits				
Number of borrow pits	0	0	0	N/A - **EIA Report Chapter 3: Description of Proposed Development,** no borrow pits proposed.
Average length of pits (m)	0	0	0	N/A
Average width of pits (m)	0	0	0	N/A
Average depth of peat removed from pit (m)	0	0	0	N/A
Access tracks				
Total length of access track (m)	10410	9369	11451	**EIA Report Chapter 3: Description of Proposed Development**
Existing track length (m)	3460	3114	3806	Drawing C5826-GCR-RD-DT-DR-P-0002 – Access Track Details
Length of access track that is floating road (m)	134	121	147	Drawing C5826-GCR-RD-DT-DR-P-0002 – Access Track Details
Floating road width (m)	5	4.5	5.5	Drawing C5826-GCR-RD-DT-DR-P-0002 – Access Track Details
Floating road depth (m)	0.75	0.68	0.83	Drawing C5826-GCR-RD-DT-DR-P-0002 – Access Track Details
Length of floating road that is drained (m)	134	121	147	Drawing C5826-GCR-RD-DT-DR-P-0002 – Access Track Details

[1] https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2023

Input data	Expected value	Minimum value	Maximum value	Source of data
Average depth of drains associated with floating roads (m)	0.5	0.45	0.55	Drawing C5826-GCR-RD-DT-DR-P-0002 – Access Track Details
Length of access track that is excavated road (m)	3408	3067	3749	Drawing C5826-GCR-RD-DT-DR-P-0002 – Access Track Details
Excavated road width (m)	5	4.5	5.5	Drawing C5826-GCR-RD-DT-DR-P-0002 – Access Track Details
Average depth of peat excavated for road (m)	0.9	0.81	0.99	Drawing C5826-GCR-RD-DT-DR-P-0002 – Access Track Details
Length of access track that is rock filled road (m)	3408	3067	3749	Drawing C5826-GCR-RD-DT-DR-P-0002 – Access Track Details
Rock filled road width (m)	5	4.5	5.5	Drawing C5826-GCR-RD-DT-DR-P-0002 – Access Track Details
Rock filled road depth (m)	0.5	0.45	0.55	Drawing C5826-GCR-RD-DT-DR-P-0002 – Access Track Details
Length of rock filled road that is drained (m)	3408	3067	3749	Drawing C5826-GCR-RD-DT-DR-P-0002 – Access Track Details
Average depth of drains associated with rock filled roads (m)	0.5	0.45	0.55	Drawing C5826-GCR-RD-DT-DR-P-0002 – Access Track Details
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	N/A – Cables follow access tracks
Average depth of peat cut for cable trenches (m)	0	0	0	N/A
Additional peat excavated (not already accounted for above)				
Volume of additional peat excavated (m^3)	911	820	1002	Appendix 8.1 – Outline Peat Management Plan.
Area of additional peat excavated (m^2)	130	117	143	Appendix 8.1 – Outline Peat Management Plan.
Peat Landslide Hazard				

Input data	Expected value	Minimum value	Maximum value	Source of data
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)	46.59	41.93	51.25	**Appendix 6.5 – Biodiversity Enhancement Strategy**
Water table depth in degraded bog before improvement (m)	0.3	0.1	0.5	Windfarm Carbon Calculator Web Tool, User Guidance
Water table depth in degraded bog after improvement (m)	0.1	0.05	0.3	Windfarm Carbon Calculator Web Tool, User Guidance
Time required for hydrology and habitat of bog to return to its previous state on improvement (years)	15	10	20	Estimate
Period of time when effectiveness of the improvement in degraded bog can be guaranteed (years)	50	50	50	The Carbon Calculator states that if the time required for hydrology and habitat to return to its previous state is 10 years and the restoration can be guaranteed over the lifetime of the Proposed Development (50 years), the period of time when the improvement can be guaranteed should be entered as 50 years.
Improvement of felled plantation land				
Area of felled plantation to be improved (ha)	21.68	19.51	23.85	**EIA Report Chapter 12 – Forestry**
Water table depth in felled area before improvement (m)	0.3	0.1	0.5	Windfarm Carbon Calculator Web Tool, User Guidance
Water table depth in felled area after improvement (m)	0.1	0.05	0.3	Windfarm Carbon Calculator Web Tool, User Guidance
Time required for hydrology and habitat of felled plantation to return to its previous state on improvement (years)	15	10	20	Estimate
Period of time when effectiveness of the improvement in felled plantation can be guaranteed (years)	50	50	50	The Carbon Calculator states that if the time required for hydrology and habitat

Input data	Expected value	Minimum value	Maximum value	Source of data
				to return to its previous state is 10 years and the restoration can be guaranteed over the lifetime of the Proposed Development (50 years), the period of time when the improvement can be guaranteed should be entered as 50 years.
Restoration of peat removed from borrow pits				
Area of borrow pits to be restored (ha)	0	0	0	N/A – No Borrow Pits Proposed.
Depth of water table in borrow pit before restoration with respect to the restored surface (m)	0	0	0	
Depth of water table in borrow pit after restoration with respect to the restored surface (m)	0	0	0	
Time required for hydrology and habitat of borrow pit to return to its previous state on restoration (years)	0	0	0	
Period of time when effectiveness of the restoration of peat removed from borrow pits can be guaranteed (years)	0	0	0	
Early removal of drainage from foundations and hardstanding				
Water table depth around foundations and hardstanding before restoration (m)	0	0	0	N/A
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)	0	0	0	N/A
Restoration of site after decommissioning				
Will the hydrology of the site be restored on decommissioning?				
Will you attempt to block any gullies that have formed due to the windfarm?	Yes	Yes	Yes	EIA Report Chapter 6 - Ecology
Will you attempt to block all artificial ditches and facilitate rewetting?	Yes	Yes	Yes	EIA Report Chapter 6 - Ecology
Will you control grazing on degraded areas?	Yes	Yes	Yes	EIA Report Chapter 6 - Ecology

Input data	Expected value	Minimum value	Maximum value	Source of data
Will you manage areas to favour reintroduction of species	Yes	Yes	Yes	EIA Report Chapter 6 - Ecology

Table 14.2 – Construction Input Data

Construction Input Data	Expected Value	Maximum	Minimum	Source of Data
Development Infrastructure				
Number of turbines in this area	7	7	7	EIA Report Chapter 3: Description of Proposed Development
Turbine Foundations				
Average Peat depth excavated when constructing foundations (m)	0.9	0.1	3.0	Estimate from peat probing datasets
Approximate geometric shape of whole dug when constructing foundations[2]	Circular	Circular	Circular	Drawing C5826-GCR-FD-DT-DR-P-0001 – Foundation Details
Diameter at bottom	22.65	22.65	22.65	Drawing C5826-GCR-FD-DT-DR-P-0001 – Foundation Details
Diameter at surface	7	7	7	Drawing C5826-GCR-FD-DT-DR-P-0001 – Foundation Details
Hardstanding				
Average Peat depth excavated when constructing foundations (m)	0.9	0	3.2	Estimate from peat probing datasets
Approximate geometric shape of whole dug when constructing hardstanding	Rectangular	Rectangular	Rectangular	Drawing C5826-GCR-RD-DT-DR-P-0001 Crane Hardstanding Details
Length at surface	98	98	98	Drawing C5826-GCR-RD-DT-DR-P-0001 Crane Hardstanding Details

[2] Carbon Calculator v2.14.1 spreadsheet version only allows rectangular foundations.

Width at surface	63	63	63	Drawing C5826-GCR-RD-DT-DR-P-0001 Crane Hardstanding Details
Length at bottom	98	98	98	Drawing C5826-GCR-RD-DT-DR-P-0001 Crane Hardstanding Details
Width at bottom	63	63	63	Drawing C5826-GCR-RD-DT-DR-P-0001 Crane Hardstanding Details
Piling				
Is Piling used	No	No	No	Post Consent Decision
Volume of concrete				
Volume of concrete used (m^3) in the entire area	3500	3150	3850	Only the turbine foundations will be concrete.

Registered Office
Green Cat Renewables
Stobo House
Roslin
Midlothian
EH25 9RE

+44 (0) 131 541 0060

info@greencatrenewables.co.uk
www.greencatrenewables.co.uk