APPENDIX 11-2

CARBON CALCULATIONS

Core input data
ENTER INPUT DATA HERE! VALUES SHOULD ONLY BE CHANGED ON THIS SHEET. **DO NOT USE EXAMPLE VALUES AS DEFAULTS!** ENTER YOUR OWN VALUES THAT ARE SPECIFIC TO YOUR PARTICULAR SITE.
Note: The input parameters include some variables that can be specified by default values, but others that must be site specific. Variables that can be taken from defaults are marked with purple tags on left hand side.

Click here to move to Payback Tin Click here
Click here to return to Instructions 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	Possible range of values: Enter maximum value here	Record source of data
Windfarm characteristics						
Dimensions						
No. of turbines	0		0		0	
Lifetime of windfarm (years)	30	Fixed	30		30	
Performance						
Power rating of turbines (turbine capacity) (MW)	4.8		4.8		4.8	
Capacity factor	Direct input of capacity fa		Direct input of capacity fac		Direct input of capacity fac	
Enter estimated capacity factor (percentage efficiency)	0.33		0.33		0.33	
Backup						
Extra capacity required for backup (%)	5		5		5	
Additional emissions due to reduced thermal efficiency of the reserve generation (%)	10		10		10	
Carbon dioxide emissions from turbine life - (eg. 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)	10		6		14.8	
Average depth of peat at site (m)	1.70		1.70		1.70	
C Content of dry peat (% by weight)	53.23		19.57		64.28	
Average extent of drainage around drainage features at site (m)	15.00		15.00		15.00	
Average water table depth at site (m)	0.50		0.10		1.00	
Dry soil bulk density (g cm^{-3})	0.13		0.01		0.29	
Characteristics of bog plants						
Time required for regeneration of bog plants after restoration (years)	10		5		15	
Carbon accumulation due to C fixation by bog plants in undrained peats (tC ha^{-1} yr^{-1})	0.25		0.2		0.3	
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)						
Average rate of carbon sequestration in timber (tC ha-1 yr-1)						
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})	1.046		1.046		1.046	
Grid-mix emission factor (t CO_2 MWh^{-1})	0.20705		0.20705		0.20705	
Fossil fuel-mix emission factor (t CO_2 MWh^{-1})	0.437		0.437		0.437	
Borrow pits						
Number of borrow pits	0		0		0	
Average length of pits (m)	0		0		0	
Average width of pits (m)	0		0		0	
Average depth of peat removed from pit (m)	0.00		0		0	
Foundations and hard-standing area associated with each turbine						
Method used to calculate CO_2 loss from foundations and hard-standing	Rectangular with vertical w 1		Rectangular with vertical w		Rectangular with vertical w	
Average length of turbine foundations (m)	22.5		22.5		22.5	
Average width of turbine foundations (m)	22.5		22.5		22.5	
Average depth of peat removed from turbine foundations (m)	1.70		1.70		1.70	
Average length of hard-standing (m)	52		52		52	
Average width of hard-standing (m)	35		35		35	
Average depth of peat removed from hard-standing (m)	1.70		1.70		1.70	
Access tracks						
Total length of access track (m)	19.02		19.02		19.02	
Existing track length (m)	9.62		9.62		9.62	
Length of access track that is floating road (m)	2.3		2.3		2.3	
Floating road width (m)	10		10		10	
Floating road depth (m)						
Length of floating road that is drained (m)						
Average depth of drains associated with floating roads (m)						
Length of access track that is excavated road (m)	3		3		3	
Excavated road width (m)	10		10		10	
Average depth of peat excavated for road (m)	1.70		1.70		1.70	
Length of access track that is rock filled road (m)	4.1		4.1		4.1	
Rock filled road width (m)						
Rock filled road depth (m)						
Length of rock filled road that is drained (m)						
Average depth of drains associated with rock filled roads (m)						
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)						
Average depth of peat cut for cable trenches (m)	1.20		1.20		1.20	
Additional peat excavated (not already accounted for above)						
Volume of additional peat excavated (m^3)	212323		212323		212323	
Area of additional peat excavated (m^2)	127388.0		127388.0		127388.0	
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)						
Water table depth in degraded bog before improvement (m)						
Water table depth in degraded bog after improvement (m)						
Time required for hydrology and habitat of bog to return to its previous state on improvement (years)						
Period of time when effectiveness of the improvement in degraded bog can be guaranteed (years)	25		25		25	
Improvement of felled plantation land						
Area of felled plantation to be improved (ha)						
Water table depth in felled area before improvement (m)						
Water table depth in felled area after improvement (m)						
Time required for hydrology and habitat of felled plantation to return to its previous state on improvement (years)						
Period of time when effectiveness of the improvement in felled plantation can be guaranteed (years)	25		25		25	
Restoration of peat removed from borrow pits						
Area of borrow pits to be restored (ha)						
Depth of water table in borrow pit before restoration with respect to the restored surface (m)						
Depth of water table in borrow pit after restoration with respect to the restored surface (m)						
Time required for hydrology and habitat of borrow pit to return to its previous state on restoration (years)						
Period of time when effectiveness of the restoration of peat removed from borrow pits can be guaranteed (years)	25		25		25	
Early removal of drainage from foundations and hardstanding						
Water table depth around foundations and hardstanding before restoration (m)						
Water table depth around foundations and hardstanding after restoration (m)						
Time to completion of backfilling, removal of any surface drains, and full restoration of the hydrology (years)	15		10		5	
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?	No		No		No	
Will you attempt to block all artificial ditches and facilitate rewetting?	No		No		No	
Will the habitat of the site be restored on decommissioning?	No		No		No	
Will you control grazing on degraded areas?	No		No		No	
Will you manage areas to favour reintroduction of species	No		No		No	

Choice of methodology for calculating emission factors	Site specific (required for planning applications)

Note: Capacity factor. The capacity factor of any power plant is the proportion of energy produced during a given period with respect to the energy that would have been produced had the wind farm been running continually and at maximum output (DECC (2004); see also www.bwea.com/ref/capacityfactors.html).
Capacity Factor = Electricity generated during the period [kWh]/ (Installed capacity [kW] x number of hours in the period [h])
We recommend that a site-specific capacity factor ~~site~~ should be used (as measured during planning stage), and should represent the average emission factor expected over the lifetime of the windfarm, accounting for decline in efficiency with age (Hughes, 2012). The 5 year average capacity factor (or "load factor") for UK onshore wind between 2010 and 2014, based on average beginning and end of year capacity, was 29.2% (DUKES, 2015).

Note: Extra capacity required for backup. If 20% of national electricity is generated by wind energy, the extra capacity required for backup is 5% of the rated capacity of the wind plant (Dale et al 2004). We suggest this should be 5% of the actual output. If it is assumed that less than 20% of national electricity is generated by wind energy, a lower percentage should be entered (0%). The House of Lords Economic Affairs Committee report on The Economics of Renewable Energy (Parliamentary Business, 2008) notes that to cover peak demand a '20% margin of extra capacity has been sufficient to keep the risk of a power cut due to insufficient generation at a very low level.' The estimate provided by BERR was a range of 10% to 20% of installed capacity of wind energy. E.ON is reported as proposing that the capacity credit of wind power should be 8%, and The Renewable Energy Foundation proposed the use of the square root of the wind capacity (in GW) as conventional capacity (e.g. 36 GW of wind plant to match 6 GW of conventional plant).

Note: Extra emissions due to reduced thermal efficiency of the reserve power generation ≈ 10%

Note: Emissions from turbine life. If total emissions for the windfarm are unknown, emissions should be calculated according to turbine capacity. The normal range of CO_2 emissions is 394 to 8147 t CO_2 MW (White & Kulcinski, 2000; White, 2007).

Note: Type of peatland An 'acid bog' is fed primarily by rainwater and often inhabited by sphagnum moss, thus making it acidic (Stoneman & Brooks,1997).
A 'fen' is a type of wetland fed by surface and/or groundwater (McBride et al., 2011).

Note: Time required for regeneration of previous habitat. Loss of fixation should be assumed to be over lifetime of windfarm only. This time could be longer if plants do not regenerate. The requirements for after-use planning include the provision of suitable refugia for peat-forming vegetation, the removal of structures, or an assessment of the impact of leaving them in situ. Methods used to reinstate the site will affect the likely time for regeneration of the previous habitat. This time could also be shorter if plants regenerate during lifetime of windfarm. If so, enter number of years estimated for regeneration.

Note: Carbon fixation by bog plants
Apparent C accumulation rate in peatland is 0.12 to 0.31 t C ha^{-1} yr^{-1} (Turunen et al., 2001; Botch et al., 1995). The SNH guidance uses a value of 0.25 t C ha^{-1} yr^{-1}.

Note: Area of forestry plantation to be felled. If the forestry was planned to be removed, with no further rotations planted, before the windfarm development, the area to be felled should be entered as zero.

Note: Plantation carbon sequestration. This is dependent on the yield class of the forestry. The SNH technical guidance assumed yield class of 16 m^3 ha^{-1} yr^{-1}, compared to the value of 14 m^3 ha^{-1} yr^{-1} provided by the Forestry Commission. Carbon sequestered for yield class 16 m^3 ha^{-1} y^{-1} = 3.6 tC ha^{-1} yr^{-1} (Cannell, 1999).

Note: Coal-fired plant emission factor (EF) from electricity supplied in 2023 = 1.046 t CO_2 MWh^{-1}; Digest of UK Energy Statistics (DUKES): electricity - GOV.UK (2024)
Grid Mix EF for 2024 = 0.20705 t CO_2 MWh^{-1}. Greenhouse gas reporting: conversion factors 2024 - GOV.UK

Note: Fossil Fuel-Mix Emission Factor. The emission factor from electricity supplied in 2024 from all non renewable fuels = 0.437 t CO_2 MWh^{-1} Digest of UK Energy Statistics (DUKES): electricity -

Note: Total length of access track. If areas of access track overlap with hardstanding area, exclude these from the total length of access track to avoid double counting of land area lost.

Note: Floating road depth. Accounts for sinking of floating road. Should be entered as the average depth of the road expected over the lifetime of the windfarm. If no sinking is expected, enter as zero.

Note: Length of floating road that is drained. Refers to any drains running along the length of the

Note: Rock filled roads. Rock filled roads are assumed to be roads where no peat has been removed and rock has been placed on the surface and allowed to settle.

Note: Depth of peat cut for cable trenches. In shallow peats, the cable trenches may be cut below the peat. To avoid overestimating the depth of peat affected by the cable trenches, only enter the depth of the peat that is cut.

Note: Peat Landslide Hazard. It is assumed that measures have been taken to limit damage (Scottish Executive, 2006, Peat Landslide Hazard and Risk Assessments. Best Practice Guide for Proposed Electricity Generation Developments. Scottish Executive, Edinburgh. pp. 34-35) so that C losses due to peat landslide can be assumed to be negligible. Link: http://www.scotland.gov.uk/Publications/2006/12/21162303/1.

Note: Period of time when improvement can be guaranteed. This guarantee should be absolute. Therefore, if you enter a value beyond the lifetime of the windfarm you should provide strong supporting evidence that this improvement can be guaranteed for the full period given. This includes the time requirement for the improvement to become effective. For example if 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 windfarm (25 years), the period of time when the improvement can be guaranteed should be entered as 25 years, and the improvement will be effective for (25 -10) = 15 years.

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Note: Period of time when improvement can be guaranteed. This is assumed to be the lifetime of the windfarm as restoration after windfarm decommissioning is already accounted for in restoration of the site

Note: Restoration of site. If the water table at the site is returned to its original level or higher on decommissioning, and habitat at the site is restored, it is assumed that C losses continue only over the lifetime of the windfarm. Otherwise, C losses from drained peat are assumed to be 100%.

Note: Choice of methodology for calculating emission factors. The IPCC default methodology is the internationally accepted standard (IPCC, 1997). However, it is stated in IPCC (1997) that these are rough estimates, and "these rates and production periods can be used if countries do not have more appropriate estimates". Therefore, we have developed more site specific estimates for use here based on work from the Scottish Government funded ECOSSE project (Smith et al, 2007. ECOSSE: Estimating Carbon in Organic Soils - Sequestration and Emissions. Final Report. SEERAD Report. ISBN 978 0 7559 1498 2. 166pp.).

Core input data
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Click here to move to Payback Time Click here
Click here to return to Instructions Click here

Results

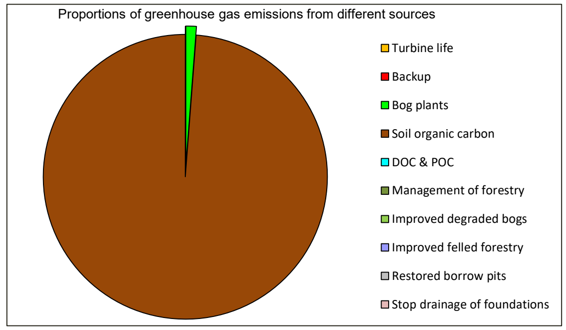
CO_2 EMISSIONS

Note: The carbon payback time has been removed from the below due to there being no payback time relevant to the carbon calculations of the Existing Development

Click here to return to Input data Click here

Click here to return to Instructions Click here

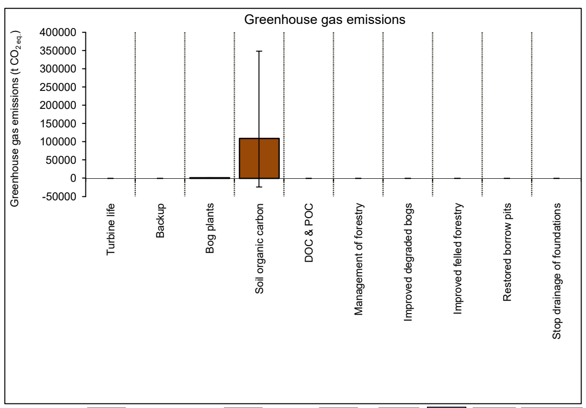
	Exp.	Min.	Max.
1. Windfarm CO_2 emission saving over…			
…coal-fired electricity generation ($tCO_2\ yr^{-1}$)	0	0	0
…grid-mix of electricity generation ($tCO_2\ yr^{-1}$)	0	0	0
…fossil fuel - mix of electricity generation ($tCO_2\ yr^{-1}$)	0	0	0
Energy output from windfarm over lifetime (MWh)	0	0	0
Total CO_2 losses due to wind farm (t CO_2 eq.)			
2. Losses due to turbine life (e.g. manufacture, construction, decommissioning)	0	0	0
3. Losses due to backup	0	0	0
4. Losses due to reduced carbon fixing potential	1339	930	1793
5. Losses from soil organic matter	109630	-24145	348442
6. Losses due to DOC & POC leaching	0	0	0
7. Losses due to felling forestry	0	0	0
Total losses of carbon dioxide	110969	-23215	350235
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	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	0	0	0
Total change in emissions due to improvements	0	0	0

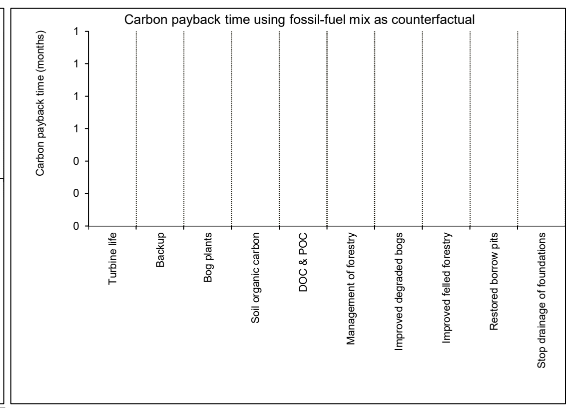


Data used in barchart of carbon payback time using fossil-fuel mix as counterfactual

Greenhouse gas emissions

	Exp.	Min	Max
Turbine life	0	0	0
Backup	0	0	0
Bog plants	1339	409	454
Soil organic carbon	109630	133775	238813
DOC & POC	0	0	0
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





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

Greenhouse gas emissions

	Exp.	Min.	Max.
Turbine life	0	0	0
Backup	0	0	0
Bog plants	1339	409	454
Soil organic carbon	109630	133775	238813
DOC & POC	0	0	0
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
	110969		

Emissions due to loss of soil organic carbon

Note: Loss of C stored in peatland is estimated from % site lost by peat removal (sheet 5a), CO_2 loss from removed peat (sheet 5b), % site affected by drainage (sheet 5c), and from drained peat (sheet 5d).

		Expected result	Minimum result	Maximum result
	CO_2 loss due to windfarm construction			
Check	CO_2 loss from removed peat (t CO_2 equiv)	108679	-24145	343374
Check	CO_2 loss from drained peat (t CO_2 equiv)	951	0	5068
	RESULTS			
	Total CO_2 loss from peat (removed + drained) (t CO_2 equiv)	**109630**	**-24145**	**348442**
	Additional CO_2 payback time of windfarm due to loss of soil CO2			
	…coal-fired electricity generation (months)	N/A	N/A	N/A
	…grid-mix of electricity generation (months)	N/A	N/A	N/A
	…fossil fuel - mix of electricity generation (months)	N/A	N/A	N/A

Click here to move to Payback Time Click here

Emissions due to loss of soil organic carbon

Note: Loss of C stored in peatland is estimated from % site lost by peat removal (sheet 5a), CO_2 loss from removed peat (sheet 5b), % site affected by drainage (sheet 5c), and from drained peat (sheet 5d).

Volume of Peat Removed
Note: % site lost by peat removal is estimated from peat removed in borrow pits, turbine foundations, hard-standing and access tracks.
If peat is removed for any other reason, this must be added in as additional peat excavated in the core input sheet.

Peat removed from borrow pits	Total Exp	Total Min	Total Max
Number of borrow pits	0	0	0
Average length of pits (m)	0	0	0
Average width of pits (m)	0	0	0
Average depth of peat removed from pit (m)	0	0	0
Area of land lost in borrow pits (m^2)	0	0	0
Volume of peat removed from borrow pits (m^3)	0	0	0

Peat removed from turbine foundations/hardstands	Total Exp	Total Min	Total Max	Construction Area 1 Exp	Construction Area 1 Min	Construction Area 1 Max
Method used to calculate CO_2 loss from foundations	Rectangular with vertical walls					
Calculation method code		1				
No. of turbines	0	0	0	0	0	0
Diameter at surface (m)					0	0
					0	0
Diameter at bottom (m)					0	0
					0	0
Depth of foundations (m)					0	0
"Area" of land lost in hard-standing (m^2)	72652	72652	72652	72652	72652	72652
Volume of peat removed from foundation area (m^3)	117851	117851	117851	117851	117851	117851

Peat removed from access tracks	Total Exp	Total Min	Total Max
Floating roads			
Length of access track that is floating road (m)	2.3	2.3	2.3
Floating road width (m)	10	10	10
Floating road depth (m)	0	0	0
Area of land lost in floating roads (m^2)	23	23	23
Volume of peat removed for floating roads	0	0	0
Excavated roads			
Length of access track that is excavated road (m)	3	3	3
Excavated road width (m)	10	10	10
Average depth of peat excavated for road (m)	1.7	1.7	1.7
Area of land lost in excavated roads (m^2)	145234	145234	145234
Volume of peat removed for excavated roads	206969	206969	206969
Rock-filled roads			
Length of access track that is rock filled road (m)	4.1	4.1	4.1
Rock filled road width (m)	0	0	0
Rock filled road depth (m)	0	0	0
Area of land lost in rock filled roads (m^2)	0	0	0
Volume of peat removed for rock-filled roads	0	0	0
Total area of land lost in access tracks (m^2)	145257	145257	145257
Total volume of peat removed due to access tracks (m^3)	206969	206969	206969

Additional peat excavated - (not already accounted for above)			
Volume of additional peat excavated (m^3)	212323	126083	126083
Area of additional peat excavated (m^2)	127388	91588	91588

RESULTS	Total Exp	Total Min	Total Max
Total volume of peat removed (m^3) due to windfarm construction	**537143**	**537143**	**537143**
Total area of land lost due to windfarm construction (m^2)	**345297**	**345297**	**345297**

Click here to move to 5b. CO2 loss from removed peat — Click here

Click here to move to Payback Time — Click here

Volume of Peat Removed
Note: % site lost by peat removal is estimated from peat removed in borrow pits, turbine foundations, hard-standing and access tracks.
If peat is removed for any other reason, this must be added in to the volume of peat removed, area of land lost and % site lost at the bottom of this worksheet.

CO_2 loss from removed peats

Note: If peat is treated in such a way that it is permanently restored, so that less than 100% of the C is lost to the atmosphere, a lower percentage can be entered in cell C10

	Expected	Minimum	Maximum
CO_2 loss from removed peat			
C Content of dry peat (% by weight)	53.23	19.57	64.28
Dry soil bulk density (g cm^{-3})	0.13	0.01	0.29
% C contained in removed peat that is lost as CO_2	100	100	100
Check Total volume of peat removed (m^3) due to windfarm construction	537143	537143	537143
CO_2 loss from removed peat (t CO_2)	138398	2775	370975

Assumption: If peat is not restored, 100% of the carbon contained in the removed peat is lost as CO_2

	Expected	Minimum	Maximum
CO_2 loss from undrained peat left in situ			
Total area of land lost due to windfarm construction (ha)	35	35	35
CO_2 loss from undrained peat left in situ (t CO_2 ha^{-1})	861	780	799
CO_2 loss from undrained peat left in situ (t CO_2)	29719	26920	27600

	Expected	Minimum	Maximum
CO_2 loss attributable to peat removal only			
CO_2 loss from removed peat (t CO_2)	138398	2775	370975
CO_2 loss from undrained peat left in situ (t CO_2)	29719	26920	27600
RESULTS			
CO_2 loss attributable to peat removal only (t CO_2)	**108679**	**-24145**	**343374**

Click here to move to 5. Loss of soil CO_2 Click here

Click here to move to Payback Time Click here

CO_2 loss from removed peats

Note: If peat is treated in such a way that it is permanently restored, so that less than 100% of the C is lost to the atmosphere, a lower percentage can be entered in cell C10

Volume of peat drained

Note: Extent of site affected by drainage is calculated assuming an average extent of drainage around each drainage feature as given in the input data.

Extent of drainage around each metre of drainage ditch	Total		
	Exp	Min	Max
Average extent of drainage around drainage features at site (m)	15	15	15

Peat affected by drainage around borrow pits	Total		
	Exp	Min	Max
Number of borrow pits	0	0	0
Average length of pits (m)	0	0	0
Average width of pits (m)	0	0	0
Average depth of peat removed from pit (m)	0.0	0.0	0.0
Area affected by drainage per borrow pit (m^2)	900	900	900
Total area affected by drainage around borrowpits (m^2)	0	0	0
Total volume affected by drainage around borrowpits (m^3)	0	0	0

Peat affected by drainage around turbine foundation and hardstanding	Total			Construction Area 1		
	Exp	Min	Max	Exp	Min	Max
No. of turbines	0	0	0	0	0	0
Average length of turbine foundations at base (m)				23	0	0
Average width of turbine foundations at base(m)				23	0	0
Average depth of peat removed from turbine foundations (m)				1.7	0.0	0.0
Average length of hard-standing at base (m)				52	0	0
Average width of hard-standing at base (m)				35	0	0
Average depth of peat removed from hard-standing (m)				1.7	0.0	0.0

Maximum depth of drains (m)				1.7	0.0	0.0
Total length of foundation and hardstanding (m)				75	0	0
Total width of foundation and hardstanding (m)				58	0	0
Area affected by drainage of foundation and hardstanding area (m^2)	0	0	0	0	0	0
Total area affected by drainage of foundation and hardstanding area (m^2)	0	0	0	0	0	0
Total volume affected by drainage of foundation and hardstanding area (m^3)	0	0	0	0	0	0

Peat affected by drainage of access tracks	**Total**		
	Exp	**Min**	**Max**
<u>Floating roads</u>			
Length of floating road that is drained (m)	0	0	0
Floating road width (m)	10.0	10.0	10.0
Average depth of drains associated with floating roads (m)	0.00	0.00	0.00
Area affected by drainage of floating roads (m^2)	0	0	0
Volume affected by drainage of floating roads (m^3)	0	0	0
<u>Excavated Road</u>			
Length of access track that is excavated road (m)	3	3	3
Excavated road width (m)	10	10	10
Average depth of peat excavated for road (m)	1.7	1.7	1.7
Area affected by drainage of excavated roads (m^2)	90	90	90
Volume affected by drainage of excavated roads (m^3)	77	77	77
<u>Rock-filled roads</u>			
Length of rock filled road that is drained (m)	0	0	0
Rock filled road width (m)	0	0	0

Average depth of drains associated with rock filled roads (m)	0.0	0.0	0.0
Area affected by drainage of rock-filled roads (m^2)	0	0	0
Volume affected by drainage of rock-filled roads (m^2)	0	0	0
Total area affected by drainage of access track (m^2)	90	90	90
Total volume affected by drainage of access track (m^3)	77	77	77

Peat affected by drainage of cable trenches	**Total**		
	Exp	**Min**	**Max**
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
Average depth of peat cut for cable trenches (m)	1.2	1.2	1.2
Total area affected by drainage of cable trenches (m^2)	0	0	0
Total volume affected by drainage of cable trenches (m^3)	0.00	0.00	0.00

Drainage around additional peat excavated	**Total**		
	Exp	**Min**	**Max**
Volume of additional peat excavated (m^3)	212323.0	0.0	126083.0
Area of additional peat excavated (m^2)	127388.0	91588.0	91588.0
Average depth of excavated peat (m)	2	0	1
Radius of area excavated (m)	201	171	171
Radius of excavated and drained area (m)	216	186	186
Total area affected by drainage (m^2)	19685	16799	16799
Total volume affected by drainage (m^3)	32810.32	0.00	23126.13

Assumption: Area excavated is assumed to be a circle

RESULTS	Total		
	Exp	Min	Max
Total area affected by drainage due to windfarm (m^2)	19775	16889	16889
Total volume affected by drainage due to windfarm (m^3)	32886.82	76.5	23202.63

Click here to move to 5d. CO2 loss from drained peat Click here

Click here to move to Payback Time Click here

Volume of peat drained

Note: Extent of site affected by drainage is calculated assuming an average extent of drainage around each drainage feature as given in the input data.

CO_2 loss due to drainage

Note: Note, CO_2 losses are calculated using two approaches: IPCC default methodology and more site specific equations derived for this project. The IPCC methodology is included because it is the established approach, although it contains no site detail. The new equations have been derived directly from experimental data for acid bogs and fens (see Nayak et al, 2008 - Final report).

Click here to move to 5. Loss of soil CO_2 Click here
Click here to move to Payback Time Click here

	Expected	Minimum	Maximum
Drained Land			
Total area affected by drainage due to wind farm construction (ha)	2	2	2
Will the hydrology of the site be restored on decommissioning?	No	No	No
Will the habitat of the site be restored on decommissioning?	No	No	No

Calculations of C Loss from Drained Land if Site is NOT Restored after Decommissioning

	Expected	Minimum	Maximum
Check Total volume affected by drainage due to wind farm (m^3)	32887	77	23203
C Content of dry peat (% by weight)	53	20	64
Dry soil bulk density (g cm^{-3})	0.13	0.01	0.29
Total GHG emissions from Drained Land (t CO_2 equiv.)	8474	0	16025
Total GHG Emissions from Undrained Land (t CO_2 equiv.)	7523	0	10957

Assumption: Losses of GHG from drained and undrained land have the same proportion throughout the emission period.

Calculations of C loss from Drained Land if Site IS Restored after Decommissioning

1. Losses if Land is Drained

	Expected	Minimum	Maximum
Flooded period (days $year^{-1}$)	0	0	0
Lifetime of windfarm (years)	30	30	30
Time required for regeneration of bog plants after restoration (years)	10	5	15
Methane Emissions from Drained Land			
Check Rate of methane emission in drained soil ((t CH_4-C) ha^{-1} yr^{-1})	-0.001	-0.015	0.016
Conversion factor: CH_4-C to CO_2 equivalents	30.67	30.67	30.67
CH_4 emissions from drained land (t CO_2 equiv.)	-3	-28	36
Carbon Dioxide Emissions from Drained Land			
Check Rate of carbon dioxide emission in drained soil (t CO_2 ha^{-1} yr^{-1})	24.28	22.75	25.50
CO_2 emissions from drained land (t CO_2)	1921	1345	1938
Total GHG emissions from Drained Land (t CO_2 equiv.)	1917	1317	1974

Assumption: The drained soil is not flooded at any time of the year.

Note:Conversion = (23 x 16/12) = 30.67 CO_2 equiv. $(CH_4\text{-}C)^{-1}$

2. Losses if Land is Undrained

	Expected	Minimum	Maximum
Flooded period (days $year^{-1}$)	178	178	178
Lifetime of windfarm (years)	30	30	30
Time required for regeneration of bog plants after restoration (years)	10	5	15
Methane Emissions from Undrained Land			
Check Rate of methane emission in undrained soil ((t CH_4-C) ha^{-1} yr^{-1})	0.00	-0.02	0.16
Conversion factor: CH_4-C to CO_2 equivalents	30.67	30.67	30.67
CH_4 emissions from undrained land (t CO_2 equiv.)	-2	-28	202
Carbon Dioxide Emissions from Undrained Land			
Check Rate of carbon dioxide emission in undrained soil (t CO_2 ha^{-1} yr^{-1})	18.67	22.75	4.19
CO_2 emissions from undrained land (t CO_2)	1704	1345	1148
Total GHG Emissions from Undrained Land (t CO_2 equiv.)	1702	1317	1350

Note:Conversion = (23 x 16/12) = 30.67 CO_2 equiv. $(CH_4\text{-}C)^{-1}$

3. CO_2 Losses due to Drainage

	Expected	Minimum	Maximum
Total GHG emissions from drained land (t CO_2 equiv.)	8474	0	16025
Total GHG emissions from undrained land (t CO_2 equiv.)	7523	0	10957
RESULTS			
Total GHG emissions due to drainage (t CO_2 equiv.)	**951**	**0**	**5068**

Click here to move to 5. Loss of soil CO_2 Click here
Click here to move to Payback Time Click here

CO_2 loss due to drainage

Note: Note, CO_2 losses are calculated using two approaches: IPCC default methodology and more site specific equations derived for this project. The IPCC methodology is included because it is the established approach, although it contains no site detail. The new equations have been derived directly from experimental data for acid bogs and fens (see Nayak et al, 2008 - Final report).

Emission rates from soils

Note: Note, CO_2 losses are calculated using two approaches: IPCC default methodology and more site specific equations derived for this project. The IPCC methodology is included because it is the established approach, although it contains no site detail. The new equations have been thoroughly tested against experimental data (see Nayak et al, 2008 - Final report).

Click here to move to 5d. Click here
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Selected Methodology = Site specific (required for planning applications)
Type of peatland = Acid Bog

Calculations following IPCC default methodology	**Expected**	**Minimum**	**Maximum**
Emission characteristics of acid bogs (IPCC, 1997)			
Flooded period (days year^{-1})	178	178	178
Annual rate of methane emission (t CH_4-C ha^{-1} yr^{-1})	0.04015	0.04015	0.04015
Annual rate of carbon dioxide emission (t CO_2 ha^{-1} yr^{-1})	35.2	35.2	35.2
Emission characteristics of fens (IPCC, 1997)			
Flooded period (days year^{-1})	169	169	169
Annual rate of methane emission (t CH_4-C ha^{-1} yr^{-1})	0.219	0.219	0.219
Annual rate of carbon dioxide emission (t CO_2 ha^{-1} yr^{-1})	35.2	35.2	35.2
Selected emission characteristics (IPCC, 1997)			
Flooded period (days year^{-1})	178	178	178
Annual rate of methane emission (t CH_4-C ha^{-1} yr^{-1})	0.04015	0.04015	0.04015
Annual rate of carbon dioxide emission (t CO_2 ha^{-1} yr^{-1})	35.2	35.2	35.2

Assumption: The period of flooding is taken to be 178 days yr^{-1} for acid bogs and 169 days yr^{-1} based on the monthly mean temperature and the lengths of inundation (IPCC, 1997, Revised 1996 IPCC guidelines for national greenhouse gas inventories, Vol 3, table 5-13)

Assumption: The CH_4 emission rate provided for acid bogs is 11 (1-38) mg CH_4-C m^{-2} day^{-1} x 365 days; and for fens is 60 (21-162) mg CH_4-C m^{-2} day^{-1} x 365 days (Aselmann & Crutzen ,1989. J.Atm.Chem. 8, 307-358)

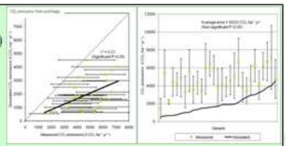
Assumption: CO_2 emissions on drainage of organic soils for upland crops (e.g., grain, vegetables) are 3.667x9.6 (7.9-11.3) t CO_2 ha^{-1} yr^{-1} in temperate climates (Armentano and Menges, 1986. J. Ecol. 74, 755-774).

Calculations following ECOSSE based methodology			
Drained Land			
Total area affected by drainage due to wind farm construction (ha)	2	2	2
Total volume affected by drainage due to wind farm construction (m^3)	32887	77	23203
Soil Characteristics that Determine Emission Rates			
Average annual air temperature at the site (^{o}C)	10	6	14.8
Average water table depth at site (m)	0.50	1.00	0.10
Average water table depth of drained land (m)	1.66	1.00	1.37
Annual Emission Rates following site specific methodology			
Acid bogs			
Rate of carbon dioxide emission in drained soil (t CO_2 ha^{-1} yr^{-1})	24.28	22.75	25.50
Rate of carbon dioxide emission in undrained soil (t CO_2 ha^{-1} yr^{-1})	18.67	22.75	4.19
Rate of methane emission in drained soil ((t CH_4-C) ha^{-1} yr^{-1})	-0.001	-0.015	0.016
Rate of methane emission in undrained soil ((t CH_4-C) ha^{-1} yr^{-1})	0.00	-0.02	0.16
Fens			
Rate of carbon dioxide emission in drained soil (t CO_2 ha^{-1} yr^{-1})	65.18	62.67	67.87
Rate of carbon dioxide emission in undrained soil (t CO_2 ha^{-1} yr^{-1})	55.58	62.67	10.46
Rate of methane emission in drained soil ((t CH_4-C) ha^{-1} yr^{-1})	-0.003	-0.006	0.000
Rate of methane emission in undrained soil ((t CH_4-C) ha^{-1} yr^{-1})	0.00	-0.01	0.21
Selected emission characteristics following site specific methodology			
Rate of carbon dioxide emission in drained soil (t CO_2 ha^{-1} yr^{-1})	24.28	22.75	25.50
Rate of carbon dioxide emission in undrained soil (t CO_2 ha^{-1} yr^{-1})	18.67	22.75	4.19
Rate of methane emission in drained soil ((t CH_4-C) ha^{-1} yr^{-1})	-0.001	-0.015	0.016
Rate of methane emission in undrained soil ((t CH_4-C) ha^{-1} yr^{-1})	0.00	-0.02	0.16

Note: Carbon dioxide emissions from acid bogs. Equation derived by regression analysis against 60 measurements (Nayak et al, 2009). The equation derived was

R_{CO2} = (3.667/1000) x ((6700 x exp(-0.26 x exp(-0.0515 × ((*W*x100)-50)))) + ((72.54 × *T*) - 800))

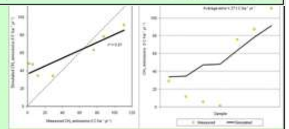
where R_{CO2} is the annual rate of CO_2 emissions (t CO_2 (ha)$^{-1}$ yr^{-1}),
T = average annual peat temperature (°C) and
W is the water table depth (m).
The equation shows a significant correlation with measurements (r^2 =0.53 $P > 0.05$).
Evaluation against 29 independent experiments shows a significant association (r^2 = 0.21; P>0.05) and an average error of 3023 t CO_2 ha^{-1} yr^{-1} which is non-significant (P<0.05) (Smith et al, 1997).



measurements (Nayak et al, 2009). The equation derived was

R_{CH4} = (1/1000) x (500 × exp(-0.1234 × (Wx100)) + ((3.529 × *T*) - 36.67))

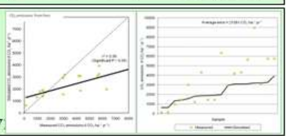
where R_{CH4} is the annual rate of CH_4 emissions (t CH_4-C (ha)$^{-1}$ yr^{-1}),
T = average annual air temperature (°C) and
W is the water table depth (m).
The equation shows a significant correlation with measurements (r^2 = 0.54, $P > 0.05$).
Evaluation against 7 independent experiments shows a significant association (r^2 = 0.81; P>0.05) and an average error of 27 t CH_4-C ha^{-1} yr^{-1} (significance not defined due to lack of replicates - Smith et al, 1997).



Note: Carbon dioxide emissions from fens. Equation derived by regression analysis against 44 measurements (Nayak et al, 2009). The equation derived was

R_{CO2} = (3.667/1000) x (16244 x exp(-0.175 x exp(-0.073 x ((*W*x100)-50)))+(153.23 x *T*))

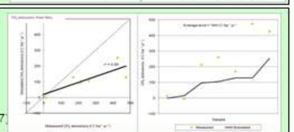
where R_{CO2} is the annual rate of CO_2 emissions (t CO_2 (ha)$^{-1}$ yr^{-1}),
T = average annual peat temperature (°C) and
W is the water table depth (m).
The equation shows a significant correlation with measurements (r^2 = 0.42, $P > 0.05$).
Evaluation against 18 independent experiments shows a significant association (r^2 = 0.56; P>0.05) and an average error of 2108 t CO_2 ha^{-1} yr^{-1} (significance not defined due to lack of replicates-Smith et al, 1997)



Note: Methane emissions from fens. Equation derived by regression analysis against experimental data from 35 measurements (Nayak et al, 2009). The equation derived was

R_{CH4} = (1/1000) x (-10+563.62 x exp(-0.097 x (*W* x 100))+(0.662 x *T*))

where R_{CH4} is the annual rate of CH_4 emissions (t CH_4-C (ha)$^{-1}$ yr^{-1}),
T = average annual air temperature (°C) and
W is the water table depth (m).
The equation shows a significant correlation with measurements (r^2 = 0.41, P>0.05).
Evaluation against 7 independent experiments shows a significant association (r^2 = 0.69; P>0.05) and an average error of 164 t CH_4-C ha^{-1} yr^{-1} (significance not defined due to lack of replicate-Smith et al, 1997)



RESULTS

Selected Emission Rates			
Rate of carbon dioxide emission in drained soil (t CO_2 ha^{-1} yr^{-1})	24.28	22.75	25.50
Rate of carbon dioxide emission in undrained soil (t CO_2 ha^{-1} yr^{-1})	18.67	22.75	4.19
Rate of methane emission in drained soil ((t CH_4-C) ha^{-1} yr^{-1})	-0.001	-0.015	0.016
Rate of methane emission in undrained soil ((t CH_4-C) ha^{-1} yr^{-1})	0.00	-0.02	0.16

Click here to move to 5d. CO2 loss from drained peat Click here
Click here to move to Payback Time Click here

Emission rates from soils

Note: Note, CO_2 losses are calculated using two approaches: IPCC default methodology and more site specific equations derived for this project. The IPCC methodology is included because it is the established approach, although it contains no site detail. The new equations have been thoroughly tested against experimental data (see Nayak et al, 2008 - Final report).

TII CARBON TOOL

Ch 15: Material Assets					Distance Assumptions	TII Embodied Carbon Tool Inputs (https://web.tii.ie/index.html)						TII Transport Inputs (https://web.tii.ie/index.html)		
Material	Total no. Truck Loads	Truck Types	TII Embodied Carbon	TII Traffic	Distance (km)	Category	Sub-Category	Material	Quantity	Unit	Embodied tCO2e	Transport Type	Distance (km)	Transport TCO2e
Concrete	983	Trucks	✓	✓	32.775	Series 1700 Structural Concrete	In Situ Concrete - General	In Situ Concrete, General	17,638,952.00	kg	14322.829	HGV - Rigid - Average	27920	28.689
Delivery and Removal of Plant	100	Large Artic		✓	32.775							HGV- All - Average	15737.7	17.068
Fencing and Gates, Geotextiles, Drainage Pipes	17	Large Artic		✓	32.775							HGV- All - Average	139.6	0.151
Steel	59	Large Artic	✓	✓	32.775	Other	Structural Steelwork	Anchorages and holding down bolt assemblies	1180	tonnes	2115.858	HGV- All - Average	14307	15.516
Ducting and Cabling (internal)	28	Large Artic		✓	32.775							HGV- All - Average	953.93	1.035
Substation Building Materials and Equipment (excluding aggregates)	70	Trucks		✓	230							HGV - Articulated - Average	7631.47	8.584
Refuelling for Plant	128	Large Artic		✓	32.775							HGV - All - Average	10260.6	11.128
Aggregates Imported (Sand, Blinding, Stone)*	1073	Trucks	✓	✓	32.775	Series 700 - Pavements	Pavement base and subbase	Aggregates and sand from recycled resources, no heat treatment, bulk, loose	2,431,696.00	kg	14.712	HGV - All - Average	476.9	0.517
			✓	✓		Series 3400: Brickwork Blockwork and Stonework	Blockwork and Stonework	General Stone	19,028.30	tonnes	1503.236			
Materials for Grid Connection	692	Large Artic	✓	✓	32.775	Series 600 - Earthworks	Backfill/Fill	Aggregates and sand from secondary resources, bulk, loose	13,840,000.00	kg	876.072	HGV - All - Average	5484.35	5.948
Grid Route Reinstatement	40	Trucks	✓	✓	32.775	Series 600 - Earthworks	Backfill/Fill	Aggregates and sand from secondary resources, bulk, loose	800,000.00	kg	50.64	HGV - Articulated - Average	8236.4	9.264
Grid Route – Excavated Material to Licenced Disposal Facility	422	Trucks		✓	32.775							HGV - Articulated - Average	1,158,657	1,303.246
Total											18,883.35			137.74

** Please note the Aggregates Imported Line Item has been split for the embodied carbon assessment due to the available information on imported stone. Transport emissions for this line item have not been split.*

Pre-Construction Activities						
Activity	Clearance Category	Sub-Category	Activity	Quantity	Unit	Activity Emissions tCO2e
Felled Forestry	Demolition and Site Clearance	General Clearance	General Clearance - Mixed Forest	73.6	ha	97.406
Peatland (i.e., area of excavated material)	Demolition and Site Clearance	General Clearance	General Clearance - Peat Bogs	30.9	ha	13.576
Total						112.56

Construction Excavation Activities						
Excavation Infrastructure	Excavation Category	Excavation Subcategory	Activity	Quantity	Unit	Activity tCO2e
Site Won Material used for the Existing Development	Earthworks - Excavation	General Excavation	General Excavation - Rock	496,614.65	m3	9661.65
Total	Total					9661.65

List of Assumptions

Macauley Carbon Tool

Item	Macauley Assumptions Description	Assumption
Peat Disturbed from November 2020 Peat Slide	As identified in Appendix 6-2 Peat and Spoil Management Plan, The estimated total area of the upper scar is about 2.4ha with the total failure volume from the upper scar estimated at 65,000m3. The estimated total area of the lower scar is about 1.18ha with the total failure volume from the lower scar estimated at 21,240m3. Total failure volume is therefore 65,000m3 + 21,240m3 which is 86,240m3. The actual volume of failed material that left the failure scar would be less than the total failure volume as a notable proportion of the failed material still remains in the upper scar. However, it has been assumed that all peat (i.e., 86,240m3) has been lost for the purposes of the carbon assessment contained in Chapter 11 of the rEIAR. Value was Manually Inputs into the Macauley Tool Worksheet 5a. Volume of Peat Removed and 5b. CO2 Loss from Removed Peat.	86,240m3
Excavated Peat from the Existing Development (volume)	As per Section 4.4.1.7.1 of Chapter 4 of the rEIAR, approximately 450,903m3 of peat has been excavated as part of the Existing Development. Value was Manually Inputs into the Macauley Tool Worksheet 5a. Volume of Peat Removed and 5b. CO2 Loss from Removed Peat.	405,903.00m3
Excavated Peat from the Existing Development (area)	As per Section 4.4.1.7.1 of Chapter 4 of the rEIAR, an area of approximately 309,474m2 has been excavated as part of the Existing Development. Value was Manually Inputs into the Macauley Tool Worksheet 5a. Volume of Peat Removed and 5b. CO2 Loss from Removed Peat.	309,474.00m2

TII Carbon Tool

Embodied Carbon Assumptions		
Item	Description	Assumption
Volume of Concrete Mixer	Calculation completed based on the average concrete mixer holding 8m3 of concrete	8
Volume of Average Artic Truck	Calculation completed based on the average artic truck having a carrying capacity of 20 tonnes	20
Ducting and cabling (internal)	Embodied carbon of electrical equipment not included as an option in TII Carbon Tool	-
Grid connection cable laying	Embodied carbon of electrical equipment not included as an option in TII Carbon Tool	-
Volume of Concrete Material	There will be approximately 7,864m3 of concrete required for the Proposed Project., The TII Carbon Tool requires this material to be in kg. The density of concrete to be used at the Existing Development is assumed to have average density of approximately 2,243m3/kg. Based on an assumed 7,864m3 of concrete being required (based on 983 truckloads of concrete with a 8m3 carrying capacity) this would result in approximately 17.638.952kg being used for the Existing Development Calculated from '*Cement General (UK Average)*' emission factor as provided in the TII Carbon Tool. Source: ICE v4. ICE DB Advanced V4.0 - Dec 2024	17,638,952.00kg
Volume of Steel	An assumed 1,180 tonnes of steel is required (based on 59 truckloads of steel with a 20 tonne carrying capacity) for the Proposd Project Calculated from '*Anchorages and holding down bolt assemblies*' emission factor as provided in the TII Carbon Tool. Source: ICE (2013), CESMM4 Carbon & Price Book 2013	1,180 tonnes

Imported Aggregate (Sand)	There will be approximately 21,460 tonnes of imported aggregate (sand, blinding and stone) required for the Existing Development. Stone volumes have been extracted from this total volume and are outlined below (i.e. 11,193.12m3/19,028.3tonnes). The remainder has been assumed to be sand/blinding. The TII Carbon Tool require this material to be in kg. Based on an assumed 2,431.7 tonnes of sand/blinding being required (based on 1,703 truckloads of material with a 20 tonnes carrying capacity and assuming that 19,028.3 tonnes of stone are imported separately) this would result in approximately 2,431,696kg of sand and blinding being used for the Existing Development. Calculated from '*Aggregates and sand from recycled resources, no heat treatment, bulk, loose*' emission factor as provided in the TII Carbon Tool. Source: ICE v4. ICE DB Advanced V4.0 - Dec 2024	2,431,696.00kg
Imported Aggregate (Stone)	There will be approximately 11,193.12m3 of stone imported to the Existing Development. The TII Carbon Tool Requires this material to be in tonnes. Based on an assumed 11,193.12m3 of material and an assumed density of stone equating to 1.7t/m3, there will be approximately 19,028.3 tonnes of stone being imported for the Existing Development. Calculated from '*General Stone*' emission factor as provided in the TII Carbon Tool. Source: National Highways Carbon Tool v2.4. Note - ICE V4 database does not provide an update for this material.	19,028.30 tonnes
Materials for Grid Connection	There will be approximately 13,840 tonnes of imported aggregate required for the Existing Development. The TII Carbon Tool require this material to be in kg. Based on an assumed 13,840 tonnes of sand/binding stone being required (based on 892 truckloads of material with a 20 tonnes carrying capacity) this would result in approximately 13,840,000kg being used for the Existing Development. Calculated from '*Aggregates and sand from recycled resources, no heat treatment, bulk, loose*' as provided in the TII Carbon Tool. Source: ICE v4. ICE DB Advanced V4.0 - Dec 2024	13,840,000.00kg
Grid Route Reinstatement	There will be approximately 800 tonnes of imported aggregate required for the Existing Development. The TII Carbon Tool require this material to be in kg. Based on an assumed 800 tonnes of sand/binding stone being required (based on 40 truckloads of material with a 20 tonnes carrying capacity) this would result in approximately 800,000kg being used for the Existing Development. Calculated from '*Aggregates and sand from recycled resources, no heat treatment, bulk, loose*' as provided in the TII Carbon Tool. Source: ICE v4. ICE DB Advanced V4.0 - Dec 2024	800,000.00kg

Please note that the assumptions for the embodied carbon and traffic assumptions are made based on best estimates of material sources. In reality the location of material sources will be dependent on what is available at the time of construction. The implications of distance variations on the estimation for carbon calculations is of a very low magnitude within the context of the overall carbon calculations and considered appropriate for the purposes of assessment in the EIAR.

Traffic Assumptions		
Item	Description	Assumption
Import (P) Distance	For modelling purposes, the average distance from Port of Dublin and Port of Galway, Co. Galway for transport of all other materials for the Site	230
Quarry (Q) Distance	For modelling purposes, the average distance from proximate city/towns to the Existing Development for transport of construction materials to the Site	32.775
Concrete Mixer Emission factor	Calculated from an HGV - Rigid - All emission factor as provided in the TII Carbon Tool. Source: 2024 DEZNZ emission factors - 'Delivery vehicles' tab, All Rigids HGVs and used Average laden weight. 2024 DEZNZ emission factors - 'WTT - delivery vehs & freight' tab, all Rigids HGVs and used Average laden weight.	1.02756

Large Artic Emission Factor	Calculated from an HGV - All - Average emission factor as provided in the TII Carbon Tool. Source: 2024 DEZNZ emission factors - 'Delivery vehicles' tab, All artics HGVs and used Average laden weight. 2024 DEZNZ emission factors - 'WTT - delivery vehs & freight' tab, all artics HGVs and used Average laden weight.	1.0845
Truck Emissions Factor	Calculated from an HGV - Rigid - All emission factor as provided in the TII Carbon Tool. Source: 2024 DEZNZ emission factors - 'Delivery vehicles' tab, All Rigids HGVs and used Average laden weight. 2024 DEZNZ emission factors - 'WTT - delivery vehs & freight' tab, all Rigids HGVs and used Average laden weight.	1.02756

Please note that the assumptions for the embodied carbon and traffic assumptions are made based on best estimates of material sources. In reality the location of material sources will be dependent on what is available at the time of construction. The implications of distance variations on the estimation for carbon calculations is of a very low magnitude within the context of the overall carbon calculations and considered appropriate for the purposes of assessment in the EIAR.

Carbon Fixing Vegetation Assumptions		
Item	Description	Assumption
Calculation of Carbon Storage Potential in Replanting Measures	The carbon storage capacity of replanting forestry will vary over time as vegetation matures and land use and the baseline environment change. Therefore, while it can be assumed that forestry replanting that has occurred elsewhere in the State will result in an increased capacity of carbon storage due to the carbon storage potential that exists within this habitat, to ensure the assessment contained in Chapter 11 is identified under a theoretical precautionary scenario the quantification of these potential carbon savings (via an increase in carbon storage potential) has not been included in the carbon savings assessment. Please note, the carbon sequestration potential associated with the replanting of forestry will be able to be determined in the future via the Teagasc Forest Carbon Tool; currently this is not able to be completed due to Teagasc carrying out further analysis and validation on current data and the sequestration potential not being available in the public domain.	Not considered in assessment or quantified
Calculation of Carbon Loss from removal of carbon fixing vegetation	Carbon losses associated with the removal of other carbon-fixing vegetation will result in additional carbon losses. These have not been quantified as the lack of consistent national-level field data and methodologies limits the ability to make accurate projections on carbon sequestration potential for other carbon fixing habitat types, i.e., hedgerow, grassland, etc., and therefore carbon loss associated with removal.	Not considered in assessment or quantified

Pre-Construction Activities		
Item	Description	Assumption
Forestry Felling	As per Section 4.4.1.7 of Chapter 4 of the rEIAR, a total of 73.6ha of forestry has been felled as part of the Existing Development. Calculated from '*Mixed Forest*' emission factors as provided in the TII Carbon Tool. Source: ICE (2013), CESMM4 Carbon & Price Book 2013	73.6ha
Peatland (i.e., area of excavated material)	As per Section 4.4.1.8.1 of Chapter 4 of the rEIAR the total area of excavated peat will be approximately 309,746m2. The TII Carbon Tool requires this value in hectares (ha). Therefore, there will be 30.9ha of peatland cleared for the purposes of excavating peat from the Existing Development Calculated from the '*General Clearance - Peat Bogs*' emission factor provided by the TII Carbon Tool. Source: ICE (2013), CESMM4 Carbon & Price Book 2013 – note, assumed same as General Clearance – general site clearance	30.9ha

Construction Excavation Activities Assumptions		
Item	Description	Assumption
Rock Excavation at the Existing Development	As identified in Section 4.4.1.3 of Chapter 4 of the rEIAR, approximately 507,808.35m3 of rock has been won on site for use as part of the Existing Development. Approximately 496,614.65m3 of rock has been used to date as part of the Existing Development. The use of the 496,614.65m3 of rock has therefore been utilised within the TII Carbon Tool. Calculated from '*General Excavation - Rock*' as provided in the TII Carbon Tool. Source: ICE (2013), CESMM4 Carbon & Price Book 2013 - note, average of all rock depths	496,614.65m3

Subject Developmnt

Origin of Losses	Expected	%age Breakdown of total Subject Development	Maximum
Losses due to reduced carbon fixing potential	1,339	0.5%	1,793
Losses from soil organic matter	109,630	38.5%	348,442
Losses associated with embodied carbon in construction materials	18,883	6.6%	18,883
Losses associated with traffic and transport movements	138	0.0%	138
Lossess associated with pre-construction activities	111	0.0%	111
Lossess associated with construction activites	9,662	3.4%	9,662
Existing Development Total	**139,763**	**49.1%**	**379,029**
Losses due to turbine life (e.g., manufacture, construction, decommissioning)	76,329	26.8%	76,329
Losses due to reduced carbon fixing potential	439	0.2%	1,793
Losses due to backup	43,641	15.3%	43,641
Losses from soil organic matter	21,999	7.7%	348,442
Losses associated with embodied carbon in construction materials	2,164	0.8%	76,329
Losses associated with traffic and transport movements	122	0.0%	122
Lossess associated with pre-construction activities	162	0.1%	162
Lossess associated with construction activites	73	0.0%	73
Prospective Development Total	**144,929**	**50.9%**	**546,891**
Subject Development Total	**284,692**	**100.0%**	**925,919**

MW per annum	53,097	21%		of the total amount of carbon dioxide emissions that will be offset by the Subject Development
MW for 25 years	1,327,425.00	64.3		months of operation to offset construction and operation
		5.4		Years

Origin of Losses	Expected	%age Breakdown of total Subject Development	Maximum
Losses due to reduced carbon fixing potential	1,778	0.6%	3,586
Losses from soil organic matter	131,629	46.2%	696,884
Losses associated with embodied carbon in construction materials	21,048	7.4%	95,212
Losses associated with traffic and transport movements	260	0.1%	260
Lossess associated with pre-construction activities	273	0.1%	273
Lossess associated with construction activites	9,734	3.4%	9,734
Losses due to turbine life (e.g., manufacture, construction, decommissioning)	76,329	26.8%	76,329
Losses due to backup	43,641	15.3%	43,641
Subject Development Total	**284,692**	**100%**	**925,919**