Whole Life Carbon Assessment

Victoria Quarter

Albert Road, East Barnet, London EN4 9SH

On behalf of Citystyle Fairview VQ LLP New Homes

June 2021

Revision History

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1 Executive Summary

Think Three have been appointed by the 'Applicant' to undertake a Whole Life Carbon (WLC) Assessment for the Victoria Quarter development in the London Borough of Barnet. The assessment has been undertaken in line with the draft guidance provided by the GLA in the Whole Life-Cycle Carbon Assessments Pre-consultation draft, April 2020. This report should be read in conjunction with the GLA Whole Life Carbon Assessment Template issued in Microsoft Excel Format.

Approved software[1] has been used to provide an indicative calculation of the whole life carbon (WLC) emissions for the development. Detailed data on material quantities is not available at this stage of the proposed residential-led mixed use development. As such key dimensional metrics have been used to create a baseline indication of the WLC emissions for the site. As the detailed design progresses post-planning, the WLC assessment will be updated to reflect better the material quantities required for the proposed designs.

The table below shows the initial calculations for the main elements making up the proposed development. It is expected that the WLC emission will increase as a result following detailed design completion since the assessment will capture more of the materials required.

Estimated Whole Life Carbon Emissions

TABLE 1 – SUMMARY WLC EMISSIONS (USING SAP10.0 & DECARBONISATION CARBON FACTORS)

Building element	BE sub-category	Assessment 1 (SAP10.0) KgCO2e	Assessment 2 (Future grid) KgCO2e
Substructure	1 Substructure	**2,028,983**	**1,778,662**
Superstructure	2.1 Frame	**548,317**	**547,371**
Superstructure	2.2 Upper Floors	**1,518,444**	**1,415,229**
Superstructure	2.3 Roof	**443,661**	**353,478**
Superstructure	2.4 Stairs & Ramps	**332,340**	**312,171**
Shell & Skin	2.5 Ext. Walls	**546,130**	**546,130**
Shell & Skin	2.6 Windows & Ext. Doors	**723,401**	**722,773**
Finishes	2.7. Int. Walls & Partitions	**89,378**	**76,439**
Finishes	2.8 Int. Doors	**72,094**	**69,864**
Services	5 Services (MEP)	**28,825,504**	**28,825,504**
TOTAL kg CO2e		**35,128,251**	**34,647,621**

Actions taken to reduce whole life-cycle carbon emissions

Energy strategy

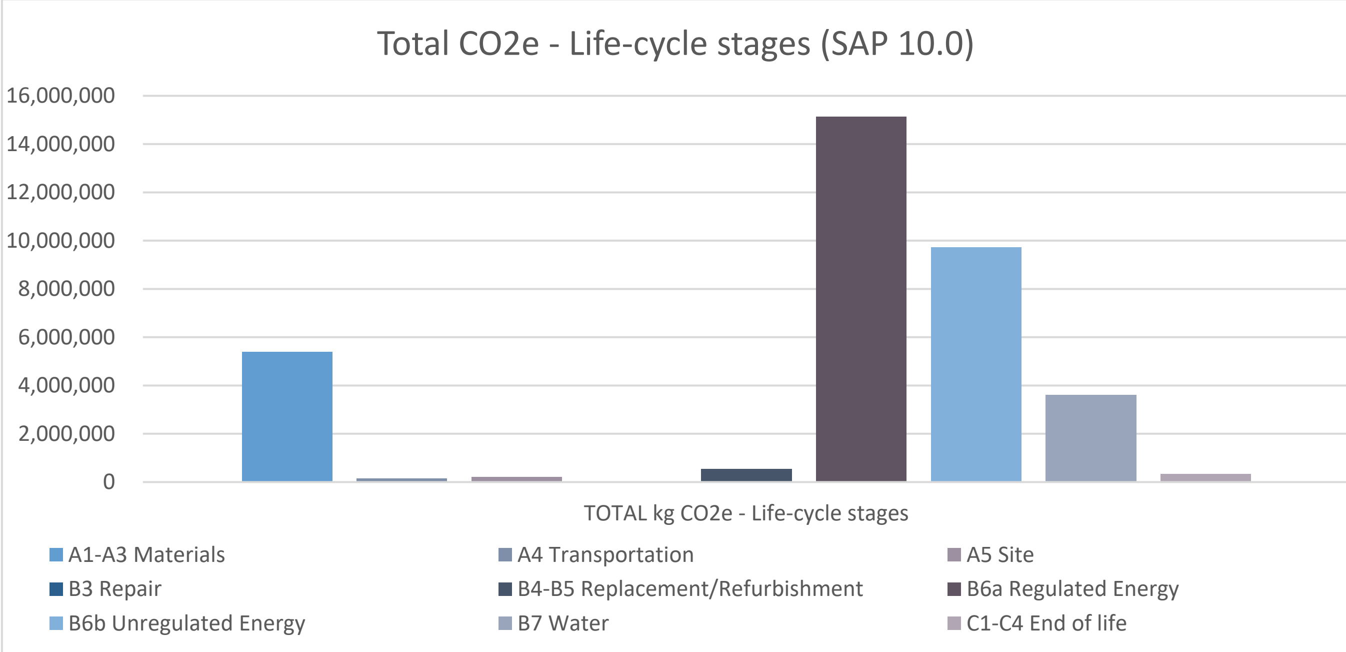
The energy strategy for the project is a key mechanism for reducing Whole Life Carbon of the development. Data from the energy statement (also prepared by Think Three) has been used to inform the WLC emission for operational energy use on the proposed development.

In addition to a passive design approach, a strategy has been proposed, which features highly efficient heat pumps to deliver heating and hot water for all dwellings and non-residential spaces on the development. In addition to heat pumps working at greater efficiency than gas boilers, the heat pumps will take advantage of the projected decarbonisation of the national grid over the life of the development.

Circular economy

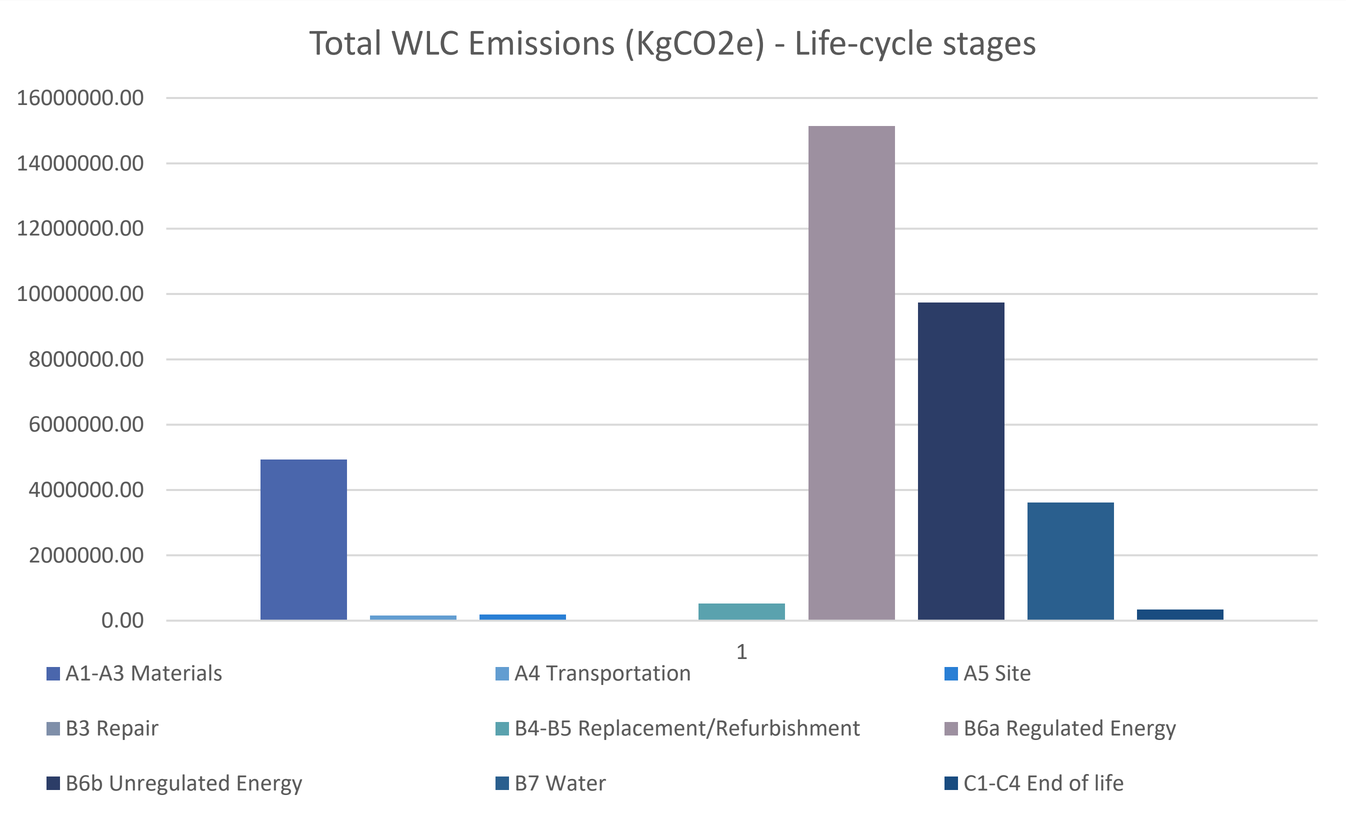
The proposed development has taken care to consider Circular Economy in its design. The Circular Economy Statement details the strategy for recovery of materials in line with the circular economy model.

FIGURE 1 – WLC EMISSIONS FOR EACH LIFE-CYCLE MODULE A-D (SAP 10.0)



[1] Once Click LCA: https://www.oneclicklca.com/

FIGURE 2 - WLC EMISSIONS FOR EACH LIFE-CYCLE MODULE A-D (FUTURE GRID)



Conclusion

This report has set out the Whole Life Carbon emissions estimated for the Victoria Quarter development in London at the pre-detailed design stage. This follows the GLA Whole Life-Cycle Carbon Assessments, Pre-consultation draft guidance, 2020.

Assessment 1 accounts for the current use of SAP10.0 emission factors for the gas and electricity grids. Assessment 2 (grid decarbonisation) accounts for future decarbonisation of the UK's electrical grid using the projected emissions under the 'Future Energy Scenario 'Steady Progression'.

TABLE 2 – SUMMARY OF WLC EMISSIONS (ASSESSMENT 1 VS ASSESSMENT 2)

Assessment	Whole Life Carbon Emissions (TCO2e)	KgCO2/m2 GIA)
Assessment 1 (SAP10.0)	**35,128**	**879**
Assessment 2 (Decarbonisation)	**34,648**	**867**

2 Introduction

2.2 Think Three have been appointed to undertake a Whole Life Carbon (WLC) Assessment for the Victoria Quarter development in the London Borough of Barnet, hereafter referred to as the Proposed Development. This assessment is aligned to the planning application 'Stage 1' submission and has been carried out in line with draft guidance provided by the GLA in the Whole Life-Cycle Carbon Assessments guidance Pre- consultation draft, October 2020.

2.3 The aim of this assessment is to assess the WLC for the Proposed Developments, defined as 'those carbon emissions resulting from the construction and the use of a building over its entire life, including its demolition and disposal.'

2.4 The study also includes an assessment of the potential carbon emissions 'benefits' from the reuse or recycling of components after the end of a building's useful life.

2.5 This report should be read in conjunction with the 'GLA Whole Life Carbon Assessment Template' issued in Microsoft Excel Format.

Site location.

2.6 The site for this planning application is located at Victoria Quarter, Albert Road, East Barnet, EN4 9SH. The Brownfield site is located near New Barnet Station within the London Borough of Barnet, in North London.

Development description.

2.7 Citystyle Fairview VQ LLP (the 'Applicant') are submitting a detailed planning application for the redevelopment of the site to provide 544 residential units (Use Class C3) within 13 buildings ranging from 4 to 8 storeys, with 267.1sqm of retail/commercial space and 112.7sqm of community space (Use Class A1/A2/A3/A4/B1/D1/D2) at ground floor, new public realm with communal landscaped amenity areas, alterations and additions to existing highways arrangements plus the removal of existing elevated footbridge and creation of new pedestrian routes, 334 car parking spaces (including car club and accessible provision) with basement and surface level provision, secure cycle parking, servicing and other associated development.

FIGURE 3 – SITE PLAN

Scope of Whole Life Carbon Assessments

2.8 WLC emissions are those carbon emissions resulting from the construction and the use of a building over its entire life, including its demolition and disposal. They capture a building's operational carbon emissions from both regulated and unregulated energy use, as well as its embodied carbon emissions, i.e. those associated with raw material extraction, manufacture and transport of building materials, construction and the emissions associated with maintenance, repair, and replacement as well as dismantling, demolition, and eventual material disposal. A WLC assessment also includes an assessment of the potential carbon emissions 'benefits' from the reuse or recycling of components after the end of a building's useful life. It provides a true picture of a building's carbon impact on the environment.

2.9 WLC assessments should be carried out using a nationally recognised assessment methodology and should demonstrate the actions that have and will be taken to reduce WLC emissions. The assessment should cover the development's carbon emissions over its lifetime, accounting for:

- its operational carbon emissions (both regulated and unregulated)
- its embodied carbon emissions
- any future potential carbon emissions 'benefits', post 'end of life', including benefits from reuse and recycling of building structure and materials. See also London Plan Policy SI 7 'Reducing waste and supporting the circular economy'

2.10 In developing a WLC assessment for compliance with Policy SI 2, applicants should follow BS EN 15978 using the RICS PS as the methodology for assessment. The rest of this section confirms various aspects of the RICS PS which are to be followed or where a different approach should be taken to comply with Policy SI 2.

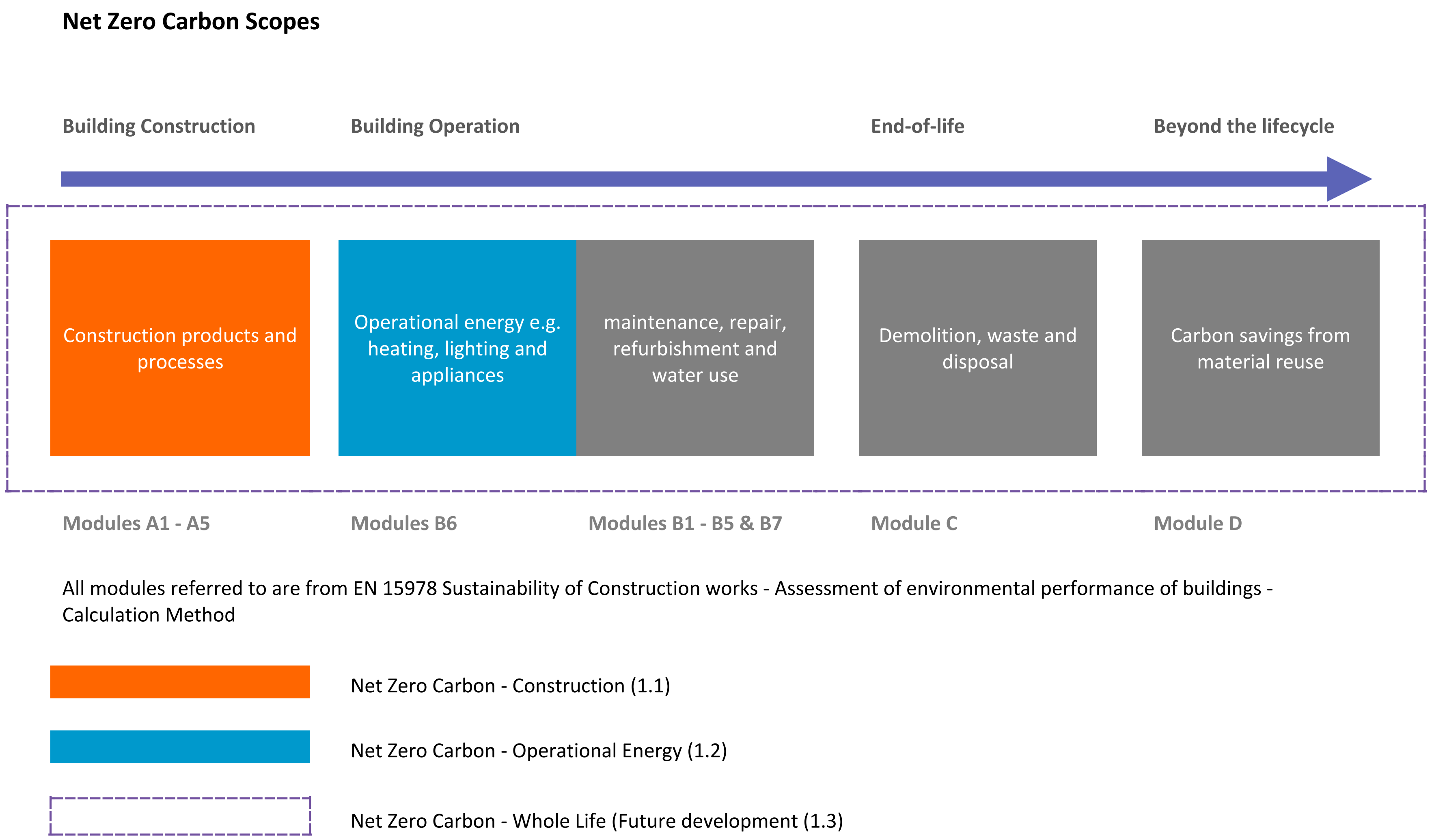
2.11 BS EN 15978 and the RICS PS set out four stages in the life of a typical project described as life-cycle modules:

- Module A1 – A5 (Product sourcing and construction stage)
- Module B1 – B7 (Use stage)
- Module C1 – C4 (End of life stage)
- Module D (Benefits and loads beyond the system boundary)

2.12 Each module should be presented separately, as identified in the WLC assessment template. The reference study period (i.e. the assumed building life expectancy) for the purposes of the assessment is 60 years. Where the design life of the project exceeds or is less than 60 years, the assessment should still be done to 60 years but with an accompanying explanation of the life cycle and end of life scenarios for the actual design life.

2.13 The WLC assessment has been carried out using the approved software by One Click LCA.

FIGURE 4 – UKGBC NET ZERO CARBON – A FRAMEWORK DEFINITION



Integration with a Circular Economy

2.14 Designing for longevity and adaptability and maximizing the use of recycled and renewable materials could reduce greenhouse gas emissions while increasing innovation opportunities and economic growth. Replacing finite and fossil-based materials with responsibly managed renewable materials can decrease carbon emissions whilst reducing dependency on finite resources. By considering the carbon emissions of a development from a whole life perspective, design decisions can be made to not only minimize embodied carbon in construction, but it can assist to produce a development which reduces resource consumption throughout its use, extending life cycles of products, maximizing re-use of building components and ensuring that all components are considered as a 'product resource', rather than 'product waste'.

3 Methodology

Assessment scope

The assessment of Whole Life Carbon (WLC) emissions consists of the following sections: total operational carbon emissions (regulated plus unregulated); embodied carbon emissions; and any future potential carbon emissions 'benefits', post end-of-life, including benefits from reuse and recycling of building structure and materials.

This assessment has been undertaken in line with the draft GLA guidance for undertaking WLC Assessments and therefore in line with the RICS Professional Statement: Whole Life Carbon Assessment for the Built Environment.

Operational carbon emissions

In line with the draft GLA guidance, the operational carbon emissions are calculated based on the Part L assessments undertaken for the Proposed Development as part of the Energy Strategy for planning. This encompasses carbon emissions related to both regulated and unregulated energy uses (in line with Part L definitions), accumulated over a 60-year study period.

Embodied carbon assessment and end-of-life emissions

To assess the embodied carbon for the project, a Life Cycle Assessment (LCA) tool – One Click LCA – has been used to make allocations for the anticipated materials quantities in an inventory analysis. The materials are represented within the model by using materials with associated Environmental Product Declarations (EPDs).

EPDs are produced by manufacturers and identify the carbon emissions of a product. By scheduling the materials proposed for the development, the overall carbon emissions can be approximated. It should be noted here that the LCA tool has a limited database of materials. In the scenario where a specified material is not included in the database, the most similar material in terms of material composition is selected instead.

In line with standard UK practice, the LCA process and results included by this report have been assessed in line with BS 15978:2011 and the RICS Professional Statement: Whole Life Carbon assessment for the built environment. All EPDs used have been produced in line with the requirements of BS EN 15804:2012. Hence, each material has been assessed against the following lifecycle stage:

- A1-A3: Product stage
- A4: Material transportation to site
- B4-B5: Replacement and maintenance
- C1-C4: End of life

Together with these stages, the contribution of life cycle stage A5 has also been explored separately, giving an estimate of the emissions related to the construction. I.e. the electrical consumption and waste disposal. In line with the draft GLA guidance, the assessment includes the following elements:

- Demolition
- Facilitating works
- Substructure
- Superstructure (frame, upper floors, roof, stairs and ramps, external walls, windows and external doors, internal walls and partitions, internal doors)
- Finishes
- Fittings, furnishings and equipment
- Building services
- Prefabricated buildings and building units
- Work to existing building
- External works (hard and soft landscaping, fencing, fixtures, drainage, services)

Data sources

There are several approaches to complete a building specific life cycle assessment. A flexible approach is needed when utilising a dataset of product specific environmental product declarations and more generic data calculated within the LCA tool.

Table 3 – Types of data required for a WLC assessment

Data (quantities)	Data (materials)	Notes
Cost Plan	Cost Plan	Cost plans can be useful for calculation of uncertain quantities which are not product specific, however often an allowance is made at early design stages which may reduce accuracy.
Revit model	Revit model	Revit model can export quantity of main building elements but is reliant on architects using build-up descriptions and knowledge of the form of construction to be used.
Architects' drawings	Specification & material build-ups	A more traditional and slower approach to determining quantity of building elements, if build-ups are available to support.

The assessment has utilised multiple data sources described above and is based on the level of detail available at the current stage of design. At this stage, detailed drawings showing construction build-ups were not available for the project. Material quantities were also not available at this stage of the development process. The data for these sections has been based on available GIA information provided by the design team and allowances made in the cost plan. The same construction has been assumed throughout the development.

Current and Future Carbon Emissions

In line with the guidance given in the draft GLA guidance to Whole Life Carbon assessments, the assessment has been undertaken based on two sets of carbon emissions:

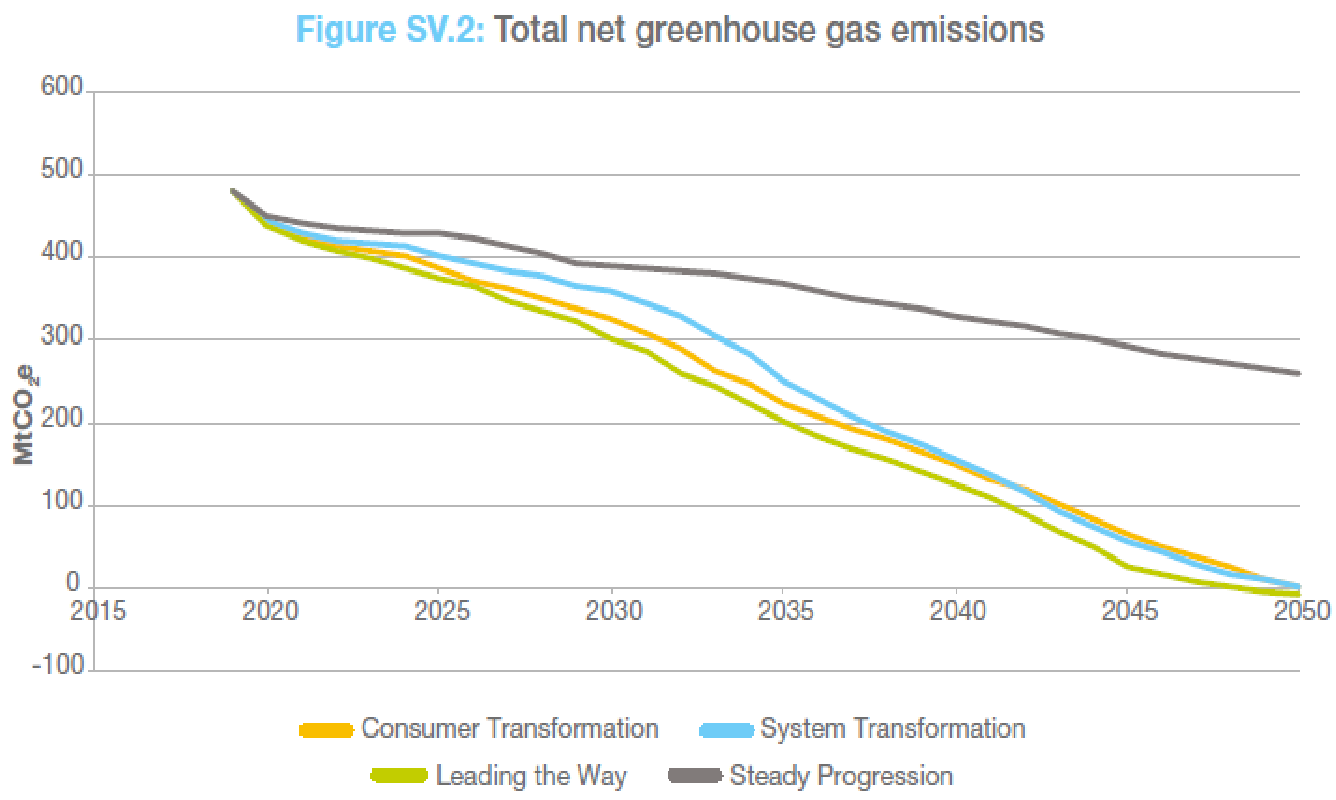
SAP 10

The first set of figures is based on the status of the electricity grid and provides a point-in-time assessment. For materials manufactured in the UK, SAP 10 emission factors are used in line with the GLA's Energy Assessment Guidance. Products sourced from outside the UK use data appropriate to the local energy figures is used in the comparison to the WLC benchmarks.

Decarbonisation

It is also important to consider the potential longer-term decarbonisation of the electricity grid and how this may impact on design decisions. The second set of figures is therefore based on the expected decarbonisation of the electricity grid over the lifetime of the development (i.e. 60 years). This Whole Life Carbon Assessment has used the National Grid's 2020 edition of the 'Steady Progression' scenario.

FIGURE 5 – TOTAL NET GREENHOUSE GAS EMISSION (FES 2020)



Life-cycle Modules

3.2 Material quantities data is not readily available at this stage of the proposed residential development. Data on the material quantities will be developed and evaluated through the detailed design stage (following the planning application). As such default industry values have been used to determine the baseline whole life-cycle carbon emissions for the proposed development using known metrics for the scheme, such as Gross Floor Area (m2). The WLC software utilised[2] draws on a large dataset of existing WLC assessments to provide a relatively accurate projection of the likely WLC emissions for the proposed use class (residential apartments).

3.3 The total GIA (m2) measurements used to determine the baseline emissions are: 39,952 m^2 (external dimensions) and 37,336 m^2 (internal dimensions), assuming a notional wall thickness of 350mm.

3.4 The use class is nominated as Residential Apartments and a basement structure has been assumed for the whole of the building footprint (albeit the basement car parking area is smaller). The form of construction assumed for the whole development is Reinforced Concrete Frame (RCF) with steel framing system (SFS) infills for the external walls. NB some of the lower height blocks are likely to use an alternative form of construction using reinforced traditional masonry.

3.5 Operational energy calculations are taken from the energy statement (also produced by Think Three).

3.6 Some elements have not been included where dimensional data is not available: Demolition materials; FFE; Building services; Site buildings; External works.

TABLE 4 – DATA SOURCE SHOWN AGAINST LIFE-CYCLE MODULES

LIFE-CYCLE MODULE	DESCRIPTION	DATA SOURCE
A1 – A3 Construction Materials	Raw material supply (A1) includes emissions generated when raw materials are taken from nature, transported to industrial units for processing and processed. Loss of raw material and energy are also considered. Transport impacts (A2) include exhaust emissions resulting from the transport of all raw materials from suppliers to the manufacturer's production plant as well as impacts of production of fuels. Production impacts (A3) cover the manufacturing of the production materials and fuels used by machines, as well as handling of waste formed in the production processes at the manufacturer's production plants until end-of-waste state.	One Click LCA
A4 Transportation to site	A4 includes exhaust emissions resulting from the transport of building products from manufacturer's production plant to building site as well as the environmental impacts of production of the used fuel.	
A5 Construction/Installation process	A5 covers the exhaust emissions resulting from using energy during the site operations, the environmental impacts of production processes of fuel and energy and water as well as handling of waste until the end-of-waste state.	
B1 – B5 Maintenance and material replacement	The environmental impacts of maintenance and material replacements (B1-B5) include environmental impacts from replacing building products after they reach the end of their service life. The emissions cover impacts from raw material supply, transportation, and production of the replaced new material as well as the impacts from manufacturing the replaced material and handling of waste until the end-of-waste state.	
B6 Energy use	The considered use phase energy consumption (B6) impacts include exhaust emissions from any building level energy production as well as the environmental impacts of production processes of fuel and externally produced energy. Energy transmission losses are also considered.	
B7 Water use	The considered use phase water consumption (B7) impacts include the environmental impacts of production processes of fresh water and the impacts from wastewater treatment.	

[2] One Click LCA - https://www.oneclicklca.com/

C1 – C4 Deconstruction	The impacts of deconstruction include impacts for processing recyclable construction waste flows for recycling (C3) until the end-of-waste stage or the impacts of pre-processing and landfilling for waste streams that cannot be recycled (C4) based on type of material. Additionally, deconstruction impacts include emissions caused by waste energy recovery.
D External impacts/end-of-life benefits	External benefits for re-used or recycled material types include the positive impact of replacing virgin-based material with recycled material and the benefits of the energy which can be recovered from the materials.

4 Inputs

Operational carbon assessment

4.2 Operational carbon emissions are taken from the Energy Strategy, submitted in support of the planning application. The assessment of operational carbon emissions has been based on the methodology set out in Part L of the building regulations, and follows the GLA energy planning guidance, April 2020. The total regulated and unregulated carbon emissions have been included in this assessment.

- Residential areas (36,957m^2 Internal Floor area): Operational carbon emissions are based on SAP calculations in line with Part L1A methodology.
- Commercial areas (380m^2 Internal Floor area): Operational carbon emissions are based on BRUKL calculations of regulated and unregulated energy.

Embodied carbon and end-of-life assessment

4.3 The table below lists the building elements covered by the assessment, in line with the Royal Institute of Chartered Surveyors (RICS) Professional Statement: Whole Life Carbon assessment for the built environment.

Building Elements

TABLE 5 – DATA USED TO CONDUCT THE WLC

Use category	BE No.	Building Elements	Description of element
Demolition	0.1	Toxic/hazardous/contaminated material treatment	Not used (awaiting pre-demolition audit)
Demolition	0.2	Major demolition works	Not used (awaiting pre-demolition audit)
Facilitating works	0..3	Temporary	Not used (awaiting pre-demolition audit)
Facilitating works	0.5	Enabling works	Not used (awaiting pre-demolition audit)
Facilitating works	0.4	Specialist groundworks	Not used (awaiting pre-demolition audit)
Substructure	1.1	Substructure	One Click LCA database
Superstructure	2.1	Frame	One Click LCA database
Superstructure	2.2	Upper floors incl. balconies	One Click LCA database
Superstructure	2.3	Roof	One Click LCA database
Superstructure	2.4	Stairs and ramps	One Click LCA database
Superstructure	2.5	External walls	One Click LCA database
Superstructure	2.6	Windows and external doors	One Click LCA database
Superstructure	2.7	Internal walls and partitions	One Click LCA database

Superstructure	2.8	Internal doors	One Click LCA database
Superstructure	3.1	Wall finishes	One Click LCA database
Finishes	3.2	Floor finishes	One Click LCA database
Finishes	3.3	Ceiling finishes	One Click LCA database
Fittings, furnishings and equipment (FF&E)	4.1	Fittings, furnishings & equipment incl. building-related*	Not used
Fittings, furnishings and equipment (FF&E)	4.2	Fittings, fixtures & equipment non-building-related**	Not used
Building services/MEP	5.1	Services building-related*	Operational energy use taken from Energy Statement
Building services/MEP	5.2	Services non-building-related**	One Click LCA
Prefabricated Buildings and Building Units	6.1	Prefabricated buildings and building units	Not used
Work to Existing Building	7.1	Minor demolition and alteration works	Not used – awaiting pre-demolition audit
External works	8.1	Site preparation works	No data
External works	8.2	Roads, paths, pavings and surfacings	No data
External works	8.3	Soft landscaping, planting and irrigation systems	No data
External works	8.4	Fencing, railings and walls	No data
External works	8.5	External fixtures	No data
External works	8.6	External drainage	No data
External works	8.7	External services	No data
External works	8.8	Minor building works and ancillary buildings	No data

5 Results

SAP10.0 and Future Grid

5.2 The graphs below show the WLC results for the life-cycle stages and the RICS classifications for both the current electricity grid emissions (SAP 10.0) and the results for a future grid scenario based on the 'Steady Progression' scenario 2020.

5.3 Unsurprisingly the elements with the largest WLC emissions are:

- Materials (A11-A3); and
- Operational energy use (B6a/B6b).

FIGURE 6 – TOTAL CO2E – LIFE-CYCLE STAGES (SAP 10.0)

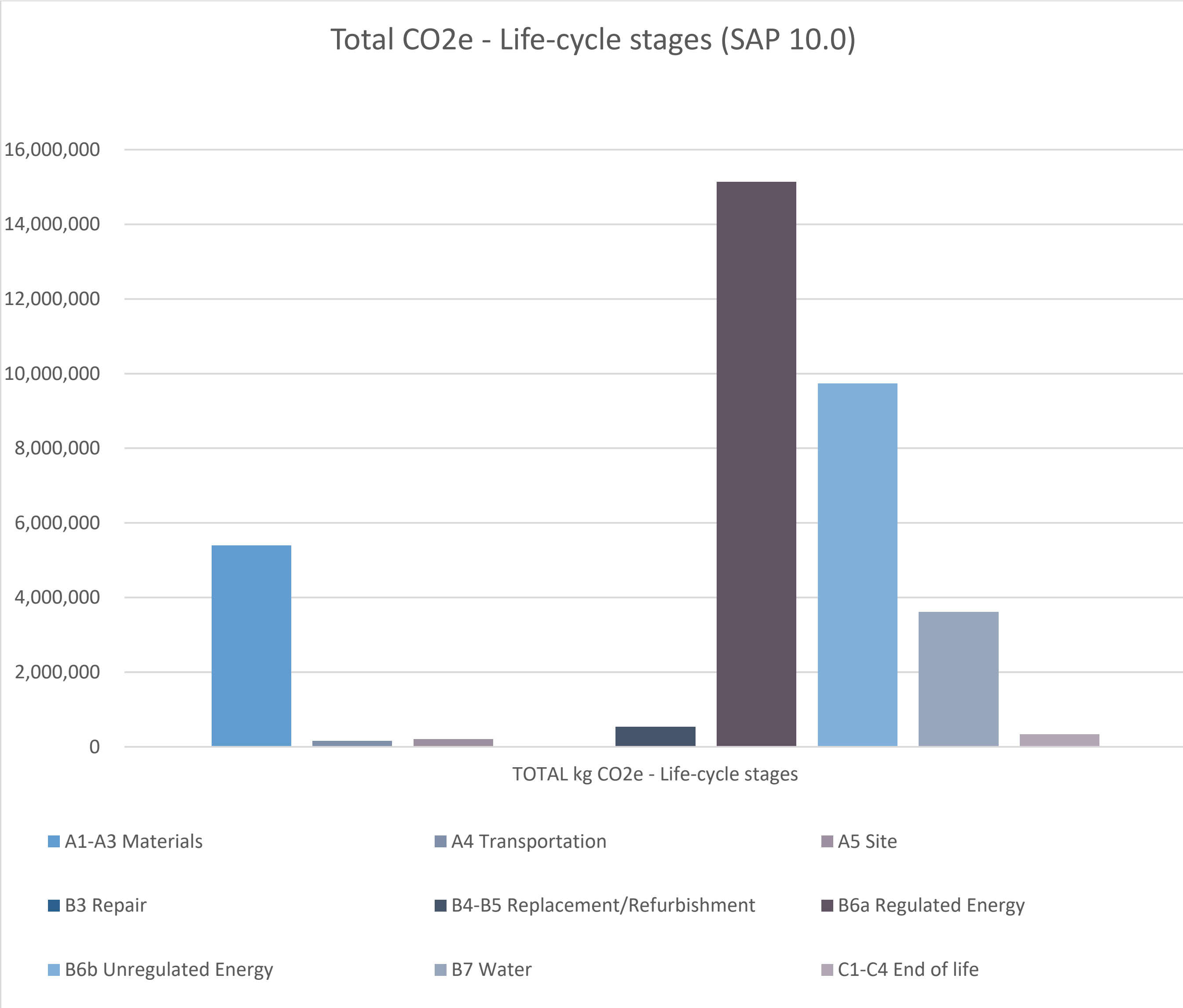


FIGURE 7 – TOTAL CO2E – CLASSIFICATIONS (SAP 10.0)

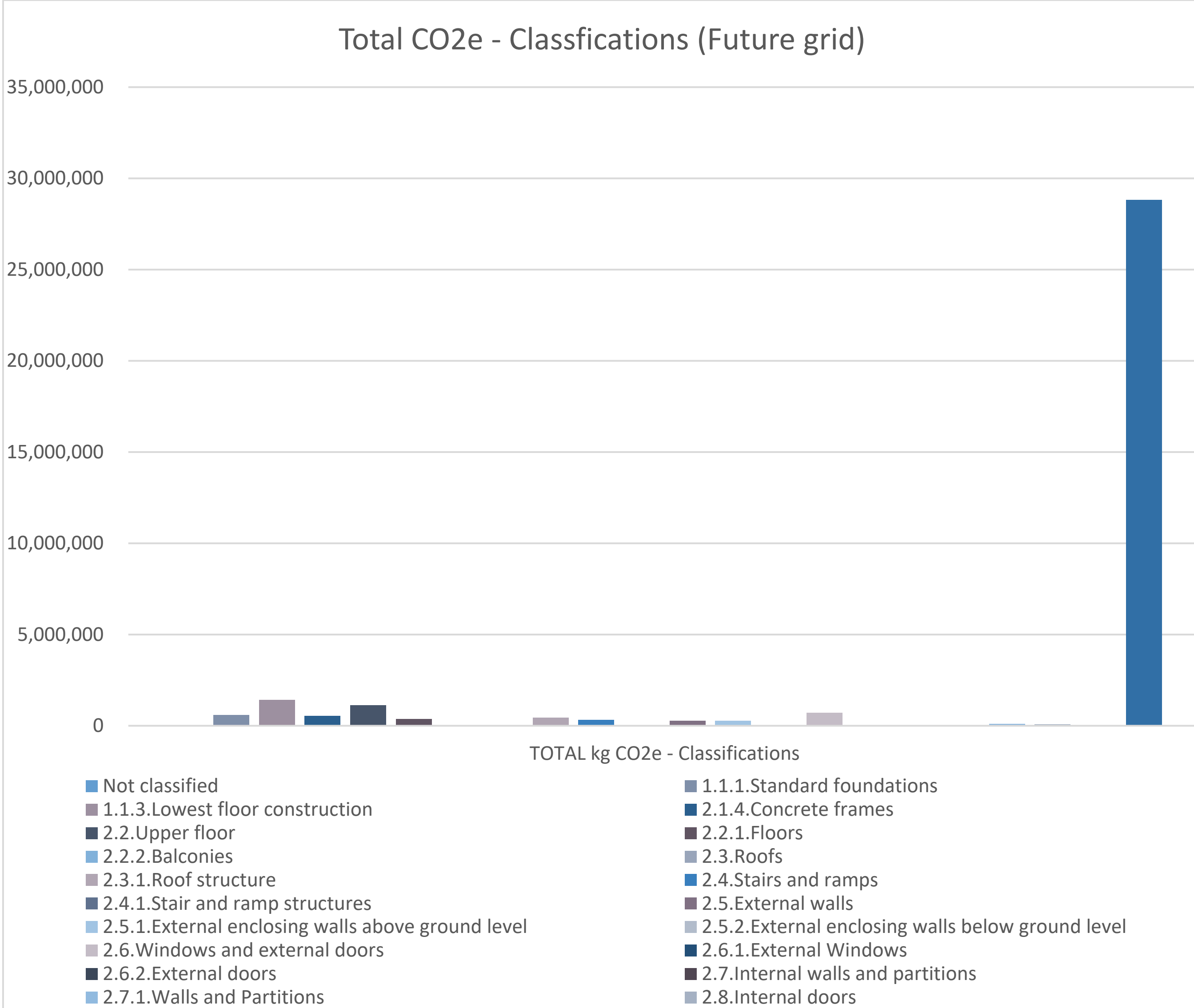


FIGURE 8 – TOTAL CO2E – LIFE-CYCLE STAGES (FUTURE GRID)

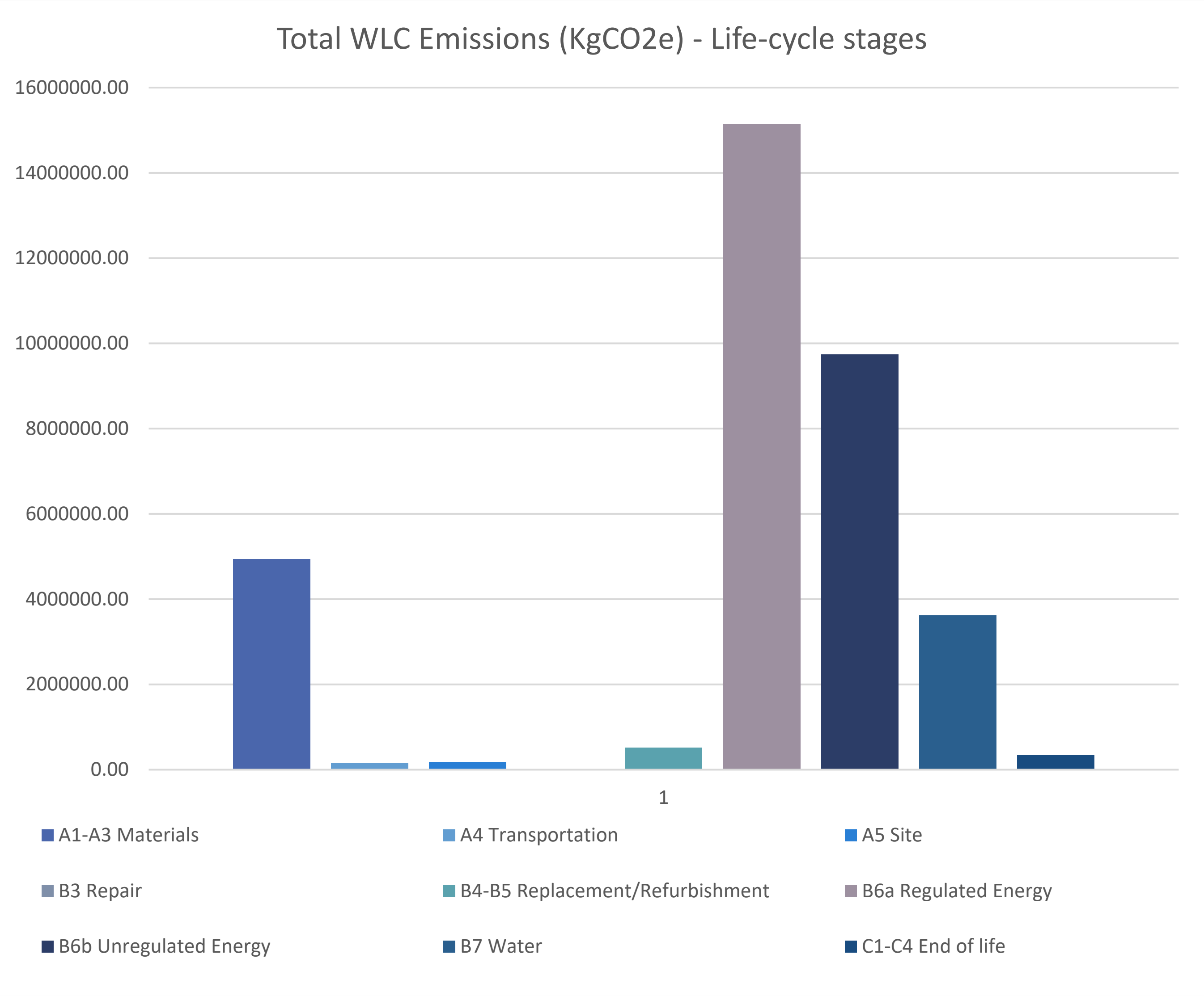
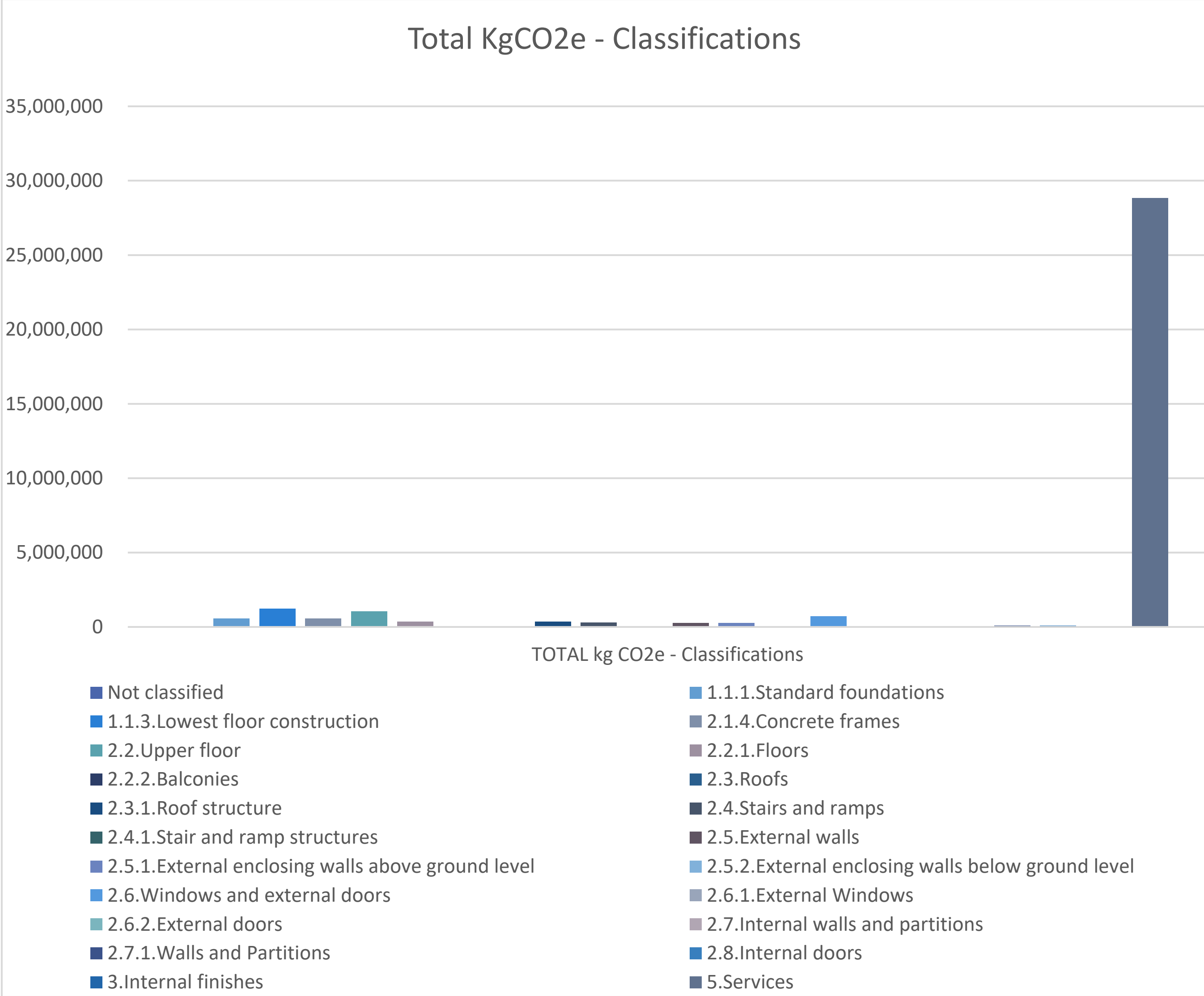


FIGURE 9 – TOTAL CO2E – CLASSIFICATIONS (FUTURE GRID)



Assessment 1 – Whole life Carbon Emissions (SAP10.0)

TABLE 6 – WLC EMISSIONS – MODULES & BUILDING ELEMENTS (SAP10.0)

Result category	Biogenic carbon (kg CO2e)	A1-A3 Product Stage	A4 Transportation to site	A5 Site operations	B1 Use Phase	B2 Maintenance	B3 Repair	B4-B5 Material replacement and refurbishment	B6 Operational Energy use - Regulated	B6 Operational Energy use - Unregulated	B7 Operational Water use	C1-C4 End of Life stage	TOTAL kg CO2e	D External impacts (not included in totals)
0.1 Toxic Mat.														
0.2 Demolition														
0.3 Supports														
0.4 Groundworks														
0.5 Diversion														
1 Substructure	0	1,744,181	81,573	73,563			0	9,904				119,762	**2,028,983**	-268,148
2.1 Frame	0	516,140	14,313	700			0					17,163	**548,317**	-140,817
2.2 Upper Floors	0	1,326,069	40,917	15,553			0					135,904	**1,518,444**	-278,703
2.3 Roof	-8,868	402,314	4,161	8,464			0	8,042				20,682	**443,661**	-42,402
2.4 Stairs & Ramps	0	280,276	16,221	12,685			0					23,159	**332,340**	-59,129
2.5 Ext. Walls	-463,214	463,214	0	82,915			0	0				0	**546,130**	0
2.6 Windows & Ext. Doors	0	380,746	2,260	538			0	333,097				6,758	**723,401**	-70,564
2.7. Int. Walls & Partitions	0	71,114	359	6,447			0	5,927				5,530	**89,378**	-7,499
2.8 Int. Doors	-64,827	35,833	176	0			0	31,647				4,439	**72,094**	-47,068
3 Finishes	0	0		0			0	0					**0**	0
4 Fittings, furnishings & equipments														
5 Services (MEP)	0	168,579	330	2,330			0	150,815	15,143,584	9,736,902	3,617,460	5,503	**28,825,504**	-3,572,958
6 Prefabricated														
7 Existing bldg														
8 Ext. works														
Unclassified / Other	0	0		0			0	0					**0**	0
TOTAL kg CO2e	**-536,909**	**5,388,467**	**160,311**	**203,196**			**0**	**539,432**	**15,143,584**	**9,736,902**	**3,617,460**	**338,899**	**35,128,251**	**-4,487,288**

Assessment 2 – Whole life Carbon Emissions (decarbonisation)

TABLE 7 – WLC EMISSIONS – MODULES & BUILDING ELEMENTS (FUTURE GRID)

Result category	Biogenic carbon (kg CO2e)	A1-A3 Product Stage	A4 Transportation to site	A5 Site operations	B1 Use Phase	B2 Maintenance	B3 Repair	B4-B5 Material replacement and refurbishment	B6 Operational Energy use - Regulated	B6 Operational Energy use - Unregulated	B7 Operational Water use	C1-C4 End of Life stage	TOTAL kg CO2e	D External impacts (not included in totals)
0.1 Toxic Mat.														
0.2 Demolition														
0.3 Supports														
0.4 Groundworks														
0.5 Diversion														
1 Substructure	0	1,509,206	81,573	64,229			0	3,892				119,762	**1,778,662**	-268,148
2.1 Frame	0	515,232	14,313	663			0					17,163	**547,371**	-140,817
2.2 Upper Floors	0	1,223,686	40,917	14,721			0					135,904	**1,415,229**	-278,703
2.3 Roof	-8,868	320,090	4,161	5,385			0	3,160				20,682	**353,478**	-42,402
2.4 Stairs & Ramps	0	260,786	16,221	12,006			0					23,159	**312,171**	-59,129
2.5 Ext. Walls	-463,214	463,214	0	82,915			0	0				0	**546,130**	0
2.6 Windows & Ext. Doors	0	380,412	2,260	538			0	332,805				6,758	**722,773**	-70,564
2.7. Int. Walls & Partitions	0	62,637	359	5,686			0	2,227				5,530	**76,439**	-7,499
2.8 Int. Doors	-64,827	34,649	176	0			0	30,601				4,439	**69,864**	-47,068
3 Finishes	0	0		0			0	0					**0**	0
4 Fittings, furnishings & equipments														
5 Services (MEP)	0	168,579	330	2,330			0	150,815	15,143,584	9,736,902	3,617,460	5,503	**28,825,504**	-3,572,958
6 Prefabricated														
7 Existing bldg														
8 Ext. works														
Unclassified / Other	0	0		0			0	0					**0**	0
TOTAL kg CO2e	**-536,909**	**4,938,492**	**160,311**	**188,474**			**0**	**523,500**	**15,143,584**	**9,736,902**	**3,617,460**	**338,899**	**34,647,621**	**-4,487,288**

6 Opportunities for Reducing WLC

Main Contributors to WLC Emissions

The materials with the biggest contributions to whole life carbon emissions are shown in the table below. Emphasis on reducing emissions from the main contributors will deliver the greatest savings over the life of the development.

TABLE 8 - MATERIALS WITH HIGHEST EMBODIED CARBON EMISSIONS (SAP 10.0)

Building Element	Cradle to gate impacts (A1 – A3) TCO2e	Cradle to gate impacts (A1 – A3) %
Substructure	372	10.3%
Superstructure	256	4.7%
Shell & Skin	147	2.4%
Services	72	0.8%
Internla Finishes	34	0.7%

TABLE 9 - MATERIALS WITH HIGHEST EMBODIED CARBON EMISSIONS (FUTURE GRID)

Building Element	Cradle to gate impacts (A1-A3) TCO2e	Cradle to gate impacts (A1-A3) %
Substructure	343	10.4%
Superstructure	240	4.9%
Shell & Skin	145	2.1%
Services	72	0.8%
Internla Finishes	29	0.6%

Maximise Recycled Content

By specifying products with high contents of recycled material, the product life cycle emissions can be significantly reduced, compared to products procured with virgin material. Using information within the EPD data, embodied carbon can be reduced at the technical design stage by specifying materials with high levels of embodied carbon emissions with alternatives that utilise recycled content (recycled steel used in manufacture of new steel) or recovered material that would otherwise be wasted (e.g. using Pulverised fuel ash; Ground Granulated Blast-furnace Slag; Limestone fines).

A number of the largest contributors to WLC emissions can be specified with higher recycled content to reduce the overall impact. These include:

- Recycled aggregate – specify recycled aggregate from local sources
- Recycled steel content – specify a minimum recycled content of 85% for all steel used in the construction of the development
- Recycled cement content – specify higher levels of cement replacement products for all elements using concrete (e.g. >50% replacement levels using PFA; GGBS; or Limestone fines).

Product Specification

There are opportunities to reduce embodied carbon further by specifying products with lower embodied carbon emissions. The specific requirements of a product can significantly impact the carbon emissions at the product manufacturing stage, often due the components of the product requiring more carbon intensive treatment & subsequent transportation prior to fabrication.

Possible product substitutions that reduce WLC emissions include:

- Timber as a replacement for PVC windows
- Timber as a replacement for light gauge steel used in internal walls

Energy strategy

The energy strategy for the project is a key mechanism for reducing whole life carbon of the development. Together with a passive design approach to reducing energy demands, an 'all electric' energy strategy has been proposed, which features highly efficient heat pumps to deliver heating and hot water for all residential dwellings and non-residential spaces on the development. In addition to heat pumps working at greater efficiency than gas boilers, the heat pumps can take advantage of the projected decarbonisation of the national grid and will continue to deliver lower emissions over the life of the development.

Comparing Assessment 1 (SAP10) and Assessment 2 (with decarbonisation) a significant improvement in emissions avoided is shown. The saving in emissions form a decarbonised electricity supply is 33% of the total carbon reported in Assessment 1. This reinforces the use of future grid scenarios to forecast the projected emissions over the life of the development. Without looking forward, strategies for parts of the development which have a big impact on the WLC emissions could result in higher emissions in the future despite lower current emissions and/or costs. It is not inconceivable that carbon will be traded in the future and therefore any legacy decisions that result in higher emissions in the future could prove to be very costly to the incumbent owners and occupants.

Re-use and recovery

The Circular Economy statement details the strategy for recovery of materials in line with the circular economy model. The benefits of recovered materials have not been accounted for in the Whole Life Carbon Assessment at this stage due uncertainty in the quantity of replacement materials. This will be accounted for at a more detailed stage of design when more accurate data on quantities and specifications for detailed build-ups is available.

7 Conclusion

This report has set out the Whole Life Carbon emissions estimated for the Victoria Quarter Development in London Borough of Barnet. It follows the GLA Whole Life-Cycle Carbon Assessment - Pre-consultation draft guidance. Assessment 1 assesses the WLC emissions for the development today using SAP 10.0 emissions factors and Assessment 2 accounts for future decarbonisation of the UK's electrical grid and gives an indication of the projected WLC emissions assuming the 'Steady Progression' towards grid decarbonisation.

TABLE 10 – SUMMARY TABLE OF THE WHOLE LIFE CARBON EMISSIONS OF THE PROPOSED DEVELOPMENT

Assessment	Whole Life Carbon Emissions (TCO2e)	KgCO2/m2 GIA)
Assessment 1 (SAP10.0)	**35,128**	**879**
Assessment 2 (Decarbonisation)	**34,648**	**867**

The life cycle module that constitutes the greatest proportion of the total Whole Life Carbon emissions of the development is Modules B6: Operational Energy use at 43% (regulated) + 27% (unregulated) of the total Whole Life Carbon emissions. The next highest category is materials, module A1-A3 (Materials), with a 15% contribution. NB a number of materials have yet to be quantified using the WLC software and therefore this element (modules A1-A5) is expected to rise as a proportion of the overall WLC emissions. As material quantities are developed through the detail design, an updated WLC emissions assessment will be provided.

FIGURE 10 – RESULTS BY LIFE-CYCLE STAGE (SAP 10.0)

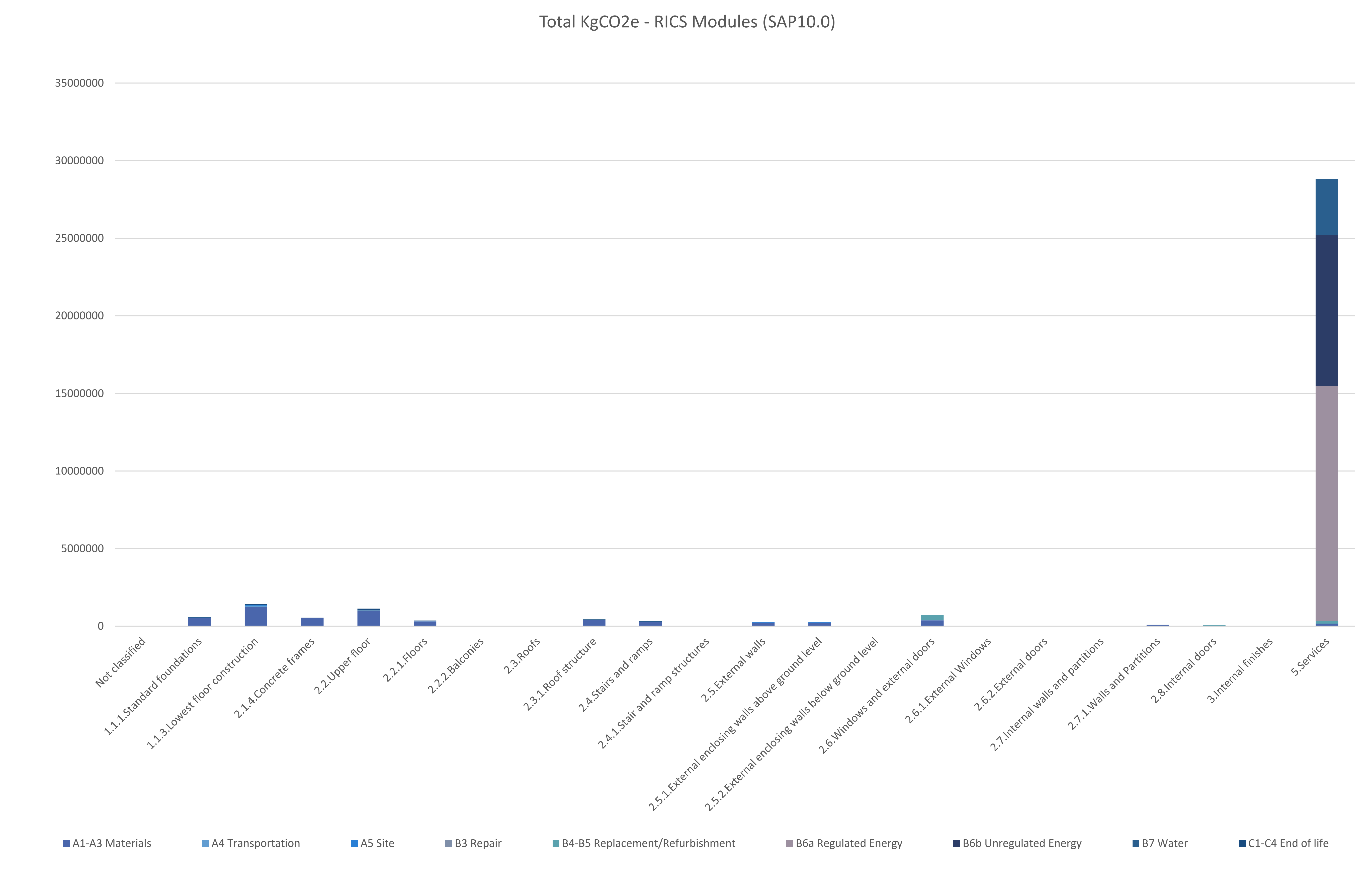
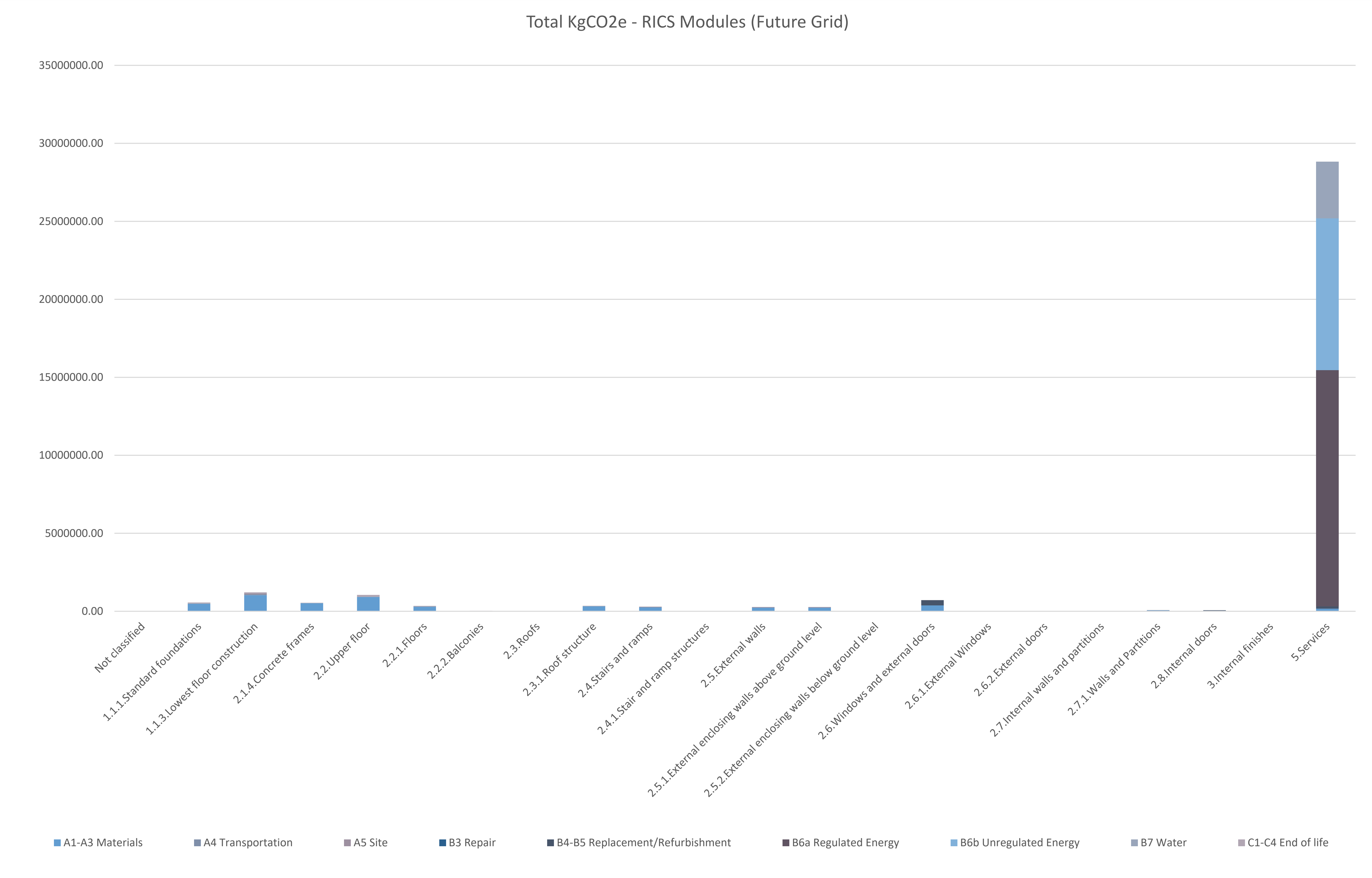


FIGURE 11 – RESULTS BY LIFE-CYEL STAGE (FUTURE GRID)



8 Appendices

Appendix 1 – Principles for reducing WLC

No.	Principle	Description	Relevant life-cycle modules
1	Reuse and retrofit of existing built structures	Before embarking on the design of a new structure or building, the retrofit or reuse of any existing built structures, in part or as a whole, should be a priority consideration as this is typically the lowest carbon option.	
2	Use recycled or repurposed materials	Significant retention and reuse of structures also reduces construction costs and can contribute to a smoother planning process.	A1-A5, B1-B5, C1-C4, D
		Using recycled or repurposed materials, as opposed to newly sourced raw materials, typically reduces the carbon emissions from constructing a new building and reduces waste.	
		This process would start by reviewing the materials already on site for their potential for inclusion into the proposed scheme. Many of the currently available standard products already include a degree of recycled content. Applicants should obtain this information from the supply chain, preferably in the form of an EPD.	
3	Material selection	This is the most important issue affecting the WLC 'cost' of a new building. Appropriate low carbon material choices are key to carbon reduction.	A1-A5, B1-B5, C1-C4, D
		Ensuring that there is synchronicity between materials selected and planned life expectancy of the building reduces waste and the need for replacement, thus reducing in-use costs. EPDs should be referenced.	
		It is important to note that the overall life-time carbon footprint of a product can be as much down to its durability as to what it is made of. For example, bricks may have a high carbon cost in terms of their manufacture, however they have an exceptionally long and durable life expectancy. The selection of reused or recycled materials and products, plus products made from renewable sources, such as timber, will also help reduce the carbon footprint of a project.	
4	Minimise operational energy use	A 'fabric first' approach should be prioritised to minimise the heating and cooling requirement of a building. Naturally ventilated buildings avoid the initial carbon and financial costs of a ventilation system installation, and the repeat carbon and financial costs of its regular replacement.	A1-A5, B1- B4, B6
5	Minimise operational water use	Carbon emissions from water use are largely due to the materials and systems used for its storage and distribution, the energy required to transfer it around the building, and the energy required to treat any wastewater. The choice of materials used and the durability of the systems, which help avoid leakage and resulting damage to building fabric, are therefore key aspects of reducing the carbon cost of water use. On-site water collection, recycling and treatment, and storage can have additional positive environmental impacts as well as reducing in-use costs.	A1-A5, B1-B5, B7, C1-C4, D
6	Disassembly and reuse	Designing for future disassembly ensures that products do not become future waste and that they maintain their environmental and economic value.	A1-A5, B1-B5, C1-C4, D
		A simple example is using lime rather than cement mortar; the former being removable at the end of a building's life, the latter not. This enables the building's components (e.g. bricks) to have a future economic value as they can be reused for their original purpose rather than becoming waste or recycled at a lower level (e.g. hardcore in foundations).	
		Designing building systems (e.g. cladding or structure) for disassembly and dismantling has similar and even broader benefits. Ease of disassembly facilitates easy access for maintenance and replacement leading to reduced maintenance carbon emissions and reduced material waste during the 'in-use' and 'end of life' phases. This leads to the potential for material and product reuse which also reduces waste and contributes to the circular economy principle.	
7	Building shape and form	Compact efficient shapes help minimise both operational and embodied carbon emissions from repair and replacement for a given floor area. This leads to a more efficient building overall, resulting in lower construction and in-use costs.	A1-A5, B1-B6
		A complex building shape with a large external surface area in relation to the floor area requires a larger envelope than a more compact building. This measure of efficiency can be referred to as the 'wall to floor ratio', or the 'heat loss form factor'. This requires a greater use of materials to create the envelope, and a potentially greater heating and/or cooling load to manage the internal environment.	
8	Regenerative design	Removing CO2 from the atmosphere through materials and systems absorbing it makes a direct contribution to carbon reduction. Examples include unfinished concrete, some carpet products and maximising the amount of vegetation.	A1, B1, D
9	Designing for durability and flexibility	Durability means that repair and replacement is reduced which in turn helps reduce lifetime building costs. A building designed for flexibility can respond with minimum environmental impact to future changing requirements and a changing climate, thus avoiding obsolescence which also underwrites future building value. Buildings designed with this principle in mind will be less likely to be demolished at the 'end of life' as they lend themselves to future refurbishment. Examples include buildings being designed with 'soft spots' in floors to allow for future modification and design as well as non-structural internal partitions to allow layout change.	A1-A5, B1-B5, C1-C4, D
10	Optimisation of the relationship between operational and embodied carbon	Optimising the relationship between operational and embodied emissions contributes directly to resource efficiency and overall cost reduction. For example, the use of insulation has a clear carbon benefit whereas its fabrication has a carbon cost. This means that it is important to look not only at the U- value of insulation, but also the carbon cost of the manufacture and installation of different product options. Avoiding fully glazed façades will reduce cooling demand and limits the need for high-carbon materials (glass units, metal frame, shading device etc) both at the construction stage, and the 'in use' stage through wholesale replacements.	A1-A5, B1-B6
11	Building life expectancy	Defining building life expectancy gives guidance to project teams as to the most efficient life expectancy choices for materials and products. This aids overall resource efficiency, including cost efficiency and helps future proof asset value.	A1-A5, B1-B5, C1-C4, D
12	Local sourcing	Sourcing local materials reduces transport distances and therefore supply chain lengths and has associated local social and economic benefits	A1-A5, B3- B4

		e.g. employment opportunities. It also has benefits for occupiers as replacement materials are easier to source. Transport type is also highly relevant. A product transported by ship will have a significantly lower carbon cost per mile than one sent by HGV. A close understanding of the supply chain and its transport processes is therefore essential when selecting materials and products.	
13	Minimising waste	Waste represents an unnecessary and avoidable carbon cost. Buildings should be designed to minimise fabrication and construction waste, and to ease repair and replacement with minimum waste, which helps reduce initial and in-use costs. This can be achieved through the use of standard sizes of components and specification and by using modern methods of construction. Where waste is unavoidable, the designers should establish the suppliers' processes for disposal or preferably reuse of waste.	A1-A5, B1-B7, C1-C4, D
14	Efficient fabrication	Efficient construction methods (e.g. modular systems, precision manufacturing and modern methods of construction) can contribute to better build quality, reduce construction phase waste and reduce the need for repairs in the post completion and defects period (snagging). Such methods can also enable future disassembly and reuse with attendant future carbon benefits.	A1-A5, B1-B7, C1-C4, D
15	Lightweight construction	Lightweight construction uses less material which reduces the carbon footprint of the building as there is less material to source, fabricate and deliver to site. Foundations can then also be reduced with parallel savings. Lightweight construction can also be easier to design for future disassembly and reuse. The benefits of lighter construction should be seen in the context of other principles such as durability.	A1-A5, C1- C4, D
16	Circular economy	The circular economy principle focusses on a more efficient use of materials which in turn leads to financial efficiency. Optimising recycled content, reuse and retrofit of existing buildings, and designing new buildings for easy disassembly, reuse and retrofit, and recycling as equivalent components for future reuse is essential. The use of composite materials and products can make future recycling difficult. Where such products are proposed, the supplier should be asked for a method statement for future disposal and recycling.	A1-A5, B1-B5, C1-C4, D

Appendix 2 – End-of-life Scenarios

End of life scenario C1 - C2 emissions

8.2 This includes the End-of-life scenario for:

- C1 (De-construction, demolition)
- C2 (Transport to waste processing)

8.3 The calculation method for C1 and C2 are based on default values for demolition and transport. Please note that the C1/C2 emissions are not used in every certification tool as often C1/C2 emissions are outside of the scope. One of the reasons for this is that these emissions often cannot be influenced and are a significantly smaller portion of the total C1-C4 emissions. C1 emissions only consider the fuel consumption of machinery, C2 emissions are based on the removed material mass.

End of life scenario C3 - C4 emissions

8.4 This includes the End-of-life scenario for:

- C3 (Waste processing for reuse, recycle and/or recycling)
- C4 (Waste Disposal)
- D (Reuse, recovery and/or recycling potentials, expressed as net impacts and benefits)

The calculation method for C3, C4 and D follows EN 15 978 / EN 15804 and follows the categorization and end-of-life scenarios from DGNB International (2014) (p. 21) This does not apply to DGNB calculation tools, in which C1-C2, C3-C4 and D information from the EPD is also taken into consideration.

Table xx - One Click LCA – Default 'End-of-life' scenarios

Material group	End of life scenario	Materials included	C3 – C4 processing and landfilling	D Recycling benefits
Mineral building materials	Recycling for groundworks	Concrete*, Cement*, Bricks, Porcelain, plaster, Clay products, Stone, Ceramics, Asphalt	C3: Construction waste preparation for recycling	Recycling benefit from replacing the primary gravel
Metals	Metal preparation and recycling**	Aluminium, Steel, Stainless steel, Galvanized steel, Copper coated, Copper uncoated, Brass, Zinc, Lead	C3: Construction waste preparation for recycling	Recycling benefits for replacing virgin metal
Bio-based materials with heating value	Incineration and energy recovery	Wood, Wood products	C3: Construction waste incineration for energy recovery	Recovered energy
Other materials with heating value	Incineration and energy recovery	Plastics	C3: Construction waste incineration for energy recovery	Recovered energy
Other materials that can be landfilled in construction waste site	Disposal / landfilling of inert materials	Coatings, Synthetic materials, Panels and boards***, Insulating materials***, Glass, Window and façade components***	C3: Construction waste incineration for energy recovery	

* Taking into account concrete carbonatization

** Recycling potential can only be reported for metals with shares of primary manufacturing, i.e. if a product is made of recycled material, it no longer has recycling potential. 5% of losses is assumed for recycling (the remaining 95% are recycled).

*** When not included to above groups

Appendix 3 – WLC Data Sources (One Click LCA)

Resource name	Technical specification	Product	Manufacturer	EPD program	EPD number	Environment Data Source	Standard	Verification	Year	Country	Upstream database	Density	Product Category Rules (PCR)	Notes about PCR	Download EPD
Air handling unit, with heat recovery through plate heat exchanger	10 000 m3/h (5885.8 ft3/min), 1256 kg/unit (2769 lbs/unit)			One Click LCA	-	One Click LCA	EN15804	Internally verified	2019	LOCAL	ecoinvent		EN15804	-	
Aluminum composite panel, curtain walling/facade, mineral filled	4 mm, 9.5 kg/m2	A2	Saray	International EPD System	S-P-00834	EPD for Aluminium Composite Panels	EN15804+A1	Third-party verified (as per ISO 14025)	2016	turkey	ecoinvent	2375	PCR 2012:01 Construction products and Construction services, ver. 2.01, 09/03/2016	Only with EN151404	Download EPD
Aluminum profile for windows and doors	2600 kg/m3	Al Profile	Saray	International EPD System	S-P-00833	EPD for Aluminium Profiles	EN15804+A1	Third-party verified (as per ISO 14025)	2016	turkey	ecoinvent		PCR 2012:01 Construction products and Construction services, ver. 2.01, 09/03/2016	Only with EN151404	Download EPD
Bitumen sheets for waterproofing of roofs, French average	ép. 2,5 mm par couche	Donnee par default	MDEGD	INIES	INIES_DFEU 20161116_1 64607, 5721	MDEGD_FDES	EN15804+A1		2016	france	ecoinvent	1800	EN15804+A1	EN15804+A1	Download EPD
Ceramic tiles, incl. underlayment membrane				One Click LCA		One Click LCA generic construction definitions				europe	Other				
Ceramic wall tiles	7.5 mm, 3000 kg/m2		Seranit Granit Seramik	International EPD System	S-P-00676	EPD for For Floor Tiles in accordance with EN15804 and ISO14025	EN15804+A1	Third-party verified (as per ISO 14025)	2015	turkey	ecoinvent	3000	PCR 2012:01 Construction products and Construction services, ver.1.2, 15/03/2013	Only with EN151404	Download EPD
Concrete assembly for stairs and elevator shafts per one metre height				One Click LCA		One Click LCA generic construction definitions				LOCAL	Other				
Concrete balcony assembly	200 mm			One Click LCA		One Click LCA generic construction definitions				LOCAL	Other				
Concrete beam - for concrete buildings	L-beam/T-beam, B45			One Click LCA		One Click LCA generic construction definitions				LOCAL	Other				
Concrete column - for concrete buildings	Rectangular column, B45			One Click LCA		One Click LCA generic construction definitions				LOCAL	Other				
Concrete external wall assembly with external insulation incl. timber frame	U-value 0.18 W/m2K, TEK17, 460 mm			One Click LCA		One Click LCA generic construction definitions				europe	Other				

Concrete ground floor slab, for apartment building, EPS	U = 0.16 W/m2K (Määräystaso)			One Click LCA		One Click LCA generic construction definitions				finland	Other				
Concrete ground slab assembly incl. insulation	550 mm			One Click LCA		One Click LCA generic construction definitions				europe	Other				
Concrete roof assembly	U-value 0.13 W/m2K, TEK17, 520 mm			One Click LCA		One Click LCA generic construction definitions				europe	Other				
Concrete roof tiles	Avg. thickness per m2: 22.4 mm, 334x420 mm, 2100 kg/m3		Eternit	IBU	EPD-ETE-20130224-IAA1-DE	EPD Eternit Dachstein Heidelberg Eternit Dachstein Verona Eternit Dachstein Göteborg Eternit Dachstein Kapstadt Eternit AG	EN15804+A1	Third-party verified (as per ISO 14025)	2014	germany	GaBi	2100	PCR Betondachsteine, 10/2012	Only with EN15804	Download EPD
Concrete sandwich element underground wall assembly, incl. EPS insulation				One Click LCA		One Click LCA generic construction definitions				europe	Other				
Concrete stairs and landing	C30/37 (B30 M60), 2380 kg/m3		Elementsør AS	EPD Norge	NEPD-2737-1432-NO	EPD Trapp og repos (B30-M60)	EN15804+A1	Third-party verified (as per ISO 14025)	2021	norway	ecoinvent	2380	NPCR 020:2018 Part B for Concrete and concrete element	Only with EN15804	Download EPD
DPL laminate flooring	9 mm, 800-1200 kg/m3		EPLF	IBU	EPD-EPL-20150021-CBE1-EN	EPD Direct Pressure Laminate Floor Covering (DPL Floor Covering) European Producers of Laminate Flooring e.V.	EN15804+A1	Third-party verified (as per ISO 14025)	2015	europe	GaBi	966.666 6667	PCR Floor coverings, 07/2014	Only with EN15804	Download EPD
District heat distribution center	per 1kW			One Click LCA	-	One Click LCA	EN15804	Internally verified	2019	LOCAL	ecoinvent		EN15804	-	

Drinking water supply piping network, per m2 GIFA (residential buildings)				One Click LCA	-	One Click LCA	EN15804	Internally verified	2019	LOCAL	ecoinvent		EN15804	-	
EPS Insulation	T: 10-2400 mm, 600 x 1200 mm, 0.031 W/m2K, 16 kg/m3		EPS-gruppen	EPD Norge	NEPD-1236-244-EN	EPD Lavlambda EPS 80 isolasjon (trykklasse 80) EPS-gruppen	EN15804+A1	Third-party verified (as per ISO 14025)	2017	norway, sweden	ecoinvent	16	NPCR 012 Insulation materials, rev1, 10/2/2012	Only with EN15804	Download EPD
Electricity distribution system, cabling and central, for all building types	per m2 GFA			One Click LCA	-	One Click LCA	EN15804	Internally verified	2019	LOCAL	ecoinvent		EN15804	-	
External doors				One Click LCA		One Click LCA generic construction definitions				italy	Other				
Filter fabric N2				One Click LCA	-	Polypropylene (PP), Environmental Product Declarations of the European Plastic Manufacturers	ISO14040	Internally verified	2008	LOCAL	ecoinvent	330	PCR for uncompounded polymer resins and reactive polymer precursors	Only with EN15804	
Flexible tile adhesivefor ceramic coverings	2.2 kg/m2, 2.4 kg/m2, 1200 kg/m3, 1400 kg/m3	Flexmörtel® S1 Rapid, Flexmörtel® S2 Rapid	PCI Augsburg GmbH	IBU	EPD-PCI-20160117-IBE1-DE	Oekobau.dat 2017-I, EPD Verformungsfähiger Fliesenkleber PCI Flexmörtel® S1 Rapid Hochverformungsfähiger Fliesenkleber PCI Flexmörtel® S2 Rapid	EN15804+A1	Third-party verified (as per ISO 14025)	2016	germany	GaBi	1300	PCR Mineralische Werkmörtel, 07/2014	Only with EN15804	Download EPD
Float glass, single pane, generic	3-12 mm (0.12-0.47 in), 10 kg/m2 (2.05 lbs/ft2) (for 4 mm/0.16 in), 2500 kg/m3 (156 lbs/ft3)			One Click LCA	-	One Click LCA	EN15804+A1	Internally verified	2018	LOCAL	ecoinvent	2500	EN15804+A1	-	

Glass wool insulation panels, unfaced, generic	L = 0.031 W/mK, R = 3.23 m2K/W (18 ft2°Fh/BTU), 25 kg/m3 (1.56 lbs/ft3), (applicable for densities: 0-25 kg/m3 (0-1.56 lbs/ft3)), Lambda=0.031 W/(m.K)			One Click LCA	-	One Click LCA	EN15804+A1	Internally verified	2018	LOCAL	ecoinvent	25	EN15804+A1	-	
Gypsum plaster	1100 kg/m3		Bundesverband der Gipsindustrie	IBU	EPD-BVG-20140073-IAG1-DE	Oekobau.dat 2017-I, EPD GIPSPUTZ Bundesverband der Gipsindustrie e.V.	EN15804+A1	Third-party verified (as per ISO 14025)	2014	germany	GaBi	1100	PCR Mineralische Werkmörtel, 10/2012	Only with EN15804	Download EPD
Gypsum plaster board, regular, generic	6.5-25 mm (0.25-0.98 in), 10.725 kg/m2 (2.20 lbs/ft2) (for 12.5 mm/0.49 in), 858 kg/m3 (53.6 lbs/ft3)			One Click LCA	-	One Click LCA	EN15804+A1	Internally verified	2018	LOCAL	ecoinvent	858.028 0607	EN15804+A1	-	
Gypsum plasterboard	7.2 kg/m2, 9.5 mm +/-0.5 mm	Windliner - X/Utvendig - X type EH2 (GU-X)	Norgips	EPD Norge	NEPD-109-177-EN	Windliner - X/Utvendig - X type EH2 (GU-X), NEPD-109-177-EN, Norgips AS	EN15804+A1	Third-party verified (as per ISO 14025)	2015	norway	ecoinvent	757.89	NPCR 010 Building boards, rev1, 2013	Only with EN15804	Download EPD
Heat distribution piping network, per m2 heated area, all building types				One Click LCA	-	One Click LCA	EN15804	Internally verified	2019	LOCAL	ecoinvent		EN15804	-	
Heat distribution system				One Click LCA		One Click LCA generic construction definitions				LOCAL	Ecoinvent				
Hollow core concrete slabs, generic	C30/37 (4400/5400 PSI), 0% (typical) recycled binders in			One Click LCA	-	One Click LCA	EN15804+A1	Internally verified	2018	LOCAL	ecoinvent	1400	EN15804+A1	-	

	cement (300 kg/m3 / 18.72 lbs/ft3), incl. reinforcement														
Hollow core concrete slabs, generic	C30/37 (4400/5400 PSI), 20% recycled binders in cement (300 kg/m3 / 18.72 lbs/ft3), incl. reinforcement			One Click LCA	-	One Click LCA	EN15804+A1	Internally verified	2018	LOCAL	ecoinvent	1400	EN15804+A1	-	
In-situ concrete slab assembly				One Click LCA		One Click LCA generic construction definitions				europe	Other				
Insulated system wall with brick slips and aircrate block, U-vaue 0.22	(Part L 2016)			One Click LCA		Part L 2016				unitedKin gdom	Other				
Insulation, EPS 100	0.035 W/mK, 18-22 kg/m3 (100 kPa), without flame retardant		EUMEPS	IBU	EPD-EPS-20130077-CBG1-EN	Expanded Polystyrene (EPS) Foam Insulation (without flame retardant, density 20 kg/m³), EPS 100, EUMEPS (region Scandinavia)	EN15804+A1	Third-party verified (as per ISO 14025)	2013	finland, sweden, denmark	-	20	PCR Insulating materials made of foam plastics, 10/2012	Only with EN15804	Download EPD
Interior doors with wooden frame		Donnee par default	MDEGD	INIES	INIES_DPOR 20180830_1 04138, 8591	MDEGD_FDES	EN15804+A1	Third-party verified (as per ISO 14025)	2018	france	ecoinvent, ELCD		EN15804+A1	EN15804+A1	Download EPD
Laminate flooring, incl. vapourproof membrane				One Click LCA		One Click LCA generic construction definitions				finland	Other				

Lightweight concrete block, with expanded clay aggregate, generic	650 kg/m3 (40.6 lbs/ft3), 18 kg/block (39.7 lbs/block), 0.5x0.3x0.185 mm (0.019x0.012x0.007 in)			One Click LCA	-	One Click LCA	EN15804+A1	Internally verified	2018	LOCAL	ecoinvent	650	EN15804+A1	-	
Macadam (8…16 mm), wet bulk density	2000 kg/m3			One Click LCA	-	LCA inventory for gravel production, Ecoinvent 2014	ISO14040	Internally verified	2014	LOCAL	ecoinvent	2000	-	Only with EN15804	
Masonry cavity wall with partial fill and aircrete block + plasterboard inner leaf, U-value 0.18	(Part L 2016)			One Click LCA		Part L 2016				unitedKingdom	Other				
Masonry mortar/facing wall mortar/mortar with special properties	1500 kg/m3, EPD coverage: >1500 kg/m3		IWM	IBU	EPD-IWM-20130239-IBG1-DE	Oekobau.dat 2017-I, EPD Mineralische Werkmörtel: Mauermörtel Vormauermörtel/Mörtel mit besonderen Eigenschaften Industrieverband WerkMörtel e.V. (IWM)	EN15804+A1	Third-party verified (as per ISO 14025)	2014	germany	GaBi	1500	PCR Mineralische Werkmörtel, 10/2012	Only with EN15804	Download EPD
Multifunctional steel door, product group 1	1000mm x 2125 mm	H 3 D, H 3 OD, H 3 VM, H 3 KT, RS 55, D 65 OD, D 65	Hörmann	ift Rosenheim	EPD-MT-0.1.1	EPD Multifunktionstüren aus Stahl Hörmann KG Freisen	EN15804+A1	Third-party verified (as per ISO 14025)	2015	germany	GaBi		PCR Dokument Turen und Tore - PCR-TT-1.1 : 2013	Only with EN15804	Download EPD
Partitioning wall system (internal insulated wall) with steel studs, glass wool core and gypsum board double siding	70mm+25mm+25mm, 1.75 K.m2/W, Lambda=0.04 W/(m.K)	High-Stil® 120/70 avec Placo® Duo'Tech® 25	PLACOPLATRE	INIES	INIES_ICLO20191220_143239, 26503	FDES	EN15804+A1	Third-party verified (as per ISO 14025)	2020	france	ecoinvent		EN15804+A1	EN15804+A1	Download EPD

Planed timber, conifer			Treindustrien	EPD Norge	NEPD-308-179-EN	Structural timber of spruce and pine, Norwegian Wood Industry Federation	EN15804+A1	Third-party verified (as per ISO 14025)	2015	norway	ecoinvent	420	NPCR 015 Wood and wood-based products for use in construction, rev1, 08/2013	Biogenic CO2 separated	Download EPD
Plasterboard, filled, sanded and painted				One Click LCA		One Click LCA generic construction definitions				europe	Other				
Plastic vapour control layer	0.2 mm		Tommen Gram	EPD Norge	NEPD-341-230-NO	Gram Dampsperre, Tommen Gram Folie AS (2015)	EN15804+A1	Third-party verified (as per ISO 14025)	2015	norway	ecoinvent	925	NPCR 022 Roof waterproofing, rev1, 12/2012	Only with EN15804	Download EPD
Precast concrete cylindrical columns, incl. reinforcement, for exterior applications	Diamètre: 300 mm, Béton/Cement: C25/30 XC4/XF1, CEM II/A		SNBPE	INIES	INIES_CC25 20171219_1 44739, 8034	FDES	EN15804+A1	Third-party verified (as per ISO 14025)	2017	france	ecoinvent		EN15804+A1	EN15804+A1	Download EPD
Rammed concrete piling foundation for hard soils for m2 GFA, model: P270, pile length: 20 m, depth to bedrock: 20 m				One Click LCA		One Click LCA generic construction definitions				LOCAL	Ecoinvent				
Ready-mix concrete, low-strength, generic	C12/15 (1700/2200 PSI), 0% recycled binders in cement (220 kg/m3 / 13.73 lbs/ft3)			One Click LCA	-	One Click LCA	EN15804+A1	Internally verified	2018	LOCAL	ecoinvent	2200	EN15804+A1	-	
Ready-mix concrete, normal-strength, generic	C30/37 (4400/5400 PSI), 10% (typical) recycled binders in cement (300 kg/m3 / 18.72 lbs/ft3)			One Click LCA	-	One Click LCA	EN15804+A1	Internally verified	2018	LOCAL	ecoinvent	2400	EN15804+A1	-	

Ready-mix concrete, normal-strength, generic	C30/37 (4400/5400 PSI), 0% recycled binders in cement (300 kg/m3 / 18.72 lbs/ft3)			One Click LCA	-	One Click LCA	EN15804+A1	Internally verified	2018	LOCAL	ecoinvent	2400	EN15804+A1	-	
Ready-mix concrete, normal-strength, generic	C40/50 (5800/7300 PSI), 10% (typical) recycled binders in cement (400 kg/m3 / 24.97 lbs/ft3)			One Click LCA	-	One Click LCA	EN15804+A1	Internally verified	2018	LOCAL	ecoinvent	2400	EN15804+A1	-	
Red brick, average production, UK	215 mm x 102.5 mm x 65 mm, 2.13 kg/unit, 1485 kg/m3		Brick Development Association (BDA) Ltd (2019)	BRE	BREG EN EPD000002, issue 04	EPD BDA Generic Brick, The Brick Development Association	EN15804+A1	Third-party verified (as per ISO 14025)	2019	unitedKingdom	ecoinvent	1485	EN15804+A1	-	Download EPD
Reinforcement steel (rebar), generic	90% recycled content, A615			One Click LCA	-	One Click LCA	EN15804+A1	Internally verified	2018	LOCAL	ecoinvent	7850	EN15804+A1	-	
Reinforcement steel (rebar), generic	80% recycled content, A615			One Click LCA	-	One Click LCA	EN15804+A1	Internally verified	2018	LOCAL	ecoinvent	7850	EN15804+A1	-	
Rock wool insulation panels, unfaced, generic	L = 0.037 W/mK, R = 2.70 m2K/W (15 ft2°Fh/BTU), 150 kg/m3 (9.36 lbs/ft3) (applicable for densities: 100-150 kg/m3 (6.24-9.36 lbs/ft3)), Lambda=0.037 W/(m.K)			One Click LCA	-	One Click LCA	EN15804+A1	Internally verified	2018	LOCAL	ecoinvent	150	EN15804+A1	-	
Self levelling mortar, for floors, walls and overhead appl.	3-50 mm, 1400 kg/m3	Pericret	PCI Augsburg	IBU	EPD-PCI-20160262-IBE1-DE	Oekobau.dat 2017-I, EPD Ausgleichsmörtel PCI Pericret für Boden, Wand und Decke PCI Augsburg GmbH	EN15804+A1	Third-party verified (as per ISO 14025)	2016	germany	GaBi	1400	PCR Mineralische Werkmörtel, 07/2014	Only with EN15804	Download EPD
Sewage water drainage piping network, per m2 GIFA (residential buildings)				One Click LCA	-	One Click LCA	EN15804	Internally verified	2019	LOCAL	ecoinvent		EN15804	-	
Steel stud internal wall assembly, 100 mm, incl. mineral wool insulation	Steel stud wall 100 mm, incl. mineral wool insulation 100 mm and			One Click LCA		One Click LCA generic construction definitions				europe	Other				

	plasterboard 13 mm on both sides														
Structural steel profiles, generic	60% recycled content, I, H, U, L, and T sections, S235, S275 and S355			One Click LCA	-	One Click LCA	EN15804+A1	Internally verified	2018	LOCAL	ecoinvent	7850	EN15804+A1	-	
Tile adhesive, all round, for ceramics	1-5 mm, 1400 kg/m3	Verlegem örtel	PCI Augsburg	IBU	EPD-PCI-20160141-IBE1-DE	Oekobau.dat 2017-I, EPD Flexibilisierter Fliesenkleber PCI Verlegemörtel für keramische Fliesen PCI Augsburg GmbH	EN15804+A1	Third-party verified (as per ISO 14025)	2016	germany	GaBi	1400	PCR Mineralische Werkmörtel, 07/2014	Only with EN15804	Download EPD
Traditional roof trusses from softwood	493.2 kg/m3, biogenic CO2 not subtracted (for CML)	Charpente traditionn elle en Douglas sans traitemen t de préservati on des adhérents de France Douglas	France Douglas	INIES	INIES_CCHA 20190219_0 95559, 10606	FDES	EN15804+A1	Third-party verified (as per ISO 14025)	2019	france	ecoinvent	493.2	EN15804+A1	EN15804+A1	Download EPD
Triple glazed window, incl. wood-alu frame				One Click LCA		One Click LCA generic construction definitions				europe	Other				
Ventilation ducting	per m linear, D: 63 mm (2.48 in)			One Click LCA	-	One Click LCA	EN15804	Internally verified	2019	LOCAL	ecoinvent		EN15804	-	
Ventilation system for residential buildings				One Click LCA		One Click LCA generic construction definitions				LOCAL	Ecoinvent				
Vinyl flooring		Be Natural Be Different Be easy Be Smart	DICKSON-CONSTANT	INIES	INIES_IREV2 0160331_15 5658, 4881	FDES	EN15804+A1	Third-party verified (as per ISO 14025)	2015	france	ecoinvent	811.688	EN15804+A1	EN15804+A1	Download EPD
Water circulation radiator	per 1kW / unit			One Click LCA	-	One Click LCA	EN15804	Internally verified	2019	LOCAL	ecoinvent		EN15804	-	
Water-borne interior paints	1.36 kg/L, average coverage 8-10 m2/L	Biora, Ekora, Kolibri Sand, Paneelikat tomaali, Ranch, Superlate ksi, Tapettipo hjamaali, Teknospro , Tela,	Teknos	RTS	RTS_14_18	EPD RTS EPD, Water-borne interior paints	EN15804+A1	Third-party verified (as per ISO 14025)	2018	finland, OCLEPD	ecoinvent	1360	RTS PCR protocol: EPDs published by the Building Information Foundation RTS sr (2016)	Only with EN15804	Download EPD

		Timantti, Trend												
Waterproof, protective, flexible coating	1.5 kg/l	Lastogum	PCI Augsburg	IBU	EPD-PCI-20150039-IBE1-DE	Oekobau.dat 2017-I, EPD Wasserdichte, flexible Schutzschicht PCI Lastogum unter Keramikbelägen in Dusche und Bad PCI Augsburg GmbH	EN15804+A1	Third-party verified (as per ISO 14025)	2015	germany	GaBi	1500	PCR Beschichtungen mit organischen Bindemitteln, 07/2012	Only with EN15804	Download EPD
Window, double glazed, PVC-U frame, tilt and turn	1.3 W/m2K, 1.23x1.48 m/piece		REHAU	IBU	EPD-QKE-20150313-IBG1-EN	PVC-U plastic windows, Tilt & turn window with dimensions 1.23 x 1.48 m insulated double-glazing; depth approx. 70 mm, QKE e.V. and EPPA ivzm (2014)	EN15804+A1	Third-party verified (as per ISO 14025)	2014	germany	GaBi		PCR Windows and doors, 10/2012	Only with EN15804	Download EPD
Window, double glazed, PVC-U frame, tilt and turn	1.3 W/m2K, 1.23x1.48 m/piece		REHAU	IBU	EPD-QKE-20150313-IBG1-EN	PVC-U plastic windows, Tilt & turn window with dimensions 1.23 x 1.48 m insulated double-glazing; depth approx. 70 mm, QKE e.V. and EPPA ivzm (2014)	EN15804+A1	Third-party verified (as per ISO 14025)	2014	germany	GaBi		PCR Windows and doors, 10/2012	Only with EN15804	Download EPD
Wooden decking, cladding and planed timber for joinery applications	540kg/m3, Moistr. 3-5%	Accoya Scots Pine	Accsys Technologies PLC	EPD Norge	NEPD-376-262-EN	Accoya Wood - decking, cladding and planed timber for joinery applications,Scots Pine, NEPD-376-262-EN, Accsys Technologies PLC	EN15804+A1	Third-party verified (as per ISO 14025)	2015	netherlan ds	ecoinvent	540	NPCR 015 Wood and wood-based products for use in construction, rev1, 08/2013	Biogenic CO2 separated	Download EPD
Wooden entrance door, per m2	809x2053 mm, 42x92 mm frame, 52 mm door leaf		Nordic Dørfabrikk	EPD Norge	NEPD-1535-525-EN	EPD Climate door / interior door Nordic Dørfabrikk AS	EN15804+A1	Third-party verified (as per ISO 14025)	2018	norway	ecoinvent		NPCR 014 Windows and doors, rev1, 03/2013	Only with EN15804	Download EPD
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