Lifecycle CO_2 Analysis and Sustainability case for demolition

134 Greencroft Gardens

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134 Greencroft Gardens

Lifecycle CO_2 Analysis

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Brief and Findings

There are two key elements to the brief:

1. To consider the case for reuse and demolition from both a feasibility and sustainability viewpoint:

Pages 7-10 details Camden's guidance (CPG) on Energy efficiency and Adaptation, chapter 9: Re-use and Resource efficiency - and the key reasons why the existing dwelling can't be retained. The proposed new dwelling will make a positive impact in terms of carbon emissions, efficient use of floor space, lifespan and more.

2. To consider the impact in terms of Life-cycle carbon emissions for three scenarios, over 60 years – key findings are below:

- Scenario 1 – Keeping the existing building and decorating
- Scenario 2 – Refurbishing the existing and extending
- Scenario 3 – New Build – traditional construction

	CO_2 embodied	**CO_2 In-Use**	**CO_2 per m^2**	**CO_2 Overall**
1. Existing	8,266	407,121	3,364	415,387
2. Refurb	117,898	287,988	1,741	405,886
3. New	133,358	55,921	831	189,279

- The study concludes the new build, scenario 3, has lower carbon emissions, emitting less than **half of the existing or the refurbishment** scenario CO_2 emissions, over a 60-year lifecycle.
- The floor areas of the proposed new build and refurbishment are similar, with a **15,460 KgCO_2** saving the existing structure – a relatively small saving compared to in-use savings.
- The existing has minimal embodied emissions due to no initial works, but **very high in-use emissions**, particularly for a small property.
- When analysed on a **Kg CO_2 per m^2 basis**, the refurb is better than the existing and new build demonstrates its impressive carbon efficiency.

Key findings

- The new build scenario can be considered a much more sustainable home from a long-term carbon emission point of view.
- The proposed new build dwelling is of an exemplary standard and will:
  - Save approx. 876,000 litres of water over 60 years.
  - Create a more efficient useable space
  - Be a healthier and lighter space for people to live.
  - Have better accessibility,
  - Will last much longer than a refurbishment in the future and;
  - Smaller, custom sites are in line with targets of London Plan
- The existing building has some age-related structural and damp issues.
- The new build scenario 3 will use 20% materials from the demolition of the existing building, as recommended by Camden Council. This will include some brick façades and crushed aggregate in the substructure (which is composed on of 70% overall recycled materials)
- New build scenario 3 surpasses the London plan targets on carbon emissions, notably 35% beyond Part L building regulations CO_2 levels, with the property meeting an **82.33%** reduction in CO2 over Part L.
- If looked at further than 60 years into the future, the carbon saving of Scenario 3 would continue to increase, due to low carbon emissions in the proposed.

Introduction
134 Greencroft Gardens
Lifecycle CO_2 Analysis

Introduction	Green Tiger Sustainability has been appointed to analyse the case for demolition of the existing and building a more efficient new house at 134 Greencroft Gardens, in Camden. This is achieved through comparison of the lifecycle carbon emission impact between existing, refurbished and the proposed demolition and new build scenarios.

Aim

This document aims to:

- Understand of the property can be re-used or retained. Where it cannot, make a case for demolition and re-development – from both practical and sustainability viewpoints.
- Analyse the impact of Life-cycle carbon emissions for three scenarios at 134 Greencroft Gardens, this environmental impact will be measured over 60 years in $KgCO_2$ and $KgCO_2$ per metre square:
    - Scenario 1 – As existing
    - Scenario 2 – Refurbishment and extension
    - Scenario 3 - New build

Methodology

The methodology used in this report has been clearly defined and the data used has been attributed to the source.

Fundamentals of whole life carbon (WLC) standards ISO14044 and BS EN 15978 have been followed in this report and the software used is FCBS CARBON.

All stages of the building lifecycle are taken into account from A1 – D, as defined by the RICS. Energy use figures are derived from SAP 10 and input into FCBS CARBON.

The software uses factors derived from the Inventory of Carbon and Energy (ICE) database and Environmental Product Declarations (EPDs).

The three scenarios have information relating to the development such as architectural drawings, consultant reports and official Part L 2021 documentation. The drawings are provided in the application.

A breakdown of the data input for each case study is provided, as well as a further breakdown of the carbon factors relating to materials and SAP results are provided in Appendix 1.

Specifications of the dwellings analysed are not finalised at this early development stage. Where we have made assumptions, we have assumed the worst-case value.

Case for Demolition & New Build
134 Greencroft Gardens

Introduction

In addition to overall Lifecycle Carbon emissions investigated in this report, a case for demolition and redevelopment is made where the existing house is problematic to upgrade to a satisfactory standard - and benefits in size, occupant accessibility, occupant health and wider development sustainability of a new build outweigh existing or refurbishment options.

Current dwelling

The current dwelling cannot be upgraded to a satisfactory standard from a practical or longevity point of view. The existing property was built around 1897, with numerous extensions, and is approximately 126 years old. Whilst some pre-war dwellings stand longer, the life expectancy of a property such as this is 60 years (BRE).

The properties layout is highly inefficient in terms of useable floorspace and circulation, with most of the property being added piecemeal over time. There is a recording history of concerns regarding subsidence since 1992 with, numerous structural cracks still visible after action having been taken. A new property would be able to design for future increase chance of subsidence through climate change. Progressive damp and leaks are an ongoing concern. If the property could not be redeveloped, the home-owner has little incentive to upgrade the current dwelling, keeping emissions high. This is investigated in more detail on the next page.

Alignment with Policy on emissions

Minor development new builds in Camden should meet a carbon emission target of 19% beyond building regulations Part L – under the policy CC1. London Plan guidance for development is also preferred (35% beyond Part L).

A refurbishment and extension of the existing dwelling would need to meet Part L building regulations in terms of energy, which are much lower than the standard of a new build meeting the London Plan requirements. As demonstrated in the long-term CO_2 analysis in this report, the new build will go far beyond building regulations and the London Plan guidance, reaching **82.33%** carbon savings beyond Part L standards, in keeping with the borough's wider aims.

Water use

The dwelling is required to meet building regulations of 110 litres/person/day, but will go beyond and target 100 litres/person/day. Based on 4 people living in the dwelling this could lead to 876,000 litres of water saved over 60 years in the new build scenario. Note that this is based on standard fittings (WCs, Bath, Shower, taps and washing machine / dishwasher only).

Local Employment

The design team are committed to employing local firms to carry out works if planning permission on the proposed new build is granted. Although small, this will add to local economic growth and employment opportunities.

A Better dwelling

The proposed dwelling will be an exemplar sustainable development for the local area– see the Design and Access Statement for further design details.

The proposed new build scenario will incorporate more internal, making better use of the building footprint, with a much healthier amount of natural light and a higher air change rate in the dwelling - contributing to better occupant health. The new dwelling will have a spacious design, surpassing all M4 access requirements, it will be much more efficient and stand for much longer, making a positive impact in terms of carbon emissions, water and access. Furthermore, renewables, live energy display devices, low-energy lights and appliances, composting facilities, rainwater collection and a 'net-greening' effect on the site as a whole, with better drainage and ecological value.

Reuse and Resource Efficiency
Greencroft Gardens

Introduction

The proposed development aims to optimise resource efficiency and use circular economy principles. The Camden Council 'Demolition Guide' has been followed and Section 9 of Energy efficiency CPG (Jan 2021) will be addressed in this section to investigate if the existing property can be retained.

The guidance notes that a condition and feasibility assessment and Development options assessment be undertaken, in addition to the Whole Life Carbon assessment in this report.

Condition and Feasibility assessment

Existing Building uses	- The current property operates as an average size 2 bedroom Victorian dwelling. - The properties layout is highly inefficient in terms of useable floorspace and circulation, with most of the property being added piecemeal over time. - There is a recording history of concerns regarding subsidence since 1992 with, numerous structural cracks still visible after action having been taken. - The property is poorly insulated and has draughts. - Brick is very old and in some poor condition.
Servicing	- Standard Gas boiler and radiator distribution network. In need of upgrading. - No renewables or alternative energy sources. - Mains water at standard pressure.
Technical Review	- **Upgrades** – Full insulation to floors, walls, roof and replacement windows/doors required to reach Part L for existing buildings. - **Material audit and estimate of embodied carbon** – Structural cracks, from local tree, will worsen with increased surface water run-off from climate change. Foundations are old and for further loading on the site, new foundations are required. For embodied carbon, see page 12 & 13 of this report. - **Energy performance of facade** - extremely poor - uninsulated 126-year-old solid brick, 1.7 u-value with signs of progressive damp and structural cracks. - **SBEM** - N/A as this is a residential building - **Air Tightness / thermal bridging** – poor - assumed to be worst possible in all energy modelling calculations undertaken, as it is uninsulated solid brick. - **Condensation Analysis** – High – the property will potentially have serious condensation and moisture issues when insulating solid brick.
Site Capacity	- The site is capable to have a new highly efficient family dwelling built.

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Reuse and Resource Efficiency
Greencroft Gardens

Development Options

The aim of the proposed development is to:

1. Eliminate the dwellings subsidence issue
2. Create a better laid out, quality family home
3. Deliver an ultra low-carbon dwelling

The following development types will be assessed and with regards to the above:

Refit
With a refit, none of the above development aims can be met.

Refurbish
A highly sustainable refurbishment would allow the property to become low carbon, however, further floorspace would be lost insulating the existing dwelling to levels required. Furthermore, a refurbishment would not remodel or importantly, it would not solve the subsidence issue.

Substantial refurbishment and extension
A substantial refurbishment and extension would allow the development to become low carbon AND create a better and more useable family space, through re-modelling and extending the dwelling. However, this proposal would not also allow for new foundations to solve the sites subsidence – and retaining 126-year-old elements, that may have been compromised, is also not considered practical.

Reclaim and recycle
The option of demolition, re-laying new high-recycled content foundations and building a new dwelling would allow for all the development aims above to be met. The property can solve subsidence issues at the root cause, create a highly efficient exemplary low-carbon dwelling, a better family space and a produce a dwelling that will last for much longer than retaining options. In this option at least 95% of demolition waste will be re-used in the new dwelling or recycle for useful purposes off site, prioritising use on site at all opportunities. A pre-demolition audit of materials will be undertaken. A Lifecycle Carbon (WLC) assessment has been prepared as part of this report to compare options of retaining existing, refurbish/extending and building a new dwelling.

The demolition and reclaim / re-use option appears to be the preferable route to meet all development goals.

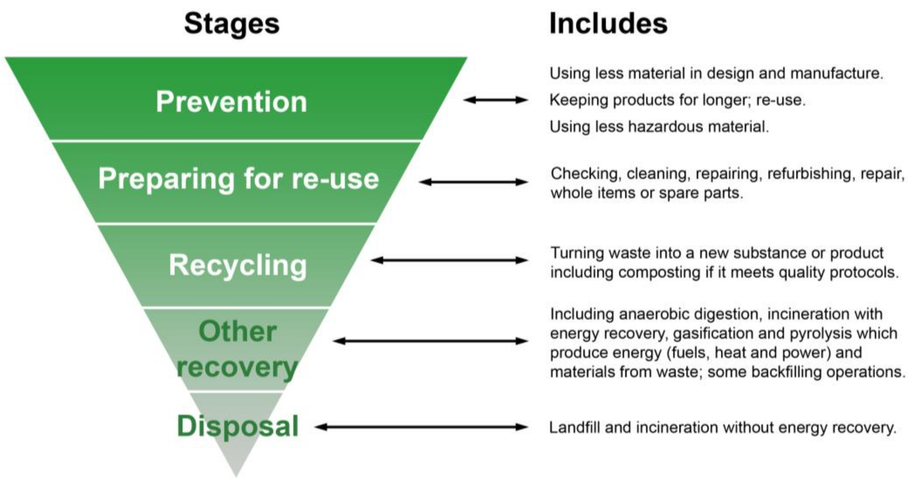
Reuse and Resource Efficiency
Greencroft Gardens

The proposed development that will incorporate measures to improve the resource efficiency and reduce waste through each stage of the development's life:

Design	Measures	Comment
	Energy efficiency building design	The proposal aims to design highly energy efficient building by incorporation passive design measures and renewables (Air source heat pump) Refer to page 11 of this report
	Material efficiency	The reuse of existing materials from the demolition of existing buildings (Brick walls, brickwork, floors) - Crushed and used as aggregate in new development. Low impact insulation throughout (EPS, Rockwool, Cellulose). At least 20% of the total value of materials used should derive from recycled and reused content in the products and materials selected (and divert the remainder from landfill. Steel and concrete will have a high recycled content (70% concrete)
Construction	Minimise the use of resources (energy, water, land)	Monitor the water and energy consumption and report the equivalent carbon emissions.
	Resource efficiency	Pre-demolition audit to be carried out and target benchmark of ≤ 11.1 tonnes of construction waste per 100m2.
	Minimise waste generation	Reusable packing solutions with key product manufacturers will be explored at the earliest opportunity. Solutions may include flat pallets, bulk bags, steel stillages and returnable cable drums; Pre-fabrication of materials/elements wherever possible.
	Diversion of waste from landfill	Construction waste – minimum 80% diversion from landfill rate; Demolition waste – 95% diversion from landfill rate.
	Sustainable Sourcing	All timber used in the development will come from a legal Source (FSC Scheme). At least 80% of the building materials will be responsibly sourced and will use suppliers who can provide an EMS certificate or equivalent. Materials rated with an A or B in the BRE Green Guide to Specification will be preferred.
Operations	Maintenance	Implement a good maintenance/ repair strategy to maximise life of materials Always consider repair before replacement When replacements required select high durability materials with low maintenance requirements
End of Life	Deconstruction	Design for deconstruction and reuse of materials. Divert waste from landfill (via reuse, recycling or recovery) Demolition and construction waste - 95% to reuse, recycling, recovery

Proposed Waste and Materials Sustainability
Greencroft Gardens

Introduction	Local Camden and London Plan planning policy states that both construction waste and operational waste should be minimised. Furthermore 'The Circular Economy' method of pre-planning how materials will be re-used so to reduce waste and in-turn the need for virgin building materials. Therefore, the site aims to practice both the Waste Hierarchy and the principles of the circular economy, within both the design and construction of the development. In addition, a site waste management plan will be implemented to ensure minimal waste on site. Also, Considerate Contractors scheme will be joined, to implement measures which seek to avoid environmental pollution including dust, noise, water etc. Further Resource Efficiency chart throughout development on the next page.
Prevention / Reduction on-site	- The project will use standard sizes and quantities of materials, and plan ahead to reduce off cuts. - Cellulose insulation derived from re-used card will be used, where possible - Over-ordering will be kept to a minimum through detailed quantity surveying as part of the SWMP requirements. - Deliveries will be arranged to match work stages, to avoid materials being stored on site longer than necessary. - All storage areas on site will be safe, secure and weatherproof. - A site induction will aim to brief the construction team on minimising rework from errors and poor workmanship.
Site Waste	The design team and construction team will procure: - A pre-demolition audit, - A Sustainable Procurement Plan, - A bespoke Site Waste Management Plan, - Target to divert minimum 95% of construction waste and 95% of the demolition/excavation waste from going into the landfill. - 20% of demolition waste re-used in the new property (as aggregate) - The benchmark target for a resource efficiency of $13.3m^3$ (or 11.1 tonnes) of waste per $100m^2$ of GIA.
Materials Sustainability	The dwelling, wherever possible, will use BRE Green Guide 'A' rated materials and manufacturers will be chosen that can demonstrate their products are sustainably sourced and manufactured. All Timber used will be FSC or PEFC certified timber. All concrete, steel and windows used in the development will be ISO14001 certified.
Waste Hierarchy	



Proposed Energy Strategy
Greencroft Gardens

Recommendation	The energy strategy for the proposed scheme is to target advanced energy efficiency fabric measures, utilizing mechanical ventilation with heat recovery (MVHR) and a highly efficient Air Source Heat Pump as the main heating and DHW system, alongside 4 kWp Solar Photovoltaics (PV) supplying clean energy. The proposal is to build using advanced fabric standards, surpassing Part L 2021 requirements. The thermal performance targets of the dwellings are as follows: U-Values of 0.12 W/m2K for the ground floor, 0.10 W/m2K for the roof, 0.15 W/m2K for walls and high performance double and triple-glazed windows of 1.0 W/m2K (average across site). A maximum air permeability of 3 m3/m2/hr at 50 pa, is targeted, and to be achieved on site. Thermal bridging will be designed out with an average Y-value of 0.05. Full MVHR ventilation will surpass Part F requirements. Overheating will be designed out through overhangs, shading and higher G-value glazing, in addition to MVHR.
CO2 Savings Summary	The baseline carbon emissions for the scheme are **4,009 kgCO2/yr**. Following implementation of measures within this report; a total saving of **3,312 kgCO2/yr** will be made, a **82.33%** overall carbon reduction, far surpassing the 19% CO2 sabing detailed in the Energy Efficiency CPG. These measures include: - Be Lean (**6.2%** savings over baseline): Energy efficiency measures to improve the building fabric and services: U-Values 0.15 for walls, 0.10 for roof, 0.12 for the ground floor and 1.0 for windows - in W/m2K, low air tightness (maximum of 3 m3/m2/hr at 50 Pa), advanced thermal bridging at an average Y-value of 0.05. - Be Clean (**0%** savings over Lean case); No further savings through the use of heat networks are planned. - Be Green (**81%** savings over Lean/Clean case): Low carbon heating and hot water through an Air Source Heat Pump and renewable electricity via 4kWp solar Photovoltaics (PV) – pictured below.
Part L 2021	The scheme will meet Building Regulations (Part L 2021) and subsequent revisions.

LCA Calculation & specification overview
Greencroft Gardens

Background	Life Cycle Analysis (LCA) or Whole Life Carbon (WLC) is a methodology for assessing the environmental performance of a product (i.e. building) over its life cycle, often referred to as cradle-to-grave analysis. The term cradle in this project refers to the extraction of raw materials. For the purpose of this report the Life Cycle will be from 'cradle' to 60 years of building operation, as the focus of the report is on the embodied carbon in the finished building and a defined time of operation. Building operation (RIBA section B6) beyond 60 years has not been taken into account. However, end of life and reuse and end stages (RIBA WLC section D) have been accounted for in the software. LCA can be measured in terms of energy or carbon emissions. All data in this report refers to carbon emissions throughout all processes.
Scenario 1 – Existing building	The existing dwelling at 134 Greencroft Gardens was built around 1897. It is a two-bedroom dwelling. In this scenario, the property is maintained as existing with figures derived from drawings and SAP 'appendix S' u-values, based on the properties age, as follows: - Walls insulated to U-value of 1.7 - Floor insulated to U-value of 1.2 - Roof insulated to U-value of 2.3 - Windows with U-value of 4.2 - Boiler to minimum 84% efficient and 250-litre tank - Overall floor area: 123m^2
Scenario 2 – Refurbishing and extending existing	The refurbishment and extension scenario at 134 Greencroft Gardens incorporates a larger space, with front and rear extensions and full refurbishment. The following is a summary and energy modelling input values: - Extensions to rear - Re-modelling throughout - New roof area / new windows - U–values: Walls – 0.18 and 0.30 / Roof 0.16 / Floor 0.18 / Windows 1.4 average - Highly efficient new gas boiler w/underfloor heating & rads mix - Overall floor area: 233m^2
Scenario 3 – Demolition and new build.	The proposed new build '134 Greencroft Gardens' will incorporate a larger and more functional space. A targeted 20% recycled content of the demolition used in the new build. The new structure will include new foundations and be of traditional build, with timber used for all partition and stud walls and best practice levels of fabric efficiency. An air Source Heat Pump will supply heat and hot water and solar PV will supply clean electricity. The following is a summary of works and energy modelling input values: - New foundations - 70% recycled content & foamglass caps - Brick and block structure, minimal steel, timber wherever possible - U–values: Walls – 0.15 / Roof 0.10 / Floor 0.12 / Windows 1.0 average - Air permeability to 3 m^2/m^3/hr @ 50pa - Full MVHR ventilation throughout - Highly efficient Air Source Heat Pump w/underfloor heating - 4 kWp Solar Photovoltaics (PV) panels - Overall floor area: 220m^2

1. Existing Embodied Carbon

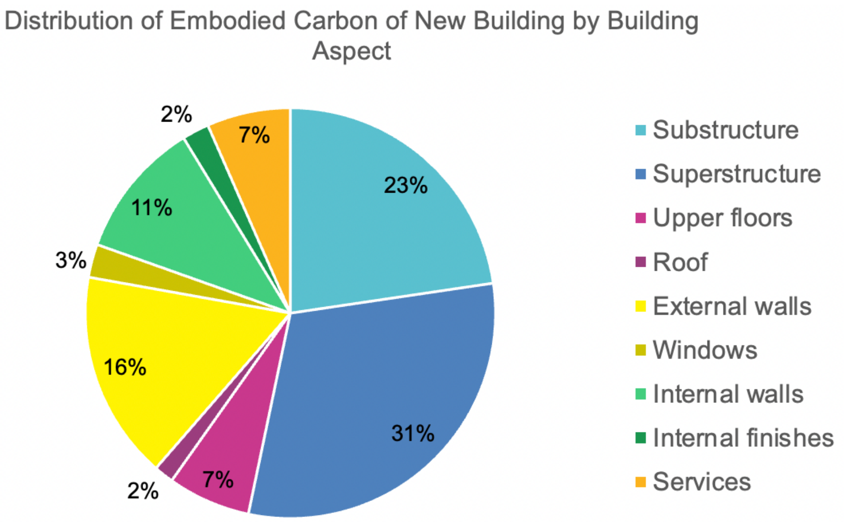
134 Greencroft Gardens

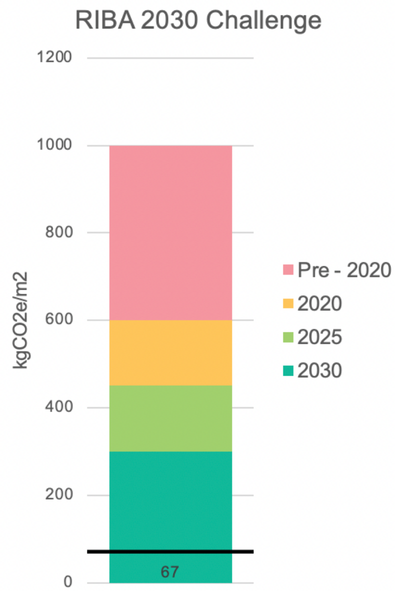
Lifecycle CO_2 Analysis

Embodied energy breakdown

Below are the key build features of the existing building and distribution of embodied carbon in the materials in the existing at 134 Greencroft Gardens.

Substructure	Piles	RC 32/40 (50kg/m3 reinforcement)	Existing
Substructure	Pile caps	RC 32/40 (200kg/m3 reinforcement)	Existing
Substructure	Basement walls	RC 32/40 (125kg/m3 reinforcement)	Existing
Substructure	Lowest floor slab	RC 32/40 (150kg/m3 reinforcement)	Existing
Superstructure	Core structure	RC 32/40 (100kg/m3 reinforcement)	Existing
Superstructure	Columns	Steel	Existing
Upper floors	Floor slab	Steel Concrete Composite	Existing
Upper floors	Joisted floors	Timber Joists + OSB topper (Domestic)	Existing
Roof	Roof	Timber Pitch Roof	Existing
Roof	Roof finishes	Bitumous Sheet	Existing
External walls	Facade	Blockwork with Brick	Existing
Windows	Glazing	Single Glazing	Existing
Windows	Window frames	Solid softwood timber frame	Existing
Internal walls	Partitions	Plasterboard + Steel Studs	Existing
Internal finishes	Ceilings	Plasterboard	Existing
Internal finishes	Floors	Carpet	Existing
Services	Services	Low	Existing





1. Existing Lifecycle Carbon

134 Greencroft Gardens

Lifecycle CO_2 Analysis

Introduction

The following section looks at the carbon emissions throughout the life cycle of the existing building. This is broken into:

- **Embodied carbon** in the physical structure, carbon associated with construction works, maintenance over time and end of life.
- **In-use carbon** from occupation and operation of the building. The operational carbon has been calculated using SAP to determine the yearly Dwelling Emission Rate if the building remains as existing.

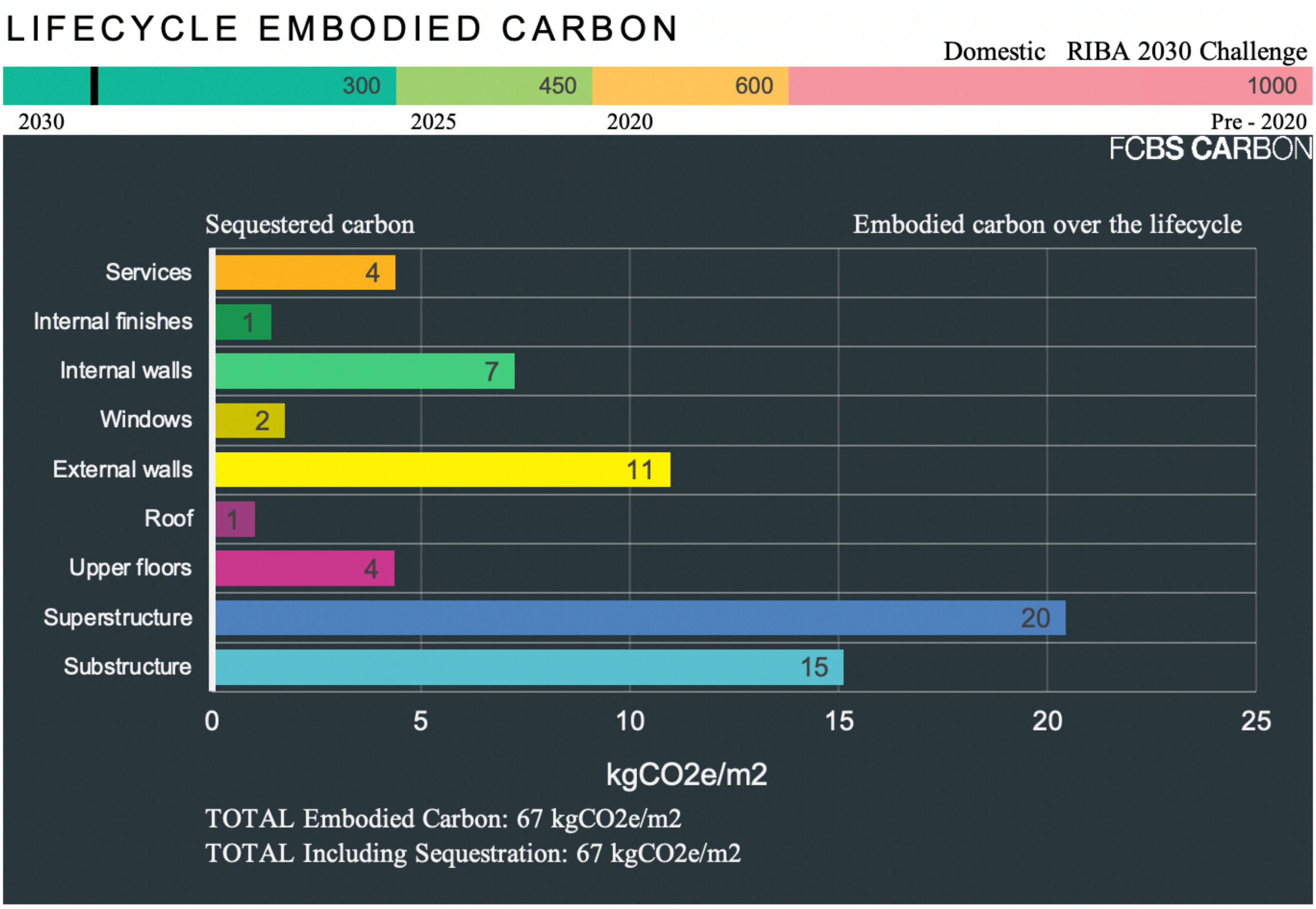
Summary Table

	$kgCO_2$ / m^2	Total $kgCO_2$
Embodied (RIBA stage A1-D, excluding B6)	**67**	**8,266**
In-use (RIBA stage B6)	**3,297**	**407,121**
TOTAL	**3,364**	**415,387**

Observations

The embodied carbon is a fraction of the overall lifecycle emissions - over a 60-year life-cycle. Operational emissions are very high due to the poor energy efficiency of the existing.

Summary Graph



2. Refurb & Extension Embodied Carbon

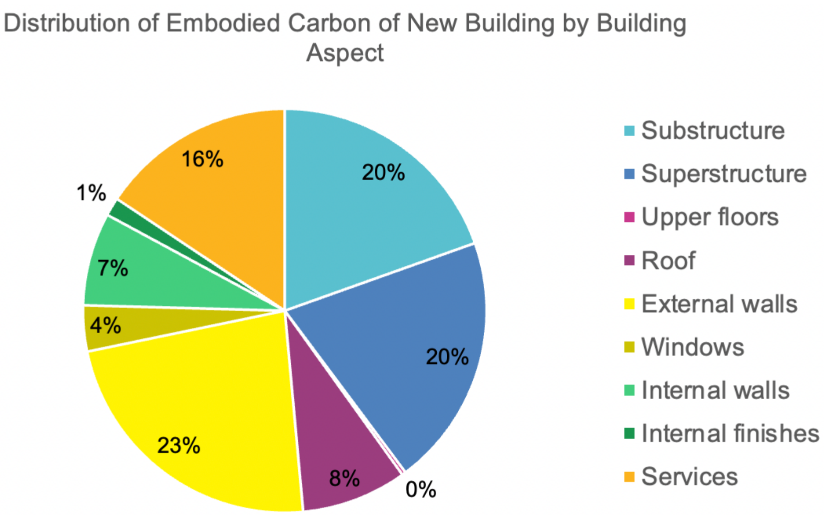
134 Greencroft Gardens

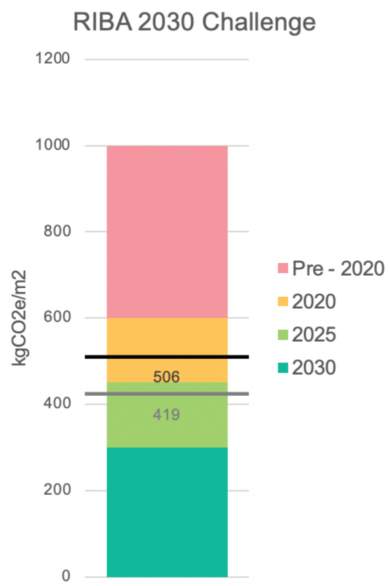
Lifecycle CO_2 Analysis

Embodied energy breakdown

Below are the key build features of the refurbishment and extension scenario and distribution of embodied carbon in the materials.

Substructure	Lowest floor slab	RC 32/40 (150kg/m3 reinforcement)	New	50%
Substructure	Ground insulation	EPS	New	
Superstructure	Core structure	RC 32/40 (100kg/m3 reinforcement)	Existing	
Superstructure	Columns	Steel	Existing	
Superstructure	Beams	Steel	New	50%
Upper floors	Joisted floors	JJI Engineered Joists + OSB topper	Existing	50%
Roof	Roof	Timber Pitch Roof	New	90%
Roof	Roof insulation	EPS	New	
Roof	Roof finishes	Ceramic tile	Existing	
External walls	Facade	Blockwork with Brick	Existing	40%
External walls	Wall insulation	PIR	Existing	
Internal walls	Partitions	Plasterboard + Steel Studs	Existing	50%
Internal finishes	Ceilings	Plasterboard	Existing	50%
Internal finishes	Floors	Carpet	Existing	50%
Services	Services	Medium	New	
Windows	Glazing	Double Glazing	New	
Windows	Window frames	Solid softwood timber frame	New	
External walls	Facade	Blockwork with Brick	New	60%
External walls	Wall insulation	PIR	New	60%
Upper floors	Joisted floors	Timber Joists + OSB topper (Domestic)	New	50%
Internal finishes	Floors	Solid timber floorboards	New	50%
Internal walls	Partitions	Plasterboard + Timber Studs	New	50%
Internal finishes	Ceilings	Plasterboard	New	50%
Roof	Roof	Timber Pitch Roof	Existing	10%





2. Refurb & Extension Lifecycle Carbon

134 Greencroft Gardens

Introduction	The following section looks at the carbon emissions throughout the life cycle of the existing building. This is broken into:

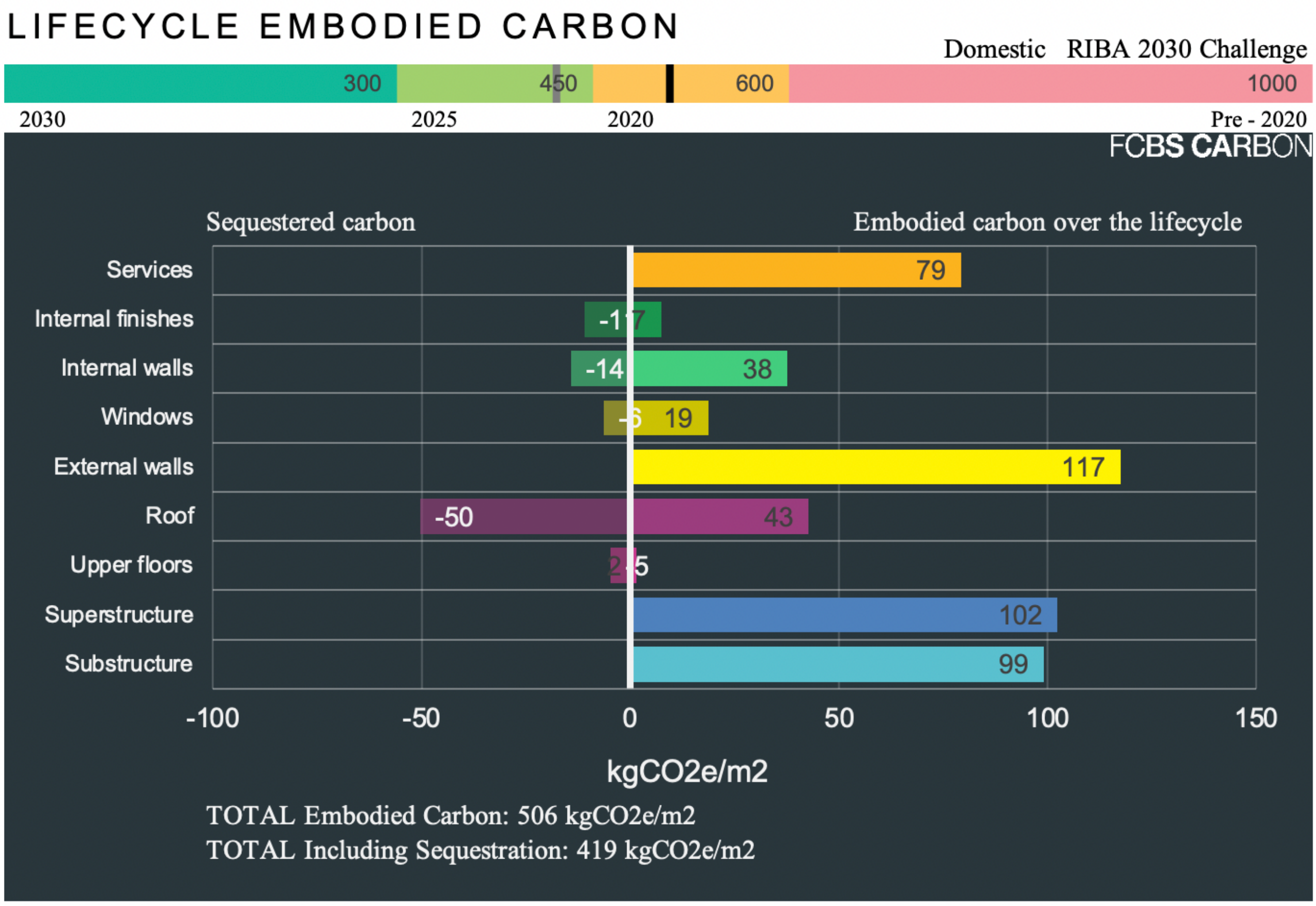
- **Embodied carbon** in the physical structure, carbon associated with construction works, maintenance over time and end of life.
- **In-use carbon** from occupation and operation of the building. The operational carbon has been calculated using SAP to determine the yearly Dwelling Emission Rate if the building is refurbished.

Summary Table

	$kgCO_2$ / m^2	Total $kgCO_2$
Embodied (RIBA stage A1-D, excluding B6)	**506**	**117,898**
In-use (RIBA stage B6)	**1,235**	**287,988**
TOTAL	**1,741**	**405,886**

Observations	The embodied carbon and construction works are considerable due to additional floorspace and steel work. Overall in-use emissions are increased due to increased floorspace, but per m^2 is average.

Summary Graph



3. New Build Embodied Carbon

134 Greencroft Gardens

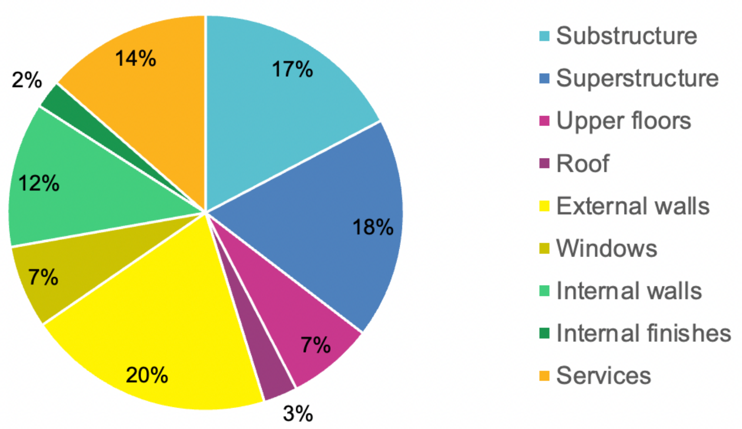
Lifecycle CO_2 Analysis

Embodied energy breakdown

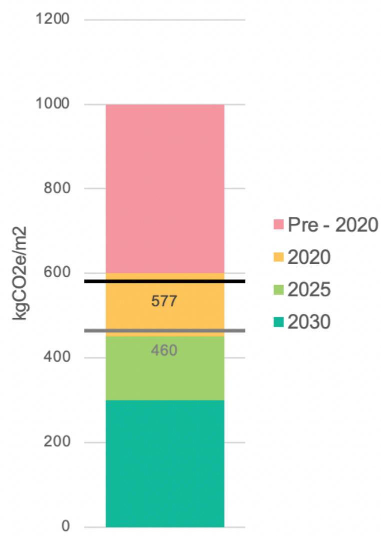
Below are the key build features of the proposed new building and distribution of embodied carbon in the materials.

Substructure	Piles	RC 32/40 70% GGBS (50kg/m3 reinforcement)	New
Substructure	Pile caps	RC 32/40 70% GGBS (200kg/m3 reinforcement)	New
Substructure	Capping beams	Foamglass (domestic only)	New
Substructure	Lowest floor slab	RC 32/40 70% GGBS (150kg/m3 reinforcement)	New
Substructure	Ground insulation	EPS	New
Superstructure	Beams	Steel	New
Upper floors	Floor slab	RC 32/40 50% GGBS (100kg/m3 reinforcement)	New
Upper floors	Joisted floors	Timber Joists + OSB topper (Domestic)	New
Roof	Roof	Timber Pitch Roof	New
Roof	Roof insulation	Cellulose, loose fill	New
Roof	Roof finishes	Ceramic tile	New
External walls	Facade	Party Wall Brick	New
External walls	Wall insulation	Rockwool	New
Windows	Glazing	Triple Glazing	New
Windows	Window frames	Solid softwood timber frame	New
Internal walls	Partitions	Plasterboard + Timber Studs	New
Internal finishes	Ceilings	Plasterboard	New
Internal finishes	Floors	Solid timber floorboards	New
Services	Services	Medium	New
External walls	Facade	Blockwork with Brick	New

Distribution of Embodied Carbon of New Building by Building Aspect



RIBA 2030 Challenge



3. New Build Lifecycle Carbon

134 Greencroft Gardens

Introduction

The following section looks at the carbon emissions throughout the life cycle of the existing building. This is broken into:

- **Embodied carbon** in the physical structure, carbon associated with construction works, maintenance over time and end of life.
- **In-use carbon** from occupation and operation of the building. The operational carbon has been calculated using SAP to determine the yearly Dwelling Emission Rate if the building remains as existing.

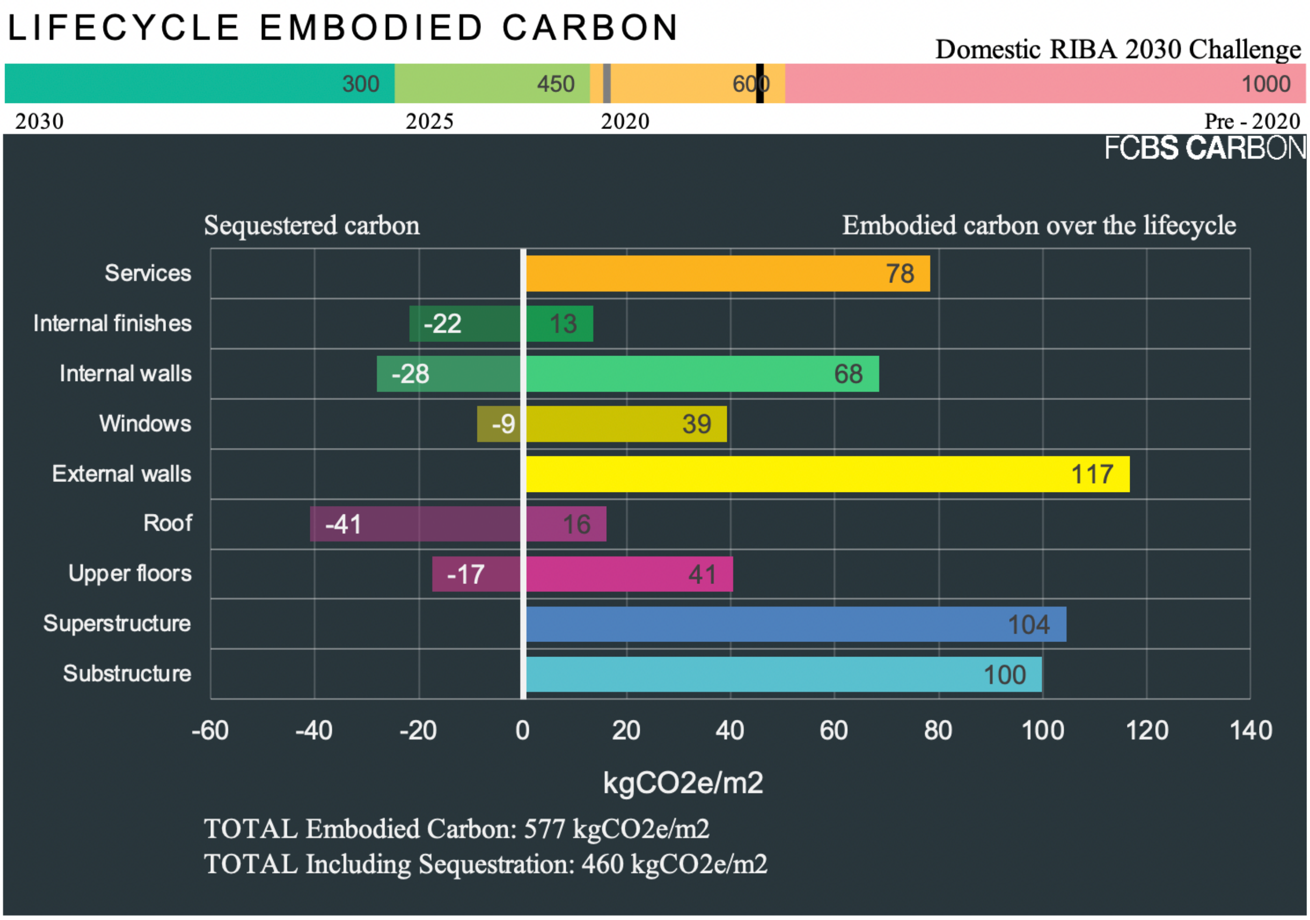
Observations

The new build is fairly carbon efficient in embodied energy, due to as much internal timber use as possible, stud walls etc. The in-use emission are particularly impressive as an ultra-low carbon build. The development emits only **182,861 $KgCO_2$** overall, over 60 years.

Summary Table

	$kgCO_2$ / m^2	Total $kgCO_2$
Embodied (RIBA stage A1-D, excluding B6)	**577**	**126,940**
In-use (RIBA stage B6)	**254**	**55,921**
TOTAL	**831**	**182,861**

Summary Graph



green tiger SUSTAINABILITY

Lifecycle Analysis Comparison
134 Greencroft Gardens

Introduction

The following section analyses the results of the three case studies in order to directly compare the scenarios.

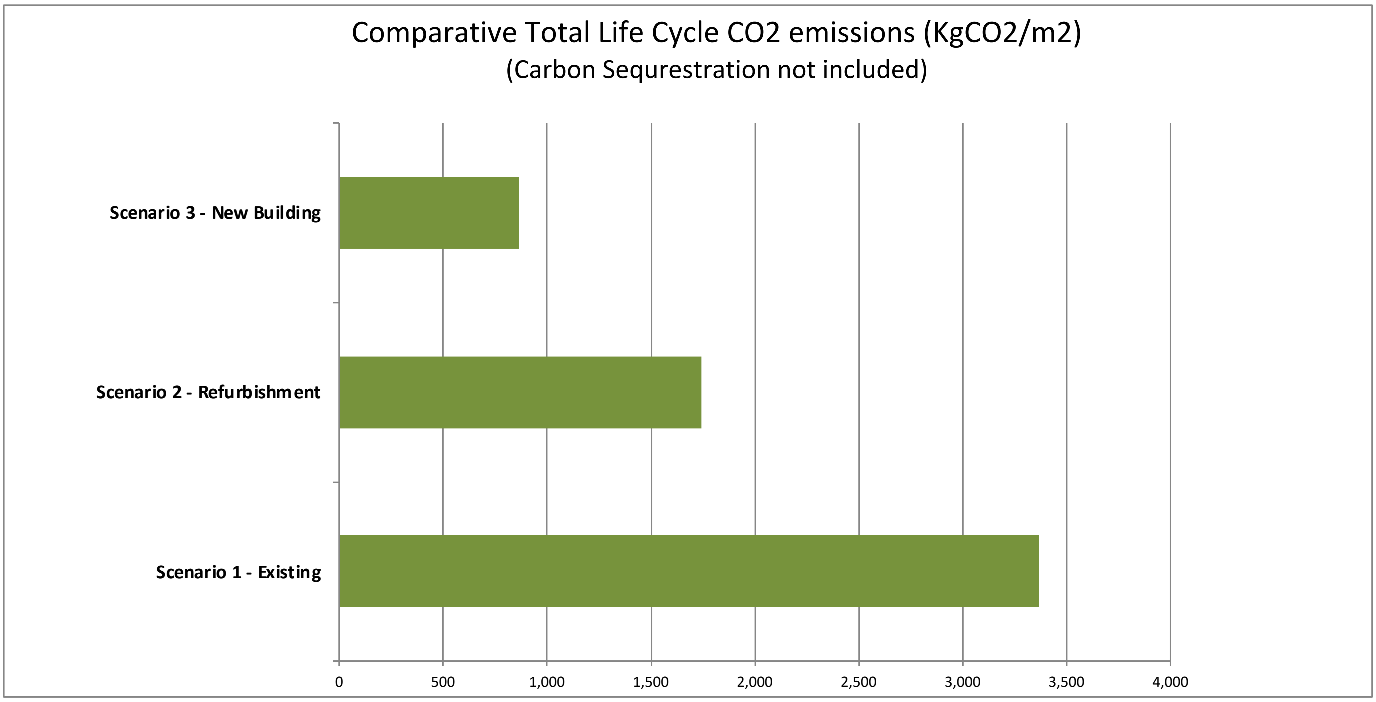
Comparative Analysis

- The study concludes the new build, scenario 3, has lower carbon emissions, emitting less than **half of the existing or the refurbishment** scenario CO_2 emissions, over a 60-year lifecycle.
- The floor areas of the proposed new build and refurbishment are similar, but despite all new elements, there is a saving of **216,607 KgCO_2** in new build embodied emissions due to the ultra-low carbon design of the proposed.
- The existing has minimal embodied emissions due to no initial works, but **very high in-use emissions**, particularly for the size if the existing property.
- If carbon sequestration is considered (i.e. carbon 'locked in' through using materials such as timber), the new build favours further still.
- When analysed on a **Kg CO_2 per m^2 basis**, the refurb is better than the existing and the new build demonstrates its impressive carbon efficiency.

Summary Table

	CO_2 embodied	CO_2 In-Use	CO^2 per m2	CO_2 Overall
1. Existing	8,266	407,121	3,364	415,387
2. Refurb	117,898	287,988	1,741	405,886
3. New	126,940	55,921	831	182,861

Summary Graph



Conclusion
134 Greencroft Gardens
Lifecycle CO_2 Analysis

Key findings

- The new build scenario 3 can be considered a much more carbon efficient and sustainable proposal from a long-term point of view.

- In addition to the low-carbon design of the proposed new build dwelling, the exemplary property will also:
  - Save approx. 876,000 litres of water over 60 years.
  - Create a more efficient and useable space
  - Be healthier and lighter space for people to live.
  - Have better accessibility, and:
  - A net-greening effect on the site.

- The existing building has some age-related structural and damp issues

- The proposed new build will last much longer than a refurbishment in the future - and will also be designed to withstand any further subsidence issues, which will increase as a result of climate change.

- The new build scenario 3 will use 20% materials from the demolition of the existing building, as recommended by Camden Council. This will include some brick façades and crushed aggregate in the substructure (which is composed of 70% overall recycled materials)

- New build scenario 3 surpasses the Camden targets, but also London plan targets on carbon emissions, notably 35% beyond Part L building regulations CO_2 levels, with the property meeting an **82.33%** reduction in CO2 over Part L. This is met through forward-thinking low carbon design and technologies.

- If looked at further in the future the carbon saving of Scenario 3 would continue to increase dramatically, due to the low carbon in-use emissions of the proposed dwelling.

Appendix

Full SAP calculations of the three scenarios can be found on the following pages.

Summary for Input Data

Property Reference	Greencroft Gardens	Issued on Date	04/05/2023
Assessment Reference	Existing	Prop Type Ref	
Property	Greencroft Gardens		

SAP Rating	48 E	DER	64.03	TER	12.24
Environmental	41 E	% DER < TER			-423.12
CO_2 Emissions (t/year)	7.09	DFEE	235.84	TFEE	47.75
Compliance Check	See BREL	% DFEE < TFEE			-393.88
% DPER < TPER	-438.92	DPER	346.52	TPER	64.30

Assessor Details	Mr. Nicholas Bowen	Assessor ID	D719-0001
Client	Green Tiger, Ross Standaloft		

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	West
Property Tenture	1
Transaction Type	6
Terrain Type	Suburban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2023
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown
6.0 Thermal Mass Parameter	Precise calculation

7.0 Electricity Tariff	Standard
Smart electricity meter fitted	No
Smart gas meter fitted	No

7.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground floor:	43.70 m	58.70 m²	2.61 m
1st Storey:	38.30 m	64.67 m²	3.30 m

8.0 Living Area 34.70 m²

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Res	Shelter	Openings	Area Calculation Type
External Wall 1	Solid Wall	Solid wall : plasterboard on dabs, insulation, any outside structure	1.70	9.00	205.00	185.32	0.00	None	19.68	Enter Gross Area

9.2 Internal Walls

Description	Construction	Kappa (kJ/m²K)	Area (m²)
GF	Dense block, plasterboard on dabs	75.00	49.50
FF	Plasterboard on timber frame	9.00	78.24

10.0 External Roofs

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Code	Shelter Factor	Calculation Type	Openings
External Roof flat	External Flat Roof	Plasterboard, insulated flat roof	2.30	9.00	13.20	0.00	None	0.00	Enter Gross Area	0.00
External Roof pitch	External Slope Roof	Plasterboard, insulated slope	2.30	9.00	50.40	1.16	None	0.00	Enter Gross Area	1.16
Dormer	External Flat Roof	Plasterboard, insulated flat roof	2.30	9.00	4.30	0.00	None	0.00	Enter Gross Area	0.00

10.2 Internal Ceilings

Description	Storey	Construction	Area (m²)
Internal Ceiling 1	Lowest occupied	Plasterboard ceiling, carpeted chipboard floor	58.70

11.0 Heat Loss Floors

Description	Type	Storey Index	Construction	U-Value (W/m²K)	Shelter Code	Shelter Factor	Kappa (kJ/m²K)	Area (m²)
Heatloss Floor 1	Ground Floor - Solid	Lowest occupied	Slab on ground, screed over insulation	1.20	None	0.00	110.00	58.70
Heatloss Floor 2	Exposed Floor - Timber	+1	Timber exposed floor, insulation between joists	1.20	None	0.00	20.00	5.97

11.2 Internal Floors

Description	Storey Index	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1		Plasterboard ceiling, carpeted chipboard floor	9.00	58.70

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Windows	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.70	4.20
Doors	Manufacturer	Solid Door							3.00
Roof lights	Manufacturer	Roof Light	Double Low-E Soft 0.05			0.63		0.70	4.20

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
Front door	Doors	External Wall 1	West	2.73	
Front elevation	Windows	External Wall 1	West	9.33	
Side elevation	Windows	External Wall 1	South	5.87	
Side door	Doors	External Wall 1	South	1.75	
RL	Roof lights	External Roof pitch	West	0.58	30
RL	Roof lights	External Roof pitch	East	0.58	30

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Default	
Y-value	0.20	W/m²K
18.0 Pressure Testing	No	
Test Method	Blower Door	

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System	No

22.0 Lighting

No Fixed Lighting	No

Name	Efficacy	Power	Capacity	Count
Lighting 1	81.00	10	810	14

24.0 Main Heating 1	SAP table	
Percentage of Heat	100.00	%
Fuel Type	Mains gas	
SAP Code	104	
In Winter	84.00	
In Summer	75.00	
Controls SAP Code	2104	
Delayed Start Stat	No	
Flue Type	Balanced	
Fan Assisted Flue	No	
Is MHS Pumped	Pump in heated space	
Heating Pump Age	2013 or later	
Heat Emitter	Radiators	
Flow Temperature	Unknown	
Boiler Interlock	Yes	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	

26.0 Heat Networks	None
28.0 Water Heating	
Water Heating	Main Heating 1
SAP Code	901
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
Cold Water Source	From header tank
Bath Count	1
28.3 Waste Water Heat Recovery System	
29.0 Hot Water Cylinder	None
In Airing Cupboard	No
34.0 Small-scale Hydro	None

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Ratings after improvement Environmental Impact
			E 48	E 42
	£3,500 - £5,500	£155	E 53	E 42
			0	0

Summary for Input Data

Property Reference	Greencroft Gardens	Issued on Date	04/05/2023
Assessment Reference	Hypothetical ASHP	Prop Type Ref	
Property	Greencroft Gardens		

SAP Rating	75 C	DER	4.87	TER	9.68
Environmental	95 A	% DER < TER			49.69
CO_2 Emissions (t/year)	0.96	DFEE	77.91	TFEE	44.76
Compliance Check	See BREL	% DFEE < TFEE			-74.09
% DPER < TPER	2.27	DPER	49.85	TPER	51.01

Assessor Details	Mr. Nicholas Bowen	Assessor ID	D719-0001
Client	Green Tiger, Ross Standaloft		

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	West
Property Tenture	1
Transaction Type	6
Terrain Type	Suburban
1.0 Property Type	House, Detached
2.0 Number of Storeys	3
3.0 Date Built	2023
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown
6.0 Thermal Mass Parameter	Precise calculation

7.0 Electricity Tariff	Standard
Smart electricity meter fitted	No
Smart gas meter fitted	No

7.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground floor:	40.70 m	92.97 m²	3.30 m
1st Storey:	39.70 m	90.44 m²	2.54 m
2nd Storey:	28.20 m	49.68 m²	2.64 m

8.0 Living Area 34.70 m²

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Res	Shelter	Openings	Area Calculation Type
External Wall 1	Solid Wall	Solid wall : plasterboard on dabs, insulation, any outside structure	0.30	9.00	123.63	91.36	0.00	None	32.27	Enter Gross Area
New walls	Cavity Wall	Cavity wall : plasterboard on dabs, AAC block, filled cavity, any outside structure	0.18	60.00	184.61	184.61	0.00	None	0.00	Enter Gross Area

9.2 Internal Walls

Description	Construction	Kappa (kJ/m²K)	Area (m²)
GF	Dense block, plasterboard on dabs	75.00	85.00
FF	Plasterboard on timber frame	9.00	110.00
SF	Plasterboard on timber frame	9.00	45.00

10.0 External Roofs

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Code	Shelter Factor	Calculation Type	Openings
Roof	External Flat Roof	Plasterboard, insulated flat roof	0.15	9.00	92.97	0.00	None	0.00	Enter Gross Area	0.00

10.2 Internal Ceilings

Description	Storey	Construction	Area (m²)
Internal Ceiling 1	Lowest occupied	Plasterboard ceiling, carpeted chipboard floor	90.44
FF	+1	Plasterboard ceiling, carpeted chipboard floor	49.68

11.0 Heat Loss Floors

Description	Type	Storey Index	Construction	U-Value (W/m²K)	Shelter Code	Shelter Factor	Kappa (kJ/m²K)	Area (m²)
Heatloss Floor 1	Ground Floor - Solid	Lowest occupied	Slab on ground, screed over insulation	0.18	None	0.00	110.00	52.80
New floor	Ground Floor - Solid	Lowest occupied	Slab on ground, screed over insulation	0.18	None	0.00	110.00	40.17

Summary for Input Data

11.2 Internal Floors

Description	Storey Index	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1		Plasterboard ceiling, carpeted chipboard floor	9.00	90.44
SF		Plasterboard ceiling, carpeted chipboard floor	9.00	49.68

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Windows	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.70	1.60
Doors	Manufacturer	Solid Door							1.60
Roof lights	Manufacturer	Roof Light	Double Low-E Soft 0.05			0.63		0.70	1.60

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
Front door	Doors	External Wall 1	West	2.18	
Front elevation	Windows	External Wall 1	West	23.83	
Side elevation	Windows	External Wall 1	South	1.04	
Rear elevation	Windows	External Wall 1	East	5.21	

14.0 Conservatory None

15.0 Draught Proofing 100 %

16.0 Draught Lobby No

17.0 Thermal Bridging Default

Y-value 0.20 W/m²K

18.0 Pressure Testing No

Test Method Blower Door

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present No

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System No

22.0 Lighting

No Fixed Lighting No

Name	Efficacy	Power	Capacity	Count
Lighting 1	81.00	10	810	20

24.0 Main Heating 1 Database

Percentage of Heat 100.00 %

Database Ref. No. 100063

Fuel Type Electricity

In Winter 0.00

In Summer 0.00

Model Name ECODAN 8.5kW

Manufacturer Mitsubishi Electric Europe B.V.

System Type Heat Pump

Controls SAP Code 2207

Is MHS Pumped Pump in heated space

Heating Pump Age 2013 or later

Heat Emitter Radiators

Flow Temperature Enter value

Flow Temperature Value 35.00

25.0 Main Heating 2 None

26.0 Heat Networks None

Heat Source	Fuel Type	Heating Use	Efficiency	Percentage Of Heat	Heat	Heat Power Ratio	Electrical	Fuel Factor	Efficiency type

Heat source 1
Heat source 2
Heat source 3
Heat source 4
Heat source 5

28.0 Water Heating

Water Heating	Main Heating 1
SAP Code	901
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
Cold Water Source	From header tank
Bath Count	1
Immersion Only Heating Hot Water	No

28.3 Waste Water Heat Recovery System

29.0 Hot Water Cylinder	Hot Water Cylinder	
Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	150.00	L
Loss	1.90	kWh/day
Pipes insulation	Fully insulated primary pipework	
In Airing Cupboard	No	

31.0 Thermal Store	None

32.0 Photovoltaic Unit	One Dwelling
Export Capable Meter?	No
Connected To Dwelling	Yes
Diverter	No
Battery Capacity [kWh]	0.00

PV Cells kWp	Orientation	Elevation	Overshading	FGHRS	MCS Certificate	Overshading Factor	MCS Certificate Reference	Panel Manufacturer
3.00	Horizontal	Horizontal			Yes	1.00		

34.0 Small-scale Hydro	None

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Recommendations
Lower cost measures
None
Further measures to achieve even higher standards

			Ratings after improvement	
	Typical Cost	**Typical savings per year**	**SAP rating**	**Environmental Impact**
	£4,000 - £6,000	£82	C 76	A 95
			0	0
			0	0

Summary for Input Data

elmhurst energy

Property Reference	Greencroft Gardens	Issued on Date	04/05/2023
Assessment Reference	Lean	Prop Type Ref	
Property	Greencroft Gardens		

SAP Rating	87 B	DER	9.06	TER	9.66
Environmental	90 B	% DER < TER			6.21
CO_2 Emissions (t/year)	1.71	DFEE	39.88	TFEE	44.40
Compliance Check	See BREL	% DFEE < TFEE			10.18
% DPER < TPER	-4.58	DPER	53.15	TPER	50.82

Assessor Details	Mr. Nicholas Bowen	Assessor ID	D719-0001
Client	Green Tiger, Ross Standaloft		

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	West
Property Tenture	1
Transaction Type	6
Terrain Type	Suburban
1.0 Property Type	House, Detached
2.0 Number of Storeys	3
3.0 Date Built	2023
4.0 Sheltered Sides	3
5.0 Sunlight/Shade	Average or unknown
6.0 Thermal Mass Parameter	Precise calculation

7.0 Electricity Tariff	Standard
Smart electricity meter fitted	No
Smart gas meter fitted	No

7.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground floor:	40.40 m	91.96 m²	2.90 m
1st Storey:	36.40 m	78.00 m²	2.80 m
2nd Storey:	28.19 m	49.38 m²	2.46 m

8.0 Living Area 82.50 m²

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Res	Shelter	Openings	Area Calculation Type
Walls	Cavity Wall	Cavity wall : plasterboard on dabs, AAC block, filled cavity, any outside structure	0.15	60.00	267.13	242.26	0.00	None	24.87	Enter Gross Area
Dormer	Timber Frame	Timber framed wall (one layer of plasterboard)	0.15	9.00	15.07	5.87	0.00	None	9.20	Enter Gross Area

9.2 Internal Walls

Description	Construction	Kappa (kJ/m²K)	Area (m²)
GF	Plasterboard on timber frame	9.00	57.42
FF	Plasterboard on timber frame	9.00	149.00
SF	Plasterboard on timber frame	9.00	28.26

10.0 External Roofs

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Code	Shelter Factor	Calculation Type	Openings
GF Flat	External Flat Roof	Plasterboard, insulated flat roof	0.10	9.00	9.00	7.76	None	0.00	Enter Gross Area	7.76
FF Flat	External Flat Roof	Plasterboard, insulated flat roof	0.10	9.00	26.50	0.00	None	0.00	Enter Gross Area	0.00
SF Flat	External Flat Roof	Plasterboard, insulated flat roof	0.10	9.00	25.50	0.00	None	0.00	Enter Gross Area	0.00
Pitch	External Slope Roof	Plasterboard, insulated slope	0.10	9.00	39.00	1.00	None	0.00	Enter Gross Area	1.00
Dormer	External Flat Roof	Plasterboard, insulated flat roof	0.10	9.00	15.07	0.00	None	0.00	Enter Gross Area	0.00

10.2 Internal Ceilings

Description	Storey	Construction	Area (m²)
Internal Ceiling 1	Lowest occupied	Plasterboard ceiling, carpeted chipboard floor	78.00

Internal Ceiling 2	+1	Plasterboard ceiling, carpeted chipboard floor	49.38

11.0 Heat Loss Floors

Description	Type	Storey Index	Construction	U-Value (W/m²K)	Shelter Code	Shelter Factor	Kappa (kJ/m²K)	Area (m²)
Heatloss Floor 1	Ground Floor - Solid	Lowest occupied	Slab on ground, screed over insulation	0.12	None	0.00	110.00	91.96

11.2 Internal Floors

Description	Storey Index	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1		Plasterboard ceiling, carpeted chipboard floor	9.00	49.38
Internal Floor 2		Plasterboard ceiling, carpeted chipboard floor	9.00	78.00

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Windows	Manufacturer	Window	Triple Low-E Soft 0.05			0.57		0.70	1.00
Door	Manufacturer	Solid Door							1.00
Roof light	Manufacturer	Roof Light	Triple Low-E Soft 0.05			0.57		0.70	1.00
Roof window	Manufacturer	Roof Window	Triple Low-E Soft 0.05			0.57		0.70	1.00

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
Front door	Door	Walls	West	2.18	
Front elevation	Windows	Walls	West	16.24	
Front dormer	Windows	Dormer	West	9.20	
Rear elevation	Windows	Walls	East	4.09	
Side elevation	Windows	Walls	South	1.18	
Side elevation	Windows	Walls	North	1.18	
RL Rear	Roof light	Pitch	East	1.00	30
RL	Roof window	GF Flat	Horizontal	7.76	0

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted	Reference:	Imported
E2 Other lintels (including other steel lintels)	Gov Approved Scheme	17.59	0.04	0.04		Yes
E3 Sill	Gov Approved Scheme	16.68	0.03	0.03		Yes
E4 Jamb	Gov Approved Scheme	54.47	0.04	0.04		Yes
E5 Ground floor (normal)	Gov Approved Scheme	40.40	0.10	0.10		Yes
E6 Intermediate floor within a dwelling	Gov Approved Scheme	64.00	0.00	0.00		No
E16 Corner (normal)	Gov Approved Scheme	26.00	0.05	0.05		No
R1 Head of roof window	Table K1 - Default	1.22	0.24	0.24		Yes
R2 Sill of roof window	Table K1 - Default	1.22	0.24	0.24		Yes
R3 Jamb of roof window	Table K1 - Default	12.77	0.24	0.24		Yes
R11 Upstands or kerbs of rooflights	Table K1 - Default	4.00	0.24	0.24		Yes
E14 Flat roof	Table K1 - Default	33.00	0.16	0.16		No
E13 Gable (insulation at rafter level)	Gov Approved Scheme	10.40	0.05	0.05		No
E12 Gable (insulation at ceiling level)	Gov Approved Scheme	6.80	0.05	0.05		No
R9 Roof to wall (flat ceiling)	Table K1 - Default	4.70	0.32	0.32		No
R7 Flat ceiling (inverted)	Table K1 - Default	4.70	0.12	0.12		No
R6 Flat ceiling	Table K1 - Default	15.00	0.12	0.12		No

Y-value	0.05	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	3.00	m³/(h.m²) @ 50 Pa
Test Method	Blower Door	

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	Yes
Mechanical Ventilation data Type	Database
Type	Balanced mechanical ventilation with heat recovery
MV Reference Number	500167
Configuration	5
Manufacturer SFP	0.86
Duct Type	Rigid
MVHR Efficiency	89.00

Wet Rooms	5
SFP from Installer Commissioning Certificate	No
MVHR System Location	Inside heated envelope (installed exclusively)
Duct Installation Specification	Level 1

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System	No

22.0 Lighting

No Fixed Lighting	No

Name	Efficacy	Power	Capacity	Count
Lighting 1	81.00	10	810	22

24.0 Main Heating 1	Database
Description	boiler
Percentage of Heat	100.00 %
Database Ref. No.	17919
Fuel Type	Mains gas
In Winter	88.50
In Summer	86.60
Model Name	NCB-28LDWE
Manufacturer	KD Navien
System Type	Combi boiler
Controls SAP Code	2110
Delayed Start Stat	Yes
Flue Type	Balanced
Fan Assisted Flue	Yes
Is MHS Pumped	Pump in heated space
Heating Pump Age	2013 or later
Heat Emitter	Radiators
Flow Temperature	Enter value
Flow Temperature Value	35.00
Boiler Interlock	No
Combi boiler type	Standard Combi
Combi keep hot type	None

25.0 Main Heating 2	None
26.0 Heat Networks	None

28.0 Water Heating

Water Heating	Main Heating 1
SAP Code	901
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
Cold Water Source	From header tank
Bath Count	1

28.3 Waste Water Heat Recovery System

29.0 Hot Water Cylinder	None

In Airing Cupboard	No
34.0 Small-scale Hydro	None

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Ratings after improvement Environmental Impact
			B 87	B 91
	£3,500 - £5,500	£180	B 90	B 91
			0	0

Summary for Input Data

Property Reference	Greencroft Gardens	Issued on Date	04/05/2023
Assessment Reference	Proposed	Prop Type Ref	
Property	Greencroft Gardens		

SAP Rating	92 A	DER	1.68	TER	9.51
Environmental	98 A	% DER < TER			82.33
CO_2 Emissions (t/year)	0.31	DFEE	39.88	TFEE	44.40
Compliance Check	See BREL	% DFEE < TFEE			10.18
% DPER < TPER	66.77	DPER	16.61	TPER	49.99

Assessor Details	Mr. Nicholas Bowen	Assessor ID	D719-0001
Client	Green Tiger, Ross Standaloft		

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	West
Property Tenture	1
Transaction Type	6
Terrain Type	Suburban
1.0 Property Type	House, Detached
2.0 Number of Storeys	3
3.0 Date Built	2023
4.0 Sheltered Sides	3
5.0 Sunlight/Shade	Average or unknown
6.0 Thermal Mass Parameter	Precise calculation

7.0 Electricity Tariff	Standard
Smart electricity meter fitted	No
Smart gas meter fitted	No

7.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground floor:	40.40 m	91.96 m²	2.90 m
1st Storey:	36.40 m	78.00 m²	2.80 m
2nd Storey:	28.19 m	49.38 m²	2.46 m

8.0 Living Area 82.50 m²

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Res	Shelter	Openings	Area Calculation Type
Walls	Cavity Wall	Cavity wall : plasterboard on dabs, AAC block, filled cavity, any outside structure	0.15	60.00	267.13	242.26	0.00	None	24.87	Enter Gross Area
Dormer	Timber Frame	Timber framed wall (one layer of plasterboard)	0.15	9.00	15.07	5.87	0.00	None	9.20	Enter Gross Area

9.2 Internal Walls

Description	Construction	Kappa (kJ/m²K)	Area (m²)
GF	Plasterboard on timber frame	9.00	57.42
FF	Plasterboard on timber frame	9.00	149.00
SF	Plasterboard on timber frame	9.00	28.26

10.0 External Roofs

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Code	Shelter Factor	Calculation Type	Openings
GF Flat	External Flat Roof	Plasterboard, insulated flat roof	0.10	9.00	9.00	7.76	None	0.00	Enter Gross Area	7.76
FF Flat	External Flat Roof	Plasterboard, insulated flat roof	0.10	9.00	26.50	0.00	None	0.00	Enter Gross Area	0.00
SF Flat	External Flat Roof	Plasterboard, insulated flat roof	0.10	9.00	25.50	0.00	None	0.00	Enter Gross Area	0.00
Pitch	External Slope Roof	Plasterboard, insulated slope	0.10	9.00	39.00	1.00	None	0.00	Enter Gross Area	1.00
Dormer	External Flat Roof	Plasterboard, insulated flat roof	0.10	9.00	15.07	0.00	None	0.00	Enter Gross Area	0.00

10.2 Internal Ceilings

Description	Storey	Construction	Area (m²)
Internal Ceiling 1	Lowest occupied	Plasterboard ceiling, carpeted chipboard floor	78.00

Internal Ceiling 2	+1	Plasterboard ceiling, carpeted chipboard floor	49.38

11.0 Heat Loss Floors

Description	Type	Storey Index	Construction	U-Value (W/m²K)	Shelter Code	Shelter Factor	Kappa (kJ/m²K)	Area (m²)
Heatloss Floor 1	Ground Floor - Solid	Lowest occupied	Slab on ground, screed over insulation	0.12	None	0.00	110.00	91.96

11.2 Internal Floors

Description	Storey Index	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1		Plasterboard ceiling, carpeted chipboard floor	9.00	49.38
Internal Floor 2		Plasterboard ceiling, carpeted chipboard floor	9.00	78.00

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Windows	Manufacturer	Window	Triple Low-E Soft 0.05			0.57		0.70	1.00
Door	Manufacturer	Solid Door							1.00
Roof light	Manufacturer	Roof Light	Triple Low-E Soft 0.05			0.57		0.70	1.00
Roof window	Manufacturer	Roof Window	Triple Low-E Soft 0.05			0.57		0.70	1.00

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
Front door	Door	Walls	West	2.18	
Front elevation	Windows	Walls	West	16.24	
Front dormer	Windows	Dormer	West	9.20	
Rear elevation	Windows	Walls	East	4.09	
Side elevation	Windows	Walls	South	1.18	
Side elevation	Windows	Walls	North	1.18	
RL Rear	Roof light	Pitch	East	1.00	30
RL	Roof window	GF Flat	Horizontal	7.76	0

14.0 Conservatory: None

15.0 Draught Proofing: 100 %

16.0 Draught Lobby: No

17.0 Thermal Bridging: Calculate Bridges

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted	Reference:	Imported
E2 Other lintels (including other steel lintels)	Gov Approved Scheme	17.59	0.04	0.04		Yes
E3 Sill	Gov Approved Scheme	16.68	0.03	0.03		Yes
E4 Jamb	Gov Approved Scheme	54.47	0.04	0.04		Yes
E5 Ground floor (normal)	Gov Approved Scheme	40.40	0.10	0.10		Yes
E6 Intermediate floor within a dwelling	Gov Approved Scheme	64.00	0.00	0.00		No
E16 Corner (normal)	Gov Approved Scheme	26.00	0.05	0.05		No
R1 Head of roof window	Table K1 - Default	1.22	0.24	0.24		Yes
R2 Sill of roof window	Table K1 - Default	1.22	0.24	0.24		Yes
R3 Jamb of roof window	Table K1 - Default	12.77	0.24	0.24		Yes
R11 Upstands or kerbs of rooflights	Table K1 - Default	4.00	0.24	0.24		Yes
E14 Flat roof	Table K1 - Default	33.00	0.16	0.16		No
E13 Gable (insulation at rafter level)	Gov Approved Scheme	10.40	0.05	0.05		No
E12 Gable (insulation at ceiling level)	Gov Approved Scheme	6.80	0.05	0.05		No
R9 Roof to wall (flat ceiling)	Table K1 - Default	4.70	0.32	0.32		No
R7 Flat ceiling (inverted)	Table K1 - Default	4.70	0.12	0.12		No
R6 Flat ceiling	Table K1 - Default	15.00	0.12	0.12		No

Y-value: 0.05 W/m²K

18.0 Pressure Testing: Yes

Designed AP_{50}: 3.00 m³/(h.m²) @ 50 Pa

Test Method: Blower Door

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	Yes
Mechanical Ventilation data Type	Database
Type	Balanced mechanical ventilation with heat recovery
MV Reference Number	500167
Configuration	5
Manufacturer SFP	0.86
Duct Type	Rigid
MVHR Efficiency	89.00

Wet Rooms	5	
SFP from Installer Commissioning Certificate	No	
MVHR System Location	Inside heated envelope (installed exclusively)	
Duct Installation Specification	Level 1	

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System	No	

22.0 Lighting

No Fixed Lighting	No	

Name	Efficacy	Power	Capacity	Count
Lighting 1	81.00	10	810	22

24.0 Main Heating 1	Database	
Description	boiler	
Percentage of Heat	100.00	%
Database Ref. No.	100063	
Fuel Type	Electricity	
In Winter	0.00	
In Summer	0.00	
Model Name	ECODAN 8.5kW	
Manufacturer	Mitsubishi Electric Europe B.V.	
System Type	Heat Pump	
Controls SAP Code	2207	
Is MHS Pumped	Pump in heated space	
Heating Pump Age	2013 or later	
Heat Emitter	Radiators	
Flow Temperature	Enter value	
Flow Temperature Value	35.00	
25.0 Main Heating 2	None	
26.0 Heat Networks	None	

28.0 Water Heating

Water Heating	Main Heating 1	
SAP Code	901	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
Cold Water Source	From header tank	
Bath Count	1	
Immersion Only Heating Hot Water	No	

28.3 Waste Water Heat Recovery System

29.0 Hot Water Cylinder	Hot Water Cylinder	
Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	150.00	L

Loss	1.90	kWh/day
Pipes insulation	Fully insulated primary pipework	
In Airing Cupboard	No	

31.0 Thermal Store	None

32.0 Photovoltaic Unit	One Dwelling
Export Capable Meter?	No
Connected To Dwelling	Yes
Diverter	No
Battery Capacity [kWh]	6.00

PV Cells kWp	Orientation	Elevation	Overshading	FGHRS	MCS Certificate	Overshading Factor	MCS Certificate Reference	Panel Manufacturer
4.00	Horizontal	Horizontal	None Or Little		No	1.00		

34.0 Small-scale Hydro	None

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
£4,000 - £6,000	£79	A 93	A 98
		0	0
		0	0