Technical Appendix 8-1

Carbon Calculator Vestas / Siemens & Input Data

Knockanarragh Wind Farm EIAR Volume 2

Knockanarragh Wind Farm Limited

SLR Project No.: 501.V00727.00008

March 2024

Data Inputs	Vestas 7.2 Mw (tCO_2e)	Siemens Gamesa 6.6 Mw (tCO2e)
Windfarm Characteristics		
Dimensions		
No. of turbines	8	8
Duration of Consent (years)	35	35
Performance		
Power rating of 1 turbine (MW)	7.2	6.6
Capacity factor (%)	33	33
Backup		
Fraction of output to backup (%)	5	5
Additional emissions due to reduced thermal efficiency of the reserve generation (%)	10	10
Total CO2 emissions from turbine life ($tCO2\ MW^{-1}$)	Calculate wrt installed capacity	calculate wrt installed capacity
Characteristics of peatland before windfarm development		
Type of peatland	Fen	Fen
Average annual air temperature at sie (°C)	9.3	9.3
Average depth of peat at site (m)	1.18	1.18
C Content of dry peat (% by weight)	19	19
Average extent of drainage around drainage features at site (m)	30	30
Dry soil bulk density ($g\ cm^{-3}$)	0.05	0.05
Characteristics of bog plants		
Time required for regeneration of bog plants after restoration (years)	2	2
Carbon accumulation due to C fixation by bog plants in undrained peats ($tc\ ha^{-1}\ yr^{-1}$)	0	0.1
Forest Plantation Characteristics		

Area of forestry plantation to be felled (ha)	19	19
Average rate of carbon sequestration in timber (tC ha^{-1} yr^{-1})	3.6	3.6
Emission Factor		
Irish Grid Emission Factor (gCO2/kWh)	332	332
Borrow Pits		
Number of borrow pits	2	2
average length of pits (m)	90	90
Average width of pits (m)	90	90
Average depth of peat removed from pit (m)	0	0
Access Tracks		
Total length of access track (m)	6,030	6030
Existing track length (m)	486	486
Length of access track that is floating road (m)	0	0
Floating road width (m)	0	0
Floating road depth (m)	0	0
Length of floating road that is drained (m)	0	0
Average depth of drains associated with floating roads (m)	0	0
Length of access track that is excavated road (m)	3,020	3,020
Excavated road width (m)	5.5	5.5
Average depth of peat excavated for road (m)	0	0
Length of access track that is rock filled road (m)	2,524	2,524
Rock filled road width (m)	5	5

Rock filled road depth (m)	0.5	0.5
Length of rock filled road that is drained (m)	6,030	6,030
Average depth of drains associated with rock filled roads (m)	1	1
Cable Trenches		
Length of any cable trench on peat that does not follow access tracks and is lined with permeable medium (e.g sand) (m)	100	100
Average depth of peat cut for cable trenches (m)	10	10
Additional peat excavated		
Volume of addition peat excavated (m^3)	0	0
Area of addition peat excavated (m^2)	0	0
Improvement of C sequestration at site by blocking drains, restoration of habitat etc		
<u>Improvement of degraded bog</u>		
Area of degraded bog to be improved (ha)	n/a	n/a
Water table depth in degraded bog before improvement (m)	n/a	n/a
Water table depth in degraded bog after improvement (m)	n/a	n/a
Time required for hydrology and habitat of bog to return to its previous state on improvement (years)	n/a	n/a
Period of time when effectiveness of the improvement in degraded bog can be guaranteed (years)	n/a	n/a
<u>Improvement of felled plantation land</u>		
Area of felled plantation to be improved (ha)	19	19
Water table depth in degraded bog before improvement (m)	1	1
Water table depth in degraded bog after improvement (m)	1	1
Time required for hydrology and habitat of bog to return to its previous state on improvement (years)	2	2
Period of time when effectiveness of the improvement in degraded bog can be guaranteed (years)	20	20

Restoration of peat removed from borrow pits		
Area of borrow pits to be restored (ha)	n/a	n/a
Water table depth in borrow pit before restoratation with respect to the restored surface (m)	n/a	n/a
Depth of water table in borrow pit after restoration with respect to retored surface (m)	n/a	n/a
Time required for hydrology and habitat of borrow pit to return to its previous state on restoration (years)	n/a	n/a
Period of time when effectiveness of the restoration of peat removed from borrow pits can be guaranteed (years)	n/a	n/a
Early removal of drainage from foundations and hardstanding		
Water table depth around foundations and hardstanding before restoration (m)	3	3
Water table deph around foundations and hardstanding after restoration (m)	1	1
Time to completion of backfilling, removal of any surface drains, and full restoration of the hydrology (years)	1	1
Improvement of C sequestration at site by blocking drains, restoration of habitat etc		
Will the hydrology of the site be restored on decommissioning?	Yes	Yes
Will the habitat of the site be restored on decommissioning?	Yes	Yes
Methodology		
Choice of methodology for calculating emissions	IPCC default	IPCC default
Construction Input Data		
Number of turbines in this area	8	8
Depth of hole dug when construction foundations (m of peat removed)	1.18	1.18
Approximate geometric shape of whole dug when construcing foundations	Circular	Circular
Diameter at bottom	28.0	21.5
Diameter at surface	28.0	21.5

Depth of hole dug when constructing hardstanding (m of peat removed)	Rectangular	Rectangular
Length at surface	80	50
Width at surface	30	20
Length at bottom	80	50
Width at bottom	30	20
Is piling used?	No	No
Volume of concrete used (m^3)	10,000	10,000

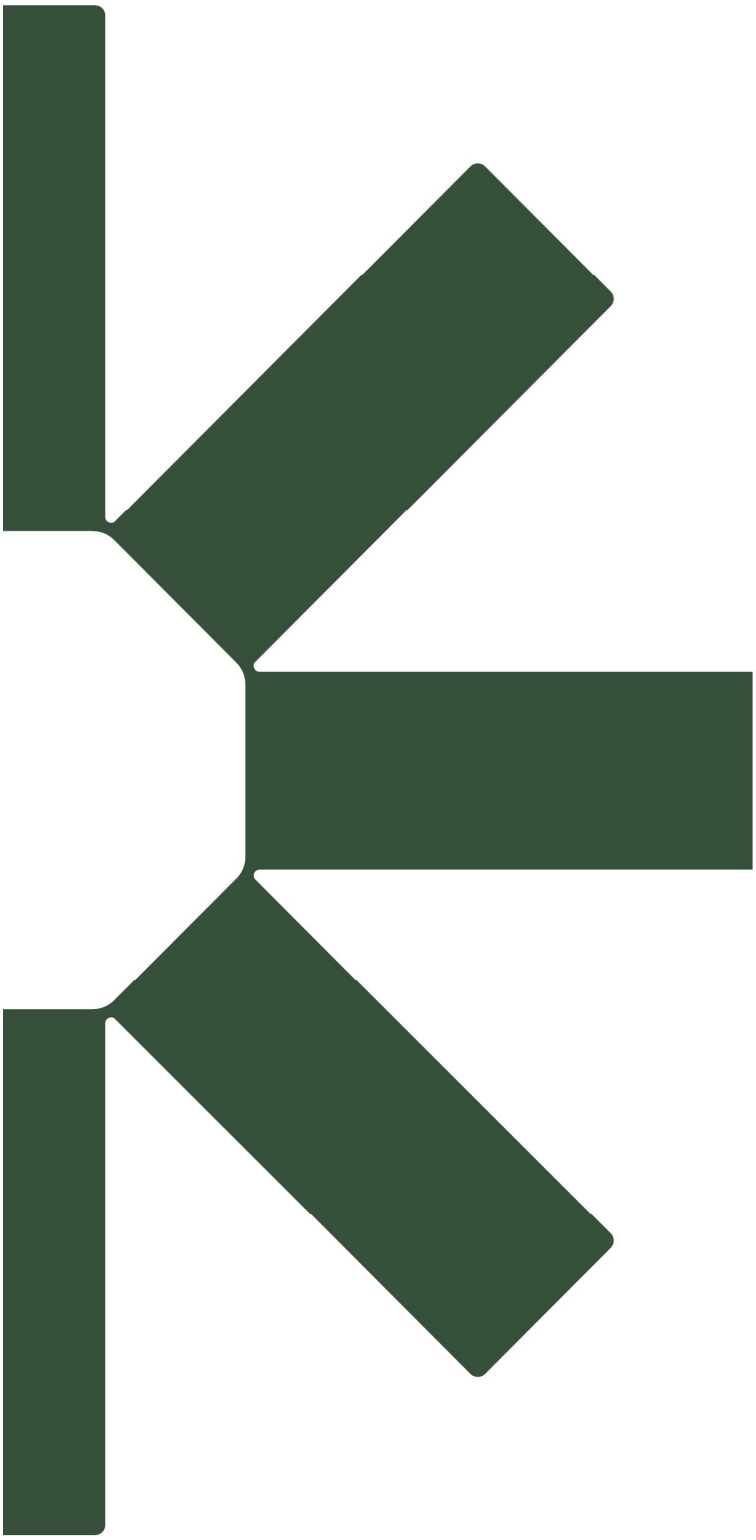
Windfarm CO2 Emission Savings	**Vestas 7.2 Mw (tCO_2e)**	**Siemens Gamesa 6.6 Mw (tCO2e)**
Annual Energy Output (MWh / yr)	166,510	152,634
Annual Avoided Emissions Grid-Mix of Electricity Generation (tCO2e / yr)	55,281	50,675
Total Energy Output (MWh)	5,827,853	5,342,198
Total Avoided Emissions Grid-Mix of Electricity Generation (tCO2e)	1,934,847	1,773,610

Total CO2 Losses Due to Wind Farm (tCO2 eq.)	**Vestas 7.2 Mw (tCO_2e)**	**Siemens Gamesa 6.6 Mw (tCO2e)**
Turbine Life (e.g Manufacture, Construction, Decommissioning)	53,238	48,753
Losses due to backup	29,315	26,873
Losses due to reduced carbon fixing potential	734	682
Losses from soil organic matter	18,902	18,228
Losses due to DOC & POC Leaching	9,728	9,213

Losses due to felling forestry	8,778	8,778
Total Losses	**120,695**	**112,527**

Total CO2 Gains Due to Improvement (tCO2e eq.)	**Vestas 7.2 Mw (tCO_2e)**	**Siemens Gamesa 6.6 Mw (tCO2e)**
Change in emissions due to improvement of degraded bogs	0	0
Change in emissions due to improvement of felled forestry	-8,778	-8778
Change in emissions due to restoration of peat from borrow pits	0	0
Change in emissions due to removal of drainage from foundations and hardstanding	-11,502	-8,804
Total Gains	**-20,280**	**-17,582**

Payback Time	**Vestas 7.2 Mw (tCO_2e)**	**Siemens Gamesa 6.6 Mw (tCO2e)**
Total Lifetime emissions	100,415	94,945
Annual Avoided	55,281	50,675
Payback Time	1.82	1.87



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