AEI Technical Appendix 15.1: Carbon Calculator

Euchanhead Renewable Energy Development AEI

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Results

PAYBACK TIME AND CO_2 EMISSIONS

Note: The carbon payback time of the windfarm is calculated by comparing the loss of C from the site due to windfarm development with the carbon-savings achieved by the windfarm while displacing electricity generated from coal-fired capacity or grid-mix.

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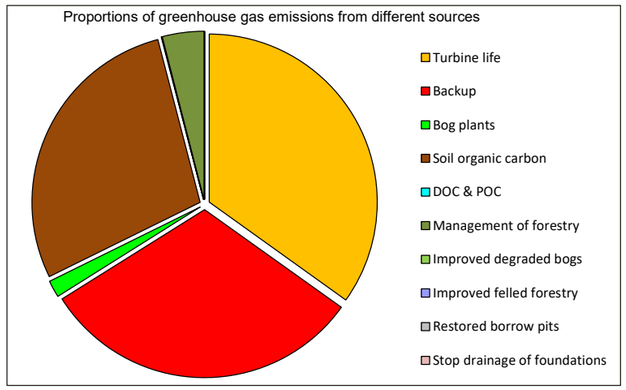
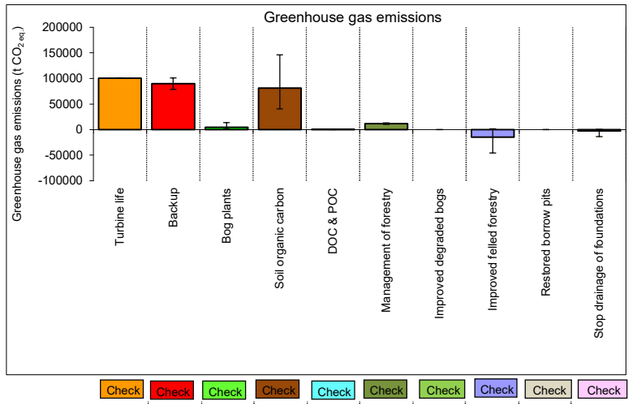
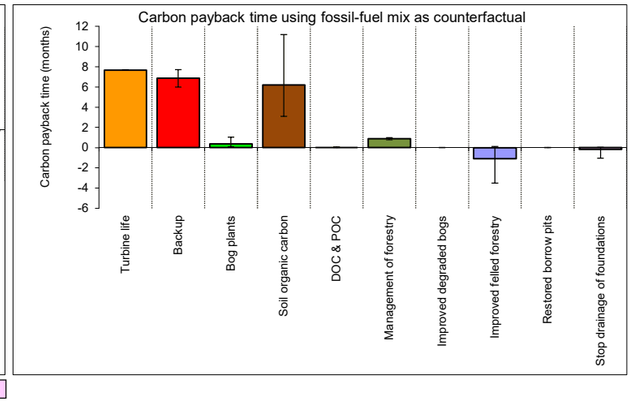
	Exp.	*Min.*	*Max.*
1. Windfarm CO_2 emission saving over…			
…coal-fired electricity generation (tCO_2 yr^{-1})	321562	321562	321562
…grid-mix of electricity generation (tCO_2 yr^{-1})	88625	88625	88625
…fossil fuel - mix of electricity generation (tCO_2 yr^{-1})	157286	157286	157286
Energy output from windfarm over lifetime (MWh)	13980960	12233340	15728580
Total CO_2 losses due to wind farm (t CO_2 eq.)			
2. Losses due to turbine life (eg. manufacture, construction, decomissioning)	100481	100481	100481
3. Losses due to backup	89878	78643	101112
4. Losses due to reduced carbon fixing potential	4705	1278	13538
5. Losses from soil organic matter	81378	40475	146378
6. Losses due to DOC & POC leaching	132	210	757
7. Losses due to felling forestry	11501	10063	12938
Total losses of carbon dioxide	288075	231150	375205
8. Total CO_2 gains due to improvement of site (t CO_2 eq.)			
8a. Gains due to improvement of degraded bogs	0	0	0
8b. Gains due to improvement of felled forestry	-14479	1462	-45928
8c. Gains due to restoration of peat from borrow pits	0	0	-55
8d. Gains due to removal of drainage from foundations & hardstanding	-2360	425	-13752
Total gains	-16839	1887	-59735

RESULTS	*Exp.*	*Min.*	*Max.*
Net emissions of carbon dioxide (t $CO_{2\ eq.}$)	**271236**	**171415**	**377092**
Carbon Payback Time			
…coal-fired electricity generation (years)	0.8	0.5	1.2
…grid-mix of electricity generation (years)	3.1	1.9	4.3
…fossil fuel - mix of electricity generation (years)	**1.7**	**1.1**	**2.4**
Ratio of soil carbon loss to gain by restoration (TARGET ratio (Natural Resources Wales) < 1.0)	**4.8**	**No gains!**	**2.5**
Ratio of CO_2 eq. emissions to power generation (g / kWh) (TARGET ratio by 2030 (electricity generation) < 50 g /kWh)	**19**	**19**	**20**







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Results

PAYBACK TIME AND CO_2 EMISSIONS

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Data used in barchart of carbon payback time using fossil-fuel mix as counterfactual

Greenhouse gas emissions

	Exp.	*Min*	*Max*
Turbine life	100481	0	0
Backup	89878	11235	11235
Bog plants	4705	3427	8834
Soil organic carbon	81378	40903	64999
DOC & POC	132	0	625
Management of forestry	11501	1438	1438
Improved degraded bogs	0	0	0
Improved felled forestry	0	0	0
Restored borrow pits	0	0	0
Stop drainage of foundations	0	0	0

Data used in barchart of carbon payback time using fossil-fuel mix as counterfactual

Greenhouse gas emissions				Carbon payback time (months)		
	Exp.	*Min.*	*Max.*	*Exp.*	*Min.*	*Max.*
Turbine life	100481	0	0	8	0	0
Backup	89878	11235	11235	7	1	1
Bog plants	4705	3427	8834	0	0	1
Soil organic carbon	81378	40903	64999	6	3	5
DOC & POC	132	-78	625	0	0	0
Management of forestry	11501	1438	1438	1	0	0
Improved degraded bogs	0	0	0	0	0	0
Improved felled forestry	-14479	-15941	-31449	-1	-1	-2
Restored borrow pits	0	0	-55	0	0	0
Stop drainage of foundations	-2360	-2785	-11392	0	0	-1
	271236			21		