South West Milton Keynes

Updated Energy Statement

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SWMK Consortium

SOUTH WEST MILTON KEYNES

Updated Energy Strategy

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SWMK Consortium

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SWMK Consortium

SOUTH WEST MILTON KEYNES

Updated Energy Strategy

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1 EXECUTIVE SUMMARY

1.1 INTRODUCTION

1.1.1. WSP was instructed by The Consortium to prepare an Energy Strategy to support the planning application for the proposed development at the site known as 'South West Milton Keynes', located immediately to the west of Far Bletchley, at the south-western edge of Milton Keynes, Buckinghamshire.

1.1.2. The description of the development is as follows:

'Outline planning application with all matters reserved except for access for a mixed-use sustainable urban extension on land to the south west of Milton Keynes to provide up to 1,855 mixed tenure dwellings, including 60 extra care units (C3); an employment area (B1) including provision for a 6GP surgery (D1); a neighbourhood centre including retail (A1/A2/A3/A4/A5), community (D1/D2) and residential (C3) uses; a primary school; a grid road reserve; multi-functional green space; a sustainable drainage system; and associated access, drainage and public transport infrastructure.'

1.2 ENERGY AND CARBON TARGETS

1.2.1. Energy and carbon requirements apply to the development at a national and local level.

1.2.2. The implications of the relevant targets for the proposed development can be summarised as follows:

- All developments must meet the prevailing Building Regulations requirements. The development will be brought forward under Part L 2013 and this has been used as the basis of this energy assessment.
- Policy C3 of the proposed submission draft of the Vale of Aylesbury Local Plan (VALP) requires in part that:
  - All residential developments of 100 dwellings or more and non-domestic developments of 1,000sqm or more are encouraged to have a feasibility assessment undertaken for district heating and cooling utilising technologies.
  - Where feasibility assessments demonstrate that decentralised energy systems are deliverable and viable and can secure 10% of their energy from decentralised and renewable or low carbon sources, such systems will be required as part of the development.

1.3 ENERGY STRATEGY

1.3.1. The Energy Strategy has been structured in accordance with the energy hierarchy: 'Be Lean, Be Clean, Be Green'. This is considered good practice by many local authorities and is recommended within the Draft VALP.

1.3.2. The proposals for the scheme have been developed in accordance with the desire to achieve an energy efficient and sustainable development. Further design development will determine the exact specification and fabric values of construction materials used and an element of flexibility is required at this stage.

Be Lean

1.3.3. The Proposed Development provides for up to 1,855 new homes including 60 extra care units. The dwellings will be designed to achieve good levels of energy performance and will incorporate the following design features:

- Exceeding the minimum fabric requirements of Part L1A (2013) of the Building Regulations.
- All dwellings will include 100% low energy lighting.
- Natural ventilation

1.3.4. The Proposed Development also includes non-residential uses: Planning Use Classes A1-A5 (retail) up to 930m^2, B1 (business employment) including a GP surgery, D1 and D2 (community) up to 575m^2, as well as a primary school and a secondary school. This assessment assumes that buildings associated with these non-residential uses will incorporate building fabric in line with notional values (Part L of the Building Regulations 2013), high efficiency LED lighting and low energy external lighting.

Be Clean

- The use of CHP and district heating is not viable in a site-wide context. This position will be kept under review as detailed designs progress.
- Considering the projected decarbonisation of the electricity grid, gas CHP systems are generally now accepted as increasing CO_2 emissions (and air pollution) and so is generally not recommended for new developments.

Be Green

- Individual air source heat pumps are proposed for the both residential and non-residential uses of the Proposed Development. Communal air source heat pumps will be used to serve the flats.
- An alternative method of compliance may also be achieved through the provision of circa 900kWp of photovoltaics located on rooftop areas.

1.4 RESULTS

1.4.1. Accredited Design SAP 2012 / SBEM software was used to determine the regulated CO2 emissions and Fabric Energy Efficiency (FEE) standards for a sample of typical buildings and flats. The results were then extrapolated across the Proposed Development to assess the total baseline CO2 emissions, the CO2 emissions after the application of energy efficiency measures and after the application of low and zero carbon technologies.

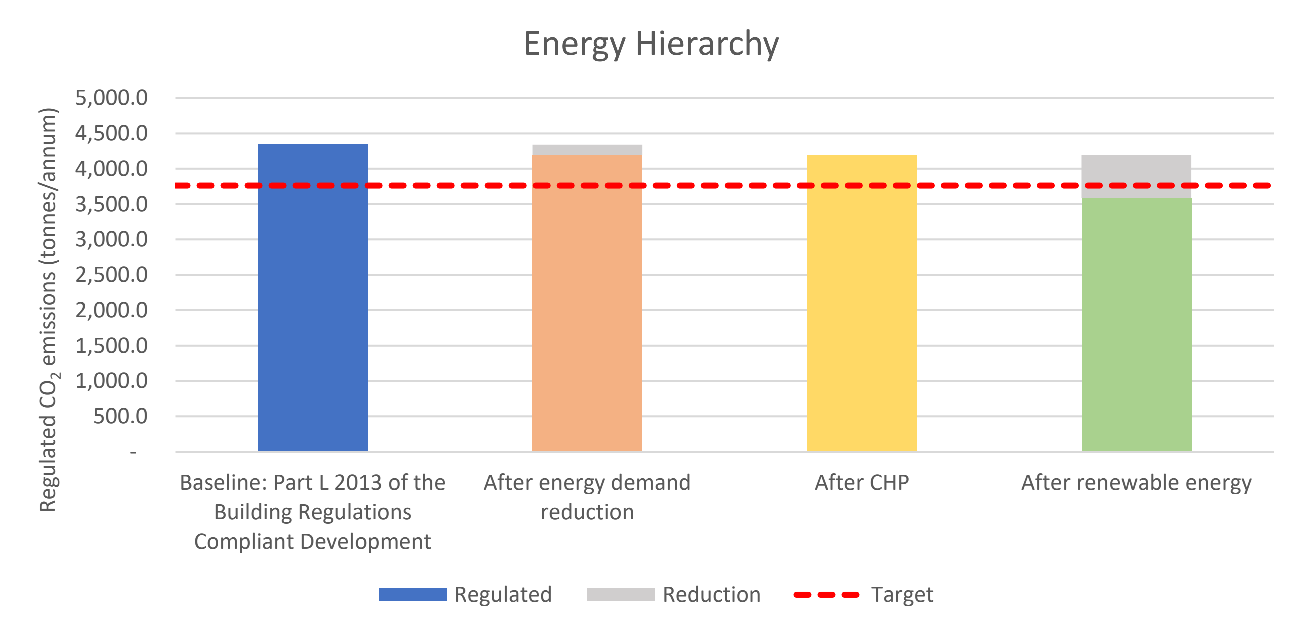
1.4.2. All project targets have been met, with the Proposed Development meeting >10% reduction in energy from renewables.

1.4.3. The results are shown in Table 1 and Figure 1 below:

Table 1 – Annual Carbon emissions reductions based on a heat pump and PV based solution

	Regulated Emissions (T CO_2)	Unregulated Emissions (T CO_2)	% Reduction in Regulated Emissions
Part L Compliant Development	4,383.1	3,476.2	0.0%
After energy demand reduction	4,229.3	3,476.2	3.5%
After energy efficient supply	4,229.3	3,476.2	3.5%
After renewable energy	3,618.8	3,476.2	17.4%

Figure 1 - Summary of the estimated carbon emissions reductions for the proposed development against 10% renewables target



1.4.4. Whilst the exact design and specification is still under development, it can be seen that the local planning policy requirements can be met by a combination of efficiency measures (fabric first approach), decentralised energy and renewable technologies.

2 APPLICATION SITE & PROJECT DESCRIPTION

2.1 CONTEXT

2.1.1. This Energy Strategy forms one of a suite of documents that support an outline application submitted by the SWMK Consortium for a new sustainable urban extension at South West Milton Keynes (the site). The Proposed Development is of a significant scale and as such would be developed over several years in a number of different phases.

2.2 PURPOSE AND SCOPE

2.2.1. The Energy Strategy sets out the planning policy framework and the regulatory framework that govern energy and CO2 emissions in new developments. It then reviews the strategic options for the site in the context of technical and financial considerations and sets out a strategy for the Proposed Development.

2.3 PROJECT DESCRIPTION

2.3.1. The description of the development for the planning applications is as follows.

'Outline planning application with all matters reserved except for access for a mixed-use sustainable urban extension on land to the south west of Milton Keynes to provide:

- *up to 1,855 mixed tenure dwellings, including 60 extra care units (C3);*
- *an employment area (B1) including provision for a 6GP surgery (D1);*
- *a neighbourhood centre including retail (A1/A2/A3/A4/A5), community (D1/D2) and residential (C3) uses;*
- *a primary school;*
- *a secondary school;*
- *a grid road reserve;*
- *multi-functional green space;*
- *a sustainable drainage system; and*
- *associated access, drainage and public transport infrastructure.'*

2.3.2. As the split in accommodation types has not been developed for this site as yet, one has been assumed for the purposes of this assessment. We have also assumed employment of 10,350 sqm (GFA), and Community / Retail areas of 575 sqm and 930 sqm respectively in line with the assumptions within the Employment Assessment.

Table 2 - Schedule of Accommodation – Dwellings (Indicative mix)

Type	Floorspace Area (m^2)	Number
1 Bed Flat	69 (assumed)	70
2 Bed Flat	76 (assumed)	80
2 Bed House	91.5 (assumed)	227
3 Bed House	117.4 (assumed)	1001
4 Bed House	119 (assumed)	363
5 Bed House	113.4 (assumed)	114
Total		**1,855**

Table 3 - Schedule of Use – Non-domestic (Indicative)

Type	Floorspace Area (m^2)
Employment	10,350
Retail	930
Community Facilities	575
Primary School	2,740
Secondary School	8,250

3 POLICY AND REGULATORY FRAMEWORK

3.1 BACKGROUND

3.1.1. The site at South West Milton Keynes has been identified historically as a suitable location for growth. The identification of an urban extension in the south west Milton Keynes area has emerged from a series of studies over the last twenty years. This section considers the policy and regulatory framework specifically regarding energy and CO2 considerations for the proposed development. In terms of energy, relevant policy applies at both a local and national level.

3.1.2. The site sits almost entirely within the administrative area of Aylesbury Vale District Council (AVDC) although the development would be adjacent to and fundamentally an extension of Milton Keynes. Whilst AVDC is the local planning authority for the determination of this outline application, it has been submitted to the Milton Keynes Council (MKC) for the determination of the access points. The policies of ADVC, as well as the National Planning Policy Framework (NPPF) and Building Regulations (Part L), are therefore reviewed herein. Policies for MKC are also noted.

3.1.3. Both Aylesbury Vale and Milton Keynes have progressed new local plans to replace extant developments plans. Once adopted the VALP will replace the saved policies of the Aylesbury Vale Local Plan. Plan:MK was adopted in 2019 and replaces the Core Strategy (2013) and the saved policies of the Milton Keynes Local Plan (2005).

3.2 AYLESBURY VALE DISTRICT LOCAL PLAN (ADOPTED JANUARY 2004) – SAVED POLICIES

3.2.1. The adopted local plan is dated and further to the Secretary of State's direction dated 24th September 2007, only some of the policies are saved. There are no saved policies with specific references to the energy performance of new developments, nor to CO_2 emissions, nor to sustainable design and construction.

3.3 PLAN:MK (MARCH 2019)

3.3.1. Milton Keynes Council adopted Plan:MK as the new Local Plan in March 2019. The key policies relating to energy within Plan:MK are Policies SC1, SC2 and SC3. Plan:MK also expects that the Low Carbon Action Plan followed by MKC will be updated soon to take into account the long-term objective of the updated Imagine MK2050 Strategy, which aims for a near zero carbon Milton Keynes by 2050.

3.3.2. Policy SC1 of Plan:MK is related to sustainable construction of buildings. It continues the MKC's approach to seeking more energy efficient and lower carbon housing, and development that is environmentally sustainable in a wider sense in order to achieve the objectives and wider vision for the Borough. Points H-K within Policy SC1 relate to energy and climate issues.

3.3.3. Policy SC2 relates to community energy networks and expects proposals for over 100 homes and non-residential developments of over 1,000 sqm to consider the integration of community energy networks in the development. All new developments in proximity of an existing or proposed combined heat and power (CHP), combined cooling heat and power (CCHP) station or local energy network will be expected to connect to the network unless it can be demonstrated that:

- a better alternative for reducing carbon emissions from the development can be achieved; or

- heating and/or cooling loads of the scheme do not justify a CHP connection; or
- the cost of achieving this would make the proposed development unviable.

3.3.4. Policy SC4 relates to low carbon and renewable energy generation. It states that planning permission will be granted for proposals to develop low carbon and renewable energy sources (including community energy networks) unless there would be significant impacts or unacceptable harm.

3.4 NATIONAL PLANNING POLICY FRAMEWORK (2019)

3.4.1. The National Planning Policy Framework 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 development can be produced.

3.4.2. Section 14 describes the challenge of climate change and how these should be planned for. Specifically, it encourages the reduction of greenhouse gas emissions, such as through the location, orientation and design of new development. Any local requirements for the sustainability of buildings should also reflect the Government's policy for national technical standards.

3.4.3. To help increase the use and supply of renewable and low carbon energy and heat, plans should:

- 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);
- consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and
- identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for collocating potential heat customers and suppliers

3.5 BUILDING REGULATIONS (PART L)

3.5.1. All new buildings constructed in England and Wales must meet the minimum requirements of the UK Building Regulations. Specifically, with regards to energy and carbon compliance, all buildings must meet the building regulations Part L 'Target Emission Rate' (TER) requirements for the Part L revision which is current at the time of initial construction works for each developmental phase. The requirements of Part L 2013 will apply to the Site but may be superseded in the coming years. This includes the requirement for the dwellings to meet the new Target Fabric Energy Efficiency standards (TFEEs) as laid out in AD L1A 2013.

3.5.2. One of the major anticipated updates in future amendments to the Building Regulations is a potential change in emissions factors associated with electricity; this is set out in the draft document for 'SAP 10.1' (The Government's Standard Assessment Procedure for Energy Rating of Dwellings Version 10.1 dated 01/10/2019). The value for carbon dioxide associated with the use of electricity reduced by around 74% (from 0.519 $kgCO_2/kWh$ to 0.136 $kgCO_2/kWh$), highly incentivising the use of electric heating in the form of heat pumps and further discourage or prohibit the use of gas in boilers and gas-fired CHP units.

3.6 DRAFT VALE OF AYLESBURY LOCAL PLAN (PROPOSED SUBMISSION, NOVEMBER 2017)

3.6.1. The Proposed Submission Draft Vale of Aylesbury Local Plan was published in November 2017. The key policy relating to energy is Policy C3, which promotes an 'energy hierarchy' as follows:

- reducing energy use, in particular by the use of sustainable design and construction measures
- supplying energy efficiently and giving priority to decentralised energy supply
- making use of renewable energy
- making use of allowable solutions, and
- an energy strategy will be encouraged for proposals for major residential developments (over 10 dwellings), and all non-residential development, to demonstrate how the energy hierarchy has been applied.

3.6.2. A feasibility assessment for district heating (DH) and cooling utilising technologies such as combined heat and power (CHP), including biomass CHP or other low carbon technology, will be encouraged for:

- all residential developments of 100 dwellings or more
- all residential developments in off-gas areas for 50 dwellings or more, and
- all applications for non-domestic developments above 1,000sqm floorspace.

3.6.3. Where feasibility assessments demonstrate that decentralised energy systems are deliverable and viable and can secure 10% of their energy from decentralised and renewable or low carbon sources, such systems will be required as part of the development.

4 BASELINE CARBON EMISSIONS

4.1.1. The first stage of the energy assessment is to establish the baseline site energy demand and CO2 emissions based on accredited SAP/SBEM software for the residential/commercial areas, respectively.

4.1.2. NHER Plan Assessor (6.2.4) SAP software was used to establish the baseline regulated carbon emissions and unregulated carbon emissions. The results for the sample apartments were then extrapolated to calculate the baseline carbon emissions and energy demand for the dwellings across the whole development. As layouts and floor areas are not currently available for the Proposed Development, typical values have been assumed based on similar projects. Table 4 summarises sample of models considered.

Table 4 - Summary of SAP models created

Identifier	Description
1	1-bed flat
2	2-bed flat
3	2-bed house
4	3-bed house
5	4-bed house
6	5-bed house

4.1.3. In order to calculate the baseline CO2 emissions, a proposed fabric performance has been assumed. These are described in the table below.

Table 5 - Fabric performance notional and backstop values - Residential

Element	Proposed Fabric Performance	Fabric Performance – Backstop Values
External Wall U-value (W/m²K)	0.18	0.30
Party wall U-value (W/m²K)	0.00	0.20
Ground floor U-value (W/m²K)	0.13	0.25
Roof U-value (W/m²K)	0.13	0.20
Glazing U-value (W/m²K)	1.40	2.00
Glazing G-value	0.70	-
Air permeability (m³/hr.m² @ 50 Pa)	5.0	10.0
Thermal Mass (kJ/m²K)	Flats - 100 (low) Houses - 250 (medium)	-
Thermal Bridging (W/m²K)	0.05	-

4.1.4. Accredited SBEM software, IES-VE 2018 was used for the commercial areas. Energy modelling was undertaken based on the methodology from Part L2A of the Building Regulations. Any building services installed have complied with the limiting values listed in the relevant Non-Domestic Building Services Compliance Guide. Again, models were developed using property types as layouts and floor areas are not currently available.

4.1.5. WSP utilised a dynamic simulation software package, the Virtual Environment (VE) suite from Integrated Environmental Solutions (IES). This is a fully validated commercially available software package that is available for demonstrating compliance with the Building Regulations. IES <VE> is an integrated suite of applications based around a 3D geometrical model.

4.1.6. Table 4 6 summarises sample of models considered.

Table 6 - Summary of SBEM models created

Identifier	Description
1	Employment Area
2	Retail
3	Community
4	Primary School
5	Secondary School

4.1.7. To calculate the baseline CO_2 emissions, a proposed fabric performance has been assumed. These are described in the table below.

Table 7 - Fabric performance notional and backstop values - Commercial

Element	Proposed Fabric Performance	Fabric Performance – Backstop Values
External Wall U-value (W/m^2K)	0.26	0.35
Ground floor U-value (W/m^2K)	0.22	0.25
Roof U-value (W/m^2K)	0.18	0.25
Glazing U-value (W/m^2K)	1.60	2.2
Glazing G-value	0.40	-
Air permeability ($m^3/hr.m^2$ @ 50 Pa)	5.0	10.0

4.1.8. Table 8 summarises the baseline carbon emissions for the whole development.

Table 8 – Annual overall baseline regulated and unregulated carbon emissions

	Regulated Emissions (T CO_2)	Unregulated Emissions (T CO_2)
Building Regulations Part L 2013 Compliant Development	4,383.1	3,476.2

4.1.9. WSP's approach is to use the 'Energy Hierarchy' in order to meet the local planning policy requirements of AVDC. The steps include:

- Be Lean – prioritising energy efficiency
- Be Clean – consideration of low carbon technologies and district heating
- Be Green – incorporation of renewable technologies

5 BE LEAN: REDUCE ENERGY DEMAND

5.1.1. The first step to achieving Building Regulations compliance and the targets outlined previously is to reduce energy demand. The measures associated with reducing demand can be termed as ‘Energy Efficiency Measures’. The Proposed Development will incorporate several relevant energy conservation measures; the benefits of which are discussed below. Further detailed design development will assess the exact specification and fabric values used in construction materials. In line with the energy hierarchy, a “fabric first” approach is to be utilised before consideration of on-site renewable energy generation.

5.1.2. In summary the following measures will be included:

- Good levels of air tightness
- High performance building fabric
- High performance glazing
- 100% low energy lighting
- Natural ventilation

5.2 BUILDING FABRIC

5.2.1. As the layouts have yet to be developed, no specifically designed measures can be recommended. The layout will ensure that all the housing units will benefit from high levels of natural daylight while also balancing the risk of overheating. While the commercial units will also consider massing, layout and orientation to minimise energy use.

5.2.2. At this stage it is anticipated that an overall U-value for the glazing will be around 1.4W/m^{2}K for the dwellings. For the purposes of this assessment this value has been used, though solutions will be sought to reduce the U-value further where possible to realise further CO_2 reductions.

5.2.3. Glazing to the dwellings will be specified to achieve a g-value of around 0.6 whilst this is lower than the notional value, this is considered to provide an improved year-round balance between maximising daylighting and beneficial wintertime solar gain; and minimising summertime solar gains to reduce the overheating risk and need for comfort cooling.

5.2.4. The current proposals for the building fabric performance for the dwellings within the Proposed Development are summarised in Table 9.

Table 9 - Fabric performance targets - Dwellings

Element	Notional Fabric Performance
External Wall U-value (W/m^2K)	0.16
Ground floor U-value (W/m^2K)	0.11
Roof U-value (W/m^2K)	0.11
Glazing U-value (W/m^2K)	1.4
Glazing G-value	0.6
Air permeability ($m^3/hr.m^2$ @ 50 Pa)	5

5.3 BUILDING SERVICES

5.3.1. A high-performance Mechanical, Electrical and Plumbing (MEP) standard is proposed for the scheme. Table 10 lists the expected specification for the heating system, lighting and ventilation strategy for the proposed dwellings and other buildings.

Table 10 - General HVAC and lighting specification for dwellings / commercial areas

Element	General Specification
Ventilation	Naturally ventilated dwellings
Internal lighting	High efficiency LEDs, with minimum efficacy of 100lm/cW
Heating controls	Time and temperature control
Heat emitters	Radiators for dwellings and school, multi-split units for offices and retail
Overheating control / cooling	Large, openable windows for dwellings. Active cooling for offices and retail

Note: For the 'Be Lean' stage high efficiency heat pumps have been assumed, however heat pumps have been proposed for the final scheme and discussed in the 'Be Green' section.

5.4 CO_2 EMISSIONS REDUCTION

5.4.1. Based upon the energy efficiency measures outlined and excluding the contribution of low or zero carbon technologies, the following total carbon emissions are calculated in Table 11.

5.4.2. The carbon emissions for the development are shown to be lower than the minimum requirements of the Building Regulations.

5.4.3. This is achieved via the improved building fabric values for the dwellings and the use of LED lighting for the commercial areas. An efficacy of 100lm/cW for the LED lighting has been proposed as a minimum at this stage, but it is likely that this can be improved upon as technology improves.

Table 11 - Be Lean: Annual carbon emissions after the application of energy efficiency measures

	Regulated Emissions (T CO_2)	Unregulated Emissions (T CO_2)	% Reduction in Regulated Carbon Emissions
Building Regulations Part L 2013 Compliant Development	4,383.1	3,476.2	0.0%
After energy demand reduction	4,229.3	3,476.2	3.5%

5.5 PART L 2013 FABRIC ENERGY EFFICIENCY (FEE)

5.5.1. Accredited Design SAP2012 software was used to determine the FEE standards for the same sample of six typical dwelling types. The results were then extrapolated across the whole development.

5.5.2. Results for the extrapolated target fabric energy efficiency (TFEE) and for the design building FEE are as follows:

Table 12 - Fabric Energy Efficiency for modelled units

Model Ref	Target FEE ($kWh/m^2/yr$)	Design FEE ($kWh/m^2/yr$)	Improvement
1	38.3	37.5	2%
2	43.5	39.5	9%
3	71.9	63.9	11%
4	65.4	58.8	10%
5	68.1	63.1	7%
6	62.9	58.2	7%

5.5.3. These results show that the proposed fabric energy efficiency for all the modelled typical units improve upon the target values.

6 BE CLEAN: SUPPLY ENERGY EFFICIENTLY

6.1.1. After consumption has been reduced through the application of energy efficiency measures, the next step is to consider low carbon technologies to provide further reduction in carbon dioxide emissions.

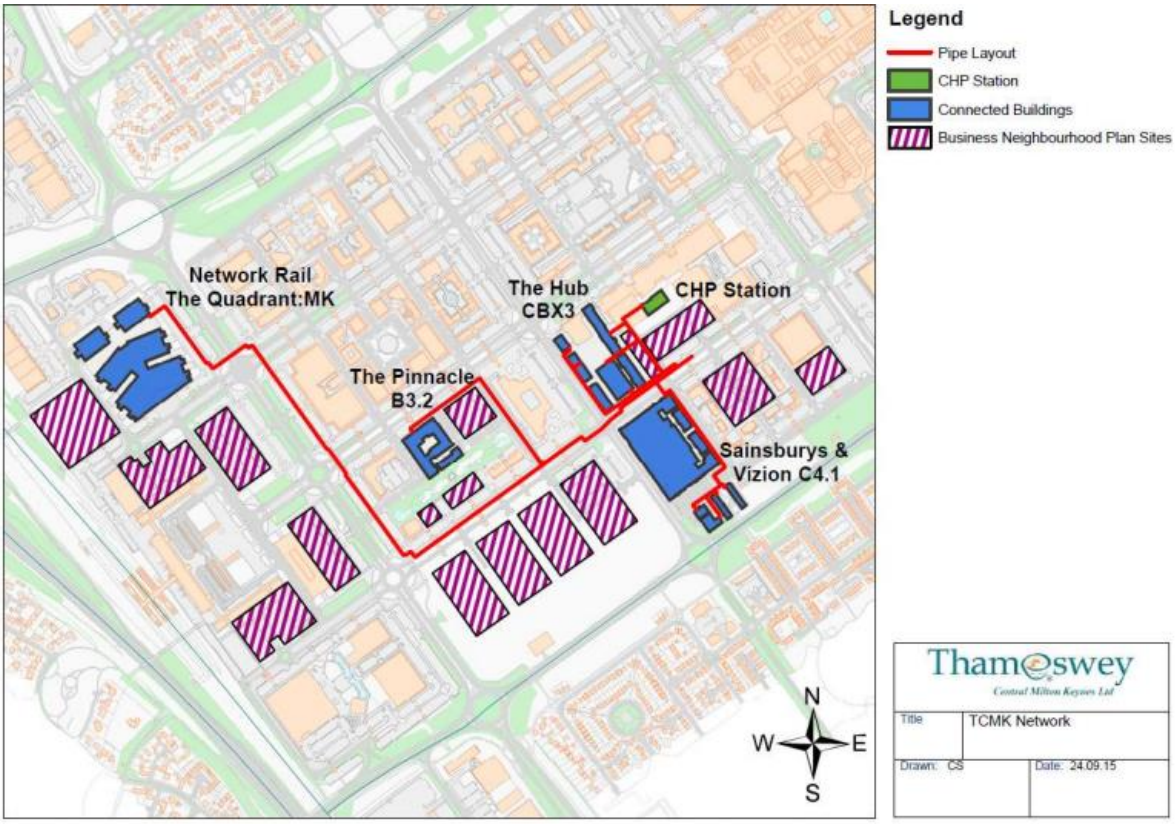
6.1.2. The following low carbon technologies have been investigated for the Proposed Development.

- District heating network
- Combined Heat and Power (CHP)

6.2 DISTRICT HEATING NETWORK

6.2.1. In 2007, Thameswey Central Milton Keynes Ltd. (TCMK) was established to build and operate a Combined Heat and Power station to deliver district heating and a private wire network in the central business district in Milton Keynes. The Energy Station is located on Avebury Boulevard in Central Milton Keynes.

Figure 4 – TCMK current and future potential connections



6.2.2. The energy centre consists of two CHP units that are fuelled by natural gas and have an electrical output of 6.4 MW. The station supplies electricity and heat, via a district-heating and private wire network to The Hub, Vizion, and The Pinnacle. The area served currently has a radius of some 1.5 km, whereas the Proposed Development is over 6 km (as the crow flies) away; making connection onto this network not viable.

6.2.3. An energy mapping study was undertaken by Milton Keynes in 2012, by the Centre for Sustainable Energy. Overall, heat demand is concentrated in Central Milton Keynes, as would be expected. There are also areas of high heat demand in Wolverton and Stony Stratford to the west, Newport Pagnell and Olney to the north, Kingston to the east and Bletchley to the south.

6.2.4. The Proposed Development consists of 1,689 dwellings at a relatively low density of 37.5 dwellings per hectare. These dwellings are proposed to be highly thermally efficient, reducing any potential heating demand from the network. In addition, there are relatively few large 'anchor loads'.

6.2.5. Due to the early stage nature of this study, final calculations for the estimated thermal demand of the site are not yet available. As such a sufficiently reliable estimation has been made based on these initial SAP and SBEM calculations.

6.2.6. Under a site thermal density of 30 kWh/m^2 a district heating system is generally thought of as not being technically viable. Only above 50 kWh/m^2 does it practically become an option. Initial analysis suggests the residential element of the Proposed Development only has a thermal density of around 31 kWh/m^2 and as such, would not be considered viable at this stage.

6.2.7. As plans develop and a better understanding of the thermal density of the site develops, certain areas may become suitable for such a system and so the matter will be kept under review.

6.3 COMBINED HEAT AND POWER (CHP)

6.3.1. CHP systems are suited to large mixed-use developments with a diverse and dense thermal demand. Therefore, this technology is dependent on a district heating network being present.

6.3.2. Industry guidance on preparing energy assessments states that for developments with fewer than 500 dwellings, it is generally not considered economically viable to install a CHP unit. Similarly, smaller systems tend to have lower efficiencies and a higher relative administrative burden.

6.3.3. Micro-CHP units, suitable for an individual property, are not as yet commercially viable.

6.3.4. Generally speaking, gas-CHP units are not now recommended for new developments due to the overall increase in CO2 emissions and the decarbonisation of the electrical system. This means that the carbon savings through the installation of gas-fired CHP have quickly become eroded and calculations show they would be much more carbon intensive than grid electricity. In December 2016 the Government consulted on the updating of the underlying assumptions used in the SAP assessments; these included the reduction in the carbon intensity of the electrical grid. These changes are likely to come into force in the next year or so and potentially during the determination of this application. In these circumstances this energy assessment will still be valid as it is unlikely to be legal to connect to gas-CHP led systems.

6.4 CARBON EMISSIONS REDUCTION

6.4.1. Following on from this step the overall carbon emissions for the development is unchanged and shown in Table 13.

Table 13 - Be Clean: Annual carbon emissions after the Be Clean step

	Regulated Emissions (T CO_2)	Unregulated Emissions (T CO_2)	% Reduction in Regulated CO_2
Building Regulations Part L 2013 Compliant	4,383.1	3,476.2	0.0%
After energy demand reduction	4,229.3	3,476.2	3.5%
After energy efficient supply	4,229.3	3,476.2	3.5%

7 BE GREEN: RENEWABLE ENERGY TECHNOLOGIES

7.1.1. Renewable Energy Technologies are those listed below which can provide a source of energy on-site that is not primarily based on the consumption of fossil fuels or grid electricity and/or utilises a heat source that is renewable, such as ground source and solar thermal systems.

- Wind Power
- Biomass Heating
- Heat Pumps for Heating and/or Cooling
- Solar Thermal Hot Water Heating
- Photovoltaic Panels

7.1.2. Several renewable energy technologies are evaluated below with an outline of how they may be applied to the development. Renewable energy technologies will be secured at the development through a Planning Condition.

7.2 WIND POWER

7.2.1. Harnessing the kinetic energy of wind can provide a renewable source of on-site electricity generation. Wind turbines need to be positioned where a frequent and steady source of wind is available that is not too turbulent or uneven in direction. Typically wind turbines are positioned on the roof of buildings that are significantly higher than their surroundings or located in open areas where there is minimum disruption to prevailing winds.

7.2.2. Turbines located within an urban environment with numerous adjacent buildings of similar height would cause turbulent wind conditions unsuitable for wind power generation. While larger turbines could be located towards the edge of the site, the residential nature of the development also mean that there will be acoustic concerns for the residents.

7.2.3. On that basis they are not proposed for the South West Milton Keynes site development.

7.3 BIOMASS HEATING

7.3.1. Biomass heating involves the combustion of wood chips or pellets to provide water suitable for heating and hot water. These types of systems are automated and so can connect to heat distribution systems with little modification. When fuel is sourced sustainably this technology can be a low carbon heating solution.

7.3.2. Whilst reducing carbon dioxide emissions, Biomass has embodied environmental impacts from transport and fuel combustion which makes it less desirable in Air Quality Management Areas (AQMAs). A review of the potential impact on air quality from increased wood fuelled biomass use indicated that increasing its contribution potentially may lead to a substantial increase in nitrogen dioxide and particulate matter concentrations.

7.3.3. Whilst there are three AQMAs in Aylesbury and one in Milton Keynes, none are close to the site. There are several technologies such as ceramic filters, electrostatic precipitators or bag filters which can all be used to significantly reduce emissions to air.

7.3.4. Solid biomass relies on a reliable fuel supply which must be delivered and stored on site. Sites using biomass solutions therefore require good access routes which are available on this site. Biomass boilers also have weekly maintenance requirements and relatively high fuel costs compared to gas.

7.3.5. There is a large space requirement for a biomass boiler. This technology is not recommended as it is a combustion system that will not futureproof the development.

7.4 GROUND / WATER / AIR SOURCE HEAT PUMPS

7.4.1. Heat pumps use electricity to turn low grade heat to a higher temperature typically suitable for providing heating and domestic hot water. They work most effectively when the source temperature (whether that is external air, the ground, or a large body of water) is at a relatively high temperature while the required output temperature is relatively low, i.e. between 35ºC and 45ºC. Some heat pumps can also be reversed to provide cooling.

7.4.2. Heat pumps produce no emissions at point of use and so do not have an impact on air quality in the locality. Additionally, their CO_2 emissions will reduce in line with the existing and expected decarbonisation of the national grid and updates in SAP (see earlier).

7.4.3. Heat pumps are measured by their Coefficient of Performance (CoP); that is the ratio of input electricity to the output of heat. Air source heat pumps (ASHPs) generally operate between a CoP of 2.5 and 3, while a good ground or water source heat pump (GSHP / WSHP) may operate with a CoP of 3.5 to 4.5. These CoPs vary considerably depending on the local source temperatures and the building heat distribution system.

7.4.4. This technology operates most effectively when used to provide space heating via very low temperature systems such as underfloor heating or low temperature radiators. If higher temperatures are required, the CoP reduces. As ground temperatures are stable year-round, GSHPs provide a consistent level of performance throughout the year. Whereas the coefficient of performance of air source heat pumps is directly related to the air temperature. This means the CoP of an ASHP drops in the winter, when demand is greatest, but rises in the summer when heating is not normally required.

7.4.5. The British Geological society's heat pump screening tool indicates that the site is suitable for an open loop heat pump with an aquifer less than 50m below ground level. However, both open-loop and closed-loop heat pumps are a less adaptable solution and requiring more maintenance. While they may be suitable for certain locations this cannot be confirmed with the level of information available at the moment.

7.4.6. On that basis air source heat pumps are proposed for the development due to their flexibility in installation and servicing.

7.5 SOLAR THERMAL

7.5.1. Solar thermal generation involves capturing solar radiant heat to preheat or heat domestic hot water.

7.5.2. Correctly located and orientated, solar thermal systems can meet a proportion of a building's domestic hot water dependent on the expected demand profile and available space for locating collectors. The contribution is usually limited to about 50% of the hot water demand to avoid excessive stagnation of the system.

7.5.3. A solar thermal system can work well alongside a number of different heating solutions including gas boilers or heat pumps, though the majority of the benefit would be during the summer months.

7.5.4. Solar Thermal panels are not suitable for this development due to their limited output capacity.

7.6 PHOTOVOLTAIC PANELS

7.6.1. The feasibility of providing photovoltaic (PV) panels has been assessed based upon estimated energy production (kWh) from the installed location along with manufacturers cost data to enable a life cycle cost analysis to be undertaken. Panels correctly orientated, maintained and not obscured by shading can be expected to provide in the region of 850kWh/kWp in Bletchley.

7.6.2. Therefore, Solar PV panels located on the top roof areas can be used to provide electricity generation which can contribute to the Local Authority targets.

7.6.3. Photovoltaic panels are suitable for both residential and commercial buildings. This solution would be a viable substitute of the ASHP technology if the development would include gas boilers instead.

7.7 SUITABILITY APPRAISAL

7.7.1. All renewable energy technologies which may be considered feasible for the scheme have been assessed and summarised in Table 13.

Table 14 - Renewable technology suitability appraisal

Technology		Appraisal
Wind		Not suitable at this site.
Biomass		Not suitable at this site.
Heat Pumps	Air Source	Potentially suitable at this site and recommended for inclusion.
	Ground Source	Not suitable at this site.
	Water Source	Not suitable at this site.
Solar Thermal		Potentially suitable for some locations at this site.
Photovoltaic Panels		Potentially suitable at this site and recommended for inclusion.

7.8 CO_2 EMISSIONS REDUCTION

7.8.1. All renewable energy technologies which may be considered feasible for the scheme have been assessed, the outcomes of which are summarised above. From that exercise, it was concluded that air source heat pumps should be the primary renewable technology. The rationale behind this approach is because heat pumps will provide increased carbon savings as the grid decarbonises. Any change in SAP which is likely to come into force prior to the detailed application would result in increased carbon savings from heat pumps than at this stage. Conversely the benefit from photovoltaics will likely reduce as the carbon emissions associated with the electricity being offset will also fall.

7.8.2. This strategy would therefore provide a degree of robustness and a conservative approach considering potential long-term changes in Building Regulations.

7.8.3. The incorporation of air source heat pumps would result in 17.1% of regulated carbon emissions being offset, exceeding the 10% renewables target set by ADVC. Alternatively, the target could also be met with the use of circa 900kWp of photovoltaics (note the quantum of PV required may increase once the changes in SAP come into effect).

Table 15 - Be Green: Annual carbon emissions utilising heat pumps and photovoltaics

	Regulated Emissions (T CO_2)	Unregulated Emissions (T CO_2)	% Reduction in Regulated CO_2 Emissions
Building Regulations Part L 2013 Compliant Development	4,383.1	3,476.2	0.0%
After energy demand reduction	4,229.3	3,476.2	3.5%
After energy efficient supply	4,229.3	3,476.2	3.5%
After renewable energy	3,618.8	3,476.2	17.4%

8 RESULTS

8.1.1. The three principal steps taken; Be Lean (Use Less Energy), Be Clean (Supply Energy Efficiently) and finally Be Green (Renewable Technology measures) are summarised below. The target for the site is to achieve Building Regulations compliance (4,241.8 tCO_2 per annum), whilst providing on-site renewable energy generation that contributes to at least a 10% reduction in the residual carbon emissions.

8.2 ENERGY CONSERVATION AND ENERGY EFFICIENCY (BE LEAN)

8.2.1. Through the application of the measures identified in Section 5 the regulated carbon emissions are shown to be **4,229 tCO_2** per annum.

8.3 SUPPLY ENERGY EFFICIENTLY (BE CLEAN)

8.3.1. The application of low carbon technologies has been explored; both the application of a district heating network and use of a CHP unit are not found to viable. Following on from this stage the regulated carbon emissions are unchanged at **4,197 tCO_2** per annum.

8.4 RENEWABLE TECHNOLOGY (BE GREEN)

8.4.1. The feasibility of a range of renewable technologies has been assessed in the context of the local planning policy target. An air source heat pump system has been proposed resulting in a reduction in regulation CO2 emissions of **611 tCO_2** per annum.

8.4.2. Overall this produces a reduction in regulated carbon emissions to **3,619 tCO_2** per annum. Using the Be Lean, Be Clean and Be Green framework, regulated CO2 emissions have been shown to be reduced by **17.4%** against Part L 2013 (13.9% from the use of renewables), exceeding the local planning policy target.

8.5 PART L 2013 FABRIC ENERGY EFFICIENCY (FEE)

8.5.1. Accredited Design SAP2012 software was used to determine the FEE standards for a sample of typical apartments. These results show that the proposed fabric energy efficiency for all the modelled typical units exceed the target values.

8.6 CONCLUSION

8.6.1. Whilst the exact design and specification is still under development, it can be seen that the local planning policy requirements (Submission Draft VALP) can be met by a combination of efficiency measures (fabric first approach), decentralised energy and renewable technologies.

Figure 5 - Summary of the estimated carbon emissions reductions for the whole development

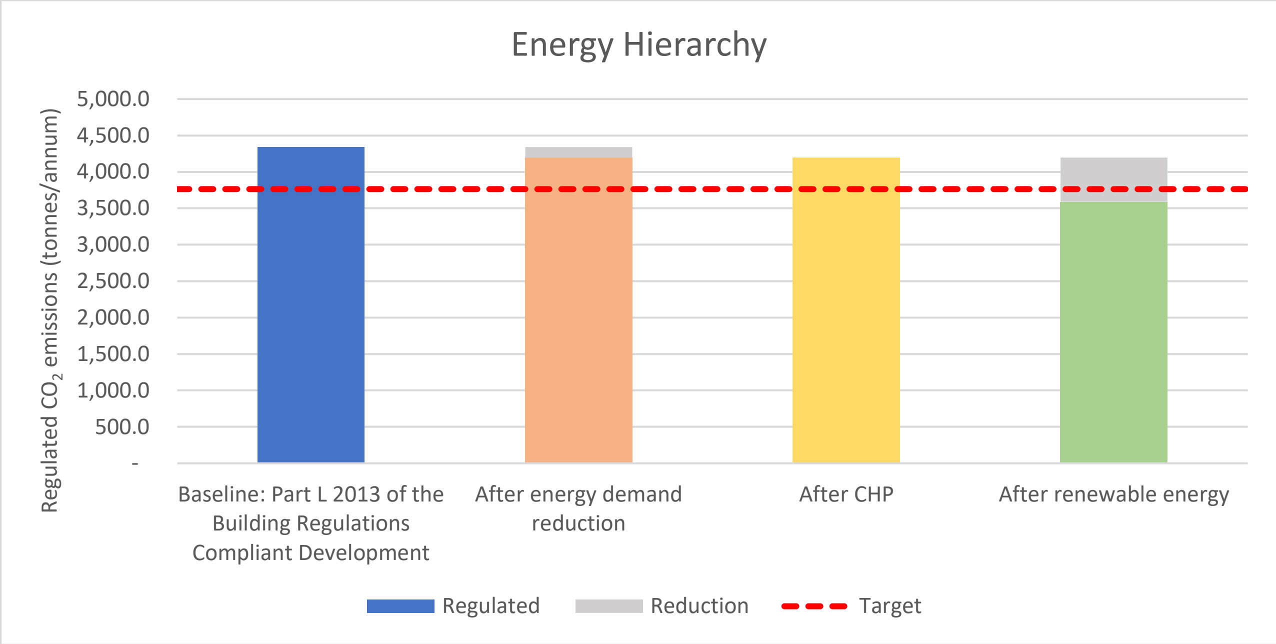


Table 16 - Regulated carbon dioxide savings from each stage of the energy hierarchy

	Regulated carbon dioxide emissions savings (T CO_2 per annum)	Regulated carbon dioxide emissions savings (%)
Savings from energy demand reduction	153.8	3.5%
Savings from energy efficient supply	0.0	0.0%
Savings from renewable energy	610.5	13.9%
Total Cumulative Savings	764.3	17.4%
Total Target Savings – 10% renewables	438.3	10.0%
Savings over Target	172.2	3.9%

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