

Renewable Energy Potential Study

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EXECUTIVE SUMMARY

Introduction

Renewable energy is seen as an essential factor in planning for a sustainable future and the Supplement to Planning Policy Statement 1 (December 2007) on Climate Change, outlines that Local Authorities should take an evidence-based approach to set a target percentage of the energy to be used in new development to come from decentralised and renewable or low-carbon energy sources¹. This study aims to provide an evidence base to enable Wealden District Council to set appropriate targets for new developments.

Wealden's strategic view of the development of renewable energy needs to be informed by detailed knowledge of the general extent of its district-wide resources and an assessment of the feasibility and viability of a renewable energy target. Wealden's developing evidence base will form the foundations on which its emerging Core Strategy Development Plan Document (as part of its Local Development Framework) can be built. The London Borough of Merton was the first to adopt (in October 2003) an on-site renewable generation policy and a target for the production of energy from renewables for new developments. The Merton Rule requires the use of onsite renewable energy to reduce carbon dioxide (CO₂) emissions from developments. It applies to developments with 10 or more domestic buildings or non-domestic developments where the floor area will be 1,000m² or more.

Future shifts in national energy policy, which are influencing the interaction of energy efficiency and renewable energy will need to be considered, particularly in relation to Building Regulations and on-site generation policies.

Enviros Consulting has undertaken this study to assess the feasibility and viability of a target percentage of energy to be used in new developments originating from decentralised² and renewable or low-carbon energy sources (a full Glossary is presented in Appendix 1). This involved assessing future energy demand from certain domestic properties and non-domestic buildings as well as investigating the potential to reduce energy. This was expressed by measuring total CO₂ emissions (regulated and unregulated emissions), through renewable and low and zero carbon technologies. Regulated emissions are those that are included within the SAP 2005 methodology and arise from space heating, water heating, fixed lighting and ventilation. Unregulated emissions are emissions arising from electrical appliances, cooking and non-fixed lighting.

Two future energy demand scenarios have been used for both domestic and non-domestic buildings to match the 25% and 44% CO₂ emissions reductions proposed in the future Building Regulations, as the regulations tighten to zero carbon³. The

1 Renewable energy covers energy flows that occur naturally and repeatedly in the environment, such as energy from wind, the fall of water, the movement of the oceans, the sun and also from biomass. Low-carbon technologies are those that can help reduce carbon emissions. Renewable and/or low-carbon energy supplies include, but not exclusively, those from biomass and energy crops; CHP/CCHP (and micro-CHP); waste heat that would otherwise be generated directly or indirectly from fossil fuel; energy-from-waste; ground source heating and cooling; hydro; solar thermal and photovoltaic generation; wind generation.

2 Decentralised energy is energy supplied from local renewable and local low-carbon sources (on-site and near-site, but not remote off-site) usually on a relatively small scale.

3 Zero carbon means zero carbon emissions from new developments. To be genuinely zero carbon the home will need to deliver zero carbon (net over the year) for all energy use in the home including space heating, hot water, washing, lighting, cooking, ventilation and electronic entertainment appliances. A zero carbon home is equivalent to Code Level 6 of the Code for Sustainable Homes.

Communities and Local Government report 'Greening the future: towards zero carbon development' outlines plans to achieve zero carbon housing within 10 years, by moving first to a 25% improvement in the energy/carbon performance set in Building Regulations in 2010; then, in 2013, to a 44% improvement; then finally in 2016 to zero carbon. The 25% and 44% improvements will be relative to Part L of the 2006 Building Regulations. It is assumed that non-domestic buildings will have reductions of similar steps, although milestones towards zero carbon in 2019 have not yet been finalised.

Modelling undertaken for this study has assumed that the proposed changes to the Building Regulations will be implemented. However, Wealden District Council should take into account the possibility that the proposed changes to these Regulations are not implemented, or do not keep to the proposed timescales, by including a section in its policy to cover this eventuality. In these circumstances or if Wealden Policy is introduced before the new Building Regulations are introduced in 2010, it is recommended that Wealden District Council sets a general carbon dioxide (CO₂) reduction target of 20% for all buildings. This is because the modelling undertaken in this study demonstrates that most buildings could achieve a 20% CO₂ reduction from renewable technologies when Building Regulations are tightened by 25%. Therefore setting a present target at 20% would provide a challenging target, whilst preparing developers for the more difficult challenge when Building Regulations are tightened.

Conclusions and Recommendations

It is recommended that, based on the following assessment, Wealden District Council should set the following renewable policy for all domestic buildings and non-domestic buildings:

- ◆ If the proposed tightening of the Building Regulations is delayed or Wealden District Council introduces a Renewable Energy Policy before the Building Regulations are tightened in 2010, it is recommended that Wealden District Council sets a general carbon dioxide (CO₂) reduction target of 20% for all buildings.
- ◆ When Building Regulations are tightened to 25% below current (2006 Building Regulations) levels (proposed for 2010 for domestic buildings, uncertain timescale for non-domestic buildings), a general target of 20% reduction in total CO₂ emissions (regulated and unregulated emissions) from low and zero carbon (LZC) technologies is recommended;
- ◆ When Building Regulations are tightened to 44% below current levels (proposed for 2013 for domestic buildings, uncertain timescale for non-domestic buildings), a general target of 10% reduction in total CO₂ emissions (regulated and unregulated emissions) from LZC technologies is recommended;
- ◆ When Building Regulations are tightened to zero carbon, it is recommended that planning policy set a 0% renewable energy target for new buildings. Setting a target at this stage would, in essence be asking developers to export energy.

Models developed for the study demonstrate that a 20% reduction could be achieved through a number of technologies for most buildings when Building Regulations are tightened to 25% below current levels. For both domestic and non-domestic buildings, renewable energy technologies would be required to meet Building Regulations when they are tightened to 44% below current levels. As a result, only a few technologies could provide further savings. It is therefore considered that a 10% target would be more appropriate at this level.

If the targets cannot be achieved, developers would be required to demonstrate that the target is not technically or financially feasible. It is considered that the obligation should be on the developer to prove that the renewable energy target is not feasible at a particular site.

It is recommended that conversions should meet the same renewable energy requirements as for new buildings. This is because only the conversions that would have to comply with Part L 1A of the Building Regulations would have calculated future building carbon emissions. This information is required to assess compliance with the renewable energy policy. It is assumed that if a conversion can achieve the standards to meet the Building Regulations, it should also be able to meet the renewable/low carbon requirements. Furthermore as conversions can vary substantially, depending on the previous building and the converted design, it would be difficult to set varying targets to encompass all the potentialities.

Most local authorities set the renewable energy target at a threshold size of the development, which is usually 10 domestic buildings or 1000 m² for non-domestic buildings. As it is recommended that the burden of evidence is on the developer to demonstrate that renewable technologies are not technically or financially viable for a site, it is proposed that all buildings in Wealden should meet the renewable energy targets. Justification for this approach can be found in Appendix 3 which demonstrates the feasibility of different building types achieving the renewable energy targets.

For both domestic and non-domestic buildings, where developers can demonstrate the renewable technology is not feasible, the maximum effort should be used to achieve at least a minimum of 5% reduction in CO₂ emissions.

Specific sites have not been tested at this stage as it is too early in the LDF process to be able to identify potential sites which may come forward as part of the LDF process. Detailed site specific assessments may demonstrate that it is possible to set exceptional site specific targets. In the same vein, future developments, both domestic and non-domestic, may be suitable to allow Wealden District Council to set higher specific renewable energy targets.

It is therefore considered at this time that it is not feasible to set explicit site specific targets for a site or particular development within the District.

1. INTRODUCTION

1.1 Background to this study

Climate Change, resulting from increasing greenhouse gas emissions, threatens the world's climate, economy and population. As over two thirds of the world's carbon dioxide (CO₂) emissions come from energy production and use, policies influencing energy reduction and use will have a major role in meeting the climate change challenge.⁴

Energy use in buildings contributes up to 40% of the UK's carbon dioxide emissions⁵, therefore tackling Climate Change will require reductions in energy consumption in buildings. Planning has a role to play in this process as it influences the type of new development allowed, both in terms of its energy efficiency and the energy sources it uses. Other regulatory regimes also have a role to play in reducing carbon emissions. Building Regulations have recently been changed to improve the energy efficiency of buildings⁶. However, further carbon reduction measures are required so that a significant contribution to UK targets can be made whilst ensuring that new buildings are fit for purpose in a future where UK CO₂ emissions must be radically reduced.

This study will help guide Wealden District Council on how it can use the Local Development Framework to promote renewable, low-carbon and decentralised energy in new developments, without impacting on the viability of those developments.

1.2 Description of Wealden District Council

Wealden is a rural district covering 323 square miles in East Sussex. The District has five relatively small market towns - Crowborough, Uckfield, Heathfield, Hailsham and Polegate. About half of the district's population live in or around these towns, while the remainder reside in the many (mainly small) villages dispersed over the area.

A significant proportion of the working population travels to larger towns just outside of the District including Eastbourne, East Grinstead/Gatwick and Tunbridge Wells, together with some further commuting into London. The north and south of Wealden differ in their landscape character. The south is partially situated within the proposed South Downs National Park. The north of the district is dominated by the High Weald Area of Outstanding Natural Beauty (AONB).

In the north of the District, the main towns are Crowborough, Uckfield and Heathfield. It is estimated that Crowborough is (marginally) the largest town in Wealden in terms of population. It is situated in the middle of, and surrounded by, the High Weald Area of Outstanding Natural Beauty (AONB) and adjacent to the Ashdown Forest Special Protection Area and Special Area of Conservation. Uckfield is a smaller town outside the two Areas of Outstanding Natural Beauty located in the District. Heathfield is a small market town, also surrounded by the High Weald AONB.

4 Meeting the Energy Challenge: A White Paper on Energy, DTI, 2007

5 Carbon Trust website: <http://www.carbontrust.co.uk/technology/technologyaccelerator/lcba.htm>

6 Part L1 of the Building Regulations 2006, Energy Saving Trust briefing note (updated March 2008)

In the south, Hailsham is the main town, with an estimated population of 20,000⁷. Polegate is the other main town in this area, located near Eastbourne, and adjacent to the proposed South Downs National Park.

The South East Plan indicates that in the south of the District, which is located within the wider Sussex Coast Sub Region, development should be in the form of urban extensions along the A22 corridor and therefore both Hailsham and Polegate have the greatest potential for new development in this area. The South East region has been chosen for significant new housing development. Wealden is required under the South East Plan to provide 11,000 homes by 2026. In the order of 7,000 of these should be located within the Sussex Coast sub-region. Wealden is currently undertaking an affordable housing viability assessment and has produced a strategic housing market assessment to assist in the development of the Local

1.3 Development Framework. What is Renewable Energy?

'Renewable Energy' is a catchall phrase for a variety of energy sources. For that reason, renewable energy is described as any energy source that naturally occurs and is very abundant. Conversely, technologies producing energy utilising finite resources such as fossil fuels are not renewable. The Supplement to PPS1 outlines that a target percentage of the energy from new developments should come from decentralised, renewable or low and zero carbon technologies where it is viable. Therefore the term renewable technologies in this study includes these decentralised and LCZ (low and zero carbon) technologies. The Supplement to PPS 1 (Dec 2007) states that these energy sources include energy for heating and cooling as well as generating electricity. *Renewable energy covers those energy flows that occur naturally and repeatedly in the environment - from the wind, the fall of water, the movement of the oceans, from the sun and also from biomass. Low-carbon technologies are those that can help reduce carbon emissions. Renewable and/or low-carbon energy supplies include, but not exclusively, those from biomass and energy crops; Combined Heat & Power/ Combined Cooling Heat and Powers (CHP/CCHP), (and micro-CHP); waste heat that would otherwise be generated directly or indirectly from fossil fuel; energy-from-waste; ground source heating and cooling; hydro; solar thermal and photovoltaic generation; wind generation.* Renewable technologies are defined in Supplementary Guidance to PPS1.

More information about the key issues arising from the policy review is available in Appendix 7.

1.4 Aims of this study

Wealden District Council has commissioned Enviro to provide an evidence base which it can use to set renewable, low carbon and decentralised⁹ energy targets for new developments in the District. This will enable Wealden to achieve the requirements in the Supplement to Planning Policy Statement 1 (December 2007) on Climate Change. This document outlines that Local Authorities should take an evidenced-based approach to set a target percentage of the energy to be used in

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http://www.wealden.gov.uk/Planning_and_Building_Control/Local_Plan/Adopted_Local_Plan/Chapter14.PDF

⁸

Combined heat and power is the simultaneous generation of usable heat and power (usually electricity) in a single process, thereby reducing wasted heat and putting to use heat that would normally be wasted. See glossary for full definition

⁹ See glossary for definition

new developments to come from decentralised and renewable or low-carbon energy sources.

This study aims to:

- ◆ Assess the potential for renewable energy in Wealden;
- ◆ Assist Wealden District Council establish a target percentage of the energy demand of new developments to be met from renewable, low-carbon and decentralised energy; and

Assist Wealden District Council, as the Local Planning Authority, to establish site-specific targets where greater opportunities exist for the use of renewable, low-carbon and decentralised energy;

1.4 Outline of method used

The following method has been used to achieve the aims of the report:

- ◆ Review of national, regional and local policy to assess the policy requirements and to look at best practice in other Local Authorities;
- ◆ Assessment of the likely energy demand from future developments. To do this, Enviros modelled typical building types, set out in Table 1 of Wealden's tender documents, using government-approved modelling software¹⁰ and including the proposed changes to the Building Regulations;
- ◆ Setting targets for specific building activities. Scenarios for energy demand were modelled based on proposed changes to the Building Regulations for typical domestic and non-domestic buildings in Wealden. Using this energy consumption data, the technical potential to reduce carbon emissions from renewable or low carbon energy sources was then assessed;
- ◆ Set a renewable target, utilising the results of the assessment on the technical feasibility of installing renewables on a site; and;
- ◆ Identify potential opportunities for site-specific targets by combining information on proposed development areas and GIS assessments of wind speeds, woodland resources and location of environmental designations; and
- ◆ Examine the impact of the targets on development viability. The cost of installing the renewable energy technology was compared to the predicted total cost of the development.

¹⁰ IES thermal modelling software tool is used to produce Building Regulations UK Part L (BRUKL) 2006 Compliance reports and Non Dwelling Energy Performance Certificates (NDEPC) whilst Standard Assessment Procedure (SAP) is used to calculate Dwelling carbon emissions

2. POLICY REVIEW

Future Wealden District Council policy concerning a renewable/low carbon energy target is required to be consistent with national, regional and local policy. A range of national and regional policies will impact on the renewable/ low carbon energy target set by Wealden District Council. These include national and regional planning policies, Building Regulations, national energy policies and housing policies¹¹. Benchmarking schemes such as the Code for Sustainable Homes and BREEAM (Building Research Establishment Environmental Assessment Methodology) are also relevant. The section below outlines the key aspects of these policies and benchmarking schemes, aiming to ensure that Wealden's renewable energy target meets the criteria outlined in national planning policy and takes account of examples of best practice in neighbouring Local Authorities.

This section is based on information, available in the public domain in October 2008, of the key drivers, and leads to a more detailed review of the national, regional and local policies

2.1 Key outcomes from the policy review

2.1.1 Main policy drivers for renewable energy targets

Climate Change Bill (Act 2008)

The Climate Change Act (2008): This provides a legally binding commitment to reduce carbon dioxide emissions nationally by at least 26% by 2020 and UK greenhouse gas emissions by at least 80% by 2050. The Act also introduces carbon budget periods, with the first budgets to be set 3 periods (15 years) ahead (i.e. 2008-2022).

Planning Policy Statement 1: Delivering Sustainable Development (PPS 1, 2005)

PPS 1 indicates that Local Authorities should promote the use of renewable energy and low carbon heating in developments.

The Climate Change Supplement to PPS1, (Dec.2007), which builds on PPS 22, (2004), requires Local Authorities to have an evidence-based understanding of the local feasibility and potential for renewable and low-carbon technologies, including microgeneration, to supply new development. This evidence-based understanding should be used to set a target percentage of the energy to be used in new developments to come from decentralised and renewable or low-carbon energy sources. The supplement also suggests that Local Authorities create site-specific targets where opportunities exist for greater use of *decentralised* and renewable or low-carbon energy.

The Supplement provides a change from the 'Merton'-style on-site renewable energy generation targets to include decentralised energy targets. The supplement also requires that local authorities create site-specific targets where opportunities exist for greater use of decentralised and renewable or low-carbon energy.

¹¹ Policies include PPS1 and Supplementary Guidance to PPS1. See section 2.3 for more details

Other standards that exist for buildings that deal with energy use include:

The Standard Assessment Procedure (SAP) is the Government's recommended system for the energy rating of domestic buildings and is used in part to fulfil the requirements of the Building Regulations. The latest version of SAP accounts for certain on-site renewables within its assessment.

The Energy Saving Trust (EST) is concerned specifically with energy use and has its own 'Good', 'Best' and 'Advanced' practice standards for homes. The 'Best' standard provides a 25% improvement in energy efficiency (ie CO₂ emissions) compared to Building Regulations, with the Advanced Standard providing a 60% improvement. These standards informed the development of The Code for Sustainable Homes (Dec 2006).

The Code for Sustainable Homes (Dec 2006) is a voluntary initiative by Government and Industry to actively promote the transformation of the building industry towards more sustainable practices. The energy elements of levels of achievement (Code 1-5) relate to specific percentage improvements over 2006 Building Regulations. Level 6 represents carbon neutral domestic buildings.

BREEAM (Building Research Establishment Environmental Assessment Method) is the non-domestic version of EcoHomes (now superseded by the Code for Sustainable Homes) and uses similar methodology.

The following sections outline the key areas of policy or regulation underpinning the future renewable energy policy.

2.1.2 The target should be measured in CO₂ rather than energy

The target percentage of renewable or low carbon sources could be articulated either in terms of units of energy or in carbon dioxide. It is considered preferable to measure the target in carbon dioxide as this will take account of the fact that saving a set amount of electricity consumption will reduce carbon emissions more than saving the same amount of gas consumption. This is because of the higher carbon intensity of the electricity generation and lower carbon burden of gas. An energy target would encourage use of electricity with lower kilo Watt hour output, but higher carbon emissions. The Planning and Climate Change Supplement to PPS1, its associated Practice Guidance (March 2008), and the brief provided by Wealden District Council all mention savings measured in carbon dioxide rather than savings measured in energy.

2.1.3 The target should allow for changes in Building Regulations

Wealden District Council's renewable energy policy target is intended to come into force in 2011, when the Core Strategy is adopted, and last until at least 2026. Over this timescale, the Government has proposed that Building Regulations will be periodically tightened to deliver zero carbon buildings. *Building a Greener Future*: policy statement (2007) sets out the requirement for major reductions in carbon emissions from new homes to achieve zero carbon by 2016. It is anticipated that these reductions will be achieved through Building Regulations. There are similar ambitions to cut carbon emissions from new non-domestic buildings. These proposed changes have also been used in the various Levels in the Code for Sustainable Homes.

It should be highlighted that neither the Code for Sustainable Homes, the EST standards nor the Building Regulations explicitly state any specific percentage

requirement for renewables. A renewables generation policy will therefore ensure a minimum level is implemented.

The predicted changes in Building Regulations will be incorporated into the methodology of determining a target, to ensure that any recommended target does not merely duplicate existing Building Regulations but would, in fact, exceed them.

2.1.4 The target should include regulated and unregulated emissions¹²

The Practice Guidance to support the Planning Policy Statement: Planning and Climate Change¹³ (2007) outlines the commonly adopted method for defining the baseline emissions. This method involves looking at the carbon dioxide emissions that would have arisen from the notional building or development if it had been designed to comply with current Building Regulations and then adding allowances for unregulated emissions. Therefore by including targets for unregulated emissions, the target will exceed the existing Building Regulations.

The Practice Guidance to support the Planning Policy Statement: Planning and Climate Change, states that unregulated as well as regulated emissions should be included.

2.1.5 Renewable energy targets are being considered at a regional level

The South East Plan includes policy NRM11 which states that Local Authorities should:

- (i) promote and secure greater use of decentralised and renewable or low-carbon energy in new development, including through setting ambitious but viable proportions of the energy supply for new development to be required to come from such sources. In advance of local targets being set in development plan documents, new developments of more than 10 dwellings or 1000m² of non-residential floorspace should secure at least 10% of their energy from decentralised and renewable or low-carbon sources unless, having regard to the type of development involved and its design, this is not feasible or viable
- (ii) use design briefs and/or supplementary planning documents to promote development design for energy efficiency, low carbon and renewable energy
- (iii) work towards incorporation of renewable energy sources including, in particular, passive solar design, solar water heating, photovoltaics, ground source heat pumps and in larger scale development, wind and biomass generated energy
- (iv) actively promote energy efficiency and use of renewable and low carbon energy sources where opportunities arise by virtue of the scale of new development including regional growth areas, growth points and eco-towns. Local authorities and other public bodies, as property owners and managers, should seek to achieve high levels of energy efficiency when refurbishing their existing stock.

¹² See glossary for definition of regulated and unregulated emissions

¹³ Planning Policy Statement: Planning and Climate Change, published by CLG (17 December 2007).

Planning Policy Statement: Planning and Climate Change - Practice Guidance, published by Faber Maunsell (March 2008)

There is already therefore a target to achieve 10% of the energy for major new developments from decentralised and renewable or low carbon sources.

2.1.6 Neighbouring councils are developing renewable energy targets

It is understood that Brighton and Hove City Council and Hastings Borough Council are developing renewable energy targets. Brighton & Hove unitary authority require carbon-neutral energy efficiency on all its medium-scale, major and greenfield developments. Hastings has proposed to set a target percentage consistent with that in the draft South East Plan as stated in their self assessment document 2006/07.

Therefore Wealden will not be alone in creating such a target. It is considered that as developers already have to meet renewable energy targets in neighbouring areas, it is unlikely such a target would discourage developers from building in Wealden.

2.2 EU energy policy

The EU has developed various energy policies:

- ◆ European Council 2007 agreed a common strategy for energy security and climate change
- ◆ European Commission has proposed that the UK contribution should be 15% of its total energy use from renewables by 2020
- ◆ The UK is committed to meeting the EU target, which will be very challenging to achieve

2.3 National policy

2.3.1 PPS1: Delivering Sustainable Development (2005)

The Planning Policy Statement sets out how planning, whilst providing for the new homes, jobs and infrastructure needed by communities, should help ensure places have lower carbon emissions and are more resilient to climate change.

- ◆ Development plans and decisions on planning applications should contribute to the delivery of sustainable development. For example, they should make use of policies which reduce energy use, reduce emissions and promote the development of renewable energy resources (paragraph 13).
- ◆ Development plan policies should consider mitigation and adaptation to Climate Change, through the reduction of greenhouse gas emissions and the use of renewable energy (paragraph 20).
- ◆ Regional planning authorities and Local Authorities should promote community heating schemes, the use of combined heat and power, small scale renewables and low carbon energy schemes in developments (paragraph 22).

2.3.2 The Supplement to PPS1 on Planning & Climate Change (Dec 2007)

The Supplementary Guidance to PPS1 (SGPPS1) on Climate Change provides a strong emphasis on renewables and local energy and sets out how regional and local planning can best support the achievement of zero-carbon targets.

Outlined below are some key statements from SG PPS1 which provide guidance for local authorities on setting renewable or low and zero carbon targets, whilst ensuring sufficient evidence is provided for the levels set:

- ◆ Have an evidence-based understanding of the local feasibility and potential for renewable and low-carbon technologies, including microgeneration, to supply new development (paragraph 26);
- ◆ Use this evidence to set a target percentage of the energy to be used in new developments to come from decentralised and renewable or low-carbon energy sources where viable ¹⁴. The target should avoid prescribing certain technologies; and
- ◆ Create development area or site-specific targets where opportunities exist for greater use of decentralised and renewable or low-carbon energy than the target percentage. This is particularly relevant where existing decentralised and renewable or low-carbon energy supply systems can be used or new systems developed. Well-founded development area and site-specific targets drawn up in line with this PPS may expect significant proportions of the energy supply in new development to be secured from decentralised and renewable or low-carbon energy sources (paragraph 30)

In bringing forward targets, SGPPS 1 states that planning authorities should:

- ◆ Set out the type and size of the development to which the target will be applied;
- ◆ Ensure there is a clear rationale for the target and that it is properly tested; and
- ◆ Ensure what is proposed is evidence-based and viable, having regard to overall cost and the need to avoid any adverse impact on the development needs of communities.

In relation to renewables and the impact of housing growth, the Climate Change Supplement to PPS1 requires:

- ◆ When setting area and site specific targets to demonstrate that the proposed approach is consistent with securing the expected supply and pace of housing development shown in the housing trajectory required by Planning Policy Statement 3 (PPS3) and ensure it does not inhibit the provision of affordable housing; and
- ◆ new developments to comply with adopted Development Plan Document (DPD) policies on local requirements for decentralised supply, unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable.

¹⁴Supplementary Guidance to PPS 1 defines low and energy supplies from biomass and energy crops; CHP/CCHP (and micro-CHP); waste heat that would otherwise be generated directly or indirectly from fossil fuel; energy-from-waste; ground source heating and cooling; hydro; solar thermal and photovoltaic generation and wind generation

It also states that Councils should consider the likely impact of proposed development on existing or proposed sources of renewable or low-carbon energy supply.

2.3.3 Planning Policy Statement 22: Renewable Energy (2004)

PPS22 sets out the Government's policies for renewable energy, which planning authorities should have regard to when preparing local development documents and when taking planning decisions. It was intended to encourage the development of renewable energy schemes throughout England. This includes schemes in urban as well as rural locations, ranging in size from domestic to commercial scale. This led to the development of the Merton Rule¹⁵ which requires new non-residential developments, above a certain size threshold, to generate at least 10% of their energy needs from renewable energy.

2.3.4 Building Regulations

Approved Document Part L of the Building Regulations details requirements for the conservation of fuel and power in buildings. The aim of Part L is to reduce carbon dioxide emissions in buildings by reducing energy consumption.

A revised version of the Part L came into force in April 2006, which has tightened the previous regulations to reduce energy consumption. With these changes, it is predicted that one million tonnes of CO₂ will be saved by 2010, which would contribute to about 5% of the UK Kyoto commitment¹⁶.

The Document is divided into 4 Sections, which follow the order in the Approved Document L:

- ◆ Part L1A – Conservation of Fuel and Power in new Domestic buildings;
- ◆ Part L1B – Conservation of Fuel and Power in existing Domestic buildings;
- ◆ Part L2A – Conservation of Fuel and Power in new Buildings other than Domestic buildings; and
- ◆ Part L2B – Conservation of Fuel and Power in existing Buildings other than Domestic buildings.

NB: The above parts all cover **regulated** emissions only, unregulated emissions are not covered.

Currently Building Regulations compliance can only be demonstrated through an approach which compares calculated future building carbon with emissions with a notional building based on 2002 Building Regulations reduced by an improvement factor. The improvement factor used in the 2006 revision of the Building Regulations was 0.2 (Table 1) for domestic buildings and non-domestic buildings (except those with natural ventilation, where the improvement factor was 0.15). Therefore the 2006-compliant domestic building has to achieve a 20% improvement compared to a 2002-compliant domestic building. Non-domestic buildings also have

¹⁵ The Merton Rule (adopted in 2003) requires the use of onsite renewable energy to reduce CO₂ emissions from developments. It applies to developments with 10 or more domestic buildings or non-domestic developments where the floor area will be 1,000m² or more. See glossary for more information

¹⁶ The Kyoto Protocol was adopted by consensus at the third Conference of Parties (COP3) to the Framework Convention on Climate Change held in Kyoto, Japan, in December 1997.

to meet the LZC (low or carbon) benchmark. The benchmark encourages the installation of renewables in non-domestic buildings.

Table 1 Improvement factors used in current Building Regulations

Building Service Strategy	Improvement Factor	Low/Zero Carbon Benchmark	Target Emission Rate (TER) = Reduction
Domestic			
Domestic building	0.2	n/a	20
Non-domestic			
Heated & Natural Ventilation	0.15	0.10	23.5
Heated & Mechanical Ventilation	0.20	0.10	28
Air Conditioned	0.20	0.10	28

As can be seen from Table 1 above, different CO₂ reductions are required from different types of buildings. The improvement factors are applied first, with the Low/Zero Carbon Benchmark (LZC) applied to the remaining CO₂ emission rate. This results in a target improvement of 23.5% for naturally ventilated buildings and 28% for mechanically ventilated and air conditioned buildings.

The Building Regulations have no direct requirement for renewable energy provision, with this being one way for making the required emission reductions. The Low or Zero Carbon (LZC) Benchmark is kept separate so that it can be made mandatory and/or increased in the future revisions of the Building Regulations.

Compliance must be demonstrated for domestic buildings using Standard Assessment Procedure (SAP 2005) methodology whilst for non-domestic buildings a Government approved tool such as the Simplified Building Energy Model (SBEM) or commercial thermal modelling software such as IES¹⁷, Tas¹⁸ and Hevacomp¹⁹ must be used.

Future changes to the Building Regulations

The intention of the proposed progressive tightening of the Building Regulations up to 2016 is to increase the energy efficiency and reduce the carbon footprint of new housing developments in a 3-step approach; i.e. a 25% improvement in the energy/carbon performance set in building regulations by 2010; a 44% improvement by 2013; and finally, zero carbon by 2016. These changes have been an integral part of our modelling to determine the viability of renewable technologies between 2010 and 2020. Section 3.2.1 provides more detail on the future changes to Building Regulations.

¹⁷ IES is software produced by Integrated Environmental Software Ltd (<http://www.iesve.com/content/default.asp?page=home>)

¹⁸ Tas software is produced by Environmental Design Solution Ltd (<http://www.edsl.net/>)

¹⁹ Hevacomp software is produced by Bentley Systems (UK) Ltd (<http://www.hevacomp.com/>)

It should be highlighted that neither the Code for Sustainable Homes, the EST standards nor the Building Regulations explicitly state any specific percentage requirement for renewables. An on-site renewables generation policy will therefore ensure a minimum level is implemented.

2.3.5 Other national policies

- ◆ *Meeting the Energy Challenge: A White Paper on Energy (DTI, 2007):* The White Paper recognises that renewables are key to tackling climate change. It sets a target that renewable energy should provide at least 10% as a proportion of electricity supplies by 2010 (it currently provides around 4% of the mix of electricity generation types in the UK), with an aspiration to double this by 2020.
- ◆ *Renewables Obligation:* This is the Government's main mechanism for supporting the generation of renewable electricity. The obligation requires licensed electricity suppliers to source a specific, and annually increasing, percentage of the electricity they supply from renewable sources. Based on government projections and their proposals to strengthen and modify the Renewables Obligation, electricity supplies from renewable sources will triple between now and 2015 to around 15% of the total electricity supplied.
- ◆ *The Code for Sustainable Homes:* The code provides a single national standard covering sustainable design and construction including energy efficiency and carbon dioxide reduction. It is now mandatory for all new homes to have a rating against the code. The code levels follow the proposed changes to the Building Regulations. Level 6 of the Code for Sustainable Homes includes unregulated emissions.
- ◆ *Building a Greener Future: Towards Zero Carbon Development:* This document proposed a timetable for revising the Building Regulations in order to reach zero carbon development in all new housing in England & Wales by 2016.
- ◆ *Climate Change Bill (Act 2008):* This bill contains provisions that will set a legally binding target for reducing UK CO₂ emissions by at least 26% by 2020 and at least 60% by 2050, compared with 1990 levels. The bill has now become the Climate Change Act 2008. See also 2.1.1.
- ◆ *National Performance Indicators 185-187:* These indicators are defined by Government to reflect national priorities. NI185 is the percentage CO₂ reduction from local authority operations, NI186 is per capita CO₂ emissions in the local authority area and NI187 looks at tackling fuel poverty.
- ◆ *The UK Fuel Poverty Strategy:* The strategy aims to seek an end to fuel poverty for vulnerable households by 2010. Renewable energy can help contribute to tackling fuel poverty by reducing energy costs, particularly if the home is off the gas network. Half of Wealden's population lives in rural areas and it is safe to assume a reasonable proportion of the population will not have access to mains gas.

2.4 Regional policy

The main renewable energy policies in the South East Plan are outlined below:

Policy NRM11 promotes development design for energy efficiency and renewable energy. It states that Local authorities *should* Promote and secure greater use of decentralised and renewable or low-carbon energy in new developments, including

through setting ambitious but viable proportions of the energy supply for new developments to be *required* to come from such sources. In advance of local targets being set in Development Plan Documents, new developments of more than 10 domestic buildings or 1000m² of non-residential floorspace should secure at least 10% of their energy from decentralised and renewable low-carbon sources unless, having regard to the type of development involved and its design, this is not feasible or viable". Policy NRM 13 sets renewable energy targets for the South East region (Table 2).

Table 2 Renewable energy targets in NRM 13 of the South East Plan

Year/Timescale	Installed Capacity (MW)	% Electricity Generation Capacity ²⁰
2010	620	5.5
2016	895	8.0
2020	1,130	10.0
2026	1,750	16.0

Policy NRM 14 sets sub-regional targets for the South East. Wealden falls within the East Sussex and West Sussex sub-region, which has the lowest renewable energy target of any of the South East sub-regions.

Table 3 Renewable energy targets in NRM 14 of the South East Plan

Sub-region	2010 Target (MW)	2016 Target (MW)
Thames Valley & Surrey	140	209
East Sussex & West Sussex	57	68
Hampshire & Isle of Wight	115	122
Kent	111	154

2.5 Local policy

2.5.1 Brighton & Hove City Council

Brighton & Hove Council is currently using a Sustainable Building Design SPD and a sustainability checklist for new developments, rather than setting a target percentage from renewable energy (as in the Merton Rule, for example).

The Sustainable Building Design SPD came into effect in September 2008. Its recommendations vary depending on the scale and type of development. For example, for a medium-scale new build residential development, it recommends achieving zero net annual CO₂ from energy use, a minimum rating of level three of the Code for Sustainable Homes as well as meeting Lifetime Homes Standard. All residential applications involving new build and conversions must also complete a sustainability checklist. This assesses the steps taken to minimise energy demand, maximise thermal efficiency, maximise the proportion of energy provided through on-site generated zero carbon energy and through low carbon technologies.

²⁰ The percentages are based on installed electricity generation capacity in 2001, with an assumption that any growth in demand or consumption of electricity is met by additional generation capacity in the region from renewables only or by imports to the region, and no increase in conventional generation capacity in the region

Brighton & Hove Council has completed a Core Strategy Revised Preferred Options Document, which was published for public consultation in 2008. The council is analysing the responses to that consultation and expects to publish the Submission Version of the Core Strategy in October 2009, before submitting it to the Secretary of State in February 2010. The Core Strategy Revised Preferred Options Document recognises the need to meet the regional targets in the draft South East Plan and the 3.5% per annum CO₂ reduction target in the Council's Sustainable Community Strategy.

See appendix 9 for more details.

2.5.2 Hastings Borough Council

In its annual monitoring report for 2006/07, Hastings mentions a target of 10% of energy used in major new development to come from on-site renewables. The preferred approach for Hastings Core Strategy (to come into force by 2011) is that all commercial development of over 1,000m² or residential development of 10 or more domestic buildings will be expected to provide at least 10% of its energy requirements from onsite renewable energy generation. This is set out in objective 12 of their Core Strategy Preferred Approaches Document (May 2008). Therefore Hastings is proposing to set a target percentage consistent with that in the South East Plan.

See appendix 10 for more details.

3. SETTING RENEWABLE ENERGY TARGETS FOR NEW BUILDINGS

3.1 Introduction

In this section we outline the methodology and resulting evidence to set low and zero carbon targets for new buildings in Wealden from 2011-2026. The proposed targets take into account proposed changes in Building Regulations set out in 2.3 - 2.4 above.

Following instruction from Wealden District Council, reduction targets in the range 5 - 30% were tested for domestic buildings and reduction targets in the range 5 - 20% were tested for non domestic buildings. These tests took account of both regulated (part L) and unregulated emissions and future proposed changes to the Building Regulations.

3.2 Methodology

The same overall approach was undertaken for both domestic and non-domestic buildings:

3.2.1 Step 1: Calculate regulated energy demand and emissions (Part L)

It is intended that Wealden District Council's policy would be adopted in 2011 and last until at least 2026. As a result, any renewable energy target for developers should accommodate changes to policy, such as Building Regulations and, if implemented, the Code for Sustainable Homes.

Table 4 outlines the proposed changes to the Building Regulations. Emissions reductions are planned, relative to current Building Regulations, for 2010 and 2013. These changes have been an integral part of our modelling to determine the viability of renewable technologies between 2010 and 2020 (see section 3.5 for details of what would happen if the proposed changes to the Building Regulations are not implemented).

Table 4 Proposed reduction on current (2006) Building Regulations (regulated emissions)

	2010	2013	2016	2018	2019
Domestic buildings ²¹	25%	44%	zero carbon		
Related level on Code for Sustainable Homes ²²	Code level 3	Code level 4	Code level 5 & 6 ²³		
Non-domestic buildings ²⁴			zero carbon: schools	zero carbon: Government buildings	zero carbon: all buildings (including industrial)

²¹ Building A Greener Future: Towards Zero Carbon Development, by Communities and Local Government, December 2006

²² Ibid

²³ Regulated emissions are covered by the Building Regulations, whereas only Level 6 of the Code for Sustainable Homes includes unregulated emissions

²⁴ The Definition of Zero Carbon, UK Green Building Council report, May 2008

As Table 4 shows, the Code for Sustainable Homes is closely linked to the Building Regulations. Part L of the Building Regulations, however, only covers the conservation of heat and power whereas the Code for Sustainable Homes aims to assess the whole home. Therefore it considers performance in a range of categories:

- ◆ Energy and CO₂ emissions
- ◆ Water
- ◆ Materials
- ◆ Surface water run-off
- ◆ Waste
- ◆ Pollution
- ◆ Health and wellbeing
- ◆ Management
- ◆ Ecology

Overall, the minimum standards for Code compliance have been set above the requirements of the Building Regulations. In terms of energy and CO₂ emissions (category 1 of the Code), by 2010, new domestic buildings will need to achieve a 25% reduction in emissions relative to the 2006 Building Regulations, equivalent to achieving Level 3 in the Code. Similarly, by 2013, new domestic buildings will need to achieve a 44% reduction in emissions relative to the 2006 Building Regulations, equivalent to Level 4 of the Code.

Although it is not mandatory for new homes to be assessed against the Code for Sustainable Homes, all new homes must have a rating against the Code. Therefore developers who have not exceeded Building Regulations do not have to pay for a Code for Sustainable Homes assessment but must display a 'zero-star certificate' instead this certificate must be included in the Home Information pack. Since April 2008, all homes built with a funding contribution from the Housing Corporation or English Partnerships must be built to at least Code level 3²⁵. Table 4 also includes non-domestic buildings. Although a timeline has not yet been produced for non-domestic buildings on reaching zero carbon, the Government has proposed that new non-domestic buildings should be carbon-neutral by 2020. It has therefore been assumed that non-domestic buildings would follow the 25% and a 44% staged reduction although the timing may not follow that of domestic buildings.

²⁵ A funding contribution is only available to dwellings that fall within the definition of affordable housing (PPS3 definition).

Figure 1 Future changes required for developments involving new domestic buildings²⁶

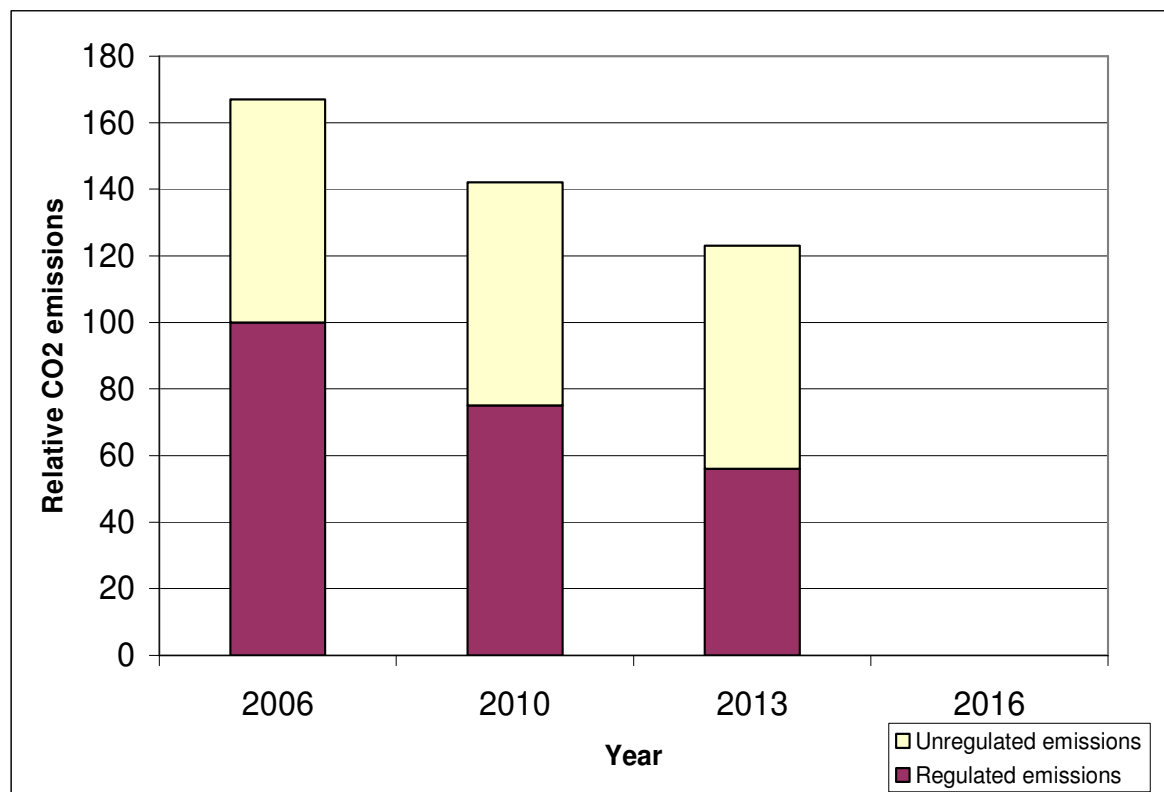


Figure 1 shows the impact on total emissions of the proposed changes to the Building Regulations. The regulated emissions decrease over time due to the strengthening of the Building Regulations. However, as the Building Regulations only act on regulated (Part L) emissions, unregulated (these are emissions that are not regulated by the Building Regulations. They include emissions from lighting, cooking and other appliances) emissions will make up an increasing proportion of total emissions by 2013. By 2016 new homes will need to achieve zero emissions for both unregulated and regulated emissions. This will be a particularly challenging target as unregulated emissions, which include emissions from lights and appliances, can currently account for 40-50% of total emissions in new domestic buildings²⁷.

As part of the study, energy consumption for regulated energy (Part L) during the period of 2010 – 2026 was determined using Standard Assessment Procedure (SAP) Software for domestic buildings and Government approved IES Dynamic Simulation Modelling (DSM) software for non-domestic buildings.

As it was only possible to model generic building types, for non-dwellings providing, only a limited data set, further use of industry benchmarks and additional published data were used to compare with modelling results.

The following scenarios were modelled:

²⁶ On the Y axis, 100 represents the regulated emissions permissible under the 2006 Building Regulations

²⁷ Working draft of practice guidance to support Planning Policy Statement: Planning and Climate Change, by Communities and Local Government, 17/12/07

- ◆ A 25% reduction on 2006 Building Regulations for domestic and non-domestic buildings
- ◆ A 44% reduction on 2006 Building Regulations for domestic and non-domestic buildings

As it is proposed that Building Regulations will require zero carbon buildings in 2016 for domestic buildings and 2019 for all other buildings, it is recommended that local planning policy sets a renewable target of 0% when the requirement for zero carbon buildings is implemented. Imposing a renewable energy target for zero carbon developments would require a building to become a net exporter of energy.

3.2.2 Step 2: Energy demand of unregulated energy

Part L of the Building Regulations covers the building fabric and main services, but does not account for all occupant energy (unregulated) consumption²⁸. Unregulated energy use can be a significant proportion of total CO₂ emissions. In domestic buildings, these emissions result from cooking and appliance consumption and add to total emissions. In industrial units, unregulated energy consumption used for process loads can dwarf emissions for operating the building services.

According to the Practice Guidance to the Supplement to PPS1, these emissions should be added to Part L emissions before setting a renewable energy target²⁹. It is considered that by imposing a renewable energy target in addition to Building Regulations this will reduce emissions directly by the use of renewable technologies, and also drive energy efficiency measures on both regulated and unregulated energy to reduce the amount of renewable energy required.

In the sections below the methodologies used for calculating unregulated emissions for domestic buildings and non-domestic buildings have been outlined in detail.

3.2.3 Step 3: Carbon dioxide emissions

Energy for regulated and unregulated sources is converted to carbon emissions in order to assess the potential and cost of renewable technologies.

Carbon factors from the Building Regulations have been used to determine these emissions³⁰.

3.2.4 Step 4: Assess the potential for renewable energy technologies

Total CO₂ emissions for each development type were calculated by combining the regulated and unregulated emissions. From this figure, the following steps were undertaken to assess the feasibility of a renewable energy target:

- ◆ Assess the maximum technically feasible carbon reduction potential for each renewable technology;

²⁸ These are emissions that not are regulated by the Building Regulations. They include emissions from lighting, cooking and other appliances. Government policy requires that all new homes should have zero emissions for both regulated and unregulated emissions by 2016.

²⁹ Section 3.60 of the Working Draft of Practice Guidance to support the Planning Policy Statement: Planning and Climate Change (March 2008)

³⁰ ODP (2006). Approved Document L2A Conservation of fuel and power in new buildings other than domestic buildings

- ◆ Assess the additional extra cost above base build costs (base build costs for domestic buildings were based on the figures provided in the London Renewables toolkit³¹ and for non domestic buildings on the Green Building Council³²) for each renewable energy at 5%, 10%, 15% , 20% and 30% reduction in overall CO₂ emissions; and
- ◆ Determine level of renewable energy target by assessing the potential from either one technology or a combination of suitable technologies to achieve the carbon reduction; and
- ◆ Calculate the additional cost of the renewable technologies to achieve the identified carbon reductions. From these figures Wealden District Council can determine the financial viability of different technologies.

Renewable Technologies

As discussed in Section 1, the definition for ‘renewable’ technology is taken from the Supplement to Planning Policy Statement 1, which proposes a target percentage of energy consumption at the development to come from decentralised, renewable or low and zero carbon energy sources. These technologies include energy supplies from biomass and energy crops; CHP/CCHP (and micro-CHP); waste heat that would otherwise be generated directly or indirectly from fossil fuel; energy-from-waste; ground source heating and cooling; hydro; solar thermal and photovoltaic generation and wind generation.

Energy from large scale wind, waste, waste heat, hydro power, large scale biomass CHP are all site-specific renewable technologies and are covered in detail in Section 4. Building integrated technologies considered in this assessment for new build are:

- ◆ Biomass;
- ◆ Combined Heat and Power (CHP);
- ◆ Heat pumps – air and ground source;
- ◆ Photovoltaics (PV);
- ◆ Solar thermal; and
- ◆ Wind (small scale).

Fuel cells and small scale biomass CHP are technologies that may become viable in the future and could assist in meeting renewable targets. However at present these technologies are not considered sufficiently mature or cost effective to use within this analysis.

The following table outlines how we have classified the renewable technologies in our assessment and the assumptions we have made for the energy these replace.

31 GLA(2004). London Renewables Toolkit

32Green Building Council (2008). Report on carbon reduction from new non-domestics

Table 5 Summary of renewable technology (Terms used in Appendix 3)

Term in Appendix 3	Renewable Technology	Assumed energy replacement
Solar 1	Solar thermal	- Half gas/oil consumption for hot water demand
Solar 2	Solar thermal providing hot water and some heating	- 60% gas/oil consumption for hot water demand - 10% of heating
Wood	Biomass technology	- Gas/oil space heating and hot water provision
GSHP	Ground Source Heat Pump	- Gas/oil for space heating and hot water
ASHP	Air Source Heat Pump	- Gas/oil for space heating and hot water
PV	Solar Photovoltaics	- Maximum of 30% of the electricity demand divided by number of floors
Wind	Wind	- Maximum potential based on small wind turbine divided by number of floors
CHP	Combined Heat and Power	- Based on gas/oil with a 25% electrical efficiency and a 60% thermal efficiency

Estimating maximum renewable potential

Not including costs, there are technical limits to the contribution to which renewable energy can make to reducing CO₂ for a particular building. For the renewable heat technologies, the upper limit is defined by the amount of heat that is required – as heat cannot easily be exported (unless connected to a district heating network). There may also be limits in terms of accessibility of the resource, but these will be site specific.

In this study, it is assumed that biomass heating could also contribute to the domestic hot water load – particularly with potential improvements to the technology in the future. The surface area of roof is a limiting factor for solar thermal especially in high rise flats. However, domestic hot water requirements will also impact on the potential size of a solar thermal installation.

For power generating technologies such as wind and solar photovoltaics, there is a potential to export electricity not required on site. However, under the current market arrangements, export is not particularly profitable and this creates a potential barrier to this technology. However, the main limiting factor is roof space to fit PV panels or install small scale wind turbines. Furthermore, for small scale wind turbines, site-specific factors such as neighbouring buildings and wind speed will be limiting factors. To account for this, an average output has been used in the modelling exercise.

Combined heat and power is included within the assessment. Although usually feasible at the small scale for one or two domestic buildings the use of CHP would usually be reserved for groups of domestic buildings with a central energy centre or non-domestic buildings with significant heat requirement.

Calculating renewable energy costs

Costs for reducing CO₂ emissions by 5%, 10%, 15% 20% and 30% by each renewable technology were calculated for regulated (i.e. proposed tightening of future Building Regulations by 25% and 44% scenarios) and unregulated emissions. If Building Regulations do not change, a target would be set that would act as a holding policy until the Building Regulations are tightened.

Using these figures, the percentage increase on base build cost was calculated. Base build costs for domestic buildings were based on the figures provided in the London Renewables toolkit³³, (often used as the industry standard to assess the feasibility of renewable technologies) and for non domestic buildings from the Green Building Council³⁴ report on zero carbon non-domestic buildings.

Setting the renewable energy target

Renewable energy targets were assessed by calculating the potential from either one technology or a combination of suitable technologies to achieve the carbon reduction target. Renewable energy costs used in this assessment can be found in Appendix 3.

This method therefore provides evidence that achieving a renewable reduction target is technically achievable and provides the additional cost above base build for each technology – it is not prescriptive to which technology should be employed. This allows the developer to choose the most suitable and cost effective technology for a particular site.

Below specific details of this methodology for different development types are provided and a discussion of the results.

3.3 Domestic buildings

3.3.1 Energy Demand

Energy consumed within a home will depend on a number of factors including size, shape, construction, insulation, position in a block or row, grid connection, orientation and proportion of living space. Wealden District Council provided a broad scope for a number of dwelling types most appropriate to the District, to ensure local distinctiveness. From modelling, the following common domestic building types were considered representative of the new domestic buildings in Wealden.

³³ GLA(2004). London Renewables Toolkit

³⁴Green Building Council (2008). Report on carbon reduction from new non-domestic buildings

Table 6 Dwelling types and sizes used in SAP modelling

Dwelling type	Floor area (m ²)
Detached house	152
Semi-detached house	111
Terraced houses (three)	111
Flats – four on two floors	71
Flats – eight on two floors	71
Flats – nine on three floors	71
Flats – twenty-four on three floors	71

As discussed above, total CO₂ emissions were calculated from Part L energy (regulated emissions), and a figure was included for unregulated emissions.

In order to determine energy broken down by end use and carbon dioxide emissions for the domestic buildings, IES modelling software with Part L1 Standard Assessment Procedure (SAP) assessment capability was used. Dwelling sizes were based on research undertaken by Nationwide Building Society³⁵ on typical sizes for new flats, terraced houses, semi-detached and detached houses. Dwelling models were initially developed following a 'Notional Building' as set out in of SAP 2005³⁶, which would comply with Building Regulations in 2002.

Energy efficiency measures have been assumed within the domestic buildings in order to meet future Building Regulations. These assumptions have been based on a series of Energy Saving Trust documents^{37, 38, 39} which outline design measures for dwelling types that would be required to achieve Code for Sustainable Homes Levels 3, 4, 5 and 6, which mirror changes to the Building Regulations (See section 3.2.1). Two scenarios have been developed.

- ◆ Building Regulations in 2010 (25% below 2006 Building Regulations); and
- ◆ Building Regulations in 2013 (44% below 2006 Building Regulations).
- ◆ These scenarios have been used as the basis to provide evidence to set renewable energy targets if Building Regulations are delayed or the Council sets its Renewable Energy Policy before the Building Regulations are implemented in 2010.

Modelling has not been undertaken for proposed changes to Building Regulations in 2016 for domestic buildings and 2019 for non-domestic buildings as the proposed target is already set at zero carbon. If a target was set for these dates, the Council would be requiring buildings to become net exporters of energy.

The table below outlines a detailed comparison of the Code for Sustainable homes and Part L of the Building Regulations.

35 <http://www.nationwide.co.uk/mediacentre/>

36 BRE (2005). The Government's Standard Assessment Procedure for Energy Rating of Domestic buildings v2

37 Energy Saving Trust (2008). CE 290 – Energy Efficiency and the Code for Sustainable Homes (level 3)

38 Energy Saving Trust (2008). CE 291 – Energy Efficiency and the Code for Sustainable Homes (level 4)

39 Energy Saving Trust (2008). CE 292 – Energy Efficiency and the Code for Sustainable Homes (level 5 & 6)

Table 7 Relationship between the Code for Sustainable Homes & the Building Regulations

Code Level	Minimum percentage reduction over Part L 2006 Building Regulations
Level 1 (*)	10
Level 2 (**)	18
Level 3 (***)	25
Level 4 (****)	44
Level 5 (*****)	100 ⁴⁰
Level 6 (*****)	Zero carbon ⁴¹

Unregulated energy use and related carbon emissions have been estimated using the calculator within the Code for Sustainable Homes Assessment Methodology. This calculated the additional CO₂ emissions related to dwelling size. An assumption has been made that 5% of this figure is related to gas hobs, the rest is attributed to electrical consumption for oven cooking and appliances

Gas heating is the primary form of heating in the UK. However a large number of homes in Wealden are currently off the main gas grid. It is therefore assumed that a number of new homes will also not have access to gas. As a result, an additional two scenarios to achieve 25% and 44% below Building Regulations have also been run using oil in place of gas.

3.3.2 Energy demand results

In Appendix 2, the results from the SAP modelling are provided. From these results, a number of observations can be made:

- ◆ Unregulated emissions
 - Are approximately a third to a half increase in CO₂ emissions above those calculated for Building Regulations;
 - As these remain a constant load in both scenarios, unregulated emissions increase slightly as a proportion of total carbon emissions as Building Regulations tighten;
 - Are proportionally greater for smaller domestic buildings (presumably resulting from cooking and small power consumption which would not decrease proportionally with dwelling size).
- ◆ Building Regulations 2010 (25% reduction) using gas
 - Energy demand measures are based on Energy Saving Trust assumptions on meeting CSH level 3 using energy efficiency measures alone;

⁴⁰ 100% reduction relative to Part L of the 2006 Building Regulations means zero regulated emissions (i.e. zero emissions from heating, hot water, ventilation and lighting)

⁴¹ Zero carbon means zero carbon emissions (both regulated and unregulated) from new developments. To be genuinely zero carbon the home will need to deliver zero carbon (net over the year) for all energy use in the home including space heating, hot water, washing, lighting, cooking, ventilation and electronic entertainment appliances

- One of the key areas across all domestic buildings to drive significant energy reductions is the use of whole house ventilation and heat recovery. Using energy efficient fans can therefore further reduce emissions under this scenario;
- Energy efficiency measures primarily impact on heating requirements with hot water and lighting remaining constant;
- As savings resulting from water efficiency measures are not currently included within the SAP assessment (although savings from reduced losses due to improved insulation from water stores are included), it has been assumed that heating required for domestic hot water remains constant from 2006 to 2016 in all scenarios.
- ◆ Building Regulations 2010 (25% reduction) using oil
 - As oil has a higher carbon factor than gas, energy demand measures to meet a 25 % reduction are based on EST assumptions on meeting CSH level 3 using energy efficiency measures alone;
 - Whole house ventilation with heat recovery is also employed.
- ◆ Building Regulations 2013 (44% reduction) using gas
 - Energy demand measures are based on EST assumptions on meeting CSH level 5 & 6 using energy efficiency measures alone;
 - Using only energy efficiency measures within the SAP assessment based on EST scenarios and without the inclusion of renewables or LZCs, it has not been possible to achieve a 44% reduction in CO₂ emissions. Domestic buildings typically achieved 31% to 36% energy reduction using energy efficiency measures alone.
 - Energy efficiency measures primarily impact on energy required for heating. Hot water, lighting and appliances make up a greater proportion of the carbon emissions.
- ◆ Building Regulations 2013 (44% reduction) using oil
 - No further energy demand measures were included beyond those suggested by EST for a CHS level 5 & 6 home used for the 25% generic modelling.
 - It was therefore not possible to achieve Building Regulations using energy efficiency measures alone, with domestic buildings typically achieving the same improvement levels to the models used to achieve 25% below Building Regulations.

3.3.3 Energy demand conclusions

- ◆ All domestic buildings using either gas or oil can achieve a 25% reduction on Building Regulations (2006) using energy efficiency measures alone;
- ◆ Using energy savings measures outlined in the EST reports and the CSH, all domestic buildings modelled would require renewable or low/zero carbon (LZC) technologies to meet a 44% reduction in Building Regulations; ie a 44% reduction in Building Regulations would not be achievable without the use of

renewable technologies. This is an important factor to take account of when assessing the renewables target. Models need to include the renewables or LZC to meet Building Regulations before calculating the further renewable potential;

- ◆ Domestic buildings that use oil rather than gas require substantial use of renewables or LZC technologies to achieve a 44% reduction.

3.3.4 Domestic buildings renewable assessment

Taking the energy demand calculations for regulated and unregulated emissions using a spreadsheet model, a range of renewables were tested for the maximum technical potential to deliver carbon savings from domestic buildings. This assessment identified whether each renewable would have the technical feasibility to achieve the required carbon reductions. All assumptions on renewable costs and output are provided in Appendix 3.

As a next step, the additional cost above base build was calculated to achieve 5%, 10%, 15% and 20%, and 30% reduction in total CO₂ (regulated and unregulated emissions) for each technology. If a technology was required at a level that exceeded the assumed technical potential for a site (e.g. roof area for PV), this technology was discounted from the pool of potential technologies to achieve the carbon reduction.

Renewable and low or zero carbon technologies can be used separately or in some cases in combination with each other. For example, all heat and power technologies can be used in combination with each other – unless they compete for roof space. However, some technologies that meet the same energy demand such as CHP and solar thermal are not usually used in combination as they compete for the baseload hot water demand.

Being a rural district, a number of homes in Wealden are off the mains gas grid and therefore use oil as the heating fuel. As a result the feasibility for the introduction of renewables in both gas and oil heated homes has been investigated.

Scale of the Development

Most local authorities set the renewable energy target at a threshold size of the development, which is usually 10 or more domestic buildings. It is proposed that all domestic buildings in Wealden should meet the renewable energy targets although it is likely that some developments (small or off the main gas grid) would find the targets technically or financially more challenging. Justification for this approach can be found in Appendix 3 which demonstrates the feasibility of different building types achieving the renewable energy targets.

Using the evidence for renewable energy potential from the assessed future houses, flats and maisonettes across Wealden enables a policy to be determined for larger scale development. This is because the modelled carbon reduction maximum potential per household from a renewable technology will be the same as for respective properties in a larger development.

Larger developments should find it easier to achieve the renewable energy targets as some technologies, such as biomass and CHP may be more viable at a larger scale connected to district heating. Furthermore larger developments should realise some benefits of economy of scale. However as the maximum reduction from each renewable would not differ between single properties and those within a large development. It is therefore considered the renewable energy target should be the same for all dwellings.

It should be possible for a developer to demonstrate that these technologies would not be viable based on the scale and type of a particular development. Some authorities require developers to demonstrate that community heating is not a viable option before considering the introduction of renewable technologies. Wealden renewable policy could also include measures that promote community heating where viable.

Site specific targets for developments that may be sited near a current heat source are discussed in the next section.

3.4 Results

Table 8 summarises the feasibility of achieving various renewable energy targets. The table takes account of the technical potential for each renewable technology and any feasible combinations of technologies. Full results can be found in Appendix 3 which outlines the technical potential for each renewable technologies, and the percentage increase in costs to achieve a 5-30% target for each renewable.

The Table below has been colour coded to show the following:

- ♦ **Green:** Properties that would be able to meet the identified renewable energy target
- ♦ **Blue:** Some properties would find it challenging to meet the identified renewable energy target
- ♦ **Red:** Most properties that would find it challenging to meet the identified renewable energy target

Table 8 Feasibility of different renewable energy targets (ranging from 5% reduction to 30% reduction) for each modelled scenario (Building Regulations changes of 25% or 44% reduction relative to 2006 regulations; gas heating or oil heating)

Carbon reduction relative to Building Regulation (2006)	Start Date	Heat Source	Feasibility of achieving renewable target				
			5%	10%	15%	20%	30%
25% reduction	2010	Gas	Yes Using a number of technologies	Yes Using a number of technologies	Yes Using CHP, Wind and biomass	Yes Using CHP, Wind or biomass	Yes Only Biomass meets target
25% reduction	2010	Oil	Yes Using a number of technologies	Yes Using a number of technologies	Yes Using CHP, Wind, PV and biomass or a combination of technologies	Yes Biomass and PV only – as all buildings use oil this is considered viable	Yes Only biomass meets target
44%*	2013	Gas	Yes Using a number of technologies	Yes Only using biomass, PV and CHP or combination of technologies	Yes Flats would find this target challenging	Yes Flats would find this target challenging	No
44%*	2013	Oil	Yes Biomass only – as all buildings use oil this is considered viable	Yes Biomass only – as all buildings use oil this is considered viable	No Only biomass for houses achieves target	No	No

* Have to use renewable sources initially, as well as part L (Building Regulations) in order to achieve target, so these levels are more onerous to achieve.

Costs of the renewable technologies, presented as percentage above base build are presented in Appendix 3. These costs show that, on average, renewable technologies add approximately between 1-3% on to base build cost. Some technologies, such as PV, required to achieve higher renewable targets add slightly more than 5% to build costs.

Conclusions for 25% reduction from gas and oil properties

In both gas and oil scenarios, solar thermal and wind provide a maximum of 10% reduction in CO₂ emissions. Ground and air source heat pumps have a limited potential to achieve significantly above 10% reduction leaving, in the majority of

cases, either a combination of technologies or biomass, PV and CHP alone to achieve a 20% reduction on total CO₂ levels.

A 30% reduction can only be achieved by biomass technology. Although a combination of CHP and solar PV achieves a 30% reduction, as CHP would be limited to large mixed use developments, this combination would be difficult to implement across the district. Solar thermal and PV combined could also achieve a 30% reduction, however these would compete for roof space – especially on flats.

In conclusion, a 30% reduction could be achieved if the majority of domestic buildings specified biomass. However, it is unlikely that biomass would be feasible for a number of domestic buildings. It is therefore recommended that to make the policy attainable for the majority of new developments, a general target of 20% reduction in CO₂ is set, subject to other Wealden District Council evidence regarding viability.

Conclusions for 44% reduction from gas and oil properties

It has been shown that buildings that use gas or oil as the main heating source would require renewable technologies in order to meet the Building Regulations when they are tightened to 44% below the 2006 level.

As a result, the pool and size of renewable technologies available to achieve further carbon savings is substantially reduced.

Modelling has shown that achieving a 20% reduction in carbon emissions is very challenging for both gas and oil buildings. This is especially the case for oil buildings which would require greater use of renewable technologies to meet Building Regulations. Only biomass technology could move towards (but does not quite achieve) a 20% reduction for oil heated buildings. PV and biomass boilers could be utilised in gas heated buildings to meet the 20% target. Overall achieving a 20% carbon reduction following the tightening of Building Regulations to 44% is a challenging target. It therefore recommended that a general target of 10% reduction in CO₂ is set, subject to other Wealden District Council evidence regarding viability.

3.4.1 Domestic Buildings Renewable Energy Policy

Following the assessment above, it is recommended that Wealden District Council set its renewable policy for all domestic buildings:

- ◆ When Building Regulations are tightened to 25% below current levels (proposed for 2010) a general target of 20% reduction in total CO₂ emissions (regulated and unregulated emissions) is recommended.
- ◆ When Building Regulations are tightened to 44% below current levels (proposed for 2013) a general target of 10% reduction in total CO₂ emissions (regulated and unregulated emissions) is recommended.
- ◆ If Building Regulations are delayed or Wealden Renewable Energy Policy is introduced before the new Building Regulations in 2010, it is recommended that the Council sets a general carbon dioxide (CO₂) reduction target of 20% for all buildings. This is because the modelling undertaken in this study demonstrates that most buildings could achieve a 20% CO₂ reduction from renewable technologies when Building Regulations are tightened by 25%. Setting a present target at 20% would provide a challenging target, whilst preparing developers for the more difficult challenge when Building Regulations are tightened.

Targets could be reduced in the case of specific developments if developers can demonstrate that the target is not technically or financially feasible. The burden of evidence should be placed on the developer to prove that renewable target is not feasible at a particular site.

It is recommended that all developments off the mains gas grid, that would otherwise use oil, should consider the use of biomass technology or demonstrate it is not feasible for the site.

Calculations (appendix 3) show that the increase in base build costs is approximately between 1-3% for the additional cost of most technologies to achieve both CO₂ emission reduction targets. With a growth in the industry, it is also likely that renewable technologies will reduce in cost over the next few years.

Costs for the introduction of renewable technologies in large developments are likely to be lower due to economies of scale. It is therefore likely that a wider range of renewable technologies would be available for larger developments.

In cases where developers can demonstrate that it is not feasible to achieve the general target set out above then the maximum possible reduction should be achieved.

It is proposed that the reduction target is applied to all domestic buildings rather than limiting it to only developments with ten or more domestic buildings. Applying it to single-dwelling developments will ensure consistency with the Government's 2016 zero carbon target as this will apply to single domestic buildings.

This is because only the conversions that would have to comply with Part L 1A of the Building Regulations would have calculated future building carbon emissions. This information is required to assess compliance with the renewable energy policy. It is assumed that if a conversion can achieve the standards to meet the Building Regulations, it should also be able to meet the renewable/low carbon requirements. Furthermore as conversions can vary substantially, depending on the previous building and the converted design, it would be difficult to set varying targets to encompass all the potentialities.

3.4 Non-domestic buildings

In general, a similar approach has been undertaken to determine the most appropriate renewable energy target for non-domestic buildings as for domestic buildings. Furthermore, the category of non-domestic buildings covers a much wider and more varied range of buildings than homes. In order to address this issue and refine the scope of the project for non-domestic buildings, the following factors have been included in the methodology:

- ◆ Undertaking limited modelling for each building type; and
- ◆ More extensive use of benchmarks to provide increased certainty in the modelling process.

Compared to domestic buildings, non-domestic buildings also have a much wider range of possible servicing strategies for providing cooling, heating, hot water and small power. This can result in a building with the same size and function meeting Building Regulations with varying levels of energy consumption and associated levels of carbon dioxide emissions.

The Green Building Council⁴² report on carbon reductions from new non-domestic buildings provided the first comprehensive review of potential for non-domestic buildings to become zero carbon. This report highlighted the difficulties in developing models or conclusions that were representative of non-domestic buildings within and across building activity types.

Although the report based its conclusions on thermal modelling and Simplified Building Energy Model (SBEM)⁴³ modelling of future buildings, it recognised the weakness of coming to conclusions without the use of actual building energy data.

3.4.2 Energy Demand

As outlined in Section 1, under Part L2A of the Building Regulations, new non-domestic buildings must achieve an improvement of 23.5% for naturally ventilated buildings and 28% for mechanically ventilated and air conditioned buildings on 2002 Building Regulations. Models and benchmark figures were used in the case of the following types of non-domestic buildings:

Table 9 Non-domestic building types and sizes used in modelling (including relevant Use Classes Order)

Building	Floor area (m ²)
Factory office (B1)	1300
Light manufacturing (B2)	1300
Storage and distribution (B8)	1612
Bank (A2)	224
Fast food (A5)	1300
General Office	224

As with domestic buildings, two scenarios have been chosen to mirror potential changes to Building Regulations in non-domestic buildings by 2020.

Although the final date for zero carbon non-domestic buildings has been outlined by the Government, no timeline for implementation has yet been finalised. Therefore the 2 same scenarios have been assessed as with domestic buildings but without linking this target to a specific date.

- ◆ A 25% reduction on 2006 Building Regulations; and
- ◆ A 44% reduction on 2006 Building Regulation.
- ◆ These scenarios have been used to provide evidence to set renewable energy targets if Building Regulations are delayed or the Council sets its Renewable Energy Policy before the new Building Regulations in 2010.

Unregulated emissions

Calculating Part L compliance using Dynamic Simulation Modelling (DSM) through IES (Integrated Environmental Solutions) provides end use energy data for regulated and unregulated emissions. However, the Green Building Council report

⁴² Green Building Council (2008). Report on carbon reduction from new non-domestics

⁴³ SBEM the software tool used to produce Building Regulations UK Part L (BRUKL) 2006 Compliance reports and Non Dwelling Energy Performance Certificates (NDEPC)

(2008) outlined that unregulated emissions in reality can be double the size of those determined from DSM modelling. Following the methodology in the report, unregulated emissions have been calculated using benchmark emissions.

3.4.3 Energy demand conclusions

- ◆ Energy demand figures vary significantly whilst still achieving at 25% and 44% reduction in Building Regulations;
- ◆ Aside from restaurants, hot water consumption is a small proportion of building energy demand across all building types;
- ◆ Lighting levels are a significant load and can be reduced, although not significantly, across all building types;
- ◆ For naturally ventilated buildings, additional renewable or low or zero carbon technology will be required to achieve Building Regulations; and
- ◆ Although technologies within mechanically ventilated non-domestic buildings vary, across most models renewables and low and zero carbon technologies would be required to meet Building Regulations

3.4.4 Non-domestic buildings renewable assessment

As with domestic buildings, taking the energy demand calculations for regulated and unregulated consumption using a spreadsheet model, a range of renewables were tested for the maximum technical potential to deliver carbon savings from each building type. This assessment identified whether each renewable would have the technical feasibility to achieve the required carbon reductions.

Renewable and low or zero carbon technologies can be used separately or in some cases in combination with each other. For example, all heat and power technologies can be used in combination with each other (unless they compete for physical roof space such as solar thermal and PV). However, technologies that meet the same energy demand should not be used in combination. For example, solar thermal and CHP should not be used together as each one helps to meet the hot water demand, so they do not complement each other.

Outlined below is a summary of the technical feasibility of achieving renewable targets. Full results can be found in Appendix 3.

The Table below has been colour coded to show the following and is based on the same colour coding as Table 7.

Table 10 Results demonstrating feasibility on reduction on CO₂ emissions in non-domestic buildings

Development type	Emission reduction target	Reduction from total CO ₂ emissions			
		5%	10%	15%	20%
Factory office	25%	Yes	Yes	Yes	Yes
	44%	Yes	Yes	Yes	Yes PV only
Light manufacturing	25%	Yes	Yes	Yes	Yes
	44%	Yes	Yes	Yes	Yes
Storage and distribution	25%	Yes	Yes	Yes	Yes
	44%	Yes	Yes	Yes	Yes
Bank	25%	Yes	Yes	Yes Combination only	No
	44%	Yes	Yes	Yes PV only	Yes PV only
Fast food	25%	Yes	Yes Biomass only	No	No
	44%	No	No	No	No
General Office	25%	Yes	Yes	Yes Combination only	Yes Combination only
	44%	Yes	Yes PV or combination	Yes PV or combination	No
Restaurant	25%	Yes	Yes Biomass only	Yes Biomass only	Yes Biomass only
	44%	Yes	Yes Biomass only	Yes Biomass only	No

A range of technologies are suitable to achieve a 5% - 10% reduction in CO₂ emissions. However, more challenging targets are only achievable through biomass technology or PV. If a building uses only electricity, such as the case with variable heat pump systems, the biomass option would no longer be viable.

3.4.5 Non-domestic Renewable Energy Policy

As non-domestic buildings have a much broader range of activities and energy consumption levels predicting future energy consumption and application of renewable technologies is significantly more complex than for dwelling. It is also likely that potential renewable application to non-domestic buildings will vary widely between different building types.

From the modelling on selected building types and benchmark figures, it is therefore proposed that Wealden District Council set its renewable policy for all non-domestic buildings at the same levels as domestic buildings:

- ◆ When Building Regulations are tightened to 25% below current levels (proposed for 2010) a general target of 20% reduction in total CO₂ emissions (regulated and unregulated emissions) is recommended;

- ◆ When Building Regulations are tightened to 44% below current levels (proposed for 2013) a general target of 10% reduction in total CO₂ emissions (regulated and unregulated emissions) is recommended.
- ◆ If Building Regulations are delayed or Wealden Renewable Energy Policy is introduced before the new Building Regulations on 2010, it is recommended that the Council sets a general carbon dioxide (CO₂) reduction target of 20% for all buildings. This is because the modelling undertaken in this study demonstrates that most buildings could achieve a 20% CO₂ reduction from renewable technologies when Building Regulations are tightened by 25%. Setting a present target at 20% would provide a challenging target, whilst preparing developers for the more difficult challenge when Building Regulations are tightened.

Setting these targets will ensure that developers are challenged when Building Regulations are tightened to 25% below current levels. Keeping the target at 20% as Building Regulations are tightened further (to 44% below current levels) could make the policy too challenging for a number of buildings, especially industrial buildings with a large process load.

As with domestic buildings, developers would have to demonstrate that the target is not technically or financially feasible. In cases where developers can demonstrate that it is not possible to achieve the above targets, then the maximum possible reduction should be achieved.

The burden of evidence should be placed on the developer to prove that renewable target is not feasible at a particular site.

3.5 If the Building Regulations do not change

The assessment of the potential renewable energy targets has been conducted on the basis that the planned changes to the Building Regulations will be implemented at determined levels.

Wealden District Council should include a section in its policy to cover the situation where Building Regulations for non domestic buildings are not tightened. In this scenario it is recommended that the target for non-domestic buildings in 2010 is raised to 45%. This will help increase the emissions reductions despite the Building Regulations not strengthening.

3.6 Whole life costs

The installation of additional renewable energy systems will add to the build cost of new developments.

Whilst the cost will initially make the developments more expensive for the developer, the cost is likely to be fully passed on to the purchaser, or indirectly to the leaseholder, of the building or dwelling.

The installation of additional generation technologies has the potential to allow developers to achieve greater profit margins, due to the competitive advantage over buildings without the low carbon technologies. Therefore developers should be encouraged to see the requirements as marketing opportunities rather than unwelcome costs.

Sited correctly, renewable energy technologies can pay back their cost during their operational lifetime. So, while the purchasers of new properties will pay a premium for their property, they will subsequently benefit from lower energy bills during the lifetime of the equipment- though less certainly for technologies that requires ongoing fuel purchases.

As an example, the whole life costs for the low and zero carbon technologies assessed in this study have been calculated for a typical flat and semi-detached house under the 2010 Building Regulations (25% below 2006 Building Regulations). The results from this assessment can be found in Appendix 5.

This Appendix provides a comparison of the simple payback on capital for identified low carbon technologies. This has been calculated by taking the modelled annual energy demand data, assumed data on the costs of conventional utilities and demonstrating the potential annual saving from using renewable technologies as a replacement. Using these annual savings a payback on the capital investment has been calculated.

Occupiers of new non-domestic buildings, such as light industrial units, may have an influence over the design and specification of the building. This situation may improve the financial viability of large scale investments in generation technology. For example, a commercial scale wind turbine will have a very high capital cost, which cannot realistically be integrated into the cost of a new commercial building. However, if the future occupier has access to sufficient finance, and has an appetite for this type of investment, there could be scope for the cost of the wind turbine to be integrated into the total build cost. The income from the large scale wind turbine could subsequently directly benefit the occupier.

A route where a developer could see a strong benefit from maximising the potential for onsite generation is in the establishment of an Energy Services Company (ESCO) for the site. The ESCO would look to generate as much energy as possible onsite- minimising the reliance on electricity or fossil fuel purchased from major suppliers. This situation could incentivise investment in commercial scale generation, such as wind turbines or district heating fuelled by biomass, in order to provide a whole site solution.

Eligibility for government incentives further improves the financial viability of electricity generation technologies, and potentially renewable heat as well. The Renewables Obligation already supports small scale electricity generation, including wind turbines and solar photovoltaics, improving their payback by allocating certificates which hold a financial value to the generator as they produce renewable electricity.

The Government has recently announced plans for a Renewable Heat Incentive, which would benefit biomass heat, solar thermal and heat pumps by paying the user for the heat they generate. Alongside this, there are plans for a fixed price 'feed in tariff' for small scale renewable electricity generation- which would be a more predictable and administratively simple alternative to the Renewables Obligation.

Grants, such as the Low Carbon Building Programme and the Bioenergy Capital Grants Scheme may provide upfront capital support, though availability is currently inconsistent and limited.

While the capital cost of developments will be increased, long term energy cost savings and incentives such as the Renewables Obligation serve to provide a return to the end user of the new development, i.e. the person or organisation who ultimately pays for the technology. For this reason, it will be important to ensure



that public perception of the additional costs on new developments is positive and seen as an investment rather than an unwanted tax.

4. SITE SPECIFIC CARBON REDUCTION TARGETS

The Government has requested that planning authorities implement higher targets for carbon reduction from renewable or low carbon energy sources in developments where there are demonstrable opportunities to do so⁴⁴.

The opportunity for higher site specific targets may be supported by an exceptional local renewable or low carbon energy resource, or a development whose energy consumption profile is particularly suited to low carbon energy sources.

This chapter identifies notable areas of renewable energy resource in Wealden and proposes criteria for developments that could justify a higher site specific target.

4.1 Description of Wealden

Wealden is a rural district covering 323 square miles in East Sussex. It consists of five main population centres:

- ◆ Crowborough is (marginally) the largest town in Wealden in terms of population, with a population of approximately 20,000. It is situated in the middle of the High Weald Area of Outstanding Natural Beauty (AONB) and surrounded to the west by Ashdown Forest (Site of Special Scientific Interest, Special Protection Area and Special Area of Conservation). The sensitive location of Crowborough may limit the type and amount of development allowed.
- ◆ Uckfield is a smaller town, also in the north of the District. It has a population of approximately 14,000. Uckfield's location means it is susceptible to flooding from both the River Ouse and the River Uck. However, Uckfield is not constrained by landscape issues in the way that Crowborough is, so the South East Plan suggests focusing on Uckfield as an area for potential new development.
- ◆ Heathfield is a much smaller town. It is surrounded by the AONB which may limit the amount of new development it can accommodate.
- ◆ Hailsham is the main town in the south of the district. It has a population of approx 20,000. It has potential for new development as it is not limited to such an extent by sensitive landscape, although it is adjacent to the nearby Pevensey Levels (Ramsar Site), whose proximity may present some constraints. It also contains more industry than the other towns in Wealden. However, two existing waste water treatment facilities serving Hailsham and Polegate discharge into a RAMSAR site (Pevensey Levels). Waste Water Treatment will need to be supplemented if any large-scale development is to occur.
- ◆ Polegate is the other main town in the south of the district. It is located near Eastbourne and has a population together with the Parish of Willingdon and Jevington (situated adjacent to Polegate) of approximately 14,000. It is adjacent to the proposed South Downs National Park, but has the potential for greenfield development

44 Planning Policy Statement: Planning and Climate Change. Supplement to Planning Policy Statement 1 p16)

4.2 Policy relating to locating renewable energy

Policy NRM15 in the South East Plan covers where renewable energy should be located. It states that Local Development Frameworks should encourage the development of renewable energy to achieve the targets in NRM 13 and NRM 14. Renewable energy should be located and designed to minimise adverse impacts on landscape, wildlife and amenity. Wind and other renewable energy developments should not be precluded in AONBs and national parks as there will be locations suitable for small scale construction, where conflict with statutory landscape protection (set out in PPS7) can be avoided or minimised. This is relevant to Wealden as the district contains part of the High Weald AONB and the proposed South Downs National Park.

Within areas of protected and sensitive landscapes, including AONBs or national parks, development should be small-scale or community-based. Proposals within or close to the boundaries of designated areas should demonstrate that development will not undermine the objectives that underpin the purposes of designation.

4.3 Renewable energy resources and site specific opportunities within Wealden

4.3.1 Wind

Wind energy resources are very site specific, and although the UK as a whole has an excellent wind resource, it varies considerably across the country.

Wind speeds increase with height. As a result, large stand alone wind turbines between 50 m and 100 m are able to access a greater wind resource than building mounted turbines at 10 m – 30 m high.

Owing mainly to its proximity to the coast and the presence of several hilly areas, Wealden has relatively high wind speeds for the South East of England. The highest wind speeds in Wealden are found in the headland area west of Eastbourne and Beachy Head, and stretching across the higher ground north west towards Tarring Neville. Predicted average wind speeds exceed 8m/s (at 45m above ground) in places, which is high for South East England. Significant wind farm development is unlikely to be viable in this area, as it falls within the South Downs AONB. However, individual and smaller wind turbines should still be feasible. For example, the now permitted Glyndebourne Opera House wind turbine near Lewes falls within the same AONB. Technically, the areas around Crowborough Heathfield may also be suitable as average wind speeds exceed 7 m/s at 45m above ground level.

No areas in Wealden have average wind speeds below 5.5m/s (at 45m above ground level), which is typically the threshold below which commercial scale wind turbines are less viable⁴⁵. However, overall viability also depends on site electricity demand and the consumer's payback requirements.

Smaller ground and building-mounted wind turbines, typically less than 20m above ground, would be exposed to lower average wind speeds. In addition, they are more vulnerable to turbulence, and a consequential reduction in performance due to local buildings, trees and local topography. It is therefore important that sites are assessed on a case by case basis for small wind turbine feasibility.

⁴⁵ This relates to large wind turbines. The wind speed of 5.5m/s is measured at 45m above ground level which is relevant to a large turbine but is not relevant to a smaller building-mounted turbine

Exposed, coastal and rural sites are likely to be most suitable. Therefore for new developments in such locations, developers should be strongly encouraged to consider wind turbines. Small scale wind turbines are likely to be most suitable in Wealden due to the widespread landscape designations. This may facilitate higher site specific carbon reduction targets, especially in Crowborough and Heathfield which have both an excellent wind resource. However there are careful considerations to be made in relation to the potential impacts of any wind generating development on the surrounding areas of AONB.

Both Planning Policy Statement 7 and 9 are relevant when considering the use of wind turbines in the District. The Planning Policy Statement 7: Sustainable Development in Rural Areas emphasises that local planning authorities should give great weight to the conservation of the natural beauty of AONBs when developing planning policies and making development control decisions. PPS 7 also states that decisions on development proposals should be based on sustainable development principles including a consideration of prudent use of natural resources. Wealden District Council could take this into account when considering an application to install a wind turbine⁴⁶. The Planning Policy Statement 9: Biodiversity and Geological Conservation outlines how local planning authorities should take into account the impact of planning decisions on biodiversity⁴⁷. In the case of applications for wind turbines, Wealden District Council would therefore need to consider the potential impact of the turbine on biodiversity, particularly bird and bat species.

4.3.2 Wood fuel

Wealden is located in one of the most wooded parts of lowland Britain. Woodlands and forests of over 0.1 hectares in size cover 16.7% of the land area (29,924 ha) of East Sussex, considerably above the national average of about 9%⁴⁸. In addition, the South East region as a whole is the most densely wooded region in England⁴⁹. The majority (91%) of the woodlands and forests of East Sussex are not owned by the Forestry Commission. The Forestry Commission does practice commercial forestry notably at Friston Forest near Eastbourne and there are a couple of large private woodland estates for instance the Paddockhurst and Cowdray estates, within the boundary of Wealden District Council. However, up to 25% of the woodland in the region is unmanaged, due to a lack of market and because the economic value has been less than the harvesting cost.

The District of Wealden has a potential tonnage of available wood of between 100 and 400 tonnes per square kilometre, with the highest density of production in the North and South West of the District (Figure 6, Appendix 5). In comparison, the unitary authority of North Lincolnshire and the borough of Scarborough, which cover a similar land area as the District Council of Wealden (835 km²) have an average tonnage per kilometre of between 10-28 t/km² and 34 – 74 t/km², respectively.

As a mainly rural area, air quality issues with biomass combustion are likely to be insignificant. However, in urban areas, an air quality assessment survey may be required before installation is permissible.

46 Planning Policy Statement 7: Sustainable Development in Rural Areas, Office of the Deputy Prime Minister, August 2004

47 Planning Policy Statement 9: Biodiversity and Geological Conservation, Office of the Deputy Prime Minister, August 2005

48 FC 2000 National Inventory of Woodland and Trees – East Sussex

49 Defra 2000 ERDP - South East Region

While wood pellet fuel is available as a commodity, traded internationally, wood chip fuel tends to be produced and supplied on a more local basis. However, the availability of wood fuel should not be a barrier to biomass heating in new developments across Wealden, owing to the excellent local woodland resource. A more likely barrier is the lack of a developed supply chain, which may be an area that requires local authority support.

Developers should be encouraged to consider biomass heating with the facility to use wood chip fuel.

4.3.3 Heat

A major consideration in setting site specific targets is to use existing sources of heat supply, or identify developments suitable for community heating. Using what would otherwise be waste heat is an effective means of cutting fossil fuel consumption at the point of heat use, and therefore reducing carbon emissions. The emissions reduction potential is greatest when the excess heat is generated from a renewable source.

Any new developments to be located in close proximity to facilities with existing significant heat output should investigate whether:

- ◆ The existing site has excess heat that could supply the new development; and
- ◆ The existing site has a high heat load that could be supplied by new CHP and/or district heating facilities.

We have been informed that no major district heating networks or renewable heat projects exist in Wealden, although in Crowborough, Beacon Community College has recently replaced its heating system with a new biomass boiler running on wood chip/sawdust, as well as food waste generated onsite. Wealden does not contain a concentration of heat intensive industry either. However, if new facilities are developed, then the opportunity to export heat to nearby developments should be assessed.

4.3.4 Energy from waste

Waste management facilities, specifically energy from waste technologies, can be a suitable source of heat for new developments. For example, the South Shropshire anaerobic digester in Ludlow is planning to distribute heat from its CHP unit to a nearby business park.

Residual waste in Wealden is currently sent to landfill. There are plans⁵⁰ for an Energy from Waste plant at Newhaven, which would provide a waste disposal facility for East Sussex, including Wealden. This facility has the potential to be able to export heat, but is located outside Wealden, in Lewes District.

If this facility goes ahead, then there is unlikely to be a need for an additional centralised municipal waste facility in the area. However, smaller scale waste management facilities such as anaerobic digester plants may be developed in the future and may generate more heat than they require. New developments could take advantage of this 'spare' heat.

No sites with available waste heat have been identified within the District, which could be used now or in the future to set a higher site specific renewable target.

50 <http://www.eastsussex.gov.uk/environment/planning/applications/erf/>

4.3.5 Non geographically specific resources

The viability of several renewable and low carbon energy technologies does not vary significantly across Wealden. These include:

- ◆ Solar photovoltaics
- ◆ Solar thermal
- ◆ Heat pumps (ground and air source)

Their viability depends on local planning constraints and site specific issues including space, access and the site energy demand profile.

4.3.6 Hydro

While there are no major opportunities for hydro power stations in Wealden, small hydro installations may be possible. This could include the conversion of disused water mills. Opportunities for hydro generation by their nature tend to be in rural locations and the installation of equipment in urban water courses may increase flood risk. However, should proposed developments be located close to a river or a disused mill, then the opportunity to generate hydro power for local use should be investigated.

4.4 Designations affecting feasibility of large scale renewable energy generation

Many areas in Wealden are covered by environmental designations, such as AONBs and SSSIs (Figure 1, Appendix 5).

4.4.1 National planning context

The requirements for renewable energy installations in those areas are regulated by the Planning Policy Statement 22 (PPS22). According to the regulation, in sites with nationally recognised designations, planning permission for renewable energy projects should only be granted under certain conditions. It needs to be demonstrated that the objectives of designation of the area will not be compromised by the development. Any significant adverse effects on the qualities for which the area has been designated have to be clearly outweighed by the environmental, social and economic benefits.

Regional planning bodies and local planning authorities have to include in their regional spatial strategies and local development documents, criteria-based policies which set out the circumstances in which particular types and sizes of renewable energy developments will be acceptable in nationally designated areas. Small-scale developments should be permitted in areas such as National Parks, Areas of Outstanding Natural Beauty and Heritage Coasts provided that there is no significant environmental detriment to the area concerned.

4.4.2 Regional planning context

For the South East region, those criteria are laid down in the Regional Spatial Strategy (South East Plan). The policies in Wealden's draft non-statutory Local Plan broadly follow the proposals in the draft South East plan relating to renewable energy development in sensitive landscapes:

- ◆ The location and design of all renewable energy proposals should be informed by landscape character assessment where available.
- ◆ Within areas of protected and sensitive landscapes, including AONBs and national parks, development should generally be small scale or community based.
- ◆ Proposals within or close to boundaries of designated areas should demonstrate that development will not undermine the objectives that underpin the purposes of designation.⁵¹

Therefore development of renewable energy installations with a significant impact, such as large scale wind turbines and centralised biomass plants, is unlikely to be permissible. So site specific targets may not be feasible for developments located within environmentally designated areas.

The PPS22 guidance material⁵² states that within designated National Parks, AONBs and Heritage Coasts, wind developments should be limited to individual turbines of no greater than 100kW installed capacity, to provide power to off-mains properties and other small users.

4.4.3 Proposed criteria for renewable energy projects

The National Association of AONBs⁵³ proposes that schemes of between one and three turbines, ranging up to 500 kW (approximately 60m high to blade tip), may be acceptable, provided that the zone of visual impact does not adversely affect the neighbouring countryside. Where more than one scheme may be feasible, these should be at least 10km apart, to avoid the creation of wide spread low-density developments, which, overall, would have a cumulative and obtrusive impact.

Based on the regulatory context, the National Association for Areas of Outstanding Natural Beauty's (NAAONB) position statement and a report for Cotswolds Conservation Board on renewable energy in AONBs, we recommend to Wealden Council:

- ◆ wind farms and wind turbines >500 kW or large scale bio mass energy generation facilities are likely to be inappropriate;
- ◆ small scale single wind turbines designed to produce electricity for local use can be more readily assimilated into the landscape;
- ◆ solar photovoltaic and solar thermal applications can be installed with only limited visual impact and should be encouraged;
- ◆ ground source heat pumps should be encouraged in new constructions or conversions;
- ◆ small scale hydro applications should be encouraged if appropriate and provided that biodiversity issues are taken into account; and

51 http://www.southeast-ra.gov.uk/southeastplan/plan/view_plan.html

52 <http://www.communities.gov.uk/documents/planningandbuilding/pdf/147447.pdf>

53 National Association for AONBs (2002) Wind Energy Developments in AONBs - A Position Statement by the National Association for AONBs

- ♦ small to medium scale biomass community projects should be encouraged, in particular where they generate heat. However, emissions associated with transporting the fuel should be taken into account.

4.5 Conclusions

Exceptional renewable energy resource availability and different types of new development can, at certain sites, justify increasing the requirement for onsite carbon reductions from renewable and low carbon energy.

Specific sites have not been tested at this stage as it is too early in the LDF process to be able to identify potential sites which may come forward as part of the LDF process. Detailed site specific assessments may demonstrate that it is possible to set exceptional site specific targets. In the same vein, future developments, both domestic and non-domestic, may be suitable to allow Wealden District Council to set higher specific renewable energy targets.

It is therefore considered at this time that it is not feasible to set explicit site specific targets for a site or particular development within the District.



APPENDICES

1. GLOSSARY

Air source heat pumps: Air source heat pumps absorb heat from the outside to heat buildings. There are two types of air-source heating systems: air-to-air systems, which provide warm air that is circulated to heat the building; and air-to-water systems, which heat water to provide heating to a building through radiators or an underfloor system.

Anaerobic digestion: This is a process in which organic matter is broken down. Unlike composting, anaerobic digestion is carried out in an oxygen-free environment, which enables specially adapted bacteria to break down the material. Anaerobic digestion can be used to generate energy through the methane gas produced by the bacteria.

Area of Outstanding Natural Beauty (AONB): An AONB is a protected area whose distinctive character and natural beauty are so outstanding that it is in the nation's interest to safeguard them.

Bioenergy Capital Grants scheme: This scheme aims to promote the efficient use of biomass for energy, by stimulating the early deployment of biomass fuelled heat and biomass combined heat and power projects. The scheme awards capital grants towards the cost of equipment in complete installations. It is aimed at businesses, organisations and charities in the commercial, industrial and community sectors that are considering investing in biomass-fuelled heat and/or combined heat and power projects, including anaerobic digestion.

Biomass: Biomass is biological material derived from living, or recently living organisms. Biomass can be used to generate energy. In this context, biomass often means plant based material, but it can equally apply to animal-derived material.

Building Regulations: These regulations aim to ensure the health and safety of people in and around buildings, and to improve the energy efficiency of buildings. The regulations apply to most new buildings and many alterations of existing buildings, whether domestic, commercial or industrial.

Building Research Establishment Environmental Assessment Methodology (BREEAM): BREEAM is an environmental assessment method for buildings. It sets the standard for best practice in sustainable level and enables building to demonstrate a level of achievement in this field.

Carbon factor: A carbon factor is a conversion factor, used to calculate the amount of CO₂ emissions resulting from burning fuel for electricity, heating or transport.

Climate Change adaptation: This involves making adjustments to natural or human systems in response to actual or expected Climate Change.

Climate Change mitigation: This involves taking action to reduce or avoid the harmful effects of actual or expected Climate Change.

Climate Change supplement to PPS1: This supplement set out how planning should contribute to Climate Change mitigation and adaptation.

Climate Change: Climate Change is occurring through human activities, principally the burning of fossil fuels, which releases greenhouse gases. Increasing levels of greenhouse gases are threatening the world's climate, economy and population.

Code for Sustainable Homes: The code provides a single national standard covering sustainable design and construction. It is now mandatory for all new homes to have a rating against the code. The code levels follow the proposed changes to the Building Regulations.

Combined heat and power (CHP): This is the simultaneous generation of usable heat and power (usually electricity) in a single process, thereby reducing wasted heat and putting to use heat that would normally be wasted. CHP is an efficient form of decentralised energy supply providing heating and electricity at the same time. It can be 70-90% efficient compared to conventional power stations which are only approximately 40-50% efficient. Micro-CHP is small scale combined heat and power. It can be used to provide heat for a home and contribute towards its electricity demands.

Community heating: Community heating systems replace individual heating systems within homes using locally-based heating plants instead. Community heating often using combined heat and power technology.

Decentralised energy supply: This is energy supplied from local renewable and local low-carbon sources (on-site and near-site, but not remote off-site) usually on a relatively small scale.

Energy Services Company (ESCO): An ESCO is an organisation that provides energy services, such as heat and light, rather than the raw energy required for that service. The package of energy services can include equipment, financing, installation, operation and maintenance. The principle behind this is that consumers need energy to provide particular services but are not necessarily interested in every step in the chain that generates the energy.

Fuel cell: A fuel cell can be used as CHP system, to generate heat and power. It works in a similar way to a battery except that fuel is fed into the cell to generate electricity and heat by an electro-chemical process producing pure water as its output emission.

Ground source heat pumps: Ground source heat pumps use a buried ground loop, which transfers heat from the ground into a building to provide space heating and to pre-heat domestic hot water.

Local Development Framework: A Local Development Framework is a folder of local development documents that outlines how planning will be managed in your area.

Low Carbon Buildings Programme: This programme provides grants for the installation of microgeneration technologies in a range of buildings. Households, community organisations, public, private and the non-profit sectors are all eligible for grants.

Merton Rule: The Merton Rule, so called because it was first introduced by the London Borough of Merton, requires the use of onsite renewable energy to reduce CO₂ emissions from developments. It applies to developments with 10 or more domestic buildings or non-domestic developments where the floor area will be 1,000m² or more.

Part L: Part L of the Building Regulations covers the conservation of heat and power in buildings.

Planning Policy Statement 1 (PPS1): This Statement sets out the Government's overarching planning policies on the delivery of sustainable development through the planning system.

Planning Policy Statement 3: Housing (PPS3): This statement covers the delivery of the Government's strategic housing policy objectives, including the goal to ensure decent, affordable housing.

Regulated emissions: These are emissions covered by the Building Regulations, principally emissions from space heating and hot water.

Renewable and low-carbon energy: Renewable energy covers energy flows that occur naturally and repeatedly in the environment, such as energy from wind, the fall of water, the movement of the oceans, the sun and also from biomass. Low-carbon technologies are those that can help reduce carbon emissions. Renewable and/or low-carbon energy supplies include, but not exclusively, those from biomass and energy crops; CHP/CCHP (and micro-CHP); waste heat that would otherwise be generated directly or indirectly from fossil fuel; energy-from-waste; ground source heating and cooling; hydro; solar thermal and photovoltaic generation; wind generation.

Renewable Heat Incentive: The government is currently considering a renewable heat incentive scheme. The scheme would operate as a levy on fossil fuel suppliers, which would raise money to subsidise renewable heat generators. Direct payments would be allocated to renewable heat generators, based on their output. The technologies that would be eligible under the scheme include biomass heating and CHP, solar thermal and heat pumps. The renewable heat incentive is not expected to come into force until at least mid 2010. The method for running the scheme is yet to be defined, as well as the amount of support that will be available.

Renewables Obligation: This is the Government's main tool to support the generation of renewable electricity. The obligation requires licensed electricity suppliers to source a specific, annually increasing percentage of the electricity they supply from renewables.

Solar photovoltaic: Solar photovoltaic technology uses cells to convert sunlight into electricity. The PV cell consists of one or two layers of a semi conducting material. When light shines on the cell, it creates an electric field across the layers causing electricity to flow. The greater the intensity of the light, the greater the flow of electricity.

South East Plan: The South East Plan outlines a vision for the future of the South East region to 2026, including how the region should respond to challenges facing the region such as housing, the economy, transport and protecting the environment. The plan aims to ensure the South East remains economically successful and an attractive place to live for future generations.

Standard Assessment Procedure (SAP): SAP is the Government's recommended system for energy rating of domestic buildings. SAP is used to calculate an energy rating based on the annual energy costs for space and water heating. SAP can be calculated using Government-approved software.

Unregulated emissions: These are emissions that not are regulated by the Building Regulations. They include emissions from lighting, cooking and other appliances. Government policy requires that all new homes should have zero emissions for both regulated and unregulated emissions by 2016.



Wood chips: Wood chip is widely used as a fuel for heating in other European countries. It is cheaper than wood pellets although the fuel quality is not as good.

Wood pellets: Wood pellets are a highly compressed standardised product, made from sawdust, normally without other additives. The use of wood pellets for heating is well established in countries such as North America, Sweden, Austria and Denmark. Wood pellets are more expensive than wood chips but are a more consistent fuel with a low moisture content, so they can easily be handled in automatic systems.

Zero carbon: This means zero carbon emissions from new developments. To be genuinely zero carbon the home will need to deliver zero carbon (net over the year) for all energy use in the home including space heating, hot water, washing, lighting, cooking, ventilation and electronic entertainment appliances. A zero carbon home is equivalent to Code Level 6 of the Code for Sustainable Homes.



2. ENERGY DEMAND RESULTS

Appendix 2 Summary of Energy Demand in Dwellings

Gas 2010 (25% below Building Regulations)

Development	Regulated				Unregulated				Total				
	Electricity kWh/m2	Gas kWh/m2	Electricity kgCO2/m2	Gas kgCO2/m2	Electricity kWh/m2	Gas kWh/m2	Electricity kgCO2/m2	Gas kgCO2/m2	Electricity kWh/m2	Gas kWh/m2	Electricity kgCO2/m2	Gas kgCO2/m2	Total CO2 kgCO2/m2
4 flats 2 floors	15.04	56.10	6.35	10.88	33.51	0.74	14.14	0.14	48.55	56.84	20.49	11.03	31.51
8 flats 2 floors	14.72	51.80	6.21	10.05	33.51	0.74	14.14	0.14	48.23	52.54	20.35	10.19	30.55
9 flats	14.35	53.98	6.06	10.47	33.51	0.74	14.14	0.14	47.86	54.72	20.20	10.62	30.81
24 flats	14.48	44.36	6.11	8.61	33.51	0.74	14.14	0.14	47.99	45.10	20.25	8.75	29.00
Terraced house (3)	14.25	50.51	6.01	9.80	26.50	0.59	11.18	0.11	40.75	51.10	17.20	9.91	27.11
Semi Detached	14.22	54.12	6.00	10.50	26.50	0.59	11.18	0.11	40.73	54.71	17.19	10.61	27.80
Detached house	13.82	45.27	5.83	8.78	20.88	0.46	8.81	0.09	34.70	45.74	14.64	8.87	23.52

Oil 2010 (25% below Building Regulations)

Development	Regulated				Unregulated				Total				
	Electricity kWh/m2	Oil kWh/m2	Electricity kgCO2/m2	Oil kgCO2/m2	Electricity kWh/m2	Oil kWh/m2	Electricity kgCO2/m2	Oil kgCO2/m2	Electricity kWh/m2	Oil kWh/m2	Electricity kgCO2/m2	Oil kgCO2/m2	Total CO2 kgCO2/m2
4 flats 2 floors	14.49	51.70	6.12	13.70	33.51	0.74	14.14	0.20	48.01	52.44	20.26	13.90	34.16
8 flats 2 floors	14.14	48.25	5.97	12.79	33.51	0.74	14.14	0.20	47.65	49.00	20.11	12.98	33.09
9 flats	13.75	48.68	5.80	12.90	33.51	0.74	14.14	0.20	47.26	49.42	19.94	13.10	33.04
24 flats	14.25	42.63	6.02	11.30	33.51	0.74	14.14	0.20	47.77	43.38	20.16	11.50	31.65
Terraced house (3)	13.77	46.25	5.81	12.26	26.50	0.59	11.18	0.16	40.27	46.84	16.99	12.41	29.41
Semi Detached	13.96	49.74	5.89	13.18	26.50	0.59	11.18	0.16	40.47	50.33	17.08	13.34	30.41
Detached house	13.82	45.76	5.83	12.13	20.88	0.46	8.81	0.12	34.70	46.22	14.64	12.25	26.89

Gas 2013 (44% below Building Regulations)

Development	Regulated				Unregulated				Total				
	Electricity kWh/m2	Gas kWh/m2	Electricity kgCO2/m2	Gas kgCO2/m2	Electricity kWh/m2	Gas kWh/m2	Electricity kgCO2/m2	Gas kgCO2/m2	Electricity kWh/m2	Gas kWh/m2	Electricity kgCO2/m2	Gas kgCO2/m2	Total CO2 kgCO2/m2
4 flats 2 floors	12.77	50.87	5.39	9.87	33.51	0.74	14.14	0.14	46.29	51.62	19.53	10.01	29.55
8 flats 2 floors	12.91	48.37	5.45	9.38	33.51	0.74	14.14	0.14	46.43	49.12	19.59	9.53	29.12
9 flats	12.84	51.66	5.42	10.02	33.51	0.74	14.14	0.14	46.36	52.41	19.56	10.17	29.73
24 flats	13.45	43.10	5.67	8.36	33.51	0.74	14.14	0.14	46.96	43.85	19.82	8.51	28.32
Terraced house (3)	12.28	45.56	5.18	8.84	26.50	0.59	11.18	0.11	38.79	46.15	16.37	8.95	25.32
Semi Detached	12.12	49.97	5.11	9.69	26.50	0.59	11.18	0.11	38.62	50.56	16.30	9.81	26.11
Detached house	11.84	46.55	5.00	9.03	20.88	0.46	8.81	0.09	32.72	47.01	13.81	9.12	22.93

Oil 2013 (44% below Building Regulations)

Development	Regulated				Unregulated				Total				
	Electricity kWh/m2	Oil kWh/m2	Electricity kgCO2/m2	Oil kgCO2/m2	Electricity kWh/m2	Oil kWh/m2	Electricity kgCO2/m2	Oil kgCO2/m2	Electricity kWh/m2	Oil kWh/m2	Electricity kgCO2/m2	Oil kgCO2/m2	Total CO2 kgCO2/m2
4 flats 2 floors	15.04	56.10	6.35	14.87	33.51	0.74	14.14	0.20	48.55	56.84	20.49	15.06	35.55
8 flats 2 floors	14.72	51.80	6.21	13.73	33.51	0.74	14.14	0.20	48.23	52.54	20.35	13.92	34.28
9 flats	14.35	53.98	6.06	14.30	33.51	0.74	14.14	0.20	47.86	54.72	20.20	14.50	34.70
24 flats	14.48	44.36	6.11	11.75	33.51	0.74	14.14	0.20	47.99	45.10	20.25	11.95	32.21
Terraced house (3)	14.25	50.51	6.01	13.38	26.50	0.59	11.18	0.16	40.75	51.10	17.20	13.54	30.74
Semi Detached	14.22	54.12	6.00	14.34	26.50	0.59	11.18	0.16	40.73	54.71	17.19	14.50	31.69
Detached house	13.82	45.27	5.83	12.00	20.88	0.46	8.81	0.12	34.70	45.74	14.64	12.12	26.76

Appendix 2 Summary of Energy Demand in Non-Dwellings

25% below building regulations

Development	Regulated				Unregulated				Total				
	Electricity	Gas	Electricity	Gas	Electricity	Gas	Electricity	Gas	Electricity	Gas	Electricity	Gas	Total CO2
	kWh/m2	kWh/m2	kgCO2/m2	kgCO2/m2	kWh/m2	kWh/m2	kgCO2/m2	kgCO2/m2	kWh/m2	kWh/m2	kgCO2/m2	kgCO2/m2	kgCO2/m2
Factory office	32.77	33.94	13.83	6.58	19.00	0.00	8.02	0.00	51.77	33.94	21.85	6.58	28.43
Light manufacturing	21.54	33.56	9.09	6.51	8.00	0.00	3.38	0.00	29.54	33.56	12.46	6.51	18.97
Storage and distribution	16.07	28.17	6.78	5.46	9.00	0.00	3.80	0.00	25.07	28.17	10.58	5.46	16.04
Bank	39.82	17.29	16.80	3.35	27.00	0.00	11.39	0.00	66.82	17.29	28.20	3.35	31.55
Fast food	254.04	370.40	107.20	71.86	144.00	205.00	60.77	39.77	398.04	575.40	167.97	111.63	279.60
General Office	64.28	29.44	27.13	5.71	17.47	0.00	7.37	0.00	81.75	29.44	34.50	5.71	40.21
Restaurant	37.84	202.83	15.97	39.35	27.00	92.50	11.39	17.95	64.84	295.33	27.36	57.29	84.66

44% below building regulations

Development	Regulated				Unregulated				Total				
	Electricity	Oil	Electricity	Oil	Electricity	Oil	Electricity	Oil	Electricity	Oil	Electricity	Oil	Total CO2
	kWh/m2	kWh/m2	kgCO2/m2	kgCO2/m2	kWh/m2	kWh/m2	kgCO2/m2	kgCO2/m2	kWh/m2	kWh/m2	kgCO2/m2	kgCO2/m2	kgCO2/m2
Factory office	26.07	21.87	11.00	4.24	19.00	0.00	8.02	0.00	45.07	21.87	19.02	4.24	23.26
Light manufacturing	16.41	24.34	6.93	4.72	8.00	0.00	3.38	0.00	24.41	24.34	10.30	4.72	15.02
Storage and distribution	12.04	20.93	5.08	4.06	9.00	0.00	3.80	0.00	21.04	20.93	8.88	4.06	12.94
Bank	33.19	5.38	14.01	1.04	27.00	0.00	11.39	0.00	60.19	5.38	25.40	1.04	26.44
Fast food	216.98	217.18	91.57	42.13	144.00	205.00	60.77	39.77	360.98	422.18	152.33	81.90	234.24
General Office	53.49	10.03	22.57	1.95	17.47	0.00	7.37	0.00	70.96	10.03	29.94	1.95	31.89
Restaurant	26.39	155.49	11.14	30.17	27.00	92.50	11.39	17.95	53.39	247.99	22.53	48.11	70.64

3. RENEWABLE ENERGY RESULTS

The following table outlines how we have classified the renewable technologies in our assessment and the assumptions we have made for the energy these replace.

These terms are used in the following appendices.

Table 11 Summary of renewable technology (Terms used in Appendix 3)

Term in Appendix 3	Renewable Technology	Assumed energy replacement
Solar 1	Solar thermal	- Half gas/oil consumption for hot water demand
Solar 2	Solar thermal providing hot water and some heating	- 60% gas/oil consumption for hot water demand - 10% of heating
Wood	Biomass technology	- Gas/oil space heating and hot water provision
GSHP	Ground Source Heat Pump	- Gas/oil for space heating and hot water
ASHP	Air Source Heat Pump	- Gas/oil for space heating and hot water
PV	Solar Photovoltaics	- Maximum of 30% of the electricity demand divided by number of floors
Wind	Wind	- Maximum potential based on small wind turbine divided by number of floors
CHP	Combined Heat and Power	- Based on gas/oil with a 25% electrical efficiency and a 60% thermal efficiency

Appendix 3 Dwellings Renewables with Gas 2010 (25% Reduction)

CO2 reduction potential

Development	Floor area	Baseline CO2	CO2 reduction potential							
	m2	tonnes	solar1	solar2	wood	GSHP	ASHP	PV	Wind	CHP
4 flats 2 floors	284	8.94	11%	14%	34%	13%	12%	27%	14%	25%
8 flats 2 floors	567	17.33	11%	14%	32%	11%	10%	28%	14%	24%
9 flats	638	19.67	12%	16%	32%	10%	9%	18%	9%	24%
24 flats	1702	49.37	12%	14%	28%	8%	8%	20%	10%	20%
Terraced house (3)	334	9.05	11%	15%	35%	13%	12%	31%	16%	26%
Semi Detached	223	6.19	11%	15%	37%	14%	13%	31%	15%	28%
Detached house	152	3.58	11%	15%	37%	15%	13%	36%	18%	28%

Percentage increase in base build cost to achieve a 5% reduction

Development	Floor area	Build cost	CO2 reduction							
	m2	£	solar1	solar2	wood	GSHP	ASHP	PV	Wind	CHP
4 flats 2 floors	283.72	1,976,000	0.81%	1.08%	0.57%	1.15%	0.72%	1.30%	0.96%	0.18%
8 flats 2 floors	567.44	1,976,000	0.79%	1.05%	0.56%	1.21%	0.76%	1.26%	0.93%	0.18%
9 flats	638.37	624,000	0.79%	1.06%	0.57%	1.38%	0.86%	1.27%	0.94%	0.18%
24 flats	1,702.32	2,643,680	0.75%	1.00%	0.54%	1.43%	0.88%	1.20%	0.89%	0.18%
Terraced house (3)	333.90	367,360	0.60%	0.80%	0.42%	0.86%	0.54%	0.96%	0.71%	0.13%
Semi Detached	222.60	2,132,000	0.57%	0.76%	0.40%	0.79%	0.50%	0.92%	0.68%	0.13%
Detached house	152.41	367,360	0.45%	0.61%	0.32%	0.61%	0.38%	0.73%	0.54%	0.10%

N/A indicates that the target reduction cannot be easily achieved technically

Percentage increase in base build cost to achieve a 10% reduction

Development	Floor area	Build cost	CO2 reduction							
	m2	£	solar1	solar2	wood	GSHP	ASHP	PV	Wind	CHP
4 flats 2 floors	283.72	1,976,000	1.62%	2.17%	1.13%	2.30%	1.44%	2.60%	1.93%	0.36%
8 flats 2 floors	567.44	1,976,000	1.57%	2.10%	1.11%	2.42%	1.51%	2.52%	1.87%	0.36%
9 flats	638.37	624,000	1.59%	2.12%	1.14%	2.76%	N/A	2.54%	N/A	0.37%
24 flats	1,702.32	2,643,680	1.49%	1.99%	1.08%	N/A	N/A	2.39%	1.77%	0.35%
Terraced house (3)	333.90	367,360	1.20%	1.60%	0.84%	1.72%	1.08%	1.92%	1.42%	0.27%
Semi Detached	222.60	2,132,000	1.15%	1.53%	0.80%	1.58%	1.00%	1.84%	1.36%	0.26%
Detached house	152.41	367,360	0.91%	1.21%	0.63%	1.22%	0.77%	1.46%	1.08%	0.20%

N/A indicates that the target reduction cannot be easily achieved technically

Percentage increase in base build cost to achieve a 15% reduction

Development	Floor area	Build cost	CO2 reduction							
	m2	£	solar1	solar2	wood	GSHP	ASHP	PV	Wind	CHP
4 flats 2 floors	283.72	1,976,000	N/A	N/A	2.27%	N/A	N/A	5.20%	N/A	0.72%
8 flats 2 floors	567.44	1,976,000	N/A	N/A	2.23%	N/A	N/A	5.04%	N/A	0.71%
9 flats	638.37	624,000	N/A	4.24%	2.28%	N/A	N/A	5.09%	N/A	0.74%
24 flats	1,702.32	2,643,680	N/A	N/A	2.17%	N/A	N/A	4.79%	N/A	0.71%
Terraced house (3)	333.90	367,360	N/A	3.19%	1.68%	N/A	N/A	3.84%	2.84%	0.53%
Semi Detached	222.60	2,132,000	N/A	3.06%	1.61%	N/A	N/A	3.67%	2.72%	0.51%
Detached house	152.41	367,360	N/A	2.42%	1.26%	2.45%	N/A	2.91%	2.16%	0.40%

N/A indicates that the target reduction cannot be easily achieved technically

Percentage increase in base build cost to achieve a 20% reduction

Development	Floor area	Build cost	CO2 reduction							
	m2	£	solar1	solar2	wood	GSHP	ASHP	PV	Wind	CHP
4 flats 2 floors	283.72	1,976,000	N/A	N/A	2.27%	N/A	N/A	5.20%	N/A	0.72%
8 flats 2 floors	567.44	1,976,000	N/A	N/A	2.23%	N/A	N/A	5.04%	N/A	0.71%
9 flats	638.37	624,000	N/A	N/A	2.28%	N/A	N/A	N/A	N/A	0.74%
24 flats	1702.32	2,643,680	N/A	N/A	2.17%	N/A	N/A	4.79%	N/A	0.71%
Terraced house (3)	333.90	367,360	N/A	N/A	1.68%	N/A	N/A	3.84%	N/A	0.53%
Semi Detached	222.60	2,132,000	N/A	N/A	1.61%	N/A	N/A	3.67%	N/A	0.51%
Detached house	152.41	367,360	N/A	N/A	1.26%	N/A	N/A	2.91%	N/A	0.40%

N/A indicates that the target reduction cannot be easily achieved technically

Percentage increase in base build cost to achieve a 30% reduction

Development	Floor area	Build cost	CO2 reduction							
	m2	£	solar1	solar2	wood	GSHP	ASHP	PV	Wind	CHP
4 flats 2 floors	283.72	1,976,000	N/A	N/A	3.40%	N/A	N/A	N/A	N/A	N/A
8 flats 2 floors	567.44	1,976,000	N/A	N/A	3.34%	N/A	N/A	N/A	N/A	N/A
9 flats	638.37	624,000	N/A	N/A	3.42%	N/A	N/A	N/A	N/A	N/A
24 flats	1702.32	2,643,680	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Terraced house (3)	333.90	367,360	N/A	N/A	2.52%	N/A	N/A	5.75%	N/A	N/A
Semi Detached	222.60	2,132,000	N/A	N/A	2.41%	N/A	N/A	5.51%	N/A	N/A
Detached house	152.41	367,360	N/A	N/A	1.89%	N/A	N/A	4.37%	N/A	N/A

N/A indicates that the target reduction cannot be easily achieved technically

Appendix 3 Dwellings Renewables with Gas 2013 (44% Reduction)

CO2 reduction potential - renewables

Development	Floor area	Baseline CO2	CO2 reduction potential							
	m2	tonnes	solar1	solar2	wood	GSHP	ASHP	PV	Wind	CHP
4 flats 2 floors	283.72	8.38	11%	15%	29%	12%	12%	29%	14%	20%
8 flats 2 floors	567.44	16.52	11%	15%	28%	12%	11%	29%	15%	19%
9 flats	638.37	18.98	13%	16%	29%	12%	11%	19%	10%	20%
24 flats	1702.32	48.22	12%	15%	26%	10%	10%	20%	10%	18%
Terraced house (3)	333.90	8.45	12%	16%	30%	13%	12%	34%	17%	21%
Semi Detached	222.60	5.81	11%	15%	32%	14%	13%	33%	16%	22%
Detached house	152.41	3.49	11%	15%	34%	15%	14%	37%	19%	24%

Excess CO2 reduction potential after meeting 44% for Bregs

Development	Floor area	Baseline CO2	CO2 reduction potential							
	m2	tonnes	solar1	solar2	wood	GSHP	ASHP	PV	Wind	CHP
4 flats 2 floors	283.72	8.38	4%	7%	20%	5%	4%	20%	7%	12%
8 flats 2 floors	567.44	16.52	3%	6%	18%	3%	2%	19%	5%	10%
9 flats	638.37	18.98	2%	5%	17%	1%	0%	7%	0%	8%
24 flats	1702.32	48.22	2%	5%	15%	1%	0%	10%	0%	7%
Terraced house (3)	333.90	8.45	4%	7%	21%	5%	4%	24%	9%	12%
Semi Detached	222.60	5.81	2%	6%	22%	5%	4%	22%	7%	12%
Detached house	152.41	3.49	3%	7%	25%	7%	6%	27%	10%	15%

Percentage increase in base building cost to achieve additional 5% reduction after achieving Building Regulations

Development	Floor area	Build cost	CO2 reduction							
	m2	£	solar1	solar2	wood	GSHP	ASHP	PV	Wind	CHP
4 flats 2 floors	284	340,464	N/A	1.02%	0.58%	1.03%	N/A	1.22%	0.90%	0.20%
8 flats 2 floors	567	680,928	N/A	1.00%	0.57%	N/A	N/A	1.20%	0.89%	0.20%
9 flats	638	766,044	N/A	1.02%	0.59%	N/A	N/A	1.23%	N/A	0.20%
24 flats	1702	2,042,784	N/A	0.97%	0.56%	N/A	N/A	1.17%	N/A	0.19%
Terraced house (3)	334	467,460	N/A	0.75%	0.43%	0.76%	N/A	0.90%	0.66%	0.15%
Semi Detached	223	333,900	N/A	0.72%	0.41%	0.70%	N/A	0.86%	0.64%	0.14%
Detached house	152	243,856	N/A	0.59%	0.34%	0.56%	0.36%	0.71%	0.53%	0.12%

N/A indicates that the target reduction cannot be easily achieved technically

Percentage increase in base building cost to achieve additional 10% reduction after achieving Building Regulations

Development	Floor area	Build cost	CO2 reduction							
	m2	£	solar1	solar2	wood	GSHP	ASHP	PV	Wind	CHP
4 flats 2 floors	284	340,464	N/A	N/A	1.17%	N/A	N/A	2.44%	N/A	0.40%
8 flats 2 floors	567	680,928	N/A	N/A	1.15%	N/A	N/A	2.40%	N/A	0.39%
9 flats	638	766,044	N/A	N/A	1.17%	N/A	N/A	N/A	N/A	N/A
24 flats	1702	2,042,784	N/A	N/A	1.12%	N/A	N/A	2.34%	N/A	N/A
Terraced house (3)	334	467,460	N/A	N/A	0.86%	N/A	N/A	1.79%	N/A	0.29%
Semi Detached	223	333,900	N/A	N/A	0.82%	N/A	N/A	1.72%	N/A	0.28%
Detached house	152	243,856	N/A	N/A	0.68%	N/A	N/A	1.42%	1.05%	0.23%

N/A indicates that the target reduction cannot be easily achieved technically

Percentage increase in base building cost to achieve additional 15% reduction after achieving Building Regulations

Development	Floor area	Build cost	CO2 reduction							
	m2	£	solar1	solar2	wood	GSHP	ASHP	PV	Wind	CHP
4 flats 2 floors	284	340,464	N/A	N/A	1.75%	N/A	N/A	3.66%	N/A	N/A
8 flats 2 floors	567	680,928	N/A	N/A	1.72%	N/A	N/A	3.60%	N/A	N/A
9 flats	638	766,044	N/A	N/A	1.76%	N/A	N/A	N/A	N/A	N/A
24 flats	1702	2,042,784	N/A	N/A	1.68%	N/A	N/A	N/A	N/A	N/A
Terraced house (3)	334	467,460	N/A	N/A	1.28%	N/A	N/A	2.69%	N/A	N/A
Semi Detached	223	333,900	N/A	N/A	1.24%	N/A	N/A	2.59%	N/A	N/A
Detached house	152	243,856	N/A	N/A	1.02%	N/A	N/A	2.13%	N/A	0.35%

N/A indicates that the target reduction cannot be easily achieved technically

Percentage increase in base building cost to achieve additional 20% reduction after achieving Building Regulations

Development	Floor area	Build cost	CO2 reduction							
	m2	£	solar1	solar2	wood	GSHP	ASHP	PV	Wind	CHP
4 flats 2 floors	284	340,464	N/A	N/A	2.33%	N/A	N/A	4.88%	N/A	N/A
8 flats 2 floors	567	680,928	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
9 flats	638	766,044	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
24 flats	1702	2,042,784	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Terraced house (3)	334	467,460	N/A	N/A	1.71%	N/A	N/A	3.58%	N/A	N/A
Semi Detached	223	333,900	N/A	N/A	1.65%	N/A	N/A	3.45%	N/A	N/A
Detached house	152	243,856	N/A	N/A	1.36%	N/A	N/A	2.84%	N/A	N/A

N/A indicates that the target reduction cannot be easily achieved technically

Appendix 3 Dwellings Renewables Oil 2010 (25% Reduction)

CO2 reduction potential

Development	Floor area	Baseline CO2	CO2 reduction potential							
	m2	tonnes	solar1	solar2	wood	GSHP	ASHP	PV	Wind	CHP
4 flats 2 floors	283.72	9.7	14%	18%	39%	20%	19%	25%	12%	21%
8 flats 2 floors	567.44	18.8	15%	18%	37%	18%	17%	26%	13%	19%
9 flats	638.37	21.1	16%	20%	37%	17%	16%	17%	9%	19%
24 flats	1702.32	53.9	15%	18%	34%	16%	15%	18%	9%	17%
Terraced house (3)	333.9	9.8	14%	19%	40%	21%	19%	29%	14%	22%
Semi Detached	222.6	6.8	14%	18%	43%	23%	20%	28%	14%	23%
Detached house	152.41	4.1	13%	18%	45%	25%	22%	32%	16%	25%

Percentage increase in base build cost to achieve a 5% reduction

Development	Floor area	Build cost	CO2 reduction							
	m2	£	solar1	solar2	wood	GSHP	ASHP	PV	Wind	CHP
4 flats 2 floors	284	340,464	0.64%	0.86%	0.46%	0.65%	0.42%	1.41%	1.04%	0.20%
8 flats 2 floors	567	680,928	0.62%	0.83%	0.45%	0.67%	0.43%	1.37%	1.01%	0.20%
9 flats	638	766,044	0.62%	0.83%	0.45%	0.71%	0.44%	1.36%	1.01%	0.21%
24 flats	1702	2,042,784	0.60%	0.80%	0.43%	0.68%	0.42%	1.31%	0.97%	0.20%
Terraced house (3)	334	467,460	0.48%	0.63%	0.34%	0.49%	0.31%	1.04%	0.77%	0.15%
Semi Detached	223	333,900	0.46%	0.61%	0.32%	0.45%	0.29%	1.00%	0.74%	0.14%
Detached house	152	243,856	0.38%	0.51%	0.27%	0.36%	0.24%	0.83%	0.62%	0.11%

N/A indicates that the target reduction cannot be easily achieved technically

Percentage increase in base build cost to achieve a 10% reduction

Development	Floor area	Build cost	CO2 reduction							
	m2	£	solar1	solar2	wood	GSHP	ASHP	PV	Wind	CHP
4 flats 2 floors	284	340,464	1.29%	1.72%	0.91%	1.30%	0.84%	2.82%	2.09%	0.40%
8 flats 2 floors	567	680,928	1.25%	1.67%	0.89%	1.34%	0.85%	2.73%	2.02%	0.40%
9 flats	638	766,044	1.25%	1.66%	0.90%	1.42%	0.89%	2.73%	N/A	0.41%
24 flats	1702	2,042,784	1.19%	1.59%	0.86%	1.36%	0.85%	2.61%	N/A	0.39%
Terraced house (3)	334	467,460	0.95%	1.27%	0.67%	0.97%	0.63%	2.08%	1.54%	0.30%
Semi Detached	223	333,900	0.92%	1.22%	0.65%	0.90%	0.59%	2.01%	1.49%	0.28%
Detached house	152	243,856	0.76%	1.01%	0.53%	0.72%	0.47%	1.66%	1.23%	0.23%

N/A indicates that the target reduction cannot be easily achieved technically

Percentage increase in base build cost to achieve a 15% reduction

Development	Floor area	Build cost	CO2 reduction							
	m2	£	solar1	solar2	wood	GSHP	ASHP	PV	Wind	CHP
4 flats 2 floors	284	340,464	N/A	3.44%	1.82%	2.61%	1.68%	5.64%	N/A	0.80%
8 flats 2 floors	567	680,928	2.50%	3.33%	1.78%	2.69%	1.70%	5.46%	N/A	0.80%
9 flats	638	766,044	2.49%	3.32%	1.79%	2.85%	1.77%	5.45%	N/A	0.82%
24 flats	1702	2,042,784	2.39%	3.19%	1.72%	2.72%	1.69%	5.22%	N/A	0.79%
Terraced house (3)	334	467,460	N/A	2.54%	1.35%	1.94%	1.25%	4.16%	N/A	0.59%
Semi Detached	223	333,900	N/A	2.45%	1.29%	1.80%	1.18%	4.02%	N/A	0.56%
Detached house	152	243,856	N/A	2.03%	1.07%	1.43%	0.94%	3.33%	2.47%	0.46%

N/A indicates that the target reduction cannot be easily achieved technically

Percentage increase in base build cost to achieve a 20% reduction

Development	Floor area	Build cost	CO2 reduction							
	m2	£	solar1	solar2	wood	GSHP	ASHP	PV	Wind	CHP
4 flats 2 floors	284	340,464	N/A	N/A	1.82%	2.61%	N/A	5.64%	N/A	0.80%
8 flats 2 floors	567	680,928	N/A	N/A	1.78%	N/A	N/A	5.46%	N/A	N/A
9 flats	638	766,044	N/A	3.32%	1.79%	N/A	N/A	N/A	N/A	N/A
24 flats	1702	2,042,784	N/A	N/A	1.72%	N/A	N/A	N/A	N/A	N/A
Terraced house (3)	334	467,460	N/A	N/A	1.35%	1.94%	N/A	4.16%	N/A	0.59%
Semi Detached	223	333,900	N/A	N/A	1.29%	1.80%	1.18%	4.02%	N/A	0.56%
Detached house	152	243,856	N/A	N/A	1.07%	1.43%	0.94%	3.33%	N/A	0.46%

N/A indicates that the target reduction cannot be easily achieved technically

Percentage increase in base build cost to achieve a 30% reduction

Development	Floor area	Build cost	CO2 reduction							
	m2	£	solar1	solar2	wood	GSHP	ASHP	PV	Wind	CHP
4 flats 2 floors	284	340,464	N/A	N/A	2.74%	N/A	N/A	N/A	N/A	N/A
8 flats 2 floors	567	680,928	N/A	N/A	2.68%	N/A	N/A	N/A	N/A	N/A
9 flats	638	766,044	N/A	N/A	2.69%	N/A	N/A	N/A	N/A	N/A
24 flats	1702	2,042,784	N/A	N/A	2.58%	N/A	N/A	N/A	N/A	N/A
Terraced house (3)	334	467,460	N/A	N/A	2.02%	N/A	N/A	N/A	N/A	N/A
Semi Detached	223	333,900	N/A	N/A	1.94%	N/A	N/A	N/A	N/A	N/A
Detached house	152	243,856	N/A	N/A	1.60%	N/A	N/A	4.99%	N/A	N/A

N/A indicates that the target reduction cannot be easily achieved technically

Appendix 3 Renewable Assessment Oil 2013 (44% Reduction)

CO2 reduction potential

Development	Floor area	Baseline CO2	CO2 reduction potential							
	m2	tonnes	solar1	solar2	wood	GSHP	ASHP	PV	Wind	CHP
4 flats 2 floors	283.72	10.09	13%	17%	41%	21%	22%	24%	12%	17%
8 flats 2 floors	567.44	19.45	13%	17%	39%	20%	20%	25%	12%	16%
9 flats	638.37	22.15	15%	19%	40%	19%	19%	16%	8%	15%
24 flats	1702.32	54.82	14%	18%	35%	16%	17%	18%	9%	13%
Terraced house (3)	333.90	10.26	14%	18%	43%	22%	22%	28%	14%	17%
Semi Detached	222.60	7.05	13%	18%	45%	23%	24%	27%	13%	18%
Detached house	152.41	4.08	13%	18%	45%	23%	24%	32%	16%	18%

Excess CO2 reduction potential after meeting 44% for Bregs

Development	Floor area	Baseline CO2	CO2 reduction potential							
	m2	tonnes	solar1	solar2	wood	GSHP	ASHP	PV	Wind	CHP
4 flats 2 floors	283.72	10.09	0%	0%	14%	0%	0%	1%	0%	0%
8 flats 2 floors	567.44	19.45	0%	0%	13%	0%	0%	2%	0%	0%
9 flats	638.37	22.15	0%	0%	12%	0%	0%	0%	0%	0%
24 flats	1702.32	54.82	0%	0%	11%	0%	0%	0%	0%	0%
Terraced house (3)	333.90	10.26	0%	0%	15%	0%	0%	3%	0%	0%
Semi Detached	222.60	7.05	0%	0%	15%	0%	0%	1%	0%	0%
Detached house	152.41	4.08	0%	0%	18%	2%	2%	8%	0%	0%

Percentage increase in base building cost to achieve additional 5% reduction after achieving Building Regulations

Development	Floor area	Build cost	CO2 reduction							
	m2	£	solar1	solar2	wood	GSHP	ASHP	PV	Wind	CHP
4 flats 2 floors	283.72	340,464	N/A	N/A	0.36%	N/A	N/A	N/A	N/A	N/A
8 flats 2 floors	567.44	680,928	N/A	N/A	0.35%	N/A	N/A	N/A	N/A	N/A
9 flats	638.37	766,044	N/A	N/A	0.36%	N/A	N/A	N/A	N/A	N/A
24 flats	1702.32	2,042,784	N/A	N/A	0.35%	N/A	N/A	N/A	N/A	N/A
Terraced house (3)	333.90	467,460	N/A	N/A	0.27%	N/A	N/A	N/A	N/A	N/A
Semi Detached	222.60	333,900	N/A	N/A	0.25%	N/A	N/A	N/A	N/A	N/A
Detached house	152.41	243,856	N/A	N/A	0.21%	N/A	N/A	0.66%	N/A	N/A

N/A indicates that the target reduction cannot be easily achieved technically

Percentage increase in base building cost to achieve additional 10% reduction after achieving Building Regulations

Development	Floor area	Build cost	CO2 reduction							
	m2	£	solar1	solar2	wood	GSHP	ASHP	PV	Wind	CHP
4 flats 2 floors	283.72	340,464	N/A	N/A	0.73%	N/A	N/A	N/A	N/A	N/A
8 flats 2 floors	567.44	680,928	N/A	N/A	0.71%	N/A	N/A	N/A	N/A	N/A
9 flats	638.37	766,044	N/A	N/A	0.71%	N/A	N/A	N/A	N/A	N/A
24 flats	1702.32	2,042,784	N/A	N/A	0.69%	N/A	N/A	N/A	N/A	N/A
Terraced house (3)	333.90	467,460	N/A	N/A	0.53%	N/A	N/A	N/A	N/A	N/A
Semi Detached	222.60	333,900	N/A	N/A	0.50%	N/A	N/A	N/A	N/A	N/A
Detached house	152.41	243,856	N/A	N/A	0.42%	N/A	N/A	N/A	N/A	N/A

N/A indicates that the target reduction cannot be easily achieved technically

Percentage increase in base building cost to achieve additional 15% reduction after achieving Building Regulations

Development	Floor area	Build cost	CO2 reduction							
	m2	£	solar1	solar2	wood	GSHP	ASHP	PV	Wind	CHP
4 flats 2 floors	283.72	340,464	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8 flats 2 floors	567.44	680,928	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
9 flats	638.37	766,044	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
24 flats	1702.32	2,042,784	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Terraced house (3)	333.90	467,460	N/A	N/A	0.80%	N/A	N/A	N/A	N/A	N/A
Semi Detached	222.60	333,900	N/A	N/A	0.76%	N/A	N/A	N/A	N/A	N/A
Detached house	152.41	243,856	N/A	N/A	0.63%	N/A	N/A	N/A	N/A	N/A

N/A indicates that the target reduction cannot be easily achieved technically

Percentage increase in base building cost to achieve additional 20% reduction after achieving Building Regulations

Development	Floor area	Build cost	CO2 reduction							
	m2	£	solar1	solar2	wood	GSHP	ASHP	PV	Wind	CHP
4 flats 2 floors	283.72	340,464	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8 flats 2 floors	567.44	680,928	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
9 flats	638.37	766,044	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
24 flats	1702.32	2,042,784	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Terraced house (3)	333.90	467,460	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Semi Detached	222.60	333,900	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Detached house	152.41	243,856	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

N/A indicates that the target reduction cannot be easily achieved technically

Appendix 3 Renewable Non-domestic (25% Reduction)

CO2 reduction potential

Development	Floor area	Baseline CO2	CO2 reduction potential							
	m2	tonnes	solar1	solar2	wood	GSHP	ASHP	PV	Wind	CHP
Factory office	1300	36.96	1%	4%	20%	8%	7%	30%	15%	13%
Light manufacturing	1300	24.67	0%	3%	30%	14%	11%	60%	30%	19%
Storage and distribution	1300	20.86	0%	3%	30%	13%	10%	53%	27%	19%
Bank	1612	50.86	2%	3%	9%	3%	3%	18%	9%	6%
Fast food	224	62.63	4%	5%	10%	7%	5%	3%	2%	6%
General Office	1300	52.27	1%	3%	12%	11%	8%	14%	7%	8%
Restaurant	224	18.96	5%	8%	22%	5%	4%	10%	5%	14%

Percentage increase in base build cost to achieve a 5% reduction

Development	Floor area	Build cost	CO2 reduction							
	m2	£	solar1	solar2	wood	GSHP	ASHP	PV	Wind	CHP
Factory office	1300	1,976,000	N/A	N/A	0.44%	0.79%	0.59%	0.93%	0.69%	0.18%
Light manufacturing	1300	1,976,000	N/A	N/A	0.30%	0.48%	0.36%	0.62%	0.46%	0.12%
Storage and distribution	1300	624,000	N/A	N/A	0.79%	1.34%	1.03%	1.65%	1.23%	0.32%
Bank	1612	2,643,680	N/A	N/A	0.46%	N/A	N/A	0.95%	0.71%	0.19%
Fast food	224	367,360	N/A	7.03%	4.04%	5.87%	4.08%	N/A	N/A	1.65%
General Office	1300	2,132,000	N/A	N/A	0.58%	0.67%	0.49%	1.21%	0.90%	0.24%
Restaurant	224	367,360	1.60%	2.13%	1.22%	3.75%	N/A	2.56%	1.89%	0.50%

N/A indicates that the target reduction cannot be easily achieved technically

Percentage increase in base build cost to achieve a 10% reduction

Development	Floor area	Build cost	CO2 reduction							
	m2	£	solar1	solar2	wood	GSHP	ASHP	PV	Wind	CHP
Factory office	1300	1,976,000	N/A	N/A	0.89%	N/A	N/A	1.85%	1.37%	0.36%
Light manufacturing	1300	1,976,000	N/A	N/A	0.59%	0.95%	0.72%	1.24%	0.92%	0.24%
Storage and distribution	1300	624,000	N/A	N/A	1.58%	2.69%	2.06%	3.31%	2.45%	0.65%
Bank	1612	2,643,680	N/A	N/A	N/A	N/A	N/A	1.91%	N/A	N/A
Fast food	224	367,360	N/A	N/A	8.07%	N/A	N/A	N/A	N/A	N/A
General Office	1300	2,132,000	N/A	N/A	1.16%	1.35%	N/A	2.43%	N/A	N/A
Restaurant	224	367,360	N/A	N/A	2.44%	N/A	N/A	5.11%	N/A	1.00%

N/A indicates that the target reduction cannot be easily achieved technically

Percentage increase in base build cost to achieve a 15% reduction

Development	Floor area	Build cost	CO2 reduction							
	m2	£	solar1	solar2	wood	GSHP	ASHP	PV	Wind	CHP
Factory office	1300	1,976,000	N/A	N/A	1.77%	N/A	N/A	3.70%	2.74%	N/A
Light manufacturing	1300	1,976,000	N/A	N/A	1.18%	N/A	N/A	2.47%	1.83%	0.48%
Storage and distribution	1300	624,000	N/A	N/A	3.16%	N/A	N/A	6.62%	4.90%	1.30%
Bank	1612	2,643,680	N/A	N/A	N/A	N/A	N/A	3.81%	N/A	N/A
Fast food	224	367,360	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
General Office	1300	2,132,000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Restaurant	224	367,360	N/A	N/A	4.89%	N/A	N/A	N/A	N/A	N/A

N/A indicates that the target reduction cannot be easily achieved technically

Percentage increase in base build cost to achieve a 20% reduction

Development	Floor area	Build cost	CO2 reduction							
	m2	£	solar1	solar2	wood	GSHP	ASHP	PV	Wind	CHP
Factory office	1300	1,976,000	N/A	N/A	1.79%	N/A	N/A	4.11%	N/A	N/A
Light manufacturing	1300	1,976,000	N/A	N/A	1.76%	N/A	N/A	3.98%	2.95%	N/A
Storage and distribution	1300	624,000	N/A	N/A	5.70%	N/A	N/A	12.71%	9.42%	N/A
Bank	1612	2,643,680	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Fast food	224	367,360	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
General Office	1300	2,132,000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Restaurant	224	367,360	N/A	N/A	1.23%	N/A	N/A	N/A	N/A	N/A

N/A indicates that the target reduction cannot be easily achieved technically

Appendix 3 Renewable Non-domestic (44% Reduction)

CO2 reduction potential

Development	Floor area	Baseline CO2	CO2 reduction potential							
	m2	tonnes	solar1	solar2	wood	GSHP	ASHP	PV	Wind	CHP
Factory office	1300	30.24	2%	3%	16%	6%	5%	37%	18%	10%
Light manufacturing	1300	19.53	0%	3%	27%	13%	10%	76%	38%	17%
Storage and distribution	1300	16.82	0%	3%	27%	12%	9%	66%	33%	17%
Bank	1612	42.63	2%	2%	3%	1%	1%	21%	11%	2%
Fast food	224	52.47	0%	0%	1%	3%	2%	4%	2%	1%
General Office	1300	41.46	1%	2%	5%	9%	7%	18%	9%	3%
Restaurant	224	15.82	2%	4%	15%	7%	6%	12%	6%	10%

Percentage increase in base building cost to achieve additional 5% reduction after achieving Building Regulations

Development	Floor area	Build cost	CO2 reduction							
	m2	£	solar1	solar2	wood	GSHP	ASHP	PV	Wind	CHP
Factory office	1300	1,976,000	N/A	N/A	0.36%	0.68%	0.50%	0.76%	0.56%	0.15%
Light manufacturing	1300	1,976,000	N/A	N/A	0.23%	0.37%	0.29%	0.49%	0.36%	0.10%
Storage and distribution	1300	624,000	N/A	N/A	0.64%	1.09%	0.85%	1.33%	0.99%	0.26%
Bank	1612	2,643,680	N/A	N/A	N/A	N/A	N/A	0.80%	0.59%	N/A
Fast food	224	367,360	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
General Office	1300	2,132,000	N/A	N/A	0.46%	0.41%	0.30%	0.96%	0.71%	N/A
Restaurant	224	367,360	N/A	N/A	1.02%	1.75%	1.22%	2.13%	1.58%	0.42%

N/A indicates that the target reduction cannot be easily achieved technically

Percentage increase in base building cost to achieve additional 10% reduction after achieving Building Regulations

Development	Floor area	Build cost	CO2 reduction							
	m2	£	solar1	solar2	wood	GSHP	ASHP	PV	Wind	CHP
Factory office	1300	1,976,000	N/A	N/A	0.72%	N/A	N/A	1.52%	1.12%	0.30%
Light manufacturing	1300	1,976,000	N/A	N/A	0.47%	0.75%	0.57%	0.98%	0.73%	0.19%
Storage and distribution	1300	624,000	N/A	N/A	1.28%	2.19%	N/A	2.67%	1.98%	0.52%
Bank	1612	2,643,680	N/A	N/A	N/A	N/A	N/A	1.60%	1.18%	N/A
Fast food	224	367,360	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
General Office	1300	2,132,000	N/A	N/A	N/A	N/A	N/A	1.93%	N/A	N/A
Restaurant	224	367,360	N/A	N/A	2.04%	N/A	N/A	4.27%	N/A	0.84%

N/A indicates that the target reduction cannot be easily achieved technically

Percentage increase in base building cost to achieve additional 15% reduction after achieving Building Regulations

Development	Floor area	Build cost	CO2 reduction							
	m2	£	solar1	solar2	wood	GSHP	ASHP	PV	Wind	CHP
Factory office	1300	1,976,000	N/A	N/A	1.45%	N/A	N/A	3.03%	2.25%	N/A
Light manufacturing	1300	1,976,000	N/A	N/A	0.94%	N/A	N/A	1.96%	1.45%	0.38%
Storage and distribution	1300	624,000	N/A	N/A	2.55%	N/A	N/A	5.34%	3.96%	1.05%
Bank	1612	2,643,680	N/A	N/A	N/A	N/A	N/A	3.19%	N/A	N/A
Fast food	224	367,360	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
General Office	1300	2,132,000	N/A	N/A	N/A	N/A	N/A	3.85%	N/A	N/A
Restaurant	224	367,360	N/A	N/A	4.08%	N/A	N/A	N/A	N/A	N/A

N/A indicates that the target reduction cannot be easily achieved technically

Percentage increase in base building cost to achieve additional 15% reduction after achieving Building Regulations

Development	Floor area	Build cost	CO2 reduction							
	m2	£	solar1	solar2	wood	GSHP	ASHP	PV	Wind	CHP
Factory office	1300	1,976,000	N/A	N/A	N/A	N/A	N/A	4.11%	N/A	N/A
Light manufacturing	1300	1,976,000	N/A	N/A	1.76%	N/A	N/A	3.98%	2.95%	N/A
Storage and distribution	1300	624,000	N/A	N/A	5.70%	N/A	N/A	12.71%	9.42%	N/A
Bank	1612	2,643,680	N/A	N/A	N/A	N/A	N/A	3.50%	N/A	N/A
Fast food	224	367,360	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
General Office	1300	2,132,000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Restaurant	224	367,360	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

N/A indicates that the target reduction cannot be easily achieved technically



4. RENEWABLE COST ASSUMPTIONS

Appendix 4 Assumptions within the report

Dwelling Costs and Area

	Floor area/unit	Total floor area	Build cost	Total build cost
			£/m2	£
4 flats 2 floors	70.93	283.72	1,200	340,464
8 flats 2 floors	70.93	567.44	1,200	680,928
9 flats	70.93	638.37	1,200	766,044
24 flats	70.93	1702.32	1,200	2,042,784
Terraced house (3)	111.3	333.9	1,400	467,460
Semi Detached	111.3	222.6	1,500	333,900
Detached house	152.41	152.41	1,600	243,856

Technology	Capital cost*	Output or saving/annum
	£/kW	kWh/kW
Solar Thermal	1000	1000
Solar PV	4000	800
Wind	2500	600
Wood logs/chip	400	2000
Wood pellets	400	2000
GSHP	1200	2000
ASHP	700	2000
AD small	5000	7446
AD large	3000	7446
Biomass CHP	2500	7446
Biomass micro CHP	4000	7446
Hydro	4000	6132
CHPelec	1000	2000

sized on heat demand



5. WHOLE LIFE COSTS

Appendix 5 Whole Life Costs

Flat (8 flats on 2 floors)

Area	567.44 m ²
Building Regulations	2010 (25% below 2006 level)
Annual CO ₂ emissions	17.33 t CO ₂

		Solar Thermal	Biomass	GSHP	ASHP	PV	Wind	CHP
Carbon reduction	%	11%	32%	13%	10%	27%	14%	24%
Carbon saving	t CO ₂	1.9	5.5	1.9	1.8	4.8	2.4	4.09
Gas saving	kWh	9,776	29,392	29,392	29,392	-	-	29,392.00
Elec savings	kWh	-	1,026	1,026	1,026	8,512	4,256	12,475.50
Gas consumption	kWh	-	-	-	-	-	-	44,088.00
Elec consumption	kWh	-	-	10,291	10,644	-	-	1,026
Size	kW	9.8	20.1	15.4	15.2	10.6	7.1	5.72
Cost	£	11,731	26,236	18,456	10,646	47,878	17,733	£ 5,724.75
Annual Costs	£	-	-	1,235	1,277	-	-	1,763.52
Annual Savings	£	391	1,299	1,299	1,299	1,404	702	2,672.74
Payback (on capital)	yr	30	20	289	495	34	25	6
Carbon Abatement	£/t CO ₂	6,186	4,753	9,504	5,938	9,903	7,336	1,401

Semi Detached House

Area	111.3 m ²
Building Regulations	2010 (25% below 2006 level)
Annual CO ₂ emissions	3.09 t CO ₂

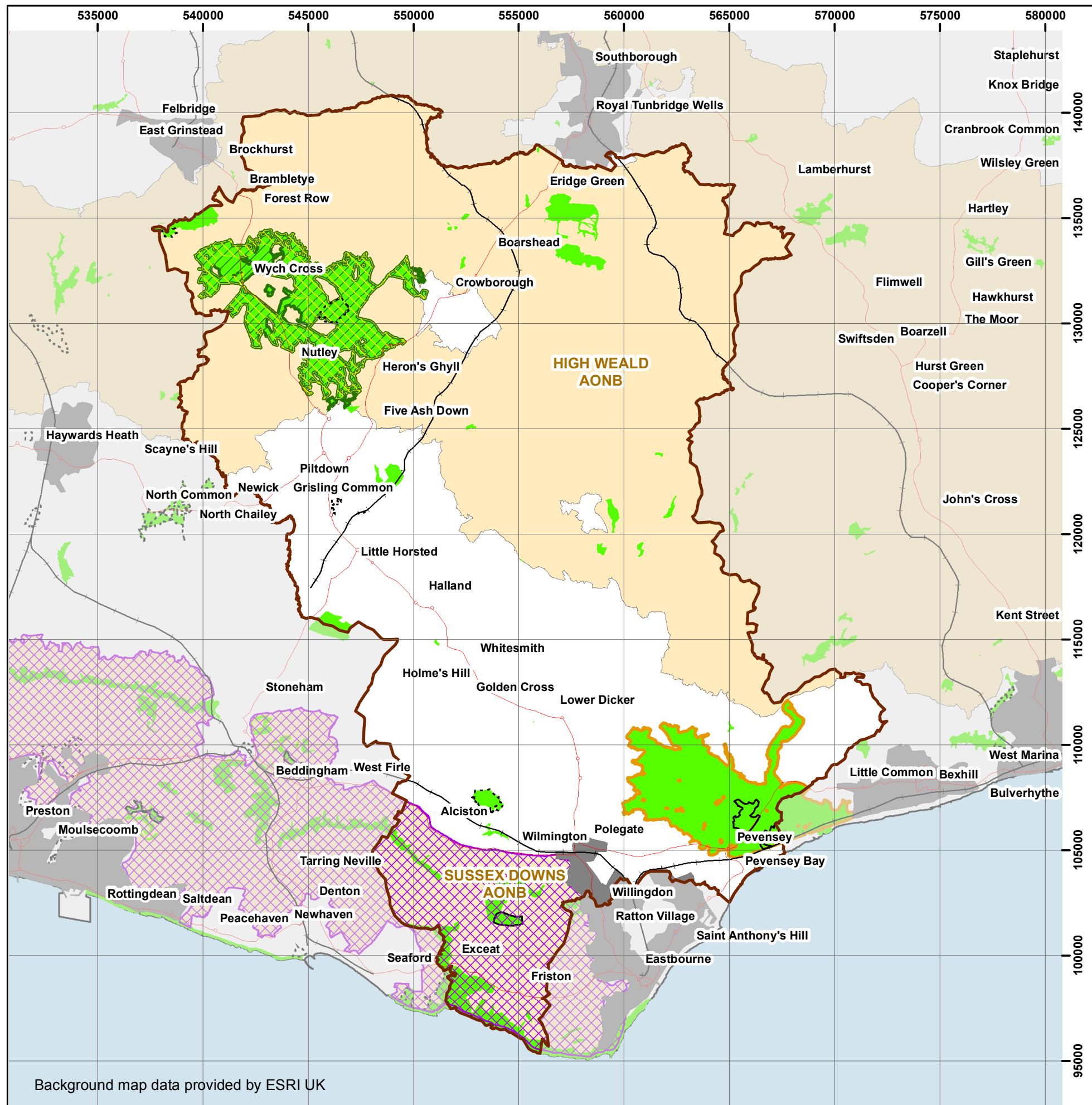
		Solar Thermal	Biomass	GSHP	ASHP	PV	Wind	CHP
Carbon reduction	%	11%	32%	11%	10%	28%	14%	24%
Carbon saving	t CO ₂	0.3	1.1	0.4	0.4	0.9	0.5	0.85
Gas saving	kWh	1,757	6,024	6,024	6,024	-	-	6,024
Elec savings	kWh	-	234	234	234	1,670	835	2,591
Gas consumption	kWh	-	-	-	-	-	-	9,036
Elec consumption	kWh	-	-	2,029	2,118	-	-	-
Size	kW	3.5	8.3	6.3	6.3	4.2	2.8	2.4
Cost	£	2,108	4,960	3,802	2,190	9,391	3,478	1,178
Annual Costs	£	-	-	243	254	-	-	361
Annual Savings	£	70	269	269	269	275	100	552
Payback (on capital)	yr	30	18	149	147	34	35	6
Carbon Abatement	£/t CO ₂	6,186	4,335	8,534	5,370	9,903	7,336	1,381

Utility Price Assumptions

Gas	0.04 £/kWh
Electricity	0.12 £/kWh
ROC	0.045 £/kWh (Assumed wind and PV would receive 1 ROC per MWh)

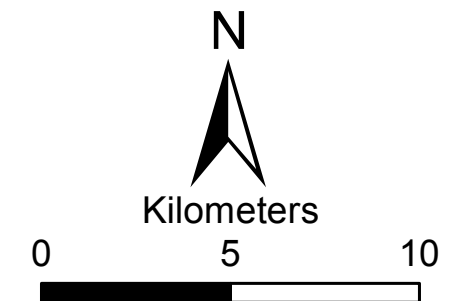


6. GIS FIGURES



Key

- Wealden District
- Settlements
- Railways
- Roads
- Urban areas
- Proposed National Park
- National Nature Reserves
- Local Nature Reserves
- RAMSAR
- SAC Sites
- SPA
- SSSI
- AONB



Wealden District Council
CAN
WE0800002

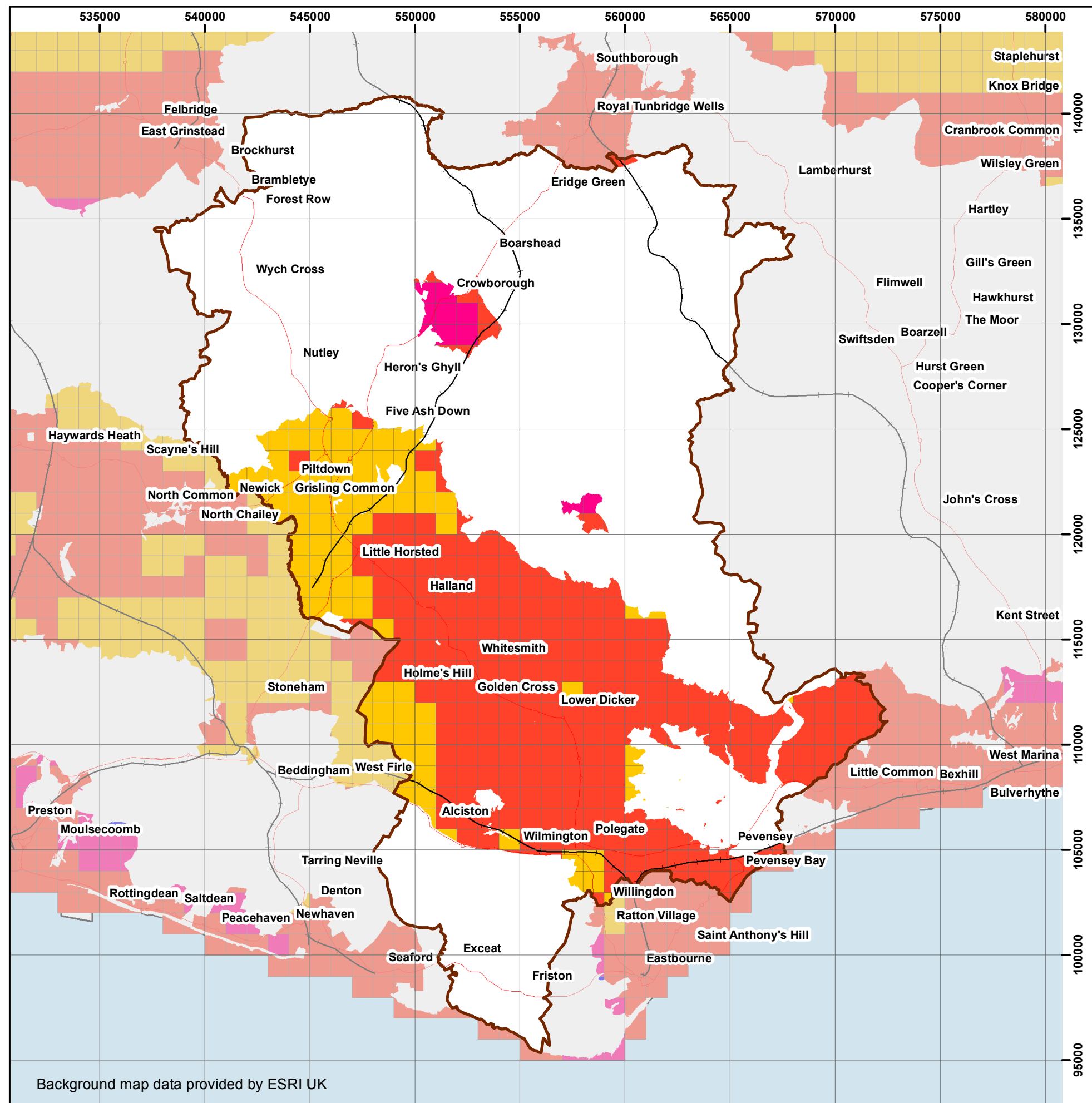
Figure 1
Environmental Designations
Wealden District

SCALE
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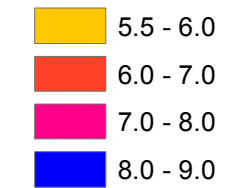
DATE
30/10/08





Key

NOABLWindspeed
m/s at 45m above ground

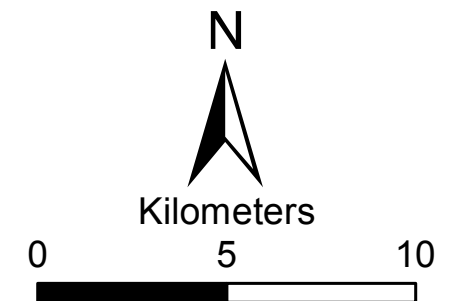


☐ Wealden District

Settlements

—+— Railways

— Roads



Wealden District Council

CAN
WE0800002

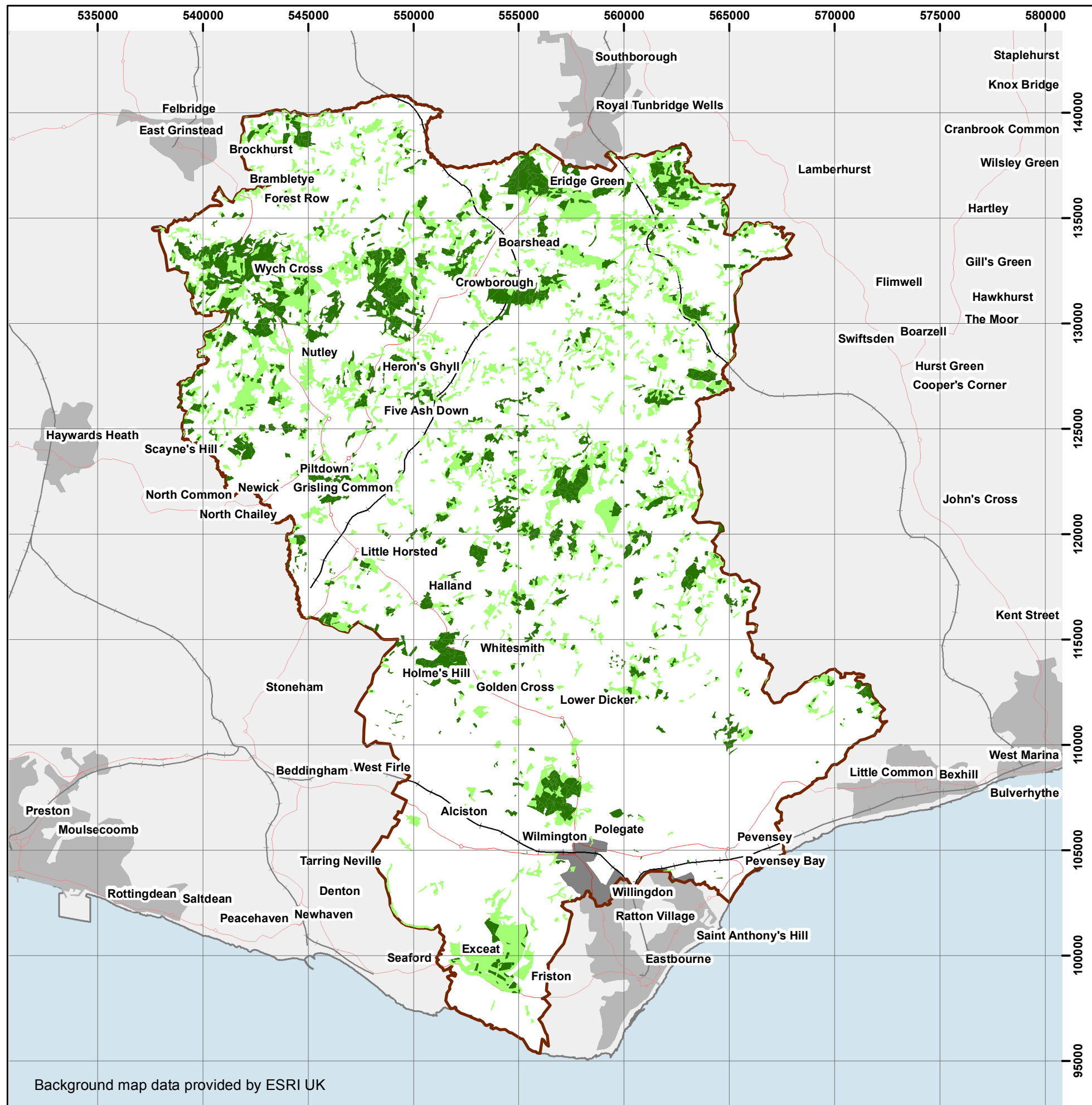
Figure 4
NOABL Wind Speed at 45m
above ground
(excluding designated areas)
Wealden District

SCALE
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DATE
30/10/08

**ENVIROS** 

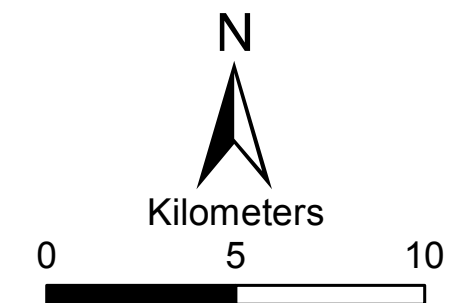


Key

Woodland

- Managed
- Unmanaged
- Wealden District
- Railways
- Roads
- Urban areas

Location of woodland taken from the Forestry Commissions Woodland Inventory



Wealden District Council
CAN
WE0800002

Figure 5
Managed and Unmanaged Woodlands

SCALE
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DATE
30/10/08



Background map data provided by ESRI UK



7. KEY ISSUES ARISING FROM POLICY REVIEW

The table below outlines what the policy documents say about several key issues; whether the target should be measured in energy of CO₂, whether the target should exceed Building Regulations and whether the target should include unregulated as well as regulated emissions.

Issue	Wealden brief	Planning policy statement 1	Planning policy statement 1: Climate Change supplement	Practice guidance to support the planning policy statement: planning and Climate Change
Target measured in energy or CO ₂	Policies will be included in the Core Strategy which will define an overall target percentage of the energy to be used in new development to come from renewable or low carbon energy sources. The council is seeking to express the percentage target of energy to be used in new developments to come from renewable or low carbon energy in terms of CO₂ savings.		Planning authorities should set out a target percentage of the energy to be used in new development to come from decentralised and renewable or low-carbon energy sources where it is viable. The target should... be flexible in how carbon savings from local energy supplies are to be secured	Policies will generally be more effective if developers are given the flexibility to choose the most appropriate technology for their development. At the same time, planning authorities should have regard to the long term carbon saving potential of different renewable and low carbon solutions Where policies are expressed as a percentage of the predicted energy demands to be met from decentralised renewable and low carbon sources, it is important to clearly define what is meant by energy. The carbon dioxide savings that result from meeting 10% of the energy demand, from renewable or low carbon sources, will vary considerably depending on whether they are offsetting electrical or fossil fuel use. One way planning authorities have overcome this problem is by using



WEALDEN DISTRICT COUNCIL RENEWABLE ENERGY STUDY

Issue	Wealden brief	Planning policy statement 1	Planning policy statement 1: Climate Change supplement	Practice guidance to support the planning policy statement: planning and Climate Change
				CO ₂ emissions as the baseline. The energy demand for the site are converted to total CO₂ emissions using standard conversion factors and it is the percentage of these total CO ₂ emissions that must be met from renewable or low carbon sources
Exceed building regs	It is envisaged that the applicant will submit to the council, the amount of emissions (expressed in terms of CO ₂) created by the development, based on current Building Regulations emission sources and additional (to be identified) unregulated sources of emissions . From the CO ₂ baseline, the applicant will need to provide renewable or low carbon technology to meet the target (expressed as a percentage). Therefore the amount/type of renewable or low-carbon energy to be provided will be determined by the applicant, in so far as the proposed building techniques will determine the baseline emissions.	Planning policies should not replicate, cut across or detrimentally affect matters within the scope of other legislative requirements, such as those set out in Building Regulations for energy efficiency	Controls under the planning, building control and other regulatory regimes should complement and not duplicate each other Regional planning bodies should ensure opportunities for renewable and low-carbon sources of energy supply and supporting infrastructure, including decentralised energy supply systems are maximised There will be situations where it could be appropriate for planning authorities to anticipate levels of building sustainability in advance of those set out nationally. When proposing any local requirements for sustainable buildings, planning authorities must be able to demonstrate clearly the local circumstances that warrant and	A commonly adopted method for defining the baseline emissions is to look at the CO₂ emissions that would have arisen from the notional building or development if it had been designed to comply with current Building Regulations and then add to this, allowances for unregulated emissions. To encourage and account for efficiency improvements, the reductions in emissions that will result from planned improvements to the energy efficiency of the building fabric, lighting and other services are then deducted to arrive at an adjusted baseline demand. The percentage contribution from decentralised renewable and low carbon services can then be measured against this adjusted baseline. As policy includes unregulated emissions it would exceed the Building Regulations.



WEALDEN DISTRICT COUNCIL RENEWABLE ENERGY STUDY

Issue	Wealden brief	Planning policy statement 1	Planning policy statement 1: Climate Change supplement	Practice guidance to support the planning policy statement: planning and Climate Change
			allow this Planning authorities should help to achieve the national timetable for reducing carbon emissions from domestic and non-domestic buildings	
Regulated & unregulated emissions	It is envisaged that the applicant will submit to the council, the amount of emissions (expressed in terms of CO ₂) created by the development, based on current Building Regulations emission sources and additional (to be identified) unregulated sources of emissions.			The Building Regulations use the Target Emission Rate (TER) which only covers end uses of energy for heating, ventilation, cooling and lighting, and excludes, for example, appliance energy use. This differs from the approach to setting renewable and low carbon energy targets that has been adopted by many planning authorities and in the London Plan. The approach in these cases seeks to establish the percentage of the site's energy demand that must be delivered from renewable energy sources, based on the total site CO₂ emissions from all end uses, not just those regulated by Building Regulations. The practical difference between the two approaches is potentially significant. For new homes, energy use for appliances and other unregulated emissions may



WEALDEN DISTRICT COUNCIL RENEWABLE ENERGY STUDY

Issue	Wealden brief	Planning policy statement 1	Planning policy statement 1: Climate Change supplement	Practice guidance to support the planning policy statement: planning and Climate Change
				typically represent 40-50% of the total CO₂ emissions. Government policy requires that all new homes should have zero emissions for both regulated and unregulated emission by 2016. It may therefore be helpful for planning authorities to include both regulated and unregulated emissions in the baseline and targets.

8. THE SOUTH EAST PLAN

The South East Plan contains seven policies related to Climate Change.

Policy CC2: Climate Change

Policy CC2 promotes measures to mitigate and adapt to the forecast effects of Climate Change and identifies encouraging the development and use of renewable energy as one such measure.

Policy CC4: Sustainable Design and Construction

Policy CC4 states that the construction of all new buildings and the redevelopment and refurbishment of existing buildings will be expected to adopt and incorporate sustainable construction standards and techniques, including designing to increase the proportion of the energy demand from renewable sources.

Policy NRM 12: Combined Heat & Power

Policy NRM 12 states that Local Development Documents and other policies should encourage the integration of combined heat and power in all developments and district heating infrastructure in large scale, mixed-use developments. Biomass fuel should be investigated and promoted where possible.

Policy NRM 13: Renewable energy targets for South East region

Policy NRM 13 sets renewable energy targets for the South East region:

Table 12 Renewable energy targets for the South East region

Year/Timescale	Installed Capacity (MW)	% Electricity Generation Capacity ⁵⁴
2010	620	5.5
2016	895	8.0
2020	1,130	10.0
2026	1,750	16.0

Although the above targets relate only to electricity generation, the draft Plan states that heat generation from renewables must also be encouraged.

The distribution of resources and potential for development of renewable energy is reasonably even throughout the South East region, implying that all sub regions can contribute to the targets in NRM 13 and therefore that all Local Authorities should include policies in their development plans to contribute to the regional targets, by supporting the development of renewable energy resources. The draft plan suggests that more detailed local consultation and assessments of potential should be undertaken to refine these indicative targets.

⁵⁴ The percentages are based on installed electricity generation capacity in 2001, with an assumption that any growth in demand or consumption of electricity is met by additional generation capacity in the region from renewables only or by imports to the region, and no increase in conventional generation capacity in the region

Policy NRM 14: Sub-Regional targets

Policy NRM 14 sets sub-regional targets for the South East.

Table 13 Renewable energy targets for the sub-regions within the South East region

Sub-region	2010 Target (MW)	2016 Target (MW)
Thames Valley & Surrey	140	209
East Sussex & West Sussex	57	68
Hampshire & Isle of Wight	115	122
Kent	111	154

Wealden falls within the East Sussex and West Sussex sub-region, which has the lowest renewable energy target of any of the South East sub-regions.

Local Development Documents should include policies, and development proposals as far as practicable should seek to contribute to the achievement of the regional and indicative sub-regional targets for land-based renewable energy (i.e. not offshore wind, tidal stream or wave power).

Policy NRM 15: Location of renewable energy

Policy NRM 15 states that Local Development Frameworks should encourage the development of renewable energy to achieve the targets in NRM 13 and NRM 14. Renewable energy should be located and designed to minimise adverse impacts on landscape, wildlife and amenity.

Wind and other renewable energy development should not be precluded in AONBs and national parks as there will be locations suitable for small scale construction, where conflict with statutory landscape protection purposes set out in PPS7 can be avoided or minimised. This is relevant to Wealden as it includes the High Weald AONB and the proposed South Downs National Park.

Outside urban areas, priority should be given to development in less sensitive parts of countryside and coast, including previously developed land and major transport hubs. Within areas of protected and sensitive landscapes, including AONBs or national parks, development should be small-scale or community-based. Proposals within or close to the boundaries of designated areas should demonstrate that development will not undermine the objectives that underpin the purposes of designation.

Policy NRM 16: Development criteria

Policy NRM16 states that Local Authorities, through their Local Development Frameworks and their decisions, should support, in principle, the development of renewable energy. Local Development Documents should include criteria-based policies that consider:

- ◆ contribution the development will make towards achieving national, regional and sub-regional renewable energy targets and CO₂ savings
- ◆ potential to integrate the proposal with existing or new development



- ◆ potential benefit to host communities and opportunities for environmental enhancement
- ◆ proximity of biomass combustion plants to fuel source and the adequacy of local transport networks
- ◆ availability of a suitable connection to the electricity transmission and distribution network

9. BRIGHTON & HOVE CITY COUNCIL'S RENEWABLE ENERGY POLICY

Local Plan

Brighton & Hove City Council produced a Local Plan, which was adopted on 21 July 2005. Under the new planning system, introduced by the government in 2004 (through the Planning and Compulsory Purchase Act 2004), Local Plan policies are automatically 'saved' for three years from adoption. In the case of Brighton & Hove's Local Plan, this period expired on 21 July 2008. Some of the policies in the Local Plan were saved and others deleted. Among those saved were SU2 on the efficiency of the development in the use of energy, water and materials, and SU16 on the production of renewable energy.

Policy SU2 states that planning permission will be granted for proposals which demonstrate a high standard of efficiency in the use of energy, water and materials. Proposals will be required to demonstrate how the siting, layout and design facilitates the use of renewable energy resources.

Policy SU16 (Production of Renewable Energy) encourages installations based on energy from renewable sources. This is supported by the forthcoming Microgeneration Planning Advice Note (PAN) which provides technical advice and information to applicants (or their agents) seeking planning permission.

Core Strategy

Brighton & Hove City Council is now producing a Core Strategy that will be adopted in January 2010. In its Core Strategy Revised Preferred Option June 2008 document, the council recognises the limitations of setting targets and minimum standards in a strategic document and proposes a more flexible system whereby standards are set and tested via a Sustainable Building Design SPD.

The preferred option in the Core Strategy requires that all new residential development (including conversions) achieve zero carbon status⁵⁵ and the minimum standards as set out by the council in the Sustainable Building Design SPD. It also requires that all development proposals (including conversions, extensions and changes of use) demonstrate how the development avoids contributing to an increase in the city's current level of carbon emissions, by measures such as the incorporation of on-site low or zero carbon technologies.

To assist developers, the council has produced a Sustainable Building Design SPD and a sustainability checklist.

The Sustainable Building Design SPD was adopted in June 2008 and came into effect in September. Its requirements are set out below:

⁵⁵ Zero carbon development is one that achieves zero net carbon (CO₂) emissions from energy use on site on an annual basis

Table 14 Brighton and Hove SPD

Development scale	Development type	What is recommended?
Householder & small-scale	New build residential (including mixed-use)	Sustainability checklist; & Level 3 of Code for Sustainable Homes (CSH)
	Residential involving existing buildings (including mixed-use, conversions & extensions)	Sustainability checklist; EST Home Energy Report; Reduction in water consumption; & Minimisation of surface water run-off
	Non-residential (including new build, conversions & extensions)	Reduction in energy & water use
Medium-scale developments	All	Minimise 'heat island effect' via contribution towards off-site tree planting; & Considerate Constructors Scheme
	New build residential (including mixed-use)	Zero net annual CO ₂ from energy use Sustainability checklist; Level 3 of CSH; and Lifetime Homes Standards
	New build non-residential	50% in energy & water sections of relevant BREEAM assessment within overall 'Very Good'
	Residential involving existing buildings (including mixed-use, conversions & extensions)	No additional net annual CO ₂ emissions from new development; Sustainability checklist; & EcoHomes for refurbishment
	Non-residential involving existing buildings (including conversions & extensions)	No additional net annual CO ₂ emissions from new development; Reduction in water consumption; & Minimisation of surface water run-off
Major developments	All	Minimise 'heat island effect' via contribution towards off-site tree planting; & Considerate Constructors Scheme

Development scale	Development type	What is recommended?
	New build residential (including mixed-use)	Zero net annual CO ₂ from energy use Sustainability checklist; Level 4 of CSH; Feasibility study on rainwater harvesting & greywater recycling; & Lifetime Homes Standards
	New build non-residential	60% in energy & water sections of relevant BREEAM assessment within overall 'Excellent'; & Feasibility study on rainwater harvesting & greywater recycling
	Residential involving existing buildings (including mixed-use & conversions)	No additional net annual CO ₂ emissions from new development; Sustainability checklist; & EcoHomes for refurbishment
	Non-residential involving existing buildings (including conversions & extensions)	No additional net annual CO ₂ emissions from new development; Reduction in water consumption; & Minimisation of surface water run-off
Greenfield developments	All	Zero annual net CO ₂ from energy use; Minimise 'heat island effect' via contribution towards off-site tree planting; & Considerate Constructors Scheme
	New build residential (including mixed-use)	Sustainability checklist; Level 5 of CSH; & Lifetime Homes Standards
	New build non-residential	70% in energy & water sections of relevant BREEAM assessment within overall 'Excellent'; & Feasibility study on rainwater harvesting & greywater recycling

The sustainability checklist will be required for all residential applications involving new build and conversions, from 21st September 2008. It assesses the energy strategy for the proposed development, looking at the steps taken to minimise demand, maximise thermal efficiency, maximising the proportion of energy provided through on-site generated zero carbon energy and meet the remaining demand through low carbon technologies. It also assesses the use of site heating or cooling, the design of the development to allow future installation of renewables and the type of energy metering.

10. HASTINGS BOROUGH COUNCIL'S RENEWABLE ENERGY POLICY

Local Plan

Chapter 9a of the Local Plan contains policy DG23 on renewable energy schemes. This states the criteria against which planning applications for renewable energy will be assessed. Policy DG24 on energy efficient development states that particular support will be given to proposals incorporating or facilitating the use of energy efficient supply technology and/or renewable energy resources.

The annual monitoring report for Hastings Local Plan 2004 for the year 2006/07 mentions a target of 10% of energy used in major new developments should come from on site renewables, stating that this target may be refined in the future due to the emerging findings from the Hastings Local Development Framework. In 2006/07, the target was not met because no major new developments were completed in the monitoring period.

Core Strategy

Hastings Borough Council is preparing a core strategy which will replace their local plan by 2011. They produced a core strategy preferred approaches document for consultation in May 2008. This included a section on renewable energy, stating that the council takes a positive attitude to the development of renewable energy provision. It says that the council will investigate the potential for identifying specific sites for renewable energy schemes. Preferred approach 46: renewable energy – on site provision outlines the flexible policy that Hastings is producing for on site renewable energy provision.

The preferred approach (subject to further evidence base work prior to the submission of the Core Strategy) is that all new commercial development above a threshold of 1,000m², or residential development of 10 or more domestic buildings, will be expected to provide at least 10% of its energy requirements from onsite renewable energy generation, unless it can be demonstrated that the development will be unviable in terms of development type, location, design or economics. The document also states that the policy targets may increase during later reviews of the plan, to reflect the need to address Climate Change.