Client	King & Co (Wells) Ltd			
Development	Wells Farm, Northaw Road East, Cuffley			
Author	Liam Bartlett	Reviewed by	Naomi Sadler	
Date	22.12.2020	Version No.	V 2.0	
Reason for version	For Information			

Energy & Sustainability Strategy

Wells Farm, Northaw Road East, Cuffley

Table of Contents

1. Executive Summary

This Statement is submitted as part of a suite of documents for an application seeking consent for the clearance of existing buildings, the construction of 14 new dwellings, engineering works and other associated works.

The developer acknowledges the council's aspiration for new developments to maximise the opportunity to reduce carbon emissions wherever possible, in order to help address the climate emergency.

With this in mind, this report highlights the energy strategy which is proposed to minimise the level of carbon emissions arising from the development.

Proposed measures include:

- Fabric First Approach to reducing the space heating energy demand
    - High specification thermal envelope minimising heat loss
    - Junctions to be designed to minimise the effects of thermal bridging
    - High levels of airtightness
- Natural ventilation and decentralised mechanical extract fans and background ventilators.
- Heat Pump technology providing high levels of thermal efficiency to provide space and water heating, dedicated low-temperature emitters will be used to ensure the system can operate at maximum efficiency.
- Advanced zone heating controls providing close control of heating.
- A Wastewater Heat Recovery System to recover up to 67% of the thermal energy typically wasted when showering.
- Installation of Photovoltaic Panels to provide free renewable energy and PV diverter to maximise energy usage on-site by ensuring hot water is produced before excess energy is exported.
- Installation of 1 EV charging point to each plot to allow easy adoption of efficient vehicles.
- Low flow sanitaryware fittings to reduce potable water usage.

Supporting calculations have been carried out using SAP 2012 and SAP 10.1 Beta software to assess for performance against both current and anticipated future Building Regulations.

The sample SAP 2012 calculations demonstrate that the proposed energy strategy should deliver an 18-21% reduction in carbon emissions from current Building Regulations through the implementation of energy efficiency and clean energy supply, increasing to between 18 and 50% after considering renewable technologies.

Sample SAP 10.1 calculation suggest the proposed strategy could deliver carbon reductions ranging from approximately 50 to 70%.

Sample SAP 10.1 calculations carried out using beta software have been provided as an illustration of how the proposed development would perform against the anticipated future Building Regulations with an aim to highlight the aspiration to future proof the development, avoiding the need for fossil fuels and making benefit from an improving grid electricity energy mix due to continued adoption of renewable energy generation.

As SAP 10.1 and future Building Regulations remain at consultation stage and the new regulations may differ at adoption, these figures are intended as a guide only.

It is considered that by following the proposed energy and sustainability measures, the development complies with the aims and objectives of the emerging plan and the Building Futures Toolkit.

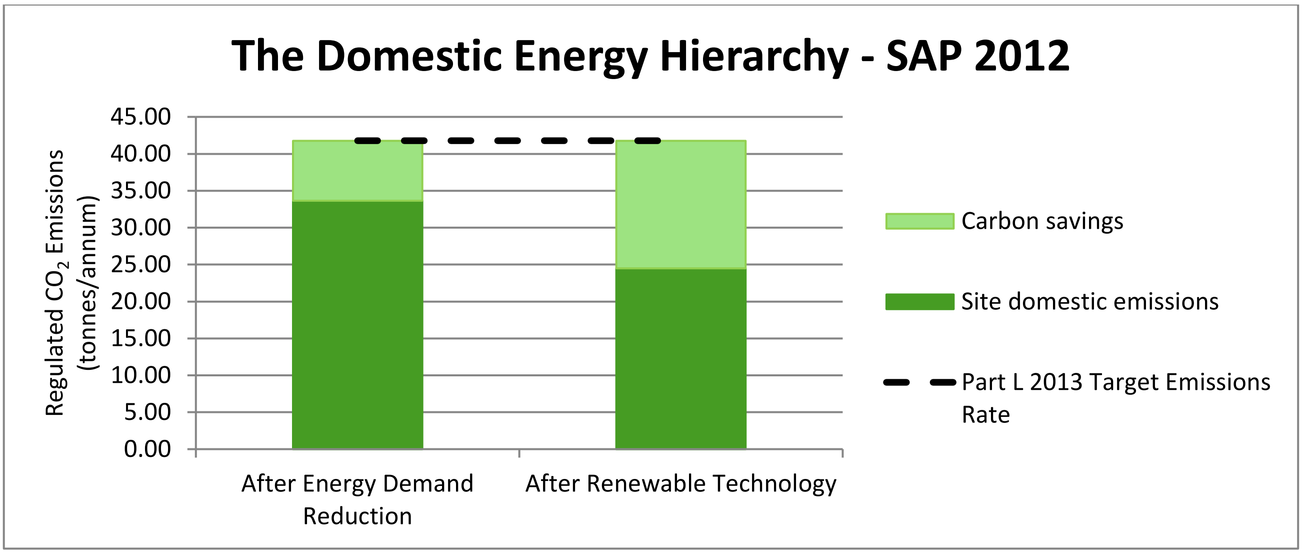

Figure 1: Energy Hierarchy Part L 2013 (SAP 2012)

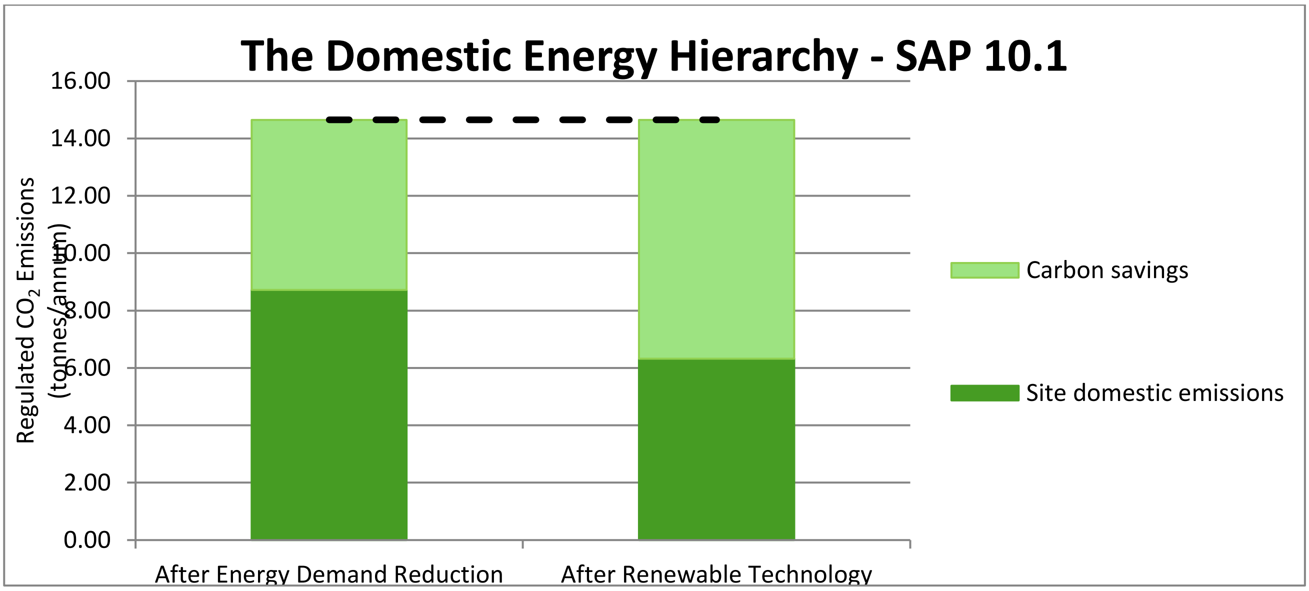

Figure 2: Energy Hierarchy Part L 2020 Consultation (SAP 10.1)

2. Site overview

This Statement is submitted as part of a suite of documents for an application seeking consent for the clearance of existing buildings, the construction of 14 new dwellings, engineering works and other associated works.

3. Planning Policy

In June 2019 Welwyn Hatfield Borough Council declared a climate emergency, with the aspiration of achieving net-zero carbon emissions by 2030.

The new Local Plan is currently under review, however this is yet to be adopted. The current District Plan 2005 provides no guidance regarding addressing the requirements to address the climate emergency.

The emerging Local Plan encourages developments to maximise opportunities for reducing carbon emissions.

This document has been developed to demonstrate how this could be achieved in the context of the proposed development.

3.1. National – National Planning Policy Framework 2018

The National Planning Policy Framework (updated in July 2018) sets out the Government's planning policies for England and how these should be applied. It provides a framework within which locally prepared plans for housing and other developments can be produced. Section 14 below is of most relevance to this report.

14.Meeting the challenge of climate change, flooding and coastal change

148. The planning system should support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change. It should help to: shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure.

Planning for climate change

149. Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures. Policies should support appropriate measures to ensure the future resilience of communities and infrastructure to climate change impacts, such as providing space for physical protection measures, or making provision for the possible future relocation of vulnerable development and infrastructure.

150. New development should be planned for in ways that: a) avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure; and b) can help to reduce greenhouse gas emissions, such as through its location, orientation and design. Any local requirements for the sustainability of buildings should reflect the Government's policy for national technical standards.

151. To help increase the use and supply of renewable and low carbon energy and heat, plans should: a) provide a positive strategy for energy from these sources, that maximises the potential for suitable development, while ensuring that adverse impacts are addressed satisfactorily (including cumulative landscape and visual impacts); b) consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development;

and c) identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers.

152. Local planning authorities should support community-led initiatives for renewable and low carbon energy, including developments outside areas identified in local plans or other strategic policies that are being taken forward through neighbourhood planning.

153. In determining planning applications, local planning authorities should expect new development to: a) comply with any development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and b) take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption. 154. When determining planning applications for renewable and low carbon development, local planning authorities should: a) not require applicants to demonstrate the overall need for renewable or low carbon energy, and recognise that even small-scale projects provide a valuable contribution to cutting greenhouse gas emissions; and b) approve the application if its impacts are (or can be made) acceptable. Once suitable areas for renewable and low carbon energy have been identified in plans, local planning authorities should expect subsequent applications for commercial scale projects outside these areas to demonstrate that the proposed location meets the criteria used in identifying suitable areas.

Figure 3: Extract from Chapter 14 of National Planning Policy Framework (p.44-45, July 2018)

3.2. Regional – Hertfordshire Building Futures

For developments which are considered significant within their local context, Welwyn Hatfield encourages the use of the Building Futures Sustainable Toolkit. The Toolkit provides questions and best practice guidance to inform sustainable design at the concept and planning stages, addressing the following:

- Energy & Climate Change
    - Reducing Demand and Energy Efficiency
    - Renewable and Low Carbon Energy Solutions
- Water
- Landscape and Biodiversity
- Air
- Noise
- Materials & Waste

The following section of this statement considers and addresses the guidance provided within the Energy and Climate Change section of the Building Futures Sustainable Design Checklist, the remaining sections are addressed in independently with the suite of submitted documents.

3.3. Local – Welwyn Hatfield District Plan 2005

The Welwyn Hatfield District Plan adopted in 2005 remains the current Local Plan. Several of its policies have been saved until it is replaced by a Local Development Framework.

Saved policies which are pertinent to this statement are detailed below:

Policy SD1 – Sustainable Development

Development proposals will be permitted where it can be demonstrated that the principles of sustainable development are satisfied and that they accord with the objectives and policies of this plan.

To assist the Council in determining this, applicants will be expected to submit a statement with their planning application demonstrating how their proposals address the sustainability criteria in the checklist contained in the Supplementary Design Guidance.

Policy R3 - Energy Efficiency

The Council will expect all development to: (i) Include measures to maximise energy conservation through the design of buildings, site layout and provision of landscaping; and (ii) Incorporate the best practical environmental option (BPEO) for energy supply.

Figure 4: Extract from Saved Policies SD1 and R3 of the Welwyn Hatfield District Plan 2018

3.4. Local – Emerging Welwyn Hatfield Local Plan

Proposals for an updated Local Plan were submitted for examination in 2017, however, its implementation has been delayed and has not yet been adopted.

This statement will however consider and incorporate the objectives of the emerging Local Plan wherever possible.

Policy SP1 - Delivering Sustainable Development

The Local Plan seeks to bring about sustainable development in the borough by applying the following principles:

- *The need to plan positively for growth in a way which supports economic growth, increases the supply of housing and helps to reduce social and health inequalities in the borough - whilst recognising environmental and infrastructure constraints.*
- *That new development should contribute to the creation of mixed and sustainable communities which are well planned, promote healthy and active lifestyles, are inclusive and safe, environmentally sensitive, accessible, culturally rich, vibrant and vital, well served, and built to high design standards reflecting local character.*
- *That the location of new development should deliver a sustainable pattern of development which prioritises previously developed land; minimises the need to travel by directing growth to those areas with good transport networks and which are well served by jobs, services and facilities; protects areas of highest environmental value; and avoids areas of high flood risk.*
- *That the natural and heritage assets of the borough should be protected and enhanced and its natural resources used prudently.*
- *That adaptation and mitigation principles relating to climate change are incorporated into the design and construction of new development which include energy and water efficiency measures, the use of low carbon and renewable energy, the provision of green infrastructure and sustainable drainage systems (SUDs).*

The Council will take a positive approach when considering development proposals that reflect the presumption in favour of sustainable development contained in the National Planning Policy Framework and the principles set out above.

Where there are no policies relevant to the application or relevant policies are out of date at the time of making the decision then the Council will grant permission unless material considerations indicate otherwise – taking into account:

- *The principles set out above;*
- *Whether there are any adverse impacts of granting permission which would significantly and demonstrably outweigh the benefits, when assessed against the policies in the National Planning Policy Framework taken as a whole; or*
- *Specific policies in that Framework, such as Green Belt policy, indicate that development should be restricted.*

Cont…

Policy SP10 - Sustainable design and construction

Proposals that adopt sustainable design and construction principles, as set out below, within an integrated design solution will be supported. This should be demonstrated via a Sustainable Design Statement and associated plans.

Materials and waste

- *Reuse land and buildings wherever feasible and consistent with maintaining and enhancing local character and distinctiveness.*
- *Reuse and recycle materials that arise through demolition and refurbishment, including the reuse of excavated soil and hardcore within the site.*
- *Prioritise the use of materials and construction techniques that have smaller ecological and carbon footprints, where appropriate.*
- *Consider the lifecycle of the building and public spaces, including how they can be easily modified to meet changing social and economic needs and how materials can be recycled at the end of their lifetime.*
- *Space is provided and appropriately designed to foster greater levels of recycling of domestic and commercial waste.*

Water sensitive design

- *Water sensitive design principles and practices are integrated into development proposals to sustainably address water supply, consumption and quality, extreme rainfall, drainage and flood risk in a holistic way that supports other design aims and objectives.*

Energy and climate change

- *Layout and design of the site and building(s) reflect the energy hierarchy to maximise opportunities to reduce carbon emissions.*
- *The use of renewable and low carbon energy infrastructure is used where it is appropriate and consistent with other policies.*
- *Proposals are responsive to how the climate will change over their lifetime and minimise their contribution to the urban heat island effect.*

Landscape and biodiversity

- *New and existing habitat and landscaping are incorporated into the layout and design of proposals in line with sound ecological principles.*
- *Site and building-level landscaping and features promote biodiversity and help achieve other aims, such as climate change adaptation, flood risk and amenity.*
- *Newly created habitat and soft landscaping prioritise the use of native species. Non-native species are only used if they significantly help achieve other policy objectives, such as adapting to climate change.*
- *Proposals seek to create space for growing food, both at a building and wider community scale*

Figure 5: Extract of Policies SP1 and SP10 of the Emerging Plan

3.5. Summary of Key Policy Requirements

Key policies against which this report will assess are detailed below:

- Compliance with Building Regulations Part L through energy efficiency measures
- Apply the energy hierarchy to maximise opportunities to reduce carbon emissions and incorporate the use of renewable and low carbon energy infrastructure.
    1. Use Less Energy
    2. Supply Energy Efficiently
    3. Renewable and Low Carbon Energy
- Reduce overheating and reliance on air conditioning through use of passive solar design
- Incorporate water saving measures to reduce consumption to 110 litres per person per day

4. Energy Efficiency - Reduction in Greenhouse Gas Emissions

The developer aims to provide homes with as close to zero carbon emissions resulting from regulated energy usage (heating, hot water, ventilation and lighting) as possible.

4.1. Methodology

This report uses the energy hierarchy to minimise onsite carbon emissions, the stages are:

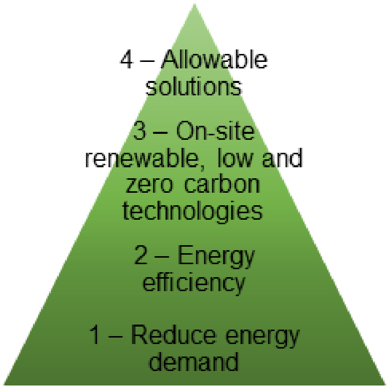

Figure 6: The Energy Hierarchy

Use Renewable Energy – assess the feasibility of renewable energy systems

Supply Energy Efficiently – Use low-carbon technology to significantly reduce energy consumption

Use less Energy – the incorporation of low energy design and passive measures to promise the reduction of energy use

Where applicable, carbon dioxide emissions and energy demand have been calculated using the latest Standard Assessment Procedure 2012 and approved Elmhurst Design SAP 2012 by a suitably qualified and accredited Domestic on Construction Energy Assessors (DOCEA)

Regulated CO_2 emission estimations (those associated with space and water heating, pumps, fans and lighting) are based on initial sample SAP calculation data. Baseline values have been derived from the Building Regulations Target Emissions Rate (TER) as calculated by SAP software

Indicative calculations have been carried out using SAP 10.1 Beta software as provided by Elmhurst Energy Systems. SAP 10.1 is yet to be formally approved, however, is expected to form the basis of the calculation method to be used for Building Regulations compliance calculations when the 2020 edition of Part L of the Building Regulations come into force.

As per previous versions of SAP, this software uses Carbon Di-Oxide emissions as a key compliance metric, alongside the soon to be introduced primary energy and affordability metrics. For this assessment, the focus has been on maximise opportunity for reducing carbon emissions arising from the development.

Supporting SAP calculation have been carried out for 4 representative house types, which have been used to estimate sitewide emissions. These house types are:

H01 – 3B5P (represented plots 7),
H06 – 4B7P (represented plots 1),
H07 2B4P (represented plots 1),
and H09 2B4P (represented plots 5).

4.2. Demand Reduction

A fabric first approach has been adopted to minimise energy demand as much as practical.

The three main sources of heat loss have been addressed.

- Thermal Envelope
- Thermal Bridging
- Uncontrolled Air Leakage

With each discussed in more detail below.

4.3. Thermal Envelope

The below table summarises the proposed performance of the thermal envelope. It is proposed that all areas significantly improve upon the minimum building fabric standards stated within the Part L 2020 consultation documents and also targeting U-values which are expected to align closely with the requirements for the Future Homes Standard which is due to come into force in 2025.

Thermal Element	Building Regulations (Part L 2020 Consultation)	Proposed target values	Improvement over proposed 2020 Building Regulations Standard
Ground Floors	0.18 W/m²K	**0.10 W/m²K**	**44%**
Exposed Floors	0.18 W/m²K	**0.13 W/m²K**	**28%**
External wall	0.26 W/m²K	**0.15 W/m²K**	**42%**
Party wall	0.20 W/m²K	**Fully filled & sealed 0.00 W/m²K**	**100%**
Roofs – Insulated at ceiling	0.16 W/m²K	**0.10 W/m²K**	**38%**
Flat roof	0.16 W/m²K	**0.10 W/m²K**	**19%**
Sloping roof	0.16 W/m²K	**0.13 W/m²K**	**19%**
Windows & rooflights	1.60W/m²K	**1.20 W/m²K**	**25%**
External doors	1.60 W/m²K	**1.00 W/m²K**	**38%**
Air permeability	8.00m³/(h.m²) at 50 Pa	**4.00m³/(h.m²) at 50 Pa**	**50%**

Table 1: Proposed Fabric Standards

4.4. Thermal Bridging

Thermal bridging occurs at the junction between fabric elements, where the continuous insulation line is broken. Through careful detailing of junctions, it is possible to mitigate against the impact of thermal bridges.

It is proposed that the dwellings achieved an assessed Y-value of no greater than 0.05. Specific detailing required will differ subject to the chosen method of construction, however, key junctions which require particular attention are the ground floor to wall junction and lintels, which can be addressed by incorporating thermal blockwork and thermally broken or independent lintels respectively.

4.5. Uncontrolled Air Leakage and Ventilation

To minimise energy demand, it is proposed that an airtightness of no greater than 4.00m^3/hr/m^2 is targeted.

The dwellings will benefit natural ventilation, with decentralised mechanical extract fans and background trickle ventilators.

4.6. Lighting

Internal lighting will be specified with a minimum efficacy of 75 lumens per circuit watt. External lighting will be designed to minimise light spill and have efficient lights and appropriate automatic controls.

4.7. Appliances

Where supplied, any white goods will achieve the following ratings (or better) under the EU Energy Efficiency Labelling Scheme:

1. Fridges, fridge-freezers: A+ rating
2. Washing machines: A++ rating
3. Dishwashers: A+ rating
4. Washer-dryers: A rating
5. Tumble-dryers: A rating (Where possible external drying lines will be included to reduce the need for tumble dryers)

Where not provided as part of the build specification, guidance regarding energy-efficient appliances will be provided to the occupant.

4.8. Water Efficiency

To minimise onsite usage of potable water it is proposed that all dwellings achieve a minimum water efficiency standard of 110 litres/person/day as set out in Building Regulations Part G. It is recommended that maximum water consumption criteria, as stated in table 2.2 of approved document Part G be followed, summarised below.

Water Fitting	Maximum Consumption
WC	4/2.6 litres dual flush
Shower	8 l/min
Bath	170 litres
Basin Taps	5 l/min
Sink Taps	6 l/min
Dishwasher	1.25 l/place setting
Washing Machine	8.17 l/kilogram dry load

Table 2: (Part G2 Table 2.2) Maximum fittings consumption optional requirement level

Each dwelling will benefit from a low heat loss unvented hot water cylinder, compatible with the lower flow temperatures associated with heat pumps. A backup immersion heater will also be present to provide a facility to purge for legionella. For houses which will benefit from a direct photovoltaic, it is proposed that a PV diverter is also installed allowing excess energy generation to be used primarily onsite to provide hot water before energy export can occur.

To reduce the amount of energy used for water heating, where viable a Wastewater Heat Recovery System (WWHRS) will be considered. This system recovers up to 67% of waste heat which would otherwise go down the drain and uses the recovered energy to preheat the cold-water supply to the shower or water cylinder.

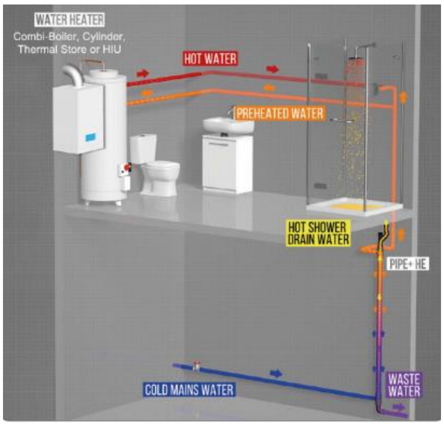

Figure 7: Wastewater Heat Recovery System (Source: Recoup WWHRS)

5. Supply Energy Efficiently

Over recent years, the electricity grid had undergone the process of de-carbonisation with coal power stations being decommissioned and generation moving to cleaner fuel sources and renewable energy such as wind and solar.

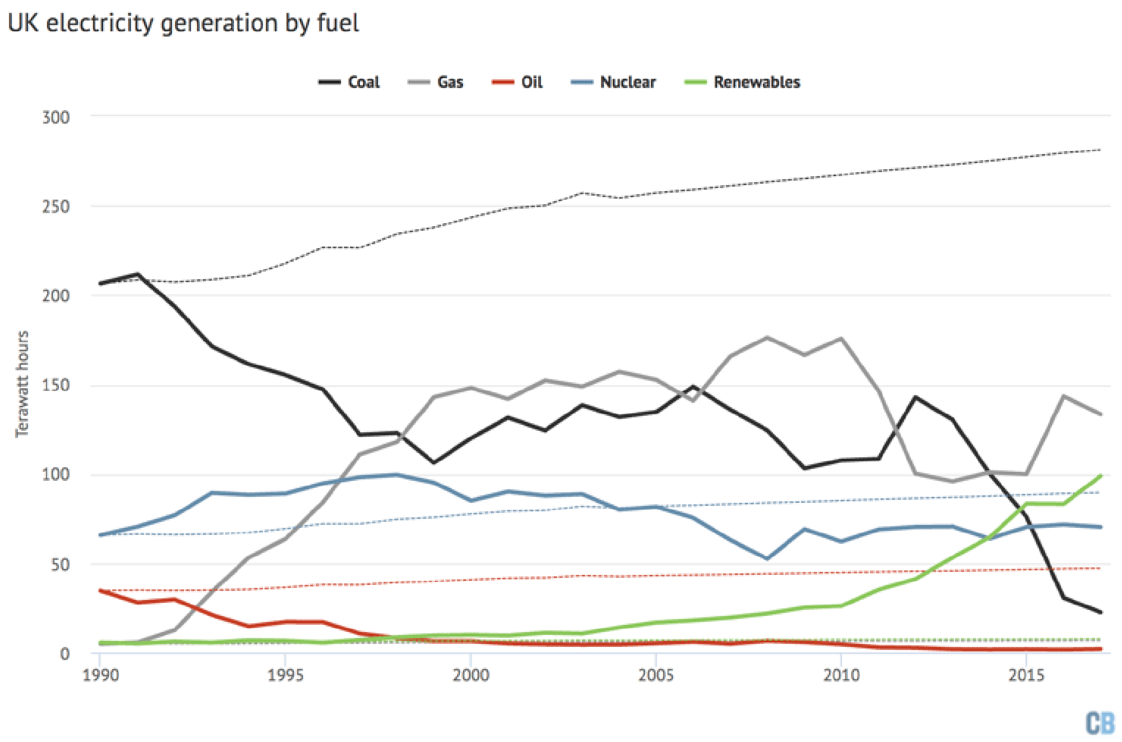

Figure 8: UK electricity generation by fuel (source: Carbon Brief 2019)

SAP 10.1 is the first version of SAP which reflects this, with emissions from grid electricity being quarter of what they were previously, which removes the significant benefit that a fossil fuel natural gas heated dwelling used to benefit from. This will encourage a move to alternative low-carbon heating systems such as heat pumps.

Fuel	CO_2 (SAP 2012)	CO_2 (SAP 10.1)	
Mains Gas	0.216	0.21	-3%
Oil	0.298	0.298	0%
LPG	0.241	0.241	0%
Electric	0.519	0.136	-74%
Electric sold to grid	0.519	0.136	-74%
Wood logs	0.019	0.028	47%

Table 3: Carbon emissions factors for fuels in SAP 10.1

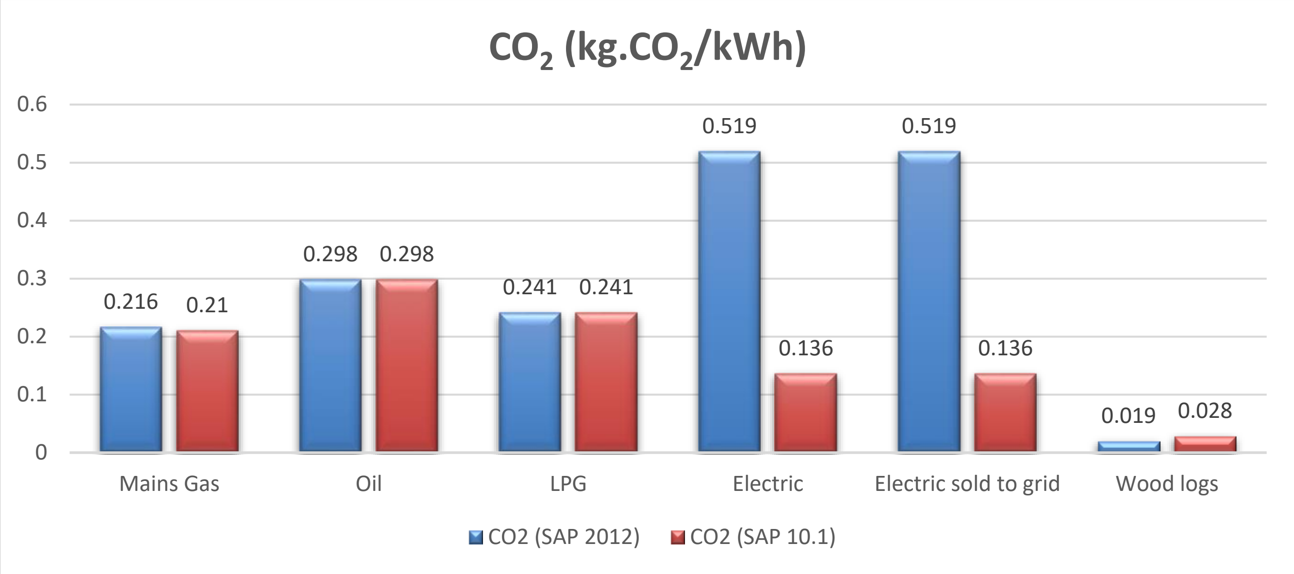

Figure 9: Carbon emissions factors for fuels in SAP 10.1

Additionally, it is anticipated that from 2025, it will no longer be permitted to install fossil-fuelled heating systems within new dwellings.

To make benefit of the continuing decarbonisation of the electricity grid, it is proposed that the dwellings benefit from a heat pump heating system, which can achieve efficiencies in excess of 300% significantly reducing the amount of energy required to provide space and water heating.

Heat pumps extract heat from the environment (ground, air or water) to provide space and water heating, using the same process as a refrigerator, they can take low-grade heat at a certain temperature and release it at a higher temperature. Most heat pumps are electrically driven although other types are available.

The efficiency of the heat pump is given by the Co-efficient of Performance (CoP), which is defined as the ratio of heat output, divided by the energy input. Generally, a heat pump can provide a CoP of at least 3, however, where higher output temperatures are required, efficiency can drop significantly. Therefore, to maximize efficiency it is important to pair a heat pump with a low-temperature heating network and emitter such as underfloor heating, low-temperature radiators or standard radiators sized accordingly to maintain heat output at lower flow temperatures.

Two different types of heat pump have been considered as part of this appraisal.

5.1. Air Source Heat Pumps (ASHP)

ASHPs use an external heat exchanger unit to extract heat from the ambient air and can continue to operate at negative external air temperatures although the CoP achieved will reduce at lower temperatures. The heat exchanger unit needs to be located in free air externally and would typically be installed on a ground plinth or wall-mounted, the fan may also produce an audible low hum in operation, for these reasons it is important to consider a suitable installation location accordingly.

The proposed development consists of low-density housing with each property benefiting from a private garden. This provides the perfect location in which to site the external condenser unit.

At the time of writing the installation of an ASHP is eligible for the Renewable Heat Incentive (RHI) allowing the occupant to claim remuneration for adopting a low carbon/renewable source of heating, which would help to reduce running costs. However, the current Domestic RHI scheme is due to close to new applicants on 31st March 2022.

5.2. Ground Source Heat Pumps (GSHP)

GSHPs use a loop of pipe buried in the ground to extract heat, water (or another fluid) is circulated through the buried pipes and passes through a heat exchanger in the heat pump that extracts heat from the fluid. The temperature of the fluid is then raised via the compression cycle to supply hot water to the building for space and water heating. As the temperature of the ground below the surface remains constant throughout the year ground source heat pumps do not suffer from drops in CoP during the winter to the same extent as air source heat pumps, making them more efficient in operation.

The ground loops are generally in the form of a horizontal ground loop installed in a wide trench, or vertical ground loop installed within a borehole. Horizontal ground loops require a significant amount of ground area to operate effectively, however, tend to be cheaper to install, where vertical borehole systems require less ground but are costly as they require holes to be drilled up to 200m deep.

The development is unlikely to provide an appropriate free area for the installation of a horizontal ground loop or shared ground loop array would be possible.

Ground source heat pumps are not considered to be viable for this development.

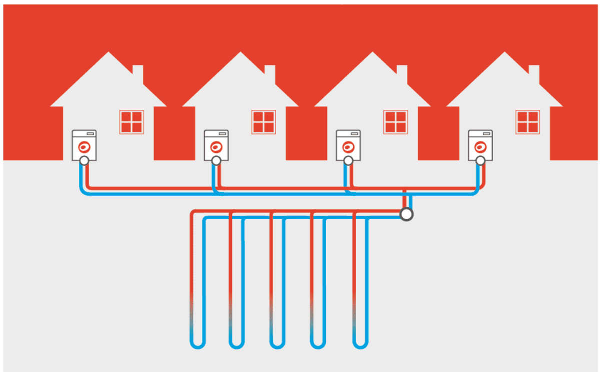

Figure 10: Shared Ground Loop Array (Source: Kensa Heat Pumps)

6. On-site renewable, low and zero carbon technologies

The energy hierarchy requires that the feasibility of on-site renewables technology be investigated. This section reviews each of the technologies that are to be considered on a new development, with the most feasible method being selected.

6.1. Renewable Energy Feasibility Checklist

Technology	Checklist	Comments	Suitable Technology
Solar Photovoltaic	Will the buildings have a southeast to the southwest (through south) facing roof or flat roof?	All houses benefit from south east or south west pitched roof	Yes
	Are roofs free from overshadowing for most of the day from buildings or other structures?	Surrounding dwelling heights do not exceed the height of the proposed buildings. Sufficient distance from the existing established trees which are to be retained.	
	Is the building in a conservation area?	No	
Solar thermal	Will the buildings have a year-round demand for hot water?	Yes	Yes
	Will the buildings have an open aspect southeast to southwest facing roof of at least 4m^2?	All houses benefit from south east or south west pitched roof	
	Is there space for a hot water cylinder near the panels?	Yes	
	Is the building in a conservation area?	No	
Biomass	Is there a local supply and space for storage of biomass fuel or can one be set up?	In-sufficient space for plant room or fuel store	Unsuitable
	Is a communal heat network proposed?	There is no district system available/proposed.	
Ground Source Heat Pumps	Will there be room for a horizontal buried pipe?	No limited space available	No
	Is there sufficient room within the dwelling to accommodate the internal unit.	Yes, buildings could be designed to accommodate internal heat pump and water cylinder	
	Is the ground suitable for vertical pipe system?	Subject to the detailed review and further assessment of ground conditions required, unlikely to be sufficient un-trafficked ground area to allow for installation of borehole ground collectors	
	Is a low-temperature heat emitter (i.e. underfloor heating) proposed?	A suitably design and sized heating emitter can be included in the design.	
Air Source Heat Pumps	Is there sufficient room within the dwelling to accommodate internal/external unit.	External condenser unit can be located to the rear of some properties in private gardens, all house have space for internal hot water cylinders	Yes
	Is a low-temperature heat emitter (i.e. underfloor heating) proposed?	A suitably design and sized heating emitter can be included in the design.	
District Heating	Is there district heating situated close to the site.	There is no district system available/proposed.	Unsuitable
Ground Source cooling	Not recommended for domestic applications	There is no district system available/proposed.	Unsuitable

Table 4: Renewable Energy Feasibility Checklist

Technologies found to be technically suitable have been investigated in further detail below.

6.2. Photovoltaic Panels

Description of technology

Photovoltaic panels (PV) convert energy from sunlight into electricity. They work in daylight, so do not require direct sunlight and are suitable for the cloudy climate of the UK. However, more energy will be produced in direct sunlight and in very shady positions on the photovoltaic panel will not function.

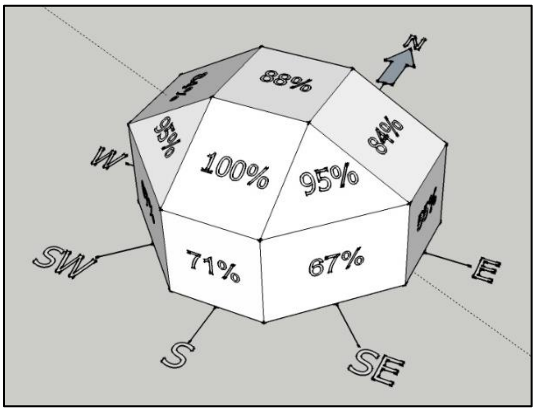

Figure 11: Optimum PV Orientation - Based on SAP 2012 criteria

Within the UK, PV panels are most efficient when installed facing south at an inclination of 30 degrees, however, provided orientation is maintained between south-east and south-west a reasonable efficiency can still be maintained. Where orientation is less optimal, installing panels at a lower pitch of 10-15 degrees larger removes orientation limitations, however, this is typically most appropriate for flat roof installations. The diagram opposite demonstrates how system efficiency changes as the orientation of the array become less optimal. Typically, a 1kWp installation of PV will generate approximately 750-850 kWh of energy per year subject to weather conditions with little or no shading.

As with all types of on-site electrical generation, maximum benefit is realised when most of the energy generated can be consumed on-site, thus avoiding the low rates currently offered for electricity export. Larger installations would be more appropriate for commercial properties where significant demand exists throughout the day when maximum generation occurs, however small installations can still be appropriate for dwellings.

Site Assessment

All houses benefit from a roof pitch orientated south easterly or south westerly, allowing the installation of PV panels to all properties whilst benefiting from a reasonable level of efficiency and access to solar irradiation. However, three properties (H06, H09 and H10) which have prominent elevations fronting the main square and rear elevations to open countryside and adjoining existing properties respectively, as such it is not considered visually appropriate to install PV in these instances.

Number of panels	6
Approximate surface area per Panel	1.65m^2
Approximate panel surface area required	9.9m^2
Panel Output (Wp)	330
Total Output (kWp)	1.98
Total Output (kWh/year)	1,590
SAP 2012 Carbon Factor (kg.CO_2 /kWh)	0.519
CO_2 Offset (kg.CO_2 /year)	825
CO_2 Offset (tonnes.CO_2 /year)	0.825

Table 5: Indicative generation of energy from PV (per house)

Where considered appropriate, it is proposed that a PV arrays of approximately 2kWp be installed to each house. SAP 2012 calculations estimate that per dwelling this will generate 1.59MWh of on-site renewable electricity annually, offsetting 0.83 tonnes of CO_2.

It is also proposed that where dwelling size permits that space provision is made for the future installation of battery storage, to allow occupants flexibility for the future without having to reconfigure the house.

6.3. Ground & Air Source Heat Pumps

These technologies have been reviewed in Section 5. Supply Energy Efficiently of this report.

6.4. Solar Hot Water

Description of technology

Solar Panels, also known as "collectors", can be fitted to a building's roof. They use the sun's energy to warm water, or another fluid, which passes through the panel. The panels work throughout daylight hours, even if the sky is overcast and there is no direct sunshine.

"Domestic hot water heating is perhaps the best overall potential application for active solar heating in Europe. It is a demand that continues all year round and still needs to be satisfied in the summer when there is plenty of sunshine. In the UK in 2000 it accounted for approximately 7% of the total national delivered energy use. A typical UK household uses approximately 15 kWh per day of delivered energy for this purpose." (Boyle G, 2004)

To maximise efficiency, panels should be installed southerly facing at an inclination of approximately 30 degrees. Hot water cylinders should also be located as close to the solar array as possible to minimise heat loss.

Site Assessment

Due to the demand for hot water, solar thermal would only be appropriate for dwellings. However, unlike PV which can generate electricity regardless of demand, the benefit of solar thermal is limited by the amount of hot water demand. As such installation of solar PV is a more beneficial use of the available roof space, a solar PV diverter and immersion is proposed to be installed water heater to provide zero-carbon hot water when surplus energy generation occurs.

7. Sustainability Measures

7.1. Managing overheating

All houses benefit from natural ventilation, with shallow floor plates, large openable windows and good opportunity for cross ventilation. Where larger expanses of glazing are present fins are to be used across the glazing (as indicated on submitted drawings) to reduce solar gains while maintaining the view out and maximizing opportunity for good levels of natural daylighting.

A balanced G value will be selected to maintain a good level of passive solar design, providing reasonable levels of solar gain but not so high that overheating risk increases unacceptably.

7.2. Sustainable Sourcing of Materials

The development will consider lifecycle environmental impacts, durability, responsible sourcing and pre-fabrication potential, with a view to optimising materials utilisation and safeguarding natural resources. Measures will include:

- The major building elements (this includes internal and external walls, upper floors and roof) will be A' or 'A+' rated as per BRE's Green Guide to Specification (www.bre.co.uk/greenguide)
- Use of all timber products that come from an accredited Forest Stewardship Council (FSC) source or Programme for the Endorsement of Forest Certification (PEFC) with relevant Chain of Custody; and 100% of timber and timber-based products used on the project are 'Legal' and 'Sustainable' as per the UK Government's Timber Procurement Policy (TPP)
- Use of suppliers/products that operate Environmental Management Systems (e.g. ISO14001, EMAS, BES 6001).

Consideration will be given to the durability of new materials and the protection of vulnerable building parts during the detailed design process. It is anticipated that this will include features such as durable floor surfaces, protection from vehicular movements and the use of materials that will resist weathering.

Products used in internal finishes (paints and varnishes) will have no or low concentrations of volatile organic compounds (VOC) to help reduce internal air quality.

7.3. Air Quality

Due to the recommendation of an electrical heating system, there will be no on-site emissions due to the provision of energy to the dwellings.

To allow occupants easy transition from fossil fuel to electric vehicles, it is proposed that each house benefits from the installation of an Electric Vehicle charging port.

A separate detailed appraisal of air quality has included as part of this application.

8. Conclusion

The proposed development has been assessed in line with the energy hierarchy, with a view of identifying the most appropriate method of achieving a significant reduction in carbon dioxide emissions from Part L 2013 as required to meet local and regional planning policies.

The purpose of the strategy was to reduce the overall energy demand as far as possible, by increasing energy efficiency and introducing low carbon and renewable technologies.

Reduce Energy Demand

• Fabric First Approach to reducing the space heating energy demand
  ○ High specification thermal envelope minimising heat loss
  ○ Junctions to be designed to minimise the effects of thermal bridging
  ○ High levels of airtightness
• Natural ventilation and decentralised mechanical extract fans and background ventilators.
• Advanced zone heating controls providing close control of heating.
• A Wastewater Heat Recovery System to recover up to 67% of the thermal energy typically wasted when showering.
• Installation of 1 EV charging point to each plot to allow easy adoption of efficient vehicles.
• Low flow sanitaryware fittings to reduce potable water usage.

Use Energy Efficiently
• Air to Water Heat Pump technology to providing high levels of thermal efficiency to provide space and water heating, dedicated low-temperature emitters will be used to ensure the system can operate at maximum efficiency.
Use renewable technologies
• Air Source Heat pumps proposed for the primary heat source (subject to further review). • Heat Pump technology to providing high levels of thermal efficiency to provide space and water heating, dedicated low-temperature emitters will be used to ensure the system can operate at maximum efficiency.

Table 6: Be Lean, Be Clean, Be Green assumptions and results

Supporting SAP 2012 calculations demonstrate that the proposed energy strategy should deliver an 18-21% reduction in carbon emissions from current Building Regulations through the implementation of energy efficiency and clean energy supply, increasing to between 18 and 50% after considering renewable technologies.

Sample SAP 10.1 calculation suggest the proposed strategy could deliver carbon reductions ranging from approximately 50 to 70%.

Sample SAP 10.1 calculations carried out using beta software have been provided as an illustration of how the proposed development would perform against the anticipated future Building Regulations with an aim to highlight the aspiration to future proof the development, avoiding the need for fossil fuels and making benefit from an improving grid electricity energy mix due to continued adoption of renewable energy generation.

As SAP 10.1 and future Building Regulations remain at consultation stage and the new regulations may differ at adoption, these figures are intended as a guide only.

It is considered that by following the proposed energy and sustainability measures, the development complies with the aims and objectives of the emerging plan and the Building Futures Toolkit.

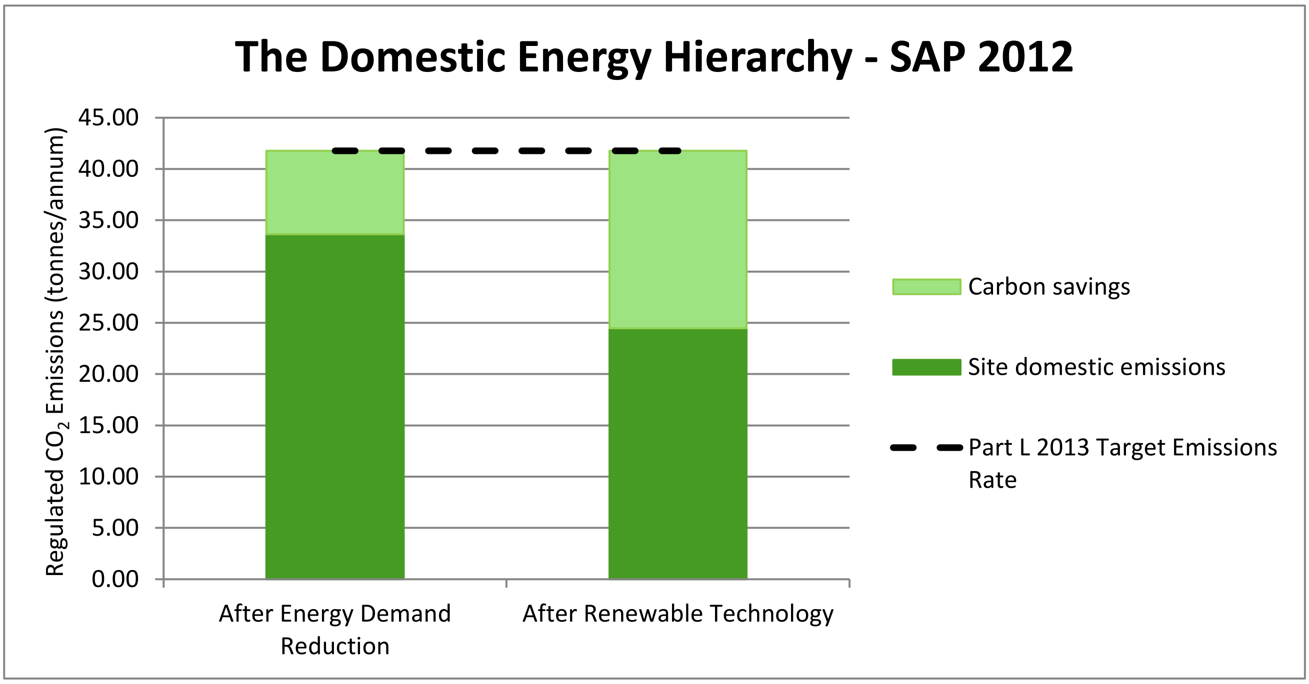

Figure 12: Energy Hierarchy Part L 2013 (SAP 2012)

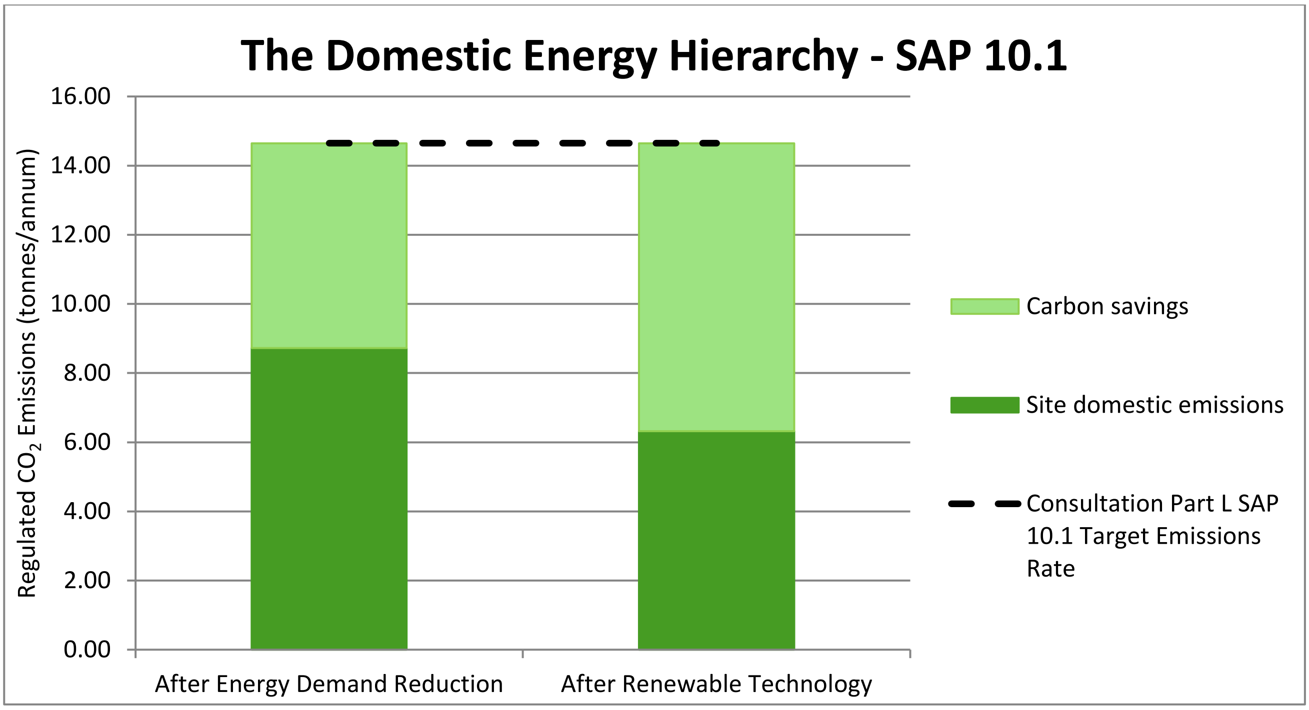

Figure 13: Energy Hierarchy Part L 2020 Consultation (SAP 10.1)

Sadler Energy and Environmental Services Ltd
2b Poles Copse
Poles Lane, Otterbourne
Winchester, Hampshire. SO21 2DZ.

Telephone: 01962 718870
Email: hello@sees.co.uk
Website: www.sadlerenergy.co.uk