APPENDIX 5.2: CARBON BALANCE

1.2.1 A carbon assessment has been undertaken for the proposed development (Tangy IV) using the Scottish Government calculator tool (v1.4.0) (https://informatics.sepa.org.uk/CarbonCalculator/index.jsp) and in accordance with the Technical Note (Version 2.10.0), Calculating Potential Carbon Losses & Savings from Wind Farms on Scottish Peatlands.

1.2.2 The carbon calculator results for the proposed development are summarised in Table 5.2.1 and illustrated in Plate 5.2.1, 5.2.2 and 5.2.3. The results confirm that the proposed development would have a maximum payback period of 4.2 years.

Table 5.2.1: Carbon Calculator v1.4.0 Results for Proposed Development

1. Windfarm CO2 emission saving over...	**Expected**	**Minimum**	**Maximum**
...coal-fired electricity generation (t CO2 / yr)	250,869	202,251	324,120
...grid-mix of electricity generation (t CO2 / yr)	94,611	76,276	122,237
...fossil fuel-mix of electricity generation (t CO2 / yr)	129,367	104,296	167,141
Energy output from windfarm over lifetime (MWh)	6,780,240	5,466,240	8,760,000
Total CO2 losses due to wind farm (tCO2 eq.)	**Exp.**	**Min.**	**Max.**
2. Losses due to turbine life (eg. manufacture, construction, decommissioning)	59,583	53,603	70,048
3. Losses due to backup	35,935	32,592	41,785
4. Losses due to reduced carbon fixing potential	1,194	335	4,685
5. Losses from soil organic matter	20,520	-5,046	107,597
6. Losses due to DOC & POC leaching	290	0	1,135
7. Losses due to felling forestry	89,266	86,626	91,915
Total losses of carbon dioxide	206,789	168,110	317,166
8. Total CO2 gains due to improvement of site (t CO2 eq.)	**Exp.**	**Min.**	**Max.**
8a. Change in emissions due to improvement of degraded bogs	-2,498	0	-5,680
8b. Change in emissions due to improvement of felled forestry	-31,720	0	-72,263
8c. Change in emissions due to restoration of peat from borrow pits	-218	0	-353
8d. Change in emissions due to removal of drainage from foundations & hardstanding	-432	0	-6,435
Total change in emissions due to improvements	-34,868	0	-84,731
RESULTS	**Exp.**	**Min.**	**Max.**
Net emissions of carbon dioxide (t CO2 eq.)	171,921	83,379	317,166
Carbon Payback Time	**Exp.**	**Min.**	**Max.**
...coal-fired electricity generation (years)	0.7	0.3	1.6
...grid-mix of electricity generation (years)	1.8	0.7	4.2
...fossil fuel-mix of electricity generation (years)	1.3	0.5	3

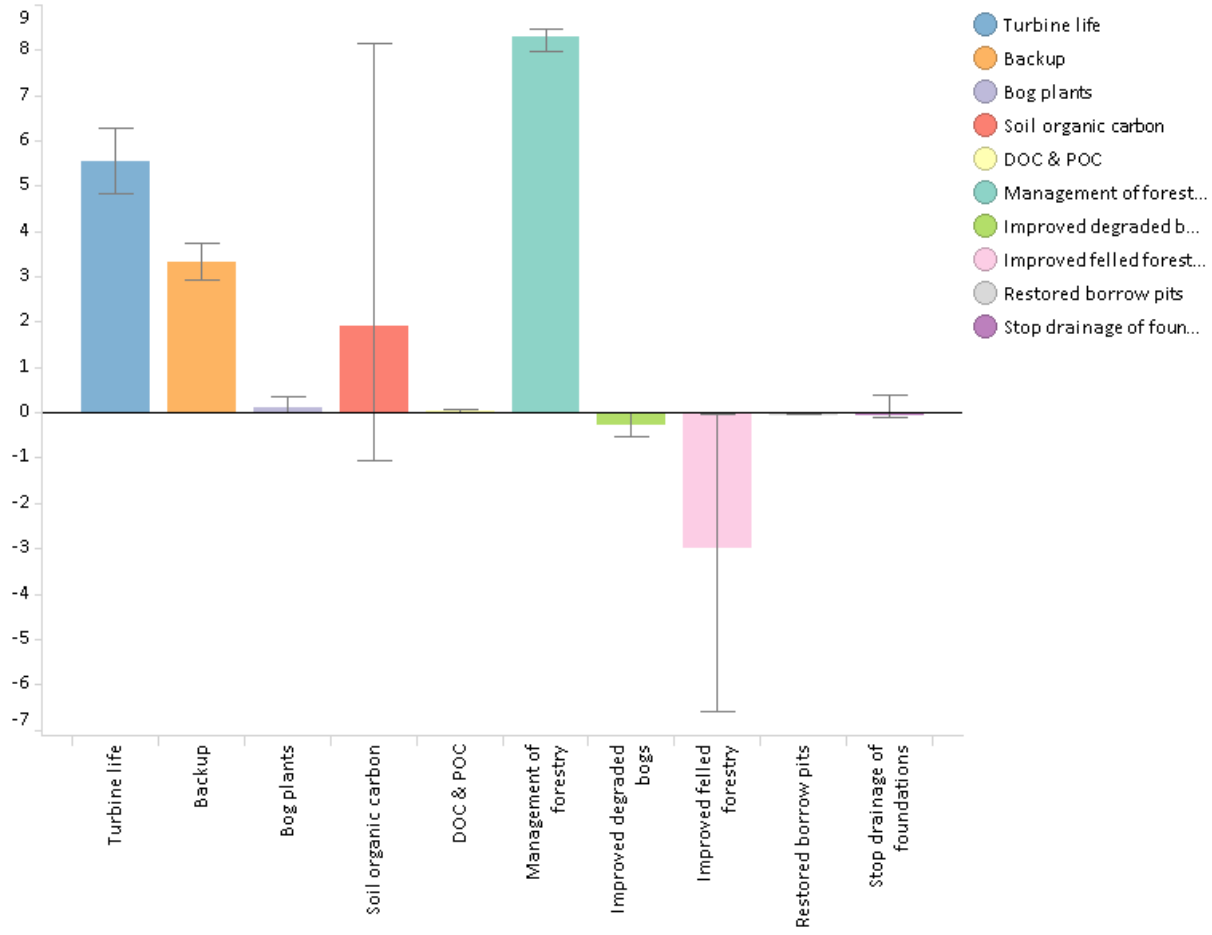

Plate 5.2.1: Carbon payback time (months) using fossil-fuel mix (output from Carbon Calculator v1.4.0) for proposed development

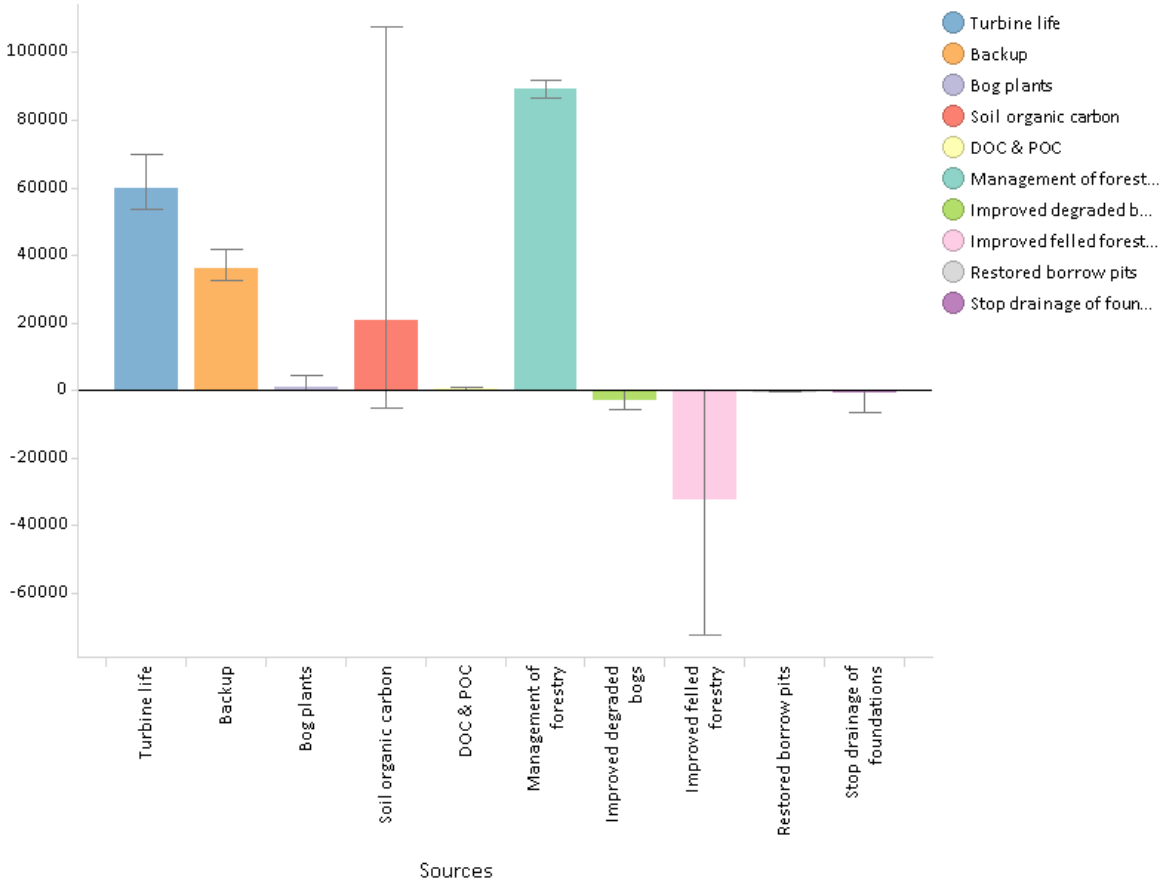

Plate 5.2.2: Greenhouse Gas Emissions (t CO_2 eq) (output from Carbon Calculator v1.4.0) for proposed development

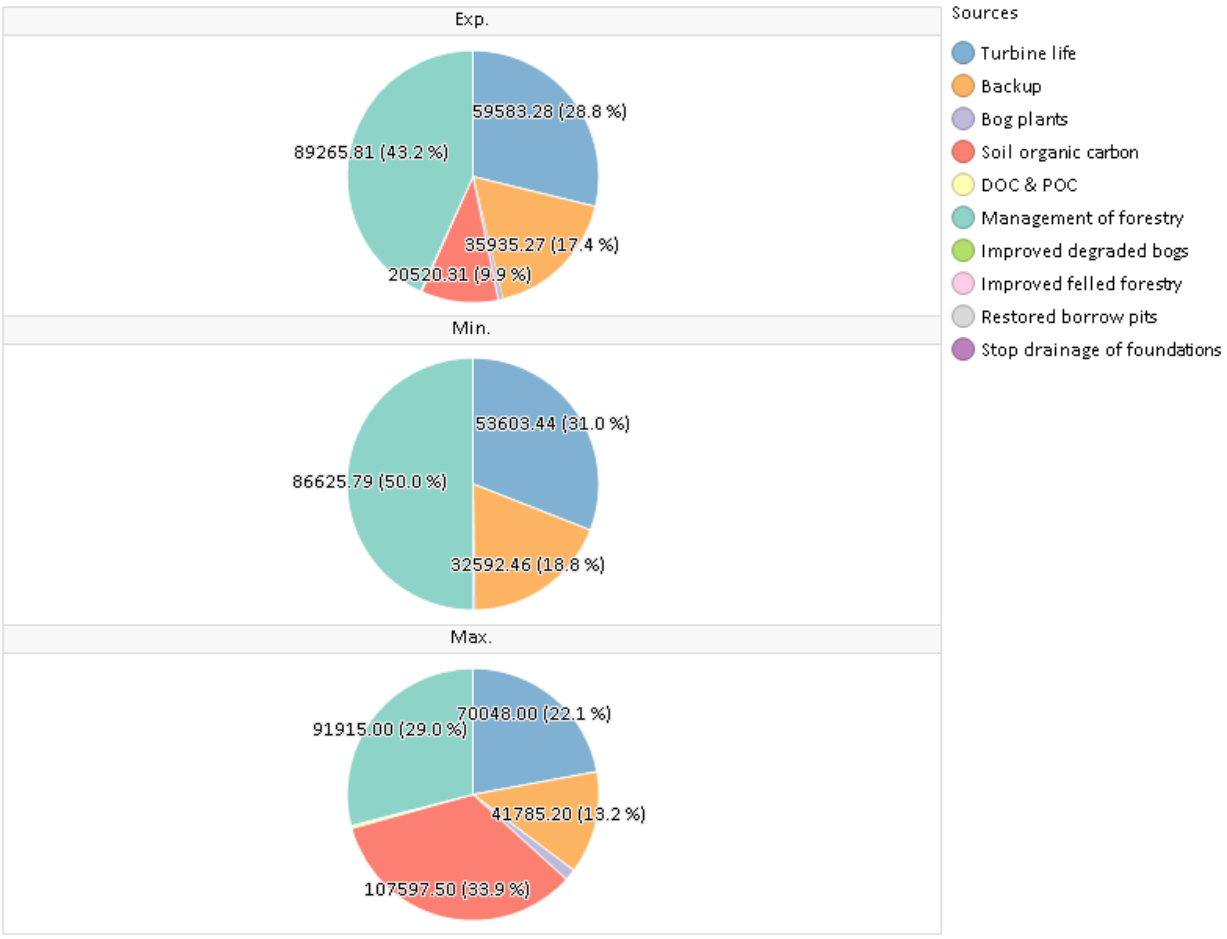

Plate 5.2.3: Proportions of Greenhouse Gas Emissions (t CO_2 eq) from different sources (output from Carbon Calculator v1.4.0) for proposed development

1.2.3 A further carbon assessment was undertaken for the existing Tangy I and Tangy II Wind Farm site also using the calculation tool (v1.4.0). The purpose of the assessment was to establish whether carbon emissions associated with the construction of the existing wind farm (completed in 2004) had been offset to date by its operation. The results confirm that the operational Tangy I and II Wind Farm would have had a maximum payback period of 3.5 years.

1.2.4 The carbon calculator results for the Tangy I and Tangy II Wind Farm are summarised in Table 5.2.2 and illustrated in Plate 5.2.4, 5.2.5 and 5.2.6.

Table 5.2.2: Carbon Calculator v1.4.0 Results for Tangy I and Tangy II Wind Farm			
1. Windfarm CO2 emission saving over...	**Expected**	**Minimum**	**Maximum**
...coal-fired electricity generation (t CO2 / yr)	40,457	40,306	40,609
...grid-mix of electricity generation (t CO2 / yr)	15,258	15,201	15,315
...fossil fuel-mix of electricity generation (t CO2 / yr)	20,863	20,785	20,941
Energy output from windfarm over lifetime (MWh)	1,093,445	1,089,350	1,097,540
Total CO2 losses due to wind farm (tCO2 eq.)	**Exp.**	**Min.**	**Max.**
2. Losses due to turbine life (eg. manufacture, construction, decommissioning)	13,152	13,152	13,152
3. Losses due to backup	9,767	9,767	9,767
4. Losses due to reduced carbon fixing potential	503	483	524
5. Losses from soil organic matter	27,125	24,649	29,563
6. Losses due to DOC & POC leaching	35	1	106
7. Losses due to felling forestry	0	0	0
Total losses of carbon dioxide	50,582	48,052	53,112
8. Total CO2 gains due to improvement of site (t CO2 eq.)	**Exp.**	**Min.**	**Max.**
8a. Change in emissions due to improvement of degraded bogs	-2,505	0	-5,589
8b. Change in emissions due to improvement of felled forestry	0	0	0
8c. Change in emissions due to restoration of peat from borrow pits	-1,177	0	-2,074
8d. Change in emissions due to removal of drainage from foundations & hardstanding	-575	-546	-601
Total change in emissions due to improvements	-4,258	-546	-8,264
RESULTS	**Exp.**	**Min.**	**Max.**
Net emissions of carbon dioxide (t CO2 eq.)	171,921	83,379	317,166
Carbon Payback Time	**Exp.**	**Min.**	**Max.**
...coal-fired electricity generation (years)	1.1	1	1.3
...grid-mix of electricity generation (years)	3	2.6	3.5
...fossil fuel-mix of electricity generation (years)	2.2	1.9	2.5

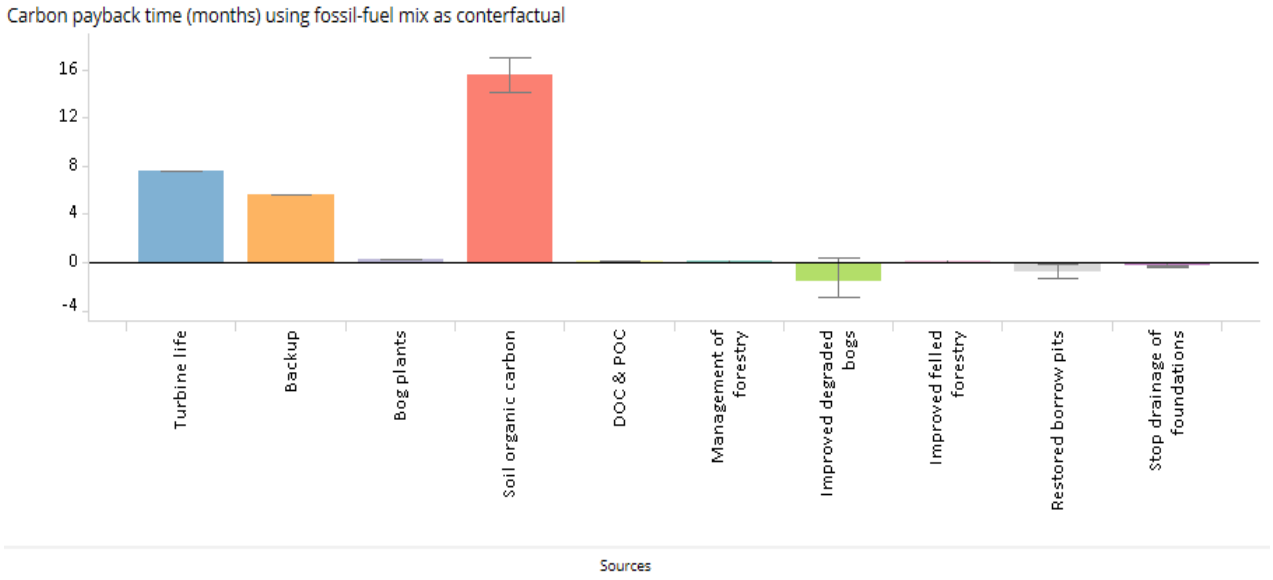

Plate 5.2.4: Carbon payback time (months) using fossil-fuel mix (output from Carbon Calculator v1.4.0) for Tangy I and II

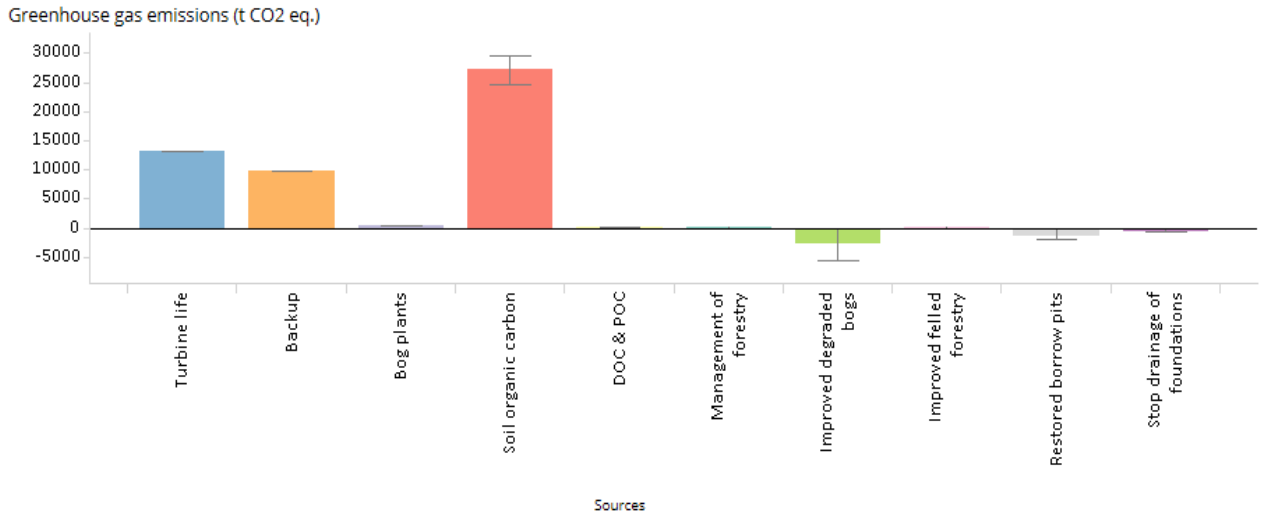

Plate 5.2.5: Greenhouse Gas Emissions (t CO_2 eq) (output from Carbon Calculator v1.4.0) for Tangy I and II

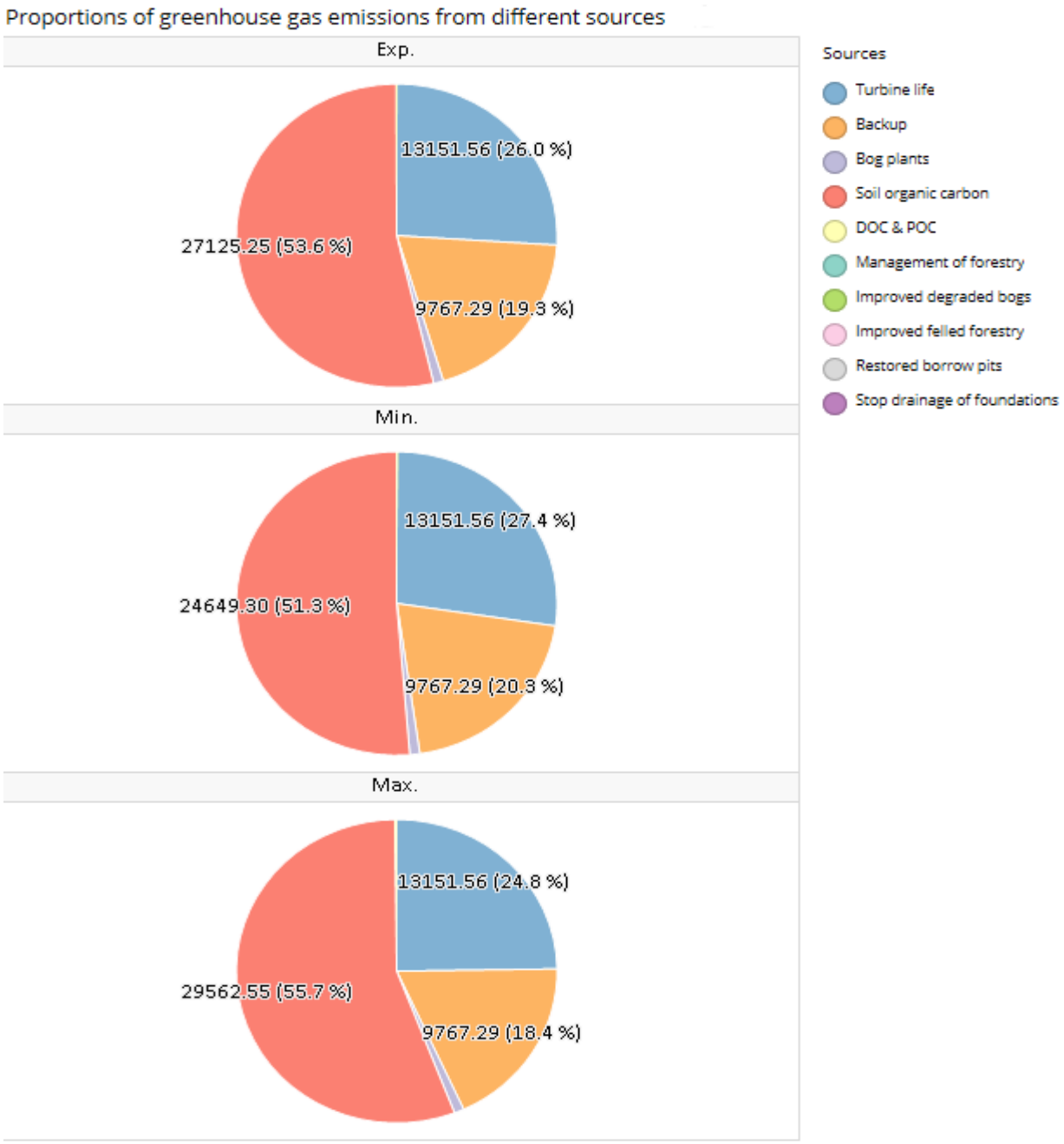

Plate 5.2.6: Proportions of Greenhouse Gas Emissions (t CO_2 eq) from different sources (output from Carbon Calculator v1.4.0) for Tangy I and II