Planning Document
RFO vs NC Comparison
Chalcot House

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Contents:

Executive Summary
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Introduction

Eight Associates has been appointed to review the Chalcot House development to analyse the anticipated life cycle embodied and operational carbon impact of each building scenario – refurbishment, and new build. The results will be presented in $kgCO_2e$. The existing scenario has also been modelled as a baseline scenario, where all carbon impacts will result from operational energy.

Refurbishment scenario

Main house external walls will be retained, remaining elements modified or replaced, and a new side extension built. Therefore, the U-values achieved for retained elements will be limited. The expected embodied carbon will be lower as there will be fewer new materials.

New build scenario

The existing building (including foundations) will be deconstructed, and a new property will be constructed in its place. Although the embodied carbon will likely be higher, the savings made in operational energy consumption may offset this as the U-values are not limited.

The Life Cycle Assessment (LCA) has been calculated using the Whole Life Carbon assessment principles, from the Greater London Authority (GLA), and will quantify the embodied carbon of the refurbishment scenario and new build scenario.

The Energy analysis has been calculated using the Standard Assessment Procedure (SAP) and will evaluate the annual energy consumption of the refurbishment scenario and new build scenario. The energy consumption figures will be converted to operational carbon using the SAP10.0 carbon factors. Decarbonisation of the grid has been considered but have not formed the basis of decisions.

Fuel Type	Carbon Factor (kg CO_2/kWh)	
	SAP 2012	SAP10.0
Natural Gas	0.216	0.210
Grid Electricity	0.519	0.233

Summary of Results

Existing scenario

The existing scenario has been modelled as though no work has been done. Therefore, as no new materials are entering the scheme, the embodied carbon of the existing scheme is 0 $kgCO_2e$. The total lifetime carbon impact (60 years) of the existing scenario is 1,882,486 $kgCO_2e$ (3,513 $kgCO_2e/m^2$).

Refurbishment scenario

The total lifetime carbon impact (60 years) of the refurbishment scenario is 776,547 $kgCO_2e$ (1,506 $kgCO_2e/m^2$):

- The operational carbon of the refurbishment scheme is 302,240 $kgCO_2e$.
- The embodied carbon of the refurbishment scheme over the study period is 474,307 $kgCO_2e$:
  - Construction stage impacts: 415,317 $kgCO_2$
  - Building operation impacts: 52,282 $kgCO_2e$/year
  - Deconstruction impacts: 20,979 $kgCO_2$
  - Reuse, recovery, and recycling potential: −14,271 $kgCO_2$

New build scenario

The total lifetime carbon impact (60 years) of the new build scenario is 718,646 $kgCO_2e$ (1,398 $kgCO_2e/m^2$).

- The operational carbon of the new build scheme is 222,840 $kgCO_2e$.
- The embodied carbon of the new build scheme over the study period is 495,806 $kgCO_2e$:
  - Construction stage impacts: 434,330 $kgCO_2$
  - Building operation impacts: 52,385 $kgCO_2e$/year
  - Deconstruction impacts: 23,395 $kgCO_2$
  - Reuse, recovery, and recycling potential: −14,305 $kgCO_2$

At Year 0, the refurbishment scenario has a lower embodied carbon compared to the new build.

As the operational impacts of the refurbished scenario is higher, the new build scenario becomes the less carbon-intensive option after Year 14. Several options have been appraised to investigate whether this can occur at an earlier year. The viability of each option should be evaluated by the design team.

The Site
Existing Site
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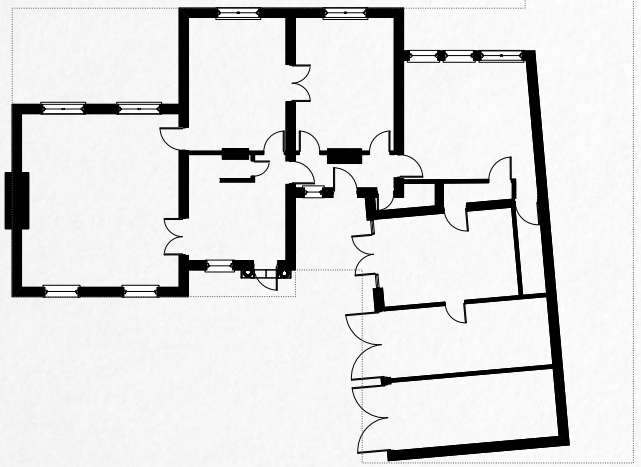
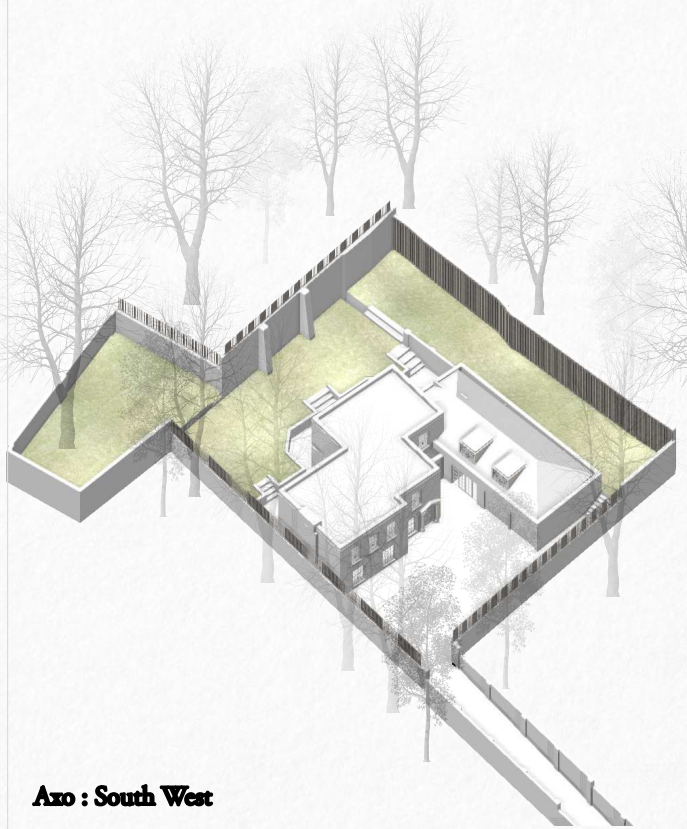
Study 0. Existing Building

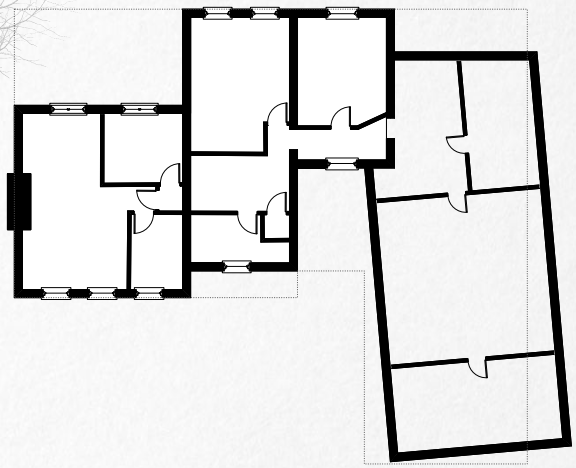
- Backlands service building converted and extended sometime in the 1990's;
- Basic construction with limited insulation.
- Shallow Foundations.
- Concrete slab without insulation.
- Single brick external walls.
- Low ceiling heights.
- Single glazed windows.
- Flat roof to main building with limited insulation, joists show signs off dry-rot will require ffull replacement.
- Internal floors, timber joists distorted would require replacement for new internal layout.



Ground Floor



Axo : South West



1st Floor

Key:
..... Proposed Building Outline

Environmental Impact Study | 0 | Existing Structure

A-041-0.1-A4

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Refurbishment Scenario
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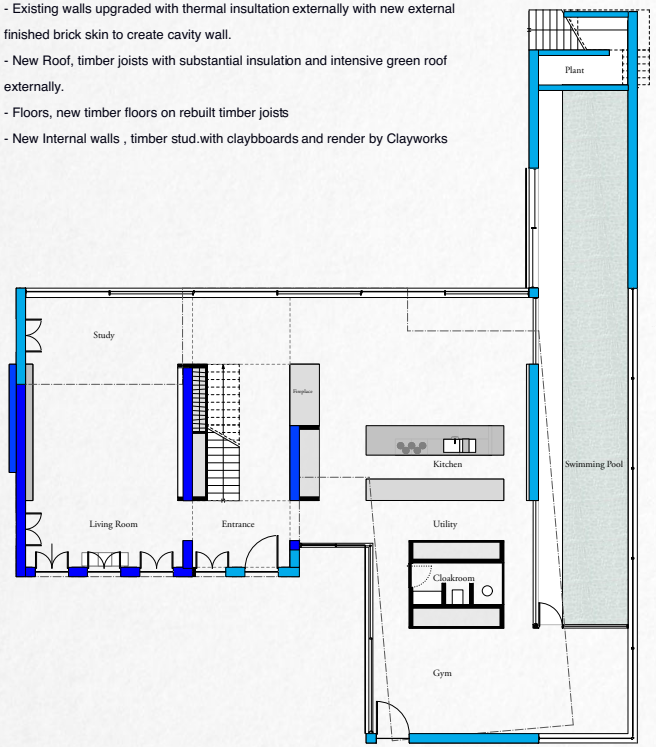
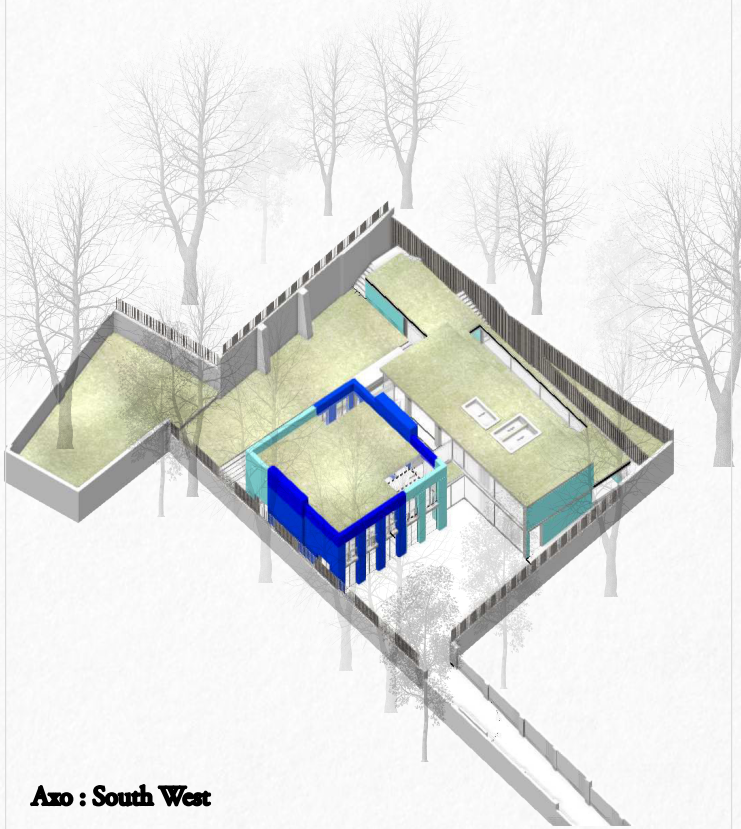
Study 1. Renovation & Extension

- Renovation and extension model working with the existing building fabric.
- Retains a majority of external walls to the main house (dark blue on the plan)
- Existing walls underpinned to increase capacity of walls to bear live loads
- New insulated slab to main house (existing removed during foundation works)
- New insulated slab on piled foundations to side extension
- Utilise recycled brickwork to the new walls (bricks from existing walls removed), built as cavity walls with insulated void.
- Existing walls upgraded with thermal insultation externally with new external finished brick skin to create cavity wall.
- New Roof, timber joists with substantial insulation and intensive green roof externally.
- Floors, new timber floors on rebuilt timber joists
- New Internal walls , timber stud.with claybboards and render by Clayworks



Ground Floor



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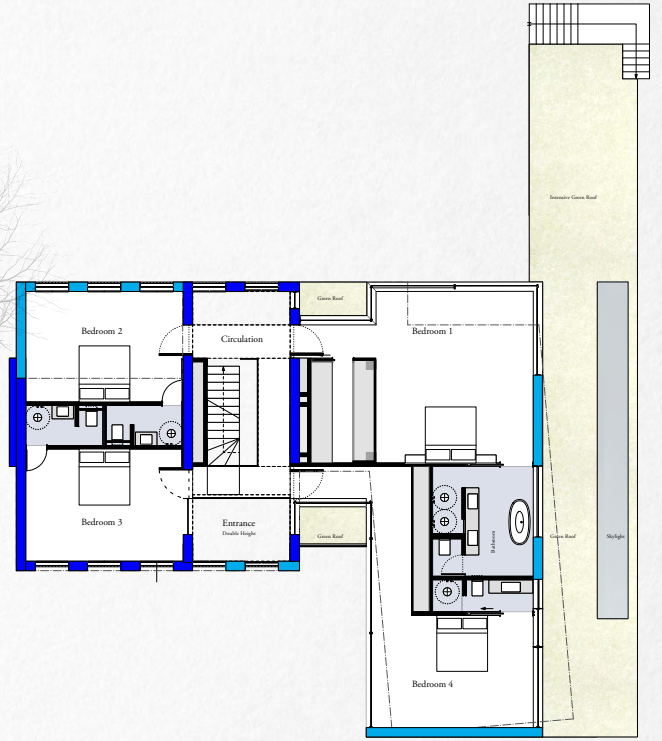

1st Floor

Key:

Existing Building Outline

Retained Brickwork - 60 m³

Recycled Brickwork - 67 m³

Environmental Impact Study | 1 | Retain & Modify Existing Structures

A-041-1.1-A4

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New Build Scenario
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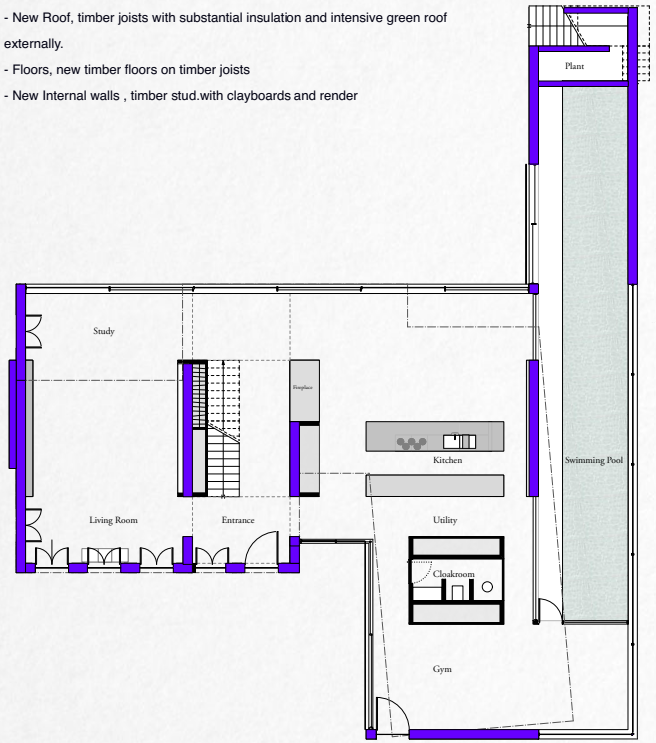
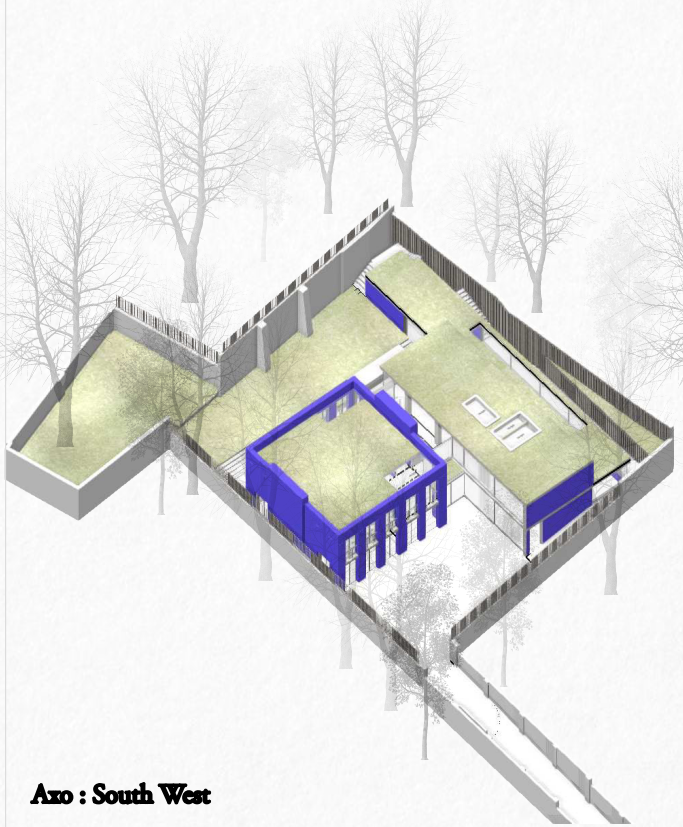
Study 2. New Framed Construction

- Complete demolition and new build using contemporary super-insulated construction.
- Existing building carefully demolished with all construction materials set-aside for re-use.
- New insulated slab on piled foundations throughout.
- Steel frame super structure.
- External finished brick skin with interior timber stud partitions with super insulation interlayer.
- New Roof, timber joists with substantial insulation and intensive green roof externally.
- Floors, new timber floors on timber joists
- New Internal walls , timber stud.with clayboards and render



Ground Floor



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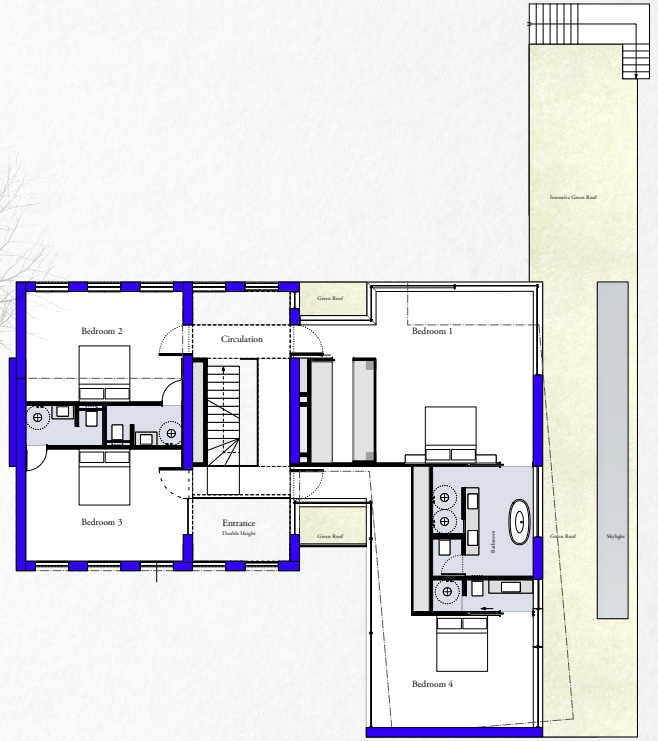

1st Floor

Key:

Existing Building Outline

Steel Framework - 12 m³

Timber framed Infill Panels - 120 m³

Environmental Impact Study | 2 | New Construction, Super-Insulated with Steel Frame

A-041-2.1-A4

Energy Inputs
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Methodology

The methodology followed in this report follows the guidance set out by the Greater London Authority (GLA) for developing energy strategies as detailed in the document: "Energy Assessment Guidance: Greater London Authority guidance on preparing energy assessments as part of planning applications (April 2020)". It should be noted that the purpose of this report is to analyse the energy consumption between a refurbished scenario and a new build scenario and should not be intended as a replacement for an energy assessment.

Modelling Inputs – Existing and Refurbishment Scenario

Element	Existing Building U-value W/m^{2}K	Part L1B U-value W/m^{2}K	Proposed U-value W/m^{2}K
Flat roof	0.68	0.18	0.10
Green roof	0.68	0.18	0.10
Wall	1.70	0.70	0.70 (improved existing)*
		0.28	0.12 (new)
Ground floor	0.50	0.22	0.10
Swimming pool basin	0.50	0.25	0.10
Windows	4.80 (g-value 0.85)	1.60	0.90 (g-value 0.50)
Rooflights	5.30 (g-value 0.85)	1.60	1.00 (g-value 0.55)
Doors	3.00	1.8	1.20
Air permeability (m^3/hm^2 @50 Pa)	15	15	5**

*There is a high risk of interstitial condensation when existing walls are internally insulated. Therefore, the maximum acceptable U-value has been used.

**Due to the retention of some existing walls and structure, it is estimated that it will not be feasible to achieve a lower air permeability.

Modelling Inputs – New Build Scenario

Element	Part L1A U-value W/m^{2}K	Proposed U-value W/m^{2}K
Flat roof	0.20	0.10
Pitched roof	0.20	0.10
Wall	0.30	0.12
Ground floor	0.25	0.10
Swimming pool basin	0.25	0.10
Windows	2.00	0.90 (g-value 0.50)
Rooflights	2.00	1.00 (g-value 0.55)
Doors	2.00	1.20
Air permeability (m^3/hm^2 @50 Pa)	10	3

Energy Inputs
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Thermal Bridging Junctions

The new dwellings within the scheme will be designed in line with the accredited construction details (ACD) and therefore it has been indicatively modelled with the accredited thermal bridge psi-values for the following junctions:

- Lintels (E2)
- Sill (E3)
- Jambs (E4)
- Ground floor (E5)
- Intermediate floor within a dwelling (E6)
- Corners (E16)
- Corners inverted (E17)

A bespoke thermal bridging calculation will be required for the following junctions in the new dwellings in order to achieve the specified psi-values:

- Flat Roof with Parapet (E15); 0.30 W/mK

The default psi-value has been used for the remaining junctions.

Thermal Mass:

Thermal mass of the scheme has been indicatively modelled as 250 kJ/m^{2}K (medium) for both refurbishment and new build.

Decarbonisation

Grid electricity carbon intensity profile will follow the 'slow progression decarbonisation scenario' from the National Grid Future Energy Scenarios 2015.

It is important to be aware that the national grid will decarbonise over time, with the proliferation of low-carbon technologies. However, this will not form the basis of the analysis and will only be reported for reference.

Mechanical and Electrical Inputs

Heating and hot water

Both scenarios (refurbishment and new-build) have been modelled with a gas boiler with an efficiency of 90% to supply 60% of the main heating output. The remaining 40% will be supplied by an air source heat pump (ASHP) with a minimum CoP of 2.80.

Ventilation

Balanced ventilation with heat recovery (MVHR) has been specified for both options, modelled with an SFP of 0.96 W/l/s and a heat recovery efficiency of 91%.

Cooling

No cooling system has been specified in either scenario.

Lighting

High efficiency lighting has been specified for both options of the dwelling.

Material Inputs
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Methodology

The construction build-ups for both scenarios have been received from the design team to ascertain the new materials entering the building as well as the existing materials removed from the building, where applicable. Both scenarios have been modelled and all relevant materials to each scenario have been quantified and inputted into the modelling software, eTool LCD.

Due to the uncertainty of procurement, default transport distances, replacement rates, disposal methods, and transport distances have been used for the analysis.

The study period for this project is 60 years, in accordance with BREEAM and ISO methodologies.

The following life stages are considered in both scenarios' analyses:

- A1-A3: Product stage – raw materials supply, transport and manufacturing
- A4: Transport of the products to the construction site
- A5: Construction of the main building elements
- B1: Use
- B2-B3: Maintenance and repair
- B4-B5: Material replacement and refurbishment
- B6: Operational Energy – taken from Energy modelling
- C1-C4: Deconstruction/demolition
- D1-D5: Benefits beyond the system boundary

Material Inputs – Refurbishment Scenario

The following building elements have been included in the refurbishment scenario:

- Structural frame (all new columns and beams and miscellaneous connections)
- Construction envelope – all new walls, roof and floor elements
- New windows and frames
- Transport of all the construction materials to the site
- Maintenance and replacement of building elements during the material lifespan

Material Inputs – New Build Scenario

The following building elements have been included in the refurbishment scenario:

- All existing elements on site to be included within the deconstruction calculation
- Structural frame (all columns and beams and miscellaneous connections)
- Construction envelope – all walls, roof and floor elements
- Windows and frames
- Internal Walls and Partitions
- Transport of all the construction materials to the site
- Maintenance and replacement of building elements during the material lifespan

Summary of Results
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Existing Scenario

The existing scenario has been modelled as though no work has been done. Therefore, as no new materials are entering the scheme, the embodied carbon of the existing scheme is 0 $kgCO_2e$. The total lifetime carbon impact (60 years) of the existing scenario is 1,882,486 $kgCO_2e$ (3,513 $kgCO_2e/m^2$).

Refurbishment Scenario

The total lifetime carbon impact (60 years) of the refurbishment scenario is 776,547 $kgCO_2e$ (1,506 $kgCO_2e/m^2$):

- The operational carbon of the refurbishment scheme is 302,240 $kgCO_2e$.
- The embodied carbon of the refurbishment scheme over the study period is 474,307 $kgCO_2e$:
  - Construction stage impacts: 415,317 $kgCO_2$
  - Building operation impacts: 52,282 $kgCO_2e$/year
  - Deconstruction impacts: 20,979 $kgCO_2$
  - Reuse, recovery, and recycling potential: −14,271 $kgCO_2$

When normalised against the gross internal area of the building, the results are as follows:

Life stage	GWP ($kgCO_2e/m^2$)	
A1– A3. Construction materials	658	
A4. Transport to site	88	
A5. Construction/installation process	29	
B1. Use	0	
B2–B3. Maintenance and repair	9	
B4–B5. Material replacement and refurbishment	89	
B6. Energy use	564	242*
C1– C4. Deconstruction	39	
D1–D5. Benefits beyond the system boundary	−27	

*Denotes $kgCO_2e/m^2$ after accounting for decarbonisation scenario, included as reference only

New Build Scenario

The total lifetime carbon impact (60 years) of the new build scenario is 718,646 $kgCO_2e$ (1,398 $kgCO_2e/m^2$).

- The operational carbon of the new build scheme is 222,840 $kgCO_2e$.
- The embodied carbon of the new build scheme over the study period is 495,806 $kgCO_2e$:
  - Construction stage impacts: 434,330 $kgCO_2$
  - Building operation impacts: 52,385 $kgCO_2e$/year
  - Deconstruction impacts: 23,395 $kgCO_2$
  - Reuse, recovery, and recycling potential: −14,305 $kgCO_2$

When normalised against the gross internal area of the building, the results are as follows:

Life stage	GWP ($kgCO_2e/m^2$)	
A1– A3. Construction materials	686	
A4. Transport to site	95	
A5. Construction/installation process	29	
B1. Use	0	
B2–B3. Maintenance and repair	9	
B4–B5. Material replacement and refurbishment	89	
B6. Energy use	416	179*
C1– C4. Deconstruction	44	
D1–D5. Benefits beyond the system boundary	−27	

*Denotes $kgCO_2e/m^2$ after accounting for decarbonisation scenario, included as reference only

Benchmarks
RFO vs NC Comparison
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Introduction

In order to compare multiple buildings, different benchmarks have been developed. In particular, the Greater London Authority (GLA) is the most applicable benchmark set for planning applications.

Greater London Authority Benchmarks

The Greater London Authority have published a new set of benchmarks for a Whole Life Carbon assessment, focusing on the embodied carbon of Construction Stage modules (A1–A5) and Use and Deconstruction Stage modules (B–C), excluding operational energy. The benchmarks cover: Offices, Retail, Education, and Apartment/Hotel. A table summarising this is provided below.

	Benchmark ($kgCO_2e/m^2$)		Aspirational Benchmark ($kgCO_2e/m^2$)	
	A1–A5	B–C (excl. B6–B7)	A1–A5	B–C (excl. B6–B7)
Offices	900 – 1,000	400 – 500	550 – 600	250 – 300
Retail	900 – 1,000	100 – 200	550 – 600	60 – 120
Education	700 – 800	200 – 300	450 – 500	120 – 180
Apartment/Hotel	750 – 850	300 – 400	450 – 500	180 – 240

It is important to note that the GLA guidance stipulates that Whole Life Carbon assessments are required for planning applications referable to the Mayor, but are supported and encouraged on major applications that are not referable to the Mayor.

As per Camden guidance, major developments are classed as developments comprising:

- 10 or more houses or flats; or
- A floor space of 1,000m^2 or more

The Chalcot House development is a single dwelling of approximately 535m^2 and therefore does not need to demonstrate compliance against the benchmarks, only a comparison against them.

UKGBC

The UK Green Building Council (UKGBC) is seen as a key driver in net zero carbon efforts. Whilst acknowledging that zero carbon cannot occur overnight, UKGBC has developed a roadmap in conjunction with the London Energy Transformation Initiative (LETI), stating the permissible targets at certain year milestones. Although benchmarks are provided for both upfront embodied carbon, only the operational energy benchmarks from the UKGBC will be acknowledged.

	Baseline Scenario	Intermediate Scenario	Stretch Scenario
Residential Operational Energy (kWh/m^2 (GIA)/year)	146 (RIBA – Business as usual)	70 (RIBA 2025 target)	35 (RIBA 2030 target)

https://www.ukgbc.org/wp-content/uploads/2020/09/Building-the-Case-for-Net-Zero_UKGBC.pdf

Results

For the refurbishment scenario, the benchmark comparisons are as follows:

Life Stage module	Results	Benchmark Compliance (Residential/Apartment)
A1–A5 ($kgCO_2e/m^2$)	775	Regular (750–850)
B–C ($kgCO_2e/m^2$)	137	Exceeds Aspirational (180–240)
B6 (kWh/m^2 (GIA)/year)	53	Intermediate (70)

For the new build scenario, the benchmark comparisons are as follows:

Life Stage module	Results	Benchmark Compliance (Residential/Apartment)
A1–A5 ($kgCO_2e/m^2$)	810	Regular (750–850)
B–C ($kgCO_2e/m^2$)	142	Exceeds Aspirational (180–240)
B6 (kWh/m^2 (GIA)/year)	41	Intermediate (70)

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RFO Results
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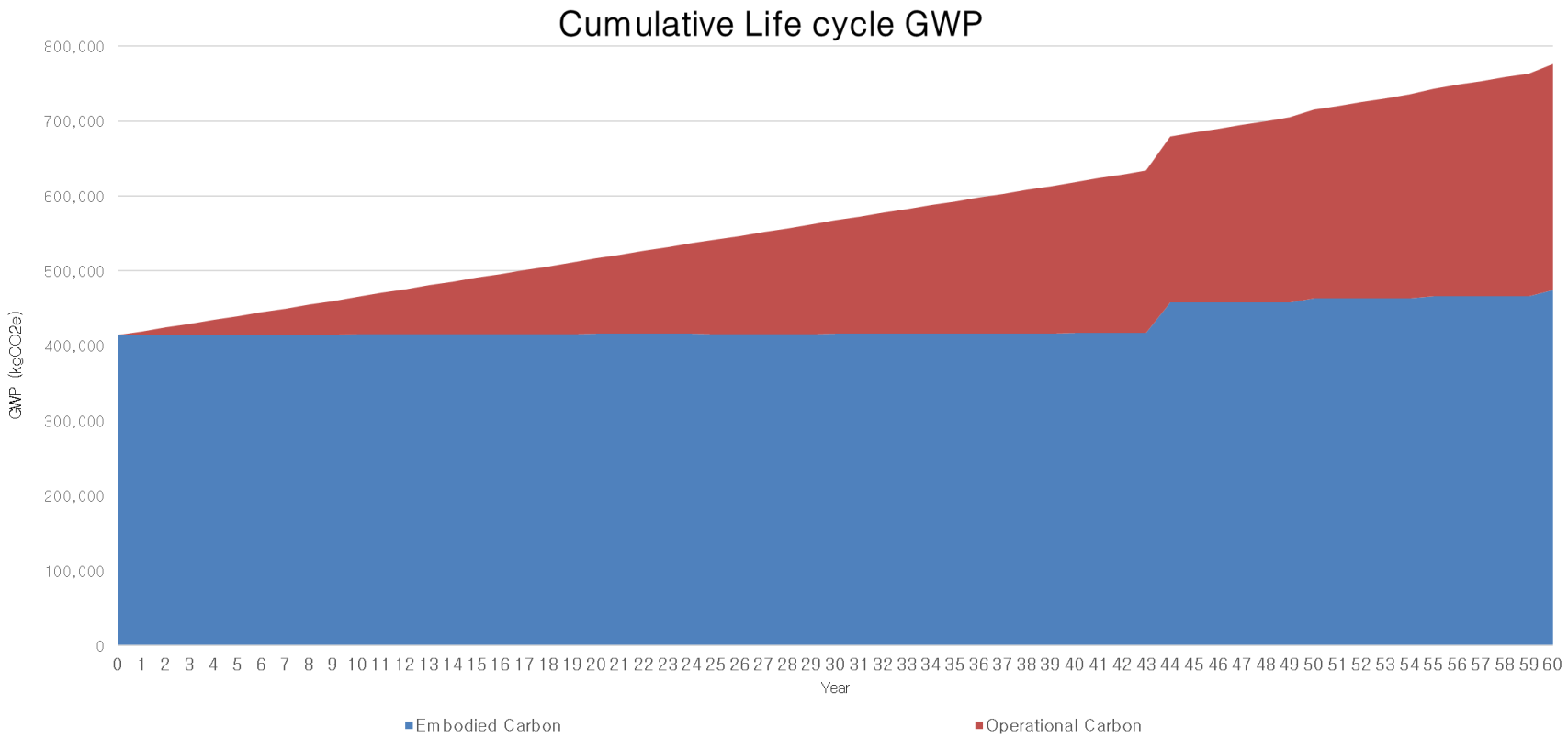
Cumulative Carbon of Refurbishment Scenario



Summary of Results
NC Results
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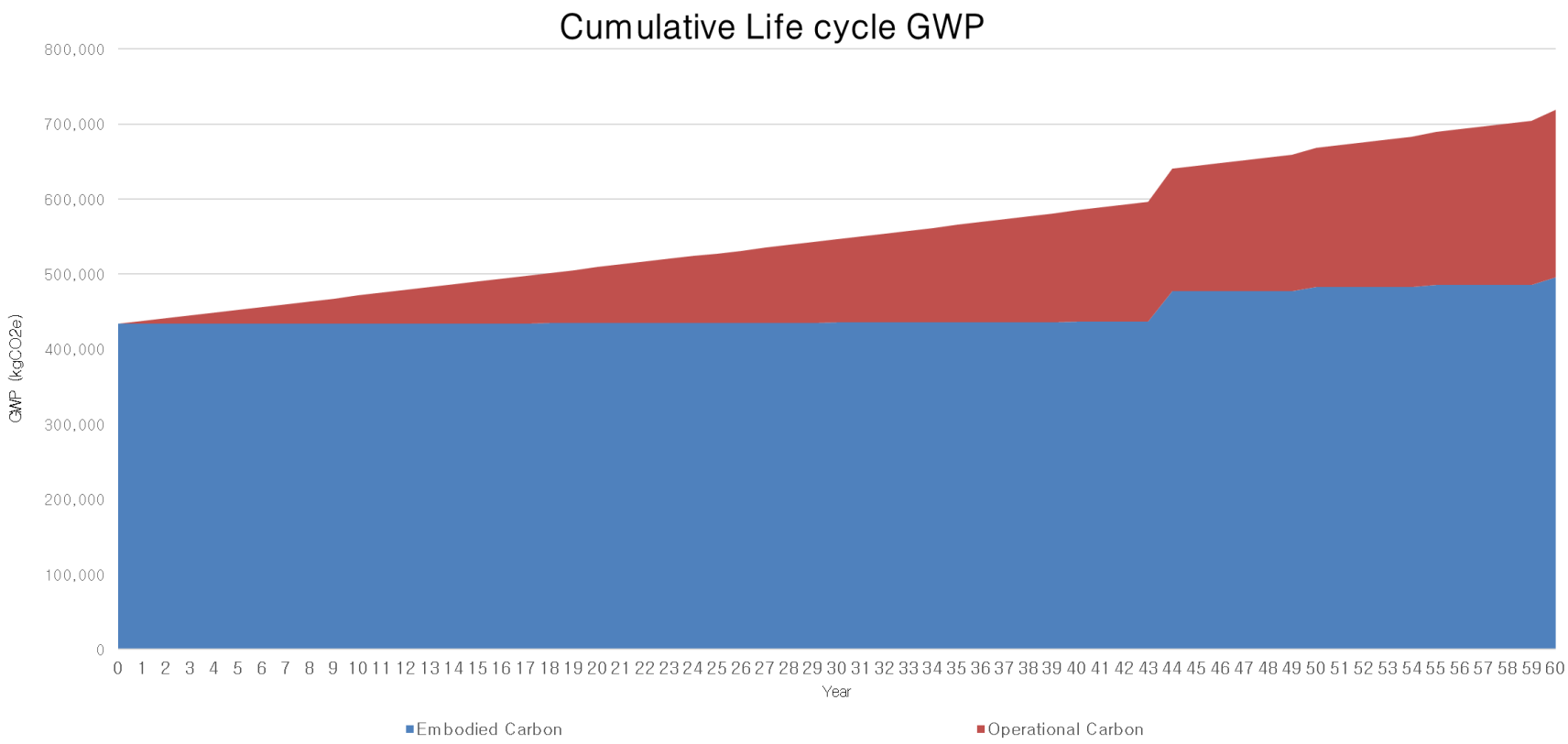
Cumulative Carbon of New Build Scenario



Summary of Results
Existing vs RFO vs NC
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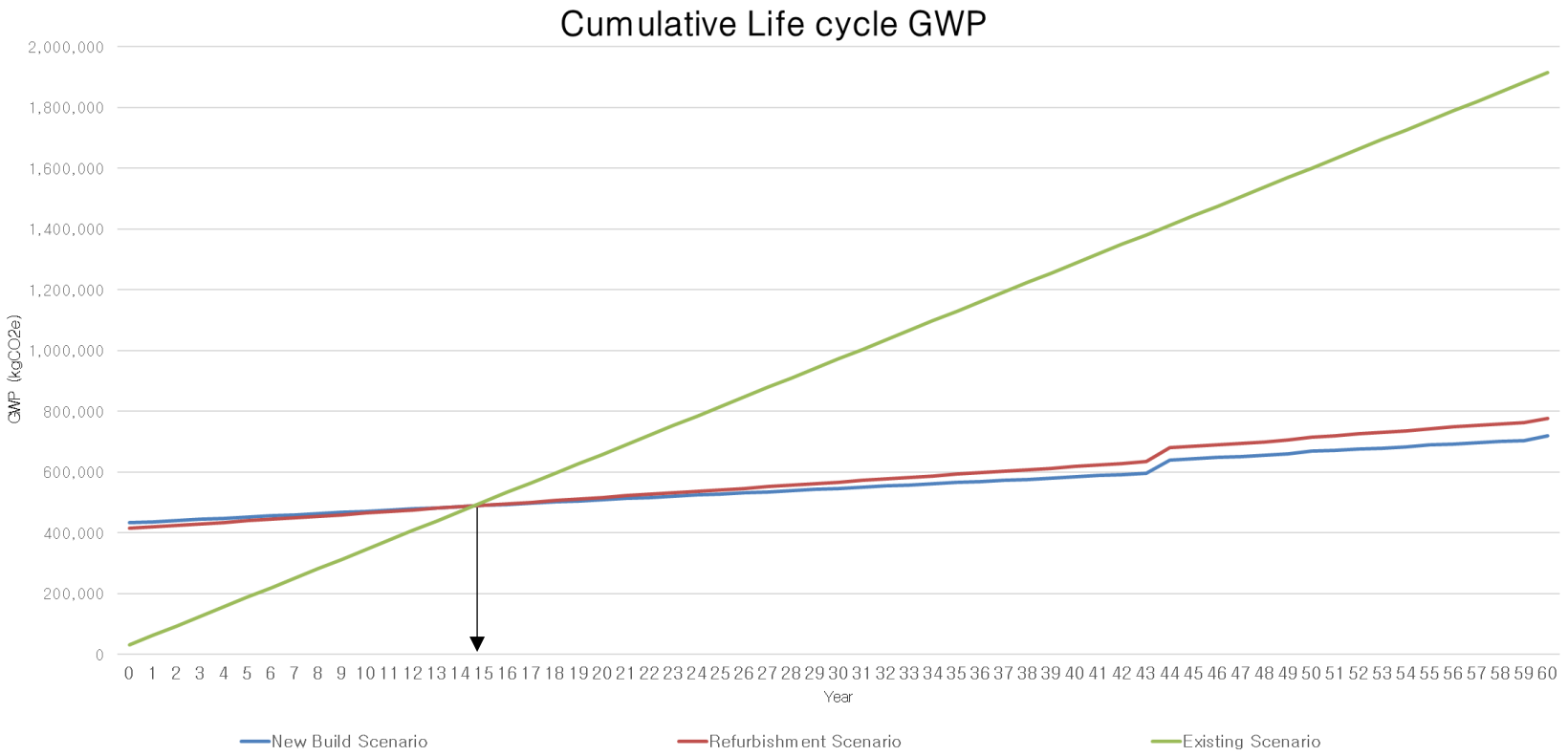
Cumulative Carbon Comparison

The existing scenario is the preferred scenario until Year 15. This is in part due to the absence of embodied carbon compared to the proposed schemes. However, as the yearly operational carbon is so high, the cumulative carbon impact over the study period is significantly higher than either option.



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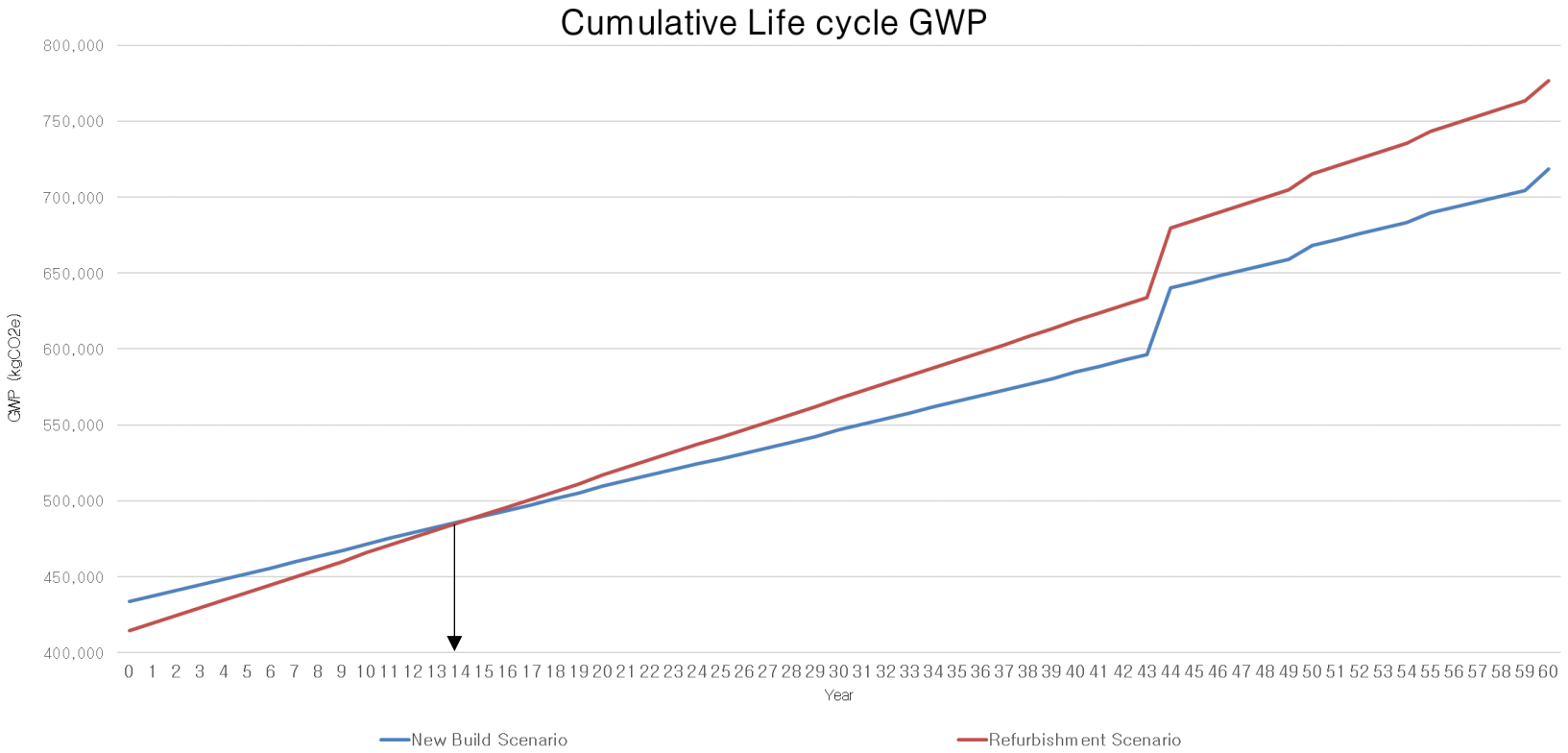
Cumulative Carbon Comparison

The refurbishment scenario has a lower embodied carbon at Year 0. However, as the operational carbon is higher in the refurbishment scenario, the cumulative carbon impact is higher over the study period. The new build scenario becomes the lower carbon impact option at Year 14.



Conclusions
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Conclusions

The refurbishment scenario demonstrates a higher operational carbon but a lower embodied carbon. The new build scenario demonstrates a lower operational carbon but a higher embodied carbon.

After Year 14, the increased operational carbon impact of the refurbished scheme results in a larger cumulative carbon impact when compared to the new build scheme. Therefore, a newly built scheme would be preferred if the lifespan is intended to be more than 14 years.

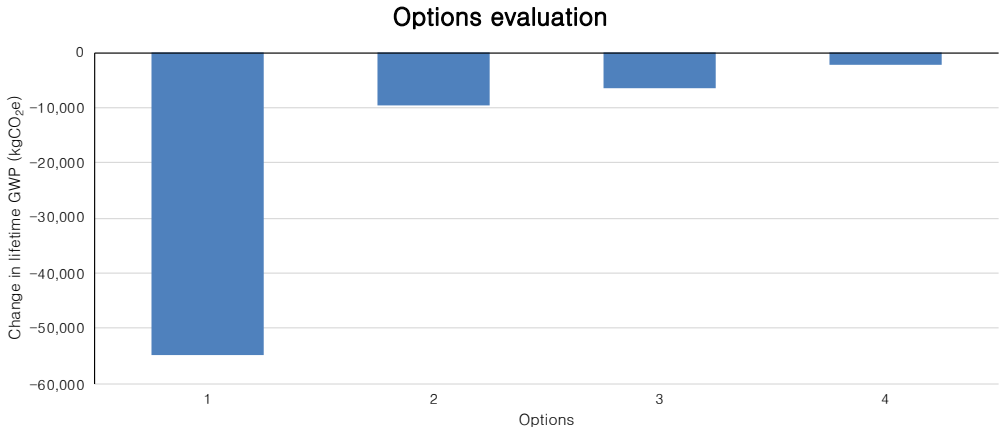
Recommendations for Further Mitigation

The design team should push to create as low an impact building as possible and, by doing so, will further increase the carbon gap between a refurbished scheme and a newly built scheme.

Several options have been analysed to determine measures that the design team may do to further reduce the total carbon of the scheme over its lifespan:

	Description of measure	Lifecycle carbon reduction ($kgCO_2e$)		
		Embodied	Operational	Total
1	Reduction in window U-value from 0.9 W/m^2K to 0.8 W/m^2K through the substitution of aluminium framed windows for timber framed windows.	-34,253	-20,722	-54,975
2	Specification of 50% repurposed brick for internal walls from the deconstruction of the existing building.	-9,728	(-)	-9,728
3	Increase in Air Source Heat Pump Co-efficient of Performance from 2.8 to 3.0	(-)	-6,487	-6,487
4	Substitution of 40% of the volume of foundation Portland Cement for Ground Granulated Blast Slag	-2,257	(-)	-2,257

Although some measures have a greater impact than others, it is important that the relevant consultants are approached to evaluate the viability of each with respect to procurement, construction time, cost, change in structural strength, etc.



Appendix
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LCA Analysis

Chalcot House – Refurbishment Scenario

Life stage	Resource	Quantity	Unit	Global warming (kg CO_2e)	Acidification (kg SO_2e)	Eutrophication (kg PO_4e)	Ozone depletion potential (kg $CFC_{11}e$)	Photochemical Ozone Creation Potential, POCP	RICS category number	Category Name	Service Life	Resource type/description
Total				**776,547**	**2,108**	**963**	**0.04**	**194**				
A1A3	C35/45	83.8	m3	37,659.18	80.96	17.61	0.00	3.71	1.1	Standard foundations	150	35 MPa
A1A3	steel reinforcement bars	11,718.5	kg	21,878.68	94.77	97.87	0.00	15.02	1.1	Standard foundations	150	Reinforcement bar
A1A3	Foil lining	342.7	Count	1,905.72	12.86	3.28	0.00	1.11	1.1	Standard foundations	80	Aluminium Unspecified
A1A3	Foil glue	76.2	Count	344.25	2.73	0.42	0.00	0.15	1.1	Standard foundations	50	Melamine Resin
A1A3	Polyurethane Insulation Board	1,624.6	Area Calculation	8,172.20	33.07	6.24	0.00	3.90	1.1	Standard foundations	80	Polyurethane
A1A3	Concrete poured floor	63.5	m3	30,623.19	66.73	14.39	0.00	3.06	1.1	Standard foundations	150	40 MPa
A1A3	steel reinforcement bars	6,346.2	kg	11,848.52	51.32	53.00	0.00	8.14	1.1	Standard foundations	150	Reinforcement bar
A1A3	structural steel	50,000.0	kg	112,191.60	948.00	557.02	0.01	72.15	2.1	Frame	150	Galvanised Structural
A1A3	Upper floors	43.7	m3	19,628.21	42.20	9.18	0.00	1.94	2.2	Upper floors	150	35 MPa
A1A3	steel reinforcement bars	4,370.2	kg	8,159.28	35.34	36.50	0.00	5.60	2.2	Upper floors	150	Reinforcement bar
A1A3	Foil lining	295.0	Count	1,640.43	11.07	2.82	0.00	0.95	2.2	Upper floors	80	Aluminium Unspecified
A1A3	Foil glue	65.6	Count	296.32	2.35	0.36	0.00	0.13	2.2	Upper floors	50	Melamine Resin
A1A3	Polyurethane Insulation Board	21.9	m3	3,517.28	14.23	2.69	0.00	1.68	2.2	Upper floors	80	Polyurethane
A1A3	Foil lining	264.1	Count	1,468.43	9.91	2.52	0.00	0.85	2.3	Roof	80	Aluminium Unspecified
A1A3	Foil glue	58.7	Count	265.25	2.10	0.33	0.00	0.12	2.3	Roof	50	Melamine Resin
A1A3	Polyurethane Insulation Board	1,251.8	Area Calculation	6,297.01	25.48	4.81	0.00	3.01	2.3	Roof	80	Polyurethane
A1A3	EPS 170mm	397.7	Count	1,933.49	6.58	0.79	0.00	3.10	2.3	Roof	75	Polystyrene EPS
A1A3	Windows / Sliding Doors	22.9	m2 (Default)	2,066.62	14.62	3.03	0.00	1.02	2.3	Roof	55	Domestic 50% Opening
A1A3	Poured Concrete (roof)	39.1	m3	15,305.95	32.83	7.21	0.00	1.52	2.3	Roof	150	25 MPa
A1A3	steel reinforcement bars	3,912.0	kg	7,303.81	31.64	32.67	0.00	5.02	2.3	Roof	150	Reinforcement bar
A1A3	Root resistant	533.5	Count	1,273.61	3.48	0.58	0.00	0.21	2.3	Roof	200	Polyvinyl Chloride (PVC)
A1A3	Bitumen	1,976.0	Count	192.33	1.09	0.15	0.00	0.06	2.3	Roof	100	Asphalt hot mix 5.5% bitumen, (0% RAP)
A1A3	Filter fabric	12.4	kg	10.84	0.02	0.01	0.00	0.00	2.3	Roof	50	Felt
A1A3	Confinement cells	158.1	kg	389.06	1.31	0.12	0.00	0.12	2.3	Roof	50	High Density Polyethylene (HDPE)
A1A3	Proxy for plantings	-284.6	kg	-171.77	-0.43	-0.14	0.00	-0.04	2.3	Roof	25	R-744 (CO2)
A1A3	100mm Growing media	9.9	m3	144.75	1.16	0.44	0.00	0.06	2.3	Roof	50	Soil
A1A3	Drainage mesh module	266.8	kg	656.53	2.21	0.20	0.00	0.21	2.3	Roof	50	High Density Polyethylene (HDPE)
A1A3	Water drainage tray	88.9	kg	218.84	0.74	0.07	0.00	0.07	2.3	Roof	50	High Density Polyethylene (HDPE)
A1A3	Root resistant membrane	533.5	kg	1,273.61	3.48	0.58	0.00	0.21	2.3	Roof	50	Polyvinyl Chloride (PVC)
A1A3	PVC irrigation piping	3.0	kg	7.73	0.02	0.00	0.00	0.00	2.3	Roof	50	Polyvinyl Chloride (PVC)
A1A3	Down pipe	6.9	Count	18.01	0.05	0.01	0.00	0.00	2.3	Roof	50	Polyvinyl Chloride (PVC)
A1A3	Gutter	23.5	Count	61.37	0.18	0.03	0.00	0.01	2.3	Roof	50	Polyvinyl Chloride (PVC)
A1A3	Oak floating staircase	0.7	m3	160.53	0.87	0.18	0.00	0.10	2.4	Stairs and ramps	110	Hardwood
A1A3	Hollow Steel Handrail (50mm diam) 2mm gauge	14.2	Count	37.26	0.20	0.06	0.00	0.02	2.4	Stairs and ramps	50	Stainless
A1A3	110mm Face Bricks	24,773.6	Area Calculation	7,152.09	25.41	4.43	0.00	1.65	2.5	External walls	150	Clay Bricks and Pavers
A1A3	Mortar	1.9	m3	1,859.82	6.91	1.30	0.00	0.32	2.5	External walls	150	1 cement : 4 sand
A1A3	Waterproof membrane 1mm	19.0	Area Calculation	46.74	0.16	0.01	0.00	0.01	2.5	External walls	150	High Density Polyethylene (HDPE)
A1A3	112.5mm Face Bricks	24,773.6	Area Calculation	114.51	0.83	0.19	0.00	0.02	2.5	External walls	150	Clay Bricks and Pavers – Recycled
A1A3	Mortar	1.9	m3	1,859.82	6.91	1.30	0.00	0.32	2.5	External walls	150	1 cement : 4 sand
A1A3	Waterproof membrane 1mm	19.0	Area Calculation	46.74	0.16	0.01	0.00	0.01	2.5	External walls	150	High Density Polyethylene (HDPE)
A1A3	Mortar	2.2	m3	2,208.68	8.21	1.55	0.00	0.39	2.5	External walls	150	1 cement : 4 sand
A1A3	Brick Hardware eg Galintals, nails etc	220.2	kg	315.56	1.36	1.17	0.00	0.19	2.5	External walls	150	General
A1A3	Brickslip external skin	13,212.6	Area Calculation	3,814.45	13.55	2.36	0.00	0.88	2.5	External walls	150	Clay Bricks and Pavers
A1A3	Windows / Sliding Doors	325.2	m2 (Default)	29,333.22	207.51	42.99	0.00	14.43	2.6	External windows and Doors	44	Domestic 50% Opening
A1A3	110mm Face Bricks	46,305.5	Count	214.03	1.55	0.35	0.00	0.04	2.7	Internal walls and partitions	150	Clay Bricks and Pavers – Recycled
A1A3	Mortar	5.9	m3	5,870.42	21.81	4.12	0.00	1.03	2.7	Internal walls and partitions	150	1 cement : 4 sand
A1A3	Alum Windows and Sliding Doors	49.8	m2 (Default)	3,207.39	24.61	4.13	0.00	1.43	2.7	Internal walls and partitions	44	Commercial Fixed
A4	C35/45	83.8	m3	4,695.93	16.50	3.77	0.00	1.10	1.1	Standard foundations	150	35 MPa
A4	steel reinforcement bars	11,718.5	kg	1,642.07	5.95	1.74	0.00	0.44	1.1	Standard foundations	150	Reinforcement bar
A4	Pour Concrete	0.6	hrs	205.71	0.73	0.17	0.00	0.05	1.1	Standard foundations	150	Concrete Pump, Diesel
A4	Concreter pour concrete	1.8	hrs	6.38	0.03	0.01	0.00	0.00	1.1	Standard foundations	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Foil lining	342.7	Count	235.06	0.87	0.20	0.00	0.06	1.1	Standard foundations	80	Aluminium Unspecified
A4	Foil glue	76.2	Count	66.51	0.25	0.06	0.00	0.02	1.1	Standard foundations	50	Melamine Resin
A4	Polyurethane Insulation Board	1,624.6	Area Calculation	272.87	0.99	0.22	0.00	0.07	1.1	Standard foundations	80	Polyurethane
A4	Concrete poured floor	63.5	m3	3,616.79	12.72	2.90	0.00	0.84	1.1	Standard foundations	150	40 MPa
A4	steel reinforcement bars	6,346.2	kg	889.27	3.22	0.94	0.00	0.24	1.1	Standard foundations	150	Reinforcement bar
A4	Pour Concrete	0.5	hrs	205.71	0.73	0.17	0.00	0.05	1.1	Standard foundations	150	Concrete Pump, Diesel
A4	Concreter pour concrete	1.4	hrs	6.38	0.03	0.01	0.00	0.00	1.1	Standard foundations	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Install reinforcement - 0.011hrs/kg	69.8	hrs	57.46	0.25	0.08	0.00	0.02	1.1	Standard foundations	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Crane install of steel	116.7	hrs	2,037.49	7.28	1.66	0.00	0.49	2.1	Frame	150	Crane, Diesel
A4	structural steel	50,000.0	kg	7,100.53	28.09	8.13	0.00	1.92	2.1	Frame	150	Galvanised Structural
A4	Install Beam (structural steel - 7hrs/t)	350.0	hrs	280.93	1.24	0.41	0.00	0.08	2.1	Frame	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Upper floors	43.7	m3	2,337.72	8.35	1.91	0.00	0.56	2.2	Upper floors	150	35 MPa
A4	steel reinforcement bars	4,370.2	kg	612.38	2.22	0.65	0.00	0.16	2.2	Upper floors	150	Reinforcement bar
A4	Foil lining	295.0	Count	202.34	0.75	0.17	0.00	0.05	2.2	Upper floors	80	Aluminium Unspecified
A4	Foil glue	65.6	Count	57.25	0.21	0.05	0.00	0.01	2.2	Upper floors	50	Melamine Resin
A4	Polyurethane Insulation Board	21.9	m3	117.44	0.43	0.09	0.00	0.03	2.2	Upper floors	80	Polyurethane
A4	Pour Concrete	0.3	hrs	205.71	0.73	0.17	0.00	0.05	2.2	Upper floors	150	Concrete Pump, Diesel
A4	Concreter pour place and work concrete pump	0.9	hrs	6.38	0.03	0.01	0.00	0.00	2.2	Upper floors	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Install reinforcement - 0.011hrs/kg	48.1	hrs	44.69	0.20	0.07	0.00	0.01	2.2	Upper floors	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Foil lining	264.1	Count	181.12	0.67	0.15	0.00	0.05	2.3	Roof	80	Aluminium Unspecified
A4	Foil glue	58.7	Count	51.25	0.19	0.04	0.00	0.01	2.3	Roof	50	Melamine Resin

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LCA Analysis

Chalcot House – Refurbishment Scenario

Life stage	Resource	Quantity	Unit	Global warming (kg CO_2e)	Acidification (kg SO_2e)	Eutrophication (kg PO_4e)	Ozone depletion potential (kg $CFC_{11}e$)	Photochemical Ozone Creation Potential, POCP	RICS category number	Category Name	Service Life	Resource type/description
A4	Polyurethane Insulation Board	1,251.8	Area Calculation	210.26	0.77	0.17	0.00	0.06	2.3	Roof	80	Polyurethane
A4	EPS 170mm	397.7	Count	66.46	0.24	0.05	0.00	0.03	2.3	Roof	75	Polystyrene EPS
A4	Windows / Sliding Doors	22.9	m2 (Default)	453.78	1.66	0.38	0.00	0.11	2.3	Roof	55	Domestic 50% Opening
A4	Installation in roof	14.6	hrs	8.51	0.04	0.01	0.00	0.00	2.3	Roof	80	Trade Staff (No Equipment, labour transport only), Electricity
A4	Installation in roof	12.6	hrs	8.51	0.04	0.01	0.00	0.00	2.3	Roof	80	Trade Staff (No Equipment, labour transport only), Electricity
A4	Pour Concrete	0.3	hrs	205.71	0.73	0.17	0.00	0.05	2.3	Roof	150	Concrete Pump, Diesel
A4	Concreter pour concrete	0.8	hrs	6.38	0.03	0.01	0.00	0.00	2.3	Roof	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Install reinforcement - 0.011hrs/kg	43.0	hrs	38.31	0.17	0.06	0.00	0.01	2.3	Roof	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Installation in roof	11.2	hrs	8.51	0.04	0.01	0.00	0.00	2.3	Roof	80	Trade Staff (No Equipment, labour transport only), Electricity
A4	Lay bitumen and EPS	24.7	hrs	25.54	0.11	0.04	0.00	0.01	2.3	Roof	100	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Heated bitumen container	31.6	hrs	56.75	0.25	0.08	0.00	0.02	2.3	Roof	100	Electrical Equipment, Large with transport and tradestaff, Electricity
A4	Install Windows	8.0	hrs	6.38	0.03	0.01	0.00	0.00	2.3	Roof	44	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Install flyscreens	10.3	hrs	12.77	0.06	0.02	0.00	0.00	2.3	Roof	20	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Poured Concrete (roof)	39.1	m3	2,158.81	7.61	1.74	0.00	0.51	2.3	Roof	150	25 MPa
A4	steel reinforcement bars	3,912.0	kg	548.18	1.99	0.58	0.00	0.15	2.3	Roof	150	Reinforcement bar
A4	Root resistant	533.5	Count	403.91	1.44	0.33	0.00	0.10	2.3	Roof	200	Polyvinyl Chloride (PVC)
A4	Bitumen	1,976.0	Count	44.91	0.16	0.04	0.00	0.01	2.3	Roof	100	Asphalt hot mix 5.5% bitumen, (0% RAP)
A4	Filter fabric	12.4	kg	9.75	0.03	0.01	0.00	0.00	2.3	Roof	50	Felt
A4	Confinement cells	158.1	kg	119.73	0.43	0.10	0.00	0.03	2.3	Roof	50	High Density Polyethylene (HDPE)
A4	Proxy for plantings	-284.6	kg	-200.75	-0.72	-0.16	0.00	-0.05	2.3	Roof	25	R-744 (CO2)
A4	100mm Growing media	9.9	m3	454.09	1.62	0.37	0.00	0.11	2.3	Roof	50	Soil
A4	Drainage mesh module	266.8	kg	197.55	0.71	0.16	0.00	0.05	2.3	Roof	50	High Density Polyethylene (HDPE)
A4	Water drainage tray	88.9	kg	65.85	0.24	0.05	0.00	0.02	2.3	Roof	50	High Density Polyethylene (HDPE)
A4	Root resistant membrane	533.5	kg	395.10	1.41	0.32	0.00	0.09	2.3	Roof	50	Polyvinyl Chloride (PVC)
A4	PVC irrigation piping	3.0	kg	2.19	0.01	0.00	0.00	0.00	2.3	Roof	50	Polyvinyl Chloride (PVC)
A4	Lay green roof	118.6	hrs	95.77	0.42	0.14	0.00	0.03	2.3	Roof	50	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Down pipe	6.9	Count	5.23	0.02	0.00	0.00	0.00	2.3	Roof	50	Polyvinyl Chloride (PVC)
A4	Gutter	23.5	Count	17.83	0.06	0.01	0.00	0.00	2.3	Roof	50	Polyvinyl Chloride (PVC)
A4	Oak floating staircase	0.7	m3	74.19	0.26	0.06	0.00	0.02	2.4	Stairs and ramps	110	Hardwood
A4	Hollow Steel Handrail (50mm diam) 2mm gauge	14.2	Count	2.04	0.01	0.00	0.00	0.00	2.4	Stairs and ramps	50	Stainless
A4	Install handrail	1.1	hrs	6.38	0.03	0.01	0.00	0.00	2.4	Stairs and ramps	50	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Bricklayer - brickwork	353.6	hrs	287.32	1.27	0.42	0.00	0.08	2.5	External walls	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Facing, Pointing & cleaning down	69.5	hrs	57.46	0.25	0.08	0.00	0.02	2.5	External walls	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Mixing mortar	1.7	hrs	28.38	0.13	0.04	0.00	0.01	2.5	External walls	150	Electrical Equipment, Large with transport and tradestaff, Electricity
A4	Install Windows	17.3	hrs	19.15	0.08	0.03	0.00	0.01	2.5	External walls	44	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Bricklayer - brickwork	112.0	hrs	95.77	0.42	0.14	0.00	0.03	2.5	External walls	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Facing, Pointing & cleaning down	22.0	hrs	19.15	0.08	0.03	0.00	0.01	2.5	External walls	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Mixing mortar	0.6	hrs	28.38	0.13	0.04	0.00	0.01	2.5	External walls	150	Electrical Equipment, Large with transport and tradestaff, Electricity
A4	Install Windows	112.9	hrs	95.77	0.42	0.14	0.00	0.03	2.5	External walls	44	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Install flyscreens	146.3	hrs	121.31	0.54	0.18	0.00	0.03	2.5	External walls	20	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Bricklayer - brickwork	112.0	hrs	95.77	0.42	0.14	0.00	0.03	2.5	External walls	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Facing, Pointing & cleaning down	22.0	hrs	19.15	0.08	0.03	0.00	0.01	2.5	External walls	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Mixing mortar	0.6	hrs	28.38	0.13	0.04	0.00	0.01	2.5	External walls	150	Electrical Equipment, Large with transport and tradestaff, Electricity
A4	Brick Layers	176.2	hrs	146.85	0.65	0.21	0.00	0.04	2.5	External walls	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	110mm Face Bricks	24,773.6	Area Calculation	3,419.76	12.21	2.79	0.00	0.82	2.5	External walls	150	Clay Bricks and Pavers
A4	Mortar	1.9	m3	427.23	1.53	0.35	0.00	0.10	2.5	External walls	150	1 cement : 4 sand
A4	Waterproof membrane 1mm	19.0	Area Calculation	14.39	0.05	0.01	0.00	0.00	2.5	External walls	150	High Density Polyethylene (HDPE)
A4	112.5mm Face Bricks	24,773.6	Area Calculation	4.31	0.02	0.00	0.00	0.00	2.5	External walls	150	Clay Bricks and Pavers - Recycled
A4	Mortar	1.9	m3	427.23	1.53	0.35	0.00	0.10	2.5	External walls	150	1 cement : 4 sand
A4	Waterproof membrane 1mm	19.0	Area Calculation	14.39	0.05	0.01	0.00	0.00	2.5	External walls	150	High Density Polyethylene (HDPE)
A4	Mortar	2.2	m3	507.37	1.81	0.41	0.00	0.12	2.5	External walls	150	1 cement : 4 sand
A4	Brick Hardware eg Galintals, nails etc	220.2	kg	28.54	0.10	0.02	0.00	0.01	2.5	External walls	150	General
A4	Brickslip external skin	13,212.6	Area Calculation	1,793.84	6.41	1.46	0.00	0.43	2.5	External walls	150	Clay Bricks and Pavers
A4	Windows / Sliding Doors	325.2	m2 (Default)	6,440.92	23.51	5.36	0.00	1.58	2.6	External windows and Doors	44	Domestic 50% Opening
A4	110mm Face Bricks	46,305.5	Count	2.82	0.02	0.00	0.00	0.00	2.7	Internal walls and partitions	150	Clay Bricks and Pavers - Recycled
A4	Mortar	5.9	m3	1,348.53	4.82	1.10	0.00	0.32	2.7	Internal walls and partitions	150	1 cement : 4 sand
A4	Alum Windows and Sliding Doors	49.8	m2 (Default)	1,036.50	3.77	0.85	0.00	0.25	2.7	Internal walls and partitions	44	Commercial Fixed
A5	steel reinforcement bars	11,718.5	kg	61.11	0.22	0.05	0.00	0.01	1.1	Standard foundations	150	Reinforcement bar
A5	Pour Concrete	0.6	hrs	49.85	0.15	0.03	0.00	0.01	1.1	Standard foundations	150	Concrete Pump, Diesel
A5	Concreter pour concrete	1.8	hrs	0.42	0.00	0.00	0.00	0.00	1.1	Standard foundations	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	Foil lining	342.7	Count	1.27	0.00	0.00	0.00	0.00	1.1	Standard foundations	80	Aluminium Unspecified
A5	Foil glue	76.2	Count	0.47	0.00	0.00	0.00	0.00	1.1	Standard foundations	50	Melamine Resin
A5	Polyurethane Insulation Board	1,624.6	Area Calculation	6.77	0.03	0.01	0.00	0.00	1.1	Standard foundations	80	Polyurethane
A5	Concrete poured floor	63.5	m3	420.16	1.89	0.41	0.00	0.11	1.1	Standard foundations	150	40 MPa
A5	steel reinforcement bars	6,346.2	kg	33.09	0.12	0.03	0.00	0.01	1.1	Standard foundations	150	Reinforcement bar
A5	Pour Concrete	0.5	hrs	37.73	0.11	0.02	0.00	0.01	1.1	Standard foundations	150	Concrete Pump, Diesel
A5	Concreter pour concrete	1.4	hrs	0.32	0.00	0.00	0.00	0.00	1.1	Standard foundations	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	Install reinforcement - 0.011hrs/kg	69.8	hrs	16.21	0.08	0.02	0.00	0.04	1.1	Standard foundations	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	Steel Fabrication	1,150.0	hrs	1,394.15	7.19	1.41	0.00	3.43	2.1	Frame	150	Offsite Manufacturing / Prefabrication Process, Electricity
A5	Crane install of steel	116.7	hrs	11,651.62	34.95	6.62	0.00	2.31	2.1	Frame	150	Crane, Diesel
A5	structural steel	50,000.0	kg	260.74	0.94	0.22	0.00	0.06	2.1	Frame	150	Galvanised Structural
A5	Install Beam (structural steel - 7hrs/t)	350.0	hrs	81.25	0.42	0.08	0.00	0.20	2.1	Frame	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	Upper floors	43.7	m3	236.51	0.93	0.21	0.00	0.06	2.2	Upper floors	150	35 MPa

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LCA Analysis

Chalcot House – Refurbishment Scenario

Life stage	Resource	Quantity	Unit	Global warming (kg CO_2e)	Acidification (kg SO_2e)	Eutrophication (kg PO_4e)	Ozone depletion potential (kg $CFC_{11}e$)	Photochemical Ozone Creation Potential, POCP	RICS category number	Category Name	Service Life	Resource type/description
A5	steel reinforcement bars	4,370.2	kg	22.79	0.08	0.02	0.00	0.01	2.2	Upper floors	150	Reinforcement bar
A5	Foil lining	295.0	Count	1.09	0.00	0.00	0.00	0.00	2.2	Upper floors	80	Aluminium Unspecified
A5	Foil glue	65.6	Count	0.40	0.00	0.00	0.00	0.00	2.2	Upper floors	50	Melamine Resin
A5	Polyurethane Insulation Board	21.9	m3	2.91	0.01	0.00	0.00	0.00	2.2	Upper floors	80	Polyurethane
A5	Pour Concrete	0.3	hrs	25.98	0.08	0.01	0.00	0.01	2.2	Upper floors	150	Concrete Pump, Diesel
A5	Concreter pour place and work concrete pump	0.9	hrs	0.22	0.00	0.00	0.00	0.00	2.2	Upper floors	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	Install reinforcement – 0.011hrs/kg	48.1	hrs	11.16	0.06	0.01	0.00	0.03	2.2	Upper floors	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	Foil lining	264.1	Count	0.98	0.00	0.00	0.00	0.00	2.3	Roof	80	Aluminium Unspecified
A5	Foil glue	58.7	Count	0.36	0.00	0.00	0.00	0.00	2.3	Roof	50	Melamine Resin
A5	Polyurethane Insulation Board	1,251.8	Area Calculation	5.21	0.02	0.01	0.00	0.00	2.3	Roof	80	Polyurethane
A5	EPS 170mm	397.7	Count	1.66	0.01	0.00	0.00	0.00	2.3	Roof	75	Polystyrene EPS
A5	Windows / Sliding Doors	22.9	m2 (Default)	0.38	0.00	0.00	0.00	0.00	2.3	Roof	55	Domestic 50% Opening
A5	manufacturing of insulation board	2.5	hrs	3.08	0.02	0.00	0.00	0.01	2.3	Roof	80	Offsite Manufacturing / Prefabrication Process, Electricity
A5	manufacturing of insulation board	2.2	hrs	2.65	0.01	0.00	0.00	0.01	2.3	Roof	80	Offsite Manufacturing / Prefabrication Process, Electricity
A5	Pour Concrete	0.3	hrs	23.26	0.07	0.01	0.00	0.00	2.3	Roof	150	Concrete Pump, Diesel
A5	Concreter pour concrete	0.8	hrs	0.19	0.00	0.00	0.00	0.00	2.3	Roof	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	Install reinforcement – 0.011hrs/kg	43.0	hrs	9.99	0.05	0.01	0.00	0.02	2.3	Roof	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	manufacturing of insulation board	2.0	hrs	2.37	0.01	0.00	0.00	0.01	2.3	Roof	80	Offsite Manufacturing / Prefabrication Process, Electricity
A5	Lay bitumen and EPS	24.7	hrs	5.73	0.03	0.01	0.00	0.01	2.3	Roof	100	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	Heated bitumen container	31.6	hrs	77.47	0.40	0.08	0.00	0.19	2.3	Roof	100	Electrical Equipment, Large with transport and tradestaff, Electricity
A5	Install Windows	8.0	hrs	1.85	0.01	0.00	0.00	0.00	2.3	Roof	44	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	Install flyscreens	10.3	hrs	2.39	0.01	0.00	0.00	0.01	2.3	Roof	20	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	Poured Concrete (roof)	39.1	m3	252.59	1.14	0.25	0.00	0.06	2.3	Roof	150	25 MPa
A5	steel reinforcement bars	3,912.0	kg	20.40	0.07	0.02	0.00	0.00	2.3	Roof	150	Reinforcement bar
A5	Root resistant	533.5	Count	15.54	0.06	0.01	0.00	0.00	2.3	Roof	200	Polyvinyl Chloride (PVC)
A5	Bitumen	1,976.0	Count	5.37	0.02	0.01	0.00	0.00	2.3	Roof	100	Asphalt hot mix 5.5% bitumen, (0% RAP)
A5	Filter fabric	12.4	kg	2.20	0.00	0.00	0.00	0.00	2.3	Roof	50	Felt
A5	Confinement cells	158.1	kg	4.60	0.02	0.00	0.00	0.00	2.3	Roof	50	High Density Polyethylene (HDPE)
A5	Drainage mesh module	266.8	kg	6.58	0.02	0.01	0.00	0.00	2.3	Roof	50	High Density Polyethylene (HDPE)
A5	Water drainage tray	88.9	kg	2.59	0.01	0.00	0.00	0.00	2.3	Roof	50	High Density Polyethylene (HDPE)
A5	Root resistant membrane	533.5	kg	13.17	0.05	0.01	0.00	0.00	2.3	Roof	50	Polyvinyl Chloride (PVC)
A5	PVC irrigation piping	3.0	kg	0.07	0.00	0.00	0.00	0.00	2.3	Roof	50	Polyvinyl Chloride (PVC)
A5	Lay green roof	118.6	hrs	27.52	0.14	0.03	0.00	0.07	2.3	Roof	50	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	Down pipe	6.9	Count	0.20	0.00	0.00	0.00	0.00	2.3	Roof	50	Polyvinyl Chloride (PVC)
A5	Gutter	23.5	Count	0.69	0.00	0.00	0.00	0.00	2.3	Roof	50	Polyvinyl Chloride (PVC)
A5	Oak floating staircase	0.7	m3	65.28	0.01	0.00	0.00	0.01	2.4	Stairs and ramps	110	Hardwood
A5	Hollow Steel Handrail (50mm diam) 2mm gauge	14.2	Count	0.07	0.00	0.00	0.00	0.00	2.4	Stairs and ramps	50	Stainless
A5	Steel handrail manufacture	21.7	hrs	26.32	0.14	0.03	0.00	0.06	2.4	Stairs and ramps	50	Offsite Manufacturing / Prefabrication Process, Electricity
A5	Install handrail	1.1	hrs	0.25	0.00	0.00	0.00	0.00	2.4	Stairs and ramps	50	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	Bricklayer – brickwork	353.6	hrs	82.09	0.42	0.08	0.00	0.20	2.5	External walls	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	Facing, Pointing & cleaning down	69.5	hrs	16.14	0.08	0.02	0.00	0.04	2.5	External walls	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	Mixing mortar	1.7	hrs	4.26	0.02	0.00	0.00	0.01	2.5	External walls	150	Electrical Equipment, Large with transport and tradestaff, Electricity
A5	Install Windows	17.3	hrs	4.02	0.02	0.00	0.00	0.01	2.5	External walls	44	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	Bricklayer – brickwork	112.0	hrs	26.01	0.13	0.03	0.00	0.06	2.5	External walls	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	Facing, Pointing & cleaning down	22.0	hrs	5.11	0.03	0.01	0.00	0.01	2.5	External walls	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	Mixing mortar	0.6	hrs	1.35	0.01	0.00	0.00	0.00	2.5	External walls	150	Electrical Equipment, Large with transport and tradestaff, Electricity
A5	Install Windows	112.9	hrs	26.21	0.14	0.03	0.00	0.06	2.5	External walls	44	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	Install flyscreens	146.3	hrs	33.97	0.18	0.03	0.00	0.08	2.5	External walls	20	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	Bricklayer – brickwork	112.0	hrs	26.01	0.13	0.03	0.00	0.06	2.5	External walls	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	Facing, Pointing & cleaning down	22.0	hrs	5.11	0.03	0.01	0.00	0.01	2.5	External walls	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	Mixing mortar	0.6	hrs	1.35	0.01	0.00	0.00	0.00	2.5	External walls	150	Electrical Equipment, Large with transport and tradestaff, Electricity
A5	Brick Layers	176.2	hrs	40.90	0.21	0.04	0.00	0.10	2.5	External walls	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	110mm Face Bricks	24,773.6	Area Calculation	35.61	0.16	0.03	0.00	0.01	2.5	External walls	150	Clay Bricks and Pavers
A5	Mortar	1.9	m3	8.50	0.04	0.01	0.00	0.00	2.5	External walls	150	1 cement : 4 sand
A5	Waterproof membrane 1mm	19.0	Area Calculation	0.55	0.00	0.00	0.00	0.00	2.5	External walls	150	High Density Polyethylene (HDPE)
A5	112.5mm Face Bricks	24,773.6	Area Calculation	35.61	0.16	0.03	0.00	0.01	2.5	External walls	150	Clay Bricks and Pavers – Recycled
A5	Mortar	1.9	m3	8.50	0.04	0.01	0.00	0.00	2.5	External walls	150	1 cement : 4 sand
A5	Waterproof membrane 1mm	19.0	Area Calculation	0.55	0.00	0.00	0.00	0.00	2.5	External walls	150	High Density Polyethylene (HDPE)
A5	Mortar	2.2	m3	10.09	0.05	0.01	0.00	0.00	2.5	External walls	150	1 cement : 4 sand
A5	Brick Hardware eg Galintals, nails etc	220.2	kg	1.15	0.00	0.00	0.00	0.00	2.5	External walls	150	General
A5	Brickslip external skin	13,212.6	Area Calculation	18.99	0.08	0.02	0.00	0.00	2.5	External walls	150	Clay Bricks and Pavers
A5	Windows / Sliding Doors	325.2	m2 (Default)	5.46	0.02	0.01	0.00	0.00	2.6	External windows and Doors	44	Domestic 50% Opening
A5	110mm Face Bricks	46,305.5	Count	16.67	0.12	0.02	0.00	0.00	2.7	Internal walls and partitions	150	Clay Bricks and Pavers – Recycled

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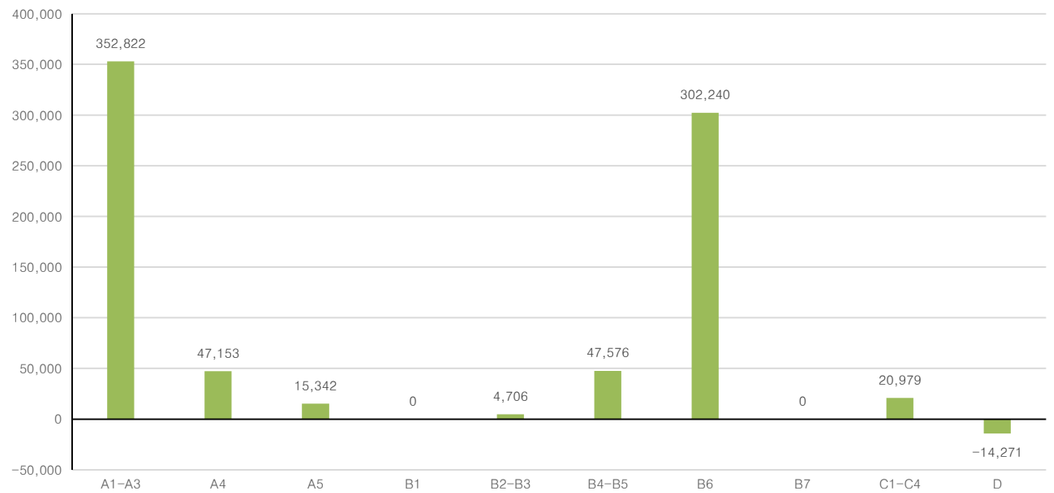
LCA Analysis

Chalcot House – Refurbishment Scenario

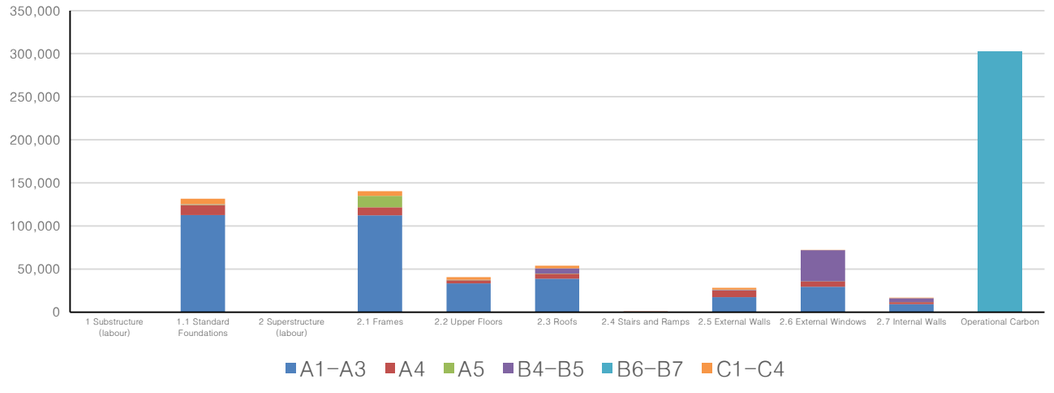
Calculation Parameters			
Service life values for materials			Technical service
Transportation distance values for materials			United Kingdom
Local compensation target region			London
Global Warming Potential per life stage	**Life Stage**	**Sector**	**Global Warming Potential (kg CO_2e)**
Construction Impact	A1–A3	Construction materials	352,822
	A4	Transportation to site	47,153
	A5	Construction/installation process	15,342
Operation Impact	B1	Use	0
	B2–B3	Maintenance and repair	4,706
	B4–B5	Material replacement and refurbishment	47,576
	B6	Electricity usage	302,240
	B7	Water usage	0
Deconstruction impact	C1–C4	Deconstruction	20,979
Reuse, recovery, and recycling potential	D	Reuse, recovery, and recycling potential	−14,271
TOTAL (Excluding reuse, recovery and recycling potential)			**790,818**
TOTAL			**776,547**

Global Warming Potential (kg CO_2e) per Life Cycle Stage



	0	A1A3	A4	A5	B1	B2B3	B4B5	B6	C
Global Warming Potential (kg CO_2e) Breakdown	**Total (Excluding D)**	**A1–A3**	**A4**	**A5**	**B1**	**B2–B3**	**B4–B5**	**B6–B7**	**C1–C4**
1 Substructure (labour)	0	–	–	–	–	–	–	–	–
1.1 Standard Foundations	131,633	112,432	11,900	627	–	–	414	–	6,260
2 Superstructure (labour)	0	–	–	–	–	–	–	–	–
2.1 Frames	140,213	112,192	9,419	13,388	–	–	–	–	5,215
2.2 Upper Floors	40,434	33,242	3,584	301	–	–	356	–	2,952
2.3 Roofs	58,600	38,715	5,658	489	–	4,706	5,935	–	3,096
2.4 Stairs and Ramps	883	198	83	92	–	–	74	–	437
2.5 External Walls	28,050	17,418	7,680	392	–	–	456	–	2,104
2.6 External Windows	72,105	29,333	6,441	5	–	–	36,053	–	273
2.7 Internal Walls	16,660	9,292	2,388	48	–	–	4,290	–	643
Operational Carbon	302,240	–	–	–	–	–	–	302,240	–
TOTAL	**790,818**	**352,822**	**47,153**	**15,342**	**0**	**4,706**	**47,576**	**302,240**	**20,979**
			–	–					

Global Warming Potential (kg CO_2e) per RICS Category and Life Cycle Stage



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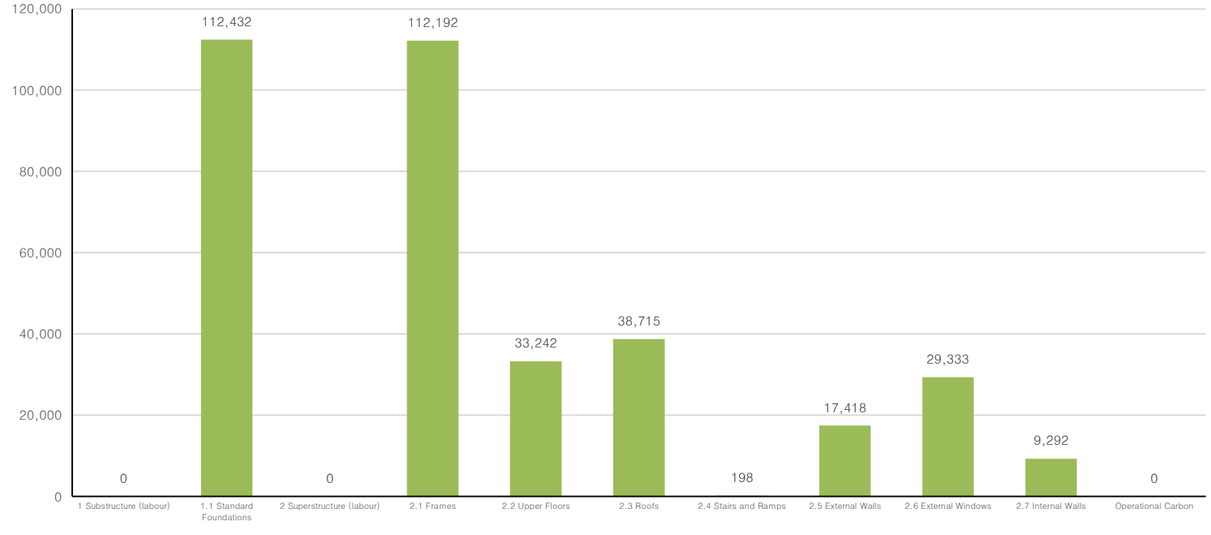
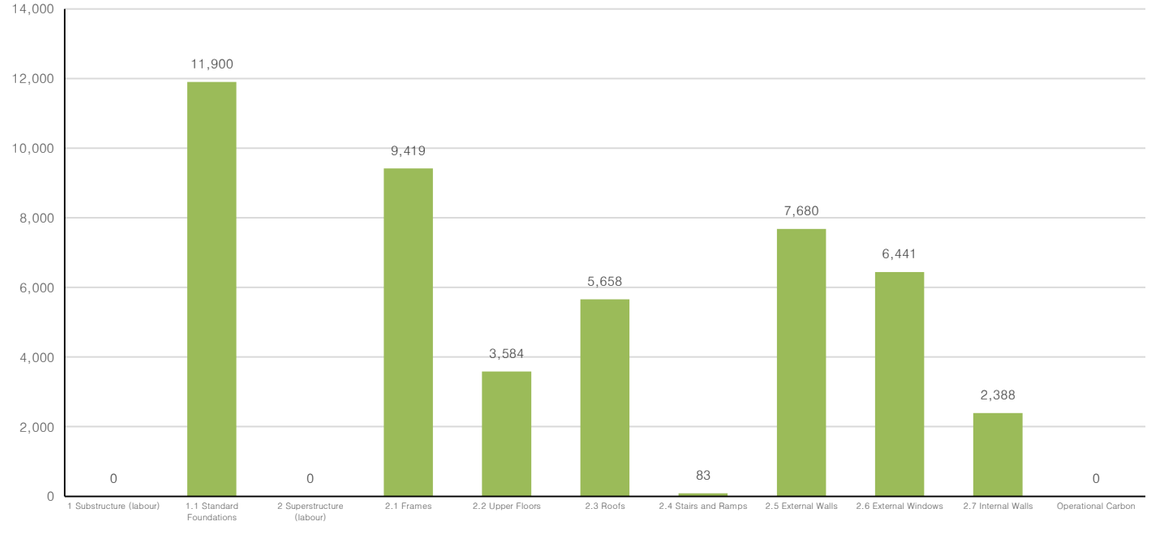
LCA Analysis

Chalcot House – Refurbishment Scenario

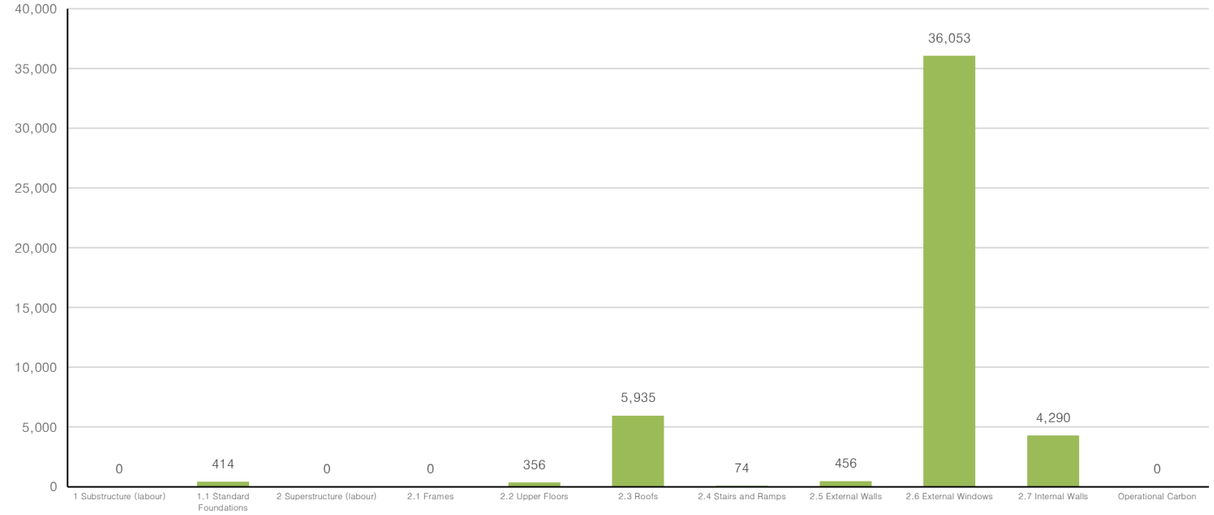
Global Warming Potential (kg CO_2e) for Life Cycle Stage A1–A3



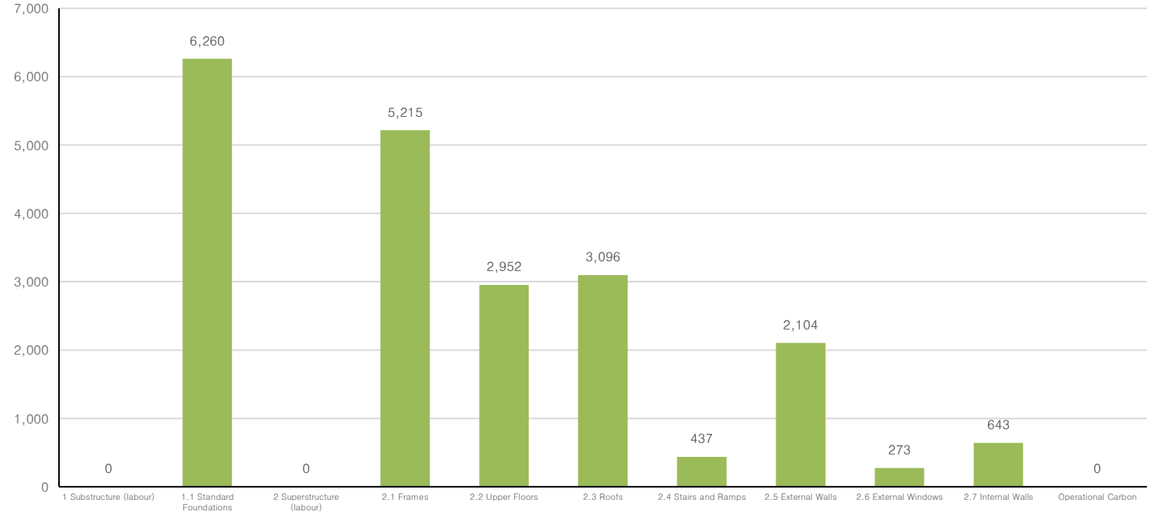
Global Warming Potential (kg CO_2e) for Life Cycle Stage A4



Global Warming Potential (kg CO_2e) for Life Cycle Stage B4–B5



Global Warming Potential (kg CO_2e) for Life Cycle Stage C1–C4



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LCA Analysis

Chalcot House – New Build Scenario

Life stage	Resource	Quantity	Unit	Global warming (kg CO_2e)	Acidification (kg SO_2e)	Eutrophication (kg PO_4e)	Ozone depletion potential (kg $CFC_{11}e$)	Photochemical Ozone Creation Potential, POCP	RICS category number	Category Name	Service Life	Resource type/description
Total				**718,646**	**2,185**	**998**	**0.04**	**203**				
A1A3	C35/45	104.8	m3	47,073.99	101.20	22.01	0.00	4.64	1.1	Standard foundations	150	35 MPa
A1A3	steel reinforcement bars	14,648.1	kg	27,348.35	118.46	122.33	0.00	18.78	1.1	Standard foundations	150	Reinforcement bar
A1A3	Foil lining	428.4	Count	2,382.15	16.08	4.10	0.00	1.39	1.1	Standard foundations	80	Aluminium Unspecified
A1A3	Foil glue	95.2	Count	430.31	3.41	0.53	0.00	0.19	1.1	Standard foundations	50	Melamine Resin
A1A3	Polyurethane Insulation Board	2,030.8	Area Calculation	10,215.25	41.34	7.80	0.00	4.88	1.1	Standard foundations	80	Polyurethane
A1A3	Concrete poured floor	63.5	m3	30,623.19	66.73	14.39	0.00	3.06	1.1	Standard foundations	150	40 MPa
A1A3	steel reinforcement bars	6,346.2	kg	11,848.52	51.32	53.00	0.00	8.14	1.1	Standard foundations	150	Reinforcement bar
A1A3	structural steel	50,000.0	kg	112,191.60	948.00	557.02	0.01	72.15	2.1	Frame	150	Galvanised Structural
A1A3	Upper floors	43.7	m3	19,628.21	42.20	9.18	0.00	1.94	2.2	Upper floors	150	35 MPa
A1A3	steel reinforcement bars	4,370.2	kg	8,159.28	35.34	36.50	0.00	5.60	2.2	Upper floors	150	Reinforcement bar
A1A3	Foil lining	295.0	Count	1,640.43	11.07	2.82	0.00	0.95	2.2	Upper floors	80	Aluminium Unspecified
A1A3	Foil glue	65.6	Count	296.32	2.35	0.36	0.00	0.13	2.2	Upper floors	50	Melamine Resin
A1A3	Polyurethane Insulation Board	21.9	m3	3,517.28	14.23	2.69	0.00	1.68	2.2	Upper floors	80	Polyurethane
A1A3	Foil lining	264.1	Count	1,468.43	9.91	2.52	0.00	0.85	2.3	Roof	80	Aluminium Unspecified
A1A3	Foil glue	58.7	Count	265.25	2.10	0.33	0.00	0.12	2.3	Roof	50	Melamine Resin
A1A3	Polyurethane Insulation Board	1,251.8	Area Calculation	6,297.01	25.48	4.81	0.00	3.01	2.3	Roof	80	Polyurethane
A1A3	EPS 170mm	397.7	Count	1,933.49	6.58	0.79	0.00	3.10	2.3	Roof	75	Polystyrene EPS
A1A3	Windows / Sliding Doors	22.9	m2 (Default)	2,066.62	14.62	3.03	0.00	1.02	2.3	Roof	55	Domestic 50% Opening
A1A3	Poured Concrete (roof)	39.1	m3	15,305.95	32.83	7.21	0.00	1.52	2.3	Roof	150	25 MPa
A1A3	steel reinforcement bars	3,912.0	kg	7,303.81	31.64	32.67	0.00	5.02	2.3	Roof	150	Reinforcement bar
A1A3	Root resistant	533.5	Count	1,273.61	3.48	0.58	0.00	0.21	2.3	Roof	200	Polyvinyl Chloride (PVC)
A1A3	Bitumen	1,976.0	Count	192.33	1.09	0.15	0.00	0.06	2.3	Roof	100	Asphalt hot mix 5.5% bitumen, (0% RAP)
A1A3	Filter fabric	12.4	kg	10.84	0.02	0.01	0.00	0.00	2.3	Roof	50	Felt
A1A3	Confinement cells	158.1	kg	389.06	1.31	0.12	0.00	0.12	2.3	Roof	50	High Density Polyethylene (HDPE)
A1A3	Proxy for plantings	-284.6	kg	-171.77	-0.43	-0.14	0.00	-0.04	2.3	Roof	25	R-744 (CO2)
A1A3	100mm Growing media	9.9	m3	144.75	1.16	0.44	0.00	0.06	2.3	Roof	50	Soil
A1A3	Drainage mesh module	266.8	kg	656.53	2.21	0.20	0.00	0.21	2.3	Roof	50	High Density Polyethylene (HDPE)
A1A3	Water drainage tray	88.9	kg	218.84	0.74	0.07	0.00	0.07	2.3	Roof	50	High Density Polyethylene (HDPE)
A1A3	Root resistant membrane	533.5	kg	1,273.61	3.48	0.58	0.00	0.21	2.3	Roof	50	Polyvinyl Chloride (PVC)
A1A3	PVC irrigation piping	3.0	kg	7.73	0.02	0.00	0.00	0.00	2.3	Roof	50	Polyvinyl Chloride (PVC)
A1A3	Down pipe	6.9	Count	18.01	0.05	0.01	0.00	0.00	2.3	Roof	50	Polyvinyl Chloride (PVC)
A1A3	Gutter	23.5	Count	61.37	0.18	0.03	0.00	0.01	2.3	Roof	50	Polyvinyl Chloride (PVC)
A1A3	Oak floating staircase	0.7	m3	160.53	0.87	0.18	0.00	0.10	2.4	Stairs and ramps	110	Hardwood
A1A3	Hollow Steel Handrail (50mm diam) 2mm gauge	14.2	Count	37.26	0.20	0.06	0.00	0.02	2.4	Stairs and ramps	50	Stainless
A1A3	110mm Face Bricks	7,575.8	Area Calculation	2,187.11	7.77	1.36	0.00	0.50	2.5	External walls	150	Clay Bricks and Pavers
A1A3	Mortar	3.7	m3	3,719.63	13.82	2.61	0.00	0.65	2.5	External walls	150	1 cement : 4 sand
A1A3	Waterproof membrane 1mm	38.0	Area Calculation	93.49	0.32	0.03	0.00	0.03	2.5	External walls	150	High Density Polyethylene (HDPE)
A1A3	140x45mm Studs 400mm centres	1,907.6	Count	-2,805.74	3.39	0.81	0.00	0.51	2.5	External walls	80	Softwood
A1A3	400mm Nogs (140x45)	635.9	Count	-935.25	1.13	0.27	0.00	0.17	2.5	External walls	80	Softwood
A1A3	Top & Bottom plates (140x45mm)	635.9	Count	-935.25	1.13	0.27	0.00	0.17	2.5	External walls	80	Softwood
A1A3	Fastners/nails	11.5	kg	16.44	0.07	0.06	0.00	0.01	2.5	External walls	80	General
A1A3	Diagonal bracing straps	11.0	kg	15.78	0.07	0.06	0.00	0.01	2.5	External walls	80	General
A1A3	Waterproof membrane	31.7	Count	77.91	0.26	0.02	0.00	0.02	2.5	External walls	80	High Density Polyethylene (HDPE)
A1A3	Windows / Sliding Doors	325.2	m2 (Default)	29,333.22	207.51	42.99	0.00	14.43	2.6	External windows and Doors	44	Domestic 50% Opening
A1A3	110mm Face Bricks	46,305.5	Count	13,368.30	47.49	8.29	0.00	3.08	2.7	Internal walls and partitions	150	Clay Bricks and Pavers
A1A3	Mortar	5.9	m3	5,870.42	21.81	4.12	0.00	1.03	2.7	Internal walls and partitions	150	1 cement : 4 sand
A1A3	Alum Windows and Sliding Doors	49.8	m2 (Default)	3,207.39	24.61	4.13	0.00	1.43	2.7	Internal walls and partitions	44	Commercial Fixed
A4	C35/45	104.8	m3	5,869.91	20.63	4.71	0.00	1.37	1.1	Standard foundations	150	35 MPa
A4	steel reinforcement bars	14,648.1	kg	2,052.58	7.43	2.18	0.00	0.55	1.1	Standard foundations	150	Reinforcement bar
A4	Pour Concrete	0.7	hrs	205.71	0.73	0.17	0.00	0.05	1.1	Standard foundations	150	Concrete Pump, Diesel
A4	Concreter pour concrete	2.2	hrs	6.38	0.03	0.01	0.00	0.00	1.1	Standard foundations	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Foil lining	428.4	Count	293.83	1.09	0.25	0.00	0.07	1.1	Standard foundations	80	Aluminium Unspecified
A4	Foil glue	95.2	Count	83.14	0.31	0.07	0.00	0.02	1.1	Standard foundations	50	Melamine Resin
A4	Polyurethane Insulation Board	2,030.8	Area Calculation	341.09	1.24	0.28	0.00	0.09	1.1	Standard foundations	80	Polyurethane
A4	Concrete poured floor	63.5	m3	3,616.79	12.72	2.90	0.00	0.84	1.1	Standard foundations	150	40 MPa
A4	steel reinforcement bars	6,346.2	kg	889.27	3.22	0.94	0.00	0.24	1.1	Standard foundations	150	Reinforcement bar
A4	Pour Concrete	0.5	hrs	205.71	0.73	0.17	0.00	0.05	1.1	Standard foundations	150	Concrete Pump, Diesel
A4	Concreter pour concrete	1.4	hrs	6.38	0.03	0.01	0.00	0.00	1.1	Standard foundations	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Install reinforcement - 0.011hrs/kg	69.8	hrs	57.46	0.25	0.08	0.00	0.02	1.1	Standard foundations	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Crane install of steel	116.7	hrs	2,037.49	7.28	1.66	0.00	0.49	2.1	Frame	150	Crane, Diesel
A4	structural steel	50,000.0	kg	7,100.53	28.09	8.13	0.00	1.92	2.1	Frame	150	Galvanised Structural
A4	Install Beam (structural steel - 7hrs/t)	350.0	hrs	280.93	1.24	0.41	0.00	0.08	2.1	Frame	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Upper floors	43.7	m3	2,337.72	8.35	1.91	0.00	0.56	2.2	Upper floors	150	35 MPa
A4	steel reinforcement bars	4,370.2	kg	612.38	2.22	0.65	0.00	0.16	2.2	Upper floors	150	Reinforcement bar
A4	Foil lining	295.0	Count	202.34	0.75	0.17	0.00	0.05	2.2	Upper floors	80	Aluminium Unspecified
A4	Foil glue	65.6	Count	57.25	0.21	0.05	0.00	0.01	2.2	Upper floors	50	Melamine Resin
A4	Polyurethane Insulation Board	21.9	m3	117.44	0.43	0.09	0.00	0.03	2.2	Upper floors	80	Polyurethane
A4	Pour Concrete	0.3	hrs	205.71	0.73	0.17	0.00	0.05	2.2	Upper floors	150	Concrete Pump, Diesel
A4	Concreter pour place and work concrete pump	0.9	hrs	6.38	0.03	0.01	0.00	0.00	2.2	Upper floors	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Install reinforcement - 0.011hrs/kg	48.1	hrs	44.69	0.20	0.07	0.00	0.01	2.2	Upper floors	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Foil lining	264.1	Count	181.12	0.67	0.15	0.00	0.05	2.3	Roof	80	Aluminium Unspecified
A4	Foil glue	58.7	Count	51.25	0.19	0.04	0.00	0.01	2.3	Roof	50	Melamine Resin

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LCA Analysis

Chalcot House – New Build Scenario

Life stage	Resource	Quantity	Unit	Global warming (kg CO_2e)	Acidification (kg SO_2e)	Eutrophication (kg PO_4e)	Ozone depletion potential (kg $CFC_{11}e$)	Photochemical Ozone Creation Potential, POCP	RICS category number	Category Name	Service Life	Resource type/description
A4	Polyurethane Insulation Board	1,251.8	Area Calculation	210.26	0.77	0.17	0.00	0.06	2.3	Roof	80	Polyurethane
A4	EPS 170mm	397.7	Count	66.46	0.24	0.05	0.00	0.03	2.3	Roof	75	Polystyrene EPS
A4	Windows / Sliding Doors	22.9	m2 (Default)	453.78	1.66	0.38	0.00	0.11	2.3	Roof	55	Domestic 50% Opening
A4	Installation in roof	18.2	hrs	12.77	0.06	0.02	0.00	0.00	2.3	Roof	80	Trade Staff (No Equipment, labour transport only), Electricity
A4	Installation in roof	12.6	hrs	8.51	0.04	0.01	0.00	0.00	2.3	Roof	80	Trade Staff (No Equipment, labour transport only), Electricity
A4	Pour Concrete	0.3	hrs	205.71	0.73	0.17	0.00	0.05	2.3	Roof	150	Concrete Pump, Diesel
A4	Concreter pour concrete	0.8	hrs	6.38	0.03	0.01	0.00	0.00	2.3	Roof	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Install reinforcement - 0.011hrs/kg	43.0	hrs	38.31	0.17	0.06	0.00	0.01	2.3	Roof	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Installation in roof	11.2	hrs	8.51	0.04	0.01	0.00	0.00	2.3	Roof	80	Trade Staff (No Equipment, labour transport only), Electricity
A4	Lay bitumen and EPS	24.7	hrs	25.54	0.11	0.04	0.00	0.01	2.3	Roof	100	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Heated bitumen container	31.6	hrs	56.75	0.25	0.08	0.00	0.02	2.3	Roof	100	Electrical Equipment, Large with transport and tradestaff, Electricity
A4	Install Windows	8.0	hrs	6.38	0.03	0.01	0.00	0.00	2.3	Roof	44	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Install flyscreens	10.3	hrs	12.77	0.06	0.02	0.00	0.00	2.3	Roof	20	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Poured Concrete (roof)	39.1	m3	2,158.81	7.61	1.74	0.00	0.51	2.3	Roof	150	25 MPa
A4	steel reinforcement bars	3,912.0	kg	548.18	1.99	0.58	0.00	0.15	2.3	Roof	150	Reinforcement bar
A4	Root resistant	533.5	Count	403.91	1.44	0.33	0.00	0.10	2.3	Roof	200	Polyvinyl Chloride (PVC)
A4	Bitumen	1,976.0	Count	44.91	0.16	0.04	0.00	0.01	2.3	Roof	100	Asphalt hot mix 5.5% bitumen, (0% RAP)
A4	Filter fabric	12.4	kg	9.75	0.03	0.01	0.00	0.00	2.3	Roof	50	Felt
A4	Confinement cells	158.1	kg	119.73	0.43	0.10	0.00	0.03	2.3	Roof	50	High Density Polyethylene (HDPE)
A4	Proxy for plantings	-284.6	kg	-200.75	-0.72	-0.16	0.00	-0.05	2.3	Roof	25	R-744 (CO2)
A4	100mm Growing media	9.9	m3	454.09	1.62	0.37	0.00	0.11	2.3	Roof	50	Soil
A4	Drainage mesh module	266.8	kg	197.55	0.71	0.16	0.00	0.05	2.3	Roof	50	High Density Polyethylene (HDPE)
A4	Water drainage tray	88.9	kg	65.85	0.24	0.05	0.00	0.02	2.3	Roof	50	High Density Polyethylene (HDPE)
A4	Root resistant membrane	533.5	kg	395.10	1.41	0.32	0.00	0.09	2.3	Roof	50	Polyvinyl Chloride (PVC)
A4	PVC irrigation piping	3.0	kg	2.19	0.01	0.00	0.00	0.00	2.3	Roof	50	Polyvinyl Chloride (PVC)
A4	Lay green roof	118.6	hrs	95.77	0.42	0.14	0.00	0.03	2.3	Roof	50	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Down pipe	6.9	Count	5.23	0.02	0.00	0.00	0.00	2.3	Roof	50	Polyvinyl Chloride (PVC)
A4	Gutter	23.5	Count	17.83	0.06	0.01	0.00	0.00	2.3	Roof	50	Polyvinyl Chloride (PVC)
A4	Oak floating staircase	0.7	m3	74.19	0.26	0.06	0.00	0.02	2.4	Stairs and ramps	110	Hardwood
A4	Hollow Steel Handrail (50mm diam) 2mm gauge	14.2	Count	2.04	0.01	0.00	0.00	0.00	2.4	Stairs and ramps	50	Stainless
A4	Install handrail	1.1	hrs	6.38	0.03	0.01	0.00	0.00	2.4	Stairs and ramps	50	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Bricklayer - brickwork	353.6	hrs	287.32	1.27	0.42	0.00	0.08	2.5	External walls	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Facing, Pointing & cleaning down	69.5	hrs	57.46	0.25	0.08	0.00	0.02	2.5	External walls	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Mixing mortar	1.7	hrs	28.38	0.13	0.04	0.00	0.01	2.5	External walls	150	Electrical Equipment, Large with transport and tradestaff, Electricity
A4	Install Windows	17.3	hrs	19.15	0.08	0.03	0.00	0.01	2.5	External walls	44	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Bricklayer - brickwork	224.1	hrs	185.16	0.82	0.27	0.00	0.05	2.5	External walls	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Facing, Pointing & cleaning down	44.0	hrs	38.31	0.17	0.06	0.00	0.01	2.5	External walls	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Mixing mortar	1.1	hrs	28.38	0.13	0.04	0.00	0.01	2.5	External walls	150	Electrical Equipment, Large with transport and tradestaff, Electricity
A4	Carpenter Install 100x50mm Studs (0.135hrs/m)	148.6	hrs	121.31	0.54	0.18	0.00	0.03	2.5	External walls	80	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	carpenter install 100x50mm noggins (0.155hrs/m)	28.4	hrs	25.54	0.11	0.04	0.00	0.01	2.5	External walls	80	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Carpenter install 100x50mm plates (0.175hrs/m)	64.2	hrs	57.46	0.25	0.08	0.00	0.02	2.5	External walls	80	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Install Windows	112.9	hrs	95.77	0.42	0.14	0.00	0.03	2.5	External walls	44	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	Install flyscreens	146.3	hrs	121.31	0.54	0.18	0.00	0.03	2.5	External walls	20	Electrical Equipment, Small with transport and tradestaff, Electricity
A4	110mm Face Bricks	7,575.8	Area Calculation	1,045.76	3.74	0.85	0.00	0.25	2.5	External walls	150	Clay Bricks and Pavers
A4	Mortar	3.7	m3	854.46	3.05	0.70	0.00	0.20	2.5	External walls	150	1 cement : 4 sand
A4	Waterproof membrane 1mm	38.0	Area Calculation	28.77	0.10	0.02	0.00	0.01	2.5	External walls	150	High Density Polyethylene (HDPE)
A4	140x45mm Studs 400mm centres	1,907.6	Count	280.61	1.04	0.24	0.00	0.07	2.5	External walls	80	Softwood
A4	400mm Nogs (140x45)	635.9	Count	93.54	0.35	0.08	0.00	0.02	2.5	External walls	80	Softwood
A4	Top & Bottom plates (140x45mm)	635.9	Count	93.54	0.35	0.08	0.00	0.02	2.5	External walls	80	Softwood
A4	Fastners/nails	11.5	kg	1.58	0.01	0.00	0.00	0.00	2.5	External walls	80	General
A4	Diagonal bracing straps	11.0	kg	1.52	0.01	0.00	0.00	0.00	2.5	External walls	80	General
A4	Waterproof membrane	31.7	Count	23.98	0.09	0.02	0.00	0.01	2.5	External walls	80	High Density Polyethylene (HDPE)
A4	Windows / Sliding Doors	325.2	m2 (Default)	6,440.92	23.51	5.36	0.00	1.58	2.6	External windows and Doors	44	Domestic 50% Opening
A4	110mm Face Bricks	46,305.5	Count	6,392.03	22.83	5.21	0.00	1.53	2.7	Internal walls and partitions	150	Clay Bricks and Pavers
A4	Mortar	5.9	m3	1,348.53	4.82	1.10	0.00	0.32	2.7	Internal walls and partitions	150	1 cement : 4 sand
A4	Alum Windows and Sliding Doors	49.8	m2 (Default)	1,036.50	3.77	0.85	0.00	0.25	2.7	Internal walls and partitions	44	Commercial Fixed
A5	steel reinforcement bars	14,648.1	kg	76.39	0.28	0.06	0.00	0.02	1.1	Standard foundations	150	Reinforcement bar
A5	Pour Concrete	0.7	hrs	62.32	0.19	0.04	0.00	0.01	1.1	Standard foundations	150	Concrete Pump, Diesel
A5	Concreter pour concrete	2.2	hrs	0.52	0.00	0.00	0.00	0.00	1.1	Standard foundations	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	Foil lining	428.4	Count	1.59	0.01	0.00	0.00	0.00	1.1	Standard foundations	80	Aluminium Unspecified
A5	Foil glue	95.2	Count	0.58	0.00	0.00	0.00	0.00	1.1	Standard foundations	50	Melamine Resin
A5	Polyurethane Insulation Board	2,030.8	Area Calculation	8.46	0.04	0.01	0.00	0.00	1.1	Standard foundations	80	Polyurethane
A5	Concrete poured floor	63.5	m3	420.16	1.89	0.41	0.00	0.11	1.1	Standard foundations	150	40 MPa
A5	steel reinforcement bars	6,346.2	kg	33.09	0.12	0.03	0.00	0.01	1.1	Standard foundations	150	Reinforcement bar
A5	Pour Concrete	0.5	hrs	37.73	0.11	0.02	0.00	0.01	1.1	Standard foundations	150	Concrete Pump, Diesel
A5	Concreter pour concrete	1.4	hrs	0.32	0.00	0.00	0.00	0.00	1.1	Standard foundations	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	Install reinforcement - 0.011hrs/kg	69.8	hrs	16.21	0.08	0.02	0.00	0.04	1.1	Standard foundations	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	Steel Fabrication	1,150.0	hrs	1,394.15	7.19	1.41	0.00	3.43	2.1	Frame	150	Offsite Manufacturing / Prefabrication Process, Electricity
A5	Crane install of steel	116.7	hrs	11,651.62	34.95	6.62	0.00	2.31	2.1	Frame	150	Crane, Diesel
A5	structural steel	50,000.0	kg	260.74	0.94	0.22	0.00	0.06	2.1	Frame	150	Galvanised Structural
A5	Install Beam (structural steel - 7hrs/t)	350.0	hrs	81.25	0.42	0.08	0.00	0.20	2.1	Frame	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	Upper floors	43.7	m3	236.51	0.93	0.21	0.00	0.06	2.2	Upper floors	150	35 MPa
A5	steel reinforcement bars	4,370.2	kg	22.79	0.08	0.02	0.00	0.01	2.2	Upper floors	150	Reinforcement bar

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LCA Analysis

Chalcot House – New Build Scenario

Life stage	Resource	Quantity	Unit	Global warming (kg CO_2e)	Acidification (kg SO_2e)	Eutrophication (kg PO_4e)	Ozone depletion potential (kg $CFC_{11}e$)	Photochemical Ozone Creation Potential, POCP	RICS category number	Category Name	Service Life	Resource type/description
A5	Foil lining	295.0	Count	1.09	0.00	0.00	0.00	0.00	2.2	Upper floors	80	Aluminium Unspecified
A5	Foil glue	65.6	Count	0.40	0.00	0.00	0.00	0.00	2.2	Upper floors	50	Melamine Resin
A5	Polyurethane Insulation Board	21.9	m3	2.91	0.01	0.00	0.00	0.00	2.2	Upper floors	80	Polyurethane
A5	Pour Concrete	0.3	hrs	25.98	0.08	0.01	0.00	0.01	2.2	Upper floors	150	Concrete Pump, Diesel
A5	Concreter pour place and work concrete pump	0.9	hrs	0.22	0.00	0.00	0.00	0.00	2.2	Upper floors	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	Install reinforcement - 0.011hrs/kg	48.1	hrs	11.16	0.06	0.01	0.00	0.03	2.2	Upper floors	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	Foil lining	264.1	Count	0.98	0.00	0.00	0.00	0.00	2.3	Roof	80	Aluminium Unspecified
A5	Foil glue	58.7	Count	0.36	0.00	0.00	0.00	0.00	2.3	Roof	50	Melamine Resin
A5	Polyurethane Insulation Board	1,251.8	Area Calculation	5.21	0.02	0.01	0.00	0.00	2.3	Roof	80	Polyurethane
A5	EPS 170mm	397.7	Count	1.66	0.01	0.00	0.00	0.00	2.3	Roof	75	Polystyrene EPS
A5	Windows / Sliding Doors	22.9	m2 (Default)	0.38	0.00	0.00	0.00	0.00	2.3	Roof	55	Domestic 50% Opening
A5	manufacturing of insulation board	3.2	hrs	3.85	0.02	0.00	0.00	0.01	2.3	Roof	80	Offsite Manufacturing / Prefabrication Process, Electricity
A5	manufacturing of insulation board	2.2	hrs	2.65	0.01	0.00	0.00	0.01	2.3	Roof	80	Offsite Manufacturing / Prefabrication Process, Electricity
A5	Pour Concrete	0.3	hrs	23.26	0.07	0.01	0.00	0.00	2.3	Roof	150	Concrete Pump, Diesel
A5	Concreter pour concrete	0.8	hrs	0.19	0.00	0.00	0.00	0.00	2.3	Roof	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	Install reinforcement - 0.011hrs/kg	43.0	hrs	9.99	0.05	0.01	0.00	0.02	2.3	Roof	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	manufacturing of insulation board	2.0	hrs	2.37	0.01	0.00	0.00	0.01	2.3	Roof	80	Offsite Manufacturing / Prefabrication Process, Electricity
A5	Lay bitumen and EPS	24.7	hrs	5.73	0.03	0.01	0.00	0.01	2.3	Roof	100	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	Heated bitumen container	31.6	hrs	77.47	0.40	0.08	0.00	0.19	2.3	Roof	100	Electrical Equipment, Large with transport and tradestaff, Electricity
A5	Install Windows	8.0	hrs	1.85	0.01	0.00	0.00	0.00	2.3	Roof	44	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	Install flyscreens	10.3	hrs	2.39	0.01	0.00	0.00	0.01	2.3	Roof	20	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	Poured Concrete (roof)	39.1	m3	252.59	1.14	0.25	0.00	0.06	2.3	Roof	150	25 MPa
A5	steel reinforcement bars	3,912.0	kg	20.40	0.07	0.02	0.00	0.00	2.3	Roof	150	Reinforcement bar
A5	Root resistant	533.5	Count	15.54	0.06	0.01	0.00	0.00	2.3	Roof	200	Polyvinyl Chloride (PVC)
A5	Bitumen	1,976.0	Count	5.37	0.02	0.01	0.00	0.00	2.3	Roof	100	Asphalt hot mix 5.5% bitumen, (0% RAP)
A5	Filter fabric	12.4	kg	2.20	0.00	0.00	0.00	0.00	2.3	Roof	50	Felt
A5	Confinement cells	158.1	kg	4.60	0.02	0.00	0.00	0.00	2.3	Roof	50	High Density Polyethylene (HDPE)
A5	Drainage mesh module	266.8	kg	6.58	0.02	0.01	0.00	0.00	2.3	Roof	50	High Density Polyethylene (HDPE)
A5	Water drainage tray	88.9	kg	2.59	0.01	0.00	0.00	0.00	2.3	Roof	50	High Density Polyethylene (HDPE)
A5	Root resistant membrane	533.5	kg	13.17	0.05	0.01	0.00	0.00	2.3	Roof	50	Polyvinyl Chloride (PVC)
A5	PVC irrigation piping	3.0	kg	0.07	0.00	0.00	0.00	0.00	2.3	Roof	50	Polyvinyl Chloride (PVC)
A5	Lay green roof	118.6	hrs	27.52	0.14	0.03	0.00	0.07	2.3	Roof	50	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	Down pipe	6.9	Count	0.20	0.00	0.00	0.00	0.00	2.3	Roof	50	Polyvinyl Chloride (PVC)
A5	Gutter	23.5	Count	0.69	0.00	0.00	0.00	0.00	2.3	Roof	50	Polyvinyl Chloride (PVC)
A5	Oak floating staircase	0.7	m3	65.28	0.01	0.00	0.00	0.01	2.4	Stairs and ramps	110	Hardwood
A5	Hollow Steel Handrail (50mm diam) 2mm gauge	14.2	Count	0.07	0.00	0.00	0.00	0.00	2.4	Stairs and ramps	50	Stainless
A5	Steel handrail manufacture	21.7	hrs	26.32	0.14	0.03	0.00	0.06	2.4	Stairs and ramps	50	Offsite Manufacturing / Prefabrication Process, Electricity
A5	Install handrail	1.1	hrs	0.25	0.00	0.00	0.00	0.00	2.4	Stairs and ramps	50	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	Bricklayer - brickwork	353.6	hrs	82.09	0.42	0.08	0.00	0.20	2.5	External walls	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	Facing, Pointing & cleaning down	69.5	hrs	16.14	0.08	0.02	0.00	0.04	2.5	External walls	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	Mixing mortar	1.7	hrs	4.26	0.02	0.00	0.00	0.01	2.5	External walls	150	Electrical Equipment, Large with transport and tradestaff, Electricity
A5	Install Windows	17.3	hrs	4.02	0.02	0.00	0.00	0.01	2.5	External walls	44	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	Bricklayer - brickwork	224.1	hrs	52.01	0.27	0.05	0.00	0.13	2.5	External walls	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	Facing, Pointing & cleaning down	44.0	hrs	10.22	0.05	0.01	0.00	0.03	2.5	External walls	150	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	Mixing mortar	1.1	hrs	2.70	0.01	0.00	0.00	0.01	2.5	External walls	150	Electrical Equipment, Large with transport and tradestaff, Electricity
A5	Carpenter Install 100x50mm Studs (0.135hrs/m)	148.6	hrs	34.51	0.18	0.03	0.00	0.09	2.5	External walls	80	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	carpenter install 100x50mm noggins (0.155hrs/m)	28.4	hrs	6.60	0.03	0.01	0.00	0.02	2.5	External walls	80	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	Carpenter install 100x50mm plates (0.175hrs/m)	64.2	hrs	14.91	0.08	0.02	0.00	0.04	2.5	External walls	80	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	Install Windows	112.9	hrs	26.21	0.14	0.03	0.00	0.06	2.5	External walls	44	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	Install flyscreens	146.3	hrs	33.97	0.18	0.03	0.00	0.08	2.5	External walls	20	Electrical Equipment, Small with transport and tradestaff, Electricity
A5	110mm Face Bricks	7,575.8	Area Calculation	10.89	0.05	0.01	0.00	0.00	2.5	External walls	150	Clay Bricks and Pavers
A5	Mortar	3.7	m3	16.99	0.08	0.02	0.00	0.00	2.5	External walls	150	1 cement : 4 sand
A5	Waterproof membrane 1mm	38.0	Area Calculation	1.11	0.00	0.00	0.00	0.00	2.5	External walls	150	High Density Polyethylene (HDPE)
A5	140x45mm Studs 400mm centres	1,907.6	Count	249.56	0.04	0.01	0.00	0.05	2.5	External walls	80	Softwood
A5	400mm Nogs (140x45)	635.9	Count	83.19	0.01	0.00	0.00	0.02	2.5	External walls	80	Softwood
A5	Top & Bottom plates (140x45mm)	635.9	Count	83.19	0.01	0.00	0.00	0.02	2.5	External walls	80	Softwood
A5	Fastners/nails	11.5	kg	0.06	0.00	0.00	0.00	0.00	2.5	External walls	80	General
A5	Diagonal bracing straps	11.0	kg	0.06	0.00	0.00	0.00	0.00	2.5	External walls	80	General
A5	Waterproof membrane	31.7	Count	0.92	0.00	0.00	0.00	0.00	2.5	External walls	80	High Density Polyethylene (HDPE)
A5	Windows / Sliding Doors	325.2	m2 (Default)	5.46	0.02	0.01	0.00	0.00	2.6	External windows and Doors	44	Domestic 50% Opening
A5	110mm Face Bricks	46,305.5	Count	66.57	0.30	0.06	0.00	0.02	2.7	Internal walls and partitions	150	Clay Bricks and Pavers
A5	Mortar	5.9	m3	26.82	0.12	0.03	0.00	0.01	2.7	Internal walls and partitions	150	1 cement : 4 sand
A5	Alum Windows and Sliding Doors	49.8	m2 (Default)	4.15	0.02	0.00	0.00	0.00	2.7	Internal walls and partitions	44	Commercial Fixed

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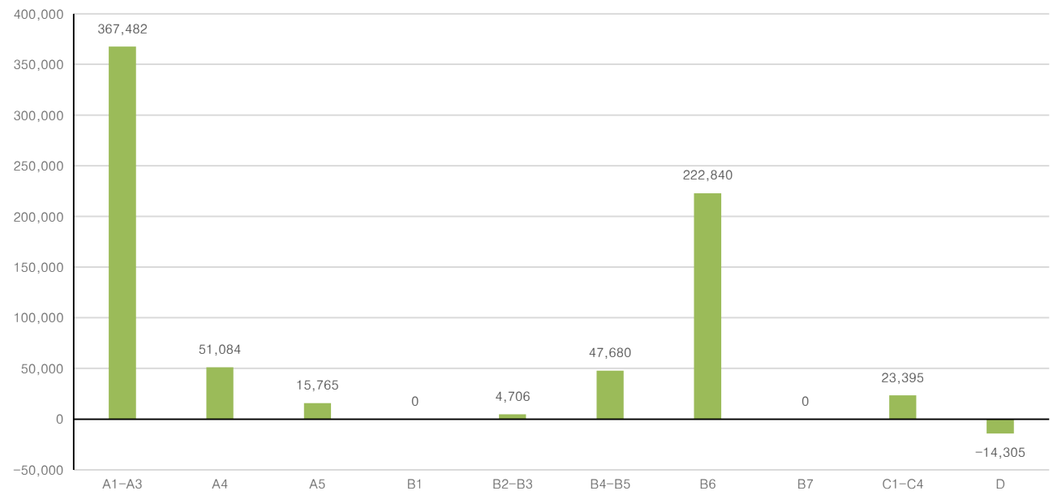
LCA Analysis

Chalcot House – New Build Scenario

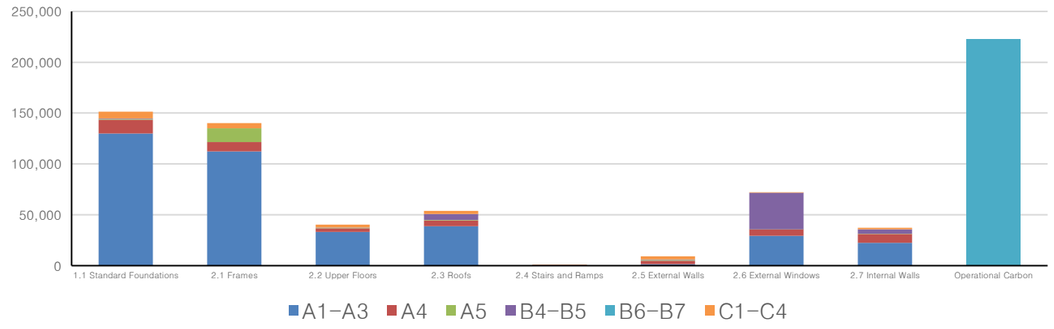
Calculation Parameters			
Service life values for materials			Technical service
Transportation distance values for materials			United Kingdom
Local compensation target region			London
Global Warming Potential per life stage	**Life Stage**	**Sector**	**Global Warming Potential (kg CO_2e)**
Construction Impact	A1–A3	Construction materials	367,482
	A4	Transportation to site	51,084
	A5	Construction/installation process	15,765
Operation Impact	B1	Use	0
	B2–B3	Maintenance and repair	4,706
	B4–B5	Material replacement and refurbishment	47,680
	B6	Energy usage	222,840
	B7	Water usage	0
Deconstruction impact	C1–C4	Deconstruction	23,395
Reuse, recovery, and recycling potential	D	Reuse, recovery, and recycling potential	−14,305
TOTAL (Excluding reuse, recovery and recycling potential)			**732,951**
TOTAL			**718,646**

Global Warming Potential (kg CO_2e) per Life Cycle Stage



	0	A1A3	A4	A5	B1	B2B3	B4B5	B6	C
Global Warming Potential (kg CO_2e) Breakdown	**Total (Excluding D)**	**A1–A3**	**A4**	**A5**	**B1**	**B2–B3**	**B4–B5**	**B6–B7**	**C1–C4**
1.1 Standard Foundations	151,334	129,922	13,628	657	–	–	517	–	6,609
2.1 Frames	140,213	112,192	9,419	13,388	–	–	–	–	5,215
2.2 Upper Floors	40,434	33,242	3,584	301	–	–	356	–	2,952
2.3 Roofs	58,605	38,715	5,663	490	–	4,706	5,935	–	3,096
2.4 Stairs and Ramps	883	198	83	92	–	–	74	–	437
2.5 External Walls	9,286	1,434	3,489	734	–	–	456	–	3,173
2.6 External Windows	72,105	29,333	6,441	5	–	–	36,053	–	273
2.7 Internal Walls	37,251	22,446	8,777	98	–	–	4,290	–	1,641
Operational Carbon	222,840	–	–	–	–	–	–	222,840	–
TOTAL	**732,951**	**367,482**	**51,084**	**15,765**	**0**	**4,706**	**47,680**	**222,840**	**23,395**
			–	–					

Global Warming Potential (kg CO_2e) per RICS Category and Life Cycle Stage



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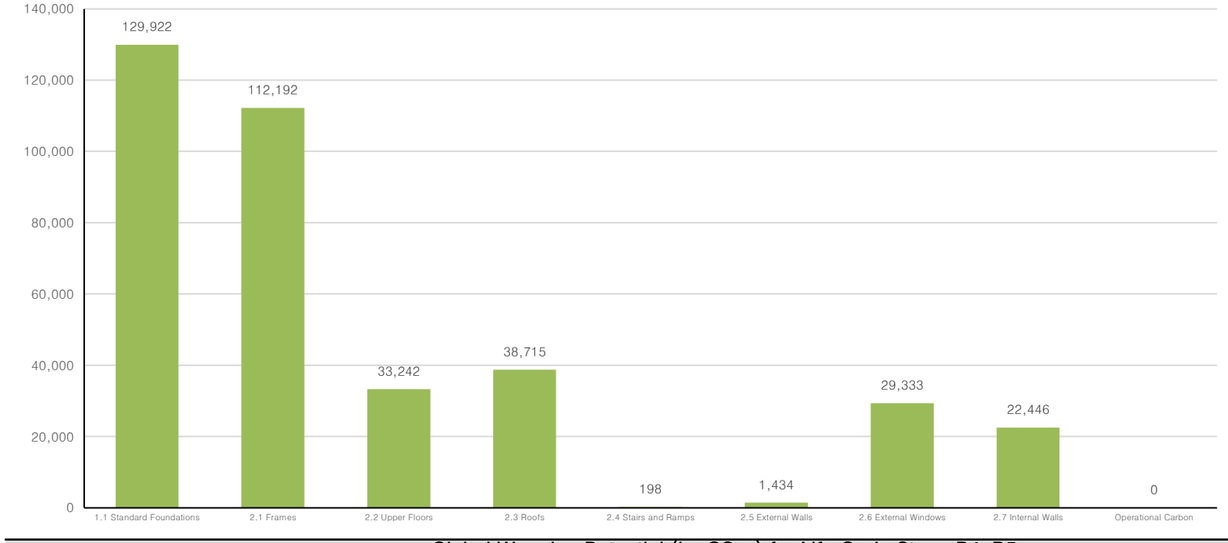
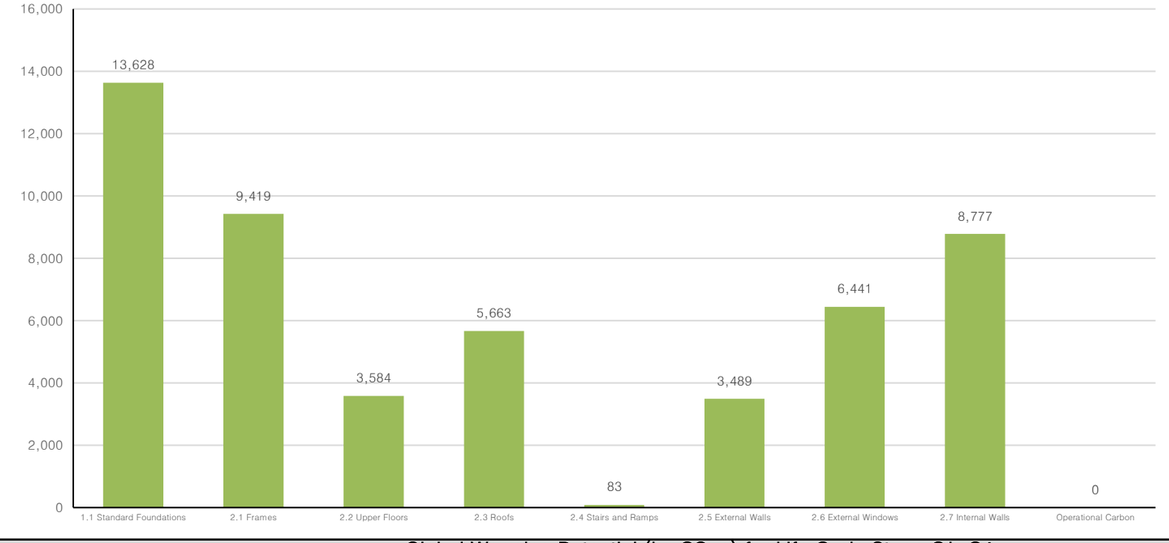
LCA Analysis

Chalcot House – New Build Scenario

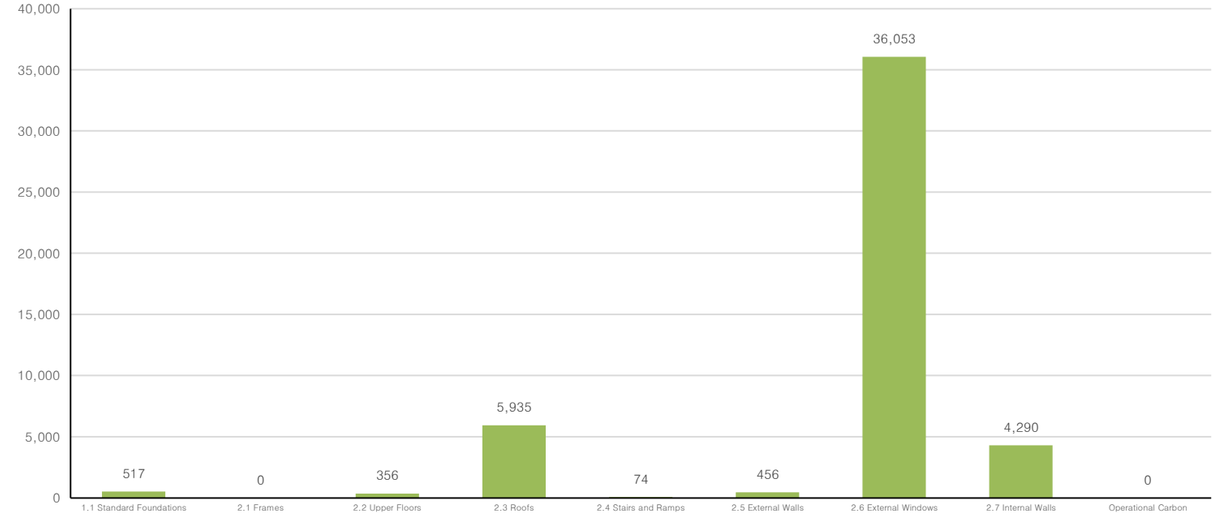
Global Warming Potential (kg CO_2e) for Life Cycle Stage A1–A3



Global Warming Potential (kg CO_2e) for Life Cycle Stage A4



Global Warming Potential (kg CO_2e) for Life Cycle Stage B4–B5



Global Warming Potential (kg CO_2e) for Life Cycle Stage C1–C4