

Derryadd Wind Farm: Carbon Balance Calculation

1. Technology Lifecycle Emissions

	Value	Unit
Turbine No.	24	
Turbine Size	4	MW
Capacity factor*	30	%
Curtailement	4	%
Operational life	30	years
Annual Output - no curt.	226,102	MWh/a
Annual Output - with curt.	217,058	MWh/a
Total Output	6,511,738	MWh
Wind lifecycle emissions	9.37	kg CO2/MWh

1. Total Technology Lifecycle emissions

Annual output	217,058	MWh
Lifespan	30	years
Lifecycle emissions	9.37	kg CO2/MWh
Total emissions	61,067	tonnes CO2

4. Carbon Balance

Windfarm Lifetime Emissions		
- technology	61,067	
- cycling	104,490	
- peat	5,287	
Total:	170,844	t CO2

2. Additional System Cycling Emissions

	Value	Unit
Carbon emissions from natural gas	56.9	kg CO2/GJ
CCGT emissions at 54% design efficiency	379.3	kg CO2/MWh
CCGT efficiency at Min Stable Generation	48.6	%
Demand Following: 18hrs@53%; 6 hrs@MSG		
Average efficiency from demand following	51.90	%
CCGT emissions at 51.9% efficiency	394.7	kg CO2/MWh
CCGT efficiency at low wind	46	%
CCGT emissions at 46% efficiency	448.9	kg CO2/MWh
CCGT efficiency at high wind	44	%
CCGT emissions at 44% efficiency	464.9	kg CO2/MWh
Additional emissions from wind cycling	16.05	kg CO2/MWh

2. Total Additional Cycling Emissions

Annual output	217,058	MWh
Lifespan	30	years
Cycling emissions	16.05	kg CO2/MWh
Total emissions	104,490	tonnes CO2

Windfarm Lifetime Savings	(t CO2)	Payback (yrs)
Against SEM mid-merit	4,847,989	1.06
Against EU FFC	4,289,933	1.19
Against 'Demand Following' CCGT	2,570,066	1.99

3. Additional Peatland Disturbance Emissions

	Value	Unit
Peat disturbed	17.33	ha
Net change in emissions	8.14	t CO2/ha/a

4. Fossil Fuel Emissions Displaced

SEM mid-merit emissions	744.5	kg CO2/MWh
EU Fossil Fuel Comparator	658.8	kg CO2/MWh
'Demand Following' CCGT unit	394.7	kg CO2/MWh

3. Total Additional Peatland Disturbance Emissions

Respread area	21.66	ha
Lifespan	30	years
Emissions increase	8.14	t CO2/ha/a
Total emissions	5,287	tonnes CO2