

Energy Statement

29-35 Station Road, Reading

Titan Property Developments

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Prepared by



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1 Introduction

Preface

- 1.1 Written by AES Sustainability Consultants Limited on behalf of Titan Property Developments, this Statement has been prepared in support of a planning application and presents an energy efficiency and renewable energy strategy suitable for demonstrating compliance with policy requirements, for the development of 107 residential units and retail space at 29-35 Station Road, Reading.

Purpose and Scope of the Statement

- 1.2 The statement will address local planning policy relating to sustainable design and construction, and specifically Policy CS1 of the adopted Core Strategy January 2008 (with alteration January 2015) and Revised Sustainable Design and Construction Supplementary Planning Document adopted July 2011 and subsequent guidance provided by Reading Borough Council.
- 1.3 The statement demonstrates that the development will incorporate a number of energy demand reduction measures and solar photovoltaic (PV) panels sufficient to meet the 9.5% reduction in Part L 2013 regulated CO₂ emissions required to meet Reading Borough Council targets of 50% Level 4 of the Code for Sustainable Homes and 50% Level 3. The retail units are designed to comply with the requirements of BREEAM 'Very Good'.
- 1.4 The client commitment is to meeting the planning requirement of 9.5% for the residential units only as a minimum, figures presented within this statement and any additional measures proposed are shown as an example of how the development could comply and is subject to ongoing design work.

Development Description

- 1.5 The Station Road development proposes to construct a twenty-two storey building in the footprint of the original building, which is to be demolished.
- 1.6 Station Road is in the centre of the former commercial area as part of a regeneration scheme, lying very close to transport links. The development consists of a basement that holds the plant, refuse and recycling storage and cycle storage. To the ground, and first floors there is to be retail space provided as shell and core for future occupiers as well as a gymnasium for the use of residents of Station Road.
- 1.7 The 107 residential apartments within Station Road comprise of a mixture of apartments with 1, 2 and 3 bedrooms. The twenty second floor has a communal amenity space winter garden.

2 Planning Policy

- 2.1 Within the context of property development, sustainability is about designing a building with as small an ecological footprint as possible and reducing its impact on the ability of future generations to support themselves. This statement principally addresses the impact of energy demand and CO₂ emissions, in accordance with the requirements contained within Reading Borough Council planning policy.

Local Policy

Reading Borough Local Development Framework: Core strategy Jan 2008

- 2.2 Core Strategy Policy CS1 sets out an overarching strategy in relation to climate change, energy efficiency, energy conservation measures, inclusion of renewable energy sources, reduction in carbon emissions, and inclusion of appropriate flood minimisation measures in new development, including the construction of new building and the redevelopment and refurbishment of existing building stock.

Policy CS1: Sustainable Construction and Design

Proposals for new development, including the construction of new buildings and the redevelopment and refurbishment of existing building stock, will be acceptable where the design of buildings and site layouts use energy, water, minerals, materials and other natural resources appropriately, efficiently and with care and take account of the effects of climate change

To meet these requirements:

- 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;*
- On larger developments of more than 10 dwellings or 1,000 m² of floorspace, ensure that 50% of the provision meets the most up to date Eco-Homes and BREEAM 'Excellent' standards;*
- All new developments maximise the use of energy efficiency and energy conservation measures in their design, layout and orientation to reduce overall energy demand;*

Policy CS1: Sustainable Construction and Design cont.

- *All developments of more than 10 dwellings or 1000m² 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;*
- *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*
- *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*

Revised Sustainable Design and Construction (SPD) adopted 11th July 2011

- 2.3 The SPD provides practical advice on the forms of sustainable design and construction plus waste minimisation that will meet these policy requirements and how these policy requirements are applied at the local level through policy CS1: Sustainable Construction and Design.

Revised Sustainable Design and Construction (SPD) adopted 11th July 2011

Current position with regard to Building Regulations

Recent changes to the Building Regulations mean that the requirement in policy CS1 to 'off-set at least 20% of predicted carbon dioxide emissions has now been superseded for both residential and non-residential developments. All other parts of policy CS1 are still relevant. For this reason, the requirement to off-set at least 20% of predicted carbon dioxide emissions from the estimated energy usage of the completed and occupied development in adopted policy CS1 is not mentioned further in this SPD.

Revised Sustainable Design and Construction (SPD) adopted 11th July 2011 cont.

There are two main standards currently used to provide a measure of a particular buildings' sustainability in terms of, for example, energy efficiency, renewable energy, carbon reductions. These standards are:

1) The Code for Sustainable Homes, which relates to new build residential buildings, and builds on the original EcoHomes standards;

2) Building Research Establishment's Environmental Assessment Method, known as BREEAM Standards. For any building other than a new build residential building.

To comply with the relevant policies and standards on energy, a combination of measures including energy efficiency measures, energy conservation measures, inclusion of renewable energy sources/low carbon sources should be considered.

For planning an energy statement is required. The Energy Statement demonstrates

Policy Requirements - Residential Development

- 2.4 Table 3.2 within the SPD shows the required level of relevant sustainability standard and shows for a development of more than 10 dwellings, 50% of the development must meet the energy standards at Level 4 of the CfSH, with the remainder meeting the standards at Level 3.
- 2.5 It is also stated that where it can be demonstrated that flats cannot easily be split into achieving a minimum of 50% at Code Level 4 and the remainder at Code Level 3, a minimum of the mid-way point between Code 3 and Code 4 can be achieved.
- 2.6 The energy requirements at Code Level 3 equate to a Part L 2013 compliant development, and Code Level 4 requires 19% improvement - therefore the overall target equates to a 9.5% reduction in CO₂ over Part L 2013 standards.

Policy Requirements - Commercial Development

- 2.7 Table 3.2 within the SPD also shows the required level of relevant sustainability standard for all new commercial development. At the Station Road development, the retail units are required to meet the most up to date BREEAM 'Very Good' as a minimum standard.
- 2.8 BREEAM Level 'Very Good' requires a 0 EPR_{NC} (Energy Performance Ratio for New Construction) over Part L 2013, equating to 0 BREEAM credits, and BREEAM Level 'Excellent' requires a 0.375 EPR_{NC}, equating to 5 BREEAM credits. Therefore, achieving

the minimum standard for BREEAM 'Excellent' would provide an 'Excellent' energy performance improvement over Part L 2013 Building Regulations.

Housing Standards Review

- 2.6 The Code for Sustainable Homes was a scheme sponsored by the Government intended to promote and support the transition to more sustainable homes.
- 2.7 On 25th March 2015 the government issued a Ministerial Statement setting out the conclusion to the Housing Standards Review. This review aimed to simplify government regulations and standards into one key set, driven by building regulations.
- 2.8 The written Ministerial Statement withdraws the Code for Sustainable Homes (in England) so Local Authorities are not required to enforce it as a planning condition for new approvals. The Deregulation Bill was given Royal Assent on 26th March 2015.
- 2.9 The relevant extract from the statement to Parliament¹ advises:

"From the date the Deregulation Bill 2015 is given Royal Assent, local planning authorities...should not set... any additional local technical standards relating to the construction, internal layout or performance of new dwellings. This includes any policy requiring any level of the Code for Sustainable Homes to be achieved by new development; the government has now withdrawn the Code..."

- 2.10 This change is required to be reflected through amendments to all Local Plans, neighbourhood plans and supplementary planning documents.
- 2.11 Local authorities are still able to enforce energy performance levels in line with existing policies, equivalent to a certain CSH standard.
- 2.12 Reading have subsequently confirmed that we are to meet the energy requirements of Policy CS1 and submit an Energy Statement and Sustainability Statement in line with their Sustainable Design and Construction SPD.

National Policies

- 2.13 The Government has developed a planning system with which to help create sustainable development and communities. This system plays a key role in delivering the governments objectives on sustainable development and comprises a number of different policy documents, each tackling a different sustainability issue. The system encourages a proactive process, which promotes environmental protection, economic growth and ensuring a better quality of life for all.

¹ DCLG, Planning update March 2015 - written Ministerial Statement, 25th March 2015

Building Regulations (Part L 2013)

- 2.14 Part L of the Building Regulations applies to all new homes and commercial spaces, and sets out a maximum permitted predicted greenhouse gas emissions rate. Part L 2013 was introduced on the 6th April 2014. For new homes, the changes deliver a 6% improvement on 2010 standards across the build mix and again to 'zero' carbon in 2016, for non-domestic. The notional building used to determine carbon dioxide targets is the same size and shape as the actual building, constructed to a concurrent specification. The Part L 2013 specifications have been strengthened to deliver 9 per cent carbon dioxide savings across the new non-domestic building mix relative to Part L 2010.
- 2.15 Part L 2013 for dwellings includes a minimum thermal performance for each building element, a maximum overall emissions rate and a minimum overall energy efficiency standard (the Fabric Energy Efficiency; FEE). This is a change from the Part L 2010 requirements, where the Approved Document includes a set of elemental backstops for the building fabric as guidance only.

Supporting Documents

- 2.16 Various documents have been submitted with the Planning Application and should be read in conjunction with this Energy Statement. These documents provide additional context to the measures proposed in this strategy.

3 Baseline CO₂ Emissions

- 3.1 In order to assess the overall CO₂ reductions required to comply with the requirements set out by the planning policies, the baseline CO₂ emissions arising from the development must be established.

Building Regulations Compliance

- 3.2 For the residential aspect of the development SAP calculations have been undertaken to a representative sample of apartment types within the development. The results for these units have been apportioned for dwellings with a similar apartment types, to give a representative of the total usage and carbon emissions.
- 3.3 For the non-residential areas, energy calculations using SBEM (Simplified Building Energy Model) have been undertaken to calculate usage and therefore emissions within the retail units and resident's gym.
- 3.4 For the purposes of this statement the heated corridor areas use benchmark figures to estimate the energy usage from similar previous developments per m² of floor space. The energy used within the corridors for heating and lighting account for a very small percentage of the energy use within the non-residential areas.
- 3.5 SAP and SBEM assesses dwellings and commercial spaces against a Target Emission Rate (TER), expressed in kilograms of carbon dioxide per metre squared of total useful floor area per annum, as the benchmark for Part L Building Regulations compliance. The Dwelling Emission Rate (DER) and Building Emission Rate (BER) must meet or exceed this level of performance in order to comply with Part L requirements.
- 3.6 The energy uses regulated by the Building Regulations are those most directly influenced by the structure and design of the building. These are energy used for space heating, water heating, lighting and ventilation. A development can reduce these more easily than the unregulated emissions, which depend more on occupant behaviour.
- 3.7 Tables 1 details the baseline CO₂ emissions of a Part L 2013 compliant development:

Table 1: Total Baseline CO₂ emissions

	Part L Compliant Carbon Dioxide emissions (kgCO ₂ /yr)
Residential	103,651.03
Non-residential²	26,777.61
Total	130,428.64

- 3.8 The first stage of the energy strategy will be to ensure that the development meets or exceed this level of performance for regulated emissions before considering low carbon or renewable energy technologies to offset emissions. The proposed strategy is discussed in the following sections of this statement.

² This includes the retail units, resident's gym and corridor areas

4 Energy and CO₂ Reduction Strategy – Fabric First

- 4.1 The proposed construction specification and sustainable design principles will ensure that the development meets the carbon dioxide reductions mandated by Part L1A and Part L2A of the Building Regulations through fabric measures alone.
- 4.2 It is proposed that the CO₂ reduction strategy for the development incorporates further improvements beyond a Part L compliant specification and initially concentrates finance and efforts on reducing energy demand as the first stage of the Energy Hierarchy (Figure 1).

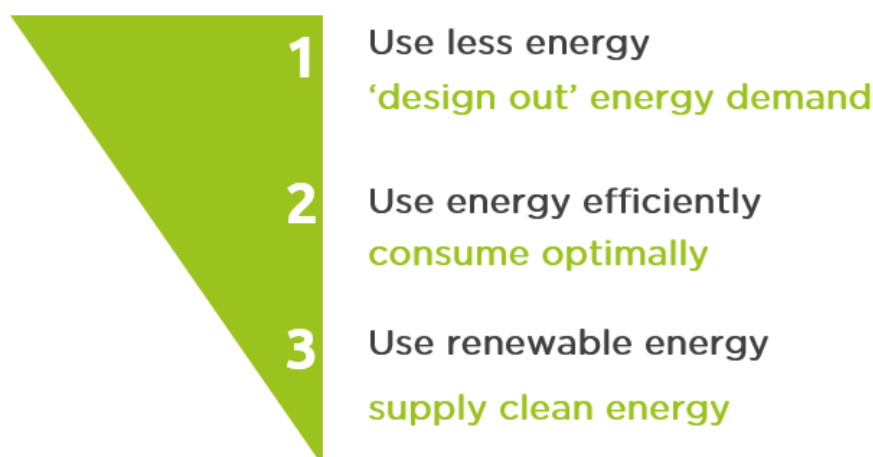


Figure 1. The Energy Hierarchy

- 4.3 As this hierarchy demonstrates, designing out energy use is weighted more highly than the generation of low-carbon or renewable energy to offset unnecessary demand. Applied to the development of new housing, this approach is referred to as 'fabric first' and concentrates finance and efforts on improving U-values, reducing thermal bridging, improving airtightness, and installing energy efficient ventilation and heating services.
- 4.4 This approach has been widely supported by industry and government for some time, with the Zero Carbon Hub³ and Energy Savings Trust⁴ having both stressed the importance of prioritising energy demand as a key factor in delivering resilient, low energy homes.
- 4.5 There is further explicit acknowledgement of the benefits of this approach through the introduction of Fabric Energy Efficiency Standards into Part L of the Building Regulations 2013, which is intended to "discourage excessive and inappropriate trade-offs... for example...

³ Zero Carbon Hub, Zero Carbon Strategies for tomorrow's new homes, Feb 2013.

⁴ Energy Saving Trust, Fabric first: Focus on fabric and services improvements to increase energy performance in new homes, 2010

poor insulation standards being offset by renewable energy systems with uncertain service lives.”⁵

- 4.6 The benefits to prospective homeowners of following the Fabric First approach are summarised in Table 2.

Table 2: Benefits of the Fabric First approach

	Fabric energy efficiency measures	Bolt-on renewable energy technologies
Energy/CO ₂ /fuel bill savings applied to all dwellings	✓	✗
Savings built-in for life of dwelling	✓	✗
Highly cost-effective	✓	✗
Increases thermal comfort	✓	✗
Potential to promote energy conservation	✓	✓
Minimal ongoing maintenance / replacement costs	✓	✗
Minimal disruption to retrofit post occupation	✓	✗

Building Regulations Standards – Fabric Energy Efficiency

- 4.7 In addition to the CO₂ reduction targets, the importance of energy demand reduction was further supported by the introduction of a minimum fabric standard into Part L1A 2013 for dwellings, based on energy use for heating and cooling a dwelling. This is referred to as the ‘Target Fabric Energy Efficiency’ (TFEE), and expressed in kWh/m²/year.
- 4.8 This standard enables the decoupling of energy use from CO₂ emissions and serves as an acknowledgement of the importance of reducing demand, rather than simply offsetting CO₂ emissions through low carbon or renewable energy technologies.
- 4.9 The TFEE is calculated based on the specific dwelling being assessed with reference values for the fabric elements contained within Approved Document L1A. These reference values are described as ‘statutory guidance’ as opposed to mandatory requirements, allowing full flexibility in design approach and balances between different aspects of dwelling energy performance to be struck so that the ultimate

⁵ The Building Regulations 2010, Approved Document L1A, 2013 Edition

goal of achieving the TFEE is met. The proposed approach and indicative construction specifications are set out in the following sections of this Statement.

Improved fabric specification

- 4.10 In order to ensure that the energy demand of the development is reduced, the building will be designed to minimise heat loss through the fabric wherever possible. Table 3 details the design fabric specification of the major building elements, with the first column in this table setting out the Part L1A limiting fabric parameters in order to demonstrate the improvements that have been made. Similar thermal performance has been applied to the non-residential spaces.

Table 3: Proposed construction specification - main elements

	Part L1a Limiting Fabric Parameters	Indicative Proposed Fabric Specification
External wall - u-value	0.30 W/m ² K	0.14 W/m ² K
Wall to unheated space - u-value	0.30 W/m ² K	0.14 W/m ² K
Party wall - u-value	0.20 W/m ² K	0.0 W/m ² K
Roof - u-value	0.20 W/m ² K	0.11 W/m ² K
Ground floor - u-value	0.25 W/m ² K	0.12 W/m ² K
Windows - u-value	2.00 W/m ² K	1.2 W/m ² K
Doors - u-value	2.00 W/m ² K	1.0 W/m ² K
Air Permeability	10 m ³ /h.m ² at 50 Pa	3 m ³ /h.m ² at 50 Pa

Thermal Bridging

- 4.11 The significance of thermal bridging as a potentially major source of fabric heat losses is increasingly understood. Improving the U-values for the main building fabric without accurately addressing the thermal bridging will not achieve the desired energy and CO₂ reduction targets.
- 4.12 The specification proposed minimises unnecessary bridging of the insulation layers, with avoidable heat loss therefore being reduced wherever possible. Accurate calculation of these heat losses forms an integral part of the SAP calculations undertaken to establish energy demand of the dwellings, and as such indicative psi values have been used throughout, based on previously calculated junctions where applicable or defaults where absolutely necessary.

- 4.13 In order to further reduce the effect of thermal bridging within the dwellings, it is proposed to provide heating to the corridor areas. This minimises the potential temperature differential between the heated apartment and an unheated space and therefore effectively eliminates the heat transfer between these spaces.
- 4.14 For the non-residential spaces default thermal bridging has been applied.

Air Leakage

- 4.15 After conductive heat losses through building elements are reduced, convective losses through draughts are the next major source of energy wastage. The proposal adopts an airtightness standard of 3 m³/m²@50Pa, for the dwellings, a significant enhancement on Part L1A minimum requirements. Pressure testing of all dwellings on completion will be undertaken to confirm that the design figure has been met. The retail units will be designed to meet 5 m³/m²@50Pa.

Passive Design Measures and Overheating Risk Mitigation

- 4.16 In order to further reduce energy demand, where practical dwellings have been designed with regard to the principles of passive design, to maximise the potential for solar gain.
- 4.17 Within the development layout, orientation and massing will be designed to maximise (within reason) passive solar gain. Wherever feasible, the buildings are orientated with a southern bias, promoting useful solar gains throughout most of the day. Glazing will be specified with a solar transmittance value (g-value) to strike the balance between useful solar gain in the winter and unwanted solar gain in the summer, this is further reinforced within the overheating analysis carried out for the residential apartments.
- 4.18 Each flat is also provided with MVHR for constant ventilation and selected opening windows for purge ventilation and an effective means of rejection of heat where necessary. MVHR units that have a summer by-pass facility and boost capability will be specified.
- 4.19 All dwellings will be fitted with a heat interface unit connected via a building-scale heat network to high efficiency communal gas-fired boilers. The heat exchanger within the flat as well as associated pipework will be insulated to ensure maximum efficiency as well as reducing any unwanted heat gains to the flats and communal areas.
- 4.20 Due to these measures to reduce internal heat gain, natural ventilation provided through window openings and MVHR with temperature sensors to allow for boost will allow sufficient air exchange rates to purge any heat build-up. Active cooling systems are therefore not proposed.
- 4.21 Within the retail units there is a large percentage of glazing present and therefore high levels of solar gain are reported within the SBEM analysis. The glazing within these

spaces has been optimised and a g-value of 0.42 is proposed, with a visual transmittance of 70%. It is also planned that these units will be provided with cooling at fit-out stage in order to combat the residual effects of the solar gain.

- 4.22 These measures will serve to ensure that the development builds in resilience to a potentially changing climate over the lifetime of the buildings and minimises the overheating risk that can be exacerbated by the drive to build better insulated, more airtight homes if not considered within the design and construction process.
- 4.23 Energy will be metered and monitored throughout the retail areas, with the metering of energy usage (i.e. heating, cooling, and electricity) for each tenancy to allow building owners/occupiers to view and interrogate where potential energy savings can be made.

Minimising Energy Use

- 4.24 Heat generation and distribution systems will be designed to give the occupants a high level of control over their use, encouraging and allowing energy-efficient behaviour. High efficiency communal gas fired boilers are to be installed, with time and temperature zoning controls being provided within each property
- 4.25 The development design seeks to provide a high standard of natural daylighting to all units. This provides the opportunity to create a high quality internal environment, which will reduce the need for artificial lighting.
- 4.26 Where feasible internal low energy lighting will be used and areas of infrequent use will be fitted with occupancy sensors. External security and space lighting will be low energy and fitted with PIR and daylight sensors where appropriate.

As-designed Performance of Dwellings

- 4.27 By following the strategy described, the dwellings will significantly reduce energy demand and consequent CO₂ emissions beyond a Part L compliant development.
- 4.28 As previously discussed, the Fabric Energy Efficiency (FEE) rating is an additional metric by which the improvement performance of the dwellings as designed can be measured.
- 4.29 Table 4 shows the average Part L complaint Target Fabric Energy Efficiency (TFEE) across the site and the as-designed calculated Dwelling Fabric Energy Efficiency (DFEE) to demonstrate the improvements made.

Table 4: Average site-wide Fabric Energy Efficiency as designed

	kWh/m ² /yr
Target Fabric Energy Efficiency (TFEE)	38.42
Dwelling Fabric Energy Efficiency (DFEE)	35.81
Improvement	6.79%

- 4.30 The CO₂ emissions for the dwellings after the energy demand reduction measures described is shown in Table 5.

Table 5: Dwelling emissions after energy demand reduction

	(kgCO ₂ /yr)	
Annual dwelling emissions - Part L compliant	103,651.03	
Annual dwelling emissions - as designed	93,951.88	
	(kgCO ₂ /yr)	%
CO ₂ savings from demand reduction	9,699.15	9.3

- 4.31 This shows that by implementing a fabric first approach, we are able to reduce CO₂ emissions by more than 9%.

As-designed Performance of Non-residential Areas

- 4.32 By following the strategy described, the non-residential areas have the potential to reduce energy demand and consequent CO₂ emissions beyond a Part L compliant development.

Table 6: Non-residential emissions after energy demand reduction

	(kgCO ₂ /yr)	
Annual non-residential emissions - Part L compliant	26,777.61	
Annual non-residential emissions - as designed	25,439.26	
	(kgCO ₂ /yr)	%
CO ₂ savings from demand reduction	1,338.35	5.0

Site-wide As-designed Performance

- 4.33 The site-wide CO₂ emissions after the energy demand reduction measures described is shown in Table 7.

Table 7: Site-wide emissions after energy demand reduction

	(kgCO ₂ /yr)	
Annual site emissions - Part L compliant	130,428.64	
Annual site emissions - as designed	119,391.14	
	(kgCO ₂ /yr)	%
CO ₂ savings from demand reduction	11,037.50	8.5

- 4.34 The above tables show that by energy demand reductions alone, we are able to reduce the CO₂ emissions from the site by 8.5%.

5 Renewable Energy Feasibility Appraisal

- 5.1 Once energy demand is reduced and energy used as efficiently as possible, methods for generating that energy in a sustainable, renewable way should be considered.
- 5.2 The feasibility will be assessed according to a number of factors:
- Renewable energy resource or fuel availability
 - Space limitations due to building design and urban location of the site.
 - Planning Permission
 - Implementation with regards the overall design strategy
 - Orientation and wind speed (for specific technologies)

Combined Heat and Power (CHP) and District Energy Networks

- 5.3 A CHP unit is capable of generating heat and electricity from a single fuel source. The electricity generated by the CHP unit used to displace electricity that would otherwise be supplied from the national grid, with the heat generated as a by-product utilised for space and water heating.
- 5.4 The economic and technical viability of a CHP system is largely reliant on a consistent demand for heat throughout the day to ensure that it operates for over 5000 hours per year. Heat demand from residential schemes is not conducive to efficient system operation, with a defined heating season and intermittent daily profile, with peaks in the morning and the evening. For this reason, the use of a CHP system is considered unfeasible to this solely residential development.
- 5.5 At present Reading does not have a decentralised heat network. The Association for Decentralised Energy, District Heating Installation Map⁶ shows the nearest district heating schemes to be over 25km away, therefore giving no current opportunities for connection.
- 5.6 However, there are a number of significant potential redevelopment sites within the vicinity of Station Road and there is significant head demand within the area. Therefore, future connection to any local district heating network may be feasible.
- 5.7 When electricity is generated by the burning of fossil fuels (or, indeed, in any of the thermal generation processes), around half of the energy is wasted as heat. Harnessing this heat would halve the effective emission intensity of fossil fuel

⁶ http://www.theade.co.uk/energy-maps_245.html

generation. Combined Heat and Power (CHP) systems perform this function by running electricity-generating plant based on heat demand, and capturing the heat to warm homes, buildings and processes. CHP's are most economical on large scales, where the generation of electricity benefits from economies of scale and the many heat loads average together to provide a fairly constant load. This means that they often lead to large scale heat networks with many buildings attached to a single heat source.

- 5.8 The capital investment in CHP plant may be substantial, so it is important to run plant to achieve maximum returns. Idle plant accrues no benefits, so it is important that the CHP plant operates for as many hours as possible. Basically, this means matching CHP capacity to base heat and power loads.
- 5.9 With this in mind developments which tend to suit CHP installation include sites which show characteristics of having high demand density with a mixed use providing year round energy demand as well as high energy users such as leisure centres, hospitals and large universities.
- 5.10 As discussed, the 29-35 Station Road development provides energy efficiency savings. Due to the high level of energy efficiency, the demand for heat is reduced. The year round base heat demand required to make CHP feasible is not met by the summer hot water load from the residential units alone, with the commercial space being provided with separate heating and cooling.
- 5.11 Given this lack of a consistent heat demand, site-specific CHP is not considered feasible.
- 5.12 Although CHP is not to be used within the development the residential units will benefit from a communal heating, this allows for improved economies of scale and flexibility for the future in terms of heat energy source options and the integration of low or zero carbon technologies.

Wind Power

- 5.13 Locating wind turbines adjacent to areas with buildings presents a number of potential obstacles to deployment. These include the area of land onsite required for effective operation, installation and maintenance access, environmental impact from noise and vibration, visual impact on landscape amenity and potential turbulence caused by adjacent obstacles. For these reasons wind power is not considered feasible.

Air Source Heat Pumps (ASHP)

- 5.14 An ASHP is not a zero-carbon technology, but it is a low carbon technology. An ASHP works by converting energy from the outside air into heat.

- 5.15 This can be used for heating in the winter, but can be reversed for cooling in the summer months. ASHPs work by extracting latent heat from the outside air and passing it through a heat exchanger which increases its temperature. The heat is then fed to the required rooms. An ASHP will produce a lower CoP than a ground source heat pump due to the lower temperature of outside air and greater variance in temperature. However, the cost of an ASHP is much lower as there is no need for any expensive ground works.
- 5.16 Although not suitable for the residential units due to space constraints, the retail units will benefit from a high efficiency ASHP. A multi-split air-to-air heat pump is anticipated to be used with the ability to operate in reverse thereby providing both heating and cooling to the retail spaces.
- 5.17 Split systems are made up of one or more indoor room units and an outdoor unit that extracts heat from the exterior when the system is in heating mode. The indoor and outdoor units are linked by pipes which transport refrigerant between the units.
- 5.18 Air-source heat pumps can have a number of environmental and operation advantages. More heat is supplied to the building than energy is consumed by the heat pump.
- 5.19 An air-source heat pump with a heating efficiency of 3.5 will supply 3 kilowatts of heat energy for the consumption of 1 kilowatt of electricity. If the heat pump is replacing (or being used as an alternative to) electric space heating, the use of the heat pump offers significant carbon savings.

Building Scale Systems

- 5.20 The remaining renewable or low carbon energy systems considered potentially feasible are at a building scale. These are as follows;
- Biomass heating
 - Solar thermal
 - Solar photo-voltaic (PV)
- 5.21 The advantages and disadvantages of these technologies are evaluated in Tables 8-10.

Table 8: Biomass Heating feasibility appraisal

Biomass Heating	
Potential Advantages	Risks & Disadvantages
• Potential to significantly reduce CO₂ emissions as the majority of space and water heating will be supplied by a renewable fuel • Decreased dependence on fossil fuel supply	• A local fuel supply is required to avoid increased transport emissions • Fuel delivery, management and security of supply are critical • Space is required to store fuel, a thermal store and plant • A maintenance regime would be required even though modern systems are relatively low maintenance • Building users or a management company must be able to ensure fuel is supplied to the boiler as required. This may have a negative impact on marketing of buildings • Local environmental impacts potentially include increased NO_x and particulate emissions
Conclusions	
Due to the access requirements and required plant and storage space biomass is not considered as a feasible energy strategy.	

Table 9: Solar Thermal systems feasibility appraisal

Solar Thermal	
Potential Advantages	Risks & Disadvantages
• Mature and reliable technology offsetting the fuel required for heating water (typically gas) • Solar thermal systems require relatively low maintenance • Typically, ~50% of hot water demand in dwellings can be met annually	• Installation is restricted to favourable orientations on an individual building basis • The benefit of installation is limited to the water heating demand of the building • Safe access must be considered for maintenance and service checks • Buildings need to be able to accommodate a large solar hot water cylinder • Distribution losses can be high if long runs of hot water pipes are required • Visual impact may be a concern in special landscape designations (e.g. AONB)
Conclusions	
It is not the intention to provide hot water cylinders within the flats, and 29-35 Station Road does not afford the space for communal water storage, therefore providing solar water heating is not considered feasible.	

Table 10: Solar Photovoltaic systems feasibility appraisal

Solar Photovoltaic (PV)	
Potential Advantages	Risks & Disadvantages
• The technology offsets the high carbon content of grid supplied electricity used for lighting, pumps and fans, appliances and equipment • Mature and well proven technology that is relatively easily integrated into building fabric • Solar resource is not limited by energy loads of the dwelling as any excess generation can be transferred to the national grid • PV systems generally require very little maintenance • Occupiers could benefit from Feed in Tariff payments	• Poor design and installation can lead to lower than expected yields (e.g. from shaded locations) • Installation is restricted to favourable orientations • Occupiers may not benefit from Feed in Tariff payments where the contract is held by a landlord • Safe access must be considered for maintenance and service checks • Visual impact may be a concern in special landscape designations (e.g. AONB) • Reflected light may be a concern in some locations
Conclusions	
At 29-35 Station Road there is the benefit of a flat roof with relatively low overshadowing due to the height of the building. PV panels may therefore be fitted, using angled mounting systems to allow for the panels to sit at an optimal angle.	

Proposed Renewable Energy Systems

- 5.22 A review of the most viable renewable energy technologies for the scheme concluded that due to the results of the air quality plan and the space constraints within the site it is proposed to focus on solar technologies for the residential units and provide a high efficiency ASHP for the retail units.
- 5.23 An array of photovoltaic panels is to be positioned on the flat roof. This will ensure the development is able to meet the carbon emissions reduction target, and further reduce electricity consumption within the flats. A 3.75 kWp array is proposed to be installed at a 30° pitch, facing south on the flat roof. SAP procedure allows for the CO₂ reductions achieved by this communal array to be allocated to each unit based on the proportional floor area of each dwelling. The final installation design will be subject to detailed design.
- 5.24 Heating and hot water for the flats is proposed to be provided via high efficiency communal gas boilers with low NO_x emissions, which will be installed within the basement plant room.
- 5.25 For the dwellings, Table 11 shows that the CO₂ emission rate to the dwellings is reduced by 1.8% due to the introduction of renewables.

Table 11: Dwellings CO₂ savings from renewable energy

	(kgCO ₂ /yr)	
Annual dwelling emissions – After demand reduction	93,951.88	
Annual dwelling emissions – after renewables	92,240.54	
	(kgCO ₂ /yr)	%
CO₂ savings from renewable energy	1,711.34	1.8

- 5.26 For the non-residential areas, Table 12 shows that the CO₂ emission rate is reduced by 14% due to the introduction of high efficiency ASHP for heating and cooling to the retail units.

Table 12: Non-residential CO₂ savings from renewable energy

	Carbon Dioxide Emissions (kgCO ₂ /yr)	
Annual non-residential emissions - after demand reduction	25,439.26	
Annual non-residential emissions - after renewables	21,872.39	
	(kgCO ₂ /yr)	%
CO ₂ savings from renewable energy	3,566.87	14.0

- 5.27 Site-wide CO₂ emissions are reduced by 4.4% due to the introduction of renewables. This is shown in table 13

Table 13: Site-wide CO₂ savings from renewable energy

	Carbon Dioxide Emissions (kgCO ₂ /yr)	
Annual site emissions - after demand reduction	119,391.14	
Annual site emissions - after renewables	114,112.93	
	(kgCO ₂ /yr)	%
CO ₂ savings from renewable energy	5,278.21	4.4

6 Overall CO₂ Savings Achieved

- 6.1 Through a combination of the described fabric first approach to sustainable construction and the installation of solar PV panels and high efficiency air source heat pumps, the development will deliver CO₂ savings significantly in excess of Part L 2013 requirements. The overall reduction achieved is shown in Table 16.
- 6.2 The development shows carbon reduction through the following measures:
- High thermal performance building envelope significantly improving on Building Regulations minimum standards.
 - Maximize daylight in all areas
 - Energy efficient heating
 - Optimise control and flexibility of the installations
 - Practical zoning of HVAC systems
 - High efficiency Mechanical Ventilation Heat Recovery in flats
 - Use of passive design measures and MVHR to mitigate overheating
 - Lighting solutions shall take consideration of appropriate lighting levels and uniformity and shall employ low energy lamps and high frequency control gear
 - Lighting solutions shall include intelligent automatic control systems where appropriate and energy beneficial
 - Use of high efficiency ASHP for heating and cooling in retail areas
 - A 3.75 kWp PV array to be mounted on the flat roof
- 6.3 The dwellings show a total reduction in CO₂ emissions of 11,410.49 kgCO₂/yr, which equates to 11%, meeting the energy target of 9.5% improvement for residential spaces.
- 6.4 The client commitment is to meeting the planning requirement of 9.5% for the residential units only as a minimum, figures presented within this statement and any additional measures proposed are shown as an example of how the development could comply and is subject to ongoing design work.

Table 14: Total residential CO₂ savings

	Carbon Dioxide Emissions (kgCO ₂ /yr)	
Baseline Part L compliant	103,651.03	
After fabric measures	93,951.88	
After renewable energy	92,240.54	
	(kgCO ₂ /yr)	%
Savings from fabric measures	9,699.15	9.4
Savings from renewable energy	1,711.34	1.8
Total savings	11,410.49	11.0

- 6.5 The non-residential areas show a total reduction of 4,905.22 kgCO₂/yr, giving a 18.3% reduction over 2013 Part L.

Table 15: Non-residential CO₂ savings

	Carbon Dioxide Emissions (kgCO ₂ /yr)	
Baseline Part L compliant	26,777.61	
After fabric measures	25,439.26	
After renewable energy	21,872.39	
	(kgCO ₂ /yr)	%
Savings from fabric measures	1,338.35	5.0
Savings from renewable energy	3,566.87	14.0
Total savings	4,905.22	18.3

- 6.6 The site-wide emissions show a reduction of 16,315.71 kgCO₂/yr, equating to an overall saving of 12.5%.

Table 16: Total site-wide CO₂ savings

Site emissions	Carbon Dioxide Emissions (kgCO ₂ /yr)	
Baseline Part L compliant	130,428.64	
After fabric measures	119,391.14	
After renewable energy	114,112.93	
	(kgCO ₂ /yr)	%
Savings from fabric measures	11,037.50	8.5
Savings from renewable energy	5,278.21	4.4
Total savings	16,315.71	12.5

- 6.7 By implementing the described efficiency and renewable measures the total regulated site wide CO₂ emissions are predicted to be 114,112.93 kgCO₂ per year; a saving of 12.5% against a Part L 2013 compliant scheme, with 4.4% of the savings being provided by the inclusion of renewable technologies.
- 6.8 Notwithstanding the proposals detailed above, the scheme remains committed to satisfying the energy requirement to achieve 50% Level 4 and 50% Level 3 of the Code for Sustainable Homes. The results presented demonstrate that the dwellings are predicted to achieve 11% improvement compared to the minimum Part L requirements, above our target of 9.5%.
- 6.9 In terms of the BREEAM commitments, the retail units achieve the following Energy Performance Ratio for New Construction) when compared to a Building Regulation 2013 Compliant Development: Retail 1: 0.659 EPR_{NC}, Retail 2: 0.880 EPR_{NC}. The worst case Ene01 score of 0.659 EPR_{NC} equates to 8 BREEAM credits, achieving the minimum standard for BREEAM 'Excellent', surpassing the 'Very Good' requirements and contributing to the overall score.
- 6.10 In summary, the proposed development is expected to reduce total CO₂ emissions by 16.315 kgCO₂/yr producing savings of 12.5% when compared to a Building Regulations 2013 compliant development.