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.

Input data	Enter your values here	Record comments or assumptions here	Uncertanities Min	Max
Wind farm characteristics				
Dimensions				
No. of turbines	32			
Life time of wind farm (years)	30			
Performance				
Turbine capacity (MW)	3		20	30
Capacity factor (percentage efficiency)	30		27	34
Backup				
Extra capacity required for backup (%)	5			
Additional emissions due to reduced thermal efficiency of the reserve generation (%)	10			
Carbon dioxide emissions from turbine life - (eg. manufacture, construction, decommissioning)	Calculate wrt installed capacity			
Total CO_2 emission from turbine life (tCO_2 wind farm^{-1}) *(if known use direct input of emissions from turbine life)*				
Characteristics of peatland before wind farm development				
Type of peatland	Acid bog			
Average air temperature at site (^oC)	9			
Average depth of peat at site (m)	0.5			
C Content of dry peat (% by weight)	55	From MLURI (1991)		
Average extent of drainage around drainage features at site (m)	50			
Average water table depth at site (m)	0.50			
Dry soil bulk density (g cm^{-3})	0.10			
Average soil pH	4.9			
Characteristics of bog plants				
Time required for regeneration of bog plants after restoration (years)	5			
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				
Area of forestry plantation to be felled (ha)	10.4			
Average rate of carbon sequestration in timber (tC ha^{-1} yr^{-1})	3.60			
Counterfactual emission factors				
Coal-fired plant emission factor (t CO_2 MWh^{-1})	0.86			
Grid-mix emission factor (t CO_2 MWh^{-1})	0.43			
Fossil fuel- mix emission factor (t CO_2 MWh^{-1})	0.607			
Borrow pits				
Number of borrow pits	0			
Average length of pits (m)	0			
Average width of pits (m)	0			
Average depth of peat removed from pit (m)	0.00			
Wind turbine foundations				
Average length of turbine foundations (m)	18			
Average width of turbine foundations(m)	18			
Average depth of peat removed from turbine foundations(m)	0.5			
Hard-standing area associated with each turbine				
Average length of hard-standing (m)	35	1,250m2 total		
Average width of hard-standing (m)	35			
Average depth of peat removed from hard-standing (m)	0.5			
Access tracks				
Total length of access track (m)	24,191			
Existing track length (m)	5,916			
Length of access track that is floating road (m)	0			
Floating road width (m)	5			
Floating road depth (m)	0			
Length of floating road that is drained (m)	0			
Average depth of drains associated with floating roads (m)	0			
Length of access track that is excavated road (m)	18,275			
Excavated road width (m)	5.5			
Excavated road depth (m)	0.5			
Length of access track that is rock filled road (m)	0			
Rock-filled road width (m)	0			
Rock-filled road depth (m)	0			
Length of rock-filled road that is drained (m)	0			
Average depth of drains associated with rock-filled roads (m)	0			
Cable Trenches				
Length of any cable trench that does not follow access tracks and is lined with a permeable medium (eg. sand) (m)	750			
Depth of cable trench (m)	1.5			
Peat Landslide Hazard				
Weblink: Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments	0			
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)	0			
Water table depth in degraded bog before improvement (m)	0.00			
Water table depth in degraded bog after improvement (m)	0.00			
Time required for hydrology and habitat of bog to return to its previous state on improvement (years)	10			
Improvement of felled plantation land				
Area of felled plantation to be improved (ha)	0			
Water table depth in felled area before improvement (m)	1.00			
Water table depth in felled area after improvement (m)	0.00			
Time required for hydrology and habitat of felled plantation to return to its previous state on improvement (years)	10			
Restoration of peat removed from borrow pits				
Area of borrow pits to be restored (ha)	0			
Water table depth in borrow pit after restoration (m)	0.00			
Time required for hydrology and habitat of borrow pit to return to its previous state on restoration (years)	0			
Removal of drainage from foundations and hardstanding				
Water table depth around foundations and hardstanding after restoration (m)	0			
Time to completion of backfilling, removal of any surface drains, and full restoration of the hydrology (years)	30			
Restoration of site after decomissioning				
Will the hydrology of the site be restored on decommissioning?	Yes			
Will the habitat of the site be restored on decommissioning?	Yes			

Choice of methodology for calculating emission factors	Site specific

Note: Capacity factor. The average capacity factor between 1998 and 2004 for Scotland was 30% (DTI, 2006, Energy Trends, March 2006). We recommend that a site-specific capacity factor site should be used (as measured during planning stage). However, if this is unknown, the best (34%) and worst case capacity factors for Scotland (27%) should be used to determine the likely range of the results .

Note: Extra capaticity 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, Energy Policy, 32, 1949-56). 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%).

Note: Extra emissions due to reduced thermal efficiency of the reserve power generation ≈ 10% (Dale et al 2004, Energy Policy, 32, 1949-56)

Note: Emissions from turbine life. Note, if total emissions for the windfarm are unknown, emissions will be calculated according to turbine capacity. The normal range of CO_2 emissions is 394 to 8147 t CO_2 MW (White & Kulcinski, 2000. Fusion Eng. Des. 48, 473-48; White, 2007, Natural Resources Research. 15, 271 - 281.)

Note: A fen is a type of wetland fed by surface and/or groundwater. A bog is fed primarily by rainwater and often inhabited by sphagnum moss, making it acidic.

Note: Time required for regeneration of previous habitat. It is suggested that loss of fixation should be assumed to be over lifetime of windfarm only.
This time could 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 reinstatement the site will affect to 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 tC ha^{-1} yr^{-1} (Turunen et al., 2001, Global Biogeochemical Cycles, 15, 285-296; Botch et al., 1995, Global Biogeochemical Cycles, 9, 37-46). The SNH guidance uses a value of 0.25 tC 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 wind farm 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} y^{-1}, compared to the value of 14 m^3 ha^{-1} y^{-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, Forestry, 72, 238-247)

Note: Coal-Fired Plant and Grid Mix Emission Factors. Coal-fired plant EF = 0.86 t CO_2 MWh^{-1}; Grid-Mix EF = 0.43 t CO_2 MWh^{-1}. Source = DEFRA, 2002. Guidelines for the measurement and reporting of emissions by Direct Participants in UK Emissions Trading Scheme (DEFRA,Oct 2002)

Note: Fossil Fuel Mix Emission Factor. The 5 year average emission factor calculated using estimated CO2 emissions for 2002 and 2003 from the National Atmospheric Emission Inventory (Baggott et al, 2007, http://www.naei.org.uk/reports.php. Report AEAT/ENV/R/2429 13/04/2007) and for 2004 to 2006 (Digest of UK Energy Statistics ,2007, http://www.berr.gov.uk/energy/statistics/source/electricity/page18527.html) is 0.607 tCO_2 MWh^{-1}

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: 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: Peat Landslide Hazard. It is assumed that measures have been taken to may 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: Restoration of site. If the water table at the site is returned to its original level or higher on decomissioning, 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 IPPC default methodology is the internationally accepted standard (IPCC, 1997, Revised 1996 IPCC guidelines for national greenhouse gas inventories, Vol 3, table 5-13). 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 SEERAD 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.)