CLIMATECONSULTING

Sustainable Construction in Maidstone Study

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Disclaimer

References to Creative Environmental Networks (CEN) refer to Climate Consulting's previous branding. All reports and papers can be obtained from Climate Consulting.

1 Executive Summary

1.1 Context and scope of study

This evidence base study has been commissioned by Maidstone Borough Council in order to define and justify requirements for sustainability in new development to be set out in the Council's Core Strategy. The requirement for such a study is set out in government's *Planning and Climate Change* supplement to Planning Policy Statement 1 (PPS1a). In accordance with national planning policy, the targets investigated are specified in terms of nationally described sustainable building standards, the Code for Sustainable Homes (CSH) and its non-residential equivalent, BREEAM.

These standards address sustainability in broad terms, and buildings assessed against them are awarded credits based on their performance against a wide range of environmental issues (e.g. relating to energy, water, waste, materials and other topics). Based on the number of credits accrued, a rating is awarded (Level 1-6 for CSH, and Pass to Outstanding for BREEAM). Both standards contain a mandatory energy requirement, which sets out improvements in energy performance beyond the national requirements set under the Building Regulations Part L (see Section 2.1.4 for further detail on these standards and their relationship to Part L).

The objective of the study is to gather and present data that will allow Maidstone Borough Council to decide whether its Core Strategy policies should include CSH and BREEAM requirements in line with the current national timetable for stepping up Part L of the Building Regulations, or whether it should set targets that pre-empt this timetable. The timetable is set out as follows:

- Part L 2010 – current standards
- Part L 2013 – maximum CO_2 emissions threshold for new development drops by 25%
- Part L 2016 – zero carbon[1] requirement for all new dwellings
- Part L 2019 - zero carbon for all new non-residential development (earlier for certain development types).

For the purposes of this assessment, CSH Level 3 and BREEAM Very Good are considered to be in line with current national standards (Part L 2010) as they do not impose sustainable energy requirements beyond those of the Building Regulations, although it must be borne in mind throughout the report that CSH and BREEAM both cover much more than just energy, and it is not true to say that meeting Part L 2010 is the same as achieving CSH Level 3. Meanwhile CSH Level 4 is considered in line with the proposed standards for 2013 (as it requires a 25% CO_2 reduction below Part L 2010) and CSH Level 6 (requiring a zero carbon development) is considered in line with Part L 2016. Although BREEAM levels are not as easy to link to Part L, BREEAM Excellent will be regarded as in line with (i.e. not exceeding) 2013 standards and BREEAM Outstanding will be considered to be in line with the zero carbon requirements of 2019 (see Section 3.1.1 for a full explanation).

[1] See *Carbon Compliance: What is the appropriate level for 2016? (interim report)* – Zero Carbon Hub 2010 http://www.zerocarbonhub.org/definition.aspx?page=8

Given current uncertainties around the trajectory for improving national standards to 2016/2019, and the significant leap expected in 2016, it is not considered sensible for Maidstone to try to pre-empt the timetable except in the first stage (2012-13). Two options for target setting are thus presented below:

- Targets with energy requirements in line with proposed national timetable
    - 2012-2013
        - Code for Sustainable Homes Level 3 (residential)
        - BREEAM Very Good (non-residential)
    - 2013-2016
        - Code for Sustainable Home Level 4 (residential)
        - BREEAM Excellent (non-residential)
    - 2016 onwards
        - Code for Sustainable Home Level 6 (residential)
    - 2019 onwards
        - BREEAM Outstanding (non-residential)

- Targets with energy requirements pre-empting proposed national timetable
    - 2012-2016
        - Code for Sustainable Home Level 4 (residential)
        - BREEAM Excellent (non-residential)
    - 2016 onwards
        - Code for Sustainable Home Level 6 (residential)
    - 2019 onwards
        - BREEAM Outstanding (non-residential)

Generally speaking, the largest part of the cost burden facing developers building to CSH and BREEAM standards will be the cost of the measures needed to meet the energy requirements which, as discussed, are equivalent to the requirements of the proposed iterations of Part L. This means that where CSH/BREEAM levels with energy requirements in line with the proposed national timetable are set, the majority of the cost facing developers at any point will stem from a national requirement, rather than as a direct result of Maidstone's policies. This point will be revisited throughout the report.

It is also worth noting that the introduction of Part L 2010 was delayed by six months (with final adoption in October 2010, rather than April as originally planned) and it is therefore possible that the uptake of future revision to Part L will be similarly delayed. Target frameworks such as the ones outlined above could therefore act as a useful "safeguard" to ensure energy and sustainability standards are stepped up according to the currently proposed timetable regardless of delays at the national level.

The study fell into two strands:

1. A "borough-wide" analysis, in which we investigated technical and financial implications of achieving CSH Levels (3 and 4) and BREEAM Levels (Very Good and Excellent) through on-site sustainable energy strategies in a range of development types.
2. An "area-wide" analysis, which assessed the suitability of potential future clusters of development sites for decentralised energy provision (e.g. a heat network supplied by a Combined Heat and Power plant, distributing heat and/or power to a cluster of

development sites) and considered the impact that such provision might have on the cost of achieving the same CSH/BREEAM Levels (but with a specific focus on CSH Level 4). The rationale behind the second strand was to test the common perception that connecting to a decentralised energy network will enable developments to achieve CO_2 reductions more cost-effectively than by employing on-site (microgeneration) strategies.

Please note: In determining which sustainability standards can be implemented through policy requirements within the Core Strategy, Maidstone Borough Council will draw on this study in the context of other studies being conducted simultaneously. In particular, development contributions for necessary infrastructure and for affordable housing will be sought through the Core Strategy, meaning that a viability model for the Core Strategy as a whole, read in conjunction with relative priorities, will guide the policies and the extent of those policies that Maidstone Borough Council will seek to implement.

1.2 Borough-wide analysis

Objective:
To ascertain whether Maidstone should set sustainability targets matching the proposed national timetable, or whether Maidstone should set targets that pre-empt this timetable.

This analysis considered the technical and financial implications of achieving various CSH/BREEAM ratings in different developments through the integration of sustainable energy measures at the building level. Only sustainable energy requirements were considered at a technical level, while the costs of wider sustainability requirements were factored alongside energy costs into a high-level financial assessment. This reflects the fact that energy standards tend to have the most profound impacts on building design and structure, and that wider sustainability measures are likely to be far more diffuse and variable between developments, meaning that any attempted modelling would not provide the level of accuracy required.

1.2.1 Methodology

The approach adopted was as follows:

- Identify development types representative of the expected future growth in the Borough
- Make energy models for these developments using nationally approved software in order to identify solutions that could meet target standards, and make a high-level assessment of the financial implications of each.

Discussion with Maidstone Borough Council's policy officers concluded that the following development types should be considered, given their likely use during the Core Strategy period:

- 3-bedroom terraced house
- 2-bedroom flat in a three storey block
- B8 Warehouse
- B1 Office
- Healthcare

- School
- Retail
- Leisure

Of these development types, the top four were investigated in detail using nationally-approved modelling software while a more general study was conducted into the implications of achieving BREEAM standards in healthcare, schools, retail and leisure developments.

Technical analysis:
The following methodology was used to model sustainable energy strategies to achieve the desired CSH and BREEAM targets for each development scenario:

1. Developments were modelled using government-approved software issued under Part L (SAP and SBEM).

2. Energy efficiency measures such as building fabric insulation, air permeability reduction and low energy lighting were applied to the models.

3. Renewable energy technologies (solar photovoltaics, solar thermal, heat pumps and biomass) were sized according to standard principles and applied to the models.

4. Strategies meeting CSH Levels 3 or 4 and BREEAM Very Good or Excellent were identified, and included in a financial analysis.

Financial analysis:
In order to understand the financial implications of the different CSH/BREEAM ratings, the following methodology was undertaken:

1. Each sustainable energy strategy identified in the technical analysis was costed, using Climate Consulting's own bank of cost data from installers[2].

2. In order to establish how much of this cost would result directly from the imposition of a CSH/BREEAM target, the cost of achieving Part L was subtracted from the total (NB: for CSH Level 3, this meant that the entire cost was attributed to Part L and thus subtracted, as the energy requirements of CSH Level 3 are identical to those of Part L).

3. The remaining costs were added to average costs of the wider sustainability measures required to meet the different CSH/BREEAM Levels to give an overall cost of achieving CSH/BREEAM Levels for each development type based on each sustainable energy solution.

4. This cost was then compared against approximate base build cost for each development type, and expressed in the form of a percentage increase to build cost resulting from each solution and hence used

[2] In conjunction with our sister companies Climate Energy Solutions Ltd and network of installers, Climate Consulting runs the largest installer network in the UK, and as such maintains a large bank of data on the technical and financial aspects of energy efficiency measures and renewable energy measures.

to establish a range of costs resulting from the imposition of the various CSH/BREEAM targets.

NB: The base building costs and costs of wider sustainability measures were sourced from various reports by CLG and Faber Maunsell – please refer to Section 3.2.2 for full details. This analysis was supplemented with a more general literature review on the implications of achieving BREEAM Levels in offices, healthcare, school and retail developments.

1.2.2 Key results and conclusions

A summary of key findings is given in Table 1-1. Note that two sets of figures are given, one excluding and one including the cost of meeting Part L as described in point (2) above.

Table 1-1: Summary of CSH/BREEAM cost analysis

Development type	CSH/BREEAM Level	% increase on build cost (excluding Part L cost)	% increase on build cost (including Part L cost)	Source
House	CSH Level 3	1	4 – 9	Climate Consulting Modelling
	CSH Level 4	6 – 8	8 – 10	Climate Consulting Modelling
Flat	CSH Level 3	1	4	Climate Consulting Modelling
	CSH Level 4	4 – 11	7 – 14	Climate Consulting Modelling
Office	BREEAM Very Good	(not modelled)	0 – 6	Climate Consulting Modelling
	BREEAM Excellent	5	13	Climate Consulting Modelling
Warehouse	BREEAM Excellent	2	28 – 34	Climate Consulting Modelling
Healthcare	BREEAM Very Good	(not modelled)	0	Literature review
	BREEAM Excellent	(not modelled)	0 – 2	Literature review
School	BREEAM Very Good	(not modelled)	1 – 3	Literature review
	BREEAM Excellent	(not modelled)	4 – 10	Literature review

As shown above, the borough-wide analysis indicates that achieving the CSH and BREEAM ratings with energy standards considered "in line with proposed national timetable" (CSH Level 3 and BREEAM Very Good) will require an increase to build cost of less than 10%, and that for residential developments, at least, the majority of this cost overlaps with the cost of meeting Part L, and therefore would not constitute an additional cost associated with achieving CSH Level 3. Meanwhile, the analysis also indicates that achieving CSH and BREEAM ratings with energy standards "pre-empting the proposed national timetable" (CSH Level and BREEAM Excellent) that will increase build cost by under 11% (or smaller) if the cost of achieving Part L is excluded from the calculation, but if this cost is included, the increases in build cost will be considerably higher (strikingly so in the case of the warehouse development, where the cost increase jumps from 2% (excluding Part L) to 34% (including Part L), as a result of the high standards set for this development type under Part L).

Whether or not to take into account the overall cost (including Part L) of achieving CSH/BREEAM or only the additional cost (excluding Part L) when deciding which targets to set is for Maidstone Borough Council to decide. This issue is considered alongside other issues in Section 3.5, and it must also be re-iterated that Maidstone Borough Council is independently preparing a viability model to determine the level of development contributions for necessary infrastructure and for affordable housing that will be sought. This will inevitably affect the final decision on which sustainable energy standards should be imposed.

1.3 Area-based analysis

Objective:

- To establish the potential for decentralised energy networks in Maidstone, and identify specific areas of high potential that may merit a more stringent sustainable energy policy standard.
- To compare costs of achieving CSH (and BREEAM) levels through connection to a decentralised energy network and through

The rationale behind conducting this analysis was to test the common perception that connecting to a decentralised energy network will enable developments to achieve CO_2 reductions more cost-effectively than by employing on-site (microgeneration) strategies. Decentralised energy provision usually refers to the communal provision of heat and sometimes power and cooling, and can range from a communal boiler in a block of flats to a city-wide heat and power network. In this study we considered decentralised energy networks at level of clusters of potential development sites.

1.3.1 Methodology

Estimating energy demand for potential development sites

Information on possible future development sites was provided by Maidstone Borough Council and subjected to a detailed review in order to provide a schedule of development opportunities that may occur over the plan period. Potential residential site allocations were based around five varying scenarios.

- **Scenario A – 8,200 (dispersed):**
  - 8,200 new homes (of which 1,170 to allocate), dispersed across urban and rural sites
- **Scenario B – 10,080 (dispersed)**
  - 10,080 new homes (of which 3,240 to allocate) dispersed across urban and rural sites
- **Scenario C – 10,080 (SDA)**
  - 10,080 new homes (of which 3,240 to allocate) with a high concentration in an urban extension in South East Maidstone ("Strategic Development Area")
- **Scenario D – 11,000 (dispersed)**
  - 11,000 new homes (of which 4,267 to allocate) dispersed across urban and rural sites

- **Scenario E – 11,000 (SDA)**
  - 11,000 new homes (of which 4,267 to allocate) with a high concentration in an urban extension in South East Maidstone ("Strategic Development Area")

Alongside these residential sites, employment and retail sites were added to the schedule. Where available information supported it, non-residential growth scenarios were aligned with those of the residential sites.

Base-load heat demand (the typical basis on which CHP systems are sized) was estimated for every potential development site and fed into the development schedule to build a base-load heat demand schedules for each of the five development scenarios. For more detail on the methodology please refer to Section 4.2.2)

Cluster analysis

Each scenario was assessed to find site "clusters" suitable for decentralised energy using the following methodology:

- Areas with adjacent or overlapping residential and non-residential sites were selected as "cluster centres".
- Sites near to cluster centres were assessed for inclusion in the cluster based on their heat demand and proximity to cluster centre
- Each cluster was then assessed by its base-load heat demand to establish its suitability for biomass CHP.
- Further opportunities, such as presence of "anchor loads" (large points of heat demand, such as hospitals, leisure centres, supermarkets and potential schools) and existing sources of heat or power that could be used to supply the site cluster were considered at for each site cluster, including those found likely to be too small for biomass CHP.

1.3.2 Key results of cluster analysis

Three site clusters, across four of the development scenarios, were identified as worth assessing in further detail on their potential for a decentralised energy network:

Scenarios C and E

1. Strategic Development Area

Scenarios B and D

2. South East Maidstone

3. North West Maidstone

1.3.3 Implications of decentralised energy networks for achieving CSH and BREEAM standards

Many factors will influence the CO_2 reductions (and by that token CSH or BREEAM ratings) a development can achieve by connecting to a decentralised energy network, including the fuel source, energy supply and energy distribution. Meanwhile, the financial implications for development of connecting to a decentralised energy network are even more difficult to define, especially when comparing the costs of achieving CSH/BREEAM standards through connection to a network against the costs of achieving such standards through on-site microgeneration. To make a fair comparison, direct capital costs to developers should be considered, and these will vary widely depending on the density of development, mix of development types on site and model of financing the energy network.

In the present study, we have looked solely at the costs residential developments face in connecting up to a decentralised energy network, as these are considerably easier to generalise than those for non-residential developments which will vary hugely from case to case. We have only considered capital costs, and it is therefore necessary to add the following caveat: all cost increases presented in the below sections are likely to be at the higher end of what might be incurred in reality, as they assume that the entire cost will be borne by developers, and that no savings will be accrued through long term involvement in site energy supply. Since connecting to a decentralised energy network will in the vast majority of cases generate CO_2 savings sufficient to achieve CSH Level 4, no separate attempt has been made to quantify the implications that connecting to a decentralised energy network will have on achieving CSH Level 3.

Table 1-2 presents the high-level results of modelling the connection to various decentralised energy systems. Rather than attempting to cost each system, a higher-level approach was taken to costing drawing on Climate Consulting's existing models of decentralised energy networks and taking into account costs including the energy centre, CHP plant, distribution pipes, dwelling interface units and auxiliary heating (see Section 6.2). Percentage cost increases were then calculated in the same way as those for the on-site microgeneration solutions, i.e. excluding energy costs of achieving Part L 2010 (and thus CSH Level 3) but including wider sustainability costs of CSH Level 4. For reference a comparison with the cost increase ranges of achieving CSH Level 4 through on-site microgeneration has also been included.

Table 1-2: Costs associated with achieving CSH Level 4 through connection to a decentralised energy network

Development type	% increase on build cost due to connection to a decentralised energy network (range drawn from Climate Consulting's past projects)	% increase on build cost from on-site microgeneration (comparison)
House	6 – 10	6 - 8
Flat	8 – 12	4 – 11

These results suggest that, rather than decreasing the cost of achieving CSH Level 4, the cost of solution involving connection to a decentralised energy network is comparable with or slightly higher than the more expensive of the microgeneration solutions. However, as explained above (and in more detail Section 4.5.1), capital cost may be a misleading indicator here as there are a variety of mechanisms available for shouldering the burden of these costs that are particular suited to decentralised energy networks (e.g. developers with long term interest in the site; capital funding provided by ESCos[3] and accrued back over time).

[3] An ESCo is an "Energy Services Company" and refers to an entity that finance, install, operate or maintain (or all four) an energy project such as a decentralised energy network. This can include a private sector offshoot of an energy company, a public-sector led organisation or a public-private partnership.

1.4 Policy Recommendations

Four options for Maidstone's Core Strategy policy are set out below, and each is followed by a brief description of the issues associated with them. These policy options and associated issues are also presented in Section 5.

Option 1: Matching the national energy timetable
New residential development is required to meet Code for Sustainable Homes Level 3, CSH Level 4 from 2013 and CSH Level 5/6 from 2016

New non-residential development over 1,000m^2 is required to meet BREEAM Very Good, BREEAM Excellent from 2013 and BREEAM Outstanding from 2019.

Issues:

- The financially significant component of the requirement set through this policy (i.e. the energy standards) is equivalent to the requirements set by or anticipated under the Building Regulations Part L, and only a small cost burden is presented by the additional ("wider sustainability") demands of CSH and BREEAM, especially at the lower ratings (Level 3/ Very Good).
- At each phase of the policy, the wider sustainability requirements not covered by national policy step up alongside the energy standards. This is a clear and effective way for Maidstone Borough Council to address climate change and broader sustainability concerns through its policy framework.
- However, the fact that the policy makes no provision for pre-empting the national energy timetable may be perceived as evidence that Maidstone Borough Council is not strongly pushing forward the sustainable energy agenda, despite the wider sustainability requirements of the CSH/BREEAM standards.

Option 2: Pre-empting the national energy timetable
New residential development is required to meet Code for Sustainable Homes Level 4 from 2012 and CSH Level 5/6 from 2016

New non-residential development over 1,000m^2 is required to meet BREEAM Excellent from 2012 and BREEAM Outstanding from 2019.

Issues:

- For the first phase of this policy (until 2013) the policy requirement exceeds national requirements in all areas including sustainable energy. Although this only pre-empting national energy standards on a relatively small level, it is worth noting that there is no guarantee that Part L of the Building Regulations will be updated according to timetable, and there is a value in having a policy that safeguards these changes in requirements. However, it places a higher cost burden on developers in the first phase than in Option 1 and there is no obvious justification for imposing this in Maidstone.
- As with Option 1, the wider sustainability requirements not covered by national policy step up alongside the energy standards in phases.

Option 3: Higher (pre-2013) standards for designated areas

New residential development and new non-residential development are required to achieve the standards set out in the table below:

	Development in designated areas (e.g. Strategic Development Area)	Development in all other areas
2012-2013	CSH Level 4 BREEAM Excellent	CSH Level 3 BREEAM Very Good
2013-2016	CSH Level 4 BREEAM Excellent	CSH Level 4 BREEAM Excellent
2016-2019	CSH Level 5/6 BREEAM Excellent	CSH Level 5/6 BREEAM Excellent
2019-2026	CSH Level 5/6 BREEAM Outstanding	CSH Level 5/6 BREEAM Outstanding

Issues:

- This policy relies on the common perception that connecting to a decentralised energy network will enable developments to achieve CO_2 reductions (and thus CSH/BREEAM ratings) more cost-effectively than by employing on-site (microgeneration) strategies.
- However, this study has yielded no compelling evidence that this perception is accurate.
- Furthermore, unless only areas with an existing decentralised energy network are designated (and none exist at present) then a policy of this kind will tie developments in certain areas into achieving higher standards (in the initial phase) based on the suitability of that area for decentralised energy provision rather than on the presence of an actual network. In effect, developments could be required to achieve higher targets (that may or may not be easier to achieve through connecting to a network) regardless of whether a network is actually present. As discussed in Section 4.5, it is not possible to achieve CSH/BREEAM ratings on the strength of a speculative energy network, so the fact that a certain area is suitable for decentralised energy provision will not help a dwelling achieve a certain CSH/BREEAM rating unless the network is actually present, or under construction.

Option 4: A practical approach to decentralised energy

New residential development is required to meet Code for Sustainable Homes Level, Code Level 4 from 2013 and CSH Level 5/6 from 2016

New non-residential development over 1,000m^2 is required to meet BREEAM Very Good, BREEAM Excellent from 2013 and BREEAM Outstanding from 2019.

AND

Where a decentralised energy network exists, new development will be required to connect up to it. In areas designated as suitable for a decentralised energy network, new development should be designed so as to facilitate a connection and planning conditions will be imposed to ensure that a connection is made once the network is operational.[4]

[4] In the supporting text of this policy, the following information should be provided: (1) a list of areas designated as suitable for decentralised energy provision; (2) practical detail for developers on what "designing a development to facilitate a connection" would entail.

Issues:

- The “practical” wording of this policy (i.e. developments should connect to networks, rather than developments in designated areas should achieve higher targets) avoids the difficulties associated with imposing higher targets in areas suitable for decentralised energy networks.
- Furthermore, by focusing on the practical, rather than the target-driven, the policy more directly supports the wider benefits of setting up a decentralised energy network (e.g. facilitating CO_2 savings across the borough by linking in existing development to the network).
- However, the policy could potentially be difficult to enforce, particularly as it will involve imposing planning conditions that may take many years to discharge.

2 Policy background for sustainable energy

2.1 National and regional background

This section identifies the national and regional context for energy opportunities and carbon reduction targets in Maidstone Borough Council by summarising the key messages from relevant national planning policy, standards and legislation.

2.1.1 National Legislation and Strategies

The UK has experienced a growing policy thrust towards delivering sustainable development, originating as a key planning objective in the Planning and Compulsory Purchase Act (2004). Since that time specific planning policy has been developed to address the potential causes and consequences of climate change.

The Planning White Paper *Planning for a Sustainable Future* (2007) emphasised the importance of planning's role in delivering sustainable development in a changing global context and, in particular, in delivering the infrastructure which provides access for all to transport, energy and water, to develop sustainable communities. The Department for Communities and Local Government's (DCLG) *Building a Greener Future* (2007) additionally set moves to tighten Building Regulations to reduce carbon emissions from new homes, and to achieve zero carbon in all new homes by 2016.

The Planning and Energy Act (2008) enables Local Planning Authorities to set "reasonable requirements" for energy use and energy efficiency in local plans. Thus planning policies can be adopted which require new developments to meet a certain proportion of their energy demand from renewable, low carbon or decentralised sources on-site or in the locality of the development. Local Planning Authorities can also require new developments to meet energy efficiency standards which exceed those of the building regulations in force at the time, for example by requiring a particular Code for Sustainable Homes rating.

2.1.2 National Planning Policy

Planning Policy Statement (PPS) 22 *Renewable Energy* (DCLG, 2004) established a requirement for target and criteria based policies for on-site renewable energy generation, through maximising opportunities to incorporate small-scale renewable energy in all new developments. PPS22 requires positive policies to be expressed in Local Development Documents to encourage such development (paragraph 18). Local planning authorities are required to develop policies in response to local circumstances, but PPS22 states that landscape and nature conservation designations alone should not restrict renewable energy developments.

PPS1 *Delivering Sustainable Development* (2005) establishes a key requirement for planning and development plans address climate change through promoting energy efficient design and supply and renewable and low carbon schemes as part of future developments. While there is therefore a real emphasis on policies to promote sustainable energy measures, the importance of design that accounts for local character is additionally emphasised by PPS1. Development should be integrated into the existing urban form, natural and built environments, policy developed to 'respond to their local context and create or reinforce local distinctiveness' (paragraph 36).

The PPS1 Supplement *Planning and Climate Change* (hereafter referred to as PPS1a) was published in 2007 pushing forward planning as a means of addressing climate change. PPS1a requires regional strategies (now due to be abolished through the Localism Bill – see Section 2.1.5) to make the fullest contribution to addressing climate change through integrating climate change considerations into all planning decisions. In response to PPS1a, local planning authorities must develop policies to promote energy efficient design, and "pay particular attention to opportunities for utilizing and expanding existing decentralised energy supply systems, and fostering the development of new opportunities for decentralised energy from renewable and low-carbon energy sources to supply proposed and existing development".

Policies within Development Plan Documents (DPDs) should expect a proportion of the energy supply for new development to be secured from decentralised and renewable or low carbon sources. Area specific opportunities for energy infrastructure should also be identified through the plan process. All policies relating to sustainable energy must be underpinned by a robust evidence base and viability assessment, and the purpose of this document is to meet that requirement.
The latest supplement, *Planning for a Low Carbon Future in a Changing Climate* (under consultation), stresses the importance of energy efficiency and decentralised energy delivery. Although this has not yet been formally adopted, a report by the Planning and Climate Change Coalition (Nov 2010) *Planning for Climate Change – Guidance and Model Policies for Local Authorities*[5] draws explicitly on the draft PPS to provide useful advice for planning departments.

2.1.3 Building Regulations Part L

Part L *Conservation of Fuel and Power* is the section of the Building Regulations that sets mandatory maximum CO_2 emissions thresholds that all new and adapted existing buildings must not exceed. Part L1 deals with dwellings only and Part L2 deals with non–residential forms of development.

The current 2010 Building Regulations Part L (adopted October 2010) requires that CO_2 emissions of new developments (called the Dwelling Emissions Rate (DER) for dwellings, or Building Emissions Rate (BER) for non-residential) should be lower than or equal to the Target Emissions Rate (TER) which is calculated specifically for individual buildings using nationally-approved software SAP or SBEM[6]. The recent revisions to Part L included a decrease in TER of 25% for all new residential development, and an average decrease of 25% (but apportioned differently amongst different development types) for new non-residential development. There is a strong expectation that the forthcoming revisions will feature increasingly stringent limits on CO_2 emissions of new buildings, as

[5] http://www.rtpi.org.uk/download/10400/pccc_guidance_web.pdf
[6] The Standard Assessment Procedure (SAP) is the government-approved methodology for modelling energy performance of residential units while the Simplified Building Energy Model (SBEM) is the equivalent used for non-residential developments.

initially set out by the Department for Communities and Local Government[7] and currently being consulted on by the Zero Carbon Hub.[8]

- 2013: TER to be 25% lower than 2010 levels (corresponding to the energy requirements of Level 4 of the Code for Sustainable Homes)[9].
- 2016: All new homes to be Zero Carbon – definition currently awaited from central government (corresponding to the energy requirements of Level 6 of the Code for Sustainable Homes).

2.1.4 Code for Sustainable Homes and BREEAM

While the Building Regulations provide the mandatory minimum requirements for all buildings, the Code for Sustainable Homes (hereafter referred to as the CSH) and its non-residential equivalent, the Building Research Establishment Environmental Assessment Method (BREEAM) serve as overall sustainability standards for new developments.

Both standards address sustainability in broad terms, and buildings assessed against these standards are awarded credits based on their performance against a set of 34 issues, relating to energy, water, waste, materials and other topics. Based on the number of credits achieved, buildings are awarded a rating (1-6 for the CSH, and from a Pass to an Outstanding rating for BREEAM). While many of the issues in both standards are “flexible” (i.e. there is no requirement to achieve credits against that particular issue, as long as the requisite total number of credits are achieved for the CSH/BREEAM Level targeted) certain issues are mandatory at different levels of CSH/BREEAM. Of particular relevance to this study is the mandatory energy/CO_2 issue that applies to different levels of both standards, but it is crucial to remember that CSH and BREEAM both cover a much broader range of issues than energy alone.

Energy and the Code for Sustainable Homes

The mandatory energy standard (called Ene1) of CSH relates directly to the TER set out in Part L (see Section 2.1.3). The Ene1 requirement for CSH Levels 1 to 3 is simply that the DER is no greater than the TER (i.e. Part L compliance), while for higher CSH levels, a percentage reduction is required, e.g. 25% for CSH Level 4.

Energy and BREEAM

There is no mandatory energy requirement at lower levels of BREEAM (Pass, Good and Very Good) but to achieve BREEAM ‘Excellent’, the CO_2 index (showing the energy performance of the building) of the new building, as taken from its Energy Performance Certificate (EPC), must be less than or equal to 40. The EPC is typically produced in SBEM and gives buildings a rating from A to G based on its energy efficiency (which will usually correspond to its CO_2 emissions and fuel bills).

2.1.5 The South East Plan

The regional strategy for the South East, the South East Plan, was adopted in May 2009. In July 2010 the Coalition Government tried to

[7] *Building a Greener Future: Towards Zero Carbon Development* – CLG – December 2006

[8] See *Carbon Compliance: What is the appropriate level for 2016 (interim report)* – Zero Carbon Hub 2010 http://www.zerocarbonhub.org/definition.aspx?page=8

[9] NB: A 25% reduction below TER 2010 is equivalent to a 44% reduction below TER 2006, as set out in the 2007 White Paper *Building a Green Future*

revoke regional strategies. However, the revocation was overturned in the courts. Currently the South East Plan still applies, but in the long term the Government intends to abolish regional strategies through the Localism Bill and this intention can be used as a material consideration in all planning decisions.

South East Plan policies that have been of particular relevance in shaping local policy and in combating climate change and sustainable natural resource management are those promoting the sustainable design and construction of new buildings, to reduce energy needs and CO2 emissions. The key policies in this respect are discussed below.

Policy CC4, Sustainable Design and Construction, requires all new development and refurbishment to incorporate sustainable construction principles - the development should be energy and water efficient and a proportion of the development's energy supply should be secured from decentralised, renewable or low-carbon sources.

Policy NRM11, Development Design for Energy Efficiency and Renewable Energy, requires local authorities to set ambitious but viable targets for new developments to meet a certain proportion of their energy requirements from decentralised, renewable or low carbon sources. In advance of such targets new major developments (10 residential units/1000m2 and above) are expected to meet 10% of their energy from these sources.

Policy NRM12 encourages the integration of Combined Heat and Power and decentralised energy networks into new development, and Policies NRM 13 – 17 deal with renewable energy technologies, setting regional (NRM13) and sub-regional targets (NRM14) and outlining location (NRM15) and development criteria (NRM16) for renewable energy development.

2.2 Case studies from other Local Authorities

2.2.1 Example 1: High sustainability standards required across the borough

The London Borough of Havering's Core Strategy was adopted in 2008 and, in policy DC49 *Sustainable Design and Construction* sets out a timetable of increase Code for Sustainable Homes requirements for new residential development:

- Level 3 from 2008
- Level 4 from 2010
- Level 5 from 2013
- Zero Carbon from 2016

There is no equivalent timetable for non-residential development, and the ongoing requirement is BREEAM Very Good. Other London Boroughs are following suit, including the London Borough of Merton whose pre-submission version Core Strategy includes Policy CS 15 *Climate Change*, which sets a CSH Level 4 requirement for residential development and a BREEAM Very Good requirement for non-residential development.

2.2.2 Example 2: High sustainability standards "encouraged" across the borough: Tonbridge and Malling Borough Council

Tonbridge and Malling Borough Council have used their Managing Development and the Environment DPD (adopted April 2010) to set out the sustainability standards expected of new development. Policy CC1.1 stipulates the following requirements:

- All new development to incorporate passive design measures to reduce energy demand e.g. good insulation and air tightness and designed to take advantage of natural light and heat from the sun and use natural air movement for ventilation, whilst maximising cooling in the summer.
- New residential development (excluding extensions and conversions) will be *encouraged* to achieve CSH Level 4
- New residential development will be required to meet a 10% reduction in CO_2 emissions though the use of installed low or zero carbon technologies
- New office (B1), retail and related development (A1, A2, A3 and A4) (excluding extensions) will not be permitted unless savings of at least 10% of the estimated CO2 emissions are achieved from installed low or zero carbon technologies. Those with a floorspace of more than 1,000m^2 (including extensions) will not be permitted unless they achieve relevant BREEAM 'Very Good' Standard.

The version of the policy submitted for inspection included a more strongly-worded "requirement" for new residential development to meet CSH Level 4, based on an evidence base study produced by CEN. The decision to replace "required" with "encouraged" was made by the inspector following concerns that enforcing CSH Level 4 in conjunction with the Council's proposed affordable housing requirements would be too onerous,

2.2.3 Example 3: Higher sustainability standards required in designated areas: Ashford Borough Council

Ashford Borough Council's Core Strategy[10] was adopted in 2008, and Policy CS10 sets out the standards required for development types in different locations across the borough. Although the Council is committed to stepping up expected standards over time, details of the standards to be applied from 2015 onwards will be set either in a review of the Core Strategy or in a separate DPD. The supporting text for policy CS10 explains that it is easier and less expensive to design sustainability into new build than to apply the same standards to existing neighbourhoods, so new build should deliver higher environmental standards than refurbishments. Moreover, town centre and brownfield site will typically be expensive to reclaim while offering good sale values, so the policy sets a lower standard than that applied for greenfield sites and new urban extensions (which are defined in policies CS4 and CS5 respectively) where it is usually easier to accommodate sustainable design and construction features and infrastructure.

[10] http://www.ashford.gov.uk/pdf/Planning_Adopted_Core_Strategy_July08.pdf

		Town Centre, Brownfield	**Greenfield sites , Urban Extension**	**Tenterden, The Villages**	**Existing and Refurbishment**
Residential (CSH)		Level 3	Level 4	Level 2	Ecohomes Very Good
Non-residential (BREEAM)	Overall	Very Good	Excellent	Good	Very Good
	Energy credits	Excellent	Excellent	Excellent	Excellent
	Water credits	Maximum	Maximum	Excellent	Excellent
	Material credits	Excellent	Excellent	Very Good	Very Good

2.2.4 Example 4: Higher standards and decentralised energy provision required in growth areas: London Borough of Brent

The London Borough of Brent's Core Strategy[11] was adopted in July 2010, and the sustainability standards set out in Core Policy 19 took their cue from an evidence base study into the feasibility of establishing a heat network in Wembley Central. The borough-wide requirement is for a minimum CSH Level 3 and BREEAM Excellent rating, but in specific growth areas:

"Major proposals are required to achieve a minimum rating of Code for Sustainable Homes level 4 rating, subject to scheme feasibility. Within the Wembley growth area, proposals will be expected (relative to their scale) to connect to, provide or contribute towards Combined Heat and Power plant, unless it can be demonstrated that such provision is not financially feasible."

[11] http://www.brent.gov.uk/tps.nsf/Files/LBBA-846/$FILE/2ndAug10%20small.pdf

3 Borough-wide analysis

3.1 Introduction and context

Objective:
To ascertain whether Maidstone should set sustainability targets matching the proposed national timetable, or whether Maidstone should set targets that pre-empt this timetable.

This chapter investigates the technical and financial implications of achieving various sustainability standards in different developments through the integration of sustainable energy measures at the building level. The objective is to identify whether such standards could realistically be required for any new buildings in the Borough without compromising their financial viability.

The approach adopted was as follows:

- Identify development types representative of the expected future growth in the Borough
- Make energy models for these developments using nationally approved software in order to identify solutions that could meet target standards, and make a high-level assessment of the financial implications of each.

A more general commentary on the implications of achieving higher sustainability standards in other non-residential development types is also presented towards the end of the chapter.

3.1.1 Background and approach to the study.

In accordance with national planning policy, the targets investigated are specified in terms of nationally described sustainable building standards, the Code for Sustainable Homes (CSH) and its non-residential equivalent, BREEAM (see Section 2.1.4 for further detail on these standards and their relationship to the national Building Regulations). In addressing the question raised as an objective (should Maidstone set sustainability targets that match or pre-empt the proposed national timetable?) only sustainable energy requirements have been considered at a technical level, in terms of the mandatory CSH/BREEAM requirements, while the costs of wider sustainability requirements were factored alongside energy costs into a high-level financial assessment. This reflects the fact that energy standards tend to have the most profound impacts on building design and structure, and also that wider sustainability measures are likely to be far more diffuse and variable between developments, meaning that any attempted modelling would not provide the level of accuracy required.

The national timetable considered is therefore that pertaining to Building Regulations Part L, currently proposed as stepping up to zero carbon in 2016 as follows:

- Part L 2010 – current standards.
- Part L 2013 – maximum CO_2 emissions threshold for new development drops by 25%.

- Part L 2016 – zero carbon[12] requirement for all new dwellings.
- Part L 2019 - zero carbon for all new non-residential development (earlier for certain development types).

For the purposes of this assessment, CSH Level 3 and BREEAM Very Good are considered to be in line with current national standards (Part L 2010) as they do not impose sustainable energy requirements beyond those of the Building Regulations. CSH Level 4 is considered in line with the proposed standards for 2013 (due to the 25% CO_2 reduction required) and CSH Level 6 is considered in line with the proposed standards for 2016, as these both ask for zero carbon development (although it is not clear at this stage whether the definition of zero carbon with be exactly the same for both Part L and CSH).

BREEAM levels are not as easy to link to Part L, as they are based on EPC ratings (see Section 2.1.4) and not raw CO_2 emissions, but in most cases achieving the energy standards of BREEAM Excellent is likely to be less onerous than meeting the proposed requirements of Part L 2013 (25% CO_2 reduction below Part L 2010) and thus BREEAM Excellent will be regarded as in line with (i.e. not exceeding) 2013 standards. For similar reasons, BREEAM Outstanding will be considered to be in line with the zero carbon requirements of 2019. Generally speaking, the largest part of the cost burden facing developers building to CSH and BREEAM standards will be the cost of the measures needed to meet the energy requirements which, as discussed, are equivalent to the requirements of the proposed iterations of Part L. This means that where CSH/BREEAM levels with energy requirements in line with the proposed national timetable are set, the majority of the cost facing developers at any point will stem from a national requirement, rather than as a direct result of Maidstone's policies. This point will be revisited throughout the report.

Given current uncertainties around the trajectory for improving national standards to 2016/2019, and the significant leap expected in 2016, it is not considered sensible for Maidstone to try to pre-empt the timetable except in the first stage (2011-13). Two options for target setting are thus presented below:

- <u>Targets with energy requirements in line with proposed national timetable</u>
  - 2012-2013
    - Code for Sustainable Homes Level 3 (residential)
    - BREEAM Very Good (non-residential)
  - 2013-2016
    - Code for Sustainable Home Level 4 (residential)
    - BREEAM Excellent (non-residential)
  - 2016 onwards
    - Code for Sustainable Home Level 6 (residential)
  - 2019 onwards
    - BREEAM Outstanding (non-residential)

[12] See *Carbon Compliance: What is the appropriate level for 2016? (interim report)* – Zero Carbon Hub 2010 http://www.zerocarbonhub.org/definition.aspx?page=8

- Targets with energy requirements pre-empting proposed national timetable
  - 2012-2016
    - Code for Sustainable Home Level 4 (residential)
    - BREEAM Excellent (non-residential)
  - 2016 onwards
    - Code for Sustainable Home Level 6 (residential)
  - 2019 onwards
    - BREEAM Outstanding (non-residential)

It is also worth noting that the introduction of Part L 2010 was delayed by six months (with final adoption in October 2010, rather than April as originally planned) and it is therefore possible that the uptake of future revision to Part L will be similarly delayed. Target frameworks such as the ones outlined above could therefore act as a useful "safeguard" to ensure energy and sustainability standards are stepped up according to the currently proposed timetable regardless of delays at the national level.

In order to understand the implications that pursuing either of these options would have on new development, only the standards that alternate between the options have been investigated in detail i.e. the standards that would be set between 2011 and 2013, as follows:

- Code for Sustainable Homes Level 3 (residential)
- Code for Sustainable Home Level 4 (residential)
- BREEAM Very Good (non-residential)
- BREEAM Excellent (non-residential)

The following sections outline the methodology employed in more detail.

3.1.2 Development types modelled

The implications of the different sustainability standards listed above were investigated in a series of development types. Discussion with Maidstone Borough Council's policy officers concluded that the following development types should be considered, given their potential relevance during the Core Strategy period:

- 3-bedroom terraced house
- 2-bedroom flat in a three storey block
- B8 Warehouse
- B1 Office
- Healthcare
- School
- Retail
- Leisure

Of these development types, four of these were investigated in detail using nationally-approved modelling software, and basic development dimensions and floor areas for each are presented in Table 3-1.

Table 3-1: Development types chosen and scenarios modelled

Development	Key dimensions	Floor area	Rationale behind chosen

			scenario
House	3 bedrooms 2 storeys Mid terrace	76m^2	Floor areas taken from CLG's 2008 and 2010 cost analysis reports on the Code for Sustainable Homes
Flat	2 bedrooms, 1st floor 3 storey block	63m^2	
B8 Warehouse	Single storey + Mezzanine	5,000 m^2	Real examples selected from Climate Consulting's bank of prior modelling projects
B1 Office	4 storeys	1,300m^2	

In addition to the above development models, a more general discussion on the implications of achieving BREEAM standards in offices, healthcare, schools, retail and leisure developments is presented at the end of the section.

3.2 Methodology

3.2.1 Technical analysis

The following methodology was used to model sustainable energy solutions to achieve the desired CSH and BREEAM targets for each development scenario:

5. Target Emissions Rates (see Section 2.1.3 were calculated using government-approved software SAP (for residential) and SBEM (B1 and B8).

6. Energy efficiency measures, based on Best Practice guidance from the Energy Saving Trust were applied to developments and modelled in SAP and SBEM. Such measures included building fabric insulation, air permeability reduction and low energy lighting.

7. Renewable energy technologies were sized according to the following principles, and modelled in SAP or SBEM.
   a. Solar photovoltaics: sized exactly to meet required targets (a discussion of implications in roof-space is given for each development type).
   b. Solar thermal: sized to meet 50% of year round hot water demand. Only modelled in residential developments, as hot water demand insufficient in B1 and B8.
   c. Ground Source Heap Pumps (GSHP) and Air Source Heat Pumps (ASHP): sized automatically in SAP for residential developments to meet 100% of space heating and hot water demand. In B1 and B8 sized to provide space heating and cooling to all zones except those that would normally be left unheated or unconditioned. Where GSHP on its own was not sufficient to meet the targets, a combination of GSHP and PV was investigated.
   d. Biomass: was only modelled in the flats and sized to meet 60% of the total heat and hot water demand. Not modelled in houses due to low heat demand. Not modelled in B1 or B8 as CO_2 emissions arising from heating and hot water account for less than 10% of overall CO_2 emissions in both, thereby limiting the potential savings from biomass in the school. Note that while biomass has strong potential to deliver CO_2 savings, there are associated concerns around the air quality impacts

of this technology, especially in relation to NOx and particulate emissions, and it is hence not advisable to set policy targets that are heavily reliant on the use of biomass.

NB: Wind turbines were not modelled in this analysis given that, at the level considered, any wind turbine used would likely be of the building-mounted variety and these are not currently considered a proven technology.

3.2.2 Financial analysis

Residential developments:

In order to give an indication of how the different sustainable energy solutions (to meet CSH 3 or 4) impact on the viability of the development, the approximate additional costs (to the developer) resulting from each have been estimated and then expressed as a percentage increase in the development cost of the development type under consideration. These development costs have been taken from the most recent report by the CLG (2010) *Code for Sustainable Homes: A Cost Review*[13]. Meanwhile the costs of energy efficiency measures and renewable energy technologies were taken from Climate Consulting's own bank of data from installers (see Section 6.2). Two further concerns were addressed in this analysis:

1. *CSH covers more than just energy: the costs of wider sustainability measures need to be added to the costs of the sustainable energy measures modelled in order to estimate an overall cost for each CSH Level.*
   - Cost data for "non-energy measures" have been sourced from the CLG (2010) cost review. While the costs vary between CSH Levels and between development types, they remain constant between the different energy strategies as there is no obvious reason why these strategies would affect the non-energy cost. These include the costs of the other mandatory elements of the relevant CSH level (e.g. water efficient sanitary-ware) and the cost of a typical range of measures that could be used to meet that level.

2. *It is important to identify which costs are a direct result of Maidstone's policies, as opposed to costs that would be a national requirement in any case. The financial analysis should thus exclude the costs of "national" requirements as explained below:*
   - The current national standards factored into this analysis are the Building Regulations Part L (2010), which impose energy requirements equivalent to those of CSH Level 3 (see subsection 2.1.4). While these standards are set to step up in 2013, only the 2011-13 period is being modelled in this analysis as this is the period in which different target options (CSH Level 3 or 4) are being proposed.
   - In calculating the costs of achieving CSH Level 3, therefore, only the "non-energy" costs (see point (1) above) have been factored into the calculation. The fact that the different sustainable energy solutions for achieving CSH Level 3 will vary in cost is not taken into account, as this is regarded as the inevitable range of costs of compliance with national standards.

[13] http://www.communities.gov.uk/documents/planningandbuilding/pdf/1501290.pdf

- In calculating the costs of achieving CSH Level 4, a “generic” energy cost of achieving Part L 2010/CSH Level 3 (from the CLG (2010) cost review) has been subtracted from the costs of each of the sustainable energy solutions modelled to achieve CSH Level 4. Thus the total cost of achieving CSH Level 4 is only the *additional* energy cost of each solution beyond Part L (2010) and the “non-energy” costs (see point (1) above).
- However, in both cases (CSH Level 3 and Level 4) a cost figure *including* the cost of meeting Part L is also given for reference.

Please note: An extra cost that has not been included in this analysis is the cost of contracting a CSH assessor (and any subcontractors) to undertake the CSH assessment from pre-design to the post-construction stage. The reason that this cost has not been included is that the variation between different developments will be so huge that it would be impossible to give a figure that would not be misleading in a large number of cases. Indeed, the assessor fees *per dwelling* of a full CSH assessment could range between £500 and £5,000 (or above). Factors contributing to the variation in cost include:

- Number of residential units in scheme (while the overall assessors’ fees will usually increase with number of units, this increase will tend to be quite small due to economies of scale, meaning that the cost charged for a CSH assessment *per dwelling* is likely to be much smaller for large residential developments than for single units).
- Complexity of scheme.
- Day rate/project rate charged by assessor.
- Prior knowledge of CSH on the part of developers, contractors and site operatives.

Non-residential developments:

A similar approach to costing CSH Levels was followed to assess the additional cost to new non-residential developments of achieving BREEAM Excellent. Development costs for a B8 Warehouse and B1 office were sourced from the Build Cost Information Service (BCIS), while energy efficiency and renewable energy costs were drawn from Climate Consulting’s installer data (as for the residential developments). The same two concerns addressed for the residential analysis were addressed here as follows:

1. *BREEAM covers more than just energy: the costs of wider sustainability measures need to be added to the costs of the sustainable energy measures modelled in order to estimate an overall cost for each BREEAM Level.*
    - Financial data for the “non-energy measures” required under BREEAM Excellent has been sourced from a variety of online reports by Faber Maunsell (AECOM) taking a similar approach to that employed by CLG in establishing the non-energy costs of CSH (i.e. including the cost of mandatory requirements under BREEAM – e.g. water efficiency – and a range of other measures that could be typically adopted to meet BREEAM Excellent).

2. *It is important to identify which costs are a direct result of Maidstone’s policies, as opposed to costs that would be a national requirement in any case. The financial analysis should thus exclude the costs of “national” requirements as explained below:*

- The current national standards factored into this analysis are the Building Regulations Part L (2010). The relationship between Part L and BREEAM is more complex than that between Part L and CSH, since the mandatory energy requirements of BREEAM relate to EPC ratings rather than a simple percentage reduction below TER (see Section 2.1.4).
- In calculating the costs of achieving BREEAM Excellent, therefore, each sustainable energy solution has been assessed to establish what level of renewable energy would be required to meet the Part L requirement, and what level is additionally required to meet BREEAM Excellent.
- The total cost of achieving BREEAM Excellent is thus only the *additional* cost of each sustainable energy solution beyond Part L (2010) and the "non-energy" costs (see point (1) above).
- However, a total cost figure *including* the cost of meeting Part L is also given for reference.

Please note: As with the residential analysis, the consultancy fees associated with the BREEAM assessment have not been in this analysis due the wide variation in these costs. For the development types under consideration, the fees charged by the BREEAM assessor might vary between £5,000 and £20,000 depending on numerous factors including whether the project is a one-off or part of a larger development, and day rate/project rate of the assessor.

3.3 Residential solutions

3.3.1 3-bed, 2-storey mid-terraced house

This development type is generally characterised by a significant heat and hot water demand and a favourable roof and ground to floor area ratio. Heat loss through building fabric will be relatively low as the surface of exposed walls is generally quite small compared to the walls that border other properties.

Solutions to meet CSH Level 3.

Table 3-2: Potential solutions to meet CSH Level 3 – 3-bed mid-terrace house

Solution	Details	DER ($kgCO_2/m^2$)	% reduction below TER	% increase on build cost excluding cost of meeting Part L *(figures in italics include cost of Part L)*
TER = 16.38				
All solutions include energy efficiency and wider sustainability measures				
Solar PV	0.4 kWp (c.3m²)	16.37	0.7	1 *(4)*
Solar thermal	3 panels (8.5m²)	15.44	5.7	1 *(9)*
ASHP	SAP 2009 default	21.98 *(TER = 27.15)*[14]	19.0	1 *(5)*

Cost analysis

[14] When modelling heat pumps in SAP, the software automatically assumes a baseline scenario of electric heating rather than gas heating and thus the TER increases accordingly.

Two cost increase figures are given. As discussed in Section 3.2.2, the first only shows the cost increase that would be directly attributable to Maidstone’s policy requirements by excluding the costs incurred in meeting Part L requirements. This figure thus includes the *additional* cost of each sustainable energy solution beyond Part L (2010) and the “non-energy” costs, but excludes the cost required to meet Part L (see Section 3.2.2 for full explanation) and represents a 1% increase in build cost. The second figure *(in italics)* includes the Part L costs and thus represents the true cost to the developer, despite this cost only being attributable in part to Maidstone’s policy requirements.

Please note – CSH assessment fees have not been included in the above analysis but, as a guideline, if the PV solution were followed, then the cost increases including the assessment fees could range from 2% to 6% (or up to 9% when including the cost of meeting Part L).

Renewable energy options

Requirement: Dwelling Emissions Rate (DER) must be no higher than Part L Target Emissions Rate (TER)

- Solar photovoltaics (PV): Given the roof to floor area ratio in most 3-bed houses, a PV installation can easily be sized to achieve either CSH Level 3 or 4.
- Solar thermal: A solar thermal system modelled in SAP to produce 50% of the dwelling’s hot water energy demand would be sufficient to enable this development to meet CSH Level 3, but not Level 4. If roof area permits, it could be possible to meet CSH Level 4 through the addition of PV panels, although this may be considered cost prohibitive in some cases.
- Air source heating (ASHP): An ASHP sized to meet 100% of the dwelling’s heat requirements, when modelled using SAP defaults will not quite meet CSH Level 4. It is possible that by using systems of a higher efficiency, or providing hot water through solar thermal panels, it may be able to meet this target.

Solutions to meet CSH Level 4

Table 3-3: Potential solutions to meet CSH Level 4 – 3-bed mid-terrace house

Solution	Details	DER ($kgCO_2/m^2$)	% reduction below TER	% increase on build cost excluding cost of meeting Part L *(figures in italics include cost of Part L)*
TER = 16.38				
All solutions include energy efficiency and wider sustainability measures				
Solar PV	1.2 kWp (c. 10m^2)	12.26	25.2	8 *(10)*
GSHP	SAP 2009 default	18.50 *(TER = 27.15)*[14]	31.2	8 *(10)*
ASHP + PV	SAP 2009 (ASHP) + 0.28 kWp (c.2m^2)	20.31 *(TER = 27.15)*Error! ookmark not defined.	25.2	6 *(8)*

Cost analysis

Two cost increase figures are given. As discussed in Section 3.2.2, the first only shows the cost increase that would be directly attributable to Maidstone's policy requirements by excluding the costs incurred in meeting Part L requirements. This figure thus includes the *additional* cost of each sustainable energy solution beyond Part L (2010) and the "non-energy" costs, but excludes the cost required to meet Part L (see Section 3.2.2 for full explanation) and represents a 6 - 8% increase in build cost. The second figure *(in italics)* includes the Part L costs and thus represents the true cost to the developer (an 8-10% increase), despite this cost only being attributable in part to Maidstone's policy requirements.

Please note – CSH assessment fees have not been included in the above analysis but, as a guideline, if the air source heating and PV solution were followed, then the cost increases including the assessment fees could range from 6% to 11% (or up to 14% when including the cost of meeting Part L).

Renewable energy options

Requirement: Dwelling Emissions Rate (DER) must be at least 25% lower than Part L Target Emissions Rate (TER)

- Solar photovoltaics (PV): see "Solutions to meet CSH Level 3" above
- Ground source heating (GSHP): A GSHP sized to meet 100% of the dwelling's heat requirements using SAP's default assumptions about system efficiency could achieve CSH Level 4 without undue ground area requirement.
- Air source heating (ASHP) and PV: The addition of PV panels to the ASHP strategy can bring CO_2 savings to the level required to achieve CSH Level 4.

3.3.2 Mid-floor flat in small block

As with the house, this development type will usually see a significant heat and hot water demand, and low overall heat loss through building fabric. The roof to floor area ratio is likely to be less favourable than for a typical house, as larger flatted developments tend to be more compact and have more storeys.

Solutions to meet CSH Level 3.

Table 3-4: Potential solutions to CSH Level 3 – 2-bed mid-floor flat (in 3 storey block)

Solution	Details	DER ($kgCO_2/m^2$)	% reduction below TER	% increase on build cost excluding cost of meeting Part L *(figure in italics includes cost of Part L)*
TER = 21.02				
Solution includes energy efficiency and wider sustainability measures				
Solar Thermal	1 panel ($2.3m^2$)	17.19	18.2	1 *(4)*

Cost analysis

Two cost increase figures are given. As discussed in Section 3.2.2, the first only shows the cost increase that would be directly attributable to Maidstone's policy requirements by excluding the costs incurred in meeting Part L requirements. This figure thus includes the *additional* cost of each sustainable energy solution beyond Part L (2010) and the "non-energy" costs, but excludes the cost required to meet Part L (see Section 3.2.2 for full explanation) and represents a 1% increase in build cost. The second figure *(in italics)* includes the Part L costs and thus represents the true cost to the developer, despite this cost only being attributable in part to Maidstone's policy requirements.

Please note – CSH assessment fees have not been included in the above analysis but, as a guideline, the cost increases including the assessment fees could range from 2% to 9% (or up to 11% when including the cost of meeting Part L).

Renewable energy options

Requirement: Dwelling Emissions Rate (DER) must be no higher than Part L Target Emissions Rate (TER)

In this model it was possible to meet CSH Level 3 through energy efficiency measures alone, suggesting that in flatted developments similar to the one modelled, renewable energy technologies may not be required (unless a separate renewable energy target is imposed). Nevertheless, a solar thermal system modelled in SAP to produce 50% of the dwelling's hot water energy demand would be sufficient to enable this development to meet CSH Level 3, but not Level 4, so it has been included as a solution here.

Solutions to meet CSH Level 4

Table 3-5: Potential solutions to meet CSH Level 4 – 2-bed mid-floor flat (in 3 storey block)

Solution	Details	DER ($kgCO_2/m^2$)	% reduction below TER	% increase on build cost excluding cost of meeting Part L *(figures in italics include cost of Part L)*
TER = 21.02				
All solutions include energy efficiency and wider sustainability measures				
Solar PV	0.3 kWp (c.2.5m^2)	15.71	25.3	6 *(8)*
GSHP	SAP 2009 default	21.62 (TER = 35.28) [14]	38.8	11 *(14)*
ASHP	SAP 2009 default	23.26 (TER = 35.28) [14]	34.1	8 *(11)*
Biomass	Wood pellet	10.96	47.9	4 *(7)*

Cost analysis

Two cost increase figures are given. As discussed in Section 3.2.2, the first only shows the cost increase that would be directly attributable to Maidstone's policy requirements by excluding the costs incurred in meeting Part L requirements. This figure thus includes the *additional* cost of each sustainable energy solution beyond Part L (2010) and the "non-energy" costs, but excludes the cost required to meet Part L (see Section 3.2.2 for full explanation) and represents a 4 – 11 % increase in build cost. The second figure *(in italics)* includes the Part L costs and thus represents the true cost to the developer (a 7-14% increase), despite this cost only being attributable in part to Maidstone's policy requirements.

The higher end cost increases from the heat pump solutions (relative to the terraced house model) are largely an artefact of comparing similar cost of technology use against a lower overall build cost, while the relatively cheap biomass solution shows how economies of scale can be achieved where communal heating solutions are employed.

Please note – CSH assessment fees have not been included in the above analysis but, as a guideline, if the PV solution were followed, then the cost increases including the assessment fees could range from 6% to 13% (or up to 16% when including the cost of meeting Part L).

Renewable energy options
Requirement: Dwelling Emissions Rate (DER) must be at least 25% lower than Part L Target Emissions Rate (TER)

- Solar photovoltaics (PV): A 3-storey block of flats is likely to provide sufficient suitable roof-space for the installation of PV panels to meet CSH Level 4. Blocks with additional storeys are likely to have a lower roof to floor area ratio and may not support sufficient numbers of panels.
- Heat pumps (GSHP and ASHP): In this model, both ASHP and GSHP can comfortably meet CSH Level 4 without the addition of PV panels. There may not be sufficient ground space to support separate GHSP systems for all the flats in a block, in which a case a communal system could be investigated.
- Biomass: The use of wood pellet heating would enable development to significantly exceed the energy requirements of CSH Level 4, as a high proportion of the development's space heating and hot water requirements will be met in this way.

3.4 Non-residential solutions

3.4.1 B1 Office, 4 storeys, 1,300m^2

The energy demand profile of this development type is very different from the residential developments hitherto modelled, with a much higher electricity demand relative to the heat demand, and a very low hot water demand. The roof to floor area ratio is likely to be unfavourable towards solar technologies given the number of storeys.

Table 3-6 details the implications of adding renewable energy technologies on the building's performance against the BREEAM Excellent (EPC rating lower than 40). As there are no mandatory energy standards associated with BREEAM Very Good, no modelling was conducted.

Table 3-6: Potential solutions to achieve BREEAM Excellent – B1 office (1,300m²)

Solution	Details	EPC rating	% increase on build cost excluding cost of meeting Part L *(figures in italics include cost of Part L)*
All solutions include energy efficiency and wider sustainability measures			
GSHP + PV	GSHP 45kW PV 15kWp (c. 120m²)	39	5 *(13)*

Cost analysis

As for the residential analysis, two cost increase figures are given. The first only shows the cost increase that would be directly attributable to Maidstone's policy requirements by excluding the costs incurred in meeting Part L requirements. This figure thus comprises the cost of the GSHP + PV solution beyond Part L (2010) and the "non-energy" costs (see Section 3.2.2 for full explanation).The second figure *(in italics)* includes the Part L costs and thus represents the true cost to the developer, despite this cost only being attributable in part to Maidstone's policy requirements.

Please note – BREEAM assessment fees have not been included in this analysis, but while likely to be more expensive than CSH fees, the additional cost *relative to build cost* is unlikely to be significant or to materially alter the figures shown above.

Renewable energy options

Requirement: Energy Performance Certificate (EPC) rating must be less than or equal to 40.

Using GSHP to provide space heating and cooling to all zones except those that would normally be left unheated or unconditioned did not yield the required EPC rating for BREEAM Excellent. Similarly, there was insufficient roofspace to achieve the target through PV alone. Combining the solutions achieved an EPC rating just within the required threshold.

3.4.2 B8 Warehouse, 5000m²

This will have a similar energy profile to the B1 Office, with a large proportion of the demand coming from electrical requirements. As warehouses are typically low-rise (in this case a single storey with a mezzanine) the roof to floor area ratio is likely to be more favourable to PV than in the B1 Office.

Table 3-7 details the implications of adding renewable energy technologies on the building's performance against the BREEAM Excellent (EPC rating lower than 40).

Table 3-7: Potential solutions to achieve BREEAM Excellent – B8 warehouse (5,000m²)

Solution	Details	EPC rating	% increase on build cost excluding cost of meeting Part L *(figures in italics include cost of Part L)*
All solutions include energy efficiency and wider sustainability measures			
PV	120kWp (c. 960m²)	39	2 *(28)*

GSHP + PV	GSHP 240kW PV 81kWp (c. 650m^2)	39	2 *(34)*
ASHP + PV	ASHP 240kW PV 110kWp (c. 880m^2)	39	2 *(34)*

Cost analysis

As for the residential analysis, two cost increase figures are given. The first only shows the cost increase that would be directly attributable to Maidstone's policy requirements by excluding the costs incurred in meeting Part L requirements. This costs thus includes the *additional* cost of each sustainable energy solution beyond Part L (2010) and the "non-energy" costs (see Section 3.2.2 for full explanation).The second figure *(in italics)* includes the Part L costs and thus represents the true cost to the developer, despite this cost only being attributable in part to Maidstone's policy requirements. As can be seen, there is an enormous disparity between the two figures, which is a reflection of the energy requirements in Part L for warehouse developments[15] and also a reflection of the fact that the sustainable energy costs represent by far the largest fraction of the cost of achieving BREEAM Excellent.
Please note – BREEAM assessment fees have not been included in this analysis, but while likely to be more expensive than CSH fees, the additional cost *relative to build cost* is unlikely to be significant or to materially alter the figures shown above.

Renewable energy options

Requirement: Energy Performance Certificate (EPC) rating must be less than or equal to 40.

- Solar Photovoltaics (PV): Due to roofspace availability, there was no technical constraint to meeting BREEAM Excellent using PV (the target could indeed be significantly exceeded on this development, but only the required area of PV panels has been shown here).

- Heat pumps and PV: As with the B1 office, neither GSHP or ASHP alone can achieve the target. In this case, there is sufficient roofspace to add enough PV to bring the EPC rating down to the required level.

3.4.3 The implications of BREEAM in other non-residential developments

The section that follows highlights key findings from a number of existing studies on the implications of achieving BREEAM ratings in offices, healthcare centres, schools, retail developments and leisure complexes.

Offices and healthcare centres

A study by Cyril Sweett and the Building Research Establishment (2005) *Putting a Price on Sustainability* demonstrated that significant improvements in the sustainability performance of a many non-residential developments can be achieved at very little additional cost. Indeed, as shown in Table 3-8, careful consideration of designs and specification at

[15] As discussion in Section 2.1.3, the average % reduction from TER 2006 and TER 2010 is 25% for non-residential development, but is apportioned differently between different development types. The largest % decrease (34%) is required for warehouse developments.

an early stage can minimise cost premiums associated with the higher standards and even result in cost savings in lower standards.

Table 3-8: Cost implications of BREEAM standards in offices and healthcare centres (Cyril Sweett and BRE 2005)

Building	Additional cost of achieving BREEAM rating (% of capital cost)		
	Good	***Very Good***	***Excellent***
Naturally ventilated office	-0.3 to -0.4	-0.4 to 2	**2.5 to 3.4**
Air-conditioned office	0 to 0.2	0.1 to 5.7	**3.3 to 7.0**
PFI-procured healthcare centre	0	0	**0.6 to 1.9**

Life-cycle savings associated with energy and water costs were included in this study, suggesting that a study concerned purely with up front costs to developers could yield less favourable figures. However, it must be remembered that since 2005 the energy requirements of the Building Regulations Part L have stepped up two occasions, meaning that a significant (but difficult to determine) portion of the additional capital cost associated with BREEAM Excellent can now be regarded as a national requirement, and therefore not an additional burden imposed by Maidstone.

The report also cites development location and site conditions as having a major impact on costs associated with achieving higher ratings. Effective management of the development process, and considering sustainability at an early stage are also critical to ensuring all low cost options identified and achieved.

Schools

A more recent report by Surgenor (BRE) & Butterss (Faithful & Gould) (2008) *Putting A Price on Sustainable Schools* identifies additional capital costs associated with a range of sustainable and low- or zero-carbon solutions for a primary school and secondary school case study, which are shown in Table 3-9.

Table 3-9: Cost implications of BREEAM standards in schools (Surgenor (BRE) and Butterss (Faithful and Gould) 2008)

Building	Additional cost of achieving BREEAM rating (% of capital cost)		
	Very Good	***Excellent***	***Low/zero carbon***
Primary school	1.8 to 3.0	**5.9 to 9.9**	2.1 to 9.8
Secondary school	0.8 to 2.7	**3.9 to 4.4**	2.7 to 15.3

As can be seen, the cost increases of achieving BREEAM Excellent are of a similar order if slightly higher than those for the offices and healthcare examples. Again, it must be remembered that the baseline of comparison has changed since this report due to the increased energy requirements of Part Land the mandatory national requirements have increased themselves.

Retail and leisure developments

There is a BREEAM scheme for retail development, which operates in much the same way as the other BREEAM schemes. While there are examples of supermarkets that have achieved “Excellent” ratings (e.g. Morrisons in Kidderminster and Sainsbury’s, Dartmouth) there are concerns that achieving these standards is too onerous for small-scale retail developments, partly due to the expensive technical requirements associated with them (e.g. pump valves for air condition refrigerant, often needed to achieve the requisite number of credits) but also due to the high cost of conducting an assessment.

Meanwhile, no BREEAM scheme currently exists for leisure complexes, and these currently have to be assessed under the “BREEAM Other Buildings” scheme. Unsurprisingly, perhaps, there are fewer examples of such BREEAM standards being achieved in Leisure Centres, although a much-celebrated recent case is that of Bletchley Leisure Centre in Milton Keynes, comprising a swimming pool, sports hall, health and fitness suite and numerous other facilities. With a view to the Leisure Centre being a lynchpin in the sustainable regeneration of the Bletchley Town Centre, Milton Keynes Council set a target of a BREEAM Excellent rating for the facilities. Just some of the features included in the design of the leisure centre were:

- Biomass boiler
- Increased insulation
- Extensive sub-metering
- Consideration of natural ventilation wherever possible
- Responsible sourcing of materials
- A-rated materials wherever possible
- Minimising water consumption
- Consideration of pollution risks in use wherever possible

Overall, the building scored well in the BREEAM assessment through excellent construction management, access to public transport and consideration of energy use, health and well-being and responsible sourcing of materials[16].

While the cost implications of achieving these assessments can vary significantly between projects, the below table (from a previous study by Climate Consulting[17] gives an example of the potential costs involved.

[16] For further information see: www.breeam.org/filelibrary/Case%20studies/Case_Study_Bletchley_Leisure_Centre.pdf
Another leisure centre, currently under construction, which is targeting a BREEAM Excellent rating, forms part of the Loampit Vale (http://renaissanceatloampitvale.co.uk/) redevelopment in the London Borough of Lewisham.

[17] CEN (2009) *Resource Efficiency Viability Study for Opportunity Peterborough*.

Table 3-10: Cost implications of BREEAM in a hypothetical leisure development (CEN, 2009)

BREEAM Level achieved	Strategy	Baseline build cost	Cost of strategy	% increase in cost due to BREEAM
BREEAM Excellent	Advanced Energy Efficiency + Gas CHP + Wider sustainability measures	£9 million	£300,000	4%
BREEAM Outstanding	Advanced Energy Efficiency + Gas CHP and PV + Wider sustainability measures	£9 million	£1,500,000	17%

As can be seen from the table, this modelled instance indicates that it may be possible to achieve a BREEAM Excellent rating at a low increase to build cost, through the use of a Combined Heat and Power. Please note that adjustments have not been made to account for the changes to the Building Regulations since the study was conducted, and that BREEAM assessment fees have not been included in this analysis. Adjusting the former would result in a reduction in the cost directly attributable to Maidstone Borough Council (see explanation in Section 3.2.2) while including the latter would result in a small increase.

3.5 Conclusions

Cost figures presented in the previous sections have been obtained through a variety of methods, and even where modelling exercises have been conducted by Climate Consulting expressly for this study, the raw data inputted into the models come from a wide range of sources. While a table summarising the cost figures is given in the table below, it is essential to be cautious when comparing these data.

Table 3-11: Summary of CSH/BREEAM cost analysis

Development type	CSH/BREEAM Level	% increase on build cost (excluding Part L cost)	% increase on build cost (including Part L cost)	Source
House	CSH Level 3	1	4 – 9	Climate Consulting Modelling
	CSH Level 4	6 – 8	8 – 10	Climate Consulting Modelling
Flat	CSH Level 3	1	4	Climate Consulting Modelling
	CSH Level 4	4 – 11	7 – 14	Climate Consulting Modelling
Office	BREEAM Very Good	(not modelled)	0 – 6	Literature review
	BREEAM Excellent	5	13	Climate Consulting Modelling
Warehouse	BREEAM Excellent	2	28 – 34	Climate Consulting Modelling

Development type	CSH/BREEAM Level	% increase on build cost (excluding Part L cost)	% increase on build cost (including Part L cost)	Source
Healthcare	BREEAM Very Good	(not modelled)	0	Literature review
	BREEAM Excellent	(not modelled)	0 – 2	Literature review
School	BREEAM Very Good	(not modelled)	1 – 3	Literature review
	BREEAM Excellent	(not modelled)	4 – 10	Literature review
Leisure	BREEAM Excellent	(not modelled)	4	Climate Consulting Modelling

As shown above, the costs associated with achieving the standards considered "in line with proposed national timetable" (CSH Level 3 and BREEAM Very Good) in most cases appear to result in an increase to build cost of 5% or lower. The results of the development modelling also show that is technically possible to achieve CSH and BREEAM targets "pre-empting the proposed national timetable" by adopting solutions that will mostly result in a 10% (or smaller) increase in build cost, if Part L costs are not included in the calculation.

However, while separating the additional costs from the mandatory (i.e. Part L) costs gives an indication of the financial impact that Maidstone Borough Council would have by imposing a policy based on CSH/BREEAM costs, it does not alter that fact that developers will still be faced with a total cost that includes cost of achieving the mandatory Part L standard as well as the additional costs of CSH/BREEAM (see Section 3.2.2 for full explanation). This is most starkly illustrated in the warehouse model, where the bulk of the cost of achieving BREEAM Excellent comes from the energy requirements of this standard, which essentially overlap with the current requirements of Part L. This poses an interesting question, which must be left to Maidstone Borough Council to resolve – should the overall cost (including Part L) of achieving CSH/BREEAM be taken into account when setting policy, or should only the additional cost (excluding Part L) be the sole consideration? A high overall cost (e.g. 28-34% increase on build cost for the Warehouse) might understandably deter the Council from setting policy requirements that could entail this cost (e.g. BREEAM Excellent for all new commercial development) but alternatively, it is possible that only a fraction of this cost could be additional to the cost associated with Part L.

Meanwhile, as discussed throughout the preceding sections, another cost not factored into the main calculation (but estimated the cost analyses for each development type) is that of the fees charged by CSH/BREEAM assessors which, particularly in residential and small non-residential development can increase the overall cost burden and as such may be advisable to consider when setting policy.

Two further issues that the Council should take into consideration when making a decision on sustainability policy are given below.

- Sustainability as a selling point: It is expected that at least part of the cost of sustainability could be recovered by adding a premium to the price of the dwelling. A research study conducted by the Sponge Sustainability Network in 2006[18] suggested that sustainability is generally attractive to home owners, and particularly that:

  i. 75% of home owners are concerned over how much electricity/gas they use

  ii. Home owners are prepared to pay extra to live in a sustainable housing development

  While such trends will inevitably have taken a knock in recent years due to the adverse economic conditions, it should be remembered that now, more than ever there are a raft of incentives for incorporating renewable energy on site, such as the feed-in tariff and possible Renewable Heat Incentive, and these may well increase the willingness of buyers to pay a premium for sustainability features.

- The need to prepare for higher CSH and BREEAM levels: The current framework of future changes to Part L features a highly ambitious leap from the 2013 requirement (maximum CO_2 emissions 44% lower than Part L 2006) to the zero carbon requirement of 2016. The non-residential requirement, although less clear, is also ambitious, with a zero carbon requirement expected by 2019.[19]

  Achieving these targets, especially the zero carbon target, is likely to be technically very challenging and there is a clear need for the industry to prepare as much as possible in advance of these targets. Incorporating "ahead of schedule" targets such as those proposed in this study into a Core Strategy is one way of effectively forcing developers to prepare. As discussed in Section 2.2 some other boroughs (such as the London Borough of Havering) have already integrated CSH Level 4 as a planning requirement and are expecting developers to comply on most new build developments. Developers who work ahead of national targets in this manner may well get a competitive advantage over rivals in the industry, thus providing them with an incentive to comply with more stringent policies.

It is important to remember that these scenarios, while chosen as a potential reflection of future development in Maidstone, cannot be absolutely comprehensive. There will be new development in Maidstone that does not conform to any of the types modelled above and, furthermore, there will be examples of development within the seven categories modelled that differ enormously from the scenarios chosen. It is therefore to be expected that not only will the solutions identified in Sections 3.4 and 3.5 for a certain development scenario not necessarily apply to all developments of that type (e.g. it may not always be possible to meet both the BREEAM Excellent in a B1 office through the use of a combination of GSHP and PV) but also that certain developments will be able to meet the targets through solutions other than those identified

[18] *Eco Chic or Eco Geek? The Desirability of Sustainable Homes* - www.spongenet.org

[19] See Part L consultation and summary: http://www.communities.gov.uk/publications/planningandbuilding/partlf2010consultation

in this study. The results of the study should therefore be interpreted as a representation of what is *likely* to be possible, not what is universally achievable.

It must also be re-iterated that Maidstone Borough Council is independently preparing a viability model to determine the level of development contributions for necessary infrastructure and for affordable housing that will be sought. This will inevitably affect the final decision on the level of sustainable energy standards that should be imposed.

4 Area-based analysis

4.1 Introduction and context

Objective:

1. To establish the potential for decentralised energy networks in Maidstone, and identify specific areas of high potential that may merit a more stringent sustainable energy policy standard.
2. To compare costs of achieving CSH (and BREEAM) levels through connection to a decentralised energy network and through microgeneration

The rationale behind this analysis is to test the common perception that connecting to a decentralised energy network will enable developments to achieve CO_2 reductions more cost-effectively than by employing on-site (microgeneration) strategies. Decentralised energy provision is a broad term of reference, but usually refers to the communal provision of heat and sometimes power and cooling. At the simplest level this can take the form of a communal boiler in a block of flats, while at the grandest scale it can involve city-wide heat and power networks as found in many Scandinavian towns and, increasingly, as being developed in the UK. One technology more than any others is associated with decentralised energy provision, and that is Combined Heat and Power (CHP) – see Section 4.1.1 for further detail.

4.1.1 Combined Heat and Power.

A CHP system simultaneously generates electricity and heat. An engine, usually fired by gas, biofuel or biomass, produces electricity, and the heat generated as a by-product of this process is recovered and can be distributed across a site for space and water heating. CHP systems are able to achieve significant CO_2 savings for two reasons. Firstly, the electricity is generated locally from gas or a renewable source, resulting in lower CO_2 emissions than conventional grid electricity which derives (in part) from inefficient coal-fired power stations and suffers higher transmission losses. Secondly, the heat generated is a by-product, and therefore results in no extra CO_2 emissions, thus reducing the CO_2 emissions arising from space and water heating (by exactly how much will depend on the proportion of the site's heat demand met by CHP).

Certain characteristics of sites that lend them to decentralised heat provision, of which two are particularly important for sizing CHP systems:

- High heat demand (due to scale of proposed development)
- Near-constant heat demand (due to mix of uses which give complementary heat profiles)

CHP plants are conventionally sized on the basis of heat demand since, unlike excess electricity which can be exported to the grid, excess heat will simply be wasted except in rare cases where it can be "dumped" onto other sites. Furthermore, CHP systems are not sized to meet total heat demand, as this would involve a hugely inefficient pattern of frequent modulation and switching the plant on and off which would result in wasting heat as well as severely reducing the life of the plant. Systems are therefore normally sized to meet *base-load heat demand*, which usually corresponds to hot water demand. Electrical output (kWe) will depend on the efficiency of the appliance used – the more efficient the appliance, the higher the electrical output relative to the heat output (kWth), as this means that less energy has been wasted during electricity production. Electrical output is invariably lower than the thermal output, although it is usually greater than half.

4.1.2 Other forms of energy provision

Aside from the more "conventional" forms of decentralised energy provision (gas- and biomass-fired CHP), another potential source of heat and/or electricity is from the treatment of waste. The most common Energy from Waste (EfW) process produce electricity directly through incineration, while others first produce a fuel (e.g. methane or methanol) which is then combusted to produce energy. An example of this second type of process in *anaerobic digestion* (AD) whereby micro-organisms are used to break down biodegradable material in the absence of oxygen to produce a biogas, which contains methane. The methane can then be combusted to produce electricity, or fed into a CHP plant to produce electricity and heat (which can be used either to heat buildings or to heat the anaerobic digesters themselves, a necessary part of the process). The CO_2 emitted from this combustion process is considered "carbon neutral" as it is released instead of the far more carbon-intensive methane. AD is a well-established technology in the water industry, and two thirds of the UK's sewage sludge is currently treated in AD plants. Beyond this, however, the technology is still in its infancy, with under 50 plants operational in the UK, including Biffa Leicester's composting facility, based in Wanlip, which accepts municipal biodegradable waste and has a potential power output of 1.5 MW.

An example of an incineration process is the Allington Quarry Waste Management Facility, just outside the Maidstone borough boundary, which takes non-hazardous waste from households and businesses in Kent and the surrounding area for recycling and energy recovery. Kent County Council has agreed a long-term contract with Kent Enviropower, the operators of the facility to recover energy from over 300,000 tonnes of waste each year. The energy from waste facility has the potential to generate at least 35 MW electricity through its fluidised bed technology, which would be sufficient to power the entire town of Maidstone. It should be noted that heat is not currently being recovered from this plant, although a nearby heat source of heat demand could represent a viable commercial opportunity for doing so.

4.2 Methodology

In order to meet the objective outlined in Section 4.1, it was necessary to build a clear picture of projected development across Maidstone over the plan period (to 2026). This picture, or development schedule, enabled us to:

- Estimate the energy demand expected across Maidstone as a result of new development
- Understand the distribution of this energy demand across sites and phases
- Identify clusters of sites where energy demand could be sufficient to establish a decentralised energy network

Further opportunities were then assessed for each cluster identified to establish the strength of the potential for a decentralised energy network. This methodology is discussed in greater detail in the following subsections.

4.2.1 Building up a development schedule

Information on possible future development sites was provided by Maidstone Borough Council (see list of data sources in Section 6.1) and subjected to a detailed review in order to provide a schedule of development opportunities that may occur over the plan period. Potential residential site allocations were based around five parallel scenarios.

- **Scenario A – 8,200 (dispersed):**
  - 8,200 new homes (of which 1,170 to allocate), dispersed across urban and rural sites
- **Scenario B – 10,080 (dispersed)**
  - 10,080 new homes (of which 3,240 to allocate) dispersed across urban and rural sites
- **Scenario C – 10,080 (SDA)**
  - 10,080 new homes (of which 3,240 to allocate) with a high concentration in an urban extension in South East Maidstone ("Strategic Development Area")
- **Scenario D – 11,000 (dispersed)**
  - 11,000 new homes (of which 4,267 to allocate) dispersed across urban and rural sites
- **Scenario E – 11,000 (SDA)**
  - 11,000 new homes (of which 4,267 to allocate) with a high concentration in an urban extension in South East Maidstone ("Strategic Development Area")

Alongside these residential sites, employment and retail sites were added to the schedule. Where available information supported it, non-residential growth scenarios were aligned with those of the residential sites. In all scenarios, projected development volume was split into three phases: 2011-16, 2017-21, 2022-26.

4.2.2 Estimating energy demand and its distribution across the borough

For the purposes of this analysis, the only energy demand modelled was the base-load heat demand (see Section 4.1), as this is typically how CHP systems are sized.

- Houses and flats: in residential developments, base-load usually corresponds to hot water demand, so these figures were taken from the SAP assessments conducted in Section 3.3. In both cases, demand was taken assuming that CSH Level 3 was already being achieved, to reflect the requirements of the current Building Regulations. No reduction in demand was assumed due to phasing, as future demand reduction as a result of changes to Part L is likely to predominantly affect space heating and electricity.
- Non-residential development: overall heat demand was taken from benchmarks such as CIBSE Guide F, and base-load calculated in Climate Consulting's internal CHP modelling tool.

These raw figures were then fed into the development schedule to build a base-load heat demand schedule for all sites in each of the five development scenarios.

4.2.3 Identifying site cluster and establishing opportunities and constraints

1. Areas with adjacent or overlapping residential and non-residential sites were selected as "cluster centres".

2. Sites near to cluster centres were assessed under the following criteria:
   a. Is the nearest edge of the site further than c. 500m[20] away from the nearest edge of the cluster centre?
      i. If NO, then include site in cluster
      ii. If YES, then move on to question (b)
   b. Is the baseload heat demand of the site greater than 500,000kWh?
      i. If NO, then exclude site from cluster
      ii. If YES, then move on to question (c)
   c. Is the nearest edge of the site further than c. 1km[21] away from the nearest edge of the cluster centre?
      i. If NO, then include site in cluster
      ii. If YES, then exclude site from cluster.

3. Each cluster was then assessed by its base-load heat demand to establish its suitability for biomass CHP.
   a. This was measured based on 500 kW_{th} being the smallest commercially available biomass CHP system, and assuming lower limit of 5,000 hours operation per year meaning that a 2,500,000kWh base-load heat demand would be required.[22]
   b. The reason for assessing this is that most biomass CHP plants have a high heat demand threshold and serve as a good indicator of whether a site cluster is likely to attract commercial interest from energy providers. While site cluster too small for biomass CHP could well be big enough for other forms decentralised energy provision (e.g. gas CHP, biomass heating) they are likely to be too small to attract outside investment, and it would therefore be less advisable to base any policy stipulations around them.

4. Further opportunities were considered at for each site cluster, including those found likely to be too small for biomass CHP. These opportunities were:
   a. Are there any "anchor loads" (large points of heat demand, such as hospitals, leisure centres, supermarkets and potential schools) that would increase the potential viability of a decentralised energy scheme?
   b. Are there any existing sources of heat or power that could be used to supply the site cluster?

[20] These distances, based on prior work by Climate Consulting and various engineering partners. are a reflection of the maximum lengths of pipe-run that could be included while ensure the network is still likely to be commercially viable.

[21] See footnote above

[22] While there are certainly examples of biomass CHP with lower thermal outputs (e.g. Talbotts indirect combustion fired hot air microturbine which runs at 200kW_{th}), at the time of writing, biomass CHP is still a relatively under-used technology with few successful examples in the UK, and a conservative approach, as endorsed by organisations such as the Biomass Energy Centre (www.biomassenergycentre.org.uk) and the energy services company Vital Energi (www.vitalenergi.co.uk) has thus been adopted.

4.3 Results of cluster analysis

Scenario A: 8,200 – no suitable clusters identified

Scenario B: 10,080 (dispersed) and Scenario D: 11,000 (dispersed)

Cluster	Sites in cluster	Base-load heat demand (kWh/year)	Suitable for Biomass CHP?	Anchor loads ?	Nearby energy source?	Suitability for DE provision
Cluster 1	North West Maidstone	3,080,000 (3,243,000)*	Likely	*Primary school *Maidstone Hospital	Allington Incinerator	High
Cluster 2	South East Maidstone	2,211,000	Possible	*Sports Hall, *Swimming Pool	-	Medium
Cluster 2b	As for Cluster 2, plus South Maidstone	2,862,000	Likely	*Sports Hall, *Swimming Pool	-	High
Cluster 3	Staplehurst (1)	528,000	Unlikely	*Supermarket	-	Medium to Low
Cluster 3b	As for Cluster 3, plus Staplehurst (2)	775,000	Unlikely	*Supermarket	-	Medium to Low
Cluster 4	**Syngenta/Yalding**	993,000	Unlikely	None	-	Low

Scenario C: 10,080 (SDA):

Cluster	Sites in cluster	Total base-load heat demand (kWh/year)	Sufficient for biomass CHP?	Anchor loads ?	Nearby energy source?	Suitability for DE provision
Cluster 1	Strategic Development Area	7,395,000	Likely	*Sports Hall, *Swimming Pool *3 no. primary schools *Care services	-	Very High
Cluster 2	**Syngenta/Yalding**	993,000	Unlikely	None	-	Low

Scenario E: 11,000 (SDA):

Cluster	Sites in cluster	Total base-load heat demand (kWh/year)	Sufficient for biomass CHP?	Anchor loads ?	Nearby energy source?	Suitability for DE provision
Cluster 1	North West Maidstone	2,383,000 (2,546,000)*	Possible	*Primary school *Maidstone Hospital	Allington Incinerator	Medium
Cluster 2	Strategic Development Area	7,395,000	Likely	*Sports Hall, *Swimming Pool *3 no. primary schools *Care services	-	Very High
Cluster 3	Staplehurst (1)	528,000	Unlikely	*Supermarket	-	Medium to Low
Cluster 3b	As for Cluster 3, plus Staplehurst (2)	726,000	Unlikely	*Supermarket	-	Medium to Low
Cluster 4	**Syngenta/Yalding**	993,000	Unlikely	None	-	Low

4.4 Summary of key opportunities

Of the opportunities assessed, three stand out as particularly meriting further investigation: the SDA itself (in Scenarios C and E) and two clusters of sites in Scenarios B and D. No opportunities were identified in Scenario A.

Scenario C and Scenario E

1. **Strategic Development Area**
   This represents the most obvious opportunity for decentralised energy provision as the scale of development will create a high heat demand and the load profiles created by the wide mix of uses on site (including potential anchor loads schools, sports halls and swimming pools) would be extremely well suited by a CHP system. This type of development scenario is also likely to represent an attractive commercial opportunity for an Energy Services Company (ESCo) who could potentially assume some or all of the financial risk of establishing a decentralised network on site.

Scenario B and Scenario D

1. **South East (and South) Maidstone**
   Even in dispersed development scenarios, the high level of heat demand created by residential sites in the South East (and South) Maidstone area, coupled with non-residential uses and potential anchor loads mean that these sites also represent a strong potential opportunity for a decentralised energy network. The smaller scale of development in these scenarios inevitably reduces the likelihood of attracting ESCO involvement, but certainly does not rule it out altogether.

2. **North West Maidstone**
   This is the only other cluster of sites with a heat demand sufficient to suggest a strong opportunity for a decentralised energy network, and only then in Scenarios B and D. The presence nearby of Allington Incinerator Waste Management Facility represents both a potential source of electricity (electricity is already being generated in an Energy from Waste process) but also a source of heat, were heat recovery technologies to be explored. Implications of decentralised energy networks for achieving CSH and BREEAM standards

4.5 Implications of decentralised energy networks for achieving CSH and BREEAM standards

Finally it is time to address the second part of this chapter's objective – a comparison of the costs of achieving CSH and BREEAM levels through decentralised energy provision and through microgeneration.

Given the level of information currently available, it is difficult to make any absolute assessment of the implications that connecting to a decentralised energy network will have on a development's ability to meet different CSH or BREEAM levels. Many factors will influence the CO_2 reductions achievable from connection, including the following:

- How energy is generated (e.g. gas, biomass, recovery from waste etc.)
- How energy is supplied (e.g. gas CHP to meet base-load heat with biomass boiler top-up; biogas CHP with gas boiler top-up etc.)
- How energy is distributed (e.g. super-insulated heat main pipes)

Meanwhile, the financial implications of decentralised energy generation present even greater conceptual problems, especially when comparing the costs of achieving CSH/BREEAM standards through connection to a decentralised energy network against the costs of achieving such standards through on-site microgeneration. To make a fair comparison, direct costs to developers should be considered and it should be noted that the following factors may cause these costs to vary widely:

- Density of development
- Mix of development types on site
- Model of financing energy network e.g.
    - o Developer finances energy infrastructure directly
    - o Local authority finances energy infrastructure
    - o Third party ('ESCo') finances energy infrastructure
    - o A combination of the above approaches
- Developer's relationship with the site (e.g. 'develop and sell' versus 'develop and manage').

The final point will have particular implications on how costs are attributed. For a developer who builds and then sells immediately, capital cost will be the only concern, whereas for a developer who builds and then manages a site, ongoing costs and cost savings will also be of interest. While models exist for estimating the Net Present Value (NPV) of energy networks, which factors in these cash flows, such models are more suited to situations where detailed information on the proposed network and its financial context are available. We have therefore looked solely at capital costs in the below study on costs of achieving CSH Level 4 through connection to a heat network, and it is therefore necessary to add the following caveat:

> *All cost increases presented in the below sections are likely to be at the higher end of what might be incurred in reality, as they assume that the entire cost will be borne by developers, and that no savings will be accrued through long term involvement in site energy supply.*

Lastly, it is very important to note that it is not possible to achieve CSH/BREEAM ratings or a lower DER on the strength of a speculative energy network, and thus the fact that a certain area is suitable for decentralised energy provision will not help a dwelling achieve a certain CSH/BREEAM rating unless the network is actually present, or under construction. This will have significant implications on how policies relating to energy networks are worded, and should be kept in mind in the following section.

4.5.1 The implications of decentralised energy on achieving CSH Level 4.

Table 4-1 presents the results of modelling the connection to various decentralised energy systems in SAP to show the range of CO_2 savings (or, specifically, the Dwelling Emissions Rates) achievable through these connections. Rather than attempting to cost each system (which would be unrealistic and potentially misleading at this stage) a higher-level approach was taken to costing drawing on Climate Consulting's existing models of decentralised energy networks and taking into account costs including the energy centre, CHP plant, distribution pipes, dwelling interface units and auxiliary heating (see Section 6.2). Reference was also paid to the CLG's (2010) *Code for Sustainable Homes: A Cost Review.*

Percentage cost increases were then calculated in the same way as those for the on-site microgeneration solutions, i.e. excluding energy costs of achieving Part L 2010 (and thus CSH Level 3) but including wider sustainability costs of CSH Level 4. For reference a comparison with the cost increase ranges of achieving CSH Level 4 through on-site microgeneration has also been included.

Please note: Since connecting to a decentralised energy network will almost inevitably generate CO_2 savings sufficient to achieve CSH Level 4, no separate attempt has been made to quantify the implications that connecting to a decentralised energy network will have on achieving CSH Level 3.

Table 4-1: CO_2 reductions and capital costs associated with achieving CSH Level 4 through connection to a decentralised energy network

Development type	Details	DER ($kgCO_2/m^2$)	% reduction below TER	% increase on build cost with a decentralised energy network (*figures in italics include cost of Part L*)	% increase on build cost with on-site microgeneration (*figures in italics include cost of Part L*)
All solutions include energy efficiency and wider sustainability measures					
3-bed mid-terrace house	Various decentralised energy systems modelled (e.g. gas CHP, biomass CHP, energy from waste, anaerobic digestion).	< 11.96	27+	6 – 10 (*8 – 12*)	6 – 8 (*8 – 10*)
2-bed mid-floor flat (in 3 storey block)		< 15.87	25+	8 – 12 (*11 – 15*)	4 – 11 (*7 – 14*)

Table 4-1 suggests that the cost of achieving CSH Level 4 through connection to a decentralised energy network is comparable with or slightly higher than the more expensive of the microgeneration solutions. As discussed in Section 4.5, while the cost increase figures for the decentralised versus microgeneration solutions are presented in the most directly comparable way (i.e. capital costs fully borne by developers) this may actually present decentralised energy costs as misleadingly high, given the variety of mechanisms available for shouldering the burden of these costs (e.g. developers with long term interest in the site; capital funding provided by ESCos and accrued back over time).

4.5.2 Decentralised energy and BREEAM

No further modelling was conducted on non-residential developments, as this was not considered likely to yield representative conclusions. In general, it is unlikely that by connecting to a decentralised energy network, non-residential developments will be able to achieve BREEAM ratings at a much lower cost (if at all) than through an on-site energy strategy. This is particularly true of development types such as retail units, where heat demand will conventionally account for only a small fraction (c. 10%) of overall CO_2 emissions. In these cases, unless the units are supplied with decentralised energy as well as heat, then it would be necessary to generate electricity on-site (e.g. using photovoltaic panels) in order to meet standards such as BREEAM Excellent, thereby incurring a cost comparable to that of a fully on-site solution. Certain development types with a higher heat demand, on the other hand, such as schools, may be able to derive sufficient CO_2 savings from a heat network to obviate the need for on-site microgeneration meaning a potentially lower overall cost.

4.6 Feasibility of connection to existing heat demand.

The application of decentralised heating is by no means restricted to new development and, indeed, heat demand from existing development can often be a key factor in ensuring the commercial viability of heat network. This is particularly true of large existing heat users with communal boilers due for renewal (e.g. a block of flats or large community or commercial building), as these can either be replaced by a larger boiler (or CHP) to supply a wider area, or can plug into a surrounding heat network if one is being developed. There are many examples of Local Authorities that have taken just this approach in linking up existing buildings into a new decentralised heat network, notably:

- **Sheffield district energy network**[23], established in 1988, now supplies heat to a range of existing buildings including the Crown Court, the University, a Victorian Theatre and two residential tower blocks.
- **Southampton district energy scheme**[24], one of the largest commercially developed district heating schemes in the UK, it has been pumping heat from a geothermal borehole through a heat network since 1986 and now supplies over a thousand residential properties and numerous large-scale commercial complexes including office, retail, healthcare and leisure. A separate CHP scheme was installed in nearby Holyrood to supply 300 existing council-owned flats whose old heating system was found to be inadequate, and it is anticipated that this standalone scheme will ultimately link into the city-wide network.
- **Aberdeen City Council community heating scheme**[25], as part of Aberdeen's affordable warmth strategy, a CHP system and heat network were set up to supply four multi-storey blocks of flats. Tenants were able to opt in to the system, and only 21 of the 288 flats chose not to join the network. Tenants were also asked how they would like to pay for their heating and hot water, and the majority voted for a flat rate weekly charge.

On the other hand, while it is technically possible to connect existing terraced and detached houses to a heat network, this is likely to be an

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[23] www.chpa.co.uk/media/dad82f34/Sheffield.pdf
[24] www.energysavingtrust.org.uk/business/Publication-Download/?oid=349755&aid=1027482
[25] www.chpa.co.uk/media/aca68579/Aberdeen.pdf

expensive process, as each house would require its own pipe run and hydraulic interface unit (the connection between the heat network and internal heating system). In general, it is easier to connect existing residential development to a heat network as part of a refurbishment programme, rather than on an ad hoc basis. Should a heat network be established in any part of Maidstone (e.g. within any urban extension) a detailed feasibility and viability study would need to be conducted into the possibility of extending the network to supply nearby existing residential development (e.g. Parkwood and Shepway for the South East (and South) scenario). A useful reference source is the Combined Heat and Power Association (CHPA)'s publication *Guide to community heating and CHP Commercial, public and domestic applications*.[26]

4.7 Conclusion

A "cluster analysis" was performed on potential development sites based around five parallel development scenarios (A to E) and results indicated that three sites in particular would merit more detailed investigated on their suitability for decentralised energy provision depending on the scenario ultimately adopted:

- The 'Strategic Development Area' in Scenarios D and E
- South East (and South) Maidstone
- North West Maidstone

While a detailed study on the feasibility and viability of a decentralised energy network is strongly recommended for whichever of the above sites is taken forward, caution should be taken before basing policy decisions on these findings. As discussed in Section 4.5.1, no compelling evidence has been found that connecting to a decentralised energy network will enable developments to meet CSH and BREEAM levels more cost effectively than on-site microgeneration will – indeed, if capital costs alone are considered, there is a possibility that this approach could actually increase the cost of the sustainable energy solution.

The following chapter takes into account the results of both analysis (borough-wide and area-based) in order to draw conclusions and make recommendations on options for Maidstone's Core Strategy policy.

[26] www.chpa.co.uk/media/81f83acc/CHPA0003%20Good%20practice%20guide%20to%20community%20heating%20and%20CHP.pdf

5 Conclusions and policy recommendations

The purpose of the preceding study has been to gather and present data that will allow Maidstone Borough Council to decide whether its Core Strategy policies should set targets (based on the Code for Sustainable Homes and BREEAM ratings) in line with the current national timetable for stepping up the Building Regulations' requirements, or whether it should set targets that pre-empt this timetable, as outlined below:

- Targets in line with proposed national timetable
  - 2012-2013
    - Code for Sustainable Homes Level 3 (residential)
    - BREEAM Very Good (non-residential)
  - 2013-2016
    - Code for Sustainable Home Level 4 (residential)
    - BREEAM Excellent (non-residential)
  - 2016 onwards
    - Code for Sustainable Home Level 6 (residential)
  - 2019 onwards
    - BREEAM Outstanding (non-residential)
- Targets pre-empting proposed national timetable
  - 2012-2016
    - Code for Sustainable Home Level 4 (residential)
    - BREEAM Excellent (non-residential)
  - 2016 onwards
    - Code for Sustainable Home Level 6 (residential)
  - 2019 onwards
    - BREEAM Outstanding (non-residential)

5.1 Summary of technical and financial analysis

The study fell into two strands:

1. A "borough-wide" analysis, which investigated technical and financial implications of achieving CSH Levels (3 and 4) and BREEAM Levels (Very Good and Excellent) through on-site sustainable energy strategies in a range of development types.
2. An "area-wide" analysis that assessed the suitability of potential future clusters of development sites for decentralised energy provision, and considered the impact that such provision might have on the cost of achieving the same CSH/BREEAM Levels (but with a specific focus on CSH Level 4).

Both analyses took account of the fact that CSH and BREEAM are holistic standards that deal with much more than just sustainable energy, and so an estimate of the cost of achieving a CSH/BREEAM rating must include the cost of meeting the wider sustainability standards associated with that rating. Furthermore, the relationship between CSH/BREEAM standards and the national Building Regulations (Part L) was also factored into the analyses, and for every strategy to meet a CSH/BREEAM rating, two costs were given: one excluding the costs associated with meeting Part L, and the other including those costs.

The **area-based analysis** revealed three site clusters across four of the development scenarios for which the potential for a decentralised energy network would be seriously worth considering in further detail.

Scenarios C and E

1. Strategic Development Area

Scenarios B and D

2. South East (and South) Maidstone

3. North West Maidstone

Only headline results of the **borough-wide analysis** (and comparison with the **area-based analysis** in the case of CSH Level 4) are given in Table 2-1 as a broad-brush summary of the increases to build cost incurred through achieving CSH/BREEAM levels. For a more detailed summary please refer to Chapter 3 (for the borough-wide analysis – summary table given in Section 3.5) and Section 4.5.1 (for the implications of decentralised energy on the cost of achieving CSH Level 4).

Table 2-1: Summary of CSH/BREEAM cost analysis

Development type	**CSH/BREEAM Level**	% increase on build cost excluding cost of meeting Part L *(figures in italics include cost of Part L)*	% increase on build cost excluding cost of meeting Part L *(figures in italics include cost of Part L)*
		ON-SITE MICROGENERATION (Borough-wide analysis)	**DECENTRALISED ENERGY NETWORK (area-based analysis)**
Residential	CSH Level 3	1 *(4 – 9)*	Not modelled
	CSH Level 4	4 – 11 *(7 – 14)*	6 – 12 *(8 – 15)*
Non-residential	BREEAM Very Good	Not modelled *(0 – 6)*	Not modelled
	BREEAM Excellent	2 – 5 *(13 – 34)*	Not modelled

As shown above, the borough-wide analysis indicates that achieving the standards considered “in line with the proposed national timetable” (CSH Level 3 and BREEAM Very Good) will require an increase to build cost of less than 10%, and that for residential developments, at least, the majority of this cost arises from the mandatory energy requirement within CSH (called ENE 1) which is equivalent to the national requirements under Part L, and therefore would not constitute an additional cost associated with achieving CSH Level 3. Meanwhile, the analysis also indicates that achieving CSH and BREEAM ratings “pre-empting the proposed national timetable” (CSH Level and BREEAM Excellent) will increase build cost by under 11% (or smaller) if the cost of achieving Part L is excluded from the calculation. However, if Part L costs are included, the increases to build cost associated with pre-empting the national timetable appear considerably higher (most of all in the warehouse development, where the cost increase jumps from 2% (excluding Part L) to 34% (including Part L), reflecting the high standards set for this development type under Part L).

The results of the area-based analysis suggest that connecting up to a decentralised energy network as part of a sustainable energy solution may not lower the capital costs of achieving CSH Level 4 (the only rating modelled in this analysis) and could potentially increase them. However, as explained in Section 4.5.1, capital cost may be a misleading indicator here as there are a variety of mechanisms available for shouldering the burden of these costs that are particular suited to decentralised energy networks (e.g. developers with a long term interest in the site; capital funding provided by ESCos and accrued back over time). Furthermore, certain considerations, such as the use of sustainability as a selling point and the role of planning in driving developmental standards forward prior to legislative changes, could be taken into account when deciding which standards to set across the borough.

Finally, it must be remembered that in determining which sustainability standards can be implemented through policy requirements within the Core Strategy, Maidstone Borough Council will draw on this study in the context of other studies being conducted simultaneously. In particular, development contributions for necessary infrastructure and for affordable housing will be sought through the Core Strategy, meaning that a viability model for the Core Strategy as a whole, read in conjunction with relative priorities, will guide the policies and the extent of those policies that Maidstone Borough Council will seek to implement.

5.2 Implications of the results on policy

Four options for Maidstone’s Core Strategy policy are set out below, and each is followed by a brief description of the issues associated with them:

Option 1: Matching the national timetable
New residential development is required to meet Code for Sustainable Homes Level 3, CSH Level 4 from 2013 and CSH Level 5/6 from 2016

New non-residential development over 1,000m^2 is required to meet BREEAM Very Good, BREEAM Excellent from 2013 and BREEAM Outstanding from 2019.

Issues:

- The financially significant component of the requirement set through this policy (i.e. the energy standards) is equivalent to the requirements set by or anticipated under the Building Regulations Part L, and only a small cost burden is presented by the additional (“wider sustainability”) demands of CSH and BREEAM, especially at the lower ratings (Level 3/ Very Good).
- At each phase of the policy, the wider sustainability requirements not covered by national policy step up alongside the energy standards. This is a clear and effective way for Maidstone Borough Council to address climate change and broader sustainability concerns through its policy framework.
- However, the fact that the policy makes no provision for pre-empting the national timetable may be perceived as evidence that Maidstone Borough Council is not strongly pushing forward the sustainable energy agenda.

Option 2: Pre-empting the national timetable
New residential development is required to meet Code for Sustainable Homes Level 4 from 2012 and CSH Level 5/6 from 2016

New non-residential development over 1,000m^2 is required to meet BREEAM Excellent from 2012 and BREEAM Outstanding from 2019.

Issues:

- For the first phase of this policy (until 2013) the policy requirement exceeds national requirements in all areas including sustainable energy.
  - This is an effective way for Maidstone Borough Council to address climate change through its policy framework.
  - However, it places a more significant cost burden on developers in the first phase than in Option 1 and there is no obvious justification for imposing this in Maidstone.
- As with Option 1, the wider sustainability requirements not covered by national policy step up alongside the energy standards in phases.

Option 3: Higher (pre-2013) standards for designated areas

New residential development and new non-residential development are required to achieve the standards set out in the table below:

	Development in designated areas (e.g. Strategic Development Area)	**Development in all other areas**
2012-2013	**CSH Level 4 BREEAM Excellent**	**CSH Level 3 BREEAM Very Good**
2013-2016	**CSH Level 4 BREEAM Excellent**	**CSH Level 4 BREEAM Excellent**
2016-2019	**CSH Level 5/6 BREEAM Excellent**	**CSH Level 5/6 BREEAM Excellent**
2019-2026	**CSH Level 5/6 BREEAM Outstanding**	**CSH Level 5/6 BREEAM Outstanding**

Issues:

- This policy relies on the common perception that connecting to a decentralised energy network will enable developments to achieve CO_2 reductions (and thus CSH/BREEAM ratings) more cost-effectively than by employing on-site (microgeneration) strategies.
- However, this study has yielded no compelling evidence that this perception is accurate.
- Furthermore, unless only areas with an existing decentralised energy network are designated (and none exist at present) then a policy of this kind will tie developments in certain areas into achieving higher standards (in the initial phase) based on the suitability of that area for decentralised energy provision rather than on the presence of an actual network. In effect, developments could be required to achieve higher targets (that may or may not be easier to achieve through connecting to a network) regardless of whether a network is actually present. As discussed in Section 4.5, it is not possible to achieve CSH/BREEAM ratings on the strength of a speculative energy network, so fact that a certain area is suitable for decentralised energy provision will not help a dwelling achieve a certain CSH/BREEAM rating unless the network is actually present, or under construction.

Option 4: A practical approach to decentralised energy

New residential development is required to meet Code for Sustainable Homes Level 3 from 2012, Code Level 4 from 2013 and CSH Level 5/6 from 2016

New non-residential development over 1,000m^2 is required to meet BREEAM Very Good from 2012, BREEAM Excellent from 2013 and BREEAM Outstanding from 2019.

AND

Where a decentralised energy network exists, new development will be required to connect up to it. In areas designated as suitable for a decentralised energy network, new development should be designed so as to facilitate a connection and planning conditions will be imposed to ensure that a connection is made once the network is operational.[27]

Issues:

- The "practical" wording of this policy (i.e. developments should connect to networks, rather than developments in designated areas should achieve higher targets) obviates the difficulties associated with imposing higher targets in areas suitable for decentralised energy networks.
- Furthermore, by focusing on the practical, rather than the target-driven, the policy more directly supports the wider benefits of setting up a decentralised energy network (e.g. facilitating CO_2 savings across the borough by linking in existing development to the network).
- However, the policy could potentially be difficult to enforce, particularly as it will involve imposing planning conditions that may take many years to discharge.

[27] In the supporting text of this policy, the following information should be provided: (1) a list of areas designated as suitable for decentralised energy provision; (2) practical detail for developers on what "designing a development to facilitate a connection" would entail.

6 Annex

6.1 Documentation provided by Maidstone Borough Council

Housing Scenarios

Strategic Housing Land Availability Assessment, Maidstone Borough Council, 2009

Employment Scenarios

Employment Land Review (draft work), Maidstone Borough Council, 2011

6.2 Cost assumptions and sources

	Cost		Source
	Per unit	Total	
Building Costs			
House 3-bed 2-storey mid-terrace (76m^2)	£1,185/m^2	£90,000	CLG (2010) *Code for Sustainable Homes: A Cost Review*
Flat 2-bed, 1st storey in 2-storey block (63m^2)	£980	£61,700	CLG (2010) *Code for Sustainable Homes: A Cost Review*
B8 Warehouse Single storey + Mezzanine (5,000 m^2)	Various	£3 million	Building Cost Information Service (average costs)
B1 Office 4 storeys (1,300m^2)	Various	£2 million	Building Cost Information Service (average costs)
Energy and Sustainability Costs			
Energy costs of CSH 3 (house)	-	£2,100	CLG (2010) *Code for Sustainable Homes: A Cost Review*
Energy costs of CSH 3 (flat)	-	£1,700	CLG (2010) *Code for Sustainable Homes: A Cost Review*
Energy Efficiency (B8 Warehouse)	-	£200,000	Various reports by CLG and AECOM-Faber Maunsell
Energy Efficiency (B1 Office)	-	£65,000	Various reports by CLG and AECOM-Faber Maunsell
Wider sustainability for CSH 3 (“non-energy” – house)	-	£915	CLG (2010) *Code for Sustainable Homes: A Cost Review*
Wider sustainability for CSH 4 (“non-energy” – house)	-	£1,120	CLG (2010) *Code for Sustainable Homes: A Cost Review*
Wider sustainability for CSH 3 (“non-energy” – flat)	-	£795	CLG (2010) *Code for Sustainable Homes: A Cost Review*
Wider sustainability for CSH 4 (“non-energy” – flat)	-	£1,000	CLG (2010) *Code for Sustainable Homes: A Cost Review*
Wider sustainability (“non-energy” – B8 Warehouse)	-	£50,000	Various reports by CLG and AECOM-Faber Maunsell
Wider sustainability (“non-energy” – B1	-	£30,000	Various reports by CLG and AECOM-Faber Maunsell

Office)			
Solar PV (domestic scale – houses and flats)	£6,000/kWp	-	Climate Consulting's network of installers
Solar PV (commercial – offices and warehouses)	£5,000/kWp	-	Climate Consulting's network of installers
Solar thermal (domestic scale)	£800/m^2	-	Climate Consulting's network of installers
GSHP (domestic scale – houses and flats)	£2,000/kW	-	Climate Consulting's network of installers
GSHP (commercial – offices and warehouses)	£1,500/kW	-	Climate Consulting's network of installers
ASHP (all scales)	£1,000/kW	-	Climate Consulting's network of installers
Connection to DE network (per house)	£5,500	-	Climate Consulting's network of installers (takes into account energy centre, CHP plant, distribution pipes, dwelling interface units and auxiliary heating)
Connection to DE network (per flat)	£7,000	-	Climate Consulting's network of installers (takes into account energy centre, CHP plant, distribution pipes, dwelling interface units and auxiliary heating)