Results

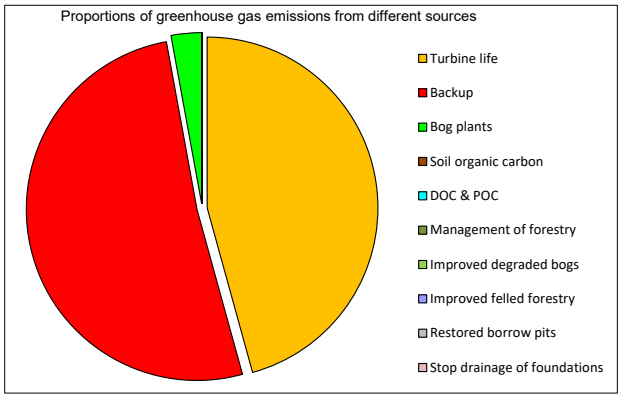
PAYBACK TIME AND CO_2 EMISSIONS

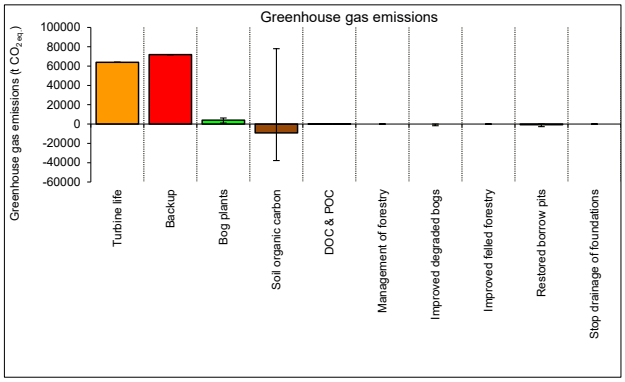
Note: The carbon payback time of the windfarm is calculated by comparing the loss of C from the site due to windfarm development with the carbon-savings achieved by the windfarm while displacing electricity generated from coal-fired capacity or grid-mix.

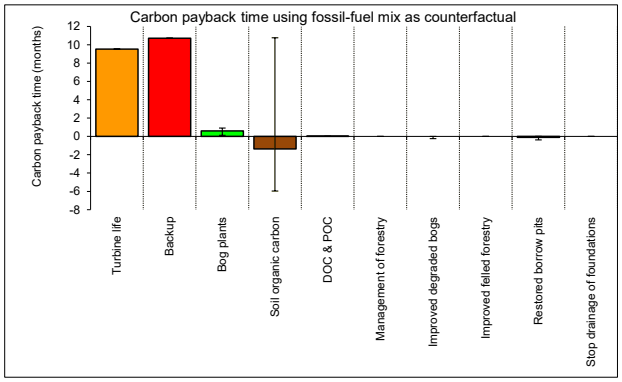
Click here to return to Input data Click here
Click here to return to Instructions Click here

	Exp.	*Min.*	*Max.*
1. Windfarm CO_2 emission saving over…			
…coal-fired electricity generation (tCO_2 yr^{-1})	179405	166590	192220
…grid-mix of electricity generation (tCO_2 yr^{-1})	39312	36504	42120
…fossil fuel - mix of electricity generation (tCO_2 yr^{-1})	80495	74745	86245
Energy output from windfarm over lifetime (MWh)	9492336	8814312	10170360
Total CO_2 losses due to wind farm (t CO_2 eq.)			
2. Losses due to turbine life (eg. manufacture, construction, decomissioning)	63903	63903	63903
3. Losses due to backup	71871	71871	71871
4. Losses due to reduced carbon fixing potential	4017	1019	6258
5. Losses from soil organic matter	-9171	-37788	78006
6. Losses due to DOC & POC leaching	5	0	102
7. Losses due to felling forestry	0	0	0
Total losses of carbon dioxide	130625	99005	220139
8. Total CO_2 gains due to improvement of site (t CO_2 eq.)			
8a. Change in emissions due to improvement of degraded bogs	0	0	-1747
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	-706	0	-2691
8d. Change in emissions due to removal of drainage from foundations & hardstanding	0	0	0
Total change in emissions due to improvements	-706	0	-4437

RESULTS	*Exp.*	*Min.*	*Max.*
Net emissions of carbon dioxide (t $CO_{2\ eq.}$)	**129919**	**94567**	**220139**
Carbon Payback Time			
…coal-fired electricity generation (years)	0.7	0.49	1.3
…grid-mix of electricity generation (years)	3.3	2.2	6.0
…fossil fuel - mix of electricity generation (years)	**1.6**	**1.10**	**2.9**
Ratio of soil carbon loss to gain by restoration (TARGET ratio (Natural Resources Wales) < 1.0)	**No gains!**	**No gains!**	**No gains!**
Ratio of CO_2 eq. emissions to power generation (g / kWh) (TARGET ratio by 2030 (electricity generation) < 50 g /kWh)	**14**	**9**	**25**







Input data	Expected values Enter expected value here	Record source of data	Possible range of values Enter minimum value here	Record source of data	Enter maximum value here	Record source of data
Windfarm characteristics						
Dimensions						
No. of turbines	18	EIAR Ch3	18	EIAR Ch3	18	EIAR Ch3
Lifetime of windfarm (years)	50	EIAR Ch3	50	EIAR Ch3	50	EIAR Ch3
Performance						
Power rating of turbines (turbine capacity) (MW)	4.3	EIAR Ch3	4.3	EIAR Ch3	4.3	EIAR Ch3
Capacity factor	Direct input of capacity fa		Direct input of capacity fa		Direct input of capacity fa	
Enter estimated capacity factor (percentage efficiency)	28.0	EIAR Ch1	26.0	EIAR Ch1	30.0	EIAR Ch1
Backup						
Extra capacity required for backup (%)	5	Carbon Calculator Guidance Doc	5	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
Carbon dioxide emissions from turbine life - (eg. manufacture, construction, decommissioning)	Calculate wrt installed ca		Calculate wrt installed ca		Calculate wrt installed ca	
Characteristics of peatland before windfarm development						
Type of peatland	Acid b	EIAR Ch8	Acid b	EIAR Ch8	Acid b	EIAR Ch8
Average annual air temperature at site (°C)	10	Met Office Weather Data	8	Met Office Weather Data	12	Met Office Weather Data
Average depth of peat at site (m)	0.60	EIAR Ch9	0.00	EIAR Ch9	5.80	EIAR Ch9
C Content of dry peat (% by weight)	53	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	19	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	65	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)	5.00	Windfarm Standard Values from Windfarm	2.00	Windfarm Standard Values from Windfarm	6.00	Windfarm Standard Values from Windfarm
Average water table depth at site (m)	0.50	Carbon Calculator Web Tool User Guidance	0.10	Carbon Calculator Web Tool User Guidance	1.00	Carbon Calculator Web Tool User Guidance
Dry soil bulk density (g cm^{-3})	0.15	Windfarm Carbon Calculator Web Tool, User Guidance	0.09	Windfarm Carbon Calculator Web Tool, User Guidance	0.25	Windfarm Carbon Calculator Web Tool, User Guidance
Characteristics of bog plants						
Time required for regeneration of bog plants after restoration (years)	15	Conservative values NatureScot Guidance	10	Conservative values NatureScot Guidance	20	Conservative values NatureScot Guidance
Carbon accumulation due to C fixation by bog plants in undrained peats (tC ha^{-1} yr^{-1})	0.25		0.12		0.31	
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	n/a	0	n/a	0	n/a
Average rate of carbon sequestration in timber (tC ha-1 yr-1)	0.00	n/a	0.00	n/a	0.00	n/a

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})	0.945	Fixed	0.945	Fixed	0.945	Fixed	
Grid-mix emission factor (t CO_2 MWh^{-1})	0.20707	Fixed	0.20707	Fixed	0.20707	Fixed	
Fossil fuel-mix emission factor (t CO_2 MWh^{-1})	0.424	Fixed	0.424	Fixed	0.424	Fixed	
Borrow pits							
Number of borrow pits	5	EIAR Ch3	5	EIAR Ch3	5	EIAR Ch3	
Average length of pits (m)	258	EIAR Ch3	210	EIAR Ch3	327	EIAR Ch3	
Average width of pits (m)	207	EIAR Ch3	172	EIAR Ch3	244	EIAR Ch3	
Average depth of peat removed from pit (m)	0.27	EIAR Ch9	0.27	EIAR Ch9	0.27	EIAR Ch9	
Foundations and hard-standing area associated with each turbine							
Method used to calculate CO_2 loss from foundations and hard-standing	Enter detailed informatior		Enter detailed informatior		Enter detailed informatior		
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)	25182	EIAR Ch3	16171	EIAR Ch3	16191	EIAR Ch3	
Existing track length (m)	6600	EIAR Ch3	6600	EIAR Ch3	6600	EIAR Ch3	
Length of access track that is floating road (m)	2002	EIAR Ch3	2001	EIAR Ch3	2003	EIAR Ch3	
Floating road width (m)	7	EIAR Ch3	5.5	EIAR Ch3	7	EIAR Ch3	
Floating road depth (m)		n/a	0.63	n/a	0.63	n/a	
Length of floating road that is drained (m)	1000	EIAR Ch3	0	EIAR Ch3	1500	EIAR Ch3	
Average depth of drains associated with floating roads (m)	0.50	EIAR Ch3	0.5	EIAR Ch3	1	EIAR Ch3	
Length of access track that is excavated road (m)	16580	EIAR Ch3	12534	EIAR Ch3	12554	EIAR Ch3	
Excavated road width (m)	7	EIAR Ch3	5.5	EIAR Ch3	7	EIAR Ch3	
Average depth of peat excavated for road (m)	0.60	EIAR Ch9	0.6	EIAR Ch9	0.6	EIAR Ch9	
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)	5	EIAR Ch3	5	EIAR Ch3	5	EIAR Ch3	
Rock filled road depth (m)	0		0		0		
Length of rock filled road that is drained (m)	0		0		0		
Average depth of drains associated with rock filled roads (m)	0.00		0		0		
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	0.06	n/a	
Additional peat excavated (not already accounted for above)							
Volume of additional peat excavated (m^3)	19434	EIAR Ch9	19434	EIAR Ch9	19434	EIAR Ch9	
Area of additional peat excavated (m^2)	65879.0	EIAR Ch9	65879.0	EIAR Ch9	65879.0	EIAR Ch9	
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)	11.6	EIAR Ch8	11.6	EIAR Ch8	11.6	EIAR Ch8
Water table depth in degraded bog before improvement (m)	0.30	Windfarm	0.10	Windfarm	0.50	Windfarm
Water table depth in degraded bog after improvement (m)	0.25	Windfarm	0.09	Windfarm	0.40	Windfarm
Time required for hydrology and habitat of bog to return to its previous state on improvement (years)	10	Conservative values	5	Conservative values	15	Conservative values
Period of time when effectiveness of the improvement in degraded bog can be guaranteed (years)	10	Duration of consent	5	Duration of consent	15	Duration of consent
Improvement of felled plantation land						
Area of felled plantation to be improved (ha)	0	n/a	0	n/a	0	n/a
Water table depth in felled area before improvement (m)	0.00		0.00		0.00	
Water table depth in felled area after improvement (m)	0.00		0.00		0.00	
Time required for hydrology and habitat of felled plantation to return to its previous state on improvement (years)	2		2		2	
Period of time when effectiveness of the improvement in felled plantation can be guaranteed (years)	2		2		2	
Restoration of peat removed from borrow pits						
Area of borrow pits to be restored (ha)	24	EIAR Ch3	24	EIAR Ch3	24	EIAR Ch3
Depth of water table in borrow pit before restoration with respect to the restored surface (m)	0.20	Windfarm Carbon Calculator Web Tool, User Guidance	0.10	Windfarm Carbon Calculator Web Tool, User Guidance	0.30	Windfarm Carbon Calculator Web Tool, User Guidance
Depth of water table in borrow pit after restoration with respect to the restored surface (m)	0.19	Windfarm Carbon Calculator Web Tool, User Guidance	0.05	Windfarm Carbon Calculator Web Tool, User Guidance	0.25	Windfarm Carbon Calculator Web Tool, User Guidance
Time required for hydrology and habitat of borrow pit to return to its previous state on restoration (years)	10	Conservative estimates.	5	Conservative estimates.	20	Conservative estimates.
Period of time when effectiveness of the restoration of peat removed from borrow pits can be guaranteed (years)	20	Duration of consent	15	Duration of consent	25	Duration of consent
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	0.10	Windfarm Carbon Calculator Web Tool, User Guidance	0.30	Windfarm Carbon Calculator Web Tool, User Guidance
Water table depth around foundations and hardstanding after restoration (m)	0.10	Windfarm Carbon Calculator Web Tool, User Guidance	0.00	Windfarm Carbon Calculator Web Tool, User Guidance	0.20	Windfarm Carbon Calculator Web Tool, User Guidance
Time to completion of backfilling, removal of any surface drains, and full restoration of the hydrology (years)	3	EIAR Ch3	3	EIAR Ch3	3	EIAR Ch3
Restoration of site after decomissioning						
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?	Yes	EIAR Ch3	Yes	EIAR Ch3	Yes	EIAR Ch3
Will you attempt to block all artificial ditches and facilitate rewetting?	No	EIAR Ch3	No	EIAR Ch3	No	EIAR Ch3
Will the habitat of the site be restored on decommissioning?	No		No		No	
Will you control grazing on degraded areas?	No	EIAR Ch3	No	EIAR Ch3	No	EIAR Ch3
Will you manage areas to favour reintroduction of species	No	EIAR Ch3	No	EIAR Ch3	No	EIAR Ch3

Construction input data

ENTER DETAILS OFCONSTRUCTION HERE!

Note: This data only used in the calculation if the selection "**Enter detailed information**" is made in cell C50 of the Core input data sheet.

Click here to move to Payback Time — Click here

Click here to return to Core input data — Click here

Input data	Expected values Enter expected value here ▼	Record source of data	Possible range of values Enter minimum value here ▼	Record source of data	Enter maximum value here ▼	Record source of data
Construction design **Note - total number of turbines already specified:**	**0**		**0**		**0**	
AREA 1						
Number of turbines in this area - Error! Total in areas < total on site!			0		0	
Turbine foundations						
Average depth of peat removed when constructing foundations (m)	0.5	EIAR Ch9		EIAR Ch9		EIAR Ch9
Approximate geometric shape of whole dug when constructing foundations	Rectangular		Rectangular		Rectangular	
Length at surface (m)	30	EIAR Ch3		EIAR Ch3		EIAR Ch3
Width at surface (m)	25	EIAR Ch3		EIAR Ch3		EIAR Ch3
Length at bottom (m)	30	EIAR Ch3		EIAR Ch3		EIAR Ch3
Width at bottom (m)	25	EIAR Ch3		EIAR Ch3		EIAR Ch3
Hardstanding						
Average depth of peat removed when constructing hardstanding (m)	0.5	EIAR Ch9		EIAR Ch9		EIAR Ch9
Approximate geometric shape of whole dug when constructing hardstanding	Rectangular		Rectangular		Rectangular	
Length at surface (m)	63	EIAR Ch3		EIAR Ch3		EIAR Ch3
Width at surface (m)	25	EIAR Ch3		EIAR Ch3		EIAR Ch3
Length at bottom (m)	64.14	EIAR Ch3		EIAR Ch3		EIAR Ch3
Width at bottom (m)	26.14	EIAR Ch3		EIAR Ch3		EIAR Ch3
Piling Is piling used?	No		No		No	
Volume of Concrete Volume of concrete used (m^3)						