Plot SGR1, Bicester

Outline Energy Statement

On behalf of **SGR (Bicester 1) Limited**

Project Ref: 41436/3002 | Rev: 1 | Date: March 2018

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1 Introduction

1.1 Background

1.1.1 Peter Brett Associates LLP (PBA) has been appointed by SGR (Bicester 1) Limited (the Applicant) to prepare an Outline Energy Statement in support of an outline planning application (with all matters reserved excluding access) for up to 75 homes, pedestrian and cycle routes, open space and play space (the Proposed Development). The application site, known as 'Plot SGR1, Bicester' (hereafter the Site), is within the North West Bicester Eco Town boundary.

1.1.2 The Site is within the administrative boundary of Cherwell District Council (CDC).

1.2 Purpose of Report

1.2.1 CDC requires applications for major development to be supported by an Energy Statement demonstrating how local planning policies relating to energy use and associated carbon dioxide (CO_2) emissions have been considered. This includes the following policies of the Cherwell Local Plan 2011-2031 (Part 1) (adopted July 2015):

- Policy ESD 1: Mitigating and Adapting to Climate Change;
- Policy ESD 2: Energy Hierarchy and Allowable Solutions;
- Policy ESD 3: Sustainable Construction;
- Policy ESD 4: Decentralised Energy Systems; and
- Policy ESD 5: Renewable Energy.

1.2.2 As the Site is within the Eco Town boundary, it should also seek to comply with the relevant and applicable targets from Policy Bicester 1: North West Bicester Eco-Town and the North West Bicester Supplementary Planning Document (SPD), including 'zero carbon' defined in paragraph **2.4.2**, where viable.

1.2.3 This Outline Energy Statement adopts an integrated approach to low carbon design principles, and considers opportunities for energy efficiency in Site layout, building design and contributions to CO_2 reductions from decentralised and low carbon and/or renewable energy technologies. It is a strategic document, and does not set-out commercially tested options at this stage. The strategy will be refined, with further detail provided, at the reserved matters stage.

1.3 Site Location

1.3.1 The Site area is 5.03 hectares. It is located on land to the west of Home Farm, adjacent to the eastern edge of the Elmbrook site which is currently under construction. The Site is bounded to the north-west and south-west by this site and to the east by the B4100. This is at the north-eastern edge of the wider North West Bicester Eco Town scheme as a whole. Access will be gained to the site from Charlotte Avenue, as part of the Elmsbrook Site.

1.3.2 The North West Bicester Eco Town is located adjacent to the town of Bicester, on the north-west side of the town. North West Bicester is bounded by Howes Lane and the A4095 to the east, the B4030 to the south and the B4100 to the north, and covers approximately 390 hectares.

1.3.3 The extent of the red line application boundary is shown on the plan included in **Appendix A**.

1.4 Proposed Development

1.4.1 The development proposals for the Site are for up to 75 residential units with a single point of vehicular access provided along Charlotte Avenue. New pedestrian and cycle routes will also be provided across the site as part of the development, which will enable sustainable access to the adjacent Elmsbrook development site.

1.4.2 The development proposals for the Site are shown on the masterplan included in **Appendix B**.

1.5 Structure of Report

1.5.1 The structure of the report is as follows:

Section 2 – Policy and Regulation Context: This section presents the relevant local / national regulations and policy;

Section 3 – Energy Demand Management: This section shows how the Proposed Development will adopt a “fabric-first” approach to reduce energy demands and associated CO_2 emissions, whilst seeking to adapt to the predicted effects of climate change;

Section 4 – Energy Demand Assessment: This section provides a preliminary assessment of predicted energy demands and associated CO_2 emissions;

Section 5 – Renewable and Low Carbon Energy: This section provides a preliminary assessment of the feasibility of adopting a district heating / Combined Heat and Power (CHP) approach, and opportunities for building-integrated technologies; and

Section 6 – Conclusions: This section summaries the key findings of the report.

2 Policy and Regulation Context

2.1 Introduction

2.1.1 The national policy and regulation, local planning policy, and guidance relevant to energy use and associated CO_2 emissions at the Proposed Development are summarised in this section.

2.2 National Policy and Regulation

National Planning Policy Framework 2012

2.2.1 The National Planning Policy Framework (NPPF) 2012 supports the role of the local plan process and introduces the "presumption in favour of sustainable development". Paragraphs 93-98 of the NPPF explain that planning plays a key role in helping shape places to secure reductions in greenhouse gas emissions, and in supporting the delivery of renewable and low carbon energy and associated infrastructure. This is central to the economic, social, and environmental dimensions of sustainable development.

2.2.2 Local planning authorities are advised to adopt proactive strategies to mitigate and adapt to climate change, and local planning authorities should:

- When setting any local requirement for a building's sustainability, do so in a way consistent with nationally prescription standards;
- In determining planning applications, local planning authorities should expect new development to take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption; and
- Have a positive strategy to promote energy from renewable and low carbon sources.

2.3 National Building Regulations Part L (Conservation of Fuel and Power)

2.3.1 The energy efficiency requirements of the Building Regulations are set out in Part L of Schedule 1, as well as in several specific building regulations. Approved Document L1A sets out the requirements for conservation of fuel and power in dwellings, whilst Approved Document L2A sets out the requirements for conservation of fuel and power in buildings other than dwellings.

2.3.2 The current edition of L1A 2013[1] came into effect on 6 April 2014. This strengthens the requirements of Part L1A to deliver 6% carbon savings across the new homes build mix relative to Part L 2010 and introduces a Fabric Energy Efficiency (FEE) target to ensure a minimum efficiency for building fabric (the longest-lasting part of a dwelling).

2.3.3 In their Productivity Plan[2], the Treasury confirmed that there would be no change in Part L of the Building Regulations in 2016. It does not intend to proceed with the previously proposed increase in on-site energy efficiency standards, zero carbon homes, or the allowable solutions carbon offsetting scheme.

[1] Conservation of fuel and power: Approved Document L, available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/540326/BR_PDF_AD__L1A__2013_with_2016_amendments.pdf (accessed 05/02/2018).

[2] HM Treasury (July 2015) Fixing the foundations: Creating a more prosperous nation, available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/443897/Productivity_Plan_print.pdf (accessed 05/02/2018)

2.3.4 Therefore, the national energy target for the Proposed Development at the time of the application submission is Part L of the Building Regulations 2013. This is subject to changes in the national Building Regulations.

2.4 Local Planning Policy – Cherwell District Council

The Cherwell Local Plan 2011-2031 (Part 1)

2.4.1 Part 1 of the Cherwell Local Plan 2011-2031 was adopted in July 2015. It sets out broadly how the district will grow and change in the period up to 2031, the long-term spatial vision for the district, and policies to help deliver that vision. The relevant policies are noted below.

Policy Bicester 1: North West Bicester Eco-Town

2.4.2 Policy Bicester 1 states that development within the Eco Town boundary should achieve a 'zero carbon' standard. This is defined in the CDC Local Plan as follows:

"The definition of zero carbon in eco-towns is that over a year the net carbon dioxide emissions from all energy use within the buildings on the eco-town development as a whole are zero or below."

2.4.3 Consultation with CDC[3] has confirmed that this target is applicable to the Site, and relates to both regulated and unregulated energy use. Compliance with this stringent target, however, must be subject to wider development viability testing, and should be negotiated with CDC at the detailed design stage.

2.4.4 Policy Bicester 1 also requires "Code [for Sustainable Homes] Level 5 for dwellings at a minimum". However, following the technical housing standards review, the Government has withdrawn the Code for Sustainable Homes, aside from the management of legacy cases[4]. Therefore, this target can no longer be applied. CDC[5] has confirmed that, whilst the Code would no longer be applied, targets around reducing water use with the aspiration towards water neutrality should be used. This is considered within the Sustainability Statement.

2.4.5 Other applicable provisions in Policy Bicester 1 relating to energy include the following:

- Housing to include "real time energy monitoring systems", with consideration given to digital access to support "smart energy management systems";
- All new buildings should be designed to incorporate "best practice on tackling overheating, taking account of the latest UKCIP [UK Climate Impacts Programme] climate predictions"; and
- Development should also demonstrate "climate change mitigation and adaption measures" in alignment with policies ESD 1 to 5.

Policy ESD 1: Mitigating and Adapting to Climate Change

2.4.6 This policy states that measures will be taken to mitigate the impact of development within the district on climate change. At a strategic level, this includes:

[3] Email from Caroline Ford (Principal Planning Officer – Major Projects Planning Team, CDC) to Michael Dray (PBA) on 09/02/2018.

[4] Planning update March 2015. Available online: https://www.gov.uk/government/speeches/planning-update-march-2015 (accessed 05/02/2018).

[5] Email from Caroline Ford (Principal Planning Officer – Major Projects Planning Team, CDC) to Michael Dray (PBA) on 09/02/2018.

"Designing developments to reduce carbon emissions and use resources more efficiently, including water (see Policy ESD 3 Sustainable Construction)."

and

"Promoting the use of decentralised and renewable or low carbon energy where appropriate (see Policies ESD 4 Decentralised Energy Systems and ESD 5 Renewable Energy)."

2.4.7 It also requires new development to incorporate suitable adaption measures to increase resilience to climate change impacts, including:

"[Demonstrating that] . . . design approaches are resilient to climate change impacts including the use of passive solar design for heating and cooling."

Policy ESD 2: Energy Hierarchy and Allowable Solutions

2.4.8 In seeking to achieve CO_2 emissions reductions, CDC promotes an energy hierarchy in Policy ESD 2 as follows (in order of priority):

"Reducing energy use, in particular by the use of sustainable design and construction measures

Supply energy efficiently and giving priority to decentralised energy supply

Making use of renewable energy

Making use of allowable solutions."

2.4.9 As noted in paragraph **2.3.3**, the Government did not adopt the allowable solutions mechanism. Consultation with CDC[6] has confirmed that they do not have any specific set requirements relating to allowable solutions. Without the legal framework for delivering the above hierarchy, the approach to achieving the policy statement will need to be considered further as the development evolves towards the detailed application stage.

Policy ESD 3: Sustainable Construction

2.4.10 This policy states that:

"All new residential development will be expected to incorporate sustainable design and construction technology to achieve zero carbon development through a combination of fabric energy efficiency, carbon compliance and allowable solutions in line with Government policy."

2.4.11 As noted in paragraph **2.3.3**, the Government has removed the zero carbon homes standard (including carbon compliance) and allowable solutions. However, consultation with CDC[7] has confirmed that the 'zero carbon' standard must be applied to this Site, although the mechanism through which this will be achieved, without a legal structure for allowable solutions as defined in ESD 2, will need further consideration at the detailed design stage. The delivery of 'zero carbon' compliance will be considered in more detail at the reserved matters application stage and subject to normal viability appraisal..

[66] Email from Caroline Ford (Principal Planning Officer – Major Projects Planning Team, CDC) to Michael Dray (PBA) on 09/02/2018.

[7] Email from Caroline Ford (Principal Planning Officer – Major Projects Planning Team, CDC) to Michael Dray (PBA) on 09/02/2018.

2.4.12 Policy ESD 3 also states that all development proposals will be encouraged to reflect high quality design and environmental standards, demonstrating sustainable construction methods including:

"Minimising both energy demands and energy loss

Maximising passive solar lighting and natural ventilation

Incorporating . . . energy efficient materials

Reducing the impact on the external environment and maximise opportunities for cooling and shading (by the provision of open space and water, planting, and green roofs, for example); and

Making use of the embodied energy within buildings wherever possible."

Policy ESD 4: Decentralised Energy Systems

2.4.13 Policy ESD 4 states:

"The use of decentralised energy systems, providing either heating (District Heating (DH)) or heating and power (Combined Heat and Power (CHP)) will be encouraged in all new developments."

2.4.14 It requires a feasibility assessment for district heating / CHP, including consideration of biomass fuelled CHP, for all residential developments for 100 dwellings or more or, in off-gas areas, for 50 dwellings or more. The Proposed Development is for a maximum of 75 dwellings, and is not within an off-gas area, and therefore does not meet these criteria. There is, however, an opportunity to connect to the Elmsbrook energy centre, which CDC has raised in their pre-application guidance (see **2.4.18**). Therefore, district heating and CHP are both considered in **Section 5.2**.

Policy ESD 5: Renewable Energy

2.4.15 Policy ESD 5 states:

"Planning applications involving renewable energy development will be encouraged provided that there is no unacceptable adverse impact, including cumulative impact, on the following issues, which are considered to be of particular local significance in Cherwell:

- *Landscape and biodiversity including designations, protected habitats and species, and Conservation Target Areas*
- *Visual impacts on local landscapes*
- *The historic environment including designated and non designated [sic] assets and their settings*
- *The Green Belt, particularly visual impacts on openness*
- *Aviation activities*
- *Highways and access issues, and*
- *Residential amenity."*

2.4.16 It also requires a feasibility assessment of the potential for significant on site renewable energy provision for all residential developments for 100 dwellings or more or, in off-gas areas, for 50 dwellings or more. Though the Proposed Development does not meet these criteria, opportunities for incorporating renewable and low carbon technologies at the Proposed Development are considered in **Section 5.3**.

North West Bicester SPD (February 2016)

2.4.17 This SPD expands upon Policy Bicester 1 of the adopted Cherwell Local Plan 2011-2031 Part 1, and provides further detail on the policy and a means of implementing the strategic allocation at North West Bicester.

Pre-application Guidance

2.4.18 Pre-application guidance from CDC[8] confirms that the 'zero carbon' target is applicable to the Proposed Development, and that a connection to the energy centre and district heating network at Elmsbrook would be viewed positively by the council. It also confirms that the energy strategy should consider factors to mitigate against future climate change scenarios, such as daylight and overheating considerations.

Cherwell Design Guide SPD (Emerging)

2.4.19 CDC is currently preparing a new Cherwell Design Guide SPD. Consultation was undertaken between 23 November and 21 December 2017, with a targeted adoption date of February 2018[9]. Though the SPD is not yet adopted, the energy-related aspects have been considered within this statement.

CDC Local Plan Part 2 – Development Management Policies and Sites

2.4.20 CDC is in the process of preparing part 2 to the Adopted Cherwell Local Plan 2011-2031 (Part 1), which will contain non-strategic site allocations and development management policies. The anticipated adoption date for this document is February 2020 and is therefore not referenced further within this statement.

Sustainable Buildings in Cherwell SPD (Emerging)

2.4.21 The latest Local Development Scheme issued by CDC in November 2017 states that this document is "to be prepared" with a commencement date of August 2018 and a proposed adoption date of June 2019. Based on these timescales, this SPD is not referenced within this statement.

2.5 Summary of Targets

2.5.1 The key targets relating to energy use and associated CO_2 emissions are therefore as follows:

- Part L of the Building Regulations (conservation of fuel and power in new dwellings). This is subject to changes in the national regulations;

[8] Email from Caroline Ford (Principal Planning Officer, CDC) to Helen Rodger (Senior Planner, Quod) dated 17/01/2018 entitled '17/00363/PREAPP Land North and Adjoining Home Farm, Banbury Road, Caversfield'

[9] Cherwell District Council (November 2017) Local Development Scheme, available online: https://www.cherwell.gov.uk/info/33/planning-policy/382/local-development-scheme (accessed 08/02/2017).

- Design development in accordance with the energy hierarchy: reducing energy use, supplying energy efficiently, giving priority to decentralised energy supply, and making use of renewable and low carbon energy where appropriate; and

- Incorporate suitable adaption measures to increase resilience to climate change.

2.5.2 In addition to these standard targets, as the Site is within the Eco Town boundary, CDC requires the Proposed Development to comply with the 'zero carbon' standard. This is defined by CDC as over a year the net CO_2 emissions from all energy use (regulated and unregulated) within the buildings should be zero or below.

2.5.3 There are a number of approaches to delivering such standards, which will emerge through the detailed design of the project. These will need to be tested and agreed with CDC in lieu of agreed approaches in the wider Eco Town policy area.

2.5.4 The following sections present an outline strategy that considers these targets, which includes a number of technology options to delivering approaches to 'zero carbon development'. Based on this range of options, the approach to delivering energy and CO_2 emission reductions at the Site will be defined in the reserved matters planning application.

3 Energy Demand Management

3.1 Introduction

3.1.1 In line with Policies ESD 1 to 3, this section demonstrates how the Proposed Development will seek to reduce energy demands and associated CO_2 emissions using sustainable design and construction measures. Development should also demonstrate measures to adapt to climate change, including tackling overheating.

3.1.2 The ambition for the Proposed Development is to adopt a “fabric-first” approach to building design (enhancing the performance of components and materials that make up a building fabric itself, before considering the use of mechanical or electrical building services systems). This approach can help reduce capital and operational costs, improve energy efficiency, reduce CO_2 emissions, and reduce the need for maintenance during a building’s lifetime.

3.2 Energy Hierarchy

3.2.1 The Proposed Development will adopt the nationally and locally (policy ESD 2) recognised energy hierarchy of reducing energy demands in the first instance, using energy efficiently and, only then, providing renewable and low carbon energy generation on site where it is appropriate to do so. The energy hierarchy for new development is illustrated in **Figure 3.1**.

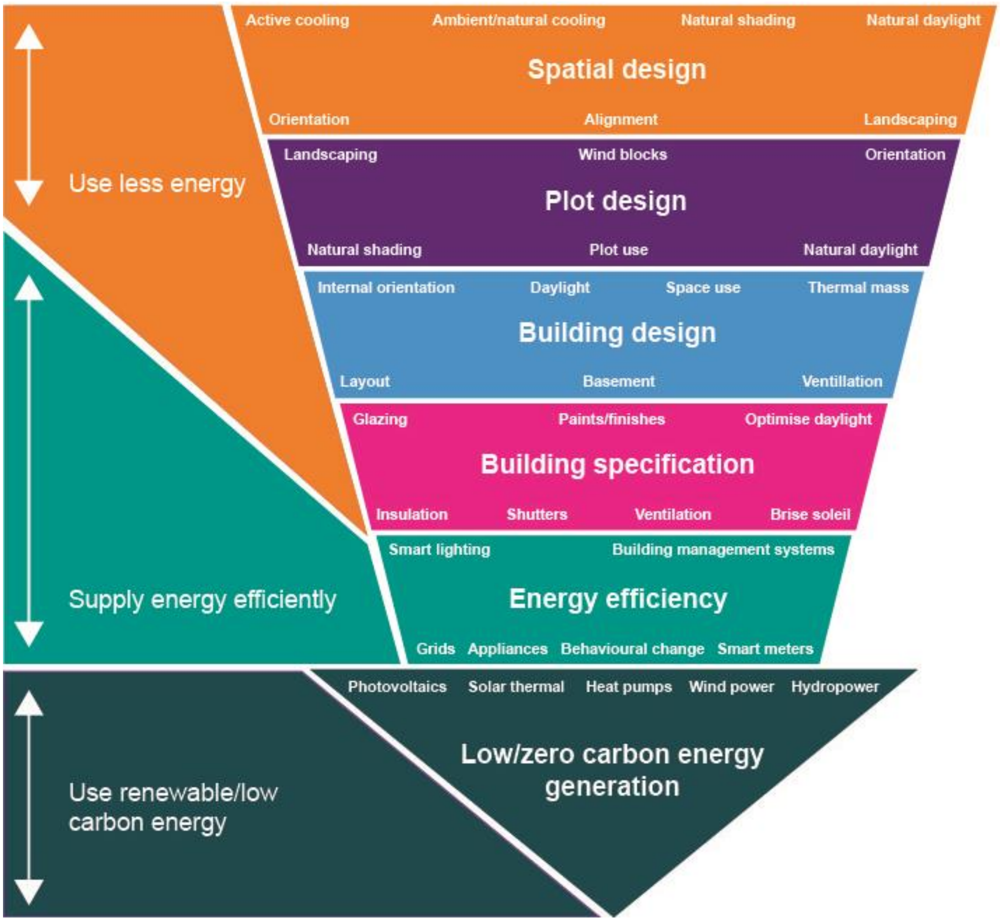

Figure 3.1: The Energy Hierarchy for New Development

3.2.2 To meet the first principles of the hierarchy (i.e. passive demand reduction), it is important to consider passive design principles through spatial planning, green infrastructure provision and development context. These items do not contribute to CO_2 reduction calculations under Part L of the Building Regulations, but can be significant in reducing the energy demands of a building.

3.3 Masterplan Design Principles to Reduce Energy Demands

3.3.1 This section presents the principles that have been considered within the proposed masterplan, and will continue to be considered as detailed design progresses following outline consent, to passively reduce energy demands. **Figure 3.2** illustrates potential masterplan design principles to reduce energy demands.

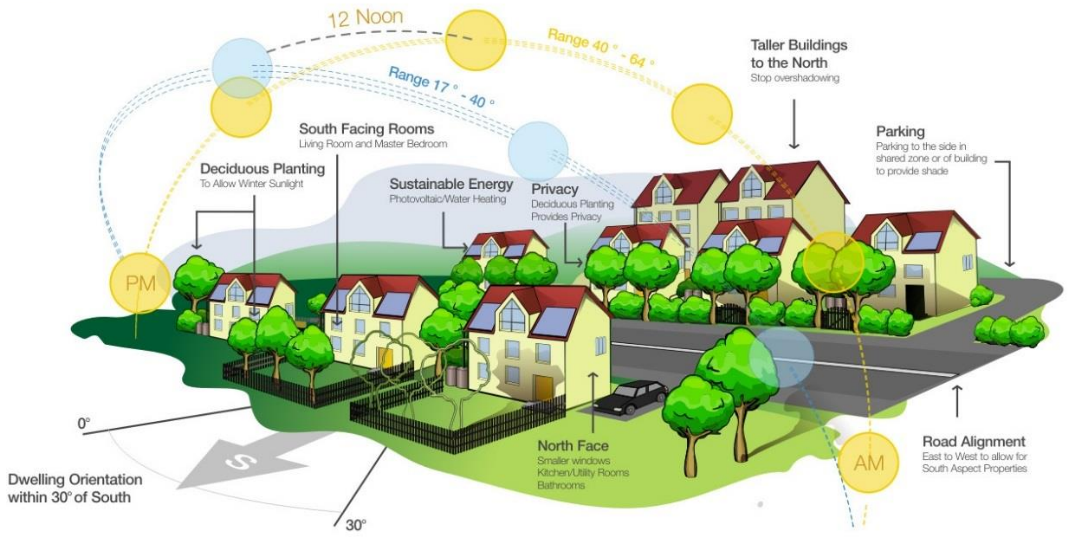

Figure 3.2: Masterplan Design Principles to Reduce Energy Demands

3.3.2 The Proposed Development is set within the comprehensive green infrastructure network of the wider North West Eco Town development. The eastern side of the Site is preserved as an open space buffer, whilst adjacent to Banbury Road community orchard / allotment space is provided. The dwellings themselves are anticipated to be relatively low density (circa 35 dwellings per hectare), interspersed with pockets of green open space and large back gardens. Green open spaces, such as these, provide evaporative cooling at night, helping to reduce the heat island effect[10].

3.3.3 The high permeability of green spaces throughout the development, as well as careful selection of plot layout and building location at the detailed design stage, will help to facilitate air movement and enhance natural ventilation, thereby reducing the risk of overheating in dwellings. Care will be taken to avoid wind tunnel effects.

3.3.4 The main residential avenue is aligned west-to-east through the Site. This will allow some of the buildings bordering the avenue (expected to be up to 2.5 to 3 storeys) to have south-facing aspects, thereby increasing opportunities for natural daylighting, passive solar gains and roof-mounted renewable technologies. Other dwellings are expected are to have a range of orientations to fit wider design considerations.

[10] The term 'heat island' describes built up areas that are hotter than nearby rural areas. This is partly caused by the replacement of natural surface by built surfaces, which absorb a higher proportion of incident radiation, which is then released as heat.

3.3.5 At the reserved matters stage, the landscaping scheme will be carefully designed to encourage passive solar shading. This could include street-scene planting to provide naturally shading areas and corridors (such as along the main carriageway) and, where appropriate, using deciduous planting to allow winter sunlight.

3.3.6 Continued consideration of the spatial layout and plot design in this manner could provide significant CO_2 savings.

3.4 Reducing Energy Demands in Buildings

3.4.1 In accordance with the energy hierarchy, individual buildings should be designed to reduce energy demands, use energy more efficiently and, where possible, adapt to the predicted impacts of climate change. These measures can be split into 'passive' and 'active' measures.

3.4.2 'Passive' measures are design features, which can include building orientation, appropriate internal layouts and building fabric selection, that inherently reduce a building's energy requirements. 'Active' measures are building services design features that will increase the efficiency of the energy used, and therefore also reduce the energy demand requirements.

Passive Measures

3.4.3 The following 'passive' measures will be considered in the detailed design of individual buildings to reduce energy demands:

- Designing the external fabric (walls, floors, and roofs) to have very low U-values[11] to reduce thermal heat loss (i.e. by providing excellent insulation);
- Reducing air permeability and the thermal bridging coefficient[12] of the building envelope to the lowest practical level;
- Incorporating building materials with high (and, where appropriate, exposed) thermal mass[13] to help keep internal temperatures stable;
- Providing larger windows on south-facing aspects, where appropriate in the context of wider design considerations (such as residents' amenity) to allow natural daylighting and passive solar gains;
- Providing smaller windows on north-facing aspects, where appropriate, to reduce excessive heat loss;
- Installing openable windows, preferably on two or more aspects facing opposite each other, to allow the through-flow of air and provide effective cross ventilation in a dwelling when required; and
- Using architectural features that deflect sunlight to reduce excessive heat gain in buildings (i.e. brise soleil).

[11] U values – otherwise known as thermal transmittance values - measure the thermal performance of a building fabric in terms of heat loss. The better-insulated a structure is, the lower the U-value will be.

[12] The thermal bridging coefficient is a collective measure of heat loss that occurs at a break in insulation at abutting elements in a building e.g. walls and ceilings.

[13] Thermal mass is a material's resistance to changes in temperature. Materials with high thermal mass (i.e. those that absorb and retain heat) include concrete slabs and masonry walls.

Active Measures

3.4.4 The following ‘active’ measures will be considered in the mechanical and electrical design of individual buildings:

- Using highly efficient Mechanical Ventilation with Heat Recovery (MVHR) systems in appropriate dwellings;
- Adopting water efficiency measures to reduce the energy demands associated with water heating (including fitting flow restrictors on basin taps, low-flow showers, small capacity baths, and time/thermostat control of hot water);
- Using real time energy monitoring systems, smart energy management systems and heating controls, where appropriate;
- Fitting variable speed drives to appropriate pumps and fans to allow greater control of energy-consuming equipment;
- Installing 100% low energy lighting and using lighting-efficiency systems, such as daylight cut-off and passive-infrared (PIR) controls;
- Selecting highly efficient white goods;
- Complying with Chartered Institution of Building Services Engineers’ (CIBSE) commissioning requirements, with providing training to any facilities managements teams or building operatives; and
- Transferring knowledge to residents through training and/or home user guides to encourage efficient operation of their homes’ energy systems.

3.4.5 A combination of ‘passive’ and ‘active’ measures will result in very well insulated, air tight buildings with appropriate and efficient building services. In accordance with the energy hierarchy, it is important that dwellings are designed to reduce energy demands as far as practical before employing any low carbon or renewable technologies on site.

4 Energy Demand Assessment

4.1 Methodology

4.1.1 The Government-approved methods for assessing CO_2 emissions in order to demonstrate compliance with Part L of the Building Regulations in England are:

- The Standard Assessment Procedure (SAP) for the energy rating of dwellings; and
- The National Calculation Methodology (NCM), implemented through the Simplified Building Energy Model (SBEM) for buildings other than dwellings.

4.1.2 At this early stage in the development process, it is not possible to undertake SAP or SBEM calculations because sufficient detailed design information is not available. Instead, a Predicted Energy Demand (PED) model has been developed using assumed notional building designs (based upon the principles outlined in **Section 3**) and the Proposed Development schedule presented in **Section 1.4**.

4.1.3 The model assumes all units are designed in accordance with Part L of the Building Regulations 2013. However, it may be the case that later phases must meet more stringent Building Regulations as energy legislation evolves over time. Furthermore, it is likely that the dwellings will have lower-than-predicted energy demands, due to high fabric energy efficiency.

4.1.4 The PED model predicts the regulated and unregulated energy demands of the Proposed Development by month-of-year and hour-of-day, as well as the associated CO_2 emissions. The model uses Building Services Research and Information Association (BSRIA) benchmark data and the Building Research Establishment's Domestic Energy Model (BREDEM) in establishing broad demand profiles.

4.1.5 Energy demand is split into regulated and unregulated where:

- Regulated energy is heat or power for hot water, space heating and cooling, lighting and associated pumps and fans (this energy is regulated through Part L of the Building Regulations); and
- Unregulated energy is all other energy uses such as cooking equipment, electrical appliances, and other small power.

4.1.6 The method, limitations and results of the PED assessment are provided in **Appendix C**. The results are summarised in **Section 4.3**.

4.2 Assumptions

4.2.1 As this is an outline planning application, limited detail is available on the type, tenure, and floor areas of the dwellings. Therefore, for the purposes of the PED model, a typical floor area of 92.3 m^2 has been used for each dwelling, which research suggests[14] is the average area of a home in England.

4.3 Results

4.3.1 The PED assessment shows that the annual predicted energy demand of the Proposed Development is approximately 310 MWh of electricity (regulated and unregulated) and 550

[14] Savills (May 2015) *Size matters. How big are our houses?*, available online: http://www.savills.co.uk/research_articles/186866/188035-0 (accessed 07/02/2017).

MWh of heat (space heating and hot water). The total annual carbon emissions associated with the predicted energy demand are approximately 280 tonnes, of which 160 tonnes are associated with regulated use.

4.3.2 Therefore, if the Proposed Development were to achieve the ‘zero carbon’ target (i.e. offsetting 100% of net CO_2 emissions from all energy use, regulated and unregulated), it is estimated at this stage that this would equate to approximately 280 tonnes of CO_2 emissions per annum.

5 Renewable and Low Carbon Energy

5.1 Introduction

5.1.1 CDC promotes the use of decentralised and renewable or low carbon energy, where appropriate, in new development. This section provides a preliminary assessment of the feasibility of adopting a district heating / CHP approach (**Section 5.2**) and opportunities for building-integrated technologies (**Section 5.3**). The final energy strategy adopted will be subject to further detailed assessment, which will be presented in the reserved matters application. For reference, further background information on each technology is presented in **Appendix D**.

5.2 District Heating and CHP

5.2.1 District heating is a means of providing heat to multiple buildings via a district heat network. The energy centre houses the heating plant, which can include a range of technologies and fuels such as gas boilers, biomass boilers, and CHP. Hot water from the energy centre is pumped through a pipe network to the individual buildings. In each building, heat is conveyed via a Hydraulic Interface Unit (HIU) to the central heating system and/or to the hot water taps.

5.2.2 Policy ESD 4 encourages the use of decentralised energy systems, providing either district heating or heating and power (CHP) in all new developments. It requires a feasibility assessment for these technologies for all residential developments of 100 dwellings or more or, in off-gas areas, for 50 dwellings or more.

5.2.3 The Proposed Development is for a maximum of 75 dwellings, and is not within an off-gas area, and therefore does not meet CDC's criteria for undertaking a feasibility assessment and delivering a heat network on the Site.

5.2.4 The Site is approximately 3.5 km away from the Ardley Energy-from-Waste (EfW) plant. It is noted that a previous study has investigated the potential to supply heat from the Ardley EfW, which showed that a connection to the Site would not be economically viable[15]. Therefore, no further consideration of connecting to Ardley is undertaken in this report.

5.2.5 It is noted that CDC encourages a connection to the energy centre and district heating network on the adjacent Elmsbrook site. The energy centre accommodates a CHP unit, and delivers hot water to taps and radiators in each property on the Elmsbrook site via a heat network, to help it achieve its 'zero carbon' status. SSE Heat Networks Limited has operational ownership of the energy centre (including the heat network) and is responsible for its long-term management.

5.2.6 The capacity of the existing heat network to be extended to the Site will need to be considered with SSE. Contact has been made with SSE, and potential opportunities are being explored.

5.3 Building-integrated Technologies

5.3.1 **Table 5.1** presents an overview of building-integrated renewable and low carbon energy technology opportunities at the Site. Those highlighted in green are preferred options for further investigation, those in orange have some potential which should be explored one further detail is available, and those in red are considered to be least appropriate for the Proposed Development.

[15] Fichtner (2014) Ardley EfW Plan CHP Feasibility, report for Viridor. Accessed 31/1/18 Available: http://myeplanning.oxfordshire.gov.uk/swiftlg/MediaTemp/205197-19989.pdf (accessed 22/02/2018)

Figure 5.1: Overview of Building-integrated Renewable and Low Carbon Energy Opportunities

Technology	Technological risk	Energy availability	Potential contribution (kW/MW)	Appropriate?	Comment
Photovoltaic solar panels (PV)	Low	Intermittent	kW	Most suitable	Could be installed on south-facing pitched roofs. Frame-mounted systems could be used on any flat roofs to optimise performance.
Solar water heating (solar thermal)	Low	Intermittent	kW	Most suitable	Could be installed on south-facing roof spaces to supply a portion of the buildings' heating demands.
Air source heat pumps	Low	Baseload	kW	Most suitable	Could be installed on suitable buildings to supply a portion of heating demands. External condensers need careful positioning to avoid visual/noise disturbance (e.g. on rear/side walls of buildings, and away from noise-sensitive uses). Widespread use throughout the Site is only suitable with spare electrical network capacity.

Technology	Technological risk	Energy availability	Potential contribution (kW/MW)	Appropriate?	Comment
Ground source heat pumps	Medium	Baseload	kW	Potential to be explored further	May be opportunities to install small-scale systems with horizontal collector loops in private gardens and localised areas of green open space. Subject to investigation of geological suitability in specific areas and the mechanical and electrical (M&E) design of buildings at detailed design.
Water source heat pumps	Medium	Baseload	kW	Potential to be explored further	Further investigation into potential subterranean water sources required. Subject to obtaining appropriate water extraction and discharge consents.
Wood burning stoves	Low	As required	kW	Limited potential	Certain houses could be adaptable should end-users wish to install wood burning stoves once purchased. The Site is outside all four of CDC's Air Quality Management Areas (AQMAs)[16]. However, feasibility would be subject to further air quality assessment at detailed design.

[16] CDC (no date) Air Quality Management, available online: https://www.cherwell.gov.uk/downloads/download/1069/air-quality-management (accessed 08/02/2018).

Technology	Technological risk	Energy availability	Potential contribution (kW/MW)	Appropriate?	Comment
Hydropower	Low	Baseload	kW	No	Nearby water courses are unlikely to have an appropriate head or flow regime to support a hydropower scheme.
Building-mounted wind energy (micro)	Low	Intermittent	kW	No	Challenges securing long-term reliable performance. Potential structural vibration issues.

5.3.2 There is a selection of building-integrated renewable and low carbon technologies that could be employed at the Site in order to achieve the policy requirements. Based upon the current masterplan, the most suitable technologies are considered to be photovoltaic solar panels (PV), solar water heating systems, and air source heat pumps. Subject to further investigation, there may be potential for small-scale ground / water source heating solutions. Furthermore, certain houses could be adaptable should end-users wish to install wood burning stoves.

5.3.3 These opportunities are based on current planning requirements and Building Regulations. As this is an outline planning application, with limited information available, the energy strategy needs to be flexible and able to respond to further detailed assessment, regulatory and market changes, and technological advances.

5.3.4 These potential technologies should continue to be reviewed as the design progresses, to support compatibility with detailed building designs and the M&E strategy. The reserved matters application will include further detail of the proposed renewable and low carbon energy approach, and the associated CO_2 offset. This will require detailed SAP calculations.

6 Conclusions

6.1.1 SGR (Bicester 1) Limited is submitting an outline planning application (with all matters reserved excluding access) for up to 75 homes, pedestrian and cycle routes, open space (including allotments and orchard) and play space on the Site known as ‘Plot SGR1, Bicester’. The Site is within the North West Bicester Eco Town boundary.

6.1.2 The key targets relating to energy use and associated CO_2 emissions are as follows:

- Part L of the Building Regulations (conservation of fuel and power in new dwellings). This is subject to changes in the national regulations;
- Design development in accordance with the energy hierarchy: reducing energy use, supplying energy efficiently, giving priority to decentralised energy supply, and making use of renewable and low carbon energy where appropriate; and
- Incorporate suitable adaption measures to increase resilience to climate change.

6.1.3 In addition to these standard targets, as the Site is within the Eco Town boundary, CDC requires the Proposed Development to comply with Policy Bicester 1 and the North West Bicester SPD, including their ‘zero carbon’ standard. A preliminary energy demand assessment shows that this would equate to offsetting approximately 280 tonnes of CO_2 per annum.

6.1.4 There are a number of approaches that can be taken to working towards reducing CO_2 emissions, which will have planning and development viability considerations. The approach to working towards these targets will be undertaken in partnership with CDC and the local energy stakeholders such as SSE.

6.1.5 This statement presents an outline strategy that considers these targets through application of the energy hierarchy. A series of design principles have been considered within the masterplan to passively reduce energy demands and increase resilience to climate change (including high permeability of green open spaces to reduce the heat island effect, and road alignment to encourage south-facing building orientations). Furthermore, several ‘active’ and ‘passive’ measures have been identified as feasible to further reduce energy demands and use energy more efficiently within individual buildings. The ambition is to adopt a “fabric-first” approach to building design (enhancing the energy performance of the building fabric itself, before adopting efficient building services).

6.1.6 The strategy has identified a selection of building-integrated renewable and low carbon technologies that could be employed at the Site. The potential technologies at this stage are photovoltaic solar panels (PV), solar water heating systems, and air source heat pumps. Subject to further investigation, there may be potential for small-scale ground / water source heating solutions. Furthermore, certain houses could be adaptable should end-users wish to install wood burning stoves.

6.1.7 Engagement has progressed with SSE in looking at the opportunities to connect to the Elmsbrook district heating scheme.

6.1.8 The final technology selection will be presented at the reserved matters stage.

Appendix A Red Line Boundary Plan

Rev	Description	Date

Notes:
This drawing is for information purposes only. It should not be relied upon for legal nor title purposes. Do NOT scale from this drawing or use in construction. Proper advice should be sought from relevant qualified entities regarding legal and construction issues. Any discrepancies should be immediately reported to the originator of the drawing.

Client:
SGR (Bicester 1) Limited

Caversfield, Bicester

Site Boundary

Scale@A2: **1:1,000** Drawn: **EW** Designed: **SH** Approved: **KC/SH**

0 45 Meters

Drawing Number: **RPC001-001** Revision: **A** Date: **07/03/2018**

50 North Thirteenth Street, Central Milton Keynes, MK9 3BP
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David Lock Associates
Town Planning and Urban Design

Appendix B Masterplan

Rev. A	Added Play Area	05.03.2018

Client:

SGR (Bicester 1) Limited

Caversfield, Bicester

Illustrative Master Plan

Scale@A3:	Drawn:	Designed:	Approved:
1:1,250	**MG**	**RM**	**SH**

0m 50m

Drawing Number:	Revision:	Date:
RPC001-016	**A**	**27.02.18**

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Town Planning and Urban Design

Appendix C Predicted Energy Demand Model

Project Name:	Plot SGR1, Bicester
Project Number:	41436-3001
Consultant:	MD

Masterplan Energy Model: Data Report

This data report provides a summary of the masterplan energy model and its results. These results are provided in line with the recommendations presented in the main body of the report and the limitations provided below.

Key Performance Indicators and Assumptions

Commercial and Industrial Use Class

Data References

Energy Efficiency in Buildings CIBSE Guide F 2004
BSRIA Rules of Thumb Fourth Edition 2003
Peter Brett Associates Industry Experience 2017
BCO Guide to Specification 2009

Methodology

The benchmark data from the above references have been adjusted to reflect a 44% reduction in carbon emissions over the 2002 Building Regulations, in order to represent Building Regulations 2010. The majority of this 44% reduction has been achieved through applying a standard reduction in regulated electricity demand of 55% and a 25% reduction in hot water demand (although this reduction changes slightly depending on use class). The remaining carbon emission reductions required in order to meet the 2013 Building Regulations were then achieved through space heating reductions.

Additional carbon emission reductions required to meet standards for Building Regulations 2013 have been established through PBA's knowledge of M&E and Structural Engineering and guidance presented by the BCO.

Unregulated energy demand has not been adjusted to reflect changes in demand use since 2002. Our assumption is that whilst appliances contributing to the unregulated demand continue to have improved efficiencies and lower energy requirements, more appliances and technologies are being bought and used, hence displacing the carbon emission savings achieved.

Each commercial use class has been subdivided into a use typology to provide a range of different use scenarios. High street and local centres have taken data from a range of end uses to provide an average energy demand for the use class.

Domestic Use Classes

Data References

The Government's Standard Assessment Procedure for Energy Rating of Dwellings 2009 edition with correction, May 2010
Energy Savings Trust Information : "Energy Efficiency and the Code for Sustainable Homes" - Level 3, Level 4 and Level 6 2009
BSRIA Rules of Thumb Fourth Edition 2003
Energy Efficiency in Buildings CIBSE Guide F 2004
BRE Domestic Energy Model (BREDEM 8 &12)
Zero Carbon Hub establishing a fabric energy efficiency standard 2012

Methodology

The baseline regulated energy demands for domestic use classes were primarily calculated using the methodology as set out in The Government's Standard Assessment Procedure (SAP). The baseline unregulated energy demand however was calculated using the methodology set out in the Code for Sustainable Homes. These methodologies enabled a 2013 baseline to be calculated for domestic units directly.

In order to calculate the predicted energy demand for 2013 and PassivHaus the percentage reduction in space heating, hot water heating and electricity that could be achieved was estimated using information set out in the Zero Carbon Hubs "Fabric Energy Efficiency Standard for Zero Carbon Homes". The information in this document enabled sample SAP calculations to be carried out on Flats, Terrace, Semi Detached and Detached Houses and thus the percentage savings in electricity, space heating and hot water heating that could be achieved through base build alone were found.

The unregulated energy demand for residential units was assumed to remain the same as the baseline for the reasons stated above, which follows the BREDEM approach to calculating unregulated supply.

RESULTS: The predicted energy demand

Description	Quantity	Total Area (m2)	Total Predicted Energy Demand (MWh)					Total CO2 Emissions (Tonnes)			
			Hot Water	Space HTG	Reg Elec	Unreg Elec	Total	Gas	Reg. Electric	Unreg. Electric	Total
Residential											
Dwellings	75	6,923	139	412	76	238	865	119	39	123	282
Subtotal	**75**	**6,923**	**139**	**412**	**76**	**238**	**865**	**119**	**39**	**123**	**282**
Non- Residential											
Uses	0	0	0	0	0	0	0	0	0	0	0
Subtotal	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
GRAND TOTAL	**75**	**6,923**	**139**	**412**	**76**	**238**	**865**	**119**	**39**	**123**	**282**

Residential	**kg CO2 / m2 (regulated):**	**22.887**
Non-Residential	**kg CO2 / m2 (regulated):**	**#DIV/0!**

Daily Maximum and Minimum Peak Demands for January and June

	January		June	
	Heat (kW)	Electricity (kW)	Heat (kW)	Electricity (kW)
Max.	353	82	77	45
Min.	19	21	2	11

Energy Efficiency % reduction for Space Heating over 2010 baseline

House Type	2010	2013	PassivHaus
Detached	0%	8%	19%
Semi Detached	0%	8%	19%
Terrace	0%	10%	31%
Flat	0%	10%	31%

Energy Efficiency % reduction for Hot water* over 2010 baseline

House Type	2010	2013	PassivHaus
Detached	0%	0%	3%
Semi Detached	0%	0%	3%
Terrace	0%	0%	3%
Flat	0%	0%	3%

Energy Efficiency % reduction for Electricity over 2010 baseline

House Type	2010	2013	PassivHaus
Detached	0%	0%	5%
Semi Detached	0%	0%	5%
Terrace	0%	0%	5%
Flat	0%	0%	5%

Assumptions and Limitations

1. The masterplan energy model is based on published benchmark data. PBA are not responsible for the benchmark data and its quality of collation or quality assurance.

2. The applications of rules of thumb have been used to adjust benchmark data to represent changes in the Building Regulations. Adjustments have been made through the use of industry guides and PBA's experience in structural engineering and M&E engineering. It is recognised that through adjustments such as these a generic approach to energy demand modelling has been created.

3. The masterplan energy model is a generic model and not building specific. The development of detailed energy infrastructure or plant should not be based on high level assessment figures.

4. The domestic energy demand is aligned to the Office of the Communities and Local Government Standard Assessment Procedure. This masterplan energy model is therefore limited by the assumption, number and calculations presented within the SAP.

5. Domestic energy demand reductions are based on Energy Saving Trust guidance as benchmark reductions. The application of energy demand reductions are therefore limited to the standards set by the Energy Savings Trust.

6. The masterplan energy model is limited by the nature of information that is present at the outline planning stage. In this respect the model is based on the masterplan development schedule broken down as use classes where available. Where use classes are not available assumptions have been made to estimate the typology.

7. Use of the Homes and Community Agency's benchmark data for occupation has been utilised to assess the likely water consumption per person within each dwelling.

8. It has been assumed that 33% of water used within a dwelling will be for hot water. Water reduction targets are taken from the CLG Code for sustainable homes standard.

9. A wide variety of factors will influence the final energy demand of a development. Many of these factors cannot be incorporated within a model without significant conjecture. It is recommended that more detailed energy demand modelling is undertaken for the development once more detailed designs are available. Detailed modelling should use both the SAP and Simplified Building Energy Model.

10. Demand profiles have been normalised to enable them to be representative of the likely total energy demand. As such these profiles provide an indication of the energy profile.

Appendix D Additional Information on Renewable and Low Carbon Energy Technologies

D.1 Photovoltaic Solar Panels

D.1.1 Photovoltaic (PV) solar panels offset grid electricity and therefore provide a CO_2 saving (currently 0.519 kg CO_2/kWh). Payback periods for PV are now commercially attractive due to the Feed-in Tariff (FiT) mechanism and a significantly increased supply base.

D.1.2 PV arrays are connected to the electrical system of a building via inverters. The electricity generated by PV can be used on-site and, when not required, can be exported to the National Grid. This process requires no user intervention.

D.1.3 Sunshine is intermittent and often unreliable in England, which can significantly impact PV performance. PV also only operates in daylight hours, so cannot generate electricity continuously. PV is generally most efficient when it is positioned as south-facing at a pitch of about 30-35° from horizontal, and in areas free from shading.

D.1.4 Use of PV arrays is subject to detailed visual impact appraisal and structural engineering assessments.

D.2 Solar Water Heating (or Solar Thermal)

D.2.1 Solar water heating systems could be used to offset a portion of the hot water demand in both the domestic and non-residential buildings at the Proposed Development. In well-designed buildings, solar water heating can reduce the fuel consumption associated with hot water by 60-70% and the associated CO_2 emissions.

D.2.2 As with PV, solar water heating systems rely on solar energy and therefore the most effective heat production occurs during the daytime and sunny periods, and efficiencies are greatly reduced in winter. Therefore, their output for the 'whole year' is relatively low.

D.2.3 To accommodate solar water heating systems, buildings must be designed to allow space for hot water cylinders and flow/return pipework. As with PV, solar water heating operates most efficiently when installed on south-facing (or almost south-facing) roof space.

D.2.4 Use of solar thermal technologies is also subject to detailed visual impact appraisal and structural engineering assessments.

D.3 Air Source Heat Pumps

D.3.1 Air source heat pumps absorb heat from the outside air, which can then be used to heat radiators, underfloor heating systems, or warm air convectors and hot water in a building. Heat pumps have some impact on the environment as they need electricity to run the fans for air extraction and compressors (typically more than 2 kW).

D.3.2 Air source heat pumps require the installation of external condensers, which are usually mounted on roofs or rear/side walls. They also feature moving parts (an electrically driven fan) and therefore make noise when they operate.

D.3.3 Air source heat pumps are generally installed on individual homes, apartment blocks or commercial buildings. The use of numerous air source heat pump systems would have an impact on electrical loads and grid reinforcements.

D.4 Ground Source Heat Pumps

D.4.1 Ground source heat pumps draw heat energy from the ground, concentrate it and then release it into a property. Some heat pumps can reverse this process in the summer, thereby providing cooling in buildings.

D.4.2 Ground source heat pumps can be either 'open loop' or 'closed loop'. Closed loop systems are typical in the UK and consist of laying a series of coiled pipes in shallow trenches (horizontal collector loops) – which requires considerable land area - or down boreholes (vertical collector loops). In open loop systems, groundwater is abstracted at ambient temperature from the ground, passed through a heat pump before being reinjected back into the ground or discharged at the surface. Open loop systems have the advantage of limited underground infrastructure, but require an environmental permit to extract and discharge water.

D.4.3 For systems to operate effectively, buildings must achieve a high standard of fabric energy efficiency and, where appropriate, an underfloor heating system (wet system) could be incorporated to optimise system performance.

D.4.4 The efficiency and cost-effectiveness of a ground source heat pump system is affected by underlying ground conditions and the thermal conductivity of the geology.

D.5 Water Source Heat Pumps

D.5.1 Water source heat pumps work on a similar principle to ground source heat pumps. Instead of taking advantage of the heat in the ground, they take advantage of the relatively consistent temperatures found in a body of water.

D.5.2 A series of flexible pipework is submerged in a body of water, like a lake, river, or stream. A heat pump pushes working fluid through the network of piping, and this fluid absorbs the heat from the surrounding water as it goes.

D.5.3 This working fluid is then compressed by an electric compressor, in a similar fashion to the other types of heat pump, which raises the temperature. A heat exchanger can then be used to remove the heat entirely from this working fluid, providing a building with hot water that can be used for space heating (in radiators or under floor heating). It can also be plumbed into a building's hot water system, where a boiler can just provide the small amount of additional heat needed to bring it up to the required temperature, so it can be used for showers and baths.

D.5.4 Once the heat has been removed from the working fluid via the heat exchanger, it is once again pumped back through the pipework, thereby completing a continuous cycle.

D.5.5 An environmental permit is required to extract and discharge water.

D.6 Biomass

D.6.1 Biomass can be used as a fuel source for heat, power and Combined Heat and Power (CHP) applications. Energy is typically derived from burning biomass in biomass boilers. Other potential technologies include gasification and pyrolysis, but these are yet to be commercially proven.

D.6.2 Biomass plants can be scaled to meet the needs of the development and to reflect the availability of biomass in the area. Large biomass plants can be used to supply heat (and power) to multiple buildings via a heat network. Smaller systems can be used to heat a single building (e.g. wood-burning stoves).

D.6.3 The lifecycle costs of biomass systems are typically greater than tradition fossil fuel heating systems. However, incentive schemes such as the Renewable Heat Incentive (RHI) can reduce the costs and provide financial returns.

D.6.4 The use of biomass technologies is subject to the availability of long-term contracts to support security of supply and sufficient generation for the site. In addition, biomass is a bulky product that requires additional space for infrastructure (including storage and delivery space).

D.7 Hydropower

D.7.1 Hydropower is a form of renewable energy that uses the water stored, for example in dams as well as flowing in rivers, to create electricity in hydropower plants.

D.8 Wind Energy

D.8.1 Wind is a well-established energy source. The expertise and skills to undertake a range of wind turbine installations is extensive and the good supply base for wind energy means there is strong market competition. With this experience and knowledge behind wind energy generation, the financial risks are relatively low. A detailed assessment of the on-site wind regime would be needed before committing to a wind power strategy.

D.8.2 Building-mounted turbines (kW-scale) are yet to be proven commercially viable, due to a combination of challenges securing long-term reliable performance and structural vibration issues.

D.9 District Energy

D.9.1 Heating and / or cooling can be provided to multiple buildings from a central energy centre via a district heating and / or cooling network. The energy centre can use a variety of fuels and this therefore enables the use of low and zero carbon energy sources. The role of district heating and cooling as a means of achieving carbon reduction targets for land development projects is increasingly being considered in the UK.

D.9.2 There are three basic elements in a district heating system:

- Production – An energy centre containing the heat sources;
- Delivery – A Hydraulic Interface Unit (HIU) for each end-user; and
- Distribution – An insulated pipe network connecting the energy centre with the end-users' HIUs.

D.9.3 The energy centre houses the heating plant, which can include a range of technologies and fuels such as gas boilers, biomass boilers and CHP. Hot water from the energy centre is pumped through the pipe network to the individual buildings. In each building, heat is conveyed via the HIU to the central heating system and to the hot water taps. Sometimes an Energy Services Company (ESCo) is established to manage the distribution and sale of heat.

D.9.4 When considering a district heating approach, it is important to consider the balance between building energy-efficient buildings (with a very low heat demand), and establishing a utility that is dependent on selling high volumes of heat in order to be viable.

D.9.5 District heating is most resource-efficient in developments with high baseload heat demands. Typically, this means residential developments of very high densities or other heat-intensive uses such as industrial manufacturing, hospital or swimming pools. Modern, energy-efficient and low density developments built to Part L 2013 standards usually have a very limited heat demands.

D.9.6 Heat losses from distribution pipes are also an important environmental consideration (heat losses tend to be higher in low density developments with longer heat main runs).

D.9.7 Establishing a district heating network requires major capital investment, but the costs vary considerably depending on the project. A major driver of the high costs of district heating is the network of hot pipes – this is quoted as up to £510 per metre[17]. This is another reason why district heating is best suited to high density developments with shorter heat main runs.

D.9.8 Heat network viability is established through the relationship of capital infrastructure costs and returns from heat sales (including standing charges and a price per kWh of heat). District heat networks are not regulated by the Office of Gas and Electricity Markets (OFGEM). Therefore, there is a risk of end-users experiencing higher prices compared to a standard gas boiler approach, in order for the developer to recover the high capital costs of installation. However, it is the intention of the emerging Heat Trust to establish a framework to protect consumers connected to heat networks.

[17] DECC (2015) Assessment of the costs, performance, and characteristics of UK heat networks.