

Input data	Expected values	Record source of data	Possible range of values			Record source of data
	Enter expected value here		Enter minimum value here	Enter maximum value here		
Windfarm characteristics						
<u>Dimensions</u>						
No. of turbines	14	EIAR Ch2	14	EIAR Ch2	14	EIAR Ch2
Lifetime of windfarm (years)	40		40		40	
<u>Performance</u>						
Power rating of turbines (turbine capacity) (MW)	5.72	EIAR Ch2	4.5	EIAR Ch2	6.4	EIAR Ch2
Capacity factor	Direct input of capacity fac ▼		Direct input of capacity fac ▼		Direct input of capacity fac ▼	
Enter estimated capacity factor (percentage efficiency)	39.3	EIAR Ch2	39.3	EIAR Ch2	39.3	EIAR Ch2
<u>Backup</u>						
Extra capacity required for backup (%)	5	Carbon Calculator or Guidance Doc	0	Carbon Calculator Guidance Doc	5	Carbon Calculator Guidance Doc
Additional emissions due to reduced thermal efficiency of the reserve generation (%)	10	Fixed	10	Fixed	10	Fixed
<u>Carbon dioxide emissions from turbine life</u> - (eq. manufacture, construction, decommissioning)	Calculate wrt installed cap. ▼		Calculate wrt installed cap. ▼		Calculate wrt installed cap. ▼	
Characteristics of peatland before windfarm development						
Type of peatland	Acid b ▼		Acid b ▼		Acid b ▼	
Average annual air temperature at site (°C)	8.04	Met Office Weather Data	8.04	Met Office Weather Data EIA Ch8	8.04	Met Office Weather Data
Average depth of peat at site (m)	0.35	EIA Ch8	0.35		0.35	EIA Ch8
C Content of dry peat (% by weight)	52	Birnie R.V., Clayton P., Hulme P.D., Robertson, R.A., Sloane B.D., and S.A.Ward. (1991). Scottish peat resources and their energy potential. Department of Energy	48	Birnie R.V., Clayton P., Hulme P.D., Robertson, R.A., Sloane B.D., and S.A.Ward. (1991). Scottish peat resources and their energy potential. Department of Energy	57	Birnie R.V., Clayton P., Hulme P.D., Robertson, R.A., Sloane B.D., and S.A.Ward. (1991). Scottish peat resources and their energy potential. Department of Energy
Average extent of drainage around drainage features at site (m)	10.00	Windfarm Standard Values from Windfarm Carbon Calculator or Web Tool User Guidance	5.00	Windfarm Standard Values from Windfarm Carbon Calculator or Web Tool User Guidance	50.00	Windfarm Standard Values from Windfarm Carbon Calculator or Web Tool User Guidance
Average water table depth at site (m)	0.30		0.10		0.50	

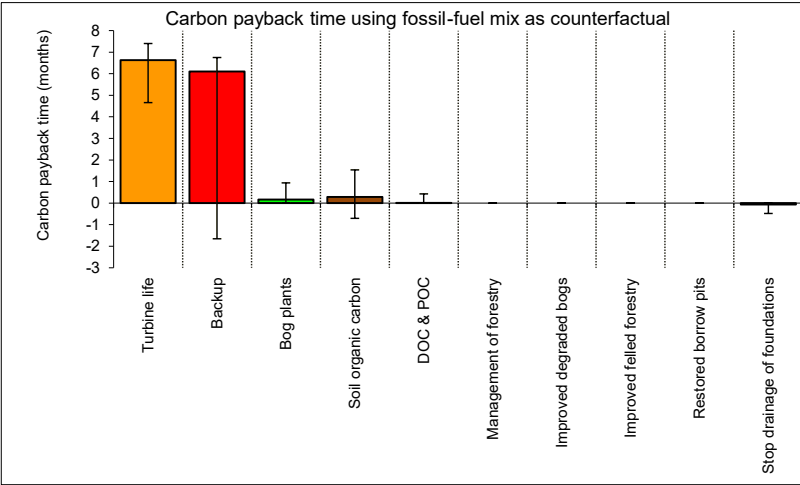
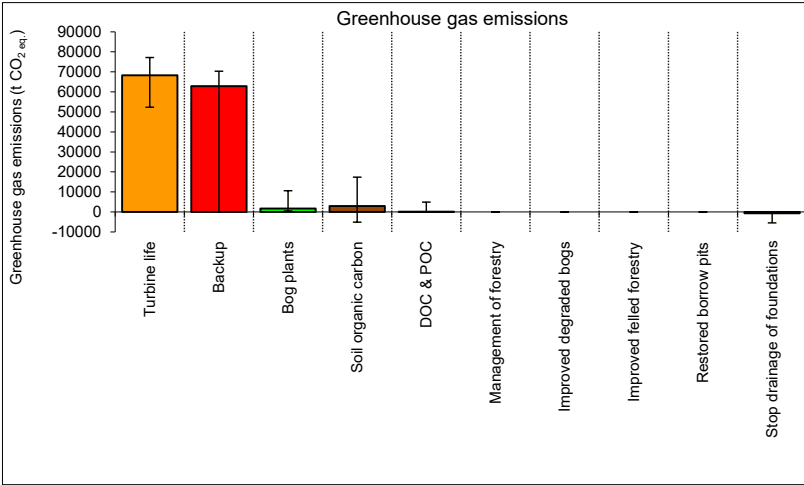
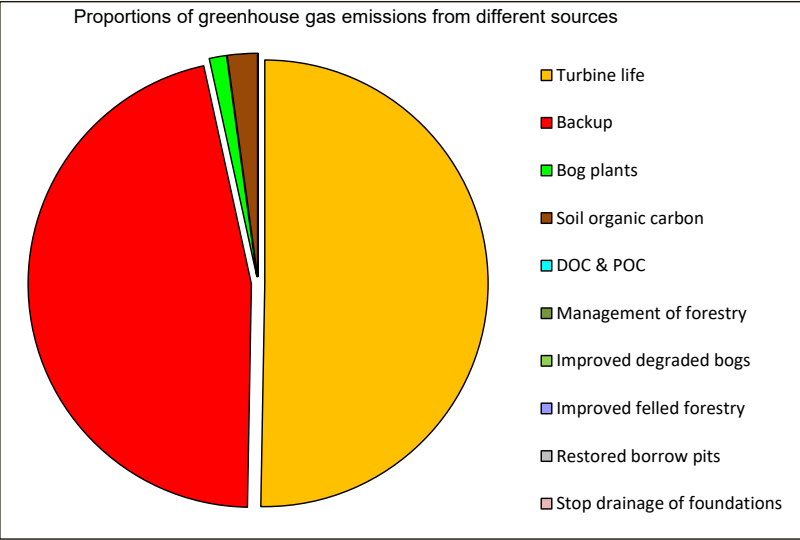
Dry soil bulk density (g cm ⁻³)	0.13	Windfarm Carbon Calculator or Web Tool, User Guidance	0.07	Windfarm Carbon Calculator or Web Tool, User Guidance	0.29	Windfarm Carbon Calculator or Web Tool, User Guidance
Characteristics of bog plants						
Time required for regeneration of bog plants after restoration (years)	5	Conservative values	3	Conservative values	15	Conservative values
Carbon accumulation due to C fixation by bog plants in undrained peats (tC ha ⁻¹ yr ⁻¹)	0.25	NatureScot Guidance	0.12	NatureScot Guidance	0.31	NatureScot Guidance
Forestry Plantation Characteristics						
Method used to calculate CO ₂ loss from forest felling	Enter simple data ▼		Enter simple data ▼		Enter simple data ▼	
Area of forestry plantation to be felled (ha)	0.0		0.0		0.0	
Average rate of carbon sequestration in timber (tC ha ⁻¹ yr ⁻¹)	3.60	Cannell, 1999	3.60	Cannell, 1999	3.60	Cannell, 1999
Counterfactual emission factors						
To update counterfactual emission factors from the web Click here (not yet operational)						
Coal-fired plant emission factor (t CO ₂ MWh ⁻¹)	0.919		0.919		0.919	
Grid-mix emission factor (t CO ₂ MWh ⁻¹)	0.177		0.177		0.177	
Fossil fuel-mix emission factor (t CO ₂ MWh ⁻¹)	0.448		0.448		0.448	
Borrow pits						
Number of borrow pits	0	n/a	0	n/a	0	n/a
Average length of pits (m)	0	n/a	0	n/a	0	n/a
Average width of pits (m)	0	n/a	0	n/a	0	n/a
Average depth of peat removed from pit (m)	0.00	n/a	0.00	n/a	0.00	n/a
Foundations and hard-standing area associated with each turbine						
Method used to calculate CO ₂ loss from foundations and hard-standing	Enter detailed information ▼		Enter detailed information ▼		Enter detailed information ▼	
Please enter construction data in sheet: Construction input data						
Average depth of peat removed from turbine foundations (m)						
Average depth of peat removed from hard-standing (m)						
Access tracks						
Total length of access track (m)	14218	EIAR Ch2	14218	EIAR Ch2	14218	EIAR Ch2
Existing track length (m)	2425	EIAR Ch2	2425	EIAR Ch2	2425	EIAR Ch2
Length of access track that is floating road (m)	0	n/a	0	n/a	0	n/a
Floating road width (m)	0	n/a	0	n/a	0	n/a
Floating road depth (m)	0.00	n/a	0.00	n/a	0.00	n/a
Length of floating road that is drained (m)	0	n/a	0	n/a	0	n/a
Average depth of drains associated with floating roads (m)	0.00	n/a	0.00	n/a	0.00	n/a
Length of access track that is excavated road (m)	11793	EIAR Ch2	11793	EIAR Ch2	11793	EIAR Ch2
Excavated road width (m)	6	EIA Ch8	6	EIA Ch8	6	EIA Ch8
Average depth of peat excavated for road (m)	0.28	EIA Ch8	0.28	EIA Ch8	0.28	EIA Ch8
Length of access track that is rock filled road (m)	0	No rock filled road proposed	0	No rock filled road proposed	0	No rock filled road proposed
Rock filled road width (m)	0	n/a	0	n/a	0	n/a
Rock filled road depth (m)	0	n/a	0	n/a	0	n/a
Length of rock filled road that is drained (m)	0	n/a	0	n/a	0	n/a
Average depth of drains associated with rock filled roads (m)	0.00	n/a	0.00	n/a	0.00	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)	0	n/a	0	n/a	0	n/a
Average depth of peat cut for cable trenches (m)	0.00	n/a	0.00	n/a	0.00	n/a
Additional peat excavated (not already accounted for above)						
Volume of additional peat excavated (m ³)	0	EIA Ch8	0	EIA Ch8	0	EIA Ch8
Area of additional peat excavated (m ²)	0.0	EIA Ch8	0.0	EIA Ch8	0.0	EIA Ch8
Peat Landslide Hazard						
Weblink: Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments						
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)		EIA Ch6		EIA Ch6		EIA Ch6
Water table depth in degraded bog before improvement (m)	0.30	n/a	0.10	n/a	0.50	n/a
Water table depth in degraded bog after improvement (m)	0.25	n/a	0.09	n/a	0.40	n/a

Time required for hydrology and habitat of bog to return to its previous state on improvement (years)	10	Conservative values Duration of consent	5	Conservative values Duration of consent	15	Conservative values Duration of consent
Period of time when effectiveness of the improvement in degraded bog can be guaranteed (years)	40		40		40	
Improvement of felled plantation land						
Area of felled plantation to be improved (ha)	0.0	Windfarm Carbon Calculator Web Tool, User Guidance Windfarm Carbon Calculator	0.0	Windfarm Carbon Calculator Web Tool, User Guidance Windfarm Carbon Calculator	0.0	Windfarm Carbon Calculator Web Tool, User Guidance Windfarm Carbon Calculator
Water table depth in felled area before improvement (m)	0.30		0.30		0.30	
Water table depth in felled area after improvement (m)	0.25		0.25		0.25	
Time required for hydrology and habitat of felled plantation to return to its previous state on improvement (years)	10	Conservative values Duration of consent	10	Conservative values Duration of consent	10	Conservative values Duration of consent
Period of time when effectiveness of the improvement in felled plantation can be guaranteed (years)	40		40		40	
Restoration of peat removed from borrow pits						
Area of borrow pits to be restored (ha)	0	n/a	0	n/a	0	n/a
Depth of water table in borrow pit before restoration with respect to the restored surface (m)	0.00	n/a	0.00	n/a	0.00	n/a
Depth of water table in borrow pit after restoration with respect to the restored surface (m)	0.00	n/a	0.00	n/a	0.00	n/a
Time required for hydrology and habitat of borrow pit to return to its previous state on restoration (years)	0	n/a	0	n/a	0	n/a
Period of time when effectiveness of the restoration of peat removed from borrow pits can be guaranteed (years)	0	n/a	0	n/a	0	n/a
Early removal of drainage from foundations and hardstanding						
Water table depth around foundations and hardstanding before restoration (m)	0.20	Windfarm Carbon Calculator Web Tool, User Guidance Windfarm Carbon Calculator	0.10	Windfarm Carbon Calculator Web Tool, User Guidance Windfarm Carbon Calculator	0.30	Windfarm Carbon Calculator Web Tool, User Guidance Windfarm Carbon Calculator
Water table depth around foundations and hardstanding after restoration (m)	0.10		0.00		0.20	
Time to completion of backfilling, removal of any surface drains, and full restoration of the hydrology (years)	3	EIA Ch6	3	EIA Ch6	3	EIA Ch6
Restoration of site after decommissioning						
Will the hydrology of the site be restored on decommissioning?	Yes		Yes		Yes	
Will you attempt to block any gullies that have formed due to the windfarm?	Yes		Yes		Yes	
Will you attempt to block all artificial ditches and facilitate rewetting?	Yes		Yes		Yes	
Will the habitat of the site be restored on decommissioning?						
Will you control grazing on degraded areas?	Yes		Yes		Yes	
Will you manage areas to favour reintroduction of species	Yes		Yes		Yes	

Input data	Expected values		Possible range of values		
	Enter expected value here	Record source of data	Enter minimum value here	Record source of data	Enter maximum value here
Construction design					
Note - total number of turbines already specified:	14		14		14
AREA 1					
Number of turbines in this area	14	EIAR Ch2	14	EIAR Ch2	14
<u>Turbine foundations</u>					
Average depth of peat removed when constructing foundations (m)	0.4	EIAR Ch8	0.4	EIAR Ch8	0.4
Approximate geometric shape of whole dug when constructing foundations	Rectangular		Rectangular		Rectangular
Diameter at surface (m)	30	EIAR Ch2	30	EIAR Ch2	30
	30	EIAR Ch2	30	EIAR Ch2	30
Diameter at bottom (m)	30	EIAR Ch2	30	EIAR Ch2	30
	30	EIAR Ch2	30	EIAR Ch2	30
<u>Hardstanding</u>					
Average depth of peat removed when constructing hardstanding (m)	0.3	EIAR Ch8	0.3	EIAR Ch8	0.3
Approximate geometric shape of whole dug when constructing hardstanding	Rectangular		Rectangular		Rectangular
Diameter at surface (m)	100	EIAR Ch2	100	EIAR Ch2	100
	25	EIAR Ch2	25	EIAR Ch2	25
Diameter at bottom (m)	100	EIAR Ch2	100	EIAR Ch2	100
	25	EIAR Ch2	25	EIAR Ch2	25
<u>Piling</u>					
Is piling used?	No		No		No
<u>Volume of Concrete</u>					
Volume of concrete used (m ³)					

	Exp.	Min.	Max.
1. Windfarm CO₂ emission saving over...			
...coal-fired electricity generation (tCO ₂ yr ⁻¹)	253552	199473	283695
...grid-mix of electricity generation (tCO ₂ yr ⁻¹)	48834	38419	54640
...fossil fuel - mix of electricity generation (tCO ₂ yr ⁻¹)	123603	97240	138297
Energy output from windfarm over lifetime (MWh)	11036011	8682176	12347984
Total CO₂ losses due to wind farm (t CO₂ eq.)			
2. Losses due to turbine life (eg. manufacture, construction, decomissioning)	68277	52318	77172
3. Losses due to backup	62854	0	70327
4. Losses due to reduced carbon fixing potential	1698	499	10608
5. Losses from soil organic matter	2941	-5102	17389
6. Losses due to DOC & POC leaching	13	0	4922
7. Losses due to felling forestry	0	0	0
Total losses of carbon dioxide	135784	47715	180418
8. Total CO₂ losses due to improvement of site (t CO₂ eq.)			
8a. Change in emissions due to improvement of degraded bogs	0	0	0
8b. Change in emissions due to improvement of felled forestry	0	0	0
8c. Change in emissions due to restoration of peat from borrow pits	0	0	0
8d. Change in emissions due to removal of drainage from foundations & hardstanding	-675	0	-5465
Total change in emissions due to improvements	-675	0	-5465

RESULTS			
	Exp.	Min.	Max.
Net emissions of carbon dioxide (t CO₂ eq.)	135109	42250	180418
Carbon Payback Time			
...coal-fired electricity generation (years)	0.5	0.1	0.9
...grid-mix of electricity generation (years)	2.8	0.8	4.7
...fossil fuel - mix of electricity generation (years)	1.1	0.3	1.9
Ratio of soil carbon loss to gain by restoration (TARGET ratio (Natural Resources Wales) < 1.0)			
	4.4	#DIV/0!	4.1
	4.4	No gains!	4.1
Ratio of CO₂ eq. emissions to power generation (g / kWh) (TARGET ratio by 2030 (electricity generation) < 50 g /kWh)			
	12	3	21



Data used in barchart of carbon payback time using fossil-fuel mix as counterfactual

Greenhouse gas emissions

	Exp.	Min	Max
Turbine life	68277	15959	8895
Backup	62854	62854	7472
Bog plants	1698	1199	8910
Soil organic carbon	2941	8043	14448
DOC & POC	13	13	4909
Management of forestry	0	0	0
Improved degraded bogs	0	0	0
Improved felled forestry	0	0	0
Restored borrow pits	0	0	0
Stop drainage of foundations	0	0	0

Data used in barchart of carbon payback time using fossil-fuel mix as counterfactual

Greenhouse gas emissions				Carbon payback time (months)		
	Exp.	Min.	Max.	Exp.	Min.	Max.
Turbine life	68277	15959	8895	7	2	1
Backup	62854	62854	7472	6	8	1
Bog plants	1698	1199	8910	0	0	1
Soil organic carbon	2941	8043	14448	0	1	1
DOC & POC	13	13	4909	0	0	0
Management of forestry	0	0	0	0	0	0
Improved degraded bogs	0	0	0	0	0	0
Improved felled forestry	0	0	0	0	0	0
Restored borrow pits	0	0	0	0	0	0
Stop drainage of foundations	-675	-675	-4790	0	0	0
	135109			13		