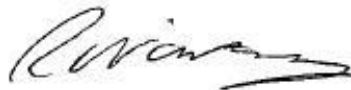


# Energy Statement

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## Conwy Close, Reading

**Prepared for:** Hill Partnerships Ltd

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|-----------------------------------------------------------------------------------|-----------------|------------------------------------------------------------------------------------|--|
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| Version | Status | Date       | Change Summary                     |
|---------|--------|------------|------------------------------------|
| ES1     | Final  | 31/10/2017 | Issued to client                   |
| ES2     | Final  | 21/11/2017 | PV amount, MVHR, PIV, House boiler |
| ES3     | Final  | 27/11/2017 | Amended house boiler               |
|         |        |            |                                    |
|         |        |            |                                    |



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## 1. Executive Summary

This Energy Statement has been produced to comply with clause A20.800 of the Employers Requirements for Conwy Close for Reading Borough Council – Revision 3 dated 11/07/17, for the construction of Conwy Close in Reading. The development will comprise 23 new build houses and 34 new build apartments.

In accordance with the requirements of Reading Borough Council, preliminary calculations have been produced and results have been measured against the national energy hierarchy. These results can be seen in Table 1, all data produced has been based on the specification provided by Hill Partnerships Ltd and will require reassessment at detailed design stage.

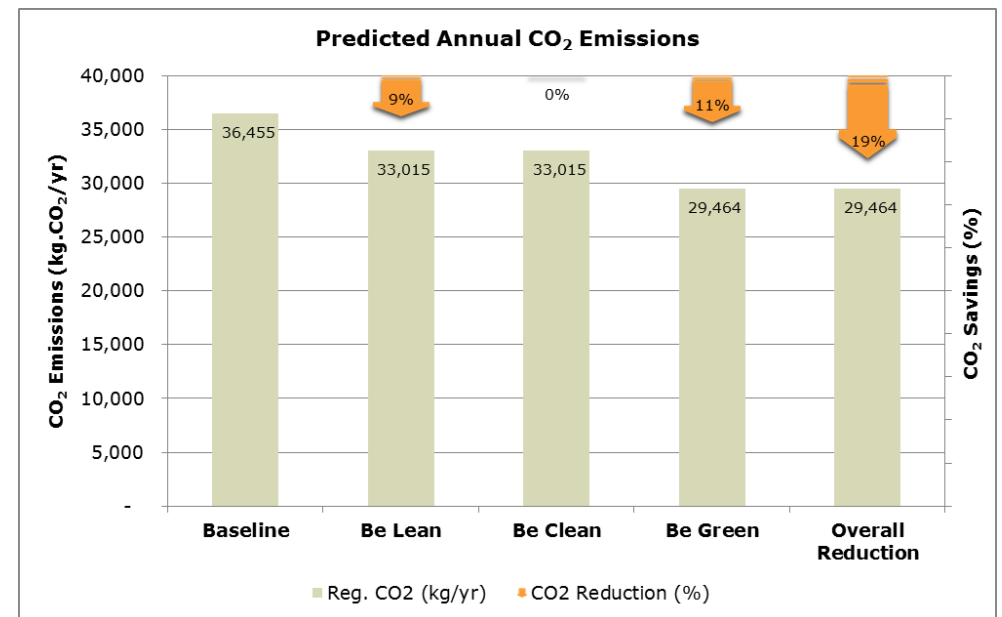
The development achieves the targets associated with clause A20.800 through a fabric first approach and including photovoltaic panels. It does so by incorporating the following:

- Low U-values
- Low air permeability
- Accredited Construction thermal bridging details
- Efficient heating and ventilation services
- Low energy lights
- Photovoltaic Panels

By using this approach, the development will attain a 20.5% reduction in CO<sub>2</sub> emissions to 58% of the site and as such has met the requirements of Reading Borough Local Development Framework Core Strategy (Policy CS1), and clause A20.800 of the Employers Requirements for Conwy Close for Reading Borough Council – Revision 3 dated 11/07/17.

|                 | Predicted Annual CO <sub>2</sub> Emissions<br>(kg.CO <sub>2</sub> /year) | CO <sub>2</sub> Reduction<br>(%) | Cumulative CO <sub>2</sub> Reduction<br>(%) |
|-----------------|--------------------------------------------------------------------------|----------------------------------|---------------------------------------------|
| <b>Baseline</b> | 42,953                                                                   | -                                | -                                           |
| <b>Be Lean</b>  | 37,595                                                                   | 12.5%                            | 12.5%                                       |
| <b>Be Clean</b> | 37,595                                                                   | 0.0%                             | 12.5%                                       |
| <b>Be Green</b> | 34,165                                                                   | 9.1%                             | 20.5%                                       |
| <b>Target</b>   | 34,362                                                                   | 20%                              | <b>Target Achieved</b>                      |

**Table 1. CO<sub>2</sub> reduction summary**



**Figure 1. Predicted annual CO<sub>2</sub> emissions**

## 2. Introduction

Stroma Technology has been commissioned by Hill Partnerships Ltd to prepare an Energy Statement in support of clause A20.800 of the Employers Requirements for Conwy Close for Reading Borough Council – Revision 3 dated 11/07/17 at Conwy Close, Reading.

The proposed development is located within the boundary of Reading Borough Council and will therefore need to meet the requirements of the Reading Borough Local Development Framework Core Strategy (adopted January 2015).

The approach taken will be based on the national energy hierarchy, which adopts a fabric first approach shown in Figure 1. The hierarchy uses a tiered methodology which follows fabric first, then low and zero carbon technology and finally renewable energy generation.

The Energy Strategy for the proposed development will be as follows:

1. Incorporate passive features such as low U-values, low air permeability and correct orientation.
2. Install energy efficient building services such as high efficiency gas condensing boilers.
3. Research the possibility of decentralised energy and integrate where viable.
4. Consider renewable technology if required to meet target.



**Figure 2. Energy Hierarchy**

### 3. The Development Site

The development site is located within the local borough of Reading, comprising of previously developed infill land and car park. The site is bounded by a significant residential development to the east and Thames Valley School to the west. Access to the development will be via Conwy close, where the existing car park exists.

The proposed development will involve the erection of 23 new build houses and 34 apartments spread over three apartment blocks.



Figure 3. Satellite image of the development site (outlined)



Figure 4. The development site viewed from Conwy Close



Figure 5. The development site viewed from The Medway



## 4. Planning Policy

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### 4.1. Local Policy – Reading Borough Council

Reading Borough Local Development Framework Core Strategy (adopted January 2015), contains frameworks for Sustainable Design and Carbon Reduction. This Energy Statement must address the following policies within this document<sup>1</sup>:

#### **Reading Borough Local Development Framework Core Strategy (adopted January 2015)**

##### **Core Strategy Policy CS1: Sustainable Construction and Design**

1. All new housing is required to meet the most up to date Eco-Homes 'Very Good' as a minimum standard, and all new commercial developments are required to meet the most up to date BREEAM 'Very Good' as a minimum standard;
  2. On larger developments of more than 10 dwellings or 1,000 m<sup>2</sup> of floorspace, ensure that 50% of the provision meets the most up to date Eco-Homes and BREEAM 'Excellent' standards;
  3. All new developments maximise the use of energy efficiency and energy conservation measures in their design, layout and orientation to reduce overall energy demand;
  4. All developments of more than 10 dwellings or 1000m<sup>2</sup> floorspace incorporate on-site generation of energy from renewable sources and energy efficient design measures (including the use of CHP where appropriate) to off-set at least 20% of predicted carbon dioxide emissions
- 

from the estimated energy usage of the completed and occupied development;

5. All developments reduce mains water use and demonstrate that water conservation measures are incorporated so that predicted per capita consumption does not exceed the appropriate levels set out in the Code for Sustainable Homes or BREEAM Standards
6. Developments incorporate sustainable urban drainage facilities and techniques as part of the layout of a development as appropriate and as advised by the Environment Agency, including minimising the size of impermeable areas so that peak run-off and annual water run-off is reduced where possible and in any case is no greater than the original conditions of the site. Particular care will be needed in areas of flood risk where different solutions may be required.

## 4.2. Planning Conditions

The decision notice for this development was submitted when there was still a requirement for Code for Sustainable Homes. As this has been withdrawn for new developments, Reading Borough Council have included clause A20.800 within the Employers Requirements that states the following:

### **'Code for Sustainable Homes**

*The Code for Sustainable Homes has been withdrawn for new developments and is not applicable.*

### **Improvement in energy efficiency standard**

*The contractor shall comply with Reading Borough Council's Planning Policy Requirement CS1 that requires that an agreed percentage of the development is to achieve an energy efficiency standard of a minimum of 19% CO<sub>2</sub> improvement over Building Regulations requirements Part L 2013 Edition with 2016 Amendments (Target Emission Rate Baseline).*

*The Contractor has confirmed that 56% of the development will achieve an energy efficiency standard of a minimum of 19% improvement over Building Regulations. The balance of the development to achieve standard Building Regulations requirements.*

*The contractor will provide SAP and other documentary evidence to show the achievement of 19% CO<sub>2</sub> improvement over Building Regulations.'*

## 5. Legislation

### 5.1. Building Regulations -Residential

Approved document L1A – Conservation of fuel and Power sets the standard for carbon emissions for new dwellings and was last revised in April 2014 (Part L: 2013). The properties will need to comply with the criteria set out in the document, as follows:

1. The predicted Dwelling Emission Rate of CO<sub>2</sub> emissions from dwellings (DER) are not greater than the Target Emission Rate (TER).
2. The performance of the building fabric and fixed building services should be no worse than the design limits set out in Table 2 of the Approved Document.
3. The dwellings will have appropriate passive control measures to limit the effect of solar gains on indoor temperatures in summer.
4. That the performance of dwellings as-built comply with the DER values achieved, including site testing of a representative sample of dwellings demonstrating that the 'air permeability' rate achieved is as per that specified, or better.
5. The necessary provisions for energy efficient operation of dwellings are put in place, including operation and maintenance instructions aimed at achieving economy in the use of fuel and power in a way that householders can understand.

Compliance with the Approved Document Part L1a should be demonstrated at detailed design stage, prior to construction.

### 5.2. Methodology

Predicted annual energy consumption has been determined using Standard Assessment Procedure (SAP) analysis. In each case, calculations have been undertaken using Government approved software by a trained and accredited assessor. Results are derived in respect of floor area and consider energy use (kWh/m<sup>2</sup>.yr) and associated CO<sub>2</sub> emissions (kg.CO<sub>2</sub>/m<sup>2</sup>.yr) from the following:

- Space heating
- Domestic hot water
- Ventilation
- Lighting
- Ancillary pumps and fans
- Energy generating technology

### 5.3. Residential (SAP)

SAP is compliant with the EU Energy Performance of Buildings Directive and is carried out using approved software. For the purposes of this report FSAP 2012 version 1.0.4.7 has been used to generate the data.

SAP calculations have been undertaken for a selection of residential apartments and results have been used to determine the predicted energy consumption and CO<sub>2</sub> emissions for the entire development.

Table 2 demonstrates that 51% of the site meets the 19% improvement target through the block compliance method. Please see Appendix A for Block Compliance Report showing 19% improvement.

An indicative fabric and systems specification has been based upon information provided by Hill Partnerships Ltd.

| Plots with PV                 |     |           |           |           |      |           |
|-------------------------------|-----|-----------|-----------|-----------|------|-----------|
| Plot                          | TFA | TER       | DER       | Baseline  |      | Be Green  |
|                               | m2  | kg.co2.m2 | kg.co2.m2 | kg.co2.yr |      | kg.co2.yr |
| 02-17-61718 Flat 1-1          |     | 70.95     | 19.99     | 16.89     | 1418 | 1198      |
| 02-17-61718 Flat 1-2          |     | 70.95     | 17.73     | 14.58     | 1258 | 1034      |
| 02-17-61718 Flat 1-3          |     | 51.69     | 21.55     | 18.52     | 1114 | 957       |
| 02-17-61718 Flat 1-4          |     | 70.95     | 22.46     | 15.74     | 1594 | 1117      |
| 02-17-61718 Flat 1-5          |     | 51.69     | 21.55     | 18.44     | 1114 | 953       |
| 02-17-61718 Flat 2-14         |     | 50.56     | 20.9      | 17.81     | 1057 | 900       |
| 02-17-61718 Flat 2-15         |     | 70.56     | 18.81     | 15.49     | 1327 | 1093      |
| 02-17-61718 Flat 2-16         |     | 70.56     | 18.81     | 15.73     | 1327 | 1110      |
| 02-17-61718 Flat 2-17         |     | 70.56     | 16.57     | 13.29     | 1169 | 938       |
| 02-17-61718 Flat 2-18         |     | 70.56     | 16.61     | 13.48     | 1172 | 951       |
| 02-17-61718 Flat 2-19         |     | 70.56     | 16.57     | 13.29     | 1169 | 938       |
| 02-17-61718 Flat 2-20         |     | 70.56     | 21.2      | 14.65     | 1496 | 1034      |
| 02-17-61718 Flat 2-21         |     | 70.56     | 18.81     | 15.5      | 1327 | 1094      |
| 02-17-61718 Flat 3-22         |     | 49.82     | 21.2      | 18.28     | 1056 | 911       |
| 02-17-61718 Flat 3-23         |     | 70.66     | 17.95     | 14.82     | 1268 | 1047      |
| 02-17-61718 Flat 3-24         |     | 50.59     | 19.82     | 16.83     | 1003 | 851       |
| 02-17-61718 Flat 3-25         |     | 51.29     | 20.41     | 17.47     | 1047 | 896       |
| 02-17-61718 Flat 3-26         |     | 62.53     | 19.14     | 16.15     | 1197 | 1010      |
| 02-17-61718 Flat 3-27         |     | 51.15     | 21.85     | 19.2      | 1118 | 982       |
| 02-17-61718 Flat 3-28         |     | 69.9      | 19.05     | 16.49     | 1332 | 1153      |
| 02-17-61718 Flat 3-29         |     | 77.14     | 17.3      | 13.19     | 1335 | 1017      |
| 02-17-61718 Flat 3-30         |     | 70.66     | 15.73     | 12.45     | 1111 | 880       |
| 02-17-61718 Flat 3-31         |     | 70.5      | 16.85     | 12.61     | 1188 | 889       |
| 02-17-61718 Flat 3-32         |     | 51.29     | 18.05     | 14.86     | 926  | 762       |
| 02-17-61718 Flat 3-33         |     | 62.53     | 16.82     | 13.62     | 1052 | 852       |
| 02-17-61718 Flat 3-34         |     | 70.43     | 17.62     | 13.62     | 1241 | 959       |
| 02-17-61718 Flat 3-35         |     | 70.43     | 22.27     | 15.7      | 1568 | 1106      |
| 02-17-61718 Flat 3-36         |     | 69.9      | 21.66     | 15.85     | 1514 | 1108      |
| 02-17-61718 Flat 3-37         |     | 77.14     | 20.68     | 14.04     | 1595 | 1083      |
| 02-17-61718 Flat 3-38         |     | 70.66     | 19.89     | 14.14     | 1405 | 999       |
| 02-17-61718 Flat 3-39         |     | 70.5      | 19.93     | 14.05     | 1405 | 991       |
| 02-17-61718 Flat 3-40         |     | 51.29     | 22.61     | 19.91     | 1160 | 1021      |
| 02-17-61718 Flat 3-41         |     | 62.53     | 21.18     | 15.41     | 1324 | 964       |
| 02-17-61718 Flat 3-42         |     | 70.43     | 22.23     | 19.41     | 1566 | 1367      |
|                               |     |           |           | 42953     |      | 34165     |
| Total No of dwellings on site | 57  |           |           |           |      |           |
| Total No achieving 19%        | 33  |           |           |           |      |           |
| % on site achieving 19%       | 58% |           |           |           |      |           |

**Table 2. Percentage of plots achieving 20.5%**

**BE LEAN**  
**USE LESS ENERGY**

## 6. Be Lean – Use Less Energy

This section outlines the proposals for specifying building fabric and services beyond the requirements of Building Regulations (the baseline).

Fundamental to achieving energy efficiency in any new building is the specification of a thermally efficient building envelope. Passive design features such as **high levels of insulation**, designing to maximise **solar gain** and limiting heat loss through **reduced air leakage and enhanced thermal bridging** are all proven techniques to increase energy consumption and reduce emissions.

### 6.1. Building Fabric-Residential

Limited assumptions have been made on this development in order to meet the fabric efficiency targets for Building Regulations 2013 as the majority of the specification has been provided by Hill Partnerships Ltd. Compliance has been attained by targeting values closer to the notional u-values set out within *Table 4: Summary of concurrent notional dwelling specification, Approved Document L1A*. The Target Fabric Energy Efficiency (TFEE) has been achieved by incorporating Accredited Construction Details (ACDs) into the calculation to reduce heat losses via thermal bridging.

Tables 3 and 4 show the proposed building fabric specification applied to the SAP calculations with respect to the upper limits stipulated by Part L1a: 2010. It can be seen that the values represent in some areas a significant bettering of the mandatory requirements set out in the current Building Regulations.

| Building fabric (Houses)                                    |                                                 |                                        |                 |
|-------------------------------------------------------------|-------------------------------------------------|----------------------------------------|-----------------|
| Element                                                     | L1A:2010 limiting U-value (W/m <sup>2</sup> .K) | Proposed U-value (W/m <sup>2</sup> .K) | Improvement (%) |
| Ground Floor                                                | 0.25                                            | 0.12                                   | 52%             |
| Floor to garage                                             | 0.25                                            | 0.3                                    | -20%            |
| External walls                                              | 0.30                                            | 0.19                                   | 37%             |
| Garage Wall                                                 | 0.30                                            | 0.19                                   | 37%             |
| Dormer Cheeks                                               | 0.30                                            | 0.19                                   | 37%             |
| Party wall between dwellings                                | 0.20                                            | 0.00                                   | 100%            |
| Roof Insulated at Ceiling                                   | 0.20                                            | 0.10                                   | 50%             |
| Sloping Roof                                                | 0.20                                            | 0.15                                   | 25%             |
| Windows                                                     | 2.00                                            | 1.20                                   | 40%             |
| Doors                                                       | 2.00                                            | 1.30                                   | 35%             |
| y-value                                                     | 0.15                                            | 0.0921 – 0.1269                        | 15%- 39%        |
| Air permeability (m <sup>3</sup> /h.m <sup>2</sup> @ 50 Pa) |                                                 |                                        |                 |
| Entire building                                             | 10.0                                            | 5.0                                    | 50%             |

**Table 4. Building fabric performance (Houses)**

| Building fabric (Apartments)                                |                                                 |                                        |                 |
|-------------------------------------------------------------|-------------------------------------------------|----------------------------------------|-----------------|
| Element                                                     | L1A:2010 limiting U-value (W/m <sup>2</sup> .K) | Proposed U-value (W/m <sup>2</sup> .K) | Improvement (%) |
| Ground Floor                                                | 0.25                                            | 0.12                                   | 52%             |
| Exposed Floor                                               | 0.25                                            | 0.12                                   | 52%             |
| External walls                                              | 0.30                                            | 0.19                                   | 37%             |
| Wall to Corridor                                            | 0.30                                            | 0.30                                   | 0%              |
| Party wall between dwelling                                 | 0.20                                            | 0.00                                   | 100%            |
| Flat Roof                                                   | 0.20                                            | 0.12                                   | 40%             |
| Windows                                                     | 2.00                                            | 1.40                                   | 30%             |
| Doors                                                       | 2.00                                            | 1.60                                   | 20%             |
| y-value                                                     | 0.15                                            | 0.0542 – 0.2108                        | -40% - 64%      |
| Air permeability (m <sup>3</sup> /h.m <sup>2</sup> @ 50 Pa) |                                                 |                                        |                 |
| Entire building                                             | 10.0                                            | 5.0                                    | 50%             |

**Table 5. Building fabric performance (Apartments)**

## 6.2. Building Services- Residential

It is taken that all heat to the dwellings will be supplied by individual boilers. Condensing boilers can increase efficiency by condensing water vapour produced from combustion in order to extract heat which would otherwise be lost.

The heating systems will be equipped with time and temperature zone controls for the houses and the apartments will use a programmer, room thermostats and TRVs. The efficiency of a heating system is greatly increased by dividing the home into distinct heating zones covering different heating needs. In most cases there is no need to heat bedrooms during the day, when they are not in use, or to run the whole system at the same temperature. This allows residents to make a more targeted and efficient use of heat generation.

The ventilation strategy is based upon an air tight construction and a mix of naturally ventilation and the incorporation of mechanical ventilation. Balanced whole-house mechanical ventilation will be utilised for the apartments using a Greenwood Vireo HR155WM or other system with equivalent efficiency. All houses will be utilising natural ventilation with wet room extracts.

Low energy lighting will be specified throughout, i.e. having a luminous efficacy of greater than 45 lumens per circuit watt. Typically this will be achieved with LEDs or compact fluorescent lights. Low voltage halogen spot lights should not be used as these are not low energy.

| Element                        | Specification (Houses & Apartments)                                                                                                                                                                       |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Boilers</b>                 | <ul style="list-style-type: none"> <li>- Houses: Worcester Greenstar 35 CDi Classic System (or equivalent efficiency)</li> <li>- Apartments: Ideal Logic Combi ESP1 (or equivalent efficiency)</li> </ul> |
| <b>Heating emitter</b>         | System with radiators                                                                                                                                                                                     |
| <b>Heating control</b>         | <ul style="list-style-type: none"> <li>- Houses: Time and temperature zone control</li> <li>- Apartments: Programmer, room thermostat &amp; TRVs</li> </ul>                                               |
| <b>Domestic hot water</b>      | From main heating system.                                                                                                                                                                                 |
| <b>Water consumption</b>       | ≤105 litres/person/day                                                                                                                                                                                    |
| <b>Internal fixed lighting</b> | 100% low energy                                                                                                                                                                                           |
| <b>Ventilation</b>             | <ul style="list-style-type: none"> <li>- Houses: Positive input from loft</li> <li>- Apartments: Nuaire MRXBOX95-WH1</li> </ul>                                                                           |
| <b>Thermal bridging</b>        | Accredited Construction Details adopted                                                                                                                                                                   |
| <b>Thermal mass parameter</b>  | Calculated Houses – (231-385 kJ/m <sup>2</sup> .K).<br>Calculated Apartments – (181-347 kJ/m <sup>2</sup> .K).                                                                                            |

**Table 6. Building services specification (Houses & Apartments)**

|                 | Predicted Annual CO <sub>2</sub> Emissions<br>(kg.CO <sub>2</sub> /year) | CO <sub>2</sub> Reduction<br>(%) | Cumulative CO <sub>2</sub> Reduction<br>(%) |
|-----------------|--------------------------------------------------------------------------|----------------------------------|---------------------------------------------|
| <b>Baseline</b> | 42,953                                                                   | -                                | -                                           |
| <b>Be Lean</b>  | 37,595                                                                   | 12.5%                            | 12.5%                                       |
| <b>Be Clean</b> | -                                                                        | -                                | -                                           |
| <b>Be Green</b> | -                                                                        | -                                | -                                           |
| <b>Target</b>   | 34,362                                                                   | 20%                              | <b>Insufficient Reduction</b>               |

**Table 7. Whole site CO<sub>2</sub> emissions after 'Be Lean' measures**

### 6.3. Summertime Overheating

Effects of overheating have been well documented over recent years, often cited to result from climate change and modern construction techniques.

Although guidance exists across the industry to forecast the risk of overheating, design considerations are often required at concept stage to provide adequate mitigation.

#### 6.3.1. Common Causes

The Zero Carbon Hub state three factors most commonly associated with overheating risk to be; location, building design and occupational usage.

##### Location

The climate or, microclimate is subject to the geographic site location. Sun, wind and rain intensity are dependent upon where the development is situated and as such the design approach will vary accordingly - for example, average summertime temperatures are higher in the south east of England compared to the north east therefore, increasing ventilation levels to combat high internal temperatures in the south east has a diminished effect.

Dense urban development with minimal open green space may present risk associated with the 'urban heat island' effect. This comprises of heat absorbed by heavy man-made structures which is then radiated at night increasing the local temperature. This can be avoided by increasing green space and the use of solar reflective material and coatings.

##### Building Design

There are several elements of building design that effect overheating performance. The orientation of a building together with the proportion and location of glazing areas will determine the level of transmitted solar gain.

Where solar gain cannot be absorbed or, extracted, internal temperatures will increase. Although there is benefit in utilising 'free' solar energy to heat a building, the amount of this energy must be controlled.

Due to increasing energy efficiency standards, modern structures are often well insulated and constructed to high levels of air tightness. In addition to lower levels of thermal mass, this often results in a reduced ability to absorb or, purge heat compared to that of older buildings.

##### Occupants

Although the exact occupant use cannot generally be controlled for new construction projects, the setting out of a building should consider the impact of room use type and location in the context of solar and other incident heat gains. Overheating risk is effected by both the occupant density and anticipated activity type in a zone. For example, glazed perimeter rooms occupied predominantly in the afternoon may be best suited to east facing locations where the sun will have already passed.

### 6.3.2. Mitigation

For new-build construction projects, design considerations to reduce an overheating risk should be made at the earliest possible opportunity. Although performance measures can be incorporated at later stages, the most robust and effective techniques are often inherent to a buildings design.

The 'cooling hierarchy', defined within the London Plan and often referred to by other regions indicates the preferred approach to reducing overheating risk and a reliance upon mechanical cooling. The hierarchal steps are as follows;

1. Minimise heat generation through energy efficient design.
2. Reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls.
3. Manage the heat within the building through exposed thermal mass and high ceilings.
4. Passive ventilation.
5. Mechanical cooling.

Further to appropriate siting and orientation, there are several properties or functions that influence overheating performance.

#### Glazed proportion and specification

The location, proportion and specification of glazing should balance the benefits of natural light and 'free heat' though also ensure that levels of gain are not excessive. Glass manufacturers offer a broad variety of products including solar control coatings to enable the level of transmitted solar gain (denoted by the 'g-value') to be reduced with minimal impact upon visual performance. Certain

glass specifications may be more appropriate for certain orientations, e.g. a lower g-value to a south façade than the north.

#### Solar shading

In a similar vein to solar control glass coatings, external solar shading can be used to prevent the direct transmission of solar gain whilst enabling glazed areas to be maintained or, maximized. Horizontal overhangs are usually more appropriate for south facing windows due to higher sun angles. Conversely, vertical fins are more appropriate for east and west facing windows.



Figure 7. External solar shading<sup>2</sup>

<sup>2</sup> <http://levolux.com/tag/timber-fins/>

## Thermal Mass

Thermal mass is a physical property which defines the ability of an object or, construction to absorb heat energy; the greater the mass, the greater the potential heat absorption. Higher thermal mass construction enables heat to be absorbed during the day then released at night. This can reduce daytime temperatures and improve the thermal *stability* of a building. However, as greater energy is also then required to 'heat' the fabric, overall energy consumption can also increase in certain cases. Therefore, as with all of these approaches, a balance must be struck. Thermal mass can be increased by exposing dense fabric or increasing the physical connection between finishing materials, e.g. plaster, and the structural core, e.g. blockwork.

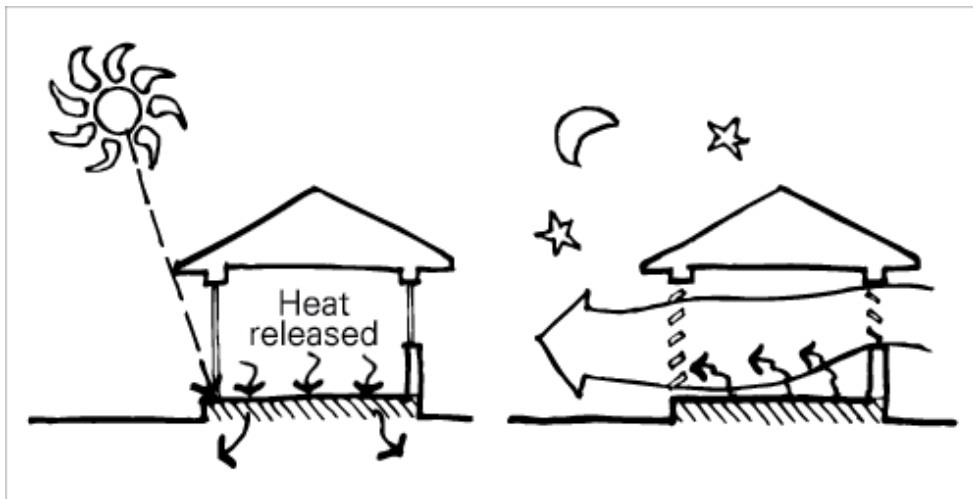


Figure 8. Principles of thermal mass<sup>3</sup>

## Ventilation

The ventilation strategy is critical to overheating performance. Background ventilation levels are low compared to the rates generally required to purge heat. Therefore, the ventilation strategy must enable the greatest volume of air to be moved should the requirement arise. The potential rate of ventilation is determined by a number of factors including;

- Opening type, size and duration.
- Building height and exposure.
- The number of storeys and opportunity for cross-ventilation.

Ventilation openings should enable the greatest possible opening for the greatest duration without compromising security and water ingress protection.

<sup>3</sup> <http://levolux.com/tag/timber-fins/>

### 6.3.3. Quantifying Overheating Risk

Several guidance documents exist which define overheating risk assessment and acceptable thresholds. These include; CIBSE Guide A, BB101, TM52 and SAP. The first three methods predominantly concern non-domestic development and require a Dynamic Simulation Modelling (DSM) exercise to be undertaken to calculate predicted internal temperatures. Predicted temperatures are compared against recommended limits to determine whether they are acceptable or, excessive.

The SAP assessment process is used for new residential developments and incorporates a summertime overheating risk calculation. Similarly to the other methods, SAP calculations consider heat gain from regional weather data, site exposure, solar and internal heat gains. The calculation determines a mean internal temperature which can be compared against the following thresholds. In order to comply with the SAP and Part L1a criteria, 'the likelihood of high internal temperatures during hot weather' must be less than 'high'.

| <b>Threshold Temperature (°C)</b> | <b>'Likelihood of high internal temperatures during hot weather'</b> |
|-----------------------------------|----------------------------------------------------------------------|
| <b>&lt; 20.5 °C</b>               | <b>Not Significant</b>                                               |
| <b>≥ 20.5 °C and &lt; 22.0 °C</b> | <b>Slight</b>                                                        |
| <b>≥ 22.0 °C and &lt; 23.5 °C</b> | <b>Medium</b>                                                        |
| <b>≥ 23.5 °C</b>                  | <b>High</b>                                                          |

**Table 8. SAP overheating criteria <sup>4</sup>**

<sup>4</sup> The governments Standard Assessment Procedure (SAP) for Energy Rating of Dwellings (2012)

**BE CLEAN**  
**SUPPLY ENERGY EFFICIENTLY**

## 7. Be Clean – Decentralised Energy

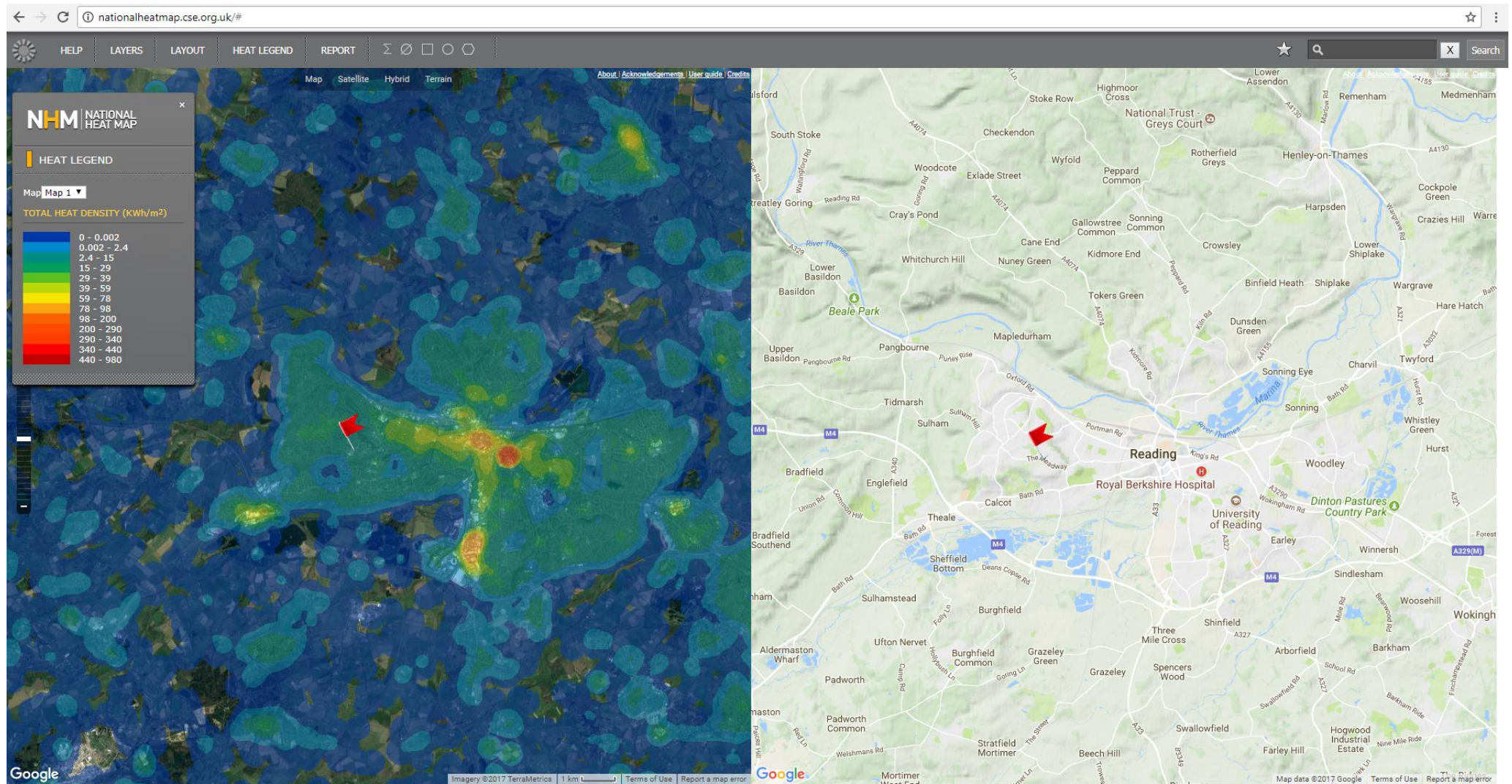


Figure 9. National Heat Map for site region

## 7.1. District Heating

Analysis of the National Heat Map was made to determine whether existing or proposed district heating networks are present in the vicinity of the development site. There are no existing district heat networks or proposed networks. As such it is not recommended to add development cost through the provision for future connection.

## 7.2. Combined Heat And Power

Combined Heat and Power (CHP) units typically comprise of a reciprocating engine, electrical generator and a series of heat exchangers fitted to the oil circuit, coolant circuit and the exhaust.

Electricity generated displaces power that would otherwise be sourced from the Grid and the thermal by-product is made useful to realise CO<sub>2</sub> and cost savings. As such and in order to be economically and technically feasible, a base heating load should exist to support regular and constant operation. The current rule of thumb calls for a minimum run hours of 5000 per annum (approx. 60%).

CHP engines are most ideally suited to developments which require significant and regular heat, e.g. swimming pools, care homes and hotels. They are not generally suited to developments where the heat load is sporadic or, infrequent, e.g. residential, offices and schools.

It is considered, that where residential developments are large, i.e. circa 500+ units, CHP may be an economic solution<sup>5</sup>. Viability may also exist in smaller

mixed-use developments (circa. 350 unit) where additional heat loads are present. In smaller residential developments, heat loads are likely to be too low and infrequent to support CHP without small engines and large buffer vessels. In addition to higher relative distribution losses, a smaller CHP system is also likely to offer a lower electrical efficiency and higher resulting NOx emissions.

As such the development size and nature renders Combined Heat and Power systems unsuitable due to the lack of a sufficient base heating load and increased distribution losses.

The well insulated fabric naturally lowers the demand for heat. Therefore it is not considered viable to achieve further CO<sub>2</sub> reductions through a decentralised energy strategy on this development.

|                 | Predicted Annual CO <sub>2</sub> Emissions<br>(kg.CO <sub>2</sub> /year) | CO <sub>2</sub> Reduction<br>(%) | Cumulative CO <sub>2</sub> Reduction<br>(%) |
|-----------------|--------------------------------------------------------------------------|----------------------------------|---------------------------------------------|
| <b>Baseline</b> | 42,953                                                                   | -                                | -                                           |
| <b>Be Lean</b>  | 37,595                                                                   | 12.5%                            | 12.5%                                       |
| <b>Be Clean</b> | 37,595                                                                   | 0.0%                             | 12.5%                                       |
| <b>Be Green</b> | -                                                                        | -                                | -                                           |
| <b>Target</b>   | 34,362                                                                   | 20%                              | <b>Insufficient Reduction</b>               |

**Table 9. Whole site CO<sub>2</sub> emissions after 'Be Clean' measures**

<sup>5</sup> ENERGY PLANNING, Greater London Authority guidance on preparing energy assessments, The London Mayor, March 2016.

**BE GREEN**  
**USE RENEWABLE ENERGY**

## 8. Be Green – Renewable Technology

### 8.1. Solar Photovoltaics

An initial energy assessment was carried out for the previous site developer to ascertain the suitability for low and zero carbon technology. This assessment concluded that further to passive design measures, solar PV would be the most viable technology in order to achieve the required CO<sub>2</sub> target. This technology would provide long term benefits and require minimal maintenance and intervention.

#### 8.1.1. Solar Photovoltaics

Solar photovoltaic (PV) panels comprise of a number of inter-connected cells that utilise semi-conductor technology to convert solar energy into electricity. High voltage, direct current is converted to alternating current and phased into the mains supply via an inverter. PV panels are most effective where mounted on exposed, south-facing areas, at an inclination close to 30° from the horizontal.

The technology is well proven and requires little maintenance; most panels are designed to be self-cleaning when mounted at appropriate angles and the design life of a panel typically exceeds the likely pay-back period by a considerable margin. PV has the significant advantage of reducing energy use and costs on site for residents whilst also reducing demand from the national grid and even contributing to grid energy.

#### 8.1.2. Technology Analysis – Solar Photovoltaics

The potential for CO<sub>2</sub> savings from solar PV has been assessed using the Governments approved SAP: 2012 methodology. This SAP methodology considers UK solar irradiance data, collector pitch, orientation and over-shading to determine the expected annual energy yield.

In order to represent a semi-optimal installation, it is taken that solar PV could be installed on roof areas offering ample space and excellent solar access, orientated south and on a horizontal pitch. On this basis, calculations show that a total installed PV capacity of 8.75 kWp (kilo-Watt peak) would be expected to generate 6,654 kWh per annum. Applying the current CO<sub>2</sub> emissions factor for grid-displaced electricity (0.519 kg.CO<sub>2</sub>/kWh), this generation corresponds to a CO<sub>2</sub> abatement of 3,454 kg.CO<sub>2</sub> per annum; to meet the target of 20.5% reduction from baseline site emissions.

|                 | Predicted Annual<br>CO <sub>2</sub> Emissions<br>(kg.CO <sub>2</sub> /year) | CO <sub>2</sub> Reduction<br>(%) | Cumulative CO <sub>2</sub><br>Reduction<br>(%) |
|-----------------|-----------------------------------------------------------------------------|----------------------------------|------------------------------------------------|
| <b>Baseline</b> | 42,953                                                                      | -                                | -                                              |
| <b>Be Lean</b>  | 37,595                                                                      | 12.5%                            | 12.5%                                          |
| <b>Be Clean</b> | 37,595                                                                      | 0.0%                             | 12.5%                                          |
| <b>Be Green</b> | 34,165                                                                      | 9.1%                             | 20.5%                                          |
| <b>Target</b>   | 34,362                                                                      | 20%                              | <b>Target Achieved</b>                         |

**Table 10. Whole site CO<sub>2</sub> emissions after 'Be Green' measures**

## 9. Conclusion

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This Energy Statement has outlined how this development will meet Building Regulations requirements by following the national energy hierarchy. This approach supports the fabric first approach improving thermal elements and building services prior to the consideration of connected heat and renewables. Decentralised energy has been researched as part of the 'Be Clean' section and finally renewable technology has been investigated.

### 9.1. Be Lean – use less energy

A building fabric and services specification is proposed which incorporates high efficiency heating, lighting and controls and a thermally efficient building fabric: low U-values; limiting air leakage and limiting thermal bridging.

### 9.2. Be Clean – supply energy efficiently

There is no current district heating network in the locality of this site. Combined Heat and Power is deemed unsuitable for a development of this type due to the lack of a sufficient base heating load.

### 9.3. Be Green – use renewable energy

Calculations show that a total installed solar photovoltaic capacity of 8.75 kWp would generate sufficient electricity to offset residual energy consumption and meet the overall 20% target to at least 56% of the site stipulated by clause A20.800 of the employer's requirements. This is based upon all panels being installed horizontal and facing towards south with little to no over-shading.

## 10. Summary

This statement has set out how the development will incorporate an energy efficient design which exceeds Part L 2013 Regulations and the requirements of Reading Borough Council by incorporating a highly efficient building fabric, services and photovoltaic panels; as such this development achieves a 20.5% reduction in CO<sub>2</sub> emissions to 58% of the site.

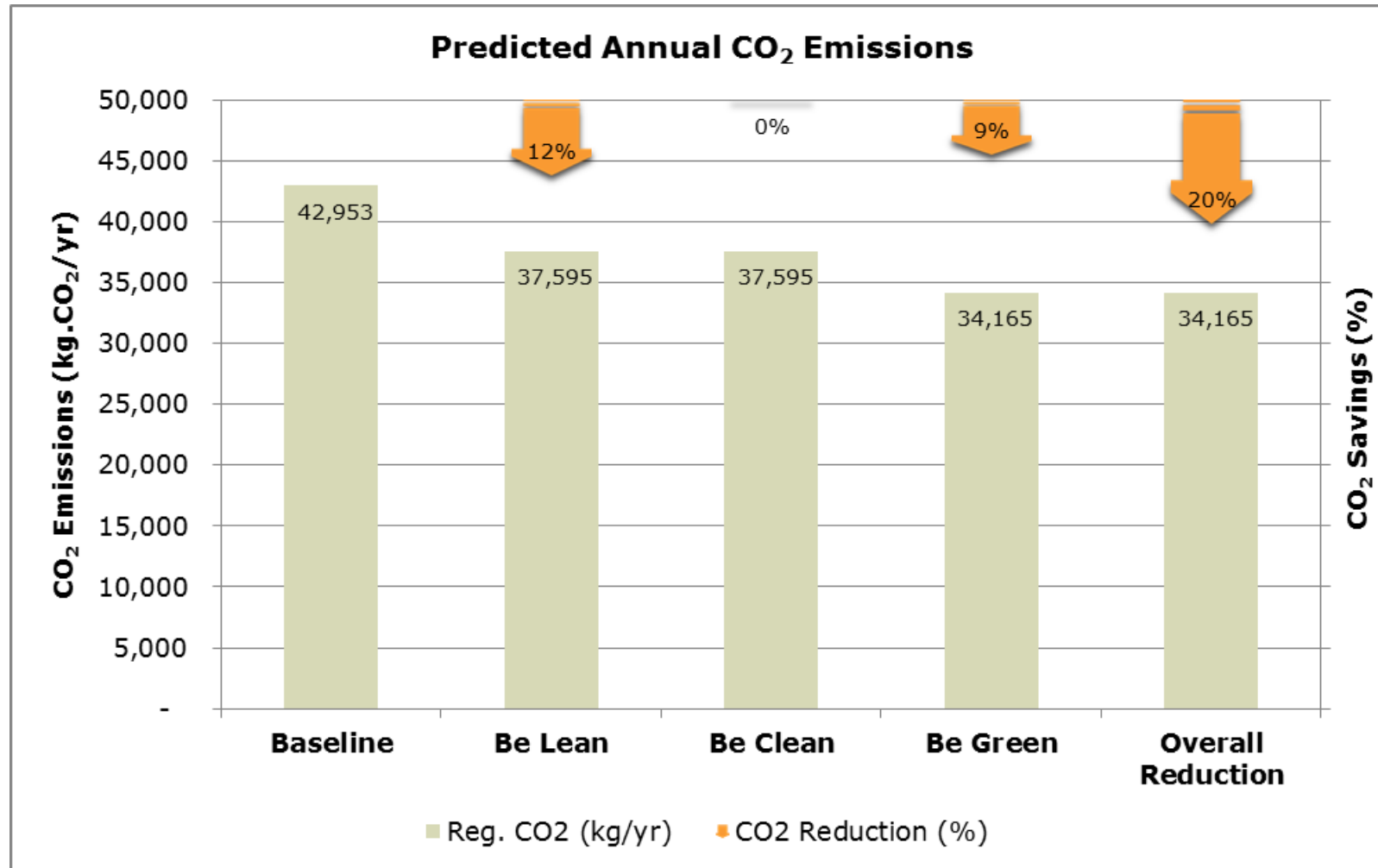


Figure 10. Whole site reduction in CO<sub>2</sub> emissions

# **APPENDICES**