

Appendix 10.2

Upper Brook Street GHG Emissions Model

Upper Brook St - GHG Emissions Model
Climate Change Adaptation and Resilience Chapter

Embodied Carbon

Embodied Carbon over Life Cycle (tCO ₂ e)	PBSA		Sci-Tech	
	Upfront Carbon	WLC Impacts	Upfront Carbon	WLC Impacts
	(A1-A5)	(B1-B4) + (C1-C4)	(A1-A5)	(B1-B4) + (C1-C4)
Substructure	3860.00	360.00	3650.00	660.00
Frame	7010.00	840.00	1100.00	110.00
Upper Floors	0.00	0.00	2550.00	310.00
Roof	460.00	80.00	740.00	50.00
Stairs and ramps	50.00	0.00	410.00	10.00
External walls	2150.00	60.00	1400.00	230.00
Glazed facade	610.00	1040.00	780.00	780.00
Internal Walls and Doors	650.00	1360.00	185.00	275.00
Furnishes	955.00	1770.00	1420.00	1515.00
Building Services (MEP)	2650.00	1620.00	3510.00	5720.00
Works to Existing Building	0.00	0.00	0.00	0.00
Total Embodied Carbon (tCO ₂ e)	18,395.00	6,888.00	15,760.00	9,668.00

Operational Energy

PBSA					
Source	kWh/m ² /year	Emission factor (60 average) (kgCO ₂ e/kWh)	kWh/year	Annual emissions (kgCO ₂ e)	Lifetime emissions (kgCO ₂ e)
Heating	1.17	0.0174	28,195.36	490.81	20,448.47
Cooling	-	0.0174	-	-	-
Auxiliary	1.90	0.0174	45,787.34	797.04	47,822.30
Lighting	9.45	0.0174	227,731.77	3,964.22	237,853.01
Hot Water	4.96	0.0174	119,529.06	2,089.69	124,841.37
Equipment	13.72	0.0174	336,632.79	5,756.46	345,357.33
TOTAL	31.20	N/A	751,878.32	13,088.21	785,292.47

Sci-Tech					
Source	kWh/m ² /year	Emission factor (60 average) (kgCO ₂ e/kWh)	kWh/year	Annual emissions (kgCO ₂ e)	Lifetime emissions (kgCO ₂ e)
Heating	2.42	0.0174	46,391.88	807.56	48,453.71
Cooling	3.63	0.0174	69,587.83	1,211.34	72,680.56
Auxiliary	8.85	0.0174	163,905.21	2,853.16	171,188.76
Lighting	5.84	0.0174	111,853.87	1,946.83	116,929.61
Hot Water	3.10	0.0174	59,427.62	1,034.48	62,988.80
Equipment	37.70	0.0174	722,716.54	12,586.61	754,856.72
PV	2.71	0.0174	51,851.24	904.34	54,280.15
TOTAL	58.53	N/A	1,122,031.81	19,531.65	1,171,896.02

Operational Waste

Phase	Waste Generated (t)	Emissions (tCO ₂ e)	Emissions factor (tCO ₂ e/t)
Operation	18,874.75	8,814.66	0.47
Total	37,749.50	17,629.32	

NOTE: For operational waste, a multiplier of 2 has been used, as only one building has provided waste estimates.

PBSA Waste Qty's	Waste (L/week)	Waste (L/year)	Waste (L over operating life)	Total Waste (kg)
Building				
Kincaid Block	11300	587600	35250000	6,640,960.00
URS Block	28510	1471720	88303200	10,288,512.00
Gym	1300	67600	4056000	648,960.00
Laundry	450	23400	1404000	224,640.00
Amenities	3000	156000	9360000	1,446,880.00
Reception/Management	250	13000	780000	124,800.00
Total				18,674,752.00

Results Summary

	Emissions Source	Emissions (MCO ₂ e)	Total (MCO ₂ e)	Manchester Carbon Budget (%)	UK Carbon Budget (%)
Construction	Upfront Carbon	0.034	0.034	1.24%	0.003%
Operation	WLC Carbon	0.017			
	Building Energy	0.002			
	Waste	0.016	0.036	1.22%	0.002%
Total			0.070	1.46%	0.005%

Additional:

Building	Construction	Operation
PBSA	2024 - 2026	2026 - 2086
Sci-Tech	2024 - 2026	2026 - 2086
Manchester	2024 - 2026	2026 - 2086

Project Timeframe	Construction (2024 - 2026)	Operation (2026 - 2086)	Total (2024 - 2086)
Carbon Budget Manchester			
Budget (MCO ₂ e)	2,780	2,959	4,739
UK Budget (MCO ₂ e)	1170,000	2665,087	2845,087

UK Carbon Budget		
Carbon Budget Period	Recommended Carbon Budget (MCO ₂ e)	MCO ₂ e/year
2023-2027	1950	390
2028-2032	1725	345
2033-2037	965	193
2038-2100 (assumed)	965	15,56451613
Total	5605	

Manchester Carbon Budget		
Carbon Budget Period	Recommended Carbon Budget (MCO ₂ e)	MCO ₂ e/year
2023 - 2027	4.6	0.92
2028 - 2032	2.4	0.48
2033 - 2037	1.2	0.24
2038 - 2042	0.6	0.12
2043 - 2047	0.3	0.06
2048 - 2100	0.3	0.005766231
Total	9.4	

Buildings	m ²
PBSA	24,099
Sci-Tech	18,170