

An emissions budget for the budget for the Whitlee wind-power site - parameters

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<u>Site details</u>		<u>Turbine base areas</u>		<u>Quarries</u>		
4	No of turbines	140	Side of base excavation (m)	20	Width	Length
5	Turbine capacity (MW)	2.3	Hard standing length (m)	50	200	100
6	Total life (years)	25	Hard standing width (m)	20	420	313
7			<u>Access tracks</u>		350	150
8	<u>On-site construction</u>		Total length (m)	78,000	280	116
9	Concrete as reported (tonnes)	120,000	Length laid over peat (m)		245	210
10	Aggregate as reported (m ³)	2,000,000	Width (m)	7	340	264
11	Aggregate as calculated (m ³)	398,686	Depth (m)	0.5	160	149
12	Aggregate as defaults (m ³)	317,500	Width of ditches (m)	5	393	240
13			<u>Base ballast</u>			
14	<u>Operational variables</u>		Volume/turbine (m ³)	500	<u>Compounds</u>	
15	Load factor (%)	30	<u>Peat</u>		100	100
16	Displacement efficiency (%)	90	Mean depth (m)	2.2	12	8
17	Displacement rate (tCO ₂ /MWh)	0.430	<u>Deforestation</u>		23	12
	Weight this for transport (%)	100	Total emissions (t/CO ₂)		50	20

Payback time (years)

Low scenario	6.5
Medium scenario	17.4
High scenario	31.5

An emissions budget for the Whitelee wind-power site - details

Constants & conversions		Degradation Extent (metres)	
Sequestration rate (gm C/m ² /year)	19	Low scenario	5
Conversion of C to CO ₂ by weight	3.67	Medium scenario	50
Carbon weight in peat (tonnes/m ³)	0.055	High scenario	100
Proportion of cement in concrete (%)	12		
Density of concrete (tonnes/m ³)	2.4	CO₂ cost of:	
Density of aggregate (tonnes/m ³)	2	turbine manufacture (tonnes/MW)	594.7
Weight of steel per turbine (tonnes)	32	transport (tonnes/MW)	594.7
Weight of concrete per turbine (tonnes)	1000	cement manufacture (tonnes CO ₂ /tonne)	0.8
Volume of ballast/turbine (m ³)	500	ballast quarrying (tonnes CO ₂ /tonne)	0.1
Track/base overlap factor	1.5	steel manufacture (tonnes CO ₂ /tonne)	2

Site performance		Accrued oxidation loss (tonnes CO ₂)	
No of turbines	140	Low scenario	
Installed capacity per turbine (MW)	2.3	Total volume of peat destroyed (m ³)	6,545,785
Total IC (MW)	322.0	Thus, CO ₂ emitted (tonnes)	1,321,267
Load Factor (%)	30	Medium scenario	
Annual output (MWh)	846,216	Weighted track length (m)	67,500
Displacement Efficiency (%)	90	Peat destroyed by tracks (m ³)	17,300,250
Thermal CO ₂ equivalent (tCO ₂)	327,486	Peat destroyed by turbine bases (m ³)	4,435,200
Access track length (m)	78,000	Peat destroyed by quarries (m ³)	2,401,762
Access track width (m)	7	Peat destroyed by compounds (m ³)	22,818
Access track depth (m)	0.5	Total (m ³)	24,160,030
Site Lifetime (years)	25	Thus, CO ₂ emitted (tonnes)	4,876,702
Deforestation		High scenario	
CO ₂ emitted (tonnes)	0	Weighted track length (m)	57,000
Emissions (tonnes CO₂) from:		Peat destroyed by tracks (m ³)	32,150,250
Turbine manufacture and transport	382,980	Peat destroyed by turbine bases (m ³)	14,907,200
Concrete manufacture	29,760	Peat destroyed by quarries (m ³)	-
Aggregate for tracks, ballast, etc	400,000	Peat destroyed by compounds (m ³)	22,818
Sequestration loss (= low scenario)		Total (m ³)	47,057,450
Weighted track length (m)	76,950	Thus, CO ₂ emitted (tonnes)	9,498,546
Area lost to tracks (m ²)	2,039,175	Total site emissions (tonnes CO₂)	
Area lost to turbine bases (m ²)	126,000	Low scenario	2,139,194
Area lost to hard standings (m ²)	140,000	Medium scenario	5,694,629
Area lost to quarries (m ²)	658,810	High scenario	10,316,473
Area lost to compounds (m ²)	11,372	Payback time (years)	
Total area lost (m ²)	2,975,357	Low scenario	6.5
Thus, site lifetime fixation loss (t/CO ₂)	5,187	Medium scenario	17.4
		High scenario	31.5