

Killean Wind Farm Technical Appendix 13.3 Carbon Payback and CO₂ Emissions

Payback Time and CO₂ emissions • 4T36-0YH7-2URH v3

1. Windfarm CO ₂ emission saving over...	Exp.	Min.	Max.
...coal-fired electricity generation (t CO ₂ / yr)	215,228	211,442	216,359
...grid-mix of electricity generation (t CO ₂ / yr)	47,145	46,316	47,393
...fossil fuel-mix of electricity generation (t CO ₂ / yr)	96,568	94,869	97,075
Energy output from windfarm over lifetime (MWh)	11,387,728	11,187,396	11,447,568

Total CO ₂ losses due to wind farm (tCO ₂ eq.)	Exp.	Min.	Max.
2. Losses due to turbine life (eg. manufacture, construction, decommissioning)	53,568	53,568	53,568
3. Losses due to backup	55,156	0	55,156
4. Losses due to reduced carbon fixing potential	1,587	516	4,443
5. Losses from soil organic matter	21,215	10,528	36,654
6. Losses due to DOC & POC leaching	933	4	6,384
7. Losses due to felling forestry	22,715	18,040	27,720
Total losses of carbon dioxide	155,175	82,656	183,925

8. Total CO ₂ gains due to improvement of site (t CO ₂ eq.)	Exp.	Min.	Max.
8a. Change in emissions due to improvement of degraded bogs	-5,693	0	-11,310
8b. Change in emissions due to improvement of felled forestry	-3,235	0	-6,426
8c. Change in emissions due to restoration of peat from borrow pits	-2,264	0	-4,498
8d. Change in emissions due to removal of drainage from foundations & hardstanding	-1,182	0	-6,195
Total change in emissions due to improvements	-12,374	0	-28,429

RESULTS	Exp.	Min.	Max.
Net emissions of carbon dioxide (t CO ₂ eq.)	142,801	54,227	183,925
Carbon Payback Time			
...coal-fired electricity generation (years)	0.7	0.3	0.9
...grid-mix of electricity generation (years)	3.0	1.1	4.0
...fossil fuel-mix of electricity generation (years)	1.5	0.6	1.9
Ratio of soil carbon loss to gain by restoration (not used in Scottish applications)	1.79	0.37	No gains!
Ratio of CO ₂ eq. emissions to power generation (g/kWh) (for info. only)	12.54	4.74	16.44