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PT18/6450/O Land West of Park Farm, Thornbury

Energy Statement

On behalf of **Barwood Development Securities Ltd & North West Thornbury Landowner Consortium**

Project Ref: 39209/3014 | V5.0 | Date: January 2020

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Revision	Date	Description	Prepared	Reviewed	Approved
V1.0	06/5/18	Draft for comment	EB	DU/JH	JR
V2.0	28/8/18	Following design team comment	DU	JH	JR
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V4.0	18/12/19	Redraft- updated development quantum	RC	JH	NT
V5.0	22/01/2020	Redraft following comments	RC	JH	NT

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1 Introduction

1.1 Report Alterations

1.1.1 **<u>This report has been updated with respect to the following:</u>**

1. **<u>Updates to the quantum of development at Land West of Park Farm, Thornbury.</u>**
2. **<u>Updated reference to the UK Government climate change targets.</u>**
3. **<u>Updated references to the National Planning Policy Framework (NPPF).</u>**
4. **<u>Updated reference to the Emerging National Building Regulations Part L (Conservation of Fuel and Power).</u>**
5. **<u>Updated status of the West of England Joint Spatial Plan.</u>**
6. **<u>Updated reference to Emerging South Gloucestershire Local Plan (SGLP).</u>**
7. **<u>Revision of the Predicted Energy Demand (PED) Model in relation to reduction in number of dwellings and inclusion of land for a primary school.</u>**

1.1.2 **<u>All amendments are highlighted in bold and underlined.</u>**

1.2 Background

1.2.1 Peter Brett Associates LLP (PBA), now part of Stantec, has been appointed by Barwood Development Securities Ltd & North West Thornbury Landowner Consortium (the 'Developer') to prepare an Energy Statement in support of an outline planning application in relation to the application proposals for Land West of Park Farm, Thornbury, South Gloucestershire (the 'Site').

1.2.2 The application proposals are comprised of up to **<u>595</u>** dwellings, **<u>land for a primary school, a Neighbourhood Hub (up to 700sqm of retail and community uses)</u>** and public open space on approximately 36 ha of land to the north west of Thornbury (the 'Proposed Development'). The Site is within the South Gloucestershire Council (SGC) boundary.

1.3 Site Location and Description

1.3.1 The Site is located to the north west of Thornbury in South Gloucestershire. Thornbury is a small market town with access to the A38, a north-south strategic corridor connecting to Bristol to the south, Gloucester to the north, and beyond.

1.3.2 The Site abuts a housing scheme to the east at Park Farm which will comprise approximately 500 residential dwellings, parts of which are under construction. The Site sits within the low-lying landscape of the Severn Vale, with Oldbury Lane running along its northern edge linking Thornbury and Oldbury-on-Severn. Adjacent to Oldbury Lane is agricultural land and the local business Oak Leaf Nurseries and Plant Centre. Agricultural land lies to the south and west of the Site.

1.3.3 The land is relatively level, lying at approximately **<u>10 m Above Ordnance Datum</u>** (AOD) in the west, and sloping gently eastwards to around **<u>15 m</u>** AOD by the eastern boundary. It is predominantly green field agricultural land is divided by existing trees, hedgerows and woodland copses, which results in the Site having a good degree of visual containment. The Site is crossed by several Public Rights of Way.

1.4 Development Proposals

1.4.1 The application for the Proposed Development is for outline planning permission with all matters except vehicular access reserved, for:

- Developed of up to **595** dwellings (Use Classes C3);
- Up to 700 m^2 for a Community Hub (Use Classes A1, A2, D1);
- **1.3 ha of land for primary education provision and nursery (Use Class D1)**;
- A network of open spaces including parkland, footpaths, allotments, landscaping and areas for informal recreation;
- New roads, a sustainable transport corridor (including a bus link), parking areas, accesses and paths; and
- The installation of services and drainage infrastructure.

1.4.2 The Site masterplan is included in **Appendix A**.

1.5 Method and Report Structure

1.5.1 This Energy Statement has been prepared to address South Gloucestershire Council's (SGC) planning policies that relate to energy.

1.5.2 This Energy Statement is structured as follows:

- **Section 2: Policy and Regulation Context** – presents the relevant national legislation and local policy, and summarises the key targets for the Proposed Development;
- **Section 3: Energy Demand Management** – presents the proposed measures to enhance energy efficiency and reduce energy demand;
- **Section 4: Development Carbon Emissions Assessment** – presents a prediction of Proposed Development energy demands and associated carbon emissions following the implementation of energy demand management measures;
- **Section 5: Targeted Renewable and Low Carbon Energy Generation** – reviews the suitability of various renewable and low carbon energy technologies for targeted use on the Proposed Development; and
- **Section 6**: **Conclusions –** summaries the key findings of the report.

2 Policy and Regulation Context

2.1 Introduction

2.1.1 This section presents and summarises the key energy requirements for the Proposed Development, as defined by national energy policy and SGC's planning policies. This is in relation to energy, CO_2 emissions, sustainability and development design policies where relevant to this Energy Statement.

2.2 National Policy Context – Climate Change

2.2.1 Climate change is recognised as one of the most immediate global environmental challenges. Government legislation now includes numerous provisions designed to minimise climate change and mitigate the anticipated effects.

2.2.2 These provisions include the Net Zero Target, which is a reduction in the emission of greenhouse gases, including CO_2 emissions, by 100% from 1990 levels by 2050[1]. A number of interim targets have also been set and the legislation around this issue is outlined below.

2.2.3 The UK Government's international commitment (transposed into national and local planning policy) has sought to reduce CO_2 emissions associated with new buildings through energy demand reduction and the incorporation of low and zero carbon technologies to deliver electricity and heat. The national and local policy position is summarised in the following sections.

2.3 National Planning Policy Framework

2.3.1 The National Planning Policy Framework (NPPF) **was updated on the 19 February 2019** and supersedes the existing policies within the previous NPPF (March 2012, revised July 2018).

2.3.2 **This supersedes the existing policies within the previous NPPF (March 2012, revised July 2018).** It sets out the Government's planning policies for England and how these should be applied. The NPPF is a material consideration in planning decisions.

2.3.3 In terms of low carbon development, the NPPF[2] states that:

"New development should be planned for in ways that:

a) avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure; and

b) can help to reduce greenhouse gas emissions, such as through its location, orientation and design. Any local requirements for the sustainability of buildings should reflect the Government's policy for national technical standards.

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

[1] Climate Change Act 2008, available online: http://www.legislation.gov.uk/ukpga/2008/27/contents

[2] National Planning Policy Framework 2019, available online: https://www.gov.uk/government/publications/national-planning-policy-framework--2

a) provide a positive strategy for energy from these sources, that maximises the potential for suitable development, while ensuring that adverse impacts are addressed satisfactorily (including cumulative landscape and visual impacts);

b) consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and

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

In determining planning applications, local planning authorities should expect new development to:

a) comply with any development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and

b) take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption."

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

Current

2.4.1 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.

2.4.2 The current edition of L1A 2013[3] 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).

2.4.3 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.

Emerging

2.4.4 <u>A new version of Part L is currently being developed. Following consultation, Westminster has released the first draft of a new Part L for England in 2019 and it is anticipated to be adopted in March 2020. The draft focuses on new and existing buildings and possible trajectory for standards beyond 2020.</u>

[3] Conservation of fuel and power: Approved Document L, available online: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/540326/BR_PDF_AD__L1A__2013_with_2016_amendments.pdf (accessed 09/12/2019).

2.4.5 **Following the Spring Statement from Her Majesty's Treasury, a Future Homes Standard will be coming forward and introduced by 2025.[4] The standard will ensure future-proofing new build homes with low carbon heating and world-leading levels of energy efficiency. The standard will build on the Prime Minister's Industrial Strategy Grand Challenge mission to at least halve the energy use of new buildings by 2030.**

2.5 Local Planning Policy

2.5.1 This section sets out the local planning policy context for the Site in relation to SGC policies.

Core Strategy 2006-2027 (adopted December 2013)

2.5.2 The Core Strategy is the key planning policy document for South Gloucestershire, setting out the general location of development, its type and scale, as well as protecting what is valued about the area. The Core Strategy also discusses the Strategy for Development in Thornbury, confirming it is a sustainable location for growth. **Policy CS5** (Location of Development) highlights that new development at Thornbury will be of a scale appropriate to revitalise the town centre and strengthen community services and facilities.

Policy CS1 – High Quality Design

2.5.3 **Policy CS1** states that development will only be permitted where the highest possible standards of design and site planning are achieved. As such, development proposal are required to demonstrate that:

- The design, orientation and location of buildings, roof pitches, windows, habitable rooms, lighting and soft landscaping help to achieved energy conservation;
- Protection of environmental resources and assist the appropriate sitting of renewable and/or low carbon energy installations and infrastructure;
- The scheme will meet the building regulations at the current time of applications; and
- Until the 'zero carbon' building regulations are implemented major residential (10 or more dwellings) and mixed use schemes will be encouraged to achieve full compliance with each code level (currently level 3) or above, and/or BREEAM 'very good' or other equivalent standard.

2.5.4 On the final point, the Government removed the requirement Code for Sustainable Homes in new schemes in 2015 and therefore this target does not apply for the Proposed Development.[5]

Policy CS3 - Renewable and Low Carbon Energy Generation

2.5.5 **Policy CS3** highlights that proposals for the generation of energy from renewable or low carbon sources, provided that the installation would not cause significant demonstrable harm to residential amenity, individually or cumulatively, will be supported. The Council assess proposals based on the below:

- *The wider environmental benefits associated with increased production of energy from renewable sources;*

[4] Spring Statement 2019, available online; https://www.gov.uk/government/news/spring-statement-2019-what-you-need-to-known (accessed 09/12/2019).

[5] Planning Updated 2015. Available online: https://www.gov.uk/government/speeches/planning-update-march-2015 (accessed 09/12/2019).

- *Proposals that enjoy significant community support and generate an income for community infrastructure purposes by selling heat or electricity to the national grid;*
- *The time limited, non-permanent nature of some type of installations; and*
- *The need for secure and reliable energy generation capacity, job creation opportunities and local economic benefits.*

2.5.6 Further to this, it is highlighted that developments will also be required to meet the objective of **Policy CS1** discussed above.

Policy CS4 - Renewable or Low Carbon District Heat Networks

2.5.7 Through **Policy CS4**, major development proposal (more than 100 dwellings that are wholly or in part greater than 50 dwellings per hectare (dph), or non-residential of more than 10,000 sqm) should, where practical and viable:

- Include renewable or low carbon heating or CHP generation and distribution infrastructure on-site and demonstrate how opportunities to accommodate an energy and or district heating solution have been maximised, taking into account density, mix of uses, layout and phasing; or
- Connect to an existing renewable or low carbon heat distribution network; or
- Provide a heat distribution network as part of the development where there are firm proposals for renewable or low carbon heat generation or CHP and distribution in the locality within a reasonable time frame; or
- Provide evidence that renewable and low carbon sources of heating or CHP have been fully explored and are unfeasible.

2.5.8 The Proposed Development at Land West of Park Farm, Thornbury is neither wholly or in part in excess of 50 dph (approximately 36 dph) and therefore this policy does not apply. This policy will not be considered further as part of this Energy Statement.

Policies, Sites and Places DPD (adopted November 2017)

2.5.9 The Policies Sites and Places Plan (PSP Plan) was adopted on 8 November 2017 and forms part of the South Gloucestershire Development Plan. The PSP Plan contains detailed planning policies to manage new development, allocate and safeguard sites for various types of development.

Policy PSP6 - Onsite Renewable and Low Carbon Energy

2.5.10 All development proposals will:

1. *Be encouraged to minimise end-user energy requirements over and above those required by the current building regulations through energy reduction and efficiency measures, and in respect of residential for sale and speculative commercial development offer micro renewables as an optional extra, and*
2. *Be expected to ensure the design and orientation of roofs will assist the potential siting and efficient operation of solar technology.*

2.5.11 In addition, all major greenfield residential development will be required to reduce CO_2 emissions further by at least 20% via the use of renewable and/or low carbon energy generation sources on or near the Site providing this is practical and viable.

2.5.12 The Council will also take positive account of and support development that provides further energy reduction, efficiency, renewable and low carbon energy measures on or near the Site, where measures comply with other policies of the plan.

Renewables SPD 2014 (adopted November 2014)

2.5.13 The SPD's stated objectives are to:

- *Help secure delivery of renewables targets and technologies in South Gloucestershire;*
- *Provide guidance for Development Management, developers and the general public as to the local authority's expectations when receiving planning applications and the methodologies / criteria by which they should be assessed;* and
- *To encourage local community engagement with proposed renewables projects, and provide guidance for community led projects.*

Local Planning Applications Requirements (revised November 2019)

2.5.14 The Local Planning Application Requirements lists which plans and documents are relevant to types of applications, and includes a section on Energy Statements. This sets out the minimum information that needs to be included in the Sustainable Energy Statement or Design and Access Statement to enable the Council to evaluate compliance with relevant planning policies.

2.5.15 The above guidance has been considered in the preparation of this Energy Statement.

Emerging West of England Emerging Joint Spatial Plan (November 2017)

2.5.16 The four West of England Councils - Bath and North East Somerset, Bristol City, North Somerset, and South Gloucestershire have prepared a Joint Spatial Plan (JSP) for the West of England. The Plan sets out the policies and principles for determining the most appropriate and sustainable locations for future development to meet its housing, employment and transport needs for the next 20 years, to 2036. This plan will sit above and guide each council's own

2.5.17 **The JSP was submitted to the Secretary of State on 13 April 2018 and underwent an examination for its compliance with statutory requirements and on its soundness. On 11 September 2019 the Inspectors found "*very substantial soundness problems*" and "*anticipate that the changes necessary would amount to a virtual re-writing of the plan*". At the time of writing this Energy Statement, the councils have not yet issued their considered response, however it is understood that it is likely that the JSP bill be withdrawn from the examination process and attention instead focused on the preparation of individual Local Plans.**

Emerging South Gloucestershire Local Plan (SGLP)

2.5.18 The new South Gloucestershire Local Plan (SGLP) will be a development plan document (DPD) covering the whole administrative area of South Gloucestershire and the plan period will be 2018-2036. It will review and eventually replace existing local planning documents, including the:

- South Gloucestershire Local Plan: Core Strategy – 2006-2027 (2013)
- South Gloucestershire Local Plan: Policies, Sites and Places Plan

2.5.19 Part of the new Local Plan's purpose will be to allocate sites for strategic development at locations identified in the emerging Joint Spatial Plan (JSP), as well as to allocate new sites for non-strategic development. The Local Plan will also set out the suite of planning policies that will be used to deliver sustainable development in South Gloucestershire.

2.5.20 The SGLP has undergone public consultation, and is due to be adopted in March 2021. Therefore, the current Core Strategy and PSP Plan are still the key planning documents in relation to the Proposed Development.

2.6 Energy Requirements for Land West of Park Farm, Thornbury

2.6.1 Based on the existing local and national policies in place, the key energy target for Land West of Park Farm is to:

- Reduce CO_2 emissions further by at least 20% via the use of renewable and/or low carbon energy generation sources on or near the Site, providing this is practical and viable (**Policy PSP6).**

3 Energy Demand Management

3.1 Introduction

3.1.1 In line with Part L of the Building Regulations, new developments should seek to enhance energy efficiency and reduce energy demand through sustainable design and construction.

3.1.2 **Policy CS1** of SGC's Adopted Core Strategy requires development proposals to demonstrate that the design, orientation and location of buildings, roof pitches, windows, habitable rooms, lighting and soft landscaping help to achieve energy conservation.

3.1.3 This section demonstrates that the Proposed Development will seek to enhance energy efficiency and reduce heating requirements through careful consideration of the masterplan design, high performance fabric and efficient building services.

3.2 Energy Hierarchy

3.2.1 The Proposed Development will adopt the nationally and locally recognised energy hierarchy of reducing energy demands in the first instance, using energy efficiently and, only then, providing renewable and low carbon energy generation technologies where it is appropriate to do so. The Energy Hierarchy is illustrated in **Figure 3.1** below. **Figure 3.2** shows basic masterplan design principles to reduce energy demand.

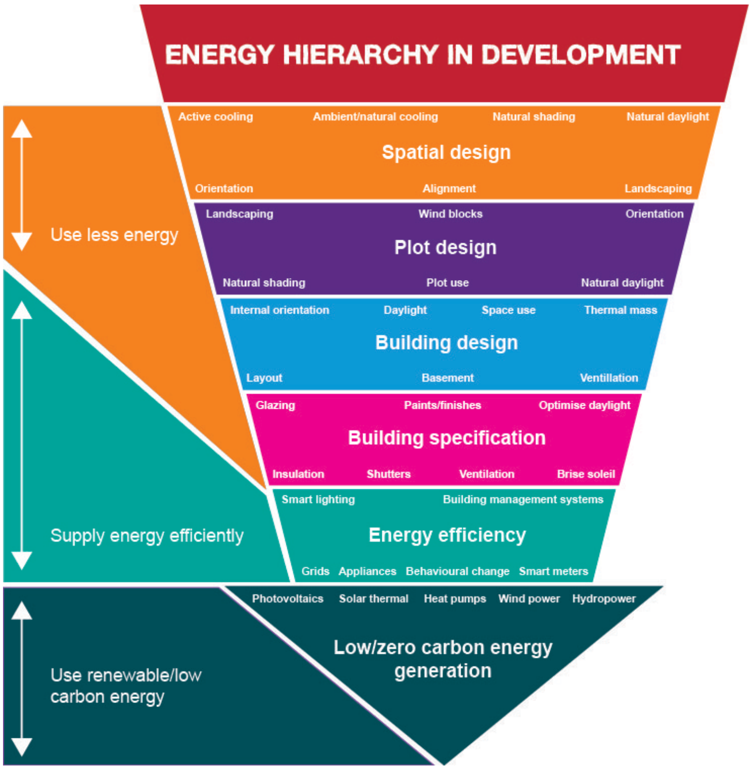


Figure 3.1: Masterplan design principles to reduce energy demand (Energy Hierarchy)

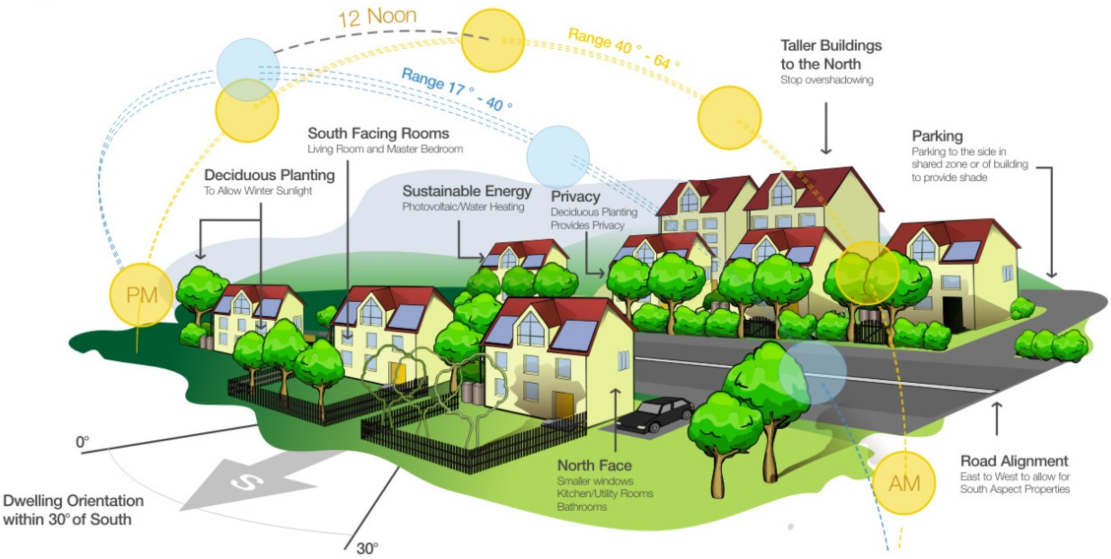


Figure 3.2: Basic masterplan design principles to reduce energy demand

3.2.2 To meet the first principles of the hierarchy (i.e. passive demand reduction) it is important to consider passive design principles within the spatial planning of the masterplan, green infrastructure provision and development context (including the anticipated impacts of climate change). These issues do not contribute to the carbon emissions reduction calculations under Part L of the Building Regulations, but can play an extremely large part in reducing a development's energy demands.

3.2.3 The following sections demonstrates how the Land West of Park Farm development will seek to enhance energy efficiency through the scheme layout, building orientation and building design.

3.3 Masterplan Design Principles to Reduce Energy Demand

3.3.1 The Site is set within the comprehensive green infrastructure network with significant areas of open space as well as retained and proposed woodland and hedgerows, formal playing pitches and children's play areas. The dwellings themselves are anticipated to be of medium density (approximately 36 dwellings per hectare), interspersed with pockets of green open space and gardens.

3.3.2 Green open spaces such as these provide evaporative cooling at night, helping to reduce the heat island effect[6]. The permeability of green spaces throughout the Proposed Development, as well as the selection of plot layout and building location, will help to facilitate air movement and enhance natural ventilation. The retention of existing vegetation and the design around will help provide shading and local cooling of microclimate.

[6] 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.

3.3.3 Where appropriate, the following may be incorporated into the scheme as the design progresses:

- Street-scene tree planting to provide naturally shaded areas and corridors connecting different land parcels; and
- Optimisation of building orientation to take advantage of south-facing aspects for passive solar gains and roof-mounted renewable technologies.

3.3.4 Continued consideration of the spatial layout and plot design in this manner could provide significant CO_2 savings. The above aspects will be defined at Reserved Matters.

3.4 Building Design Principles to Reduce Energy Demands and Use Energy More Efficiently

3.4.1 The Energy Hierarchy requires that measures are adopted in building design to reduce energy demand requirements from the use of buildings. These measures can be split into two categories as '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 the buildings' 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 In order to reduce the energy demand from buildings following passive design measures will be considered in the building design:

- Designing the external fabric (walls, floors and roofs) to have low U-values to reduce thermal heat loss (i.e. by providing high efficiency insulation);
- Reducing the air permeability and thermal bridging coefficient of the building envelope to the lowest practical level;
- Incorporating building materials with high (and, where appropriate, exposed) thermal mass to help keep the internal building 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;
- Locating plant rooms away from southern elevations to avoid excessive heat gain and to encourage higher plant efficiency;
- 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 within a dwelling when required; and
- Using architectural features that deflect sunlight to reduce excess heat gain buildings (e.g. brise soleil and blinds).

Active Measures

3.4.4 The following active design measures will be considered in the mechanical and electrical elements of the 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;
- Using controls to optimise and compensate for heating variations;
- Using zonal heating controls (e.g. through the use of Building Management Systems, BMS, where appropriate);
- Fitting variable speed drives fitted to appropriate pumps and fans to allow greater control of energy-consuming equipment;
- Installing 100% low energy lighting and using lighting-efficiency systems (e.g. daylight cut-off and Passive Infra-Red, PIR, lights);
- Selecting highly efficient white goods;
- Installing energy display devices to promote user behavioural change;
- Complying with Chartered Institution of Building Services Engineers (CIBSE) commissioning requirements, with training provided to any facilities management teams and 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 These and other energy management measures will be explored and detailed for approval at the Reserved Matters stage.

4 Development Carbon Emissions Assessment

4.1 Assessment Methodology

4.1.1 The Government-approved methodologies for assessing CO_2 emissions 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) for buildings other than dwellings.

4.1.2 At this stage in the development process it is not possible to undertake SAP or NCM calculations because sufficient detailed design information is not available.

4.1.3 Instead, a predicted energy demand (PED) model has been developed using the development schedule. The model uses BSRIA benchmark data and the Building Research Establishment's (BRE) Domestic Energy Model (BREDEM) in establish broad demand profiles.

4.1.4 Energy demand is split into regulated and unregulated demand where:

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

4.1.5 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.

4.1.6 The predicted energy demands are based on all buildings being built to Part L 2013 standards and the proposed energy demand management measures presented in **Section 4**.

4.1.7 The methodology and results of PED are provided in full in **Appendix B** and summarised in the sections below. The PED calculations are considered on the basis of the predicted energy demand for the outline planning application.

4.2 Predicted Energy Demand

4.2.1 The demand assessment has been based on the following parameters which are considered as the upper limit of the likely final development.

- <u>**595**</u> residential dwellings;
- <u>**1 Form Entry Primary School (for the purpose of this assessment this is assumed to be 2,311 m^2 of educational floor space. Calculated using Government area guidelines of an average sized primary school nationally (210 pupils))[7];**</u> and
- Community hub (for the purposes of the energy demand assessment this is assumed to include 300m^2 D1, 200m^2 A1, and 200m^2 A2 uses).

[7] Department of Education – Schools, Pupils and their Characteristics (January 2018), reception to Year 6 (7 classes), assuming a class size of 30 (revised up from 27.1 to account for slightly higher class sizes at new primary schools).

4.2.2 The PED shows that the predicted energy demand of the Proposed Development parameters is approximately **2,188** MWh of electricity (regulated and unregulated) and **3,637** MWh of gas (space heating and hot water).

4.2.3 The total annual CO_2 emissions associated with the predicted energy demand are approximately **1,974** tonnes, of which **964** tonnes are associated with regulated use.

4.2.4 **Table 4.1**, sets these estimates in the context of the requirements of PSP Policy 6 as set out in SGC's Energy in Planning Applications Guidance Paper.

Table 4.1 Carbon calculation for proposed residential element of development (in line with Energy Table 1: Expected compliance with PSP Policy 6)

	Factor	kg CO_2/ year
A	Projected annual energy demands for heat and power (Regulated energy):	**851,000**
B	Projected annual energy demands for heat and power (Unregulated energy):	**982,000**
C	Total Projected annual energy demands for heat and power = A+B	**1,834,000**
D	Additional CO_2 reductions anticipated from further energy efficiency measures in the design that exceed compliance with Part L (Building Regulations).	- (see **Section 4.2.5**)
E	Total residual energy consumption = C-D	**1,834,000**
F	CO_2 reduction from renewable energy generation sources included in the design	**367,000**
G	CO_2 reductions from low carbon energy generation sources included in the design	-
H	Total CO_2 reduction from renewables and/or low carbon energy generation (F+G)	**367,000**
I	CO_2 reduction from renewable and / or low carbon energy generation sources expressed as a percentage of the baseline = H/E X 100.	**20%**

4.2.5 The proposed/potential energy efficiency measures which could be included are described in **Section 3**. However none can be assumed at this outline stage as this will be subject to the buildings M&E strategy determined by the Applicants at Reserved Matters for which SAP calculations will be produced. For the purposes of this calculation, it has been assumed, as a worse case, that only Building Regulation Part L compliance is achieved.

4.2.6 Opportunities to incorporate on site low carbon and renewable energy are explored in **Section 5** including a demonstration of how these technologies could be used to achieve 20% carbon reductions.

5 Renewable and Low Carbon Energy Generation

5.1 Introduction

5.1.1 **Policy CS1** of SGC's Adopted Core Strategy requires development proposals to demonstrate that that they have been designed to assist the appropriate siting of renewable and/or low carbon energy installations and infrastructure. **Policy PSP6** requires major developments to reduce CO_2 emissions by at least 20% via the use of renewable and/or low carbon energy generation sources where this is practical and viable. Lastly, **Policy CS3** supports proposals for the generation of energy from renewable or low carbon sources, provided that the installation would not cause significant demonstrable harm to residential amenity, individually or cumulatively.

5.1.2 A review of the suitability of various renewable and low carbon energy technologies has been undertaken in the Full Renewable Energy Feasibility Study, which is presented in **Appendix C**. In summary, the variables affecting suitability include:

- **Environmental constraints**: e.g. suitable geology for group source heat pumps or the presence of protected ecological species that may be affected by the technology;
- **Resource constraints**: e.g. the availability and reliability of local biomass fuel supplies or the local wind resource;
- **Social constraints**: e.g. visual or health impacts of placing combustion-based technologies near housing; and
- **Infrastructure constraints**: e.g. impacts on aviation from wind turbines or the availability of suitable transport infrastructure to import fuel, plant or equipment.

5.2 Summary of Renewable Energy Feasibility Study

5.2.1 A summary of the Renewable Energy Feasibility Study is presented in **Table 5.1** below.

5.2.2 Options highlighted in green are preferred options for further investigation, those in orange have some potential which should be explored once further detail is available, and those in red are considered to be the least appropriate for the Proposed Development at the Site, subject to further consideration required in respect of their feasibility as well as the implications on the viability of the development.

Table 5.1: Renewable Energy Feasibility Study summary

Technology	Technology risk	Energy availability	Appropriate?	Comment
Photovoltaic solar panels (PV)	Low	Intermittent	Potentially 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	Potentially suitable	Could be installed on south-facing roof spaces to supply a portion of the buildings' heating demands.
Air source heat pumps	Low	Baseload	Potentially 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 will increase overall power requirements and so will require consultation with local electrical network provider to confirm capacity to ensure this can be accommodated without additional reinforcements.
Ground source heat pumps	Medium	Baseload	Potential to be explored further	It is understood from the preliminary Geology investigations that the local geology of the site comprises clay/sand deposits across the majority of the Site and as such a borehole solution would appear less viable. There may be opportunities to install small-scale systems with horizontal collector loops in private gardens and localised areas of green open space. Suitability of this technology will be subject to further investigation of geological suitability in specific areas and the mechanical and electrical (M&E) design of buildings at detailed design.
CHP	Medium	Baseload	Potential to be explored further	Potential to use in certain buildings (e.g. school), subject to further detailed building design and AQ assessment.
Water source heat pumps (ground)	Medium	Baseload	No	Unlikely to be practical or viable for the Proposed Development.

Technology	Technology risk	Energy availability	Appropriate?	Comment
Hydropower	High	Baseload	No	The Pickedmore lane rhine watercourse flows along the southern aspect of the Site but is not of sufficient flow/head to support a hydropower scheme.
Water source heat pump (River)	High	Baseload	No	As above the limited flow/volume of water within the Pickedmoor Brook watercourse is unlikely to support a WSHP.
Building-mounted wind energy (micro)	Medium	Intermittent	No	Challenges securing long-term reliable performance. Potential structural vibration issues.

5.2.3 There is a 'suite' of renewable and low carbon technologies that could be employed at the Site in order to attempt to achieve the policy requirements. These could be employed to help meet Part L of the Building Regulations and any future regulatory changes, if needed, as well the **Policy PSP6** target to reduce CO_2 emissions by at least 20% via the use of renewable and/or low carbon energy generation sources.

5.2.4 Based upon the current masterplan, the technologies that have the most potential at this stage in the design process are considered to be photovoltaic solar panels (PV), solar water heating systems, and air source heat pumps.

Potential to achieve 20% carbon reductions through Solar PV

5.2.5 Each of the above technologies have the potential to contribute to the 20% carbon reduction requirement set out in **Policy PSP6**. In order to illustrate this, this section sets out an approach to achieve this through one of the technologies identified as having potential for implementation at the Proposed Development. **This would be subject to further feasibility and costs appraisal as part of the development's viability assessment**.

5.2.6 Based on the carbon calculation presented in **Table 4.1**, 20% of carbon emissions associated with the residential element of the Proposed Development equates to 367 tonnes CO_2 (tCO_2).

5.2.7 1 kWp of solar PV panels is estimated to produce 998 kWh annually[8], which effectively saves 0.5 tCO_2 per annum based on the current Building Regulations Part L grid electric emission factor of 0.519kg CO_2 /kWh.

5.2.8 Therefore, to offset **367 tCO_2** will require around ,**735** kWp of Solar PV panels which equates to approximately a total area of around **5,138 m^2, or around 9 m^2 or 1.3 kWp** per dwelling[9].

5.2.9 The final technology selection and calculations will be presented at Reserved Matters and subject to overall scheme viability.

[8] 1kWp generates 998kWh annually (https://ec.europa.eu/jrc/en/pvgis accessed 12/12/2019)

[9] 1kWp requires approximately 7m^2 of PV panels

Next steps

5.2.10 The potential technologies identified for the Proposed Development 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.

5.2.11 These potential technologies should continue to be reviewed as the design progresses, to support compatibility with detailed building designs and the M&E strategy. Each Reserved Matters application will include further detail of the proposed renewable and low carbon energy approach, and the percentage of energy demands met. This will require detailed SAP and SBEM/DSM[10] calculations.

[10] Standard Assessment Procedure (SAP) for the energy rating of dwellings; Simplified Building Energy Model (SBEM) or Dynamic Simulation Modelling (DSM) for buildings other than dwellings.

6 Conclusions and Next Steps

6.1.1 Barwood Development Securities Ltd & North West Thornbury Landowner Consortium (the Developer) are submitting an outline planning application for the Proposed Development at Land West of Park Farm, Thornbury. The Proposed Development will comprise of up to **595** dwellings (at a density of approximately **36** dph), a primary school and a community hub.

6.1.2 In line with national and local policy, this Energy Statement has applied the energy hierarchy to inform the energy strategy for the Proposed Development. A series of design principles will be considered through the masterplanning process that will target passively reducing energy demands (including high permeability of green open spaces to reduce the heat island effect, and road alignment to encourage south-facing building orientations).

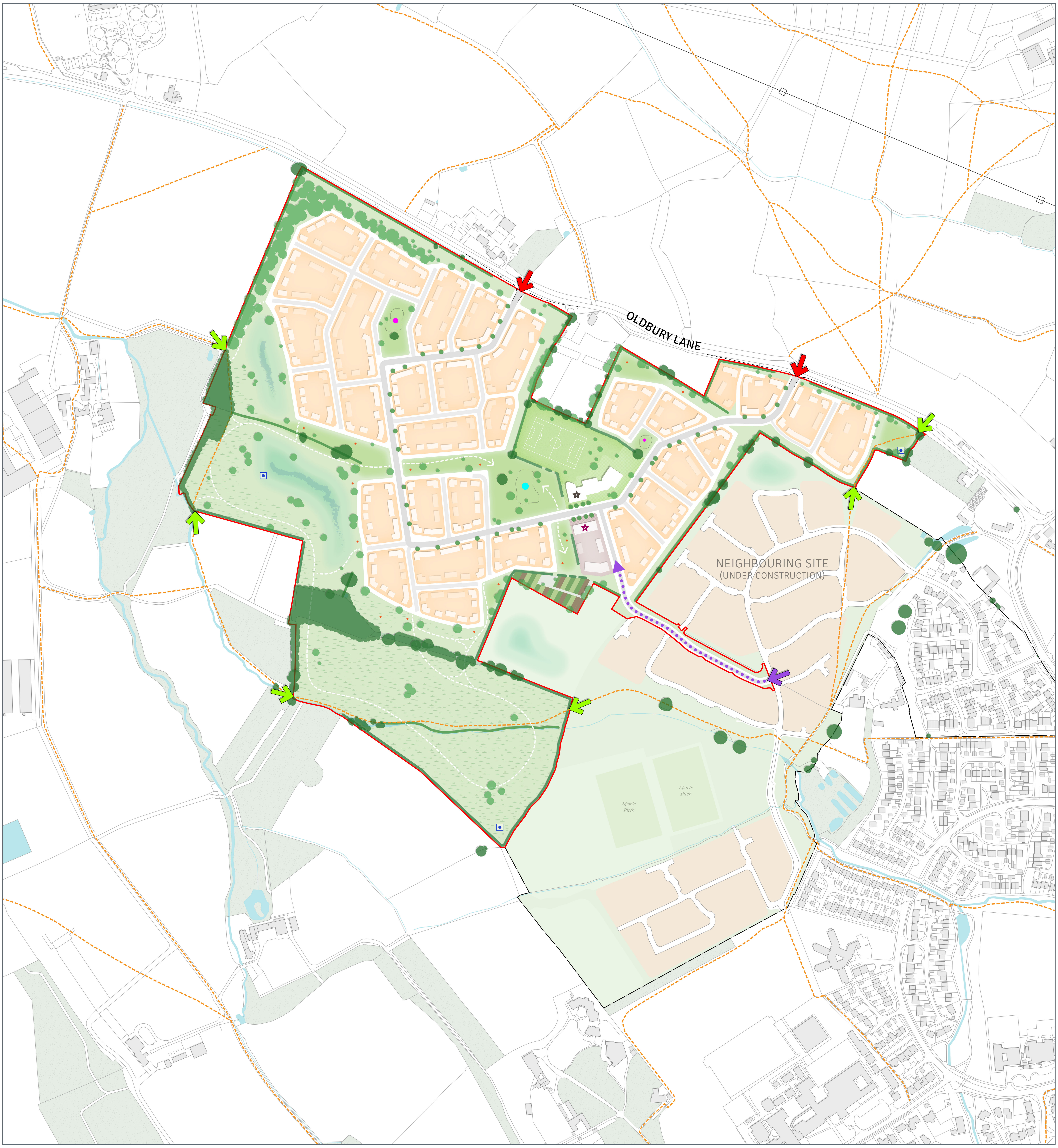
6.1.3 Furthermore, several 'active' and 'passive' measures have been identified as feasible to further reduce energy demands and use energy more efficiently within individual buildings as detail designs emerge. The ambition is to adopt a "fabric-first" approach to building design (enhancing the energy performance of the building fabric itself, before adopting efficient building services).

6.1.4 The key energy target for the Proposed Development is a 20% renewables target set out in **Policy PSP6** of the Policies, Sites and Places Plan (2017).

6.1.5 In response to this, a suite of building-integrated renewable and low carbon technologies has been identified that could be employed at the Proposed Development. 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.

6.1.6 The final technology selection will be developed following outline planning and secured through future Reserved Matters' approvals.

Appendix A Site Location Plan and Masterplan



Key	
Site Boundary	Existing Trees
Residential	Proposed Trees
Mixed-Use	Hedgerows
Public Open Space	Destination Park
1FE School	Neighbourhood Greens
Drainage	Opportunities for Natural Play
Natrual / Semi-Natural Open Space	PROW
Primary Vehicle Access Point	Allotments
Retained Pedestrian Access (PROW)	Potential Wildlife Pond Location
Pedestrian, Cycle and Bus Access Point (Sustainable Transport Link)	School Building
Sustainable Transport Connection	Indicative Location of Retail / Community Hub

Scale for planning purposes only

Rev A (23.08.18) - Update to site boundary (GR)
Rev B (06.09.18) - Plan amended to reflect updated tree survey (GR)
Rev C (16.09.18) - Sustainable Transport Connection added (GR)
Rev D (30.10.18) - Layout adjusted (GR)
Rev E (01.11.18) - Proposed hedgerow adjusted (GR)
Rev F (07.11.18) - Proposed hedgerow adjusted (GR)
Rev G (08.11.18) - Illustrative tree planting updated (GR)
Rev H (21.10.19) - School added, layout revised (GR)
Rev I (22.11.19) - Indicative built form updated (GR)
Rev J (25.11.19) - Hedge added along site boundary (GR)
Rev K (05.12.19) - Additional wildlife pond (AT)
Rev L (19.12.19) - Minor change to hedgerows (GR)

PROJECT
NW Thornbury

DRAWING TITLE
Illustrative Masterplan

DATE	SCALE	DRAWN BY	CHECK BY
15.08.18	1:2500@A1 1:5000@A3	GR	AJT
PROJECT NO	**DRAWING NO**		**REVISION**
27982	9410		L

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Appendix B Predicted Energy Demand Assessment

Project Name: Thornbury
Project No: 39209
Consultant: Roxy Cottey

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 2016
BSRIA Rules of Thumb Fourth Edition 2018
Peter Brett Associates Industry Experience 2019
BCO Guide to Specification 2018

Methodology

The benchmark data from the above references have been used to create Building Regulation 2016 compliance. Predicted energy demand reduction is based on efficiency in water and space heating only to meet the prevailing policy changes.

Additional carbon emission reductions required to meet standards for Building Regulations 2020 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 2016. 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 2016 edition
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 2016
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 BREDEM. These methodologies enabled a 2016 baseline to be calculated for domestic units directly.

In order to calculate the predicted energy demand for 2020 and 2025 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.

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											
Phase 1	595	55,335	1,107	2,418	199	1,893	5,618	762	103	982	1,847
Subtotal	**595**	**55,335**	**1,107**	**2,418**	**199**	**1,893**	**5,618**	**762**	**103**	**982**	**1,847**
Non- Residential											
Phase 1	4	3,011	29	178	49	53	309	45	25	28	98
Subtotal	**4**	**3,011**	**29**	**178**	**49**	**53**	**309**	**45**	**25**	**28**	**98**
GRAND TOTAL	**599**	**58,346**	**1,136**	**2,596**	**248**	**1,946**	**5,926**	**806**	**129**	**1,010**	**1,945**

Residential	**kg CO2 / m2 (regulated):**	**15.6303**
Non-Residential	**kg CO2 / m2 (regulated):**	**23.2363**

RESULTS: 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											
Phase 1	595	55,335	1,044	2,418	199	1,893	5,554	748	103	982	1,834
Subtotal	**595**	**55,335**	**1,044**	**2,418**	**199**	**1,893**	**5,554**	**748**	**103**	**982**	**1,834**
Non- Residential											
Phase 1	4	3,011	25	150	43	53	271	0	113	28	140
Subtotal	**4**	**3,011**	**25**	**150**	**43**	**53**	**271**	**0**	**113**	**28**	**140**
GRAND TOTAL	**599**	**58,346**	**1,069**	**2,568**	**242**	**1,946**	**5,825**	**748**	**216**	**1,010**	**1,974**

Residential	**kg CO2 / m2 (regulated):**	**15.3822**
Non-Residential	**kg CO2 / m2 (regulated):**	**37.4886**

Energy Efficiency % reduction for Space Heating over 2016 baseline

House Type	2020	2025	2030
Detached	0%	8%	19%
Semi Detached	0%	8%	19%
Terrace	0%	10%	31%
Flat	0%	10%	31%

Energy Efficiency % reduction for Hot water over 2016 baseline

House Type	2020	2025	2030
Detached	0%	0%	3%
Semi Detached	0%	0%	3%
Terrace	0%	0%	3%
Flat	0%	0%	3%

Energy Efficiency % reduction for Electricity over 2016 baseline

House Type	2020	2025	2030
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 likely 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. It has been assumed that 33% of water used within a dwelling will be for hot water. Water reduction targets are taken from Building Regulations Part G.

8. BEIS future carbon emission projects have been used to assess the carbon benefits of energy used.

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 C Renewable Energy Feasibility Study

Introduction

This Renewable Energy Feasibility Study examines a selection of well-established renewable and low carbon energy sources and reviews their suitability for West of Park Farm, Thornbury, South Gloucestershire.

Variables affecting their suitability include:

- Environmental constraints (e.g. suitable geology for group source heat pumps or the presence of protected ecological species that may be affected by the technology);
- Resource constraints (e.g. the availability and reliability of local biomass fuel supplies or the local wind resource);
- Social constraints (e.g. visual or health impacts of placing combustion-based technologies near housing); and
- Infrastructure constraints (e.g. impacts on aviation from wind turbines or the availability of suitable transport infrastructure to import fuel, plant or equipment).

Solar Photovoltaic Panels (PV)

Photovoltaic panels (PV) offset grid electricity and therefore provide a CO_2 saving (currently 0.233 $kgCO_2/kWh$). Payback periods for PV are now commercially attractive due to the Smart Export Guarantee (SEG) mechanism and a significantly increased supply base.

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.

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

PV is considered to be an effective potential renewable energy technology to employ at the Proposed Development at the Site, in order to meet the CO_2 reduction targets associated with the 2013 Building Regulations.

PV arrays can be installed on suitably orientated roof spaces and, on flat roofs, frame systems can be used to help optimise their performance (by adjusting their pitch and orientation).

The use of PV arrays (especially on wide-spanning roofs) is subject to detailed assessment of landscape/visual impacts and structural engineering calculations.

Solar Water Heating (or Solar Thermal)

Solar water heating could be used to offset a portion of the hot water demand in the domestic buildings at West of Park Farm, Thornbury. 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.

Solar water heating systems rely on solar energy and, therefore, the most effective heat production occurs during the daytime and sunny periods. The efficiency of solar water heating is greatly reduced during the winter. Therefore, their output for the ‘whole year’ is relatively low.

In order 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.

At West of Park Farm, Thornbury, solar water heating systems could be employed on suitable roof spaces, subject to visual/structural impacts, as part of a ‘suite’ of effective technologies to meet the mandatory energy targets. Although a technically feasible option, solar water heating would compete with PV for roof space.

Air Source Heat Pumps

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 and compressors for air extraction (typically in excess of 2 kW).

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. If adopted, the external condensers will need to be positioned carefully to avoid visual/noise disturbance to the Site users and existing or future residents within proximity of the Site.

The use of numerous air source heat pump systems would have an impact on electrical loads and grid reinforcements. Large-scale use is only suitable with spare electrical network capacity.

Ground Source Heat Pumps

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

Ground source heat pumps systems 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.

In order 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.

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. Certain geological conditions (including sands, gravels and dry clays) have poor geothermal properties and therefore are not suitable. Following intrusive works at the Site, it is understood that the site geology comprises clay/sand deposits across the majority of the Site overlying clayey limestone gravel and mudstone. Therefore a borehole solution would appear less viable.

If a ground source heating approach is pursued, the masterplan must allow space for the installation of horizontal collector loops. A review of the current Proposed Development masterplan (**Appendix A**) shows that there may be space to install such systems. Further investigation on the geological conditions on-site would be required to assess the feasibility and viability of implementing ground source heat pumps.

Wind Energy

Wind is a well-established energy source. The expertise and skills to undertake a range of wind turbine installations is extensive in the UK 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.

The NOABL Wind Map[11] indicates that the Site has the following moderate wind speeds:

- At 10 meters: 4.5 m/s (10.1 mph);
- At 25 meters: 5.3 m/s (11.9 mph); and
- At 45 meters: 5.9 m/s (13.2 mph).

However, the accuracy of the NOABL Wind Map can vary considerably, even to the extent that it can make an Site unviable. In addition, it does not consider the impact of the built environment on wind regimes, including increased turbulence and reduced speed. A thorough assessment of actual on-site wind speeds would be needed before committing to any incorporation of wind turbines.

The Site is not considered suitable for a ‘showcase’ or ‘flagship’ wind turbine development as it is likely to cause a significant visual/noise disturbance and wind flicker, which could be detrimental to the amenity of existing residents in the surrounding settlements and new residents at the Site itself.

Building-mounted turbines (kW scale) are unlikely to provide long-term reliable performance at the Application Site due to the wind turbulence from surrounding new/existing buildings. These systems also present engineering challenges as they often cause structure vibration.

Hydropower

To the south of the Site is the Pickedmore Lane Rhine. Preliminary investigation indicates that this watercourse does not have sufficient head or flow for a hydropower scheme.

Biomass Heat, Power and Combined Heat and Power

Biomass can be used as a fuel source for heat, power and CHP applications. Biomass is typically burnt in biomass boilers. Other potential technologies include gasification and pyrolysis, but these are yet to be commercially proven.

Biomass plants can be scaled to meet the needs of the Proposed 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.

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[11] NOABL Wind Map[1.01] [online] available at: http://www.rensmart.com/Weather/BERR [accessed 10/05/2018]

The lifecycle costs of biomass systems are 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.

As a solid fuel, biomass often requires transportation over significant distances. However, the carbon intensity of biomass is still significantly less than traditional fossil fuels (oil and gas), even including the emissions associated with intercontinental transportation.

The use of biomass technologies is subject to the availability of long-term contracts to ensure 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).

In high density built-up areas where air quality already presents an issue, the emissions from biomass boilers may exceed local air quality standards.

Certain homes could be adaptable should end-users wish to install wood burning stoves once purchased, subject to further air quality assessment at detailed design.

Fossil Fuel Combined Heat and Power

The use of fossil fuels (normally gas) in CHP plants is a common and well understood technology. It works with reciprocating engines, turbines or combined cycling. High exhaust temperatures can be utilised for heating purposes and fuel availability is typically not an issue.

Fossil fuel CHP plants are usually designed to meet the heat demand rather than electrical demand. This maximises the CHP output to more favourable electricity supply markets.

Fossil fuel CHP is not a renewable energy and, therefore, does not contribute towards renewable energy production at the Site. However, it does offer a significant contribution to CO_2 reduction because of improved efficiency.

Micro-gas CHP systems are now available in the market and may be appropriate for use within the school building subject to viability.