

# Lifecycle CO<sub>2</sub> analysis and sustainability case for demolition

## 9 Woodland Rise

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# Issue Status

## 9 Woodland Rise

### Lifecycle CO<sub>2</sub> Analysis

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## 9 Woodland Rise

### Lifecycle CO<sub>2</sub> Analysis

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# Executive Summary

## 9 Woodland Rise

### Lifecycle CO<sub>2</sub> Analysis

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#### Brief and Findings

There are three key elements to the brief:

1. To consider the case for demolition from both a practical and sustainability viewpoint.

Page 6 notes the key reasons why the proposed new property outweighs the benefits of refurbishing or retaining the existing dwelling. The new dwelling will stand for much longer, make a positive impact in terms of carbon emissions, occupant health, water use and efficient use of floor space.

2. To consider the impact in terms of life-cycle carbon emissions for two scenarios at 9 Woodland Rise: Scenario 1 - refurbishing the existing building to Part L standards, and Scenario 2 – demolition of the existing building and a new build.

- The study concludes the new build, scenario 2 has lower carbon emissions over a 50-year lifecycle, with scenario 2 emitting **181,923 KgCO<sub>2</sub>** less on site.
- Scenario 2 has a larger the internal floor area of scenario 1 and is new build, therefore more embodied carbon emissions. The embodied energy of the materials in the Scenario 2 is **4.09 times** greater than in the scenario 1, which is **63,364 KgCO<sub>2</sub>** more, however this compensates with the savings on the operational phase.
- The carbon emissions of the operational phase of Scenario 1 is **16 times** that in scenario 2, which is **261,762 KgCO<sub>2</sub>** more. This makes the scenario 2 the most carbon efficient in the long term.

3. Ensure carbon emissions of the scheme are low across the whole lifecycle of the project.

- Page 13 of the report addresses this and concludes that the refurbishment emits more carbon emissions than the new build scenario over 50 years. When analysed on a Kg CO<sub>2</sub> per m<sup>2</sup> basis, the new build scenario 2 is even more carbon efficient.

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#### Key findings

- The proposed dwelling is of an exemplary standard and will:
    - Save approx. 1,460,000 litres of water over 50 years.
    - Create a more efficient useable space
    - Be healthier and lighter space for people to live.
    - Be more accessible, and;
    - Will last much longer than refurbishment in the future.
  - Importantly, the new build scenario can be considered much more sustainable from both a long-term carbon emission point of view.
  - Scenario 2 is inline with London plan targets on carbon emissions, notably 35% beyond Part L building regulations CO<sub>2</sub> levels.
  - Overall carbon emissions lower in the new build scenario when analysed over 50 years. If looked at further in the future this carbon saving of Scenario 2 would continue to increase dramatically.
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# Introduction

## 9 Woodland Rise

### Lifecycle CO<sub>2</sub> Analysis

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#### Introduction

Green Tiger Sustainability has been appointed to analyse the lifecycle carbon emissions and making a case for demolition of the existing and building a more efficient new home at 9 Woodland Rise.

Justification that the demolition of the existing dwelling and erection of a new dwelling is required. To have a case, the long-term sustainability of the site should be improved and needs to be demonstrated.

The case for demolition from a sustainability point of view can be made if a comparison of the long-term carbon emission impact between a refurbished only scheme of the existing dwelling and the proposed demolition and new build can be made.

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#### Aim

This document Aims to:

- Make a case for demolition and re-development – from both practical and sustainability viewpoints.
- Consider the impact in terms of Life-cycle carbon emissions for two scenarios at 9 Woodland Rise, this environmental impact will be measured in KgCO<sub>2</sub> and KgCO<sub>2</sub> per metre square:
  - o Scenario 1 - refurbishing the existing building or;
  - o Scenario 2 – demolition of the existing building, building a new build dwelling.
- Establish and analyse the CO<sub>2</sub> impact of the two cases to determine the relative impact and consider the case for demolition from a carbon emission viewpoint

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#### Caveats

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

There are several ways to undertake Life Cycle Analysis, one being the methodology we have developed. There is no set national calculation methodology (unless specified in policy). However, fundamentals and core elements of both ISO14044 and BS EN 15978 on lifecycle analysis have been followed in this report, with a focus on the key factors: cradle to gate embodied CO<sub>2</sub> and in-use regulated emissions – some, less impactful sub-stages are not included in this analysis.

Core elements of the building has been analysed in embodied carbon calculations – services, landscaping and cosmetic finishes have not been taken into account in either scenario, due to them being predominantly unknown or have no accurate data. Note that sequestered carbon is not factored, which would further reduce emissions where wood is used.

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.

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# Case for Demolition & New Build

## 9 Woodland Rise

### Introduction

A case for demolition and redevelopment is made where it is deemed more practical, better for design and more sustainable long-term. This section looks at wider reasons a new build would be better than refurbishment of the existing.

### Current dwelling

The current dwelling cannot be easily upgraded to a satisfactory standard from a practical or longevity point of view. The existing property was built around 1930 and is approximately 92 years old and, whilst many pre-war dwellings stand longer, the life expectancy of a property such as this is 60 years (BRE).

The current dwelling survey details damp issues, some floor and wall issues, pipes and guttering replacement and finishing upgrades required. Electrical and plumbing services are also in dire disrepair and require replacement. The property has a relatively inefficient use of space and the layout is not open. If the property could not be redeveloped, the home-owner has no incentive to upgrade the current dwelling beyond building regulations (i.e. Part L for existing buildings), or at all, keeping carbon emissions very high.

### Alignment with Policy on emissions

New builds in Haringey should meet a minimum carbon emission target 35% beyond building regulations Part L – under the London Plan guidance and local policy requires 100% overall carbon reduction, through on-site means first and contribution to Haringey offset fund for remaining emissions.

A refurbishment of the existing dwelling would need to meet Part L for existing dwellings building regulations in terms of energy, which are less rigorous than the standard of new build regulations and considerably lower than the London Plan or local new build requirements. As demonstrated in the long term CO<sub>2</sub> analysis in this report, the new building will go far beyond building regulations (**84.5% over new build Part L**) and contribute to much lower carbon emissions in the long term over the refurbishment scenario, in keeping with the borough's and cities wider aims.

### Water use

The dwelling is required to meet building regulations of 125 litres/person/day, but will go beyond and target 105 litres/person/day. Based on 4 people living in the dwelling this could lead to 1,460,000 litres of water saved over 50 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 more design details.

The proposed new build scenario will incorporate more space, making better use of the building footprint, with an extra floor - 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, meeting M4 access requirements, it will be more efficient and stand for much longer, making a positive impact in terms of carbon emissions, water and access.

Furthermore, composting facilities, rainwater collection and live energy display devices – encouraging lower energy use from appliances will be implemented.

# Lifecycle Methodology

## 9 Woodland Rise

### Lifecycle CO<sub>2</sub> Analysis

#### Introduction

The below section provides a step-by-step description of the project methodology.

#### Brief

The brief is to analyse and then compare the carbon intensity of two scenarios of development on the site at 9 Woodland Rise – a refurbishment of the existing building (Scenario 1) and a new build development (Scenario 2).

A particular focus is to be placed on a whole life cycle analysis, which encompasses all stages of development from the sourcing of the materials, the activity during construction works and the operations of the building. The outcome will help determine if there is a case for demolition based on long-term carbon emissions of the scheme. Wider sustainability issues should also be considered.

#### Life Cycle modelling

The two 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 planning application.

Green Tiger Sustainability has modelled the two scenarios, taking into account the construction type, volume of materials, materials used, activity during construction works and operational usage using energy modelling.

A detailed 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 fuel is provided in Appendix 1.

#### Analysis of Carbon Emissions

Green Tiger Sustainability has broken down the whole life carbon emissions and provided the embodied carbon, carbon relating to construction works and the operational carbon using the same methodology for both scenarios.

The embodied carbon and site works calculations are based on drawings and information from the project Architects, XUL Architecture, together with recognised data from the Environment Agency, Bath University ICE database, Greenspec and DEFRA.

The operational carbon is based on Standard Assessment Procedure (SAP) modelling using architectural drawings, proposed specifications and Part L. This study will look at the Carbon emissions of life cycles over 50 years.

The study will have two types of comparative analysis, one comparing the whole environmental impact over the entire life cycle of the buildings, and also we are comparing the environmental impact per metre square of construction, as the new build, scenario 2, adds more m<sup>2</sup> of living space.

Embodied CO<sub>2</sub> of services (except Solar Panels), landscaping and finishes have not been taken into account in either scenario.

#### Comparative Analysis of Carbon intensity

A comparison of life cycle emissions between the refurbishment scenario and new build scenario is made to indicate the respective carbon intensity of developments.

This will indicate which development shows the higher carbon emissions over a 50-year lifecycle.

# Calculation & Modelling Overview

## 9 Woodland Rise

### Lifecycle CO<sub>2</sub> Analysis

#### Background

Life Cycle Analysis (LCA) 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 50 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 beyond 50 years has not been taken into account.

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 - Refurbishment

The existing dwelling at 9 Woodland Rise was built around 1930. It is a four bedroom dwelling. A full refurbishment of the property would be required, with new floor and roof. The sustainability targets for this are to meet Part L 2021 standards. The following works would need to be undertaken to meet Part L for existing dwellings:

- Walls insulated to U-value of 0.30
- Floor insulated to U-value of 0.25
- Roof insulated to U-value of 0.16
- Windows replaced with U-value of 1.4
- Boiler upgraded to minimum 84% efficient and 250-litre tank

#### Scenario 2 – demolition of the existing building, building a new build.

The proposed new build incorporates a larger and more functional space, with a basement inclusion. An Air Source Heat Pump will supply heat and hot water and Solar PV will be maximised. The following works would need to be undertaken:

- Demolition of existing building
- U-values: Walls – 0.14 / Roof 0.12 / Floor 0.11 / Windows 1.2 & 0.9
- Air permeability to 3 m<sup>2</sup>/m<sup>3</sup>/hr @ 50pa
- MVHR ventilation throughout
- Highly efficient Air Source Heat Pump w/underfloor heating & rads mix
- Solar PV maximised with 4 kWp panels & 8 kWp battery storage.

#### Modelling Data

##### Building data input

- Construction plans, drawings, elevations and measurements
- Construction Method Statements

##### Benchmark data

- Environmental agency – All material volume to weight factors
- Bath University Inventory of Carbon and Energy (ICE) V2.0, 1.6 – CO<sub>2</sub> factors
- Greenspec and DEFRA – where noted

##### Model

- Combined building data and benchmark data (See Appendices)
- SAP 10 and SAP 10 (2022) emission factors

##### Information in appendix

- All model data and calculations

# 1. Refurbishment Embodied Carbon

## 9 Woodland Rise

### Embodied energy breakdown

Below are the key figures and distribution of embodied carbon in the materials needed to refurbish 9 Woodland Rise.

As concrete deteriorates over time, the refurbishment requires a new concrete slab added, which along with a new roof and windows, are the key carbon emissions in this scenario. A new gas boiler and distribution system is added in this scenario.

All insulation would be upgraded to a minimum U-value of Part L and carries high-embodied carbon throughout the scheme.

| Phase 01- Production of Materials / Embodied |                  |           |           |                        |                   |                        |                  |
|----------------------------------------------|------------------|-----------|-----------|------------------------|-------------------|------------------------|------------------|
| Components                                   | Material         | Area (m2) | Depth (m) | Weight factor (kg/ m3) | Total Weight (kg) | Carbon Factor kgCO2/Kg | KgCO2            |
| <b>Ground Floor</b>                          |                  |           |           |                        |                   |                        |                  |
| Insulation                                   | Polyurethane     | 103.10    | 0.100     | 30.00                  | 309.30            | 4.26                   | 1,317.62         |
| Membrane                                     | Plastic          | 103.10    | 0.003     | 1,470.00               | 454.67            | 3.13                   | 1,423.12         |
| Concrete slab                                | General Concrete | 103.10    | 0.200     | 2,000.00               | 41,240.00         | 0.11                   | 4,536.40         |
| <b>Exterior Wall</b>                         |                  |           |           |                        |                   |                        |                  |
| Insulation                                   | Polyurethane     | 248.40    | 0.100     | 30.00                  | 745.20            | 4.26                   | 3,174.55         |
| Finshes                                      | Plasterboard     | 248.40    | 0.012     | 950.00                 | 2,831.76          | 0.38                   | 1,076.07         |
| <b>Interior Wall</b>                         |                  |           |           |                        |                   |                        |                  |
| Insulation                                   | Polyurethane     | 74.52     | 0.100     | 30.00                  | 223.56            | 4.26                   | 952.37           |
| Finishes                                     | Plasterboard     | 74.52     | 0.012     | 950.00                 | 849.53            | 0.38                   | 322.82           |
| <b>Roof</b>                                  |                  |           |           |                        |                   |                        |                  |
| Insulation                                   | Rockwool         | 98.70     | 0.250     | 100.00                 | 2,467.50          | 1.05                   | 2,590.88         |
| Timber - new structure                       | General Timber   | 98.70     | 0.080     | 480.00                 | 3,790.08          | 0.41                   | 1,553.93         |
| Membrane                                     | Plastic          | 98.70     | 0.003     | 1,470.00               | 435.27            | 3.13                   | 1,362.39         |
| Finishes                                     | Plasterboard     | 98.70     | 0.012     | 950.00                 | 1,125.18          | 0.38                   | 427.57           |
| Slate                                        | Slate            | 98.70     | 0.003     | 2,700.00               | 799.47            | 0.06                   | 47.97            |
| <b>Doors</b>                                 |                  |           |           |                        |                   |                        |                  |
| All Doors                                    | General Timber   | 20.50     | 0.050     | 480.00                 | 492.10            | 0.46                   | 226.36           |
| <b>Windows</b>                               |                  |           |           |                        |                   |                        |                  |
| Windows Double glazed (4+4/8/8 mm)           | Timber frames    | 6.46      | 0.080     | 480.00                 | 248.00            | 0.41                   | 101.68           |
|                                              | Glass            | 53.82     | 0.008     | 2,500.00               | 1,076.40          | 1.27                   | 1,367.03         |
| <b>TOTAL EMBODIED CO2 EMISSIONS</b>          |                  |           |           |                        | <b>57,088.01</b>  |                        | <b>20,480.75</b> |

# 1. Refurbishment Lifecycle Carbon

## 9 Woodland Rise

### Introduction

The following section looks at the carbon emissions throughout the life cycle of the building. This is broken into three figures – Embodied carbon in the physical structure, carbon associated with construction works and the actual occupation and operation of the building.

### Description of Stages

**Embodied carbon** – The previous page of this report showed the embodied carbon associated with the physical structure of the development.  
**Construction works** – The carbon emissions of construction works takes into account the energy from site plant, material and staff transportation and construction waste disposal, based on benchmark data.  
**Operations** – The operational carbon has been calculated using SAP to determine the yearly Dwelling Emission Rate of the building if refurbished to part L building regulations.

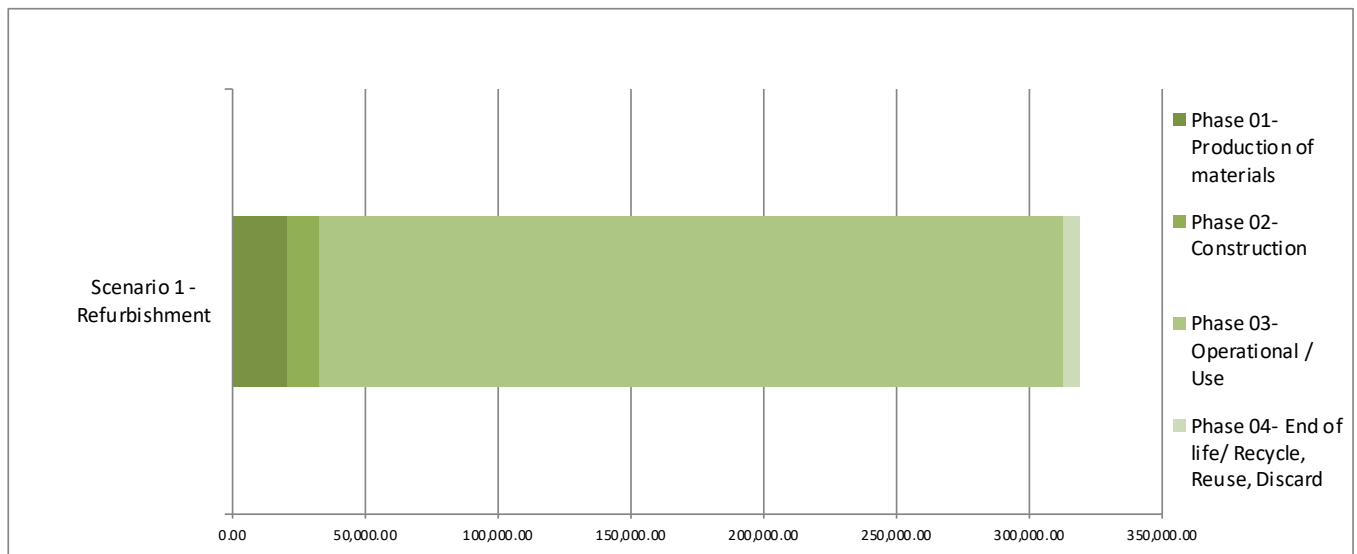
### Observations

The embodied carbon and carbon emissions from construction account for less than a tenth of emissions over a 50 year life-cycle. Operational emissions are very high.

### Summary Table

|                                                | kgCO <sub>2</sub> |
|------------------------------------------------|-------------------|
| Phase 01- Production of materials              | <b>20,480.75</b>  |
| Phase 02- Construction                         | <b>12,475.20</b>  |
| Phase 03- Operational / Use                    | <b>279,724.80</b> |
| Phase 04- End of life/ Recycle, Reuse, Discard | <b>6,079.20</b>   |
| <b>TOTAL</b>                                   | <b>318,759.95</b> |

### Summary Graph



## 2. New Build

# Embodied Carbon

### 9 Woodland Rise

#### Embodied energy breakdown

Below are the key figures and distribution of embodied carbon in the materials needed build the proposed new property at 9 Woodland Rise.

Traditional brick and block will make up the main structure (with partial supporting steel) and re-enforced concrete basement.

The concrete slabs, steel, bricks and blocks account for the majority of the carbon emissions. Concrete emissions could be reduced further using a lower impact concrete where possible.

| Phase 01 - Production of Materials / Embodied |                  |           |           |               |                   |               |                  |
|-----------------------------------------------|------------------|-----------|-----------|---------------|-------------------|---------------|------------------|
| Components                                    | Material         | Area (m2) | Depth (m) | Weight factor | Total Weight (kg) | Carbon Factor | KCO2             |
| <b>Foundation</b>                             |                  |           |           |               |                   |               |                  |
| Concrete (average depth)                      | General concrete | 26.04     | 1.000     | 2,000.00      | 52,080.00         | 0.11          | 5,728.80         |
| <b>Basement Concrete</b>                      |                  |           |           |               |                   |               |                  |
| Basement Walls                                | General concrete | 112.84    | 0.300     | 2,000.00      | 67,704.00         | 0.11          | 7,447.44         |
| Reinforced steel (100kg/m3 concrete)          | General Steel    | -         | -         | 7,800.00      | 3,385.20          | 1.77          | 5,991.80         |
| <b>Steel Supports</b>                         |                  |           |           |               |                   |               |                  |
| Steel beams                                   | General Steel    | 30.78     | 0.010     | 7,800.00      | 2,400.84          | 1.77          | 4,249.49         |
| <b>Ground Slab</b>                            |                  |           |           |               |                   |               |                  |
| Concrete slab                                 | General concrete | 109.80    | 0.200     | 2,000.00      | 43,920.00         | 0.11          | 4,831.20         |
| Membrane                                      | Plastic          | 109.80    | 0.003     | 1,470.00      | 453.04            | 3.13          | 1,418.01         |
| Hardcore                                      | Stone Gravel     | 109.80    | 0.200     | 1,800.00      | 39,528.00         | 0.02          | 671.98           |
| <b>Floors</b>                                 |                  |           |           |               |                   |               |                  |
| Insulation                                    | PUR              | 109.80    | 0.125     | 72.10         | 989.57            | 4.26          | 4,215.58         |
| Timber Floors                                 | General Timber   | 309.70    | 0.080     | 480.00        | 11,892.48         | 0.46          | 5,470.54         |
| Internal Finish                               | General Timber   | 309.70    | 0.001     | 480.00        | 148.66            | 0.46          | 68.38            |
| <b>Exterior Wall</b>                          |                  |           |           |               |                   |               |                  |
| Insulation                                    | PUR              | 197.80    | 0.125     | 72.10         | 1,782.67          | 4.26          | 7,594.18         |
| External Brick finsh                          | Clay Brick       | 197.80    | 0.100     | 1,700.00      | 33,626.00         | 0.22          | 7,397.72         |
| Block                                         | Blocks           | 197.80    | 0.100     | 750.00        | 14,835.00         | 0.80          | 11,868.00        |
| Internal finish                               | Plasterboard     | 333.80    | 0.012     | 950.00        | 3,805.32          | 0.38          | 1,446.02         |
| <b>Interior Wall</b>                          |                  |           |           |               |                   |               |                  |
| Insulation                                    | Cellulose        | 133.52    | 0.080     | 3.30          | 35.25             | 0.11          | 3.74             |
| Internal finish                               | Plasterboard     | 133.52    | 0.024     | 950.00        | 3,044.26          | 0.38          | 1,156.82         |
| <b>Doors</b>                                  |                  |           |           |               |                   |               |                  |
| All Doors                                     | General Timber   | 20.35     | 0.050     | 480.00        | 488.45            | 0.46          | 224.69           |
| <b>Roof</b>                                   |                  |           |           |               |                   |               |                  |
| Insulation                                    | PUR              | 110.00    | 0.125     | 72.10         | 991.38            | 4.26          | 4,223.26         |
| Timber roof                                   | General Timber   | 110.00    | 0.080     | 480.00        | 4,224.00          | 0.46          | 1,943.04         |
| Membrane                                      | Plastic          | 110.00    | 0.003     | 1,470.00      | 485.10            | 3.13          | 1,518.36         |
| Slate                                         | Slate            | 110.00    | 0.003     | 2,700.00      | 891.00            | 0.06          | 53.46            |
| <b>Windows</b>                                |                  |           |           |               |                   |               |                  |
| Windows double/triple glazed (4+4+4/8/5 mm)   | Timber Frames    | 8.11      | 0.080     | 480.00        | 311.39            | 0.46          | 143.24           |
|                                               | glass            | 81.09     | 0.024     | 2,500.00      | 4,865.40          | 1.27          | 6,179.06         |
| <b>Solar PV</b>                               |                  |           |           |               |                   |               |                  |
| Solar Panels                                  | Monocrystalline  | 10.00     |           |               |                   | 200.00        | 2,000.00         |
| <b>TOTAL EMBODIED CO2 EMISSIONS</b>           |                  |           |           |               | <b>291,886.99</b> |               | <b>83,844.80</b> |

# 2. New Build

## Lifecycle Carbon

### 9 Woodland Rise

### Lifecycle CO<sub>2</sub> Analysis

#### Introduction

The following section looks at the carbon emissions throughout the life cycle of the building. This is broken into three figures – Embodied carbon in the physical structure, carbon associated with construction works and the actual occupation and operation of the building.

#### Description of Stages

**Embodied carbon** – The previous page of this report showed the embodied carbon associated with the physical structure of the development.  
**Construction works** – The carbon emissions of construction works takes into account the energy from site plant, material and staff transportation and construction waste disposal, based on benchmark data.  
**Operations** - The operational carbon has been calculated using SAP to determine the yearly Dwelling Emission Rate (DER).

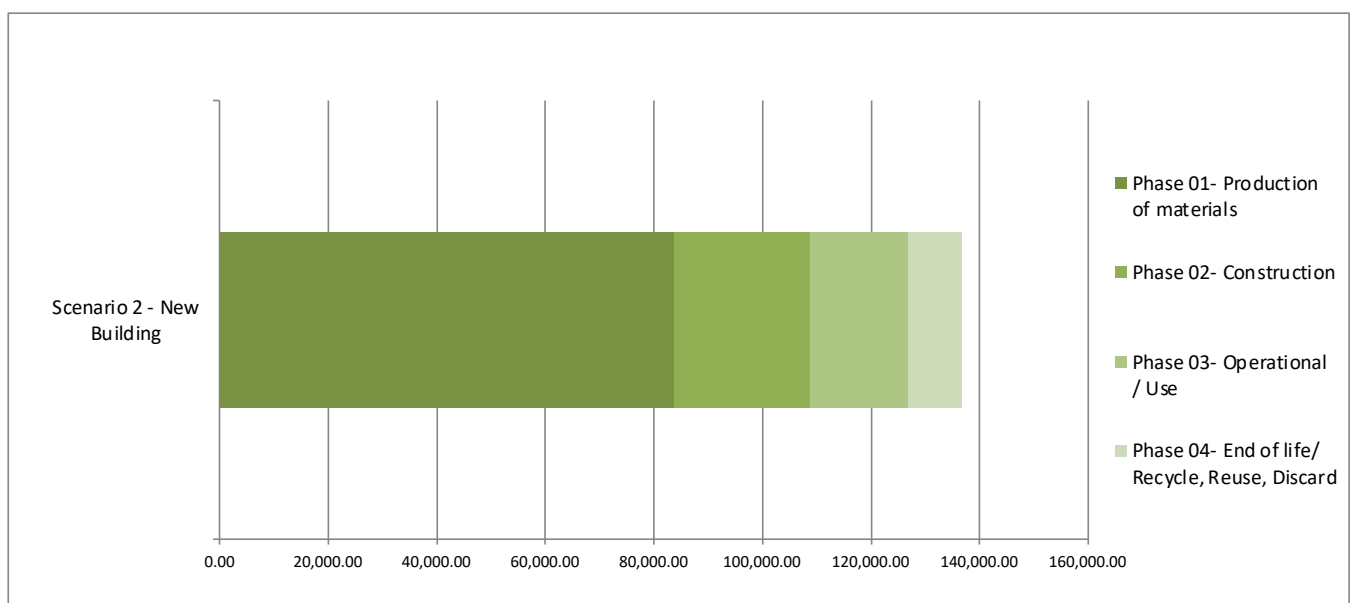
#### Observations

The embodied carbon and construction works are considerable and are equivalent to the operational carbon over 50 years.

#### Summary Table

|                                                | kgCO <sub>2</sub> |
|------------------------------------------------|-------------------|
| Phase 01- Production of materials              | <b>83,844.80</b>  |
| Phase 02- Construction                         | <b>24,950.40</b>  |
| Phase 03- Operational / Use                    | <b>17,962.60</b>  |
| Phase 04- End of life/ Recycle, Reuse, Discard | <b>10,079.20</b>  |
| <b>TOTAL</b>                                   | <b>136,837.00</b> |

#### Summary Graph



# Lifecycle Analysis New Build Vs Refurb 9 Woodland Rise Lifecycle CO<sub>2</sub> Analysis

## Introduction

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

## Comparative Analysis

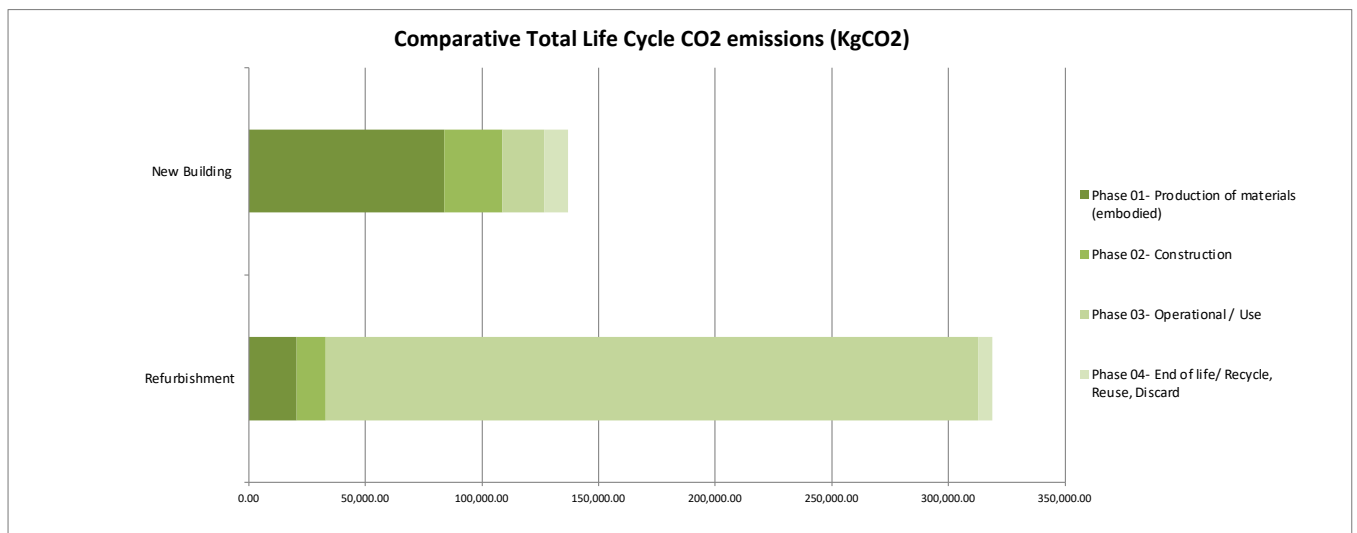
There are numerous observations from the data and can be seen in the chart below:

- The embodied CO<sub>2</sub> emissions are **4.09 times** more in new build scenario 2 than scenario 1, this means **63,364 KgCO<sub>2</sub>** more.
- The operational carbon emissions from the refurbishment are **16 times** more than the new build over 50 years, this means **261,763 KgCO<sub>2</sub>** more.
- When the KgCO<sub>2</sub> as analysed per m<sup>2</sup>, The new build scenario 2 is **3 times** as efficient, with **442 kgCO<sub>2</sub>/m<sup>2</sup>** emissions as appose to the refurbishment which emits **1,239 KgCO<sub>2</sub>/m<sup>2</sup>**
- Taking embodied, construction and operational emissions into account, the refurbishment scenario 1 emits **2.3 times more carbon** - which is a difference of the overall carbon emission impact of the two scenarios is **181,923 kgCO<sub>2</sub> over 50 years** more in the refurbishment scenario.
- If analysed beyond 50 years, the savings from new build scheme would continue to grow, and the differences in the two scenarios would continue to favour the new build.

## Summary Table

|                                                | Scenario 1 - Refurbishment | Scenario 2 - New Build |
|------------------------------------------------|----------------------------|------------------------|
| Phase 01- Production of materials              | <b>20,480.75</b>           | <b>83,844.80</b>       |
| Phase 02- Construction                         | <b>12,475.20</b>           | <b>24,950.40</b>       |
| Phase 03- Operational / Use                    | <b>279,724.80</b>          | <b>17,962.60</b>       |
| Phase 04- End of life/ Recycle, Reuse, Discard | <b>6,079.20</b>            | <b>10,079.20</b>       |
| <b>TOTAL</b>                                   | <b>318,759.95</b>          | <b>136,837.00</b>      |

## Summary Graph



# Conclusion

## 9 Woodland Rise

### Lifecycle CO<sub>2</sub> Analysis

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#### Key findings

- The new build scenario can be considered much more sustainable from a long-term carbon emission point of view.
  - The proposed dwelling is of an exemplary standard and will:
    - Save approx. 1,460,000 litres of water over 50 years.
    - Create a more efficient useable space
    - Be healthier and lighter space for people to live.
    - Better accessxs, and;
    - Will last much longer than refurbishment into the future.
  - Scenario 2 is inline with London plan targets on carbon emissions, notably over 35% beyond Part L building regulations CO<sub>2</sub> levels.
  - The proposed development goes **84.5%** beyond building regulations and can be considered an outstanding low carbon and low impact building (see energy strategy assessment for further details).
  - Overall carbon emissions lower in the new build scenario when analysed over 50 years. If looked at further in the future this carbon saving of Scenario 2 would continue to increase dramatically.
-

# Appendix 1 CO<sub>2</sub>

## Emission calculations

### 9 Woodland Rise

| Area                                                |                  |           |           |                        |                   |                        |                  |
|-----------------------------------------------------|------------------|-----------|-----------|------------------------|-------------------|------------------------|------------------|
| Ground Floor                                        | 103.10           | m2        |           |                        |                   |                        |                  |
| Exterior Walls                                      | 248.40           | m2        |           |                        |                   |                        |                  |
| Interior Walls                                      | 74.52            | m2        |           |                        |                   |                        |                  |
| Roof                                                | 98.70            | m2        |           |                        |                   |                        |                  |
| Exterior Door                                       | 5.60             | m2        |           |                        |                   |                        |                  |
| Interior Doors                                      | 14.90            | m2        |           |                        |                   |                        |                  |
| Windows Glass area                                  | 53.82            | m2        |           |                        |                   |                        |                  |
| Windows Frame area                                  | 6.46             | m2        |           |                        |                   |                        |                  |
| <b>Scenario 1 - Refurbishment</b>                   |                  |           |           |                        |                   |                        |                  |
| <b>Phase 01- Production of Materials / Embodied</b> |                  |           |           |                        |                   |                        |                  |
| Components                                          | Material         | Area (m2) | Depth (m) | Weight factor (kg/ m3) | Total Weight (kg) | Carbon Factor kgCO2/Kg | KgCO2            |
| <b>Ground Floor</b>                                 |                  |           |           |                        |                   |                        |                  |
| Insulation                                          | Polyurethane     | 103.10    | 0.100     | 30.00                  | 309.30            | 4.26                   | <b>1,317.62</b>  |
| Membrane                                            | Plastic          | 103.10    | 0.003     | 1,470.00               | 454.67            | 3.13                   | <b>1,423.12</b>  |
| Concrete slab                                       | General Concrete | 103.10    | 0.200     | 2,000.00               | 41,240.00         | 0.11                   | <b>4,536.40</b>  |
| <b>Exterior Wall</b>                                |                  |           |           |                        |                   |                        |                  |
| Insulation                                          | Polyurethane     | 248.40    | 0.100     | 30.00                  | 745.20            | 4.26                   | <b>3,174.55</b>  |
| Finishes                                            | Plasterboard     | 248.40    | 0.012     | 950.00                 | 2,831.76          | 0.38                   | <b>1,076.07</b>  |
| <b>Interior Wall</b>                                |                  |           |           |                        |                   |                        |                  |
| Insulation                                          | Polyurethane     | 74.52     | 0.100     | 30.00                  | 223.56            | 4.26                   | <b>952.37</b>    |
| Finishes                                            | Plasterboard     | 74.52     | 0.012     | 950.00                 | 849.53            | 0.38                   | <b>322.82</b>    |
| <b>Roof</b>                                         |                  |           |           |                        |                   |                        |                  |
| Insulation                                          | Rockwool         | 98.70     | 0.250     | 100.00                 | 2,467.50          | 1.05                   | <b>2,590.88</b>  |
| Timber - new structure                              | General Timber   | 98.70     | 0.080     | 480.00                 | 3,790.08          | 0.41                   | <b>1,553.93</b>  |
| Membrane                                            | Plastic          | 98.70     | 0.003     | 1,470.00               | 435.27            | 3.13                   | <b>1,362.39</b>  |
| Finishes                                            | Plasterboard     | 98.70     | 0.012     | 950.00                 | 1,125.18          | 0.38                   | <b>427.57</b>    |
| Slate                                               | Slate            | 98.70     | 0.003     | 2,700.00               | 799.47            | 0.06                   | <b>47.97</b>     |
| <b>Doors</b>                                        |                  |           |           |                        |                   |                        |                  |
| All Doors                                           | General Timber   | 20.50     | 0.050     | 480.00                 | 492.10            | 0.46                   | <b>226.36</b>    |
| <b>Windows</b>                                      |                  |           |           |                        |                   |                        |                  |
| Windows Double glazed (4+4/8/8 mm)                  | Timber frames    | 6.46      | 0.080     | 480.00                 | 248.00            | 0.41                   | <b>101.68</b>    |
|                                                     | Glass            | 53.82     | 0.008     | 2,500.00               | 1,076.40          | 1.27                   | <b>1,367.03</b>  |
| <b>TOTAL EMBODIED CO2 EMISSIONS</b>                 |                  |           |           |                        | <b>57,088.01</b>  |                        | <b>20,480.75</b> |

### Phase 02- Construction

#### Construction Side works time

|                          |                  |                  |
|--------------------------|------------------|------------------|
| Time                     | 6.00             | Months           |
| Carbon Factor per months | 2,000.00         | KgCO2/Per months |
| <b>TOTAL</b>             | <b>12,000.00</b> | kgCO2            |

#### Site Travel

|                                                   |               |           |
|---------------------------------------------------|---------------|-----------|
| Assume average travel distance                    | 15.00         | Km        |
| Amount of Vans per day<br>(4 staff per van)       | 5.00          | Und       |
| Transportation emissions<br>Van (4 staff per van) | 0.24          | KgCO2/Km  |
| Day per months on site                            | 22.00         | Days      |
| Time of construction                              | 6.00          | Months    |
| Total of days in site                             | 132.00        |           |
| Total of Km per month                             | 1,980.00      | Km/Months |
| <b>TOTAL EMISSIONS</b>                            | <b>475.20</b> |           |

#### TOTAL EMBODIED CO2 EMISSIONS

|                   |                  |          |
|-------------------|------------------|----------|
| Site works energy | 12,000.00        | kgCO2    |
| Staff Travel      | 475.20           | kgCO2    |
| <b>TOTAL</b>      | <b>12,475.20</b> | kgCO2    |
|                   | <b>48.52</b>     | KgCO2/m2 |

### Phase 03- Operational / Use

|                                |                 |             |
|--------------------------------|-----------------|-------------|
| SAP Results show a DER (dwell) | 21.76           | kgCO2/m2/yr |
| Total floor area of proposed   | 257.10          | m2          |
| <b>Total CO2 emissions</b>     | <b>5,594.50</b> | kgCO2       |

|                            |                 |           |                   |          |
|----------------------------|-----------------|-----------|-------------------|----------|
| Over 30 year period        | 5,594.50        | 30        | 167,834.88        | kgCO2    |
| Over 40 year period        | 5,594.50        | 40        | 223,779.84        | kgCO2    |
| <b>Over 50 year period</b> | <b>5,594.50</b> | <b>50</b> | <b>279,724.80</b> | kgCO2    |
|                            |                 |           | <b>1,088.00</b>   | kgCO2/m2 |

### Phase 04- End of life /Recycle, Reuse, Discard

#### End of Life works time

|                          |                 |                  |
|--------------------------|-----------------|------------------|
| Time                     | 3.00            | Months           |
| Carbon Factor per months | 2,000.00        | KgCO2/Per months |
| <b>TOTAL</b>             | <b>6,000.00</b> | kgCO2            |

#### Site Travel

|                                                   |              |           |
|---------------------------------------------------|--------------|-----------|
| Assume average travel distance                    | 15.00        | Km        |
| Amount of Vans per day<br>(4 staff per van)       | 5.00         | Und       |
| Transportation emissions<br>Van (4 staff per van) | 0.24         | KgCO2/Km  |
| Day per months on site                            | 22.00        | Days      |
| Time of Demo                                      | 1.00         | Months    |
| Total of days in site                             | 22.00        |           |
| Total of Km per month                             | 330.00       | Km/Months |
| <b>TOTAL EMISSIONS</b>                            | <b>79.20</b> |           |

#### TOTAL EMBODIED CO2 EMISSIONS

|                   |                 |          |
|-------------------|-----------------|----------|
| Site works energy | 6,000.00        | kgCO2    |
| Staff Travel      | 79.20           | kgCO2    |
| <b>TOTAL</b>      | <b>6,079.20</b> | kgCO2    |
|                   | <b>23.65</b>    | kgCO2/m2 |

| Area               |        |    |  |  |  |  |  |
|--------------------|--------|----|--|--|--|--|--|
| Wall Perimeter     | 43.4   | m  |  |  |  |  |  |
| Foundations        | 26.04  | m2 |  |  |  |  |  |
| Ground Slab        | 109.80 | m2 |  |  |  |  |  |
| Steel Supports     | 30.78  | m2 |  |  |  |  |  |
| Floor Area         | 309.70 | m2 |  |  |  |  |  |
| Basement Walls     | 112.84 | m2 |  |  |  |  |  |
| Exterior Walls     | 197.80 | m2 |  |  |  |  |  |
| Party Walls        | 136.00 | m2 |  |  |  |  |  |
| Interior Walls     | 133.52 | m2 |  |  |  |  |  |
| Exterior Doors     | 7.00   | m2 |  |  |  |  |  |
| Interior Doors     | 13.35  | m2 |  |  |  |  |  |
| Roof               | 110.00 | m2 |  |  |  |  |  |
| Windows Glass area | 81.09  | m2 |  |  |  |  |  |
| Windows Frame area | 8.11   | m2 |  |  |  |  |  |

## Scenario 2 - New Building

### Phase 01 - Production of Materials / Embodied

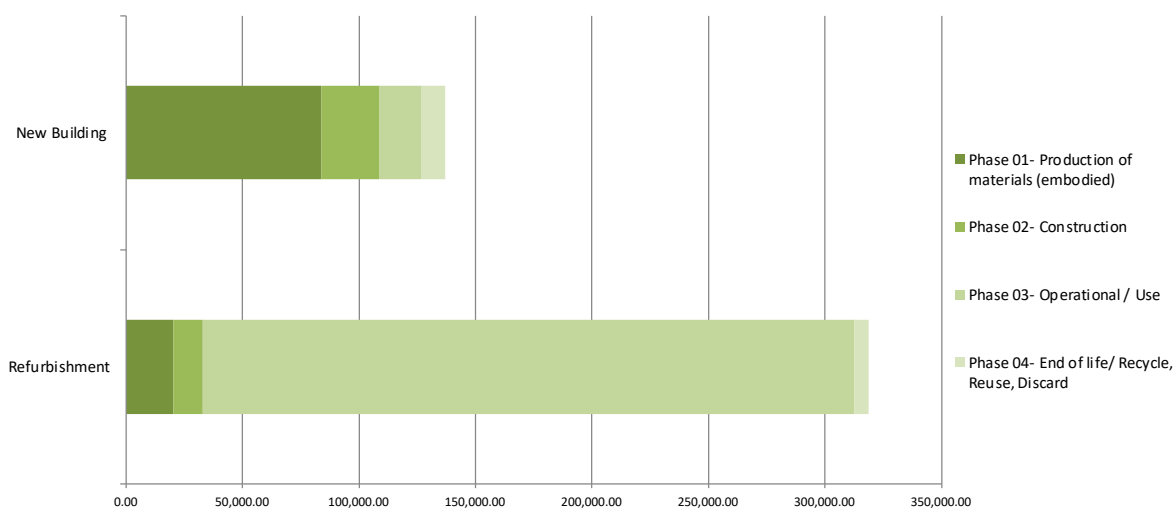
| Components                                  | Material         | Area (m2) | Depth (m) | Weight factor | Total Weight (kg) | Carbon Factor | KCO2             |
|---------------------------------------------|------------------|-----------|-----------|---------------|-------------------|---------------|------------------|
| <b>Foundation</b>                           |                  |           |           |               |                   |               |                  |
| Concrete (average depth)                    | General concrete | 26.04     | 1.000     | 2,000.00      | 52,080.00         | 0.11          | 5,728.80         |
| <b>Basement Concrete</b>                    |                  |           |           |               |                   |               |                  |
| Basement Walls                              | General concrete | 112.84    | 0.300     | 2,000.00      | 67,704.00         | 0.11          | 7,447.44         |
| Reinforced steel (100kg/m3 concrete)        | General Steel    | -         | -         | 7,800.00      | 3,385.20          | 1.77          | 5,991.80         |
| <b>Steel Supports</b>                       |                  |           |           |               |                   |               |                  |
| Steel beams                                 | General Steel    | 30.78     | 0.010     | 7,800.00      | 2,400.84          | 1.77          | 4,249.49         |
| <b>Ground Slab</b>                          |                  |           |           |               |                   |               |                  |
| Concrete slab                               | General concrete | 109.80    | 0.200     | 2,000.00      | 43,920.00         | 0.11          | 4,831.20         |
| Membrane                                    | Plastic          | 109.80    | 0.003     | 1,470.00      | 453.04            | 3.13          | 1,418.01         |
| Hardcore                                    | Stone Gravel     | 109.80    | 0.200     | 1,800.00      | 39,528.00         | 0.02          | 671.98           |
| <b>Floors</b>                               |                  |           |           |               |                   |               |                  |
| Insulation                                  | PUR              | 109.80    | 0.125     | 72.10         | 989.57            | 4.26          | 4,215.58         |
| Timber Floors                               | General Timber   | 309.70    | 0.080     | 480.00        | 11,892.48         | 0.46          | 5,470.54         |
| Internal Finish                             | General Timber   | 309.70    | 0.001     | 480.00        | 148.66            | 0.46          | 68.38            |
| <b>Exterior Wall</b>                        |                  |           |           |               |                   |               |                  |
| Insulation                                  | PUR              | 197.80    | 0.125     | 72.10         | 1,782.67          | 4.26          | 7,594.18         |
| External Brick finsh                        | Clay Brick       | 197.80    | 0.100     | 1,700.00      | 33,626.00         | 0.22          | 7,397.72         |
| Block                                       | Blocks           | 197.80    | 0.100     | 750.00        | 14,835.00         | 0.80          | 11,868.00        |
| Internal finish                             | Plasterboard     | 333.80    | 0.012     | 950.00        | 3,805.32          | 0.38          | 1,446.02         |
| <b>Interior Wall</b>                        |                  |           |           |               |                   |               |                  |
| Insulation                                  | Cellulose        | 133.52    | 0.080     | 3.30          | 35.25             | 0.11          | 3.74             |
| Internal finish                             | Plasterboard     | 133.52    | 0.024     | 950.00        | 3,044.26          | 0.38          | 1,156.82         |
| <b>Doors</b>                                |                  |           |           |               |                   |               |                  |
| All Doors                                   | General Timber   | 20.35     | 0.050     | 480.00        | 488.45            | 0.46          | 224.69           |
| <b>Roof</b>                                 |                  |           |           |               |                   |               |                  |
| Insulation                                  | PUR              | 110.00    | 0.125     | 72.10         | 991.38            | 4.26          | 4,223.26         |
| Timber roof                                 | General Timber   | 110.00    | 0.080     | 480.00        | 4,224.00          | 0.46          | 1,943.04         |
| Membrane                                    | Plastic          | 110.00    | 0.003     | 1,470.00      | 485.10            | 3.13          | 1,518.36         |
| Slate                                       | Slate            | 110.00    | 0.003     | 2,700.00      | 891.00            | 0.06          | 53.46            |
| <b>Windows</b>                              |                  |           |           |               |                   |               |                  |
| Windows double/triple glazed (4+4+4/8/5 mm) | Timber Frames    | 8.11      | 0.080     | 480.00        | 311.39            | 0.46          | 143.24           |
|                                             | glass            | 81.09     | 0.024     | 2,500.00      | 4,865.40          | 1.27          | 6,179.06         |
| <b>Solar PV</b>                             |                  |           |           |               |                   |               |                  |
| Solar Panels                                | Monocrystalline  | 10.00     |           |               |                   | 200.00        | 2,000.00         |
| <b>TOTAL EMBODIED CO2 EMISSIONS</b>         |                  |           |           |               | <b>291,886.99</b> |               | <b>83,844.80</b> |

| Phase 02 - Construction                                                               |                  |                  |                  |          |  |
|---------------------------------------------------------------------------------------|------------------|------------------|------------------|----------|--|
| <b>Construction - Site works (demolition, power, deliveries and associated works)</b> |                  |                  |                  |          |  |
| Time                                                                                  | 12.00            | Months           |                  |          |  |
| Carbon Factor per months                                                              | 2,000.00         | KgCO2/Per months |                  |          |  |
| <b>TOTAL</b>                                                                          | <b>24,000.00</b> | kgCO2            |                  |          |  |
| <b>Site Travel</b>                                                                    |                  |                  |                  |          |  |
| Assume average travel distance per                                                    | 15.00            | Km               |                  |          |  |
| Amount of Vans per day<br>(4 staff per van)                                           | 5.00             | Und              |                  |          |  |
| Transportation emissions<br>Van (4 staff per van)                                     | 0.24             | KgCO2/Km         |                  |          |  |
| Day per months on site                                                                | 22.00            | Days             |                  |          |  |
| Time of construction                                                                  | 12.00            | Months           |                  |          |  |
| Total of days in site                                                                 | 264.00           |                  |                  |          |  |
| Total of Km per month                                                                 | 3,960.00         | Km/Months        |                  |          |  |
| <b>TOTAL EMISSIONS</b>                                                                | <b>950.40</b>    |                  |                  |          |  |
| <b>TOTAL EMBODIED CO2 EMISSIONS</b>                                                   |                  |                  |                  |          |  |
| Site works energy                                                                     | 24,000.00        | kgCO2            |                  |          |  |
| Staff Travel                                                                          | 950.40           | kgCO2            |                  |          |  |
| <b>TOTAL</b>                                                                          | <b>24,950.40</b> | kgCO2            |                  |          |  |
|                                                                                       | <b>80.56</b>     | KgCO2/m2         |                  |          |  |
| Phase 03 - Operational / Use                                                          |                  |                  |                  |          |  |
| SAP Results show a DER (dwelling e                                                    | 1.16             | kgCO2/m2/yr      |                  |          |  |
| Total floor area of proposed                                                          | 309.70           | m2               |                  |          |  |
| <b>Total CO2 emissions</b>                                                            | <b>359.25</b>    | kgCO2            |                  |          |  |
| Over 30 year period                                                                   | 359.25           | 30               | 10,777.56        | kgCO2    |  |
| Over 40 year period                                                                   | 359.25           | 40               | 14,370.08        | kgCO2    |  |
| <b>Over 50 year period</b>                                                            | <b>359.25</b>    | <b>50</b>        | <b>17,962.60</b> | kgCO2    |  |
|                                                                                       |                  |                  | <b>58.00</b>     | kgCO2/m2 |  |
| Phase 04- End of life / Recycle, Reuse, Discard                                       |                  |                  |                  |          |  |
| <b>End of Life works time</b>                                                         |                  |                  |                  |          |  |
| Time                                                                                  | 5.00             | Months           |                  |          |  |
| Carbon Factor per months                                                              | 2,000.00         | KgCO2/Per months |                  |          |  |
| <b>TOTAL</b>                                                                          | <b>10,000.00</b> | kgCO2            |                  |          |  |
| <b>Site Travel</b>                                                                    |                  |                  |                  |          |  |
| Assume average travel distance per                                                    | 15.00            | Km               |                  |          |  |
| Amount of Vans per day<br>(4 staff per van)                                           | 5.00             | Und              |                  |          |  |
| Transportation emissions<br>Van (4 staff per van)                                     | 0.24             | KgCO2/Km         |                  |          |  |
| Day per months on site                                                                | 22.00            | Days             |                  |          |  |
| Time of Demo                                                                          | 1.00             | Months           |                  |          |  |
| Total of days in site                                                                 | 22.00            |                  |                  |          |  |
| Total of Km per month                                                                 | 330.00           | Km/Months        |                  |          |  |
| <b>TOTAL EMISSIONS</b>                                                                | <b>79.20</b>     |                  |                  |          |  |
| <b>TOTAL EMBODIED CO2 EMISSIONS</b>                                                   |                  |                  |                  |          |  |
| Site works energy                                                                     | 10,000.00        | kgCO2            |                  |          |  |
| Staff Travel                                                                          | 79.20            | kgCO2            |                  |          |  |
| <b>TOTAL</b>                                                                          | <b>10,079.20</b> | kgCO2            |                  |          |  |
|                                                                                       | <b>32.55</b>     | KgCO2/m2         |                  |          |  |

### COMPARE TOTAL LIFE CYCLE CO2 EMISSIONS

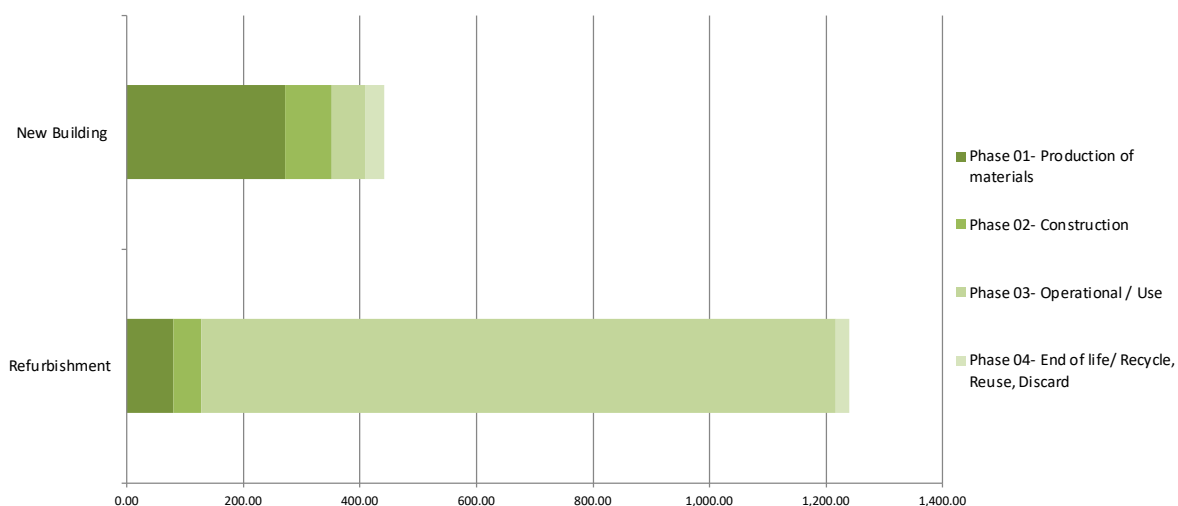
|                                                | Refurbishment     | New Building      |              |
|------------------------------------------------|-------------------|-------------------|--------------|
| Phase 01- Production of materials (embodied)   | 20,480.75         | 83,844.80         | kgCO2        |
| Phase 02- Construction                         | 12,475.20         | 24,950.40         | kgCO2        |
| Phase 03- Operational / Use                    | 279,724.80        | 17,962.60         | kgCO2        |
| Phase 04- End of life/ Recycle, Reuse, Discard | 6,079.20          | 10,079.20         | kgCO2        |
| <b>TOTAL</b>                                   | <b>318,759.95</b> | <b>136,837.00</b> | <b>kgCO2</b> |

Comparative Total Life Cycle CO2 emissions (KgCO2)

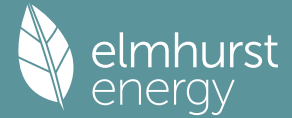


|                                                | Scenario 1 - Refurbishment | Scenario 2 - New Building |              |
|------------------------------------------------|----------------------------|---------------------------|--------------|
| Phase 01- Production of materials              | 79.66                      | 270.73                    | kgCO2        |
| Phase 02- Construction                         | 48.52                      | 80.56                     | kgCO2        |
| Phase 03- Operational / Use                    | 1,088.00                   | 58.00                     | kgCO2        |
| Phase 04- End of life/ Recycle, Reuse, Discard | 23.65                      | 32.55                     | kgCO2        |
| <b>TOTAL</b>                                   | <b>1,239.83</b>            | <b>441.84</b>             | <b>kgCO2</b> |

Comparative Total Life Cycle CO2 emissions (KgCO2/m2)



# Summary for Input Data



|                      |                           |                |            |
|----------------------|---------------------------|----------------|------------|
| Property Reference   | Woodland Rise             | Issued on Date | 10/11/2022 |
| Assessment Reference | Existing                  | Prop Type Ref  |            |
| Property             | 9, Woodland Rise, N10 3UP |                |            |

|                                    |          |                |         |      |       |
|------------------------------------|----------|----------------|---------|------|-------|
| SAP Rating                         | 76 C     | DER            | 21.76   | TER  | 8.10  |
| Environmental                      | 75 C     | % DER<TER      | -168.64 |      |       |
| CO <sub>2</sub> Emissions (t/year) | 4.85     | DFEE           | 72.98   | TFEE | 39.84 |
| Compliance Check                   | See BREL | % DFEE < TFE E | -83.16  |      |       |
| % DPER < TPER                      | -183.80  | DPER           | 120.70  | TPER | 42.53 |

|                  |                 |             |           |
|------------------|-----------------|-------------|-----------|
| Assessor Details | Mr. Nicky Bowen | Assessor ID | D719-0001 |
| Client           |                 |             |           |

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

|                            |                     |
|----------------------------|---------------------|
| Orientation                | South               |
| Property Tenure            | 1                   |
| Transaction Type           | 6                   |
| Terrain Type               | Suburban            |
| 1.0 Property Type          | House, Mid-Terrace  |
| 2.0 Number of Storeys      | 4                   |
| 3.0 Date Built             | 2022                |
| 4.0 Sheltered Sides        | 0                   |
| 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 |
|------------------|---------------------|-----------------------|-----------------------|
| Basement:        | 25.70 m             | 22.10 m <sup>2</sup>  | 2.17 m                |
| Ground floor:    | 24.91 m             | 103.10 m <sup>2</sup> | 3.20 m                |
| 1st Storey:      | 25.30 m             | 86.30 m <sup>2</sup>  | 2.95 m                |
| 2nd Storey:      | 32.00 m             | 45.60 m <sup>2</sup>  | 2.00 m                |

|                 |                      |
|-----------------|----------------------|
| 8.0 Living Area | 19.10 m <sup>2</sup> |
|-----------------|----------------------|

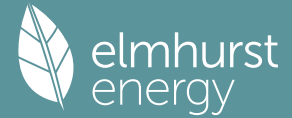
| 9.0 External Walls | Description   | Type         | Construction                                                         | U-Value (W/m <sup>2</sup> K) | Kappa (kJ/m <sup>2</sup> K) | Gross Area(m <sup>2</sup> ) | Nett Area (m <sup>2</sup> ) | Shelter Res | Shelter | Openings | Area Calculation Type |
|--------------------|---------------|--------------|----------------------------------------------------------------------|------------------------------|-----------------------------|-----------------------------|-----------------------------|-------------|---------|----------|-----------------------|
|                    | Existing wall | Solid Wall   | Solid wall : plasterboard on dabs, insulation, any outside structure | 0.30                         | 9.00                        | 210.00                      | 158.73                      | 0.00        | None    | 51.27    | Enter Gross Area      |
|                    | Walls in roof | Timber Frame | Timber framed wall (one layer of plasterboard)                       | 0.30                         | 9.00                        | 38.40                       | 38.40                       | 0.00        | None    | 0.00     | Enter Gross Area      |

| 9.1 Party Walls | Description  | Type       | Construction | U-Value (W/m <sup>2</sup> K) | Kappa (kJ/m <sup>2</sup> K) | Area (m <sup>2</sup> ) | Shelter Res | Shelter |
|-----------------|--------------|------------|--------------|------------------------------|-----------------------------|------------------------|-------------|---------|
|                 | Party Wall 1 | Solid Wall | Other        | 0.00                         | 0.00                        | 136.00                 |             | None    |

| 9.2 Internal Walls | Description | Construction                 | Kappa (kJ/m <sup>2</sup> K) | Area (m <sup>2</sup> ) |
|--------------------|-------------|------------------------------|-----------------------------|------------------------|
|                    | GF          | Plasterboard on timber frame | 9.00                        | 144.42                 |
|                    | FF          | Plasterboard on timber frame | 9.00                        | 160.38                 |
|                    | SF          | Plasterboard on timber frame | 9.00                        | 22.80                  |

| 10.0 External Roofs | Description         | Type                | Construction                             | U-Value (W/m <sup>2</sup> K) | Kappa (kJ/m <sup>2</sup> K) | Gross Area(m <sup>2</sup> ) | Nett Area (m <sup>2</sup> ) | Shelter Code | Shelter Factor | Calculation Type | Openings |
|---------------------|---------------------|---------------------|------------------------------------------|------------------------------|-----------------------------|-----------------------------|-----------------------------|--------------|----------------|------------------|----------|
|                     | Flat roof           | External Flat Roof  | Plasterboard, insulated flat roof        | 0.16                         | 9.00                        | 13.00                       | 1.44                        | None         | 0.00           | Enter Gross Area | 1.44     |
|                     | External Roof Pitch | External Slope Roof | Plasterboard, insulated slope            | 0.16                         | 9.00                        | 45.00                       | 1.10                        | None         | 0.00           | Enter Gross Area | 1.10     |
|                     | External Roof       | External Plane Roof | Plasterboard, insulated at ceiling level | 0.16                         | 9.00                        | 40.70                       | 0.00                        | None         | 0.00           | Enter Gross Area | 0.00     |

# Summary for Input Data



## 10.2 Internal Ceilings

| Description        | Storey          | Construction                                   | Area (m²) |
|--------------------|-----------------|------------------------------------------------|-----------|
| Internal Ceiling 1 | Basement        | Plasterboard ceiling, carpeted chipboard floor | 22.10     |
| Internal Ceiling 2 | Lowest occupied | Plasterboard ceiling, carpeted chipboard floor | 86.30     |
| Internal Ceiling 3 | +1              | Plasterboard ceiling, carpeted chipboard floor | 45.60     |

## 11.0 Heat Loss Floors

| Description      | Type                                 | Storey Index | Construction                           | U-Value (W/m²K) | Shelter Code | Shelter Factor | Kappa (kJ/m²K) | Area (m²) |
|------------------|--------------------------------------|--------------|----------------------------------------|-----------------|--------------|----------------|----------------|-----------|
| Basement         | Ground Floor - Solid Basement        |              | Slab on ground, screed over insulation | 0.25            | None         | 0.00           | 110.00         | 22.10     |
| Heatloss Floor 2 | Ground Floor - Solid Lowest occupied |              | Slab on ground, screed over insulation | 0.25            | None         | 0.00           | 110.00         | 81.00     |

## 11.2 Internal Floors

| Description      | Storey Index | Construction                                   | Kappa (kJ/m²K) | Area (m²) |
|------------------|--------------|------------------------------------------------|----------------|-----------|
| Internal Floor 1 |              | Plasterboard ceiling, carpeted chipboard floor | 9.00           | 22.10     |
| Internal Floor 2 |              | Plasterboard ceiling, carpeted chipboard floor | 9.00           | 86.30     |
| Internal Floor 3 |              | Plasterboard ceiling, carpeted chipboard floor | 9.00           | 45.60     |

## 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            |
| Door        | Manufacturer | Solid Door  |                        |             |              |         |            |              | 1.60            |
| RL          | Manufacturer | Roof Window | 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      | Door         | Existing wall       | South       | 5.27      |       |
| Front elevation | Windows      | Existing wall       | South       | 19.30     |       |
| Front RL        | RL           | External Roof Pitch | South       | 1.10      | 28    |
| Rear elevation  | Windows      | Existing wall       | North       | 26.71     |       |
| RL              | RL           | Flat roof           | Horizontal  | 1.44      | 0     |

## 14.0 Conservatory

## 15.0 Draught Proofing

 %

## 16.0 Draught Lobby

## 17.0 Thermal Bridging

Y-value

 W/m²K

## 18.0 Pressure Testing

Test Method

## 19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present

## 20.0 Fans, Open Fireplaces, Flues

## 21.0 Fixed Cooling System

## 22.0 Lighting

No Fixed Lighting

| Name       | Efficacy | Power | Capacity | Count |
|------------|----------|-------|----------|-------|
| Lighting 1 | 41.00    | 50    | 2050     | 28    |

## 24.0 Main Heating 1

Percentage of Heat

 %

Fuel Type

SAP Code

In Winter

In Summer

Controls SAP Code

Delayed Start Stat

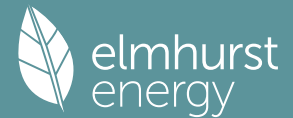
Flue Type

Fan Assisted Flue

Is MHS Pumped

Heating Pump Age

# Summary for Input Data



|                     |                |
|---------------------|----------------|
| Heat Emitter        | Radiators      |
| Flow Temperature    | Unknown        |
| Boiler Interlock    | No             |
| Combi boiler type   | Standard Combi |
| Combi keep hot type | None           |

25.0 Main Heating 2

26.0 Heat Networks

| 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 mains     |
| Bath Count                                       | 1              |

## 28.1 Showers

| Description | Shower Type | Flow Rate [l/min] | Rated Power [kW] | Connected | Connected To |
|-------------|-------------|-------------------|------------------|-----------|--------------|
|-------------|-------------|-------------------|------------------|-----------|--------------|

## 28.3 Waste Water Heat Recovery System

## 29.0 Hot Water Cylinder

|                    |    |
|--------------------|----|
| In Airing Cupboard | No |
|--------------------|----|

## 34.0 Small-scale Hydro

|                                   |     |     |     |     |     |     |     |     |     |     |     |     |
|-----------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| <input type="text" value="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  
£3,500 - £5,500

Typical savings per year  
£173

Ratings after improvement  
SAP rating C 79  
Environmental Impact C 76

# Summary for Input Data



|                      |                           |                |            |
|----------------------|---------------------------|----------------|------------|
| Property Reference   | Woodland Rise             | Issued on Date | 10/11/2022 |
| Assessment Reference | Proposed 2.55             | Prop Type Ref  |            |
| Property             | 9, Woodland Rise, N10 3UP |                |            |

|                                    |          |                |       |      |       |
|------------------------------------|----------|----------------|-------|------|-------|
| SAP Rating                         | 94 A     | DER            | 1.16  | TER  | 7.47  |
| Environmental                      | 99 A     | % DER<TER      | 84.47 |      |       |
| CO <sub>2</sub> Emissions (t/year) | 0.37     | DFEE           | 32.91 | TFEE | 37.72 |
| Compliance Check                   | See BREL | % DFEE < TFE E | 12.75 |      |       |
| % DPER < TPER                      | 70.84    | DPER           | 11.42 | TPER | 39.15 |

|                  |                 |             |           |
|------------------|-----------------|-------------|-----------|
| Assessor Details | Mr. Nicky Bowen | Assessor ID | D719-0001 |
| Client           |                 |             |           |

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

|                            |                     |
|----------------------------|---------------------|
| Orientation                | South               |
| Property Tenure            | 1                   |
| Transaction Type           | 6                   |
| Terrain Type               | Suburban            |
| 1.0 Property Type          | House, Mid-Terrace  |
| 2.0 Number of Storeys      | 4                   |
| 3.0 Date Built             | 2022                |
| 4.0 Sheltered Sides        | 0                   |
| 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 |
|------------------|---------------------|-----------------------|-----------------------|
| Basement:        | 43.40 m             | 109.80 m <sup>2</sup> | 2.60 m                |
| Ground floor:    | 23.80 m             | 104.79 m <sup>2</sup> | 3.20 m                |
| 1st Storey:      | 25.20 m             | 94.70 m <sup>2</sup>  | 2.95 m                |
| 2nd Storey:      | 19.20 m             | 71.60 m <sup>2</sup>  | 2.00 m                |

|                 |                      |
|-----------------|----------------------|
| 8.0 Living Area | 22.70 m <sup>2</sup> |
|-----------------|----------------------|

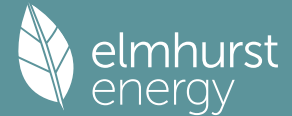
| 9.0 External Walls | Description   | Type         | Construction                                                         | U-Value (W/m <sup>2</sup> K) | Kappa (kJ/m <sup>2</sup> K) | Gross Area(m <sup>2</sup> ) | Nett Area (m <sup>2</sup> ) | Shelter Res | Shelter | Openings | Area Calculation Type |
|--------------------|---------------|--------------|----------------------------------------------------------------------|------------------------------|-----------------------------|-----------------------------|-----------------------------|-------------|---------|----------|-----------------------|
|                    | walls         | Solid Wall   | Solid wall : plasterboard on dabs, insulation, any outside structure | 0.14                         | 9.00                        | 150.40                      | 72.76                       | 0.00        | None    | 77.64    | Enter Gross Area      |
|                    | Walls in roof | Timber Frame | Timber framed wall (one layer of plasterboard)                       | 0.14                         | 9.00                        | 38.40                       | 38.40                       | 0.00        | None    | 0.00     | Enter Gross Area      |
|                    | Basement      | Solid Wall   | Solid wall : plasterboard on dabs, insulation, any outside structure | 0.14                         | 9.00                        | 112.84                      | 112.84                      | 0.00        | None    | 0.00     | Enter Gross Area      |
|                    | Dormer        | Timber Frame | Timber framed wall (one layer of plasterboard)                       | 0.14                         | 9.00                        | 9.00                        | 5.55                        | 0.00        | None    | 3.45     | Enter Gross Area      |

| 9.1 Party Walls | Description  | Type       | Construction | U-Value (W/m <sup>2</sup> K) | Kappa (kJ/m <sup>2</sup> K) | Area (m <sup>2</sup> ) | Shelter Res | Shelter |
|-----------------|--------------|------------|--------------|------------------------------|-----------------------------|------------------------|-------------|---------|
|                 | Party Wall 1 | Solid Wall | Other        | 0.00                         | 0.00                        | 136.00                 |             | None    |

| 9.2 Internal Walls | Description | Construction                 | Kappa (kJ/m <sup>2</sup> K) | Area (m <sup>2</sup> ) |
|--------------------|-------------|------------------------------|-----------------------------|------------------------|
|                    | GF          | Plasterboard on timber frame | 9.00                        | 143.90                 |
|                    | FF          | Plasterboard on timber frame | 9.00                        | 160.38                 |
|                    | SF          | Plasterboard on timber frame | 9.00                        | 22.80                  |
|                    | Base        | Plasterboard on timber frame | 9.00                        | 178.00                 |

| 10.0 External Roofs | Description         | Type                | Construction                      | U-Value (W/m <sup>2</sup> K) | Kappa (kJ/m <sup>2</sup> K) | Gross Area(m <sup>2</sup> ) | Nett Area (m <sup>2</sup> ) | Shelter Code | Shelter Factor | Calculation Type | Openings |
|---------------------|---------------------|---------------------|-----------------------------------|------------------------------|-----------------------------|-----------------------------|-----------------------------|--------------|----------------|------------------|----------|
|                     | Flat roof           | External Flat Roof  | Plasterboard, insulated flat roof | 0.12                         | 9.00                        | 33.10                       | 1.44                        | None         | 0.00           | Enter Gross Area | 1.44     |
|                     | External Roof Pitch | External Slope Roof | Plasterboard, insulated slope     | 0.12                         | 9.00                        | 54.00                       | 12.66                       | None         | 0.00           | Enter Gross Area | 12.66    |

# Summary for Input Data



|               |                     |                                          |      |      |       |      |      |      |                  |      |
|---------------|---------------------|------------------------------------------|------|------|-------|------|------|------|------------------|------|
| External Roof | External Plane Roof | Plasterboard, insulated at ceiling level | 0.12 | 9.00 | 23.10 | 0.00 | None | 0.00 | Enter Gross Area | 0.00 |
|---------------|---------------------|------------------------------------------|------|------|-------|------|------|------|------------------|------|

## 10.2 Internal Ceilings

| Description        | Storey          | Construction                                   | Area (m²) |
|--------------------|-----------------|------------------------------------------------|-----------|
| Internal Ceiling 1 | Basement        | Plasterboard ceiling, carpeted chipboard floor | 109.80    |
| Internal Ceiling 2 | Lowest occupied | Plasterboard ceiling, carpeted chipboard floor | 94.70     |
| Internal Ceiling 3 | +1              | Plasterboard ceiling, carpeted chipboard floor | 71.60     |

## 11.0 Heat Loss Floors

| Description | Type                          | Storey Index | Construction                           | U-Value (W/m²K) | Shelter Code | Shelter Factor | Kappa (kJ/m²K) | Area (m²) |
|-------------|-------------------------------|--------------|----------------------------------------|-----------------|--------------|----------------|----------------|-----------|
| Basement    | Ground Floor - Solid Basement |              | Slab on ground, screed over insulation | 0.11            | None         | 0.00           | 110.00         | 109.80    |

## 11.2 Internal Floors

| Description      | Storey Index | Construction                                   | Kappa (kJ/m²K) | Area (m²) |
|------------------|--------------|------------------------------------------------|----------------|-----------|
| Internal Floor 1 |              | Plasterboard ceiling, carpeted chipboard floor | 9.00           | 104.79    |
| Internal Floor 2 |              | Plasterboard ceiling, carpeted chipboard floor | 9.00           | 94.70     |
| Internal Floor 3 |              | Plasterboard ceiling, carpeted chipboard floor | 9.00           | 71.60     |

## 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         | 1.20            |
| Door        | Manufacturer | Solid Door  |                        |             |              |         |            |              | 1.00            |
| RL          | Manufacturer | Roof Window | Double Low-E Soft 0.05 |             |              | 0.63    |            | 0.70         | 1.20            |
| Window 0.9  | Manufacturer | Window      | Triple Low-E Soft 0.05 |             |              | 0.57    |            | 0.70         | 0.90            |
| RL 0.9      | Manufacturer | Roof Window | Triple Low-E Soft 0.05 |             |              | 0.57    |            | 0.70         | 0.90            |

## 13.0 Openings

| Name            | Opening Type | Location            | Orientation | Area (m²) | Pitch |
|-----------------|--------------|---------------------|-------------|-----------|-------|
| Front door      | Door         | walls               | South       | 5.27      |       |
| Front elevation | Windows      | walls               | South       | 27.59     |       |
| Front RL        | RL           | External Roof Pitch | South       | 2.21      | 28    |
| Rear elevation  | Windows      | walls               | North       | 8.77      |       |
| RL              | RL           | Flat roof           | Horizontal  | 1.44      | 0     |
| Rear RL         | RL 0.9       | External Roof Pitch | North       | 9.00      | 20    |
| Rear dormer     | Windows      | Dormer              | North       | 3.45      |       |
| RL              | RL           | External Roof Pitch | North       | 1.46      | 0     |
| Rear bifold     | Window 0.9   | walls               | North       | 36.01     |       |

## 14.0 Conservatory

## 15.0 Draught Proofing

 %

## 16.0 Draught Lobby

## 17.0 Thermal Bridging

## 17.1 List of Bridges

| Bridge Type                                          | Source Type         | Length | Psi  | Adjusted Reference: | Imported |
|------------------------------------------------------|---------------------|--------|------|---------------------|----------|
| E1 Steel lintel with perforated steel base plate     | Gov Approved Scheme | 38.11  | 0.04 | 0.04                | Yes      |
| E3 Sill                                              | Gov Approved Scheme | 35.77  | 0.03 | 0.03                | Yes      |
| E4 Jamb                                              | Gov Approved Scheme | 99.60  | 0.04 | 0.04                | Yes      |
| E5 Ground floor (normal)                             | Gov Approved Scheme | 43.40  | 0.10 | 0.10                | Yes      |
| E6 Intermediate floor within a dwelling              | Gov Approved Scheme | 68.20  | 0.00 | 0.00                | Yes      |
| E18 Party wall between dwellings                     | Gov Approved Scheme | 43.00  | 0.03 | 0.03                | Yes      |
| R1 Head of roof window                               | Table K1 - Default  | 4.01   | 0.24 | 0.24                | Yes      |
| R2 Sill of roof window                               | Table K1 - Default  | 4.01   | 0.24 | 0.24                | Yes      |
| R3 Jamb of roof window                               | Table K1 - Default  | 10.26  | 0.24 | 0.24                | Yes      |
| P2 Party wall - Intermediate floor within a dwelling | Gov Approved Scheme | 50.00  | 0.03 | 0.03                | No       |
| E10 Eaves (insulation at ceiling level)              | Gov Approved Scheme | 17.40  | 0.09 | 0.09                | No       |
| P4 Party wall - Roof (insulation at ceiling level)   | Gov Approved Scheme | 14.00  | 0.05 | 0.05                | No       |

Y-value  W/m²K

## 18.0 Pressure Testing

Designed AP<sub>50</sub>  m³/(h.m²) @ 50 Pa

Test Method

## 19.0 Mechanical Ventilation

### Mechanical Ventilation

Mechanical Ventilation System Present

Approved Installation

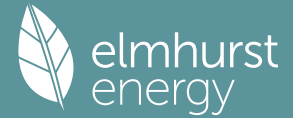
Mechanical Ventilation data Type

Type

MV Reference Number

Configuration

# Summary for Input Data



|                                              |                                                |
|----------------------------------------------|------------------------------------------------|
| Manufacturer SFP                             | 0.99                                           |
| Duct Type                                    | Rigid                                          |
| MVHR Efficiency                              | 88.00                                          |
| Wet Rooms                                    | 6                                              |
| 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                        |                           |                    |                         |                    |
|                   | <b>Name</b><br>Lighting 1 | <b>Efficacy</b><br>810.00 | <b>Power</b><br>10 | <b>Capacity</b><br>8100 | <b>Count</b><br>35 |

## 24.0 Main Heating 1

|                        |                                 |   |
|------------------------|---------------------------------|---|
| Percentage of Heat     | 100.00                          | % |
| Database Ref. No.      | 103164                          |   |
| Fuel Type              | Electricity                     |   |
| In Winter              | 0.00                            |   |
| In Summer              | 0.00                            |   |
| Model Name             | Ecodan 11.2 kW                  |   |
| 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 and Underfloor        |   |
| Underfloor Heating     | Yes - Pipes in thin screed      |   |
| Flow Temperature       | Enter value                     |   |
| Flow Temperature Value | 35.00                           |   |

|                     |      |
|---------------------|------|
| 25.0 Main Heating 2 | None |
|---------------------|------|

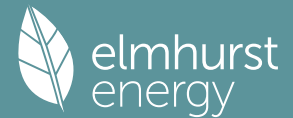
|                    |      |
|--------------------|------|
| 26.0 Heat Networks | None |
|--------------------|------|

| 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 mains     |
| Bath Count                                       | 1              |
| Immersion Only Heating Hot Water                 | No             |

# Summary for Input Data



## 28.1 Showers

| Description | Shower Type | Flow Rate<br>[l/min] | Rated Power<br>[kW] | Connected | Connected To |
|-------------|-------------|----------------------|---------------------|-----------|--------------|
|-------------|-------------|----------------------|---------------------|-----------|--------------|

## 28.3 Waste Water Heat Recovery System

### 29.0 Hot Water Cylinder

|                          |                                  |  |  |         |  |
|--------------------------|----------------------------------|--|--|---------|--|
|                          | Hot Water Cylinder               |  |  |         |  |
| Cylinder Stat            | Yes                              |  |  |         |  |
| Cylinder In Heated Space | Yes                              |  |  |         |  |
| Insulation Type          | Measured Loss                    |  |  |         |  |
| Cylinder Volume          | 300.00                           |  |  | L       |  |
| Loss                     | 2.43                             |  |  | 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] | 8.00         |  |  |  |  |  |  |  |  |  |

| PV Cells kWp | Orientation | Elevation | Overshading    | FGHRS | MCS Certificate | Overshading<br>Factor | MCS<br>Certificate<br>Reference | Panel<br>Manufacturer |
|--------------|-------------|-----------|----------------|-------|-----------------|-----------------------|---------------------------------|-----------------------|
| 4.00         | South       | 30°       | 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  
0

Environmental Impact  
0