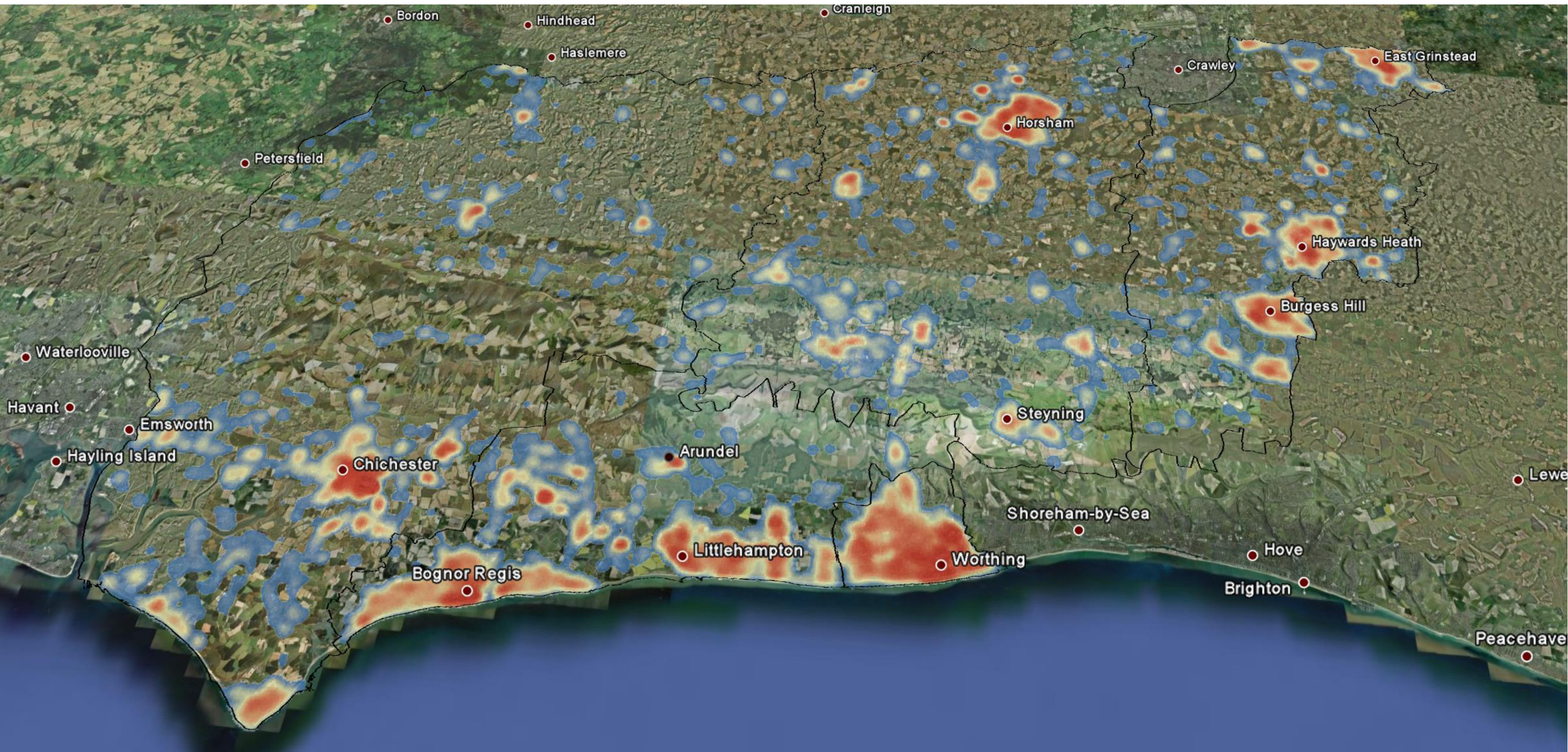
West Sussex Sustainable Energy Study

Informing the opportunities and spatial planning requirements for renewable and low carbon energy in five West Sussex local authorities

Final Report



Undertaken by the Centre for Sustainable Energy
in conjunction with Impetus Consulting Ltd and Land Use Consultants

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Executive Summary

Introduction

This report presents the results of the West Sussex Sustainable Energy Study and has been produced by the Centre for Sustainable Energy in conjunction with Impetus Consulting and Land Use Consultants. The underlying aim of this study is to assist a consortium of five West Sussex Local Authorities in developing Local Development Framework (LDF) policies which positively encourage reduced energy consumption and carbon emissions from buildings and greater sustainable energy generation. The study also provides a robust evidence base to inform spatial planning requirements set out in *Planning Policy Statement: Planning and Climate Change - Supplement to PPS1*.

PPS1 and a number of other national policy drivers now require local authority planning policies to adequately address sustainability issues. National planning guidance recommends that development plans should contribute to global sustainability by addressing the causes and potential impacts of climate change - through policies which reduce energy use, reduce emissions and promote the development of renewable energy resources.

The South East Plan also places responsibility on local authorities to achieve low carbon building standards in advance of changes to Building Regulations. In particular, policy NRM11 allows local authorities to require higher levels of decentralised and renewable or low-carbon energy in new development.

This study therefore investigates the local sustainable energy resources that exist in West Sussex and evaluates them in relation to their potential for the reduction of carbon emissions. The resources are also considered in the context of proposed new development in the area and the need for increasingly challenging standards for carbon emissions. A set of policy scenarios for new residential development is modelled and the potential for decentralised energy supply such as district heating networks is assessed. Policy recommendations and issues around their implementation are then discussed.

Resource assessment

West Sussex currently hosts a number of renewable/low carbon energy installations ranging in both scale and type from large landfill gas generation plant to small scale wind turbines. Based on the number and type of installations, it is estimated that these comprise a capacity of approximately 23MW electricity generation and 12MW heat generation. The figures for electricity can be compared with renewable energy sub-regional targets for East and West Sussex in the South East Plan i.e. 57MW by 2010 and 68MW by 2016. Taken as a proportion of the total annual overall carbon emissions for the five districts under study, the existing annual carbon saving resulting from the above installations is estimated at 2.4%.

A detailed assessment of renewable energy resources was undertaken for each local authority, covering both heat and electricity generating resources and technologies. In order to inform the resource assessment and future work on the location of renewable energy generating plant, a landscape sensitivity assessment was also undertaken to assess those technologies that have the potential, in the wrong location, to have significant impact on landscape character – mainly wind energy developments and energy crops.

Estimates of the technical (unconstrained) resource for technologies were calculated and, where relevant, mapped using GIS techniques. A set of constraints were then applied to certain resources i.e. wind and energy crops to assess their impact. The table below summarises the results:

Summary of resource assessment across study area			
Resource	**Technical capacity**		**Proportion of potential annual carbon savings relative to 2006 area-wide total emissions [%]**
	Electricity [MWe]	**Heat [MWth]**	
Onshore wind	1,255 (168)	–	23.9 (2.8)
Woodfuel (energy crops)	83 (4)	208 (10)	13.7 (0.7)
Waste (Industrial &commercial)	27	69	4.6
Waste (Municipal Solid Waste)	10	24	1.6
Local Biomass (woodland residues)	–	94	1.1
Waste (Agriculture & food)	5	12	0.8
Solar photovoltaics	76	–	0.6
Solar Water Heating	–	45	0.1
Total	**1,456 (290)**	**452 (254)**	**46.4 (12.3)**

Notes:

- Figures in brackets refer to the constrained resource. For wind this excludes designated areas and areas of high landscape sensitivity; for biomass (energy crops) this assumes 5% of suitable land is planted.
- Assumes energy crops and waste are used in CHP plant; woodland residues used in heat only plant
- The solar resource relates to roof space on existing buildings. In some cases the two solar technologies may compete for this roof space, so the combined resource may in practice be lower.

Although some resources are not specifically quantified and would in practice be expected to add to the overall resource e.g. natural gas for CHP and biomass from outside West Sussex, the analysis highlights the scale of the challenge presented by the Government's national target of an 80% emissions reduction by 2050 over 1990 levels. The significant shortfall will have to be addressed by measures including absolute demand reduction through behaviour change, increased energy efficiency in existing buildings, low carbon transport measures, and decarbonising the national grid.

The key issue for exploiting the wind resource concerns its impact on designated areas and landscape character. Much of the resource for large scale wind is located within the South Downs, which will soon receive National Park designation. Although wind power is not formally prohibited in these areas there will be significant constraints to deployment, particularly for large and medium scale installations. Due to the potential impact on landscape character, a strategy to accept landscape character change in some areas may be needed if large/medium scale wind is to significantly contribute to renewable electricity generation in the study area. Planning can be used to guide renewable energy proposals so as to spread them apart to avoid cumulative issues, or to cluster them in certain parts of the landscape & keep other areas free of development.

Although the development of energy crops is less constrained by landscape issues, the key challenges will be convincing farmers to invest in this crop by offering long-term supply contracts tied to its end-use, and factoring in the time needed to establish energy crop plantations before harvesting.

A key area to address in exploiting the woodfuel resource will be the establishment of a network of local biomass supply chains in parallel with demand creation strategies. However, future Building Regulations and the policy scenarios considered in this study are likely to instigate a step-change in demand by placing heavy reliance on biomass to meet carbon reduction targets. This is especially true considering the zero carbon requirements on residential developments from 2016, when the constraints with on-site wind power will in many cases require an alternative biomass solution.

The development of the waste and biomass resource will be largely influenced by the identification and implementation of macro-scale district heat networks requiring heat-only or CHP energy plant. These technologies will be increasingly drawn upon to meet post-2016 targets, again due to the constraints placed on wind power.

Although the solar resource represents the technical potential on existing buildings, only a fraction of this would be realised due to the capital cost constraints in today's economic climate. Solar has much larger potential for new developments where its ease of application at the design stage can make it a viable proposition to developers to meet earlier lower targets or as part of an appropriate technology mix to meet later higher targets.

Policy scenarios for new development

A set of planning policy scenarios were constructed to examine different standards and timescales for 'energy efficiency' and 'carbon compliance' requirements that developers would need to satisfy in each case alongside 'allowable solutions' to deal with residual emissions (as set out under the proposed definition of zero carbon homes). The impacts of these scenarios were then assessed by the modelling of SHLAA data (Strategic Housing Land Availability Assessment) for the study area.

Note - although this process was undertaken jointly by the five authorities, it is essential to note that each authority is currently at a different stage in its SHLAA process and as such not all identified sites are likely to be developed. At the time of the preparation of this report, Chichester's SHLAA data was not sufficiently developed to use in the dataset and the other local authority SHLAA data used in this report should be considered as potential sites only.

The table below presents the scenarios. Scenario 1 effectively assumes that the local authorities impose minimum standards for new developments as currently expected through future changes to Building Regulations (see Section 2). Scenario 2 introduces a more demanding target for Phase 3 and Scenario 3 brings forward the expected national targets to an earlier date. Scenario 4 represents a combination of Scenarios 2 and 3 and is the most ambitious scenario in terms of carbon reductions.

Planning policy scenarios for new development				
		Phase 1 (2010-2012)	**Phase 2 (2013-2015)**	**Phase 3 (2016 on)**
Scenario 1 (baseline)	CO_2 reduction target relative to Part L 2006	25% of regulated[1] emissions through energy efficiency and carbon compliance measures	44% of regulated emissions through energy efficiency and carbon compliance measures	**Zero carbon:** 70% of regulated emissions through energy efficiency and carbon compliance measures plus 'allowable solutions' for residual emissions
	Equivalent level of the Code for Sustainable Homes[2]	Level 3	Level 4	Level 4/5
Scenario 2	CO_2 reduction target relative to Part L 2006	25% of regulated emissions through energy efficiency and carbon compliance measures	44% of regulated emissions through energy efficiency and carbon compliance measures	**Zero carbon:** 100% of regulated emissions through energy efficiency and carbon compliance measures plus 'allowable solutions' for residual emissions
	Equivalent level of the Code for Sustainable Homes	Level 3	Level 4	Level 5
Scenario 3	CO_2 reduction target relative to Part L 2006	44% of regulated emissions through energy efficiency and carbon compliance measures	**Zero carbon:** 70% of regulated emissions through energy efficiency and carbon compliance measures plus 'allowable solutions' for residual emissions	
	Equivalent level of the Code for Sustainable Homes	Level 4	Level 4/5	
Scenario 4	CO2 reduction target relative to Part L 2006	44% of regulated emissions through energy efficiency and carbon compliance measures	**Zero carbon:** 100% of regulated emissions through energy efficiency and carbon compliance measures plus 'allowable solutions' for residual emissions	
	Equivalent level of the Code for Sustainable Homes	Level 4	Level 5	

The above scenarios specifically concern residential development, as phased standards for non-residential development have yet to be proposed by Government. Additionally, the five local authorities hold no SHLAA-equivalent data for non-residential buildings. For these reasons non-residential developments have not been modelled.

Potential for sustainable energy supply on new development

The table below summarises the results of the SHLAA modelling. The generation capacities indicated are made up of various combinations of biomass heat/CHP with district heating and solar PV, as these technologies have been shown to be the least cost options for the targets modelled. The analysis does not include wind power due to the inherent site-specific constraints with this resource which cannot be modelled at this level.

[1] Regulated emissions only include those associated with space heating, ventilation, hot water and fixed lighting. Total emissions include regulated emissions plus those associated with cooking and other appliances.
[2] The level shown refers to the carbon reduction achieved through energy efficiency and carbon compliance (onsite generation or direct connection of low or zero carbon heat) measures only.

Carbon impacts of new residential development										
Local authority	Scenario	Generation capacity [MW] Power	Generation capacity [MW] Heat	Gross emissions, Part L 2006 standards [tonnesCO_2/yr]	Gross emissions from new development before adding renewables [tonnesCO_2/yr]	Emissions savings from renewables [tonnesCO_2/yr]	Net emissions from new development [tonnesCO_2/yr]	Net scenario increase in emissions (%), as proportion of district-wide emissions (2006)	Net increase @Part L 2006 Standards (%)	Average cost increase over Part L 2006 standards (%)
Arun	Scenario 1 (multiphase)	14.64	15.53	45,243	38,405	12,483	25,922	3.1%	5.4%	17.0%
	Scenario 2 (multiphase)	9.54	15.56			14,511	23,984	2.9%		18.8%
	Scenario 3 (multiphase)	16.38	19.52			15,009	23,395	2.8%		18.1%
	Scenario 4 (multiphase)	9.9	19.57			17,590	20,815	2.5%		20.4%
Horsham	Scenario 1 (multiphase)	9.65	10.34	30,239	25,669	8,285	17,384	1.8%	3.1%	17.0%
	Scenario 2 (multiphase)	6.42	10.4			9,688	15,980	1.7%		18.8%
	Scenario 3 (multiphase)	10.86	13.01			9,985	15,684	1.6%		18.1%
	Scenario 4 (multiphase)	6.75	13.07			11,771	13,897	1.4%		20.4%
Mid Sussex	Scenario 1 (multiphase)	11.48	13.01	38,703	32,856	10,246	22,610	2.3%	3.9%	17.0%
	Scenario 2 (multiphase)	8.5	13.33			12,378	20,479	2.1%		18.9%
	Scenario 3 (multiphase)	13.02	16.45			12,397	20,459	2.1%		18.1%
	Scenario 4 (multiphase)	9.23	16.75			15,110	17,747	1.8%		20.5%
Worthing	Scenario 1 (multiphase)	3.54	5.73	17,236	14,639	3,995	10,644	2.0%	3.2%	16.9%
	Scenario 2 (multiphase)	3.66	5.99			5,361	9,278	1.7%		18.9%
	Scenario 3 (multiphase)	4.24	7.19			4,939	9,700	1.8%		18.0%
	Scenario 4 (multiphase)	8.43	7.51			6,677	7,961	0.9%		20.5%

The table below compares the renewable energy resources available at district-level (as estimated in the resource assessment) against the potential capacities required on new residential development (as modelled using SHLAA data for Scenario 4). It can be seen that the constrained resource is larger than the estimated requirement on new residential development in each case. However, the constrained resource includes wind power where locational constraints will still apply in relation to developments. It should be noted that the MW capacities for power and heat do not necessarily increase overall when considering a higher target e.g. moving from Scenario 3 to Scenario 4. This is largely due to the differing load factors of each of the technologies and the fact that CHP tends to displace PV at higher target levels. Comparison of costs on a £ per MW installed capacity basis should therefore be approached with caution as these will not necessarily correlate with resulting carbon savings.

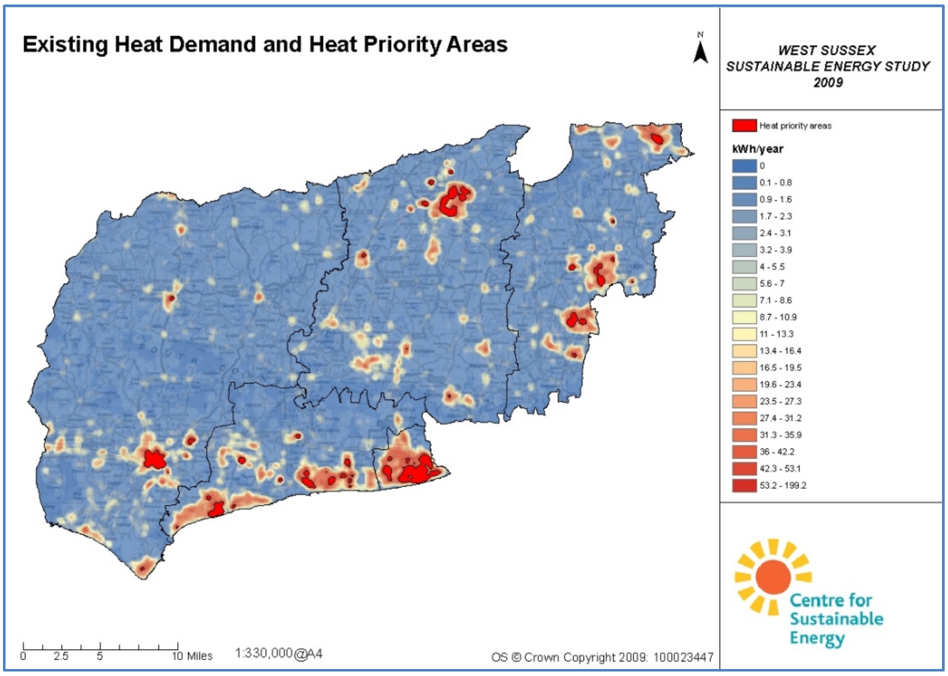
Comparison of renewable energy resources with potential capacities required on new residential development				
	Renewable energy resource* (from resource assessment – see Annex A)		**Indicative renewable energy capacities required on new residential development (Scenario 4)**	
Local authority	**Power [MW]**	**Heat [MW]**	**Power [MW]**	**Heat [MW]**
Arun	323 (73)	102 (69)	9.9	19.6
Horsham	326 (68)	87 (46)	6.8	13.1
Mid Sussex	177 (39)	72 (56)	9.2	16.8
Worthing	32 (10)	13 (13)	8.4	7.5

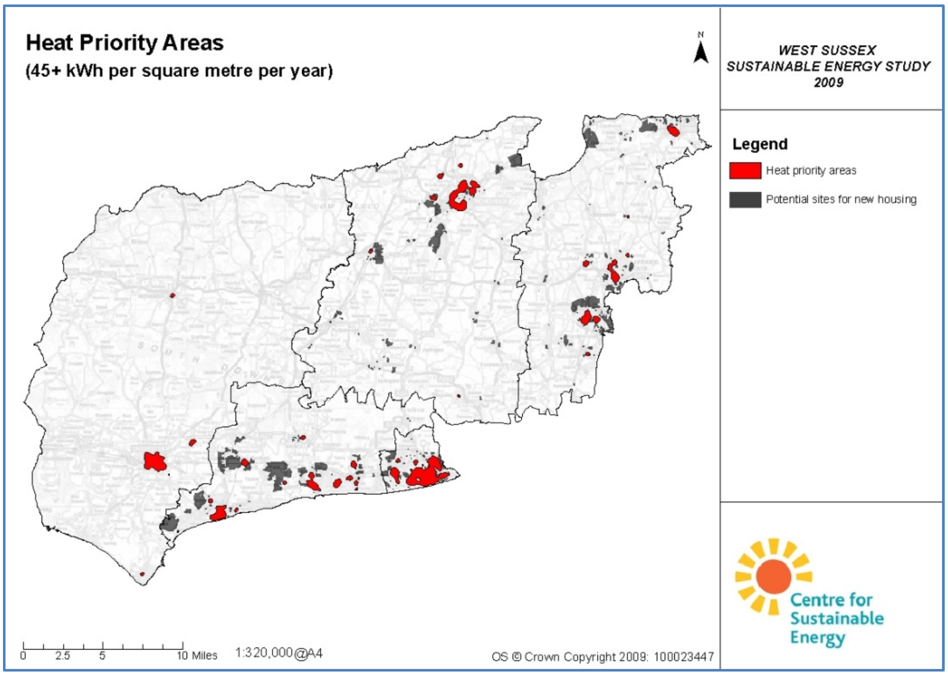
*Main figures refer to technical resource; bracketed figures refer to constrained resource

The results highlight that, although new development up to 2026 will clearly result in a net increase in district-wide emissions, the proposed building regulation standards (Scenario 1) will limit this increase to approximately 60% of the equivalent Part L 2006 emissions i.e if all development is built to Part L 2006 standards. The results also compare the relative additional costs of Scenarios 2, 3 and 4 against the gains in carbon savings they are likely to achieve.

Heat Priority Areas and district heating

An analysis of existing heat loads throughout the five districts alongside those expected from new development has led to the identification of Heat Priority Areas (HPA), in which conditions are likely to favour larger scale, more economic and effective forms of sustainable energy generation such as CHP with district heating (and/or cooling). The figures below show the location of these HPAs in relation to existing heat demand and proposed new development.





The combined Heat Priority Areas identified for each district are shown in the table below along with their relative size and heat demand. Also shown are the resulting emission savings if these heat demands were supplied from biomass fuel, offsetting natural gas.

Heat demands within districts showing Heat Priority Areas (HPA)

		% of area	Heat demand (GWh/year)	% of total heat demand	Potential emission savings if heat demand within HPAs met using biomass heat-only plant (tonnes CO_2/yr)	% of district-wide emissions
Arun	Total area	100%	1,529	100	67,969	11.3
	Area within HPA	2.2%	374	24%		
	Area outside HPA	98%	1,155	76%		
Chichester	Total area	100%	1,389	100	60,336	10.4
	Area within HPA	0.5%	332	24%		
	Area outside HPA	99.5%	1,057	76%		
Horsham	Total area	100%	1,431	100	62,154	9.9
	Area within HPA	0.9%	342	24%		
	Area outside HPA	99.1%	1,088	76%		
Mid Sussex	Total area	100%	1,412	100	53,794	9.7
	Area within HPA	1.2%	296	21%		
	Area outside HPA	98.8%	1,116	79%		
Worthing	Total area	100%	1,003	100	95,230	17.9
	Area within HPA	23.0%	524	52%		
	Area outside HPA	77.0%	479	48%		

Additional carbon savings would be achieved if the heat was produced in biomass CHP plant(s). Assuming the use of steam turbine technology, and considering all HPAs, nearly 747GWh of zero carbon electricity would be generated along with the heat. This could save a further 284,000 tonnes of CO_2 by offsetting electricity supplied from the national grid – equivalent to a further 7% reduction in area-wide emissions. However, this would require a very large supply of biomass fuel – around 628,000 tonnes of woodfuel per year – equivalent to the entire unconstrained energy crops resource.

The savings from heat supply could potentially be achieved by gas-fired CHP also. This assumes that the carbon intensity of electricity from gas-fired CHP (assuming all the carbon is allocated to the electricity) is equal to or lower to that for grid electricity. Where this is the case, the CHP heat output will effectively be zero carbon.

Viability of targets for new development

Targets proposed through future Building Regulation changes will impose additional build costs on new developments, which will need to incorporate a range of low or zero carbon energy measures to meet the targets. The analysis undertaken on new residential development (SHLAA sites) proposed in West Sussex suggests additional cost ranges relative to Part L 2006 for Scenarios 1, 2, 3 and 4 of 12-19%, 12-21%, 16-19% and 16-21% respectively. It should be noted however that considering Scenario 1 is a 'baseline' scenario, i.e. which will happen anyway through the proposed building regulations, the costs of the other scenarios could be considered relative to Scenario 1. This would result in additional costs of Scenarios 2, 3 and 4 being around 2-4%.

Additional costs associated with the Code for Sustainable Homes are well-documented in theory, although have yet to be fully tested in practice. There is a significant step-change in cost in achieving Code level 6 over level 5, although it is likely that the definition of Code level 6 will change following the Government's consultation on the *Definition of Zero Carbon Homes and Non-Domestic Buildings*. Additional costs resulting from BREEAM standards on non-residential development are much less defined.

A range of existing and emerging institutional and financial mechanisms can assist in the successful delivery of carbon reduction targets. Management and operation of district heating systems will need tailored arrangements such as the formation of an Energy Service Company (ESCo). Although no standard 'model' currently exists for ESCos, there are increasing numbers now being established for a variety of applications. Initiatives such as the Community Infrastructure Levy may also assist in establishing sustainable energy infrastructure through up-front funding.

As mentioned above, the set of allowable solutions being proposed by the Government to be implemented from 2016 will offer developers a certain degree of flexibility in meeting the zero carbon requirements on new homes where zero carbon cannot be achieved solely through on-site measures or by directly connected heat. Opportunities therefore exist for local planning authorities to introduce locally tailored allowable solutions in advance of Building Regulations, which could include off-site contributions for local district heating infrastructure.

Policy recommendations

The following policy recommendations are made to the five local authorities:

Recommendation 1

Prepare an overarching statement on climate change in line with national policy on emissions and renewable energy targets. For example:

"XXX Council is committed to reducing total CO_2 emissions in line with the Climate Change Committee's recommendation for an 80% cut by 2050, relative to the year 1990"

To justify and contextualise the development specific policies, each local authority should prepare an overarching statement at the outset focused on climate change, CO_2 reduction targets and renewable and low carbon energy targets. An overall greenhouse gas reduction target of 80% by 2050 and 34% by 2020 is recommended, in line with the latest UK policy set out in the Climate Change Act (2008). Both these targets are set against a 1990 baseline. Area or district-wide targets for renewable and low carbon energy technologies and how they may relate to an appropriate trajectory of CO_2 reduction towards the 2050 target should be the subject of further study and consultation. These should be informed by the results of the renewable energy resource assessment presented in this report.

Recommendation 2

Evaluate whether local conditions and local authority in-house capacity (such as the measures stated in Recommendations 8 -11 below) could be developed sufficiently to justify the adoption of Scenario 4 in this study for new residential development, expressed in terms of the Code for Sustainable Homes; that is:

- ***Code level 4 (44% reduction on regulated emissions) from 2010***
- ***Code level 5 (100% reduction on regulated emissions) from 2013 onwards***

As a fall-back option, set policies for carbon emission standards on new residential development according to a <u>minimum</u> of Scenario 2 in this study, expressed in terms of the Code for Sustainable Homes; that is:

- ***Code level 3 (25% reduction on regulated emissions) from 2010***
- ***Code level 4 (44% reduction on regulated emissions) from 2013***
- ***Code level 5 (100% reduction on regulated emissions) from 2016***

Following the consultation on the *Definition of Zero Carbon Homes and Non-Domestic Buildings*, the Government has indicated a preferred set of standards for new homes which sets a trajectory of carbon reduction targets up to 2016. These standards are represented in Scenario 1 of this study: 25% reduction on regulated emissions from 2010, 44% reduction on regulated emissions from 2013 and zero carbon from 2016, with the latter target made up of a carbon compliance level of 70% of regulated emissions plus allowable solutions for residual emissions. Future consultations on Building Regulations will establish more detail on these targets, such as the minimum level of energy efficiency to be achieved.

The analysis[3] behind this announcement suggests that these standards can generally be applied to all housing types without placing undue burden on developers regarding technical or economic viability. Where these standards are exceeded, there should be sufficient evidence to justify their technical and financial viability for the majority of developments. Clearly there will be some cases where a degree of flexibility is required whereby developers can be offered alternative 'allowable' solutions if standards can be shown to be technically or financially unviable.

By offering allowable solutions to allow a degree of flexibility on certain developments where targets are shown to be unviable e.g. small scale developments, planning departments should therefore still be able to 'set the bar high' in order to maximise carbon savings on the majority of developments regardless of scale or location. For this reason, and considering the importance of ensuring the earliest possible action on climate change, each local authority should first consider bringing forward and increasing such standards for earlier implementation as proposed in Scenario 4, i.e. 44% reduction on regulated emissions from 2010 and 100% from 2013 onwards.

The analysis has shown that the average additional cost per dwelling (over Part L 2006 standards) associated with this scenario are minimal (around 20.5%) when compared with proposed Building Regulation standards up to 2016 (around 17%). Additionally, the analysis shows that the area's renewable energy resources could potentially support the energy generation requirements on new residential development (as modelled on the SHLAA data set) that this scenario (and the other scenarios) would require (see Table 37). However, this includes the wind resource where locational constraints will still apply in relation to developments. In most cases, the majority of electricity demand could potentially be met by solar PV in conjunction with biomass CHP.

The adoption of Scenario 4 will raise the immediate challenge of ensuring that the delivery structures required to implement standards proposed by Building Regulations from 2013 are in place three years earlier i.e. from 2010. The viability of this would therefore depend on each local authority's view of how quickly supply chains, infrastructure, council in-house capacity and resources etc could be established.

Scenario 2 in this report should be considered the fall-back *minimum* standard by each local authority, which increases the 2016 carbon compliance level to 100% of regulated emissions. The analysis has shown that the average additional cost burden associated with this standard is marginal, around 18.9%, compared with proposed Building Regulation costs of 17%, relative to Part L 2006 costs. As per Scenario 4, the area's resources could potentially meet the demand. For example, under Scenario 2, new residential development would need around 25% of the combined biomass and waste resource in the study area.

Although the focus of this study concerns sustainable energy, the broader scope of environmental benefits resulting from sustainable design and construction also needs to be considered. Areas such as water use, the life cycle of materials, biodiversity, waste recycling and sustainable drainage systems are covered within the Code for Sustainable Homes and BREEAM, so unless otherwise specified, the use of these standards to express CO_2 emissions targets will also imply certain standards for other aspects of sustainable design and construction. Water conservation has particular implications in the South East region where water scarcity and waste water treatment capacity concerns are resulting from growing demands from planned development.

[3] See http://www.communities.gov.uk/publications/planningandbuilding/zerocarbondefinition

An advantage of expressing carbon savings as Code for Sustainable Homes and BREEAM targets is that scheme Assessors would be employed to assess the development (funded by the developer), avoiding further burden on Council Officer resources.

However, unlike the Code standards, the carbon reduction levels corresponding to the various BREEAM categories are less explicit but will be subject to review once the outcomes from the Government's consultation on the Code for Sustainable Buildings are known.

Recommendation 3

Targets for non-residential development should be considered in the context of the Government's proposed timeline for zero carbon buildings within this sector (Table 32 of this report). This should use the BREEAM rating system for non-residential buildings.

A baseline overall standard of BREEAM 'Very Good' should be set from 2010, with scope to upgrade this to 'Excellent' or 'Outstanding' for schools and public buildings. In parallel with this, non-residential development should be required to achieve an energy-specific BREEAM rating of Excellent or Outstanding.

There is currently very little evidence available on cost and viability issues to inform the choice of targets for non-residential developments. This is mainly due to the many different types and uses of buildings in the non-residential sector. The definition of zero carbon within this sector and the trajectory leading up to this standard have yet to be defined by Government. The Government is currently consulting on these issues and until this is concluded it is recommended that BREEAM 'Very Good' is used as a general baseline from 2010. However, BREEAM 'Excellent' or 'Outstanding' could potentially be considered for schools and public buildings where there are opportunities to do so. In parallel with this, non-residential development should be required to achieve an energy-specific BREEAM rating of Excellent or Outstanding.

All targets and standards should be revised and updated periodically as national policy, sustainability best practice and low and zero carbon technologies develop.

Recommendation 4

Local authorities should consider varying targets and assessment criteria on development in specific areas where opportunities for greater carbon savings have been shown to exist.

For example, in Heat Priority Areas, a flexible approach should be taken to ensure maximum uptake of district heating and related technologies, while in other areas the focus should be on low/zero carbon heat from biomass, solar hot water, and ground-source heat pumps.

Each local authority should consider the application of higher targets to localised areas where greater carbon saving opportunities have been shown to exist, such as the Heat Priority Areas identified in this study.

Across the West Sussex districts there is naturally some variation in terms of resources, land types and uses. The low and zero carbon energy resource assessment indicates the spatial distribution of resources, particularly in terms of wind and woodfuel, but there is little evidence to suggest that local sustainable energy targets for new development (Recommendations 2 and 3) should in general differ across the districts.

It is recommended that any site-specific targets should be based on the spatial distribution of new and existing development. Districts with higher proportions of Heat Priority Areas, for example, could adopt a flexible approach to ensure maximum uptake of district heating and related technologies. CHP/district heating for new development within these areas could be encouraged by encouraging developers to consider the 'rules of thumb' criteria for district heating and by following the heating/cooling hierarchy (Recommendation 6). In other areas, including most rural locations, the focus should be on other types of low/zero carbon technologies such as heat from biomass, solar hot water, and ground-source heat pumps.

Recommendation 5

Require an explicit site Energy Strategy based on an Energy Hierarchy to accompany development proposals.

Example:

"Proposals should be accompanied by an Energy Strategy which should be consistent with the priorities set out in the following Energy Hierarchy:

(1) Energy Efficiency (minimise demand)

(2) Zero carbon energy sources (use renewables)

(3) Low carbon energy sources (use CHP and community heating)"

Recommendation 6

In addition, policy should include reference to an explicit Heating/Cooling Hierarchy such as the following:

"New development will be expected to demonstrate that the heating and cooling systems have been selected according to the following hierarchy :

(1) Connection to existing (C)CHP distribution networks

(2) Site wide renewable (C)CHP

(3) Site wide gas-fired (C)CHP

(4) Site wide renewable community heating/cooling

(5) Site wide gas-fired community heating/cooling

(6) Individual building renewable heating"

Note that the above hierarchy would have the effect of implicitly banning electric heating in new developments.

Including these hierarchies will ensure that the lowest-carbon outcomes are achieved in a given context and will require developers to put forward valid justification for deviating from the preferred approach e.g. where small, low density developments in rural areas may not warrant CHP or district heating solutions.

Recommendation 7

A 'Merton'-style on-site generation policy should be included in the context of the hierarchies mentioned above.

Example:

"New development will be required to include sufficient on-site renewable energy generation to reduce total CO_2 emissions by at least 20% after the accounting for energy efficiency and low carbon energy sources, wherever feasible"

Whether or not already in place, 'Merton'-style on-site generation targets should be considered as part of a hierarchy, and should be expressed as a requirement to reduce site residual emissions by (at least) a certain proportion. Although the default level recommended at regional level in the South East is 10%, the London Plan now requires a 20% emissions reduction through on-site renewables considered within a hierarchy, that is, to tackle residual emissions after the inclusion of energy efficiency, CHP and communal heating.

The modelling undertaken in this study has shown that Scenario 2 alone would be likely to result in around 5% on-site renewables from 2010, rising to 18.5% by 2013 and 52% by 2016. With Scenario 4 alone, the figures would be 18.5% from 2010 and 52% from 2013 onwards. A stand-alone on-site renewables policy target of 20% reduction in total emissions would therefore encourage additional savings in the short term, particularly for Scenario 2, before being superseded by Building Regulations in later phases. Additionally, their use in the short term may help to stimulate the local skills market and supply chains for the renewable energy sector.

Recommendation 8

Consider developing Supplementary Planning Documents to provide detailed guidance on meeting carbon reduction targets for new developments.

Further consideration should be given to material to be included within Supplementary Planning Documents (SPD), such as detailed criteria-based policies, additional details on the required structure and content of proposals for sustainable energy supply (site energy strategies) submitted as part of planning applications, and details on any 'allowable solutions' offered to developers. These should include increased flexibility to encourage the development of district heating in Heat Priority Areas and could be developed in collaboration across the West Sussex local authorities. SPD will also provide the opportunity to include guidance on other carbon reduction measures such as encouraging behaviour change, increased energy efficiency and low carbon transport.

Recommendation 9

Develop in-house capacity to facilitate the implementation of planning policy targets through planning decisions. These should include:

- ***The provision of detailed information on the Code for Sustainable Homes and BREEAM assessment process to officers in both Planning and Building Control, and other officers involved in sustainability issues***
- ***The provision of detailed information on renewable energy and low carbon technologies to officers in both Planning and Building Control***
- ***The inclusion of wording within planning policies to ensure that the monitoring systems are installed and that data is collected***
- ***The development of a methodology/protocol for monitoring***
- ***Measures to ensure that the cost of monitoring is not prohibitive and is carried by the developer***
- ***Measures to ensure that the information is provided in a format which can be used by the local authority (for other activities including NI 186 and renewable energy generation reporting); and***
- ***Measures to ensure that the monitoring systems and associated protocol are designed such that the role of the local authority is to review and if necessary check the data, and that the local authority is not required to collect and analyse data from multiple systems on an on-going basis.***

In implementing the trajectory of targets expected through LDF targets and the Building Regulations, and in particular a hierarchy of measures, there is a risk of placing undue burden on local authorities to enforce compliance and administer the system. It is therefore recommended that the local authorities consider implementing these and other in-house capacity-building measures.

General recommendations

The following other recommendations are made to the five local authorities:

Recommendation 10

Local authorities should develop an Energy Strategy for West Sussex which builds on the resource assessment presented here, and formally prioritises the key carbon reduction opportunities within the five local authorities and the county. This should cover the following issues as a minimum:

- ***Energy efficiency in buildings and transport (not part of the evidence base)***
- ***Wind power***
- ***CHP and district heating***
- ***Biomass and woodfuel***

There is a significant opportunity to reduce carbon emissions across West Sussex using local sustainable energy resources. As demonstrated by the resource assessment undertaken in this study, a theoretical saving of some 46% of area-wide emissions could potentially be achieved. A further recommendation of this report is therefore for each local authority to develop an energy strategy to prioritise the key carbon reduction opportunities in the study area, including but going beyond opportunities related strictly to new development sites.

Such an approach could use the findings of the resource assessment presented in this report to identify and promote opportunities to exploit onshore wind power, biomass and waste, and CHP/district heating. Including some specific spatial guidance in Core Strategies would allow local authorities to adopt a strategic approach to stating their preferences, rather than simply responding to developer choices. In addition, given the opportunities for large scale renewable and low carbon energy developments in the sub-region, identifying spatial preferences will help to enable the most to be made of those opportunities.

The timetable for the implementation of strategy measures i.e. an action plan will largely depend on which policy scenario and/or district-wide targets are adopted. However, once policies are finalised, the measures given in Recommendations 9 and 11 should all be considered as urgent i.e. they should be initiated as soon as possible.

Recommendation 11

In support of the Energy Strategy recommended above, local authorities should:

- ***Adopt a facilitating and coordinating role in planning and delivering the key priorities in the West Sussex Energy Strategy. This may include establishing Energy Service Companies (ESCos) and identifying opportunities to use the Community Infrastructure Levy (CIL)***
- ***Build on the CHP/district heating analysis undertaken on the SHLAA data within this study and examine in more detail the opportunities available***
- ***Develop a strategic plan to establish woodfuel supply chains across West Sussex***
- ***Coordinate further discussion on wind power development and the level of landscape-type constraints that should be applied in light of the setting of area-wide carbon reduction or renewable energy targets***

In order to deliver macro-scale energy supply solutions such as district heating in Heat Priority Areas, early intervention is needed to develop the necessary commercial and physical infrastructure. This is less likely to occur without significant involvement from local authorities and, in some cases, the public sector, particularly in implementing the Community Infrastructure Levy (CIL) to provide up-front finance and in facilitating an ESCo partnership.

A coordinating role by local authorities will help facilitate multi-sector partnerships – especially for large scale mixed-use developments, where renewable energy infrastructure may be shared between different building types and potentially both new and existing development. It will also help to ensure a unified area-wide approach is adopted rather than piecemeal, and should serve to maximise carbon savings and benefit overall viability through economy of scale.

The local authorities should investigate the CIL and determine whether this will be taken forward. Should a council decide to implement the CIL in their area, they will have to:

- Produce up to date development plan, so that a clear idea can be given of how the funds raised might be spent. As part of this, the relationship between the CIL and local development plans must be made clear;
- Identify gaps where funding will be needed to support infrastructure development and to set the charge at a level that reflects the extent of these gaps; and
- Issue a 'charging schedule', clearly showing the criteria that will be used to determine the amount of the CIL to be charged for different types of local development.

The local authorities should build on the CHP/district heating analysis undertaken on the SHLAA data and examine in more detail the opportunities available. They should ensure at the earliest opportunity (re: phasing of developments) that developers meeting existing planning policies relating to renewable energy do not invest in systems that would be incompatible with connection to a future heat network, where this would be appropriate.

There is a strong argument for bringing forward and implementing macro-scale solutions as soon as possible to minimise the implementation of less cost effective micro-renewables and to potentially exceed Building Regulation targets. Planning policy will therefore need to prioritise the development of CHP and district heating networks over micro-renewables from the earliest opportunity, on sites and in areas where these technologies are appropriate. Examples of this approach could be to actively discourage the use of micro-scale heat generation where district heat networks are available, and ensuring that new buildings are compatible with and able to connect to the network in the future.

A key area to address in exploiting the woodfuel resource will be the establishment of a network of local biomass supply chains in parallel with demand creation strategies. Future demands on the wood fuel resource in the South East are expected to significantly increase in light of future national, regional and local carbon reduction targets. A longer term reliance on wood fuel to supply developments across the districts will therefore require a strategic plan to establish adequate supply chains from a variety of sources, including forestry residues, energy crops and waste wood. These supply chains will be particularly important to spatially constrained boroughs/districts such as Worthing, which has a very small woodfuel resource. Local authorities should also consider the development of a strategic partnership between regional, sub-regional and local government bodies, along with biomass suppliers and landowners.

The constraints applied to wind power within the resource assessment undertaken in this study are considerable and the stakeholder consultation events revealed that there are mixed views over their appropriateness. The use of wind power to meet the on-site generation requirements of new development is clearly limited by a number of constraints associated with built-up areas and the legitimacy of linking carbon savings from off-site wind power to particular developments is currently unclear with regard to forthcoming Building Regulations. Large scale stand-alone wind farms could therefore play a vital role in helping to meet district-wide targets on carbon emissions reduction. The main constraining factor of landscape sensitivity should therefore be discussed further with stakeholders to establish the acceptable levels of impact in light of such targets, which may require a strategy to accept landscape character change in some areas through wind power deployment.

1 Introduction

1.1 Aim of study

This report presents the results of the West Sussex Sustainable Energy Study and has been produced by the Centre for Sustainable Energy in conjunction with Impetus Consulting and Land Use Consultants. The underlying aim of this study is to assist the West Sussex Local Authorities in developing Local Development Framework (LDF) policies which positively encourage reduced energy consumption and carbon emissions from buildings and greater sustainable energy generation. The study also provides a robust evidence base to inform spatial planning requirements set out in *Planning Policy Statement: Planning and Climate Change - Supplement to PPS1*.

In response to this policy framework, five West Sussex local authorities have formed a consortium with the purpose of developing a joint evidence base at the strategic (sub-regional) level leading to the production of local targets. The authorities that make up the consortium are:

- Horsham District Council
- Mid Sussex District Council
- Arun District Council
- Worthing Borough Council
- Chichester District Council

The study addresses low and zero carbon energy generation in general but also considers sustainable energy standards in new developments, with particular reference to the Strategic Housing Land Availability Assessments (SHLAA) that are being undertaken by each local authority.

1.2 Background

West Sussex is a county comprising the local authority areas of Adur, Arun, Chichester, Crawley, Horsham, Mid Sussex, and Worthing (the Adur and Crawley areas are not covered in this study). The population of West Sussex, including Adur and Crawley, is approximately 776,000 people (the population of the study area is 615,000). West Sussex has a total land area of just under 2,000 square kilometres, while the study area (excluding Crawley and Adur) is 1,903 sq km.

A large proportion of West Sussex's land area is protected. The High Weald and Chichester Harbour areas are both designated Areas of Outstanding Natural Beauty (AONB). The South Downs area, previously designated as another AONB, will formally become a National Park in 2011.

The county town of West Sussex is Chichester, although Crawley and Worthing are the largest settlements with approximately 100,000 people each. Gatwick Airport, the second busiest in the UK, is located in Crawley. Most settlements in the county are along the coast, to the south of the region and the A23 corridor, which runs north-south roughly parallel to the authority boundary shared by Horsham and Mid Sussex.

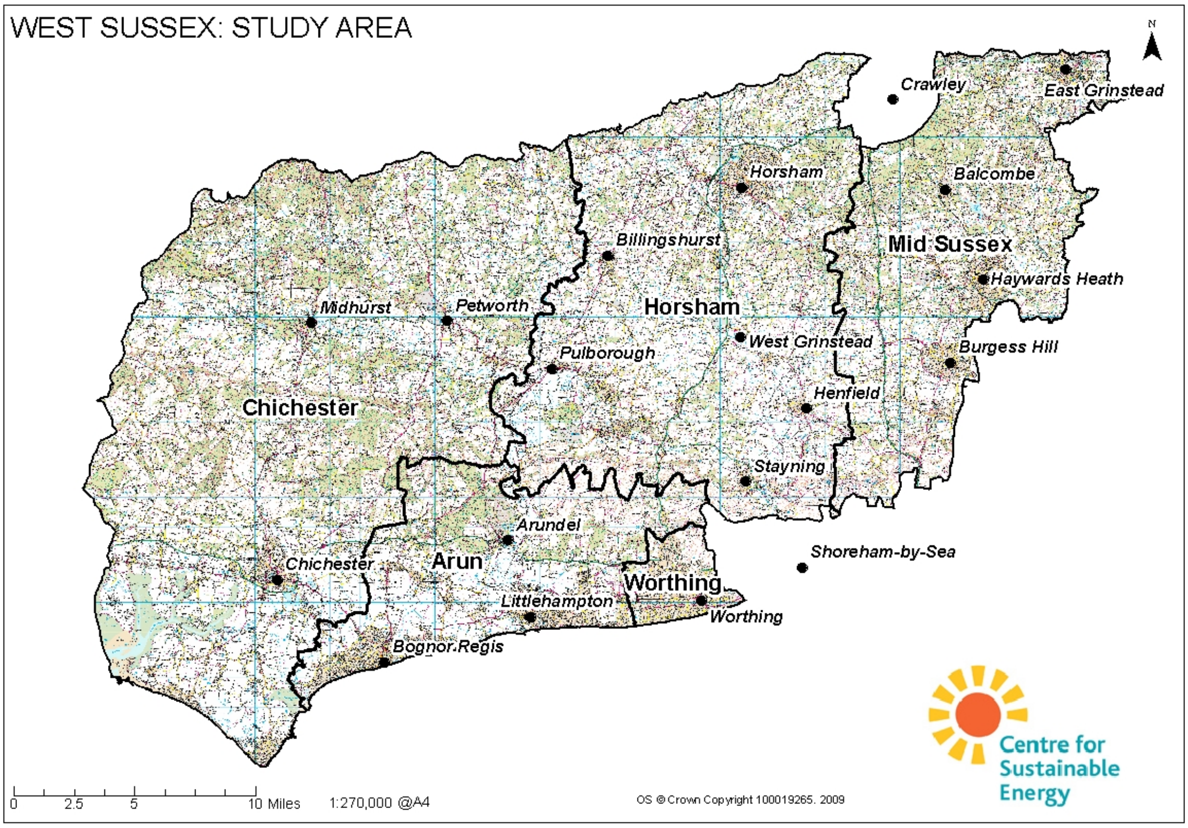


Figure 1: The study area – showing the five participating local authorities in West Sussex

Some key statistics about the county are summarised in Table 1 below[4].

Table 1: West Sussex statistics

Local authority	Land area (sq km)	Population (mid-2007)	Approximate population density (per sq km)	Percentage of population living in rural areas areas	Number of dwellings
Arun	221	146,000	660	63.5%	68,700
Chichester	786	109,000	138	96.1%	52,700
Horsham	530	130,000	245	96.5%	55,400
Mid Sussex	334	130,000	389	86.2%	57,700
Worthing	32	100,000	3,120	0%	47,000
Crawley	*45*	*100,000*	*2,220*	*0%*	*41,200*
Adur	*42*	*61,000*	*1,450*	*16.4%*	*27,300*

West Sussex has low unemployment, at 1.1% (as at 2008), but there are significant differences in earnings across the county. House prices are significantly above the national average; in 2007 the median house price was almost ten times the median income[5].

Table 2 below shows 2006 Gross Value Added for West Sussex and its neighbours[6].

[4] Data from Government Office South East: www.gos.gov.uk/gose/ourRegion/aboutLocalities/surreyEWSussex/?a=42496
[5] A Local Area Agreement for West Sussex, 2008-2011, www.idea.gov.uk/idk/aio/8516503
[6] Office for National Statistics, www.statistics.gov.uk/statbase/Product.asp?vlnk=14650

Table 2: Gross Value Added: West Sussex and neighbours		
Area	**2006 GVA (£ million)**	**2006 GVA per capita (£)**
West Sussex	14, 877	19,301
Brighton and Hove	4,897	19,477
East Sussex	7,207	14,238
Hampshire	23,506	18,568
Surrey	24,211	22,309

Area-wide emissions

Table 3 below shows West Sussex's total 2006 carbon emissions, per capita emissions, and their ranking among 354 English local authorities (where 1 is the highest per capita emissions). Those local authorities with lower population densities tend to have higher per capita emissions.

Table 3: West Sussex statistics						
Local authority	**Industry / Commercial (kt CO_2)**	**Domestic (kt CO_2)**	**Transport (kt CO_2)**	**Total emissions (kt CO_2)**	**Per capita emissions (tonnes CO_2)**	**Rank in England (1=highest 354=lowest)**
Arun	246	377	223	842	5.78	313
Chichester	331	326	303	917	8.42	149
Horsham	326	332	310	962	7.50	203
Mid Sussex	242	343	413	982	7.61	197
Worthing	191	243	98	533	5.40	332
Crawley	*439*	*214*	*134*	*785*	*7.86*	*182*
Adur	*92*	*143*	*111*	*347*	*5.75*	*316*

Regional Housing Provision

Policy H1 in the South East Plan (Regional Housing Provision 2006-2026) currently defines the region's housing targets between 2006 and 2026. 654,000 homes are expected to be built across the region, with an average annual provision of 32,700 homes.

This target is broken down by individual sub-regions, as highlighted below.

> *"Local planning authorities will allocate sufficient land and facilitate the delivery of 654,000 net additional dwellings between 2006 and 2026.*
>
> *"In managing the supply of land for housing and in determining planning applications local planning authorities should work collaboratively to facilitate the delivery of the following level of net additional dwellings in sub-regions and in rest of the sub-regional areas."*

The regional housing targets for the West Sussex local authorities involved in this study are outlined in Table 4 below.

Table 4: Extract of Table H1b (South East Plan)		
Local Planning Authority	**Average no. of new homes per year**	**Total**
Arun District Council	565	11,300
Chichester District Council	480	9,600
Horsham District Council	650	13,000
Mid Sussex District Council	855	17,100
Worthing Borough Council	200	4,000
	Total	**55,000**

Each local authority needs to address these targets through documents in the Local Development Framework. Strategic Housing Land Availability Assessments (SHLAA) undertaken by each local authority identify the potential numbers and phasing for housing delivery, but are technical background studies which will help inform decisions for housing allocations in later development plan documents.

2 Policy context

This section of the report highlights the national and regional policy that defines the context within which local standards must be established.

Details of the relevant policy and guidance documents that affect the West Sussex area have been provided below.

Note: As described below there are a number of issues currently under discussion at national level, such as the Code for Sustainable Homes, the definition of zero carbon buildings and how these fit with future Building Regulations. The policy framework for energy is continually evolving and it will therefore be necessary for each local authority to undertaken regular reviews of this section, especially when preparing a baseline for future planning documents.

2.1 Climate change, renewable energy and low carbon legislative drivers

The UK government believes that climate change is the greatest long-term challenge facing the world today and addressing climate change is a principal concern for sustainable development. In light of this, there have been a number of policy documents and legislative drivers introduced, including:

- **The UK Energy White Paper (2003)** – set out an aspiration to stimulate the renewables sector in order to produce 10% of electricity from renewable sources by 2010 and 20% by 2020 and stated that the planning system should give weight to the wider benefits of renewables even if there are no immediately apparent local benefits (Renewables Statement of Need).
- **The Stern Review (2006)** – outlined the economic impacts of climate change and concluded that 'the benefits of strong, early action considerably outweigh the costs';
- **The UK Climate Change Programme (2006)** – set out national greenhouse gas reduction targets and created a requirement for annual reporting to Parliament on progress against these;
- **The Climate Change Act (2008)** – committed the UK to meeting challenging targets for reducing carbon emissions (80% reduction by 2050).
- **The EU Renewable Energy Directive (2009)** – requires that 15% of all UK energy is to come from renewables (electricity, heat and transport) by 2020;
- **The UK Low Carbon Transition Plan (2009)** – plots out how the UK will meet the cut in emissions set out in the budget of 34% on 1990 levels by 2020.

Local policies and strategies for carbon reduction from both new and existing buildings will be instrumental in achieving the aims set out by this policy framework.

There are also a number of additional key policy drivers particularly relevant to this project, two of which have been outlined below in more detail.

2.1.1 Local Government White Paper (2006)

Local authorities are uniquely placed to act on climate change as they can not only tackle their own assets and housing stock but they can also motivate the wider community into action, based on their understanding of local priorities and drivers.

Their role is further emphasised in the 2006 Local Government White Paper, which introduced a new performance framework for local authorities, known as Comprehensive Area Assessment (CAA). The new process will be centred on an annual joint-inspectorate assessment of the prospects for the local area and the quality of life for local people. In addition, performance in each area against a set of national indicators will be published annually. Key indicators relevant to this study include:

- Climate change mitigation:
  - NI 185 - carbon dioxide reduction from local authority operations.
  - NI 186 - per capita carbon dioxide emissions in the local authority area.
  - NI 187 - tackling fuel poverty - people receiving income based benefits living in homes with a low energy efficiency rating.
- Climate change adaptation:
  - NI 188 - planning to adapt to climate change.
- Waste:
  - NI 191 - residual household waste per head.
  - NI 192 - household waste recycled and composted.
  - NI 193 - municipal waste land filled.

The introduction of renewable energy and sustainable construction planning policy will help the authorities to make progress in these areas and meet any relevant targets.

2.1.2 The UK Renewable Energy Strategy (2009)

The UK Renewable Energy Strategy commits the UK to meet the European Union Renewable Energy Directive (2009) target of 15% of all UK energy to be supplied by renewables (electricity, heat and transport) by 2020.

The strategy suggests that to achieve the EU target, more than 30% of electricity must be supplied by renewables by 2020. Of this, two percent is expected to be met by small scale generation technologies, while the remaining bulk of the target will be met through a combination of larger scale technologies such as onshore and offshore wind; biomass, hydro and wave.

The strategy also states that a Heat and Energy Saving Strategy is being developed and suggests that 12% of heat will be supplied by renewables by 2020.

In addition, the strategy:

- Introduces Feed-in-Tariffs[7] (2010) and a Renewable Heat Incentive[8] (2011), which will provide guaranteed payments to individuals, business and communities for renewable heat and small scale electricity generation;
- Suggests that a strategic approach to planning is required to ensure that regions can deliver their renewable energy potential in line with the 2020 targets; and
- States the need for a swifter delivery of renewable projects through the planning system and quicker, smarter grid connection.

The UK Renewable Energy Strategy also states:

> *"At the heart of our Strategy is an approach that is based on an assessment of the renewables capacity and constraints to deployment in each region and which seeks to ensure willing engagement by regional bodies, local authorities and communities. Through the*

[7] The 2008 Energy Act allows introduction of FITs for renewable and some other low-carbon technologies. The Government's consultation on FITs was published in July 2009 and the scheme is expected to be in place by April 2010

[8] The 2008 Energy Act also allows introduction of RHIs for the renewable generation of heat. The Government is expected to consult towards the end of 2009 on the design and implementation of the RHI and to have the RHI up and running by April 2011

planning system, communities will play an integral role in decisions on where renewable energy is located."

(Page 18, paragraph 4.3)

The Strategy also expects regional bodies to set targets for renewable energy capacity and states that:

"…we expect regions to set targets for renewable energy capacity in line with national target, or better where possible."

(Page 75, paragraph 4.23, see also paragraph 4.33)

It goes on to state that:

"…applicants for renewable energy should no longer be questioned about the energy need of their project either in general or in particular locations"

(Page 76, paragraph 4.23)

2.2 National planning policy

The land use planning system is one of the most powerful tools available for supporting a move towards greater use of sustainable energy. An overview of the most relevant planning policies and legislation at the national level can be found below.

2.2.1 The Planning White Paper (2007)

In May 2007 the Government published the Planning White Paper, 'Planning for a sustainable future'. This sets out detailed proposals for the reform of the planning system and makes it clear that local planning authorities have a crucial role to play in tackling climate change. The paper includes a commitment to set out clearly the role of Local Planning Authorities (LPA) in tackling energy efficiency and climate change and underlines the important role of regional and local policy in actively planning for and supporting renewable and low-carbon energy supplies.

Tackling climate change is identified as a key theme within the paper. It suggests the planning system can fulfil its important role by helping to meet targets for the reduction of greenhouse gas emissions by, for example:

- Supporting the building of zero carbon homes and business premises;
- Locating development to reduce the need to travel;
- Making walking and cycling accessible and attractive components of new development; and
- Supporting integrated public transport.

It also states that the planning system can help ensure that new developments are resilient to the consequences of climate change, including flooding and higher temperatures, through the use of adaptation measures.

2.2.2 The Planning Act (2008)

The Planning Act (2008) was granted Royal Assent in November 2008. The Act builds on the proposals set out in the Planning White Paper and establishes a new system for approving major infrastructure projects. In addition, the Act introduced the Community Infrastructure Levy (CIL) as a means of developments contributing to the provision of infrastructure either directly or indirectly related to the development in question. Further information on the CIL can be found in Section 7.1.2.

2.2.3 Planning Policy Statements

Planning Policy Statements (PPS) set out the Government's national policies on different aspects of spatial planning in England. They set out a range of guidance on planning policy that LPAs should take into account when drafting documents and determining applications. The ambitions and policies outlined in PPSs should be fully reflected by planning authorities in the preparation of Local Development Documents.

PPS22 on *Renewable Energy* (2004) requires regional and local planning policies to include renewable energy targets, criteria policies and the identification of broad areas for renewable energy development at regional level.

PPS1 Supplement: *Planning and Climate Change* (2007) makes it clear that tackling climate change is central to what is expected of good planning. The PPS1 supplement highlights the following requirements:

- That it should take precedence over other PPS's if there is a policy conflict
- That Core Strategies should add to RSS policy in order to achieve progress in achieving the PPS's Key Objectives (paragraph 18)
- That Core Strategies and supporting LDDs should provide a framework that promotes and encourages renewable and low-carbon energy development (paragraph 19). These policies are to reflect local opportunities and go further than RSS policy.
- That planning authorities should "alongside any criteria-based policy developed in line with PPS22, consider identifying suitable areas for renewable and low carbon energy sources" (paragraph 20)
- If renewable energy targets are not being achieved a prompt and effective response is required.

A list of the relevant PPSs linked to energy and climate change and a more detailed summary of the PPS1 supplement are provided in Annex E.

Note - to support the Low Carbon Transition Plan and its route map to carbon reduction, the Government is also planning to review and combine PPS1 Supplement and PPS22 and to consult in detail on proposals before the end of 2009.

2.2.4 Planning and Energy Act (2008)

The Planning and Energy Act 2008 enables local planning authorities in England and Wales to set requirements for energy use and energy efficiency in local plans.

This gives local authorities the power to introduce policies that impose reasonable requirements for:

- A proportion of energy used in development to be delivered using renewable energy technologies in the locality of the development;
- A proportion of energy used in development to be low carbon energy technologies in the locality of the development; and
- Development in their area to comply with energy efficiency standards that exceed the energy requirements of the Building Regulations (Part L1).

This establishes the legality of so-called 'Merton'-style policies[9]. The Act does not provide a definitive answer to what is classed as 'reasonable' but does state that the policies must be consistent with relevant national policies.

2.3 On-site generation 'Merton' policies

Many local authorities, including some in West Sussex, have now set their own on-site generation targets at levels typically between 10-20%.

There are three issues that often need clarification when referring to these types of policies:

1. Whether the required reduction is applied to the predicted **energy consumption** of the site or its **CO_2 emissions**. It is now generally accepted that the latter method is more effective in reducing emissions due to subtleties around the differing carbon content of gas and electricity.
2. Whether the required reduction is applied to the **regulated**[10] or **total** CO_2 emissions of a site. For example, a 10% reduction in total CO_2 emissions equates to a reduction in regulated CO_2 emissions of around 15-20%.
3. At which point the policy is applied in relation to any hierarchical approach to CO_2 reduction (see Section 4.2). For example, when the policy is applied to any residual carbon emissions after energy efficiency and/or district heating/CHP measures, it achieves two distinct ends. Firstly, it incentivises the developer to maximise the emissions reductions achieved through energy efficiency, CHP and communal heating systems. This is because the lower the projected residual site emissions are, the smaller the capacity of renewables required to meet a given target. In this context, increased investment in energy efficiency can reduce overall costs. Secondly, the renewable energy capacity directly reduces site emissions, again contributing to energy policy objectives

It should be noted that on-site generation policy requirements of this type will effectively be made redundant for most development when Building Regulation requirements post-2013 increase as expected towards the 2016 zero carbon target. This is because carbon reduction requirements through Building Regulations will then begin to necessitate levels of on-site generation in excess of that typically required by these policies.

2.4 Regional planning policy – the South East Plan

The South East Plan[11] was published by the Secretary of State in May 2009 and provides a framework for the South East region to 2026. The Plan sets out a regional policy framework requiring that local planning authorities promote the development of renewable and low carbon energy generation. In addition, it highlights how planning authorities should encourage the establishment of local evidence based targets and policies that will contribute towards the regional carbon emissions reduction goals.

Adaptation to and mitigation of climate change, is addressed through a number of policies, particularly those for energy efficiency and renewable energy, waste management and transport. The Plan specifically highlights that:

[9] The London Borough of Merton was the first local authority to include renewable energy targets in its adopted Unitary Development Plan (UDP), setting the target for all new non-domestic major developments in the borough to generate 10 per cent of their energy through onsite renewable energy technologies. This became known as the 'Merton Rule' - a planning requirement for developers to incorporate on-site renewables to generate a proportion of a development's energy use.
[10] A definition of regulated emissions is included in Section 6.1.1 of this report
[11] The South East Plan: www.gos.gov.uk/gose/planning/regionalPlanning/815640/.

- The South East is facing unprecedented levels of population growth, combined with declining household sizes; and
- The South East is relatively sensitive to climate change.

The Plan therefore presents a number of policies to both mitigate and adapt to climate change, including options such as behavioural changes and enhanced development standards. Relevant policies include:

Table 5: Policies relating to climate change and sustainable energy in the South East Plan

Cross-cutting sustainability policies	Natural resource management policies	Growth policies
• CC1: Sustainable Development • CC2: Climate Change • CC3: Resource Use • CC4: Sustainable Design and Construction • CC7: Infrastructure and Implementation • CC8: Green Infrastructure	• NRM11: development design for energy efficiency and renewable energy • NRM12: combined heat and power • NRM13: regional renewable energy targets • NRM14: sub-regional targets • NRM15: location of renewable energy development • NRM16: renewable energy development criteria • W11: biomass	• H1: Regional Housing Provision 2006-2026

2.5 Regional and sub-regional targets

A Merton-style policy as described above is referred to in Policy NRM11 of the South East Plan, 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 1000m^2 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;*

However, in relation to this policy, recent guidance from the South East England Partnership Board[12] states that:

> *"The strengthening of building regulations, as set out in the Code for Sustainable Homes, will mean that on site renewables will be required to meet carbon compliance standards on new residential developments. Therefore LPAs should specify energy requirements in accordance*

[12] Climate Change within Local Development Frameworks: South East England Partnership Board (June 2009) – see Footnote 12, Page 13 of this guidance

with the Code rather than specifying a percentage of energy generated to come from renewable and low carbon sources."

The South East Plan also sets targets for installed renewable electricity generation capacity within the region as follows:

"The following minimum regional targets for electricity generation from renewable sources should be achieved by the development and use of all appropriate resources and technologies."

Table 6: Minimum regional targets for electricity generation from all renewable sources		
Year/timescale	**Installed capacity (MW)**	**% electricity generation capacity**
2010	620	5.5
2016	895	8.0
2020	1,130	10.0
2026	1,750	16.0

The Plan highlights that the renewable energy resources with the greatest potential for electricity generation are offshore and onshore wind, biomass, and solar (PV), while the renewable energy resources with the greatest potential for heat generation are solar (thermal) and biomass.

The South East Plan then breaks down the renewable electricity generation capacity targets between the sub-regions and states that:

"Development plans should include policies, and development proposals as far as practicable should seek to contribute to the achievement of the following regional and indicative sub-regional targets for land-based renewable energy".

.

Table 7: Sub-regional targets for land-based renewable energy across the South East[13]		
Sub-region	**2010 renewable energy target (MW)**	**2016 renewable energy target (MW)**
Thames Valley and Surrey	140	209
East and West Sussex	57	68
Hampshire and Isle of Wight	115	122
Kent	111	154

Additionally, the Regional Economic Strategy for South East England 2006 – 2016 refers to a target for 10% of electricity **supply** from renewables:

…increase the contribution of renewable energy to at least 10% of energy supply in the South East by 2010 as a step towards achieving 20% by 2020

[13] Offshore wind, tidal stream and wave power have not been included in the sub-regional targets as development will be outside of normal local authority planning jurisdiction

Given that the current Government/EU target is for the UK to deliver 15% of all energy from renewables by 2020, which could mean a requirement of over 30% electricity from renewables, both the South East Plan and the Regional Economic Strategy targets are likely to be revised in near future in regard of the forthcoming Single Regional Strategy for the South East region, which will be produced jointly by SEEDA and the SE Leaders' Board.

2.6 Zero carbon buildings

In December 2006, the Government announced its ambition for all new homes to be 'zero carbon' from 2016. In March 2008, the Government announced its aspiration that all new non-domestic buildings would be carbon neutral by 2019.

CLG has since taken forward a package of action to help deliver the Government's ambition of achieving zero carbon developments. It has introduced the Code for Sustainable Homes, a consultation document and a policy statement both entitled 'Building a Greener Future', which sets out how planning, the Building Regulations and the Code for Sustainable Homes could drive change and innovation within the construction sector.

An overview of the 'Building a Greener Future' policy statement, the Code for Sustainable Homes and BREEAM, its equivalent for non-domestic buildings, has been provided below.

2.6.1 Building a Greener Future

In December 2006, alongside the introduction of the Code for Sustainable Homes, the Government issued the consultation document 'Building a Greener Future: towards zero carbon development' which outlined a ten-year timetable for moving towards zero carbon new build dwellings by 2016. The document proposed to use the minimum carbon dioxide reduction requirements of the Code for Sustainable Homes as the basis for future improvements to the Building Regulations. This timetable was confirmed in the 'Building a Greener Future: policy statement' published in July 2007.

It was proposed that there will be three rounds of improvements to the carbon dioxide requirements in Part L of the Building Regulations, as shown in Table 8 below.

Table 8: Increasing energy efficiency requirements of Part L of the Building Regulations

Date	2010	2013	2016
Energy efficiency improvement of the dwelling compared to 2006 Part L Building Regulations	25%	44%	Zero carbon
Equivalent standard of the Code for Sustainable Homes	Level 3	Level 4	Level 6

The Government later acknowledged that the high-level definition of zero carbon set out in this policy statement (and that under Code level 6) might not apply in all situations. The Government has since published a consultation on the definition of zero carbon homes and non-domestic buildings (see below) to assess this issue.

2.6.2 The Code for Sustainable Homes

The Code for Sustainable Homes was introduced in April 2007 as a single national standard and sustainability rating system for new build homes. The Code looks at the overall sustainability of a new home against a full range of criteria including energy, water, waste, materials, biodiversity and other sustainability criteria. The Code was introduced as a direct replacement for the EcoHomes standard.

Since April 2008 all new social housing in England must be built to a minimum of Code level 3 and as of May 2008 a rating against the Code has been mandatory for any new build homes. Privately-built housing does not have to be built to any specific level of the Code other than the increased energy standards specified in the Building Regulations, unless specified within Local Development Documents (LDD).

Figure 2 illustrates the nine-categories appraised in Code assessments, each category of which is weighted with regard to environmental importance. Table 9 shows the minimum requirements for percentage CO_2 reduction and water consumption for each Code level. Minimum standards at Code entry level are also required for other categories such as materials, surface water run-off and waste. In addition to these requirements, the Code is phasing in a mandatory requirement for the Lifetime Homes standards[14] to be adopted.

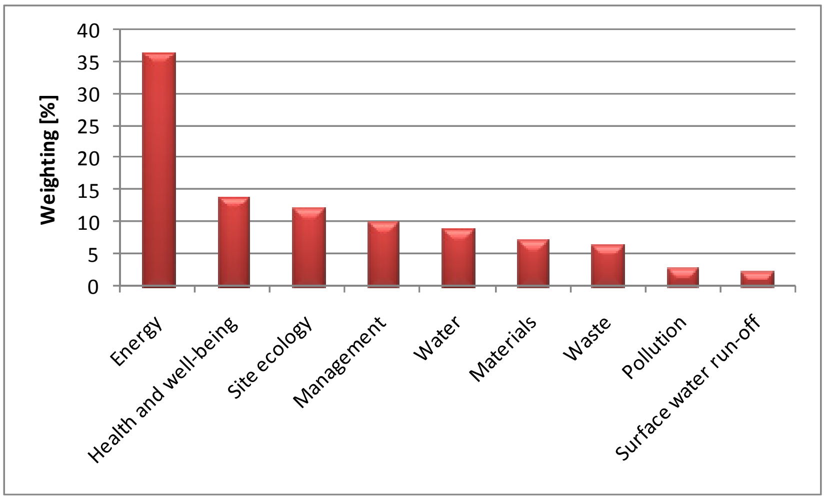


Figure 2: Assessment weightings for the categories of the Code for Sustainable Homes

Table 9: Code levels for carbon emissions and water consumption		
Code Level	**Minimum % CO_2 reduction (on regulated emissions)**	**Maximum indoor water consumption [litres/person/day]**
1	10	120
2	18	120
3	25	105
4	44	105
5	100	80
6	'Zero carbon home'	80

[14] Lifetime Homes incorporate 16 design features that together create a flexible blueprint for accessible and adaptable housing. The Lifetime Homes concept aims to increases choice, independence and longevity of tenure, vital to individual and community well being. See: www.lifetimehomes.org.uk/pages/16_lth_standards.html.

2.6.3 BREEAM

The Building Research Establishment Environmental Assessment Method (BREEAM) is the World's longest established and most widely used environmental assessment method for buildings. It is regarded by the UK's construction and property sectors as the measure of best practice in environmental design and management. As with the Code for Sustainable Homes, BREEAM certification is undertaken by licensed assessors, ensuring that assessment services are offered by assessors working within a rigorous quality assurance framework.

BREEAM assesses buildings' performance in the following areas:

- Management: overall management policy, commissioning site management and procedural issues;
- Energy use: operational energy and carbon dioxide (CO_2) issues;
- Health and well-being: indoor and external issues affecting health and well being;
- Pollution: air and water pollution issues;
- Transport: transport-related CO_2 and location-related factors;
- Land use: green and brownfield sites;
- Ecology: ecological value conservation and enhancement of the site;
- Materials: environmental implication of building materials, including life-cycle impacts; and
- Water: consumption and water efficiency.

Credits are awarded in each area according to performance. A set of environmental weightings then enables the credits to be added together to produce a single overall score. The building is then rated on a scale of Pass, Good, Very Good, Excellent and Outstanding.

In its 2008 Budget the Government announced its ambition that all new non-domestic buildings should be zero carbon from 2019 (with earlier targets for schools and other public buildings). Following this announcement the Government has proposed that a task force be set up to consider how this ambition can be achieved. It is possible that BREEAM will be updated in light of these policy changes, or that a new Code for Sustainable Buildings will be introduced. An announcement is expected later in 2009 about further work on zero carbon non-domestic buildings.

2.7 Consultations

There are a number of consultations currently being undertaken by the government relevant to these ambitions for zero carbon developments. These include:

- The definition of zero carbon consultation
- The UK Heat and Energy Saving Strategy consultation.

Information relevant to this study is summarised below.

2.7.1 The definition of zero carbon

The 'Definition of zero carbon' consultation relates predominantly to the new definition of zero carbon homes that will apply for new homes built from 2016, however, it also sought views on the Government's ambition for new non-domestic buildings to be zero carbon from 2019.

The Government announced in the 'Building a Greener Future' policy statement that new homes would be zero carbon from 2016, but at the same time acknowledged that the high-level definition set out in the policy statement might not apply in all situations. For example, the original technical guidance for the Code referred to a clause that off-site renewables must be physically connected to the development through private wire systems.

The consultation sets out what zero carbon would mean for homes and takes into account:

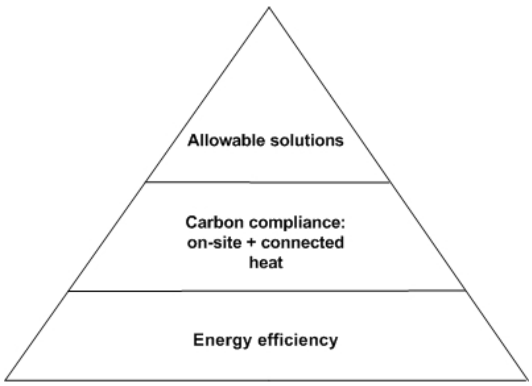
- Emissions from space heating, ventilation, hot water and fixed lighting (regulated emissions);
- Expected energy use from appliances and non-fixed lighting (unregulated emissions); and
- Exports and imports of energy from the development (and directly connected energy installations) to and from centralised energy networks.

A zero carbon building would therefore have no net zero carbon emissions over the course of a year from these sources.

Proposed approach

There are three elements to the hierarchal definition proposed in the consultation:

- Energy efficiency – high standards;
- Carbon compliance - on-site and connected heat; and
- Allowable solutions – a range of solutions from offsite renewable energy to carbon offsetting.



Energy efficiency

It is proposed that high levels of energy efficiency be included as standard regardless of the mix of carbon reduction measures adopted. The Government's intention is to review and consult on changes to Part L of the Building Regulations every three years. Therefore CLG does not believe that the zero carbon definition consultation is the right vehicle for deciding the precise level of the energy efficiency backstops or of the carbon compliance level. Those will be determined through the regular Building Regulations review cycle, taking into account detailed analysis (including, crucially, latest revisions to SAP). Nonetheless, CLG does want to use the consultation to give a steer to industry as to the approximate range of energy efficiency and carbon compliance values that it will aim for by 2016. In referring to existing standards for energy efficiency such as Germany's PassivHaus standard and the Energy Saving Trust's CE290 guidance, CLG has stated that:

> *"We understand that using such energy efficiency standards should permit carbon reductions in excess of the 25 per cent improvement that has been announced for 2010 and perhaps approaching the 44 per cent announced for 2013. Government is minded to include demanding energy efficiency backstops within the 2016 Building Regulations which will yield carbon reductions within this range, with an appropriate trajectory towards that level in 2010 and 2013"*[15]

[15] Definition of Zero Carbon Homes and Non-Domestic Buildings (Para 5.7) – Consultation Dec 2008

The analysis within the consultation document is based on the Energy Saving Trust's 'Advanced Practice' energy efficiency standards (approximately equivalent to 28% of regulated emissions) although this does not imply that this is the standard to be adopted.

Carbon compliance

The carbon compliance standard would require at least a minimum level of carbon reduction (compared to Part L 2006 Building Regulations) through:

- A combination of energy efficiency measures;
- Incorporation of on-site low and zero carbon (LZC) energy technologies; and
- Directly-connected heat (not necessarily on-site).

The Government asserted that it would like to specify the level somewhere between 44 – 100% of regulated emissions. Important findings from the analysis undertaken for the consultation include:

- The higher the carbon compliance level is set, the fewer technology combinations that can meet the requirement, and the greater the capital cost;
- No technology combination eliminates 100% (regulated and unregulated) of emissions in flats; and
- Beyond 70% carbon reductions, biomass technologies feature more strongly among the viable technology combinations (and almost exclusively for the most demanding standard).

A written statement from CLG issued in July 2009 has since indicated that 70% will be an appropriate carbon compliance level. If the outcome of this consultation is that this should be the regulatory aim, then the Part L reviews between now and 2016 can decide the exact level and details, and any potential variation by dwelling type, based on the latest information available at the time the review takes place.

Allowable solutions

The energy efficiency and carbon compliance standards set out in the Government's consultation and outlined in the preceding section will significantly reduce the carbon emissions of a new home compared to current regulations. However, this leaves a residual carbon footprint that needs to be addressed in order to meet the zero carbon home standard (100% carbon reduction, including regulated and unregulated emissions).

The Government has therefore proposed 'allowable solutions' to deal with the residual emissions. CLG's July 2009 statement listed those measures that received broad support during the consultation:

- Further carbon reductions on site beyond the regulatory standard
- Energy efficient appliances meeting a high standard which are installed as fittings within the home
- Advanced forms of building control system which reduce the level of energy use in the home
- Exports of low carbon or renewable heat from the development to other developments
- Investments in low and zero carbon community heat infrastructure

Regarding the last measure, there is currently interest in investigating whether the Community Infrastructure Levy (CIL) can be used as an allowable solution in a way that is consistent with the Government's approach to the CIL - for example where local authorities prioritise CIL spending on energy infrastructure such as a district heating scheme. Further information on the CIL can be found in Section 7.1.2.

Other allowable solutions remain under consideration and the Government has also proposed a mechanism providing a capped cost that industry is expected to bear in deploying the allowable solutions. For the purposes of the impact assessment undertaken for the consultation, a level of £100 per tonne of CO_2 was assumed and that any residual emissions would be covered for 30 years. This policy will be reviewed in 2012 to confirm allowable solutions.

It is expected that the Government's response to the original zero carbon definition consultation will be published in December 2009. The technical guidance of the Code for Sustainable Homes will be updated following this.

Non-domestic buildings

Establishing the requirement for non-domestic buildings to meet zero carbon standards in the future is a complex process due to the extreme variation in terms of their size and shape and the use to which they are put. As such, there is currently no clear indication on the definition of zero carbon within this sector or the trajectory of carbon reductions expected up to this point. A more detailed consultation on the definition of zero carbon in non-domestic buildings is expected to be published in late 2009 – early 2010. As discussed above, it has been predicted that this will then lead to BREEAM being updated or the development of a new 'Code for Sustainable Buildings' (for non-domestic buildings only).

2.7.2 The Heat and Energy Saving Strategy consultation (2009)

The Heat and Energy Saving Strategy (HESS) consultation sets out the Government's long term vision for reducing carbon dioxide emissions from buildings. The overall vision is for emissions from buildings to be approaching zero by 2050.

The consultation, which focuses on delivering greater energy efficiency in existing dwellings, provides a new focus on district heating and combined heat and power (CHP) systems. The document sets out a number of mechanisms for promoting such systems and recognises that the role of local authorities is crucial to their delivery.

There is potential that the aims and objectives set out in this consultation could be met by the authorities in West Sussex, should new development lead to the installation of district heating and CHP systems in new buildings and in areas where such systems can be connected to existing buildings.

In addition, the Renewable Heat Incentive for households, which was introduced in the Energy Act 2008, will provide a guaranteed supplemental revenue stream for producers of renewable heat. The HESS consultation document looks at whether it could make more sense to provide the renewable heat incentive as an upfront lump sum to offset the financial outlay for the technology (in the domestic sector only). Depending on the outcome of this consultation, this could lead to developers offsetting the costs of the technology within new build development.

2.8 Summary

As described above, a number of national policy drivers call for sustainability planning policies from local planning authorities. This is especially significant for authorities in West Sussex due to their location on the coast of the South East of England and the predicted effects of climate change in this region.

National planning guidance recommends that development plans should contribute to global sustainability by addressing the causes and potential impacts of climate change - through policies which reduce energy use, reduce emissions and promote the development of renewable energy resources.

The South East Plan also places responsibility on local authorities to achieve low carbon building standards in advance of changes to Building Regulations. In particular, policy NRM11 allows local authorities to require higher levels of decentralised and renewable or low-carbon energy in new development.

It is also important to highlight the innovative approaches set out by a number of local authorities across England, including the London Boroughs of Merton and Croydon, Milton Keynes Council and Ashford Borough Council. These forward-looking authorities are incorporating sustainable building standards (BREEAM and the Code for Sustainable Homes) in addition to Merton-style requirements into their Local Development Documents. This has set a precedent for other local authorities wishing to build on this experience and introduce similar policies of their own.

3 Landscape sensitivity and resource assessment

3.1 Landscape sensitivity assessment

In order to inform the resource assessment (described below) and future work on the location of renewable energy generating plant, a landscape sensitivity assessment has been undertaken by Land Use Consultants within the scope of this study. A primary reason for undertaking this task relates to PPS22, which notes that planning policies that place constraints on all or specific types of renewable energy should have sufficient reasoned justification. The landscape sensitivity assessment is therefore focussed on those technologies that have the potential, in the wrong location, to have significant impact on landscape character – namely wind energy developments[16] and energy crops. However generic guidance on other renewable energy technologies has also been provided.

The study will also assist in identifying suitable areas for renewable energy deployment and will provide developers, local planning authorities and others with guidance for minimising impacts of renewable energy technologies on the landscape. It will also indicate criteria that need to be taken into account when assessing the potential impact of renewable energy proposals.

There is currently no agreed method for evaluating sensitivity or capacity of different types of landscape. However, the approach taken in this study builds on current guidance published by the Countryside Agency and Scottish Natural Heritage including the Landscape Character Assessment Guidance[17] and Topic Paper 6 that accompanies the Guidance, as well as the author's considerable experience from previous and ongoing studies of a similar nature.

Para 4.2 of Topic Paper 6 states that:

> *'Judging landscape character sensitivity requires professional judgement about the degree to which the landscape in question is robust, in that it is able to accommodate change without adverse impacts on character. This involves making decisions about whether or not significant characteristic elements of the landscape will be liable to loss... and whether important aesthetic aspects of character will be liable to change'*

In this study the following definition of sensitivity has been used:

Sensitivity is the extent to which the character of the landscape is susceptible to change as a result of the proposed renewable energy generation.

This landscape sensitivity assessment is based on an assessment of landscape character using carefully defined criteria, and assumes that it is desirable to conserve existing landscape character (as set out in existing landscape strategies for the study area). The approach and conclusions of the study are the subject of a separate report entitled *Landscape Sensitivity Analysis & Guidance for West Sussex Low Carbon Study*, Land Use Consultants, 2009.

The report summarises key attributes of the landscapes across West Sussex, highlights the special qualities of designated areas, provides a sensitivity judgement highlighting those attributes that would be sensitive to specific renewable technologies, and provides guidance on how these technologies can be located to minimise adverse impacts.

[16] Note that, at the time of writing, Natural England is in the process of consulting on proposed guidance. See: http://www.naturalengland.org.uk/ourwork/policy/consultations/closedconsultations/windenergy.aspx
[17] Countryside Agency and Scottish Natural Heritage (2002) Landscape Character Assessment: Guidance for England and Scotland CAX 84

Key conclusions from the study include:

- Results indicate that a strategy to accept character change in some areas may be needed if large/medium scale wind is to contribute to renewable electricity generation in the study area
- There was found to be variable sensitivity to biomass crops due to the fact that much of the study area is wooded and could subsequently provide screening for short rotation coppice
- When considering the impact of renewable energy generation technologies on landscape character, it is important to recognise that climate change itself will result in changes to our landscapes
- Planning can be used to guide renewable energy proposals so as to spread them apart to avoid cumulative issues, or to cluster them in certain parts of the landscape & keep other areas free of development.

3.2 Resource assessment

3.2.1 Introduction

Certain sustainable energy resources are easier to quantify in that their potential can be independently expressed in terms of stand-alone (i.e. non-building integrated) technology capacities, although in practice their application will be linked to developments. These include wind, woodfuel and waste. Woodfuel in particular will be a key resource in meeting higher carbon reduction targets due to the importance of biomass CHP and community heating systems at this level. Solar and heat pump technologies are specifically building-related and so are directly influenced by development policies. Sustainable energy resources specifically related to transport e.g. biofuels, are beyond the scope of this study.

A summary of the main low or zero carbon energy resources and their potential in West Sussex are listed in Table 10. Note – CHP and district heating are considered separately in Section 5.

Table 10: Summary of low or zero carbon energy resources

Resource/technology	Potential in West Sussex
Wind	Considered in more detail below
Biomass	
Energy recovery from waste	
Solar	
Heat pumps	
Sewage gas	Most of resource already being exploited.
Landfill gas	Most of resource already being exploited.
Hydro power	Very limited potential on water courses. Not considered further.
Off-shore wind and marine renewables (incl. wave and tidal)	Lies outside planning jurisdiction of the West Sussex authorities so not considered further.
Geothermal	Not technically or economically proven in the UK and difficult to evaluate resource within the scope of this study. Not considered further.
Hydrogen fuel cells	Emerging technology; CO_2 savings dependent on hydrogen production technique. Not considered further.

3.2.2 Existing low carbon and renewable energy generation capacity

In order to assess the current installed capacity in the study area, information was obtained from several sources[18]. For the larger installations it was possible to ascertain installed capacity. The installations for which capacity is known are listed in Table 11 below; this results in an approximate total of 22 MW_e (electricity) and 11 MW_{th} (heat).

Table 11: Low carbon and renewable energy generation installations

Name	Local authority	Technology	Capacity [MW_e]	Capacity [MW_{th}]
Climping School	Arun	Wind	0.006	0
Lidsey Landfill	Arun	Landfill Gas	2.01	0
West Dean Estate	Chichester	Biomass Heating	0	1.2
Tangmere Airfield Nurseries	Chichester	CHP	*7.04 (estimated)*	8.8
Wind (RH14 0JN)	Chichester	Wind	0.005	0
Horton Landfill Site	Horsham	Landfill Gas	1.98	0
Brockhurst Wood	Horsham	Landfill Gas	5.19	0
Windmill Quarry	Horsham	Landfill Gas	5.13	0
Goddards Green (Southern Water Services)	Mid Sussex	Sewage Gas Electricity	0.465	0
Hoathly Hill	Mid Sussex	Biomass Heating	0	0.3
Southern Water Services CHP (East Worthing)	Worthing	Sewage Gas CHP	0.28	*0.35 (estimated)*
		Total	**22**	**11**

In addition, there are several smaller installations for which information on capacity is not available. Based on the number and type of installations, it is estimated that these comprise an additional capacity of approximately 0.6MW of electrical capacity (20 installations) and 1.25MW (17 installations) of heat capacity.

These figures for electricity can be compared with renewable energy sub-regional targets for East and West Sussex in the current South East Plan i.e. 57MWe by 2010 and 68MWe by 2016. By estimating annual energy yields from these installations and then applying carbon emission factors[19], the total resulting carbon saving is estimated to be around 2.4% of the total annual overall carbon emissions for the five districts under study.

The map in Figure 3 below shows all known installations of renewable and low carbon generation capacity in the five local authority areas.

[18] The estimate of electrical and heat capacity is based on information from several sources, some of which include planning applications. It is possible that some of the smaller projects listed here have received planning permission but have not yet been installed. Sources of information were the DECC planning database (http://www.restats.org.uk/2010_target.htm), the stakeholder consultation events, the Renewable Energy Association (www.r-e-a.net/installations) SEE-Stats (www.see-stats.org), and The Environment Centre Southampton (www.environmentcentre.com), who kindly updated the published data from SEE-Stats.
[19] The carbon factors used in this study are as follows: 0.43kgCO_2/kWh (electricity), 0.205kgCO_2/kWh (gas) and 0.025kgCO_2/kWh (woodfuel)

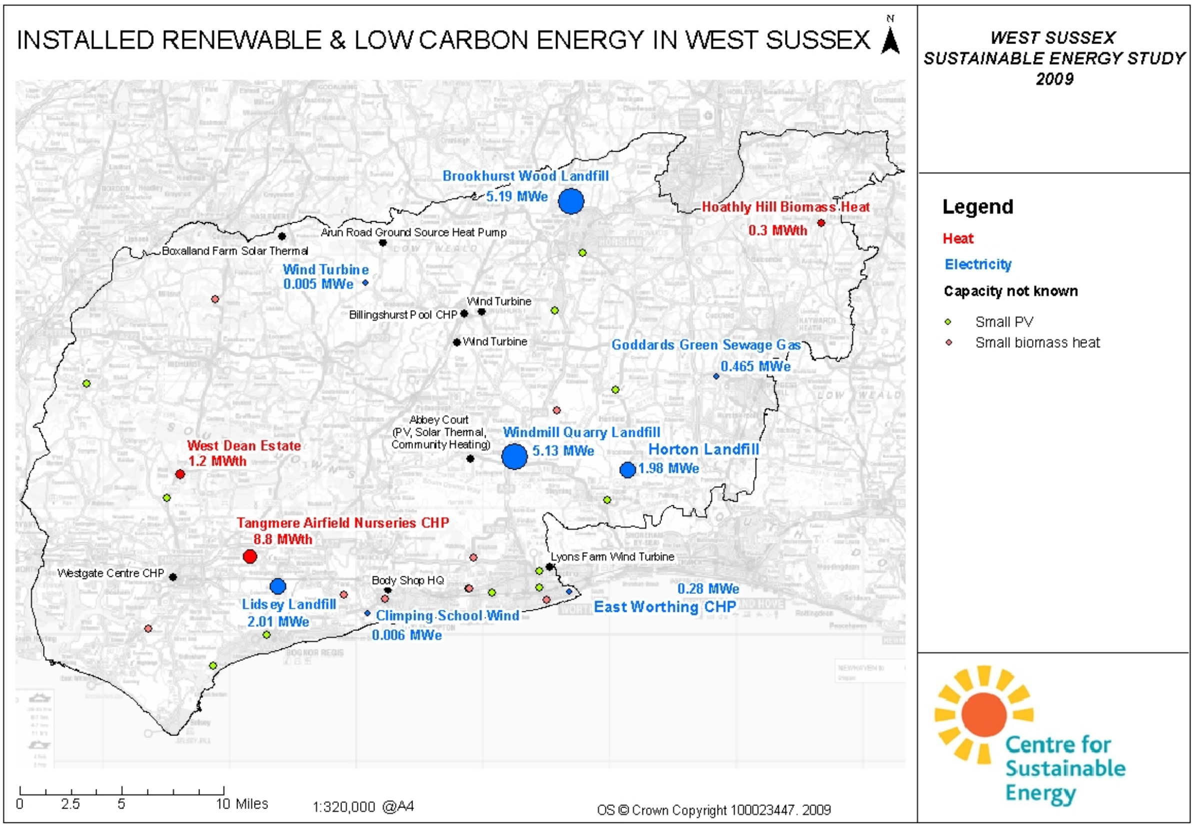


Figure 3: Installed renewable & low carbon energy generating plant in West Sussex

3.2.3 Wind power

a) Overview

The UK has the largest wind resource in Europe yet wind energy currently generates only around 2% of the UK's electricity supply, with an expectation in the 2009 UK Renewable Energy Strategy of this rising to around 20% by 2020. It is planned that this will be delivered by both onshore and offshore plants comprising around 33GW of capacity.[20]

Modern wind turbines convert a portion of the kinetic energy in wind into rotational motion via a rotating blade system, which is then converted into electricity by a generator. The amount of electricity generated annually will depend upon the characteristics of the turbine and the average wind speed at the site. An appropriately sited large scale turbine (e.g. 2-2.5MW) will typically generate an amount of electricity equivalent to the annual needs of around 1,200-1,600 homes[21]. The energy balance or payback of a typical wind farm i.e. the time needed to generate the equivalent amount of energy used in its manufacture is typically six to eight months, which is similar to coal or nuclear power plants.[22]

Although the wind resource is variable, a typical turbine will generate electricity for 70-85% of the time and its output will vary between zero and full rated output in accordance with the local wind speed. However, the combined output of the UK's entire wind power portfolio shows less variability, given the differences in wind speeds over the country as a whole.

[20] See UK Renewable Energy Strategy, 2009
[21] assuming an average annual domestic consumption of 3,300 kWh and a load factor of approx. 25%
[22] See http://www.bwea.com/ref/faq.html

Large scale wind is a predominantly stand-alone technology i.e. the installation is off-site and not directly linked to any specific development. Exceptions to this include on-site single large turbines e.g. located on a commercial/industrial estate. For the large majority of developments, particularly ones comprising dwellings, large scale wind is not a feasible option as an on-site solution although under the 'Building a Greener Future' zero carbon definition, connection by 'private wire' to the development is permitted[23]. Crucially, 'direct physical connection' of off-site renewable electricity is included as an 'allowable solution' in the list currently proposed in the Government's *Definition of Zero Carbon Homes and Non-domestic Buildings* consultation, but is not permitted under the 'carbon compliance' requirements. However, a July 2009 statement by the Government[24] did not list this measure as one that had received 'broad support' under allowable solutions during the consultation.

It is therefore more likely that small scale, and to some extent, medium scale turbines will be the on-site wind power options for developers. Planning restrictions and decreased economy of scale however will still limit their viability when compared to other forms of zero carbon generation.

b) Technical constraints and limitations

To assess the total potential wind resource in the study area, a constraints analysis was undertaken using Geographic Information Systems (GIS) mapping. Three scales of wind turbine were assessed, as detailed in the table below:

Table 12: Scales of wind turbine used for resource assessment

Scale	Generation capacity	Hub height
Large	~ 2 MW	80m
Medium	~ 300 kW	44m
Small	~15 kW	15m

For each scale, a set of criteria was identified, describing the characteristics of unconstrained land. These were as follows:

Table 13: Characteristics of unconstrained land for wind resource assessment

Criteria	Turbine size		
	Large	Medium	Small
Minimum distance from existing homes	750m	400m	120m
Minimum distance from other buildings	400m	60m	20m
Minimum distance from roads	120m	60m	20m
Woodland and trees	Turbines not to be located in wooded areas	Turbines not to be located in wooded areas	Turbines not to be located in wooded areas
Minimum wind speed	6m/s at 80m above ground level	6 m/s at 44m above ground level	5.5 m/s at 15m above ground level

Note – micro-scale wind (most commonly roof-mounted turbines less than 5kW) was not specifically considered in the above analysis. As with all turbines, performance is highly dependent on sites with suitable wind and it has been shown that urban rooftops generally suffer from turbulence and low annual average wind speeds[1] making this technology less viable for the majority of urban sites in the study area. Whilst some sites such as tower blocks or very exposed buildings may offer limited potential, these are not considered within this study.

[23] It should be noted that 'private wire' type arrangements run contrary to recent policy thinking and are made more difficult by recent European Court of Justice findings (see para 5.19 in *Definition of Zero Carbon Homes and Non-domestic Buildings* consultation Dec 2008)
[24] http://www.communities.gov.uk/statements/corporate/ecozerohomes

For wind speeds, the UK Windspeed database was used[25]. This is a database of UK wind speeds provided by BIS (formerly BERR/DTI), showing the average (modelled) wind speed at different heights for areas of one square kilometre. Although this data is the best available for large areas, its low resolution means that some suitably windy areas may be missed out. It also neglects the effect of surface roughness, which can significantly change wind speeds on a very localised basis, particularly at lower hub heights. Consequently a developer would need to undertake a site-specific analysis of wind speed for any proposed installation.

Another consideration is that aviation activities may limit the possibilities for turbines in some areas, because wind turbines can interfere with radar operation. Data published by NATS En Route (NERL, the company responsible for the safe movement of in-flight aircraft operating in the UK) indicates that wind developments of medium and large scale in most parts of West Sussex would have the potential to interfere with radar[26]. However, in other parts of the country, wind turbines have been installed within similar areas of constraint identified by NERL, and so suitability would need to be ascertained on a site-specific basis. For this reason we have not included proximity to airports as a constraint, although the locations of airports have been shown for information on the map in Figure 4.

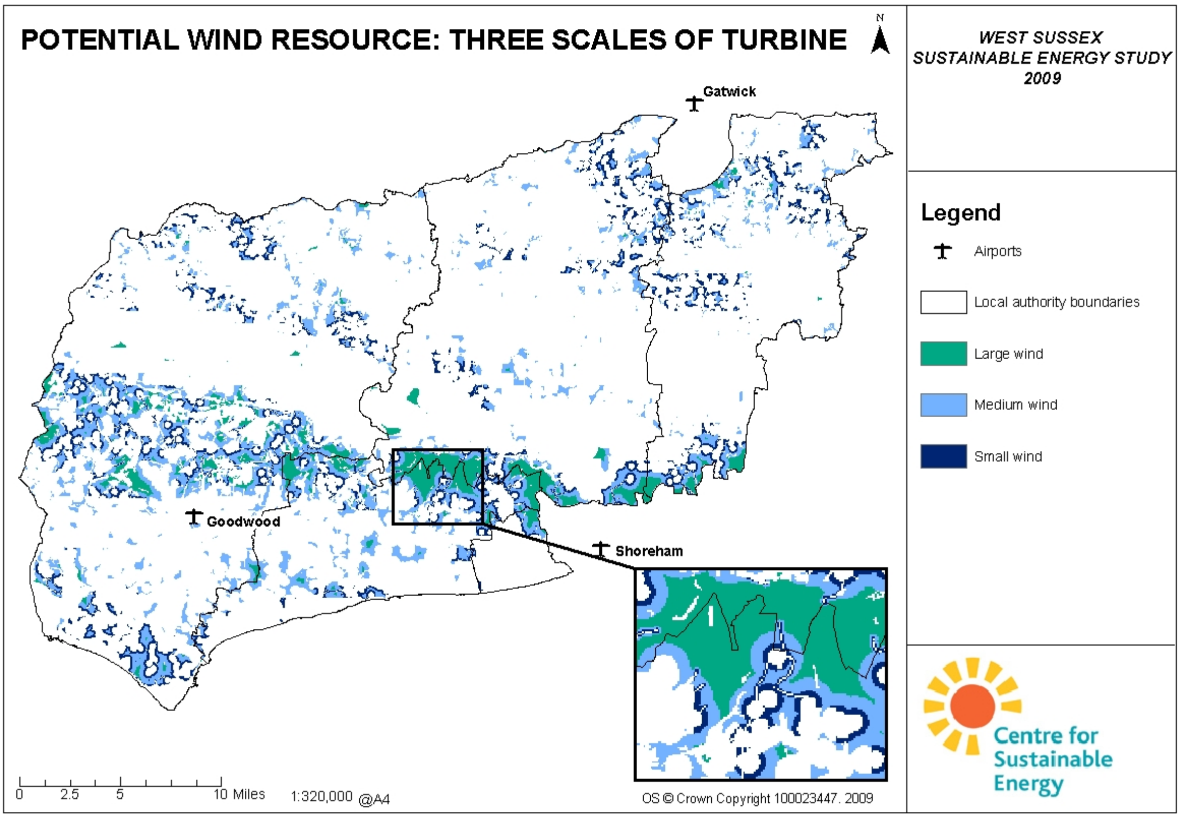


Figure 4: Areas of technical potential for wind energy generation

Shown in Figure 4 above is the unconstrained area of land for each turbine size i.e. after applying the constraints shown in Table 13. It should be noted that this indicates all areas where wind turbines could be technically viable. It is not suggesting that all of these areas are necessarily appropriate for wind turbines.

[25] For more information, see http://www.berr.gov.uk/energy/sources/renewables/explained/wind/windspeed-database/page27326.html
[26] For more information, see www.bwea.com/aviation/nats.html

The map shows that the highest wind resource is to be found in a swathe across the middle of the county. This is due to high wind speed and low population. The green areas show places with technical potential for large wind (and therefore normally also technical potential for medium and small scale wind). The blue areas show land areas with technical potential for medium wind (and therefore also small wind as well, but not large wind), while the orange areas show areas with technical potential for small wind only. The inset box shows how these areas are often grouped with a central area with technical potential for all wind types, surrounded by an area with technical potential for medium wind (and therefore also small wind), which is in turn surrounded by an area with technical potential for small wind only.

Alongside the constraints explored above, there are a number of other technical or physical issues that need to be addressed at a site specific level when considering wind power development. These include:

- Practical access to sites for abnormal loads, e.g. turbine blades
- Effect of slope and aspect of site topography on wind speeds
- Landowner agreement
- Potential ecological, ornithological, cultural heritage and archaeological impacts
- Hydrology & hydrogeology impacts
- Detailed noise impact assessments (the dwelling buffers used above are a crude approximation of acceptable noise limits)
- Shadow flicker effects on nearby buildings
- Line of sight for telecommunications links
- The capacity of the local grid infrastructure to accept new generation capacity

c) Landscape and visual impact

As well as the physical constraints already described (buildings, roads, woodland and wind speed), there are landscape constraints that could limit wind development. Much of West Sussex's land area is protected: there are two AONBs, covering the High Weald and Chichester Harbour; the South Downs area will soon become a national park; and there are several areas designated as protected habitats, either as Special Protection Areas, Ramsar areas (internationally important wetlands), or Special Areas of Conservation. Some areas are covered by more than one designation.

Note - two Special Areas of Conservation, Ebernoe Common and The Mens, are home to important bat populations, which may limit wind development around these areas. No data was available on bat migration routes outside of these areas.

While wind turbine development is not formally prohibited within these areas, it is less likely to go ahead in some of them, in particular the protected habitats which are home to important bird species. However, in other designated areas, such as the AONBs and the national park, some scale of wind development may be more suitable (see extract from South East Plan guidance below). In addition, those responsible for designated areas will be aware that climate change poses a threat to these protected landscapes and so may be open to the possibility of some wind turbines in these areas, as a contribution towards climate change mitigation.

Figure 5 below shows the areas with technical potential for wind development overlaid with the relevant designated areas. This illustrates the significantly increased constraint that would be placed on the resource if wind development was excluded from these designated areas. For large scale wind, the sites with most (technical) potential fall mostly within the planned South Downs National Park.

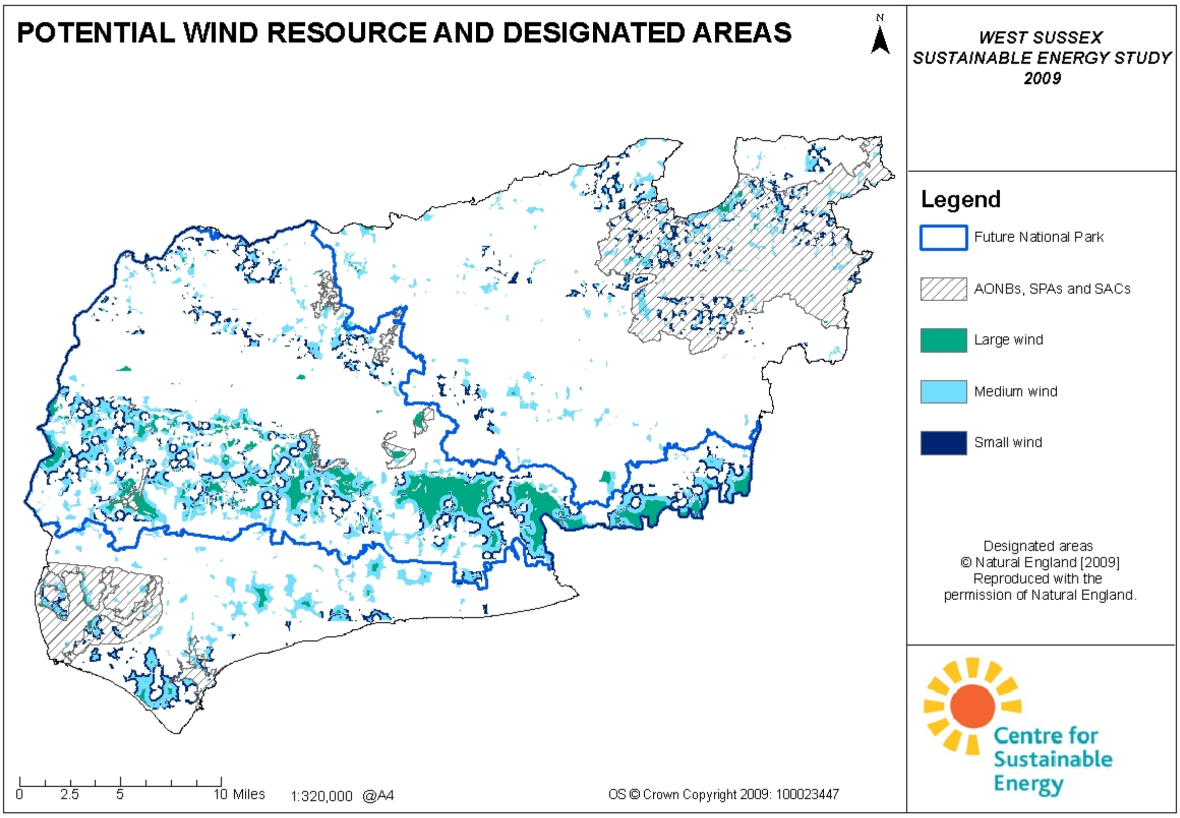


Figure 5: Areas of technical potential for wind energy generation overlaid with designated areas

The South East Plan provides guidance on the location of renewable energy developments such as wind power in Policy NRM15 as follows:

> *"Local development documents should encourage the development of renewable energy in order to achieve the regional and sub-regional targets. Renewable energy development, particularly wind and biomass, should be located and designed to minimise adverse impacts on landscape, wildlife, heritage assets and amenity. Outside of urban areas, priority should be given to development in less sensitive parts of countryside and coast, including on previously developed land and in major transport areas.*
>
> *"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 Areas of Outstanding Natural Beauty or the national parks, development should generally be of a 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."*

The Plan's supporting text for this policy states that:

> *"Priority should be given to the development of renewable energy schemes, particularly larger scale ones, in less sensitive areas including previously developed and industrial land and areas where there is already intrusive development or infrastructure, for example major transport corridors….";*
>
> *"However, wind and other renewable energy development should not be precluded in AONBs and the national parks as there will be locations where small scale construction e.g. a wind*

> *development of between one and four turbines not generating more than 5MW, can be accommodated where conflict with statutory landscape protection purposes set out in PPS7 can be avoided or minimised through careful siting and design, including reducing the cumulative impact of a number of individual schemes"*

The Landscape Sensitivity Assessment undertaken as part of this study (see Section 3.1) identifies broad areas where the landscape may be significantly altered by the introduction of wind turbines. Rather than hub height, it is the height to the tip of the turbine blade that is considered in this type of assessment, i.e. 90-125m (large scale), 25-90m (medium scale) and up to 25m (small scale). Key findings of the study regarding wind power include:

- Most of the landscapes in West Sussex have a high sensitivity to large scale wind turbines (i.e. this scale of turbine could not be accommodated without changing character)
- Landscapes also have a relatively high sensitivity to medium scale wind turbines because the landscapes of West Sussex are relatively small in scale
- There is generally lower sensitivity to small scale turbines due to the human scale of the landscape and the presence of scattered development – this type of wind turbine could form part of farm complexes or business developments.

The figures below show the wind resource and areas that are considered to be highly sensitive to the corresponding scale of wind, for large and medium sized turbines. No areas were identified as being highly sensitive to small scale wind development, and so the third map shows the small scale wind resource, with the areas that have 'high to medium' sensitivity to small wind development.

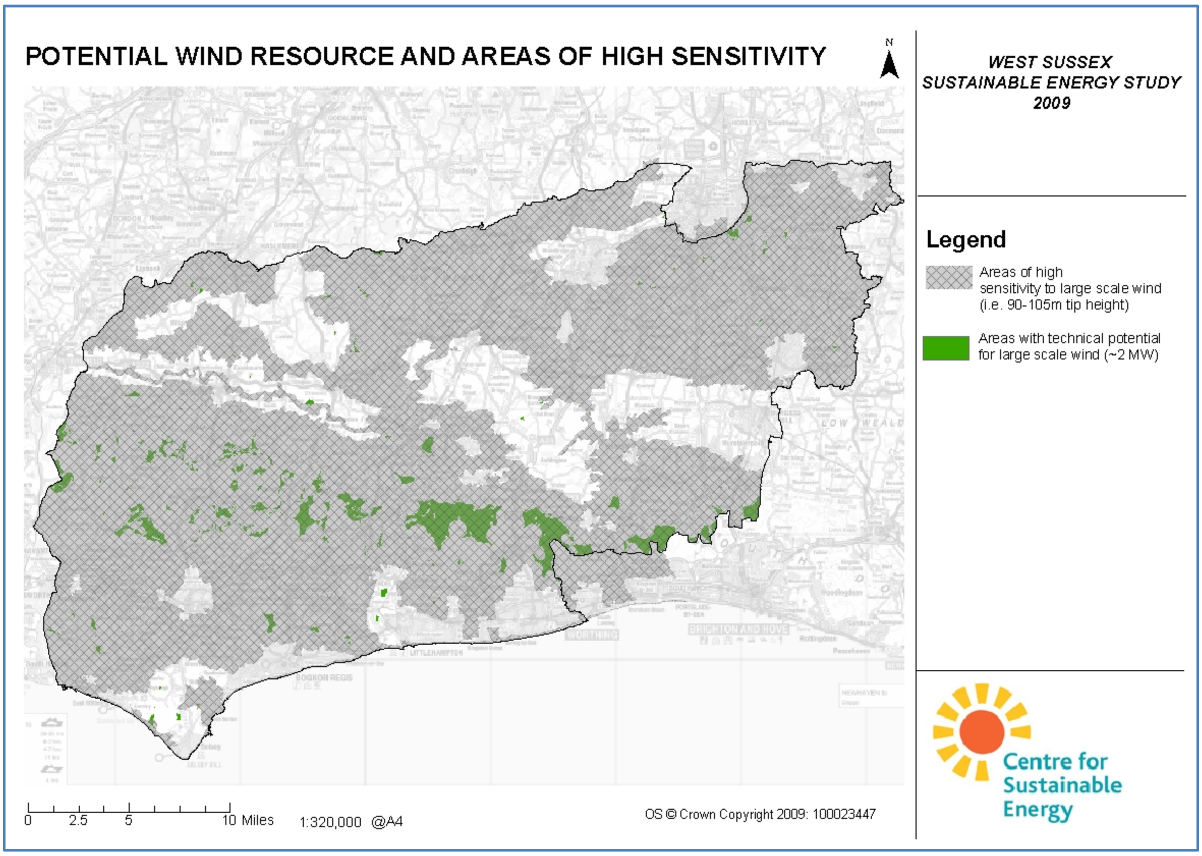


Figure 6: Areas of technical potential for large scale wind energy generation overlaid with corresponding landscape sensitivity

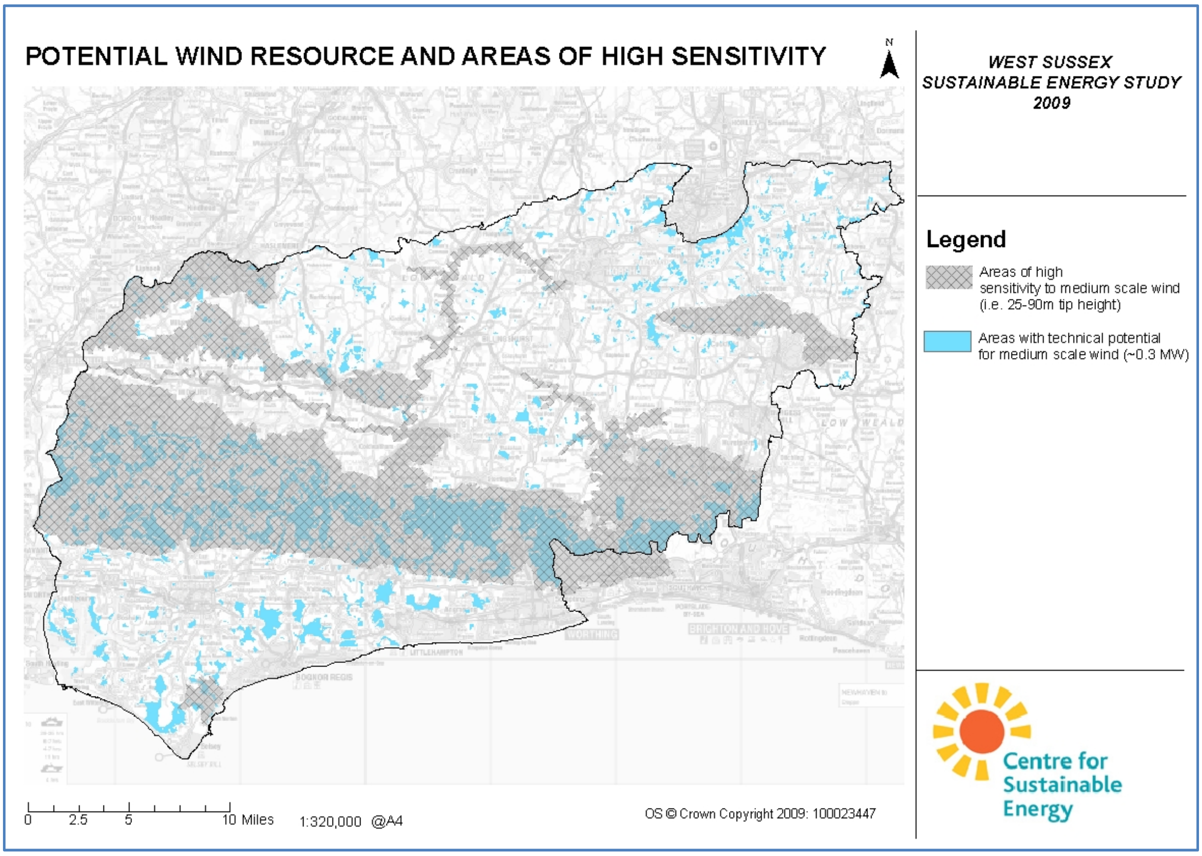


Figure 7: Areas of technical potential for medium scale wind energy generation overlaid with corresponding landscape sensitivity

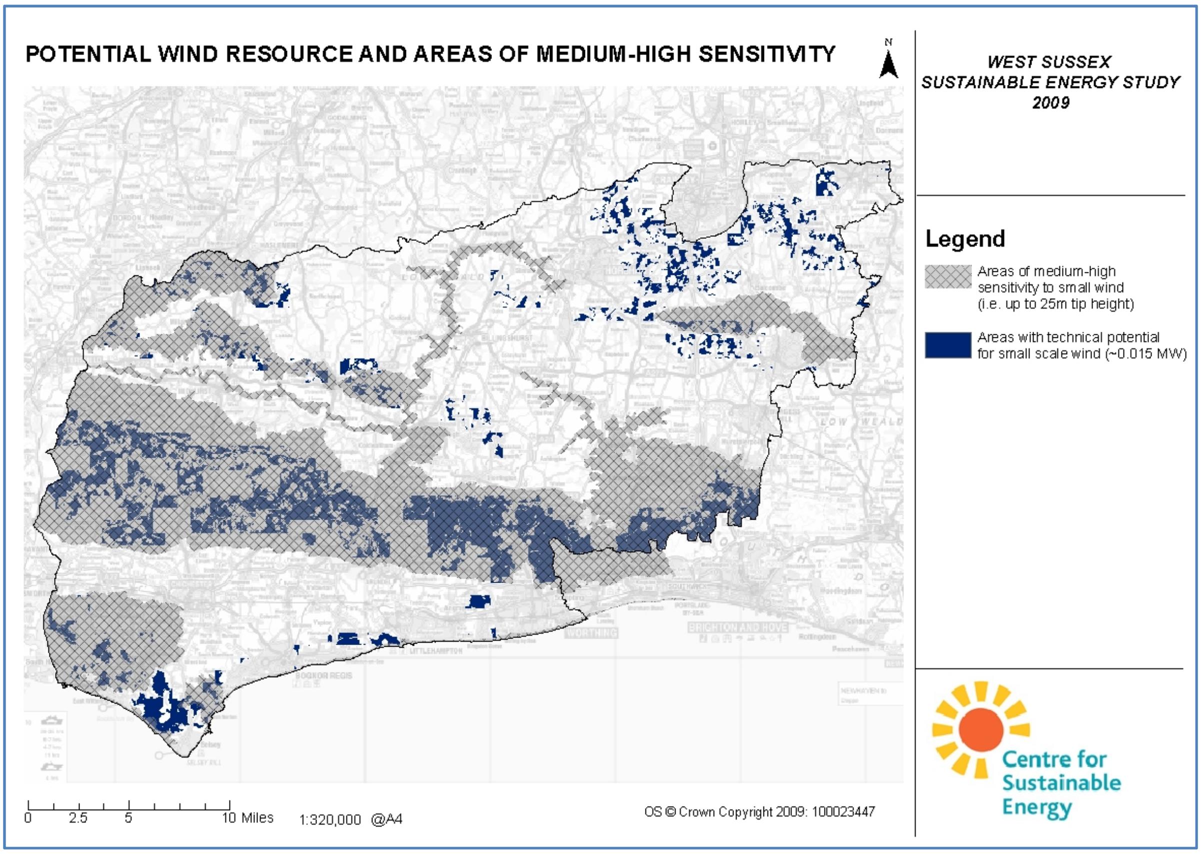


Figure 8: Areas of technical potential for small scale wind energy generation overlaid with corresponding landscape sensitivity

Figure 6 shows that there are very few areas with technical potential for large wind that are not also in areas which are highly sensitive to large wind. There are some small areas of suitable land remaining, totalling 84 hectares (71 if designated areas are removed), in small patches in Arun, Horsham and Chichester. The second map shows that around 30% of the land with technical potential for medium wind is not in areas of high sensitivity. These areas can be found in all districts (although potential in Worthing is very small), with Chichester having the highest resource. However, referring back to Figure 5, it can be seen that some of these are in the Chichester Harbour AONB area – when designated areas are excluded, the potential in Chichester is similar to that in the other districts.

No areas were found to be highly sensitive to small scale wind, and so Figure 8 shows areas of 'medium-high' sensitivity. Note - this is shown for illustration; in Table 14 below only high sensitivity areas are taken into account within Scenario C.

It should be noted that the landscape areas identified are quite broad, and so within an area identified as highly sensitive there are likely to be localised areas that would be less sensitive to wind development.

Cumulative impacts of wind development should also be considered a potential constraint. Planning policy and the development management process can be used to guide renewable energy proposals so as to either keep them apart to avoid cumulative issues, or to cluster them in certain parts of the landscape to avoid development in more valued areas. This indicates that, in larger scale landscapes that do not lie within designated areas, for example the Lower Coastal Plain (away from the Chichester Harbour AONB) and the Lower Arun Valley, it might be beneficial to have fewer larger turbines rather than a larger number of smaller turbines to minimise cumulative effects. This might also be the case on the top of the conifer planted Forest Plateau in the High Weald Forests area, which falls mainly within the western half of High Weald AONB.

However, in many of the other landscapes a larger number of smaller scale turbines (associated with built development) are likely to be more suitable than fewer larger turbines due to the scale of the landscape and scattered form of development. It will also be important that adjacent turbines/ wind farms respect each other in terms of scale and design to minimise cumulative impacts.

d) Potential energy yield

Table 14 below shows the land area available to turbines under different scenarios of landscape constraints across the study area. Where an area of land is suitable for more than one scale of turbine, the largest scale has been chosen. The table also translates this land area into installed capacities and energy yields assuming that the calculated areas are populated with the relevant scale of wind turbines. Energy yields are also summarised in Figure 9.

Table 14: Wind resource under different landscape constraints –total study area

Scale of wind power	**A**. Land unconstrained by proximity to infrastructure and wind speeds			**B**. Land unconstrained by proximity to infrastructure, wind speeds and designated areas			**C**. Land unconstrained by proximity to infrastructure, wind speeds, designated areas and high landscape sensitivity		
	Hectares	**MW**	**MWh/yr**	**Hectares**	**MW**	**MWh/yr**	**Hectares**	**MW**	**MWh/yr**
Large	6,021	602	1,318,490	321	32	70,354	71	7	15,440
Medium	17,554	527	922,612	4,588	138	241,132	4,431	133	232,867
Small	8,387	126	110,208	1,818	27	23,882	1,846	28	24,253

Note - energy yield calculations assume a turbine spacing of 0.05 per ha (large scale), 0.1 per ha (medium scale) and 1 per ha (small scale). Assumes load factors of 0.25 (large scale), 0.20 (medium scale) and 0.1 (small scale). Cumulative impact is not considered.

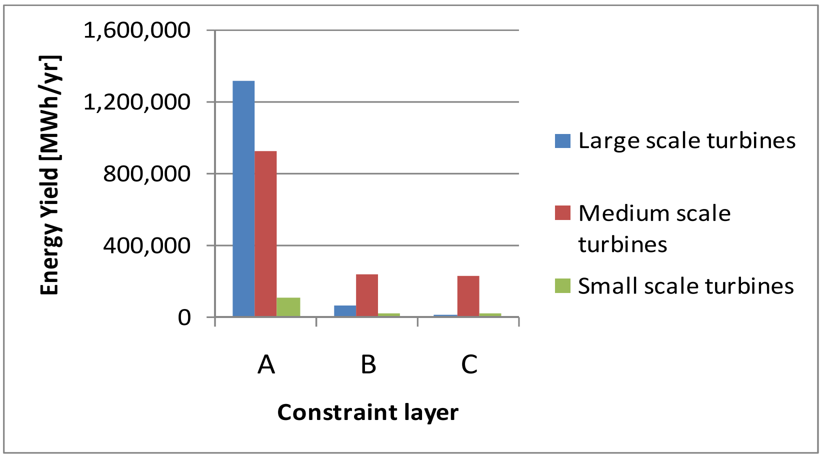


Figure 9: Potential energy yields at various scales of turbine modeled for three scenarios of landscape constraint - total study area

It can be seen that the potential declines as the scenarios become more restrictive. The exception to this is small wind between Scenarios B and C. Here, because there are no areas that are highly sensitive to small wind (the highest classification is 'medium-high' for sensitivity to small wind), the reduction in the potential areas for medium wind 'free up' just under 30 hectares for small wind.

Table 15 and Figures 10-14 present the results of the assessment split by local authority.

Table 15: Wind resource under different landscape constraints – by local authority

Local authority	Scale of wind power	A. Land unconstrained by proximity to infrastructure and wind speeds			B. Land unconstrained by proximity to infrastructure, wind speeds and designated areas			C. Land unconstrained by proximity to infrastructure, wind speeds, designated areas and high landscape sensitivity		
		Hectares	MW	MWh/yr	Hectares	MW	MWh/yr	Hectares	MW	MWh/yr
Arun	Large	1,602	160	350,893	97	10	21,188	34	3	7,391
	Medium	3,622	109	190,372	1,311	39	68,906	1,359	41	71,416
	Small	1,081	16	14,204	244	4	3,206	246	4	3,236
Chichester	Large	2,035	203	445,556	144	14	31,481	26	3	5,694
	Medium	8,534	256	448,534	1,570	47	82,506	1,641	49	86,251
	Small	3,736	56	49,084	571	9	7,503	599	9	7,868
Horsham	Large	1,728	173	378,323	80	8	17,465	11	1	2,354
	Medium	3,106	93	163,265	1,472	44	77,381	1,201	36	63,098
	Small	1,646	25	21,632	785	12	10,308	785	12	10,308
Mid Sussex	Large	527	53	115,358	1	0	219	0	0	0
	Medium	2,063	62	108,418	235	7	12,338	230	7	12,102
	Small	1,829	27	24,026	205	3	2,694	203	3	2,671
Worthing	Large	130	13	28,361	0	0	0	0	0	0
	Medium	229	7	12,023	0	0	0	0	0	0
	Small	96	1	1,261	13	0	171	13	0	171

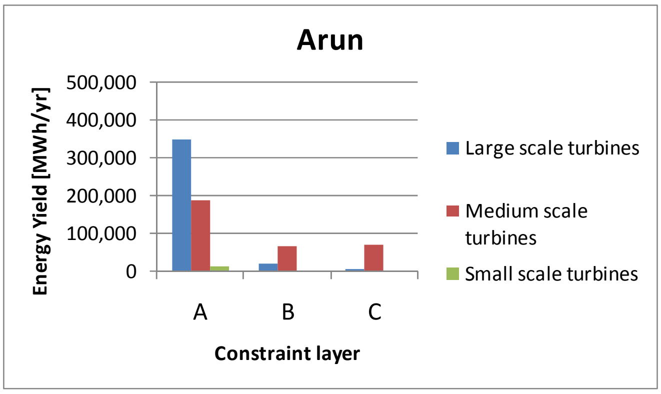


Figure 10: Wind resource under different constraints – Arun

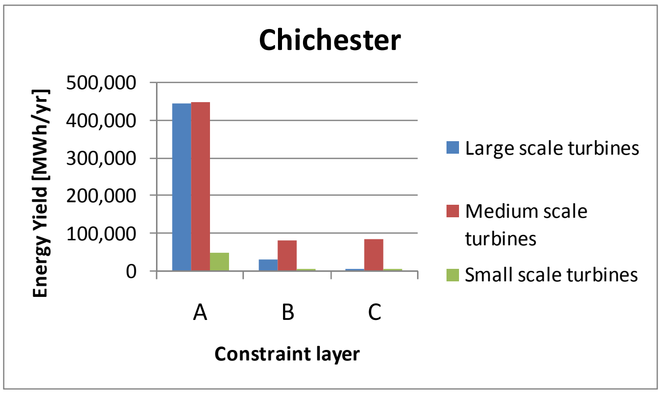


Figure 11: Wind resource under different constraints – Chichester

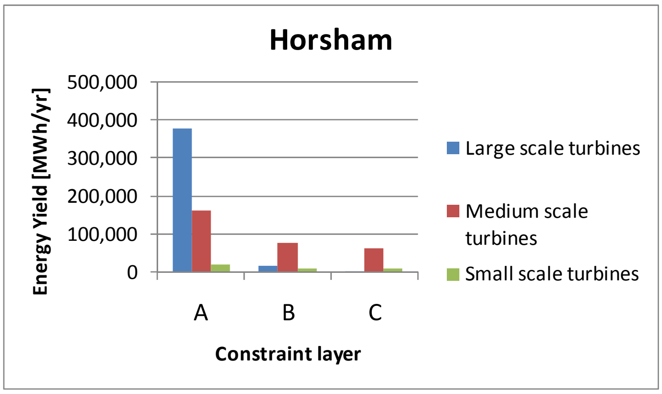


Figure 12: Wind resource under different constraints - Horsham

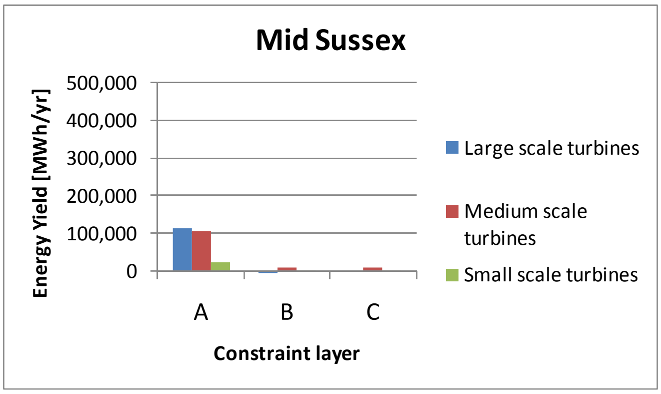


Figure 13: Wind resource under different constraints – Mid Sussex

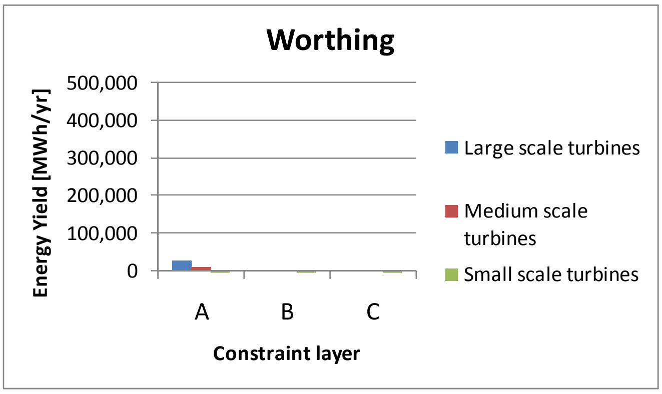


Figure 14: Wind resource under different constraints – Worthing

3.2.4 Woodfuel – woodland residues and energy crops

a) Overview

The woodfuel resource considered here includes virgin (untreated) wood residues (from forestry, arboriculture, etc.) and energy crops (Miscanthus and short rotation coppice). There is some overlap with waste (Section 3.2.5) where virgin wood is present in certain waste streams, but this can be difficult to segregate from non-virgin (contaminated) wood. The distinction between virgin or contaminated wood will determine the areas of legislation that will apply to its use regarding emissions permits. Woodland residues and energy crops are generally considered to be clean or 'untreated' whereas other waste wood residues may contain contaminants such as paint, preservative, etc. and would fall under stricter emission and pollution prevention controls.

Lifecycle carbon emissions of using woodfuel are very low compared to fossil fuels, providing the wood is sustainably sourced. The carbon dioxide released when energy is generated from wood is balanced by that absorbed during new growth, although there is inevitably a small amount of net emissions resulting from wood harvesting, processing and transport operations.

Woodland residues are normally sourced as the residues of the sustainable management of existing woodland. The resource is normally produced as woodfuel in the form of wood chip, logs or occasionally wood pellets. The two main woodfuel energy crops are Miscanthus and short rotation coppice (SRC) willow, which are planted specifically for energy production. Both woodland residues and energy crops can be used to produce either heat-only or electricity and heat (combined heat and power) via a range of energy conversion technologies including direct combustion, gasification and pyrolysis. The form and quality of the woodfuel product, particularly size and moisture content, will potentially influence the type of conversion technology employed.

b) Technical constraints and limitations

Woodland residues

The woodland residue technical resource can be estimated by first considering the total area of woodland in the study area and making assumptions about the woodfuel yield that can be sustainably extracted. The woodland area in this study was assessed using the Forestry Commission's National Inventory of Woodland and Trees[27] and is illustrated in Figure 15 below.

[27] See http://www.forestry.gov.uk/inventory

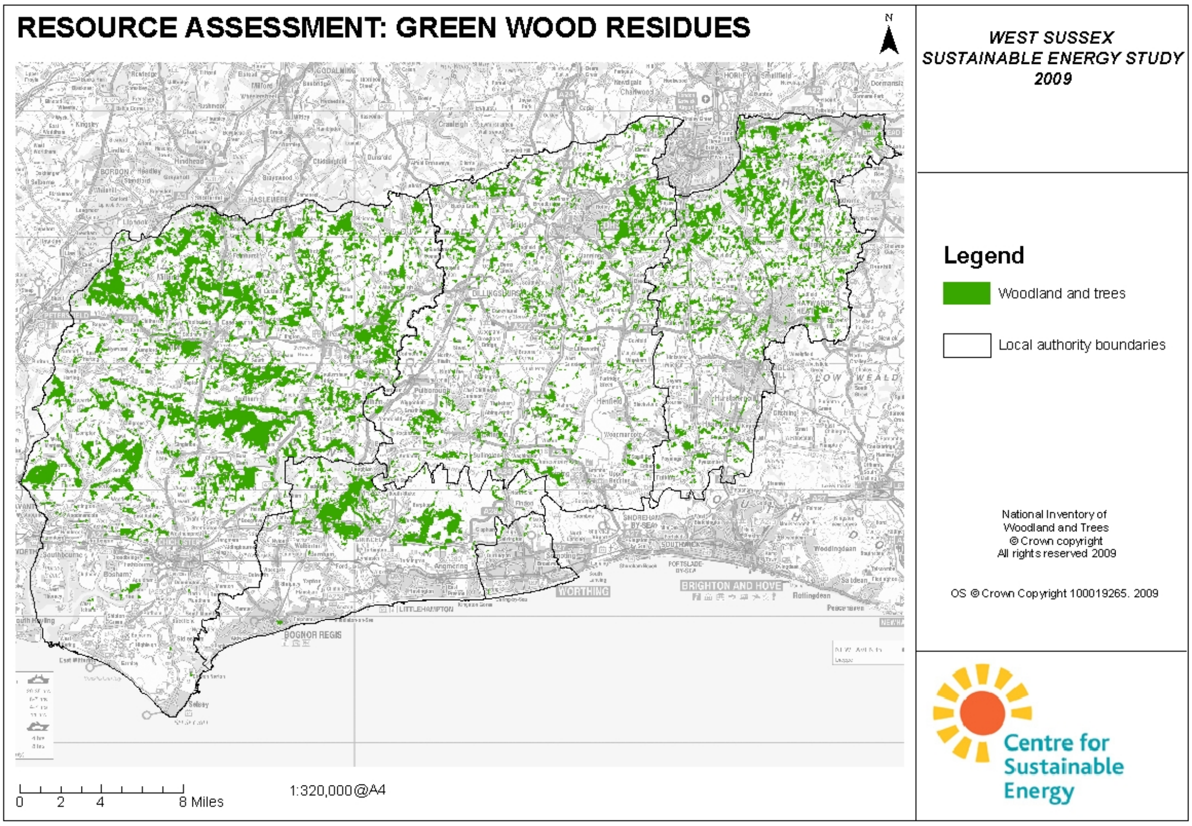


Figure 15: Woodland areas across the study area

The district with the highest green wood residues is Chichester, followed by Mid Sussex and Horsham. Worthing has very little, while Arun has a considerable amount relative to its size.

Woodfuel yields vary according to woodland types but are assumed to be between 2 and 2.5 oven dried tonnes (odt) per hectare per year. The constraints on using this resource clearly depend on how much woodland can be brought under active management and the incentives available for landowners to extract and process woodfuel. Clearly it would not be viable to actively manage all areas of woodland in West Sussex, especially where smaller areas of woodland are concerned or where the slope of the land places constraints on accessibility. The logistics of woodfuel supply and demand will also limit opportunities to use this resource unless adequate supply chains are established across the area.

Energy crops

The technical resource for energy crops can be broadly based on the amount of arable land across the study area. EU Environment Agency land cover data[28], produced in 2000 and based on satellite imagery, was used to ascertain this amount, from which potential yields can be estimated.

Miscanthus typically yields 16-18 odt per hectare per year; almost twice as much as SRC, which yields 8-10 odt per hectare per year. However, Miscanthus does not grow well in exposed areas, defined in this study as being those areas where the average annual wind speed is more than 7 metres per second at 10m above ground level. For this resource assessment, it is assumed that Miscanthus would be planted in all areas of potential i.e. less exposed arable land, whereas SRC would only be planted in areas which are not suitable for Miscanthus i.e. exposed arable land.

[28] Data available from www.eea.europa.eu/themes/landuse/clc-download. Report available from www.eea.europa.eu/publications/COR0-landcover

Clearly much of the land is currently being used to produce other crops and so a number of land-take scenarios have been calculated to illustrate the size of the resource – including the theoretical maximum for the study area and a figure assuming five per cent of this maximum is exploited. Conflicts over land-use for food production and energy crops (including transport biofuels) will need to be considered in relation to the scale of energy crop production envisaged.

Some of this land falls into areas designated as protected habitats (Special Areas of Conservation, Special Protection Areas, and Ramsar sites). Although there are no formal prohibitions against growing energy crops within these areas (or other designated areas such as AONBs), it may be less appropriate than other areas without such constraints.

The production of energy crops will be dependent on landowners and farmers being offered sufficient incentive to grow and harvest the crops, with longer-term supply contracts often needing to be arranged well in advance with end-users. As with woodland residues, the logistics of fuel processing and establishing supply chains may initially act as a barrier to the widespread take-up of this resource. Other issues that may limit the exploitation of this resource include the planning and permitting of generating plant and the question of alternative markets for Miscanthus and SRC.

Emissions from woodfuel

As discussed above, biomass is often treated as carbon neutral, because when combusted (or otherwise converted) it only releases the same amount of carbon dioxide that it took up when it was growing; however, if the resource is transported a long distance, carbon emissions from transport must be considered. A general rule of thumb is that biomass fuel should not be transported more than 40km from its origin to avoid excessive emissions.

The combustion of woodfuel also releases carbon monoxide, particulates and volatile organic compounds, which are similarly produced by the burning of fossil fuels, particularly coal and oil. The emissions created by biomass vary depending on the combustion technology used, which means that in Smoke Control Areas only exempted appliances[29] are permitted.

West Sussex does not currently have any smoke control areas, and so use of biomass is not likely to be restricted, although there may be cumulative impacts if a large amount of the resource is used in one area. There are three Air Quality Management Areas (AQMA) in the study area, covering small areas of Chichester.[30] These areas have been designated AQMAs because of traffic emissions. Planning applications within these areas have the potential both to affect and to be affected by the air quality of the area, and so where appropriate planning applications in theses areas must be accompanied by an air quality assessment. Therefore the potential for using extensive biomass in these areas may be limited.

Research conducted by the Department for Environment, Food and Rural Affairs (Defra) has concluded that any large unmanaged expansion in biomass heat could have a significant effect on air quality and people's health. In light of these findings, Environmental Protection UK and LACORS have produced guidance[31] to help local authorities make informed decisions on individual biomass planning applications.

Larger scale plants are likely to produce proportionally fewer emissions than small plant due to the difficulties and cost of fitting additional pollution abatement equipment on the latter. Emissions will therefore be more manageable on the larger scale plants that are typically required for heat networks. Heat networks also allow plant to be located some distance from heat delivery points.

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[29] For a list of appliances exempted see: http://www.uksmokecontrolareas.co.uk/appliances.php

[30] It should be noted that the 'HDC Local Air Quality Management Progress Report, 2008' identified 2 exceedances in UKAQOs in 2007 in Cowfold and Storrington. It is therefore likely that 2 AQMAs will be declared in HDC in the near future.

[31] Biomass and Air Quality Guidance for Local Authorities (England and Wales): www.environmental-protection.org.uk/biomass/.

c) Landscape and visual impact

Woodland residues

The sustainable harvesting and use of woodland residues will have minimal impact on the landscape as the activity is concerned only with existing woodland and tends to employ traditional forestry practices and equipment. The cultivation of energy crops, however, will potentially have more of an impact on the landscape depending on the previous land cover, the type of crop, scale and location. The acceptability of generating plant and the issue of crop monocultures may also be factors to consider.

Energy crops

From a visual point of view, Miscanthus is very different from SRC. As Miscanthus is harvested every year, every plantation will go from clear fell to 4 metres in height. With SRC there is likely to be several age classes at different heights grown on adjacent plots. This breaks up the landscape reducing the uniformity as well as providing differing habitats for a range of flora and fauna.

The landscape sensitivity study described in Section 3.1 identified areas which are highly sensitive to energy crops. Chichester Harbour AONB provided data on Brent goose and wader roosting areas, where energy crops would not be suitable, which correspond with the areas identified as highly sensitive[32]. Key findings from the landscape sensitivity study include:

- There is variable sensitivity to Miscanthus crop across the study area - the more pastoral and open landscapes (e.g. the Open Downs and Coastal Harbours) are particularly sensitive to the crop;
- Many landscapes in West Sussex are well wooded and could therefore integrate some short rotation coppice without substantially changing character.

Figure 16 below illustrates the land area available to both Miscanthus and SRC, with overlaps with protected areas removed and areas of high sensitivity to energy crops identified. It shows that although Chichester has a high potential for energy crop development, a large amount is located in protected areas or areas of high sensitivity. Even so, when these areas are excluded, Chichester still has the highest potential for energy crops. After Chichester, Horsham has the second highest potential, with less land area falling within designated areas. Arun has the third highest potential, followed by Mid Sussex. Worthing has relatively little potential for energy crops due to its comparative lack of arable land.

[32] Apart from an area of approximately 50 hectares which overlaps an area identified as suitable for miscanthus.

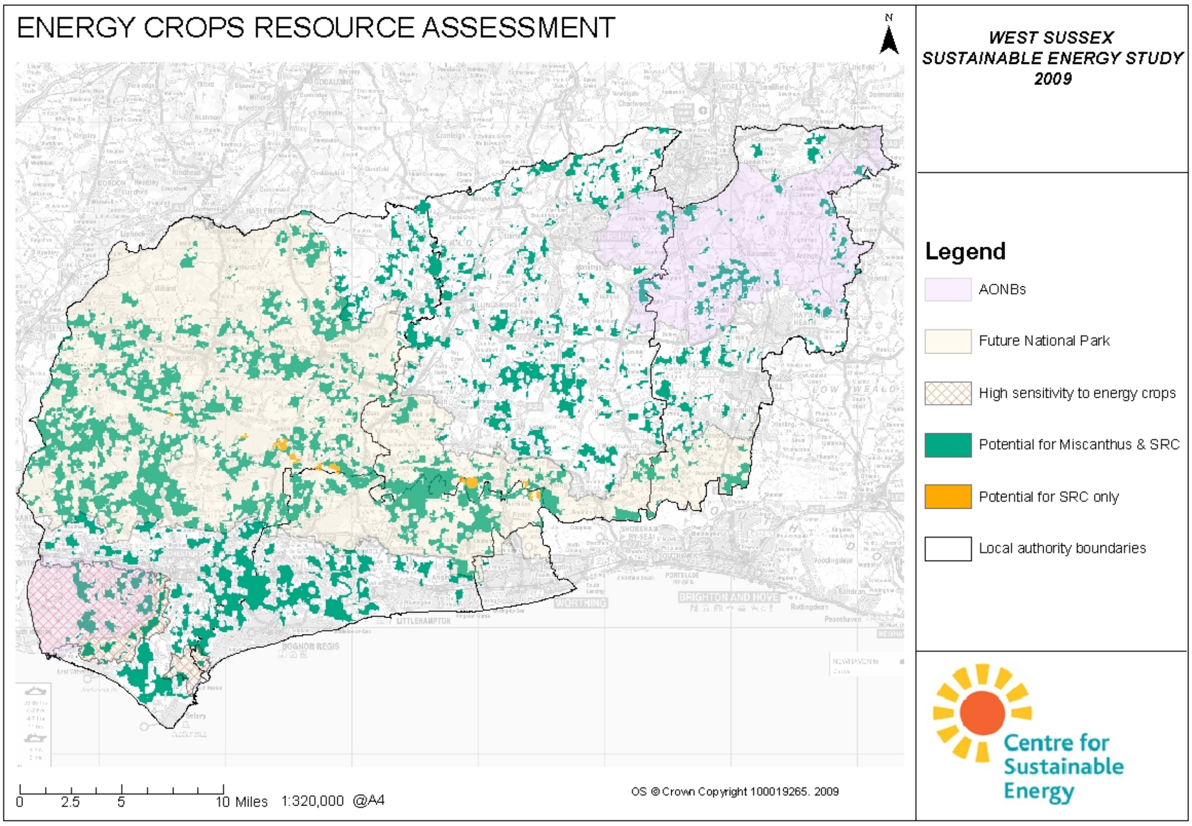

Figure 16: Potential areas for energy crop development

d) Potential energy yield

Woodland residues

The total technical resource available from sustainable management of woodland in West Sussex is shown in the table below along with corresponding energy generation capacity and energy yield. The Sustainable Yield Factor represents the amount of wood that can be sustainably retrieved from woodland from standard forest management practices. The resource identified is assumed to be used in heat-only plant for reasons of fuel cost i.e. the market value of green wood chip or logs is likely to be in excess of that acceptable for larger scale biomass CHP plants.

Table 16: Woodland residue resource across study area

Type	Hectares	Sustainable yield factor [odt/ha/yr][a]	Sustainable annual yield [odt/yr]	Capacity[b] [MWth]	Potential output[c] [MWh/yr]
Broadleaved	16,103	2.588	41,674	60	184,199
Other	12,108	2	24,216	35	107,035
Total	**28,211**	**–**	**65,890**	**95**	**291,234**

Notes:

a) Source: *Woodfuel Supply and Demand in Dorset*. Report to Dorset Woodlink by Crops for Energy and the Centre for Sustainable Energy 2009.

b) Assumes 700 odt (oven dried tones) is required per MWth per year

c) Assumes an energy content of 5,200kWh/odt and a seasonal plant efficiency of 85%

Table 17: **Woodland residue resource** presents the results split by local authority area.

Table 17: Woodland residue resource split by local authority

Local authority	Type	Hectares	Sustainable yield factor [odt/ha/yr]	Sustainable annual yield [odt/yr]	Capacity [MWth]	Potential output [MWh/yr]
Arun	Broadleaved	1,029	2.588	2,664	4	11,773
	Other	12,108	2	24,216	35	107,034
	Total	**13,137**	**–**	**26,880**	**38**	**118,807**
Chichester	Broadleaved	7,725	2.588	19,993	29	88,369
	Other	7,403	2	14,806	21	65,442
	Total	**15,128**	**–**	**34,799**	**50**	**153,811**
Horsham	Broadleaved	3,484	2.588	9,016	13	39,850
	Other	2,027	2	4,053	6	17,916
	Total	**5,510**	**–**	**13,069**	**19**	**57,766**
Mid Sussex	Broadleaved	3,835	2.588	9,925	14	43,866
	Other	3,114	2	6,228	9	27,528
	Total	**6,949**	**–**	**16,153**	**23**	**71,395**
Worthing	Broadleaved	30	2.588	77	0	341
	Other	21	2	42	0	184
	Total	**51**	**–**	**119**	**0**	**526**

Additional sources of virgin woodfuel include residues from arboricultural activities such as urban tree surgery work and untreated residues from timber processing activities. The magnitude of this resource is more difficult to quantify.[33]

Energy crops

Table 18 below quantifies the energy crop resource by applying several land-take scenarios to the theoretical maximum yields. The resource identified is assumed to be used in larger scale CHP plant.

Table 18: Energy crop areas and yields under various constraint scenarios across study area

Land-take scenario	Land area [ha]		Yield [odt/yr]		Capacity[a] [MWe]		Energy[b] [MWh]	
	Mi	SRC	Mi	SRC	Mi	SRC	Mi	SRC
S1. All arable land	38,830	405	621,280	3,240	82.8	0.4	738,436	3,851
S2. All arable land excluding SPA, SAC and Ramsar areas	38,600	405	617,600	3,240	82.3	0.4	734,062	3,851
S3. All arable land excluding designated areas and areas of high sensitivity	14,918	0	238,688	0	31.8	0	283,698	0
S4. Five per cent of land area defined in S2	1,930	20	30,880	162	4.1	0	36,703	193

Notes:

a) Assumes 7,500 odt is required per MWe per year

b) Assumes an energy content of 5,200kWh/odt and a seasonal CHP plant efficiency of 80% with an electricity:heat ratio of 1:2.5

[33] A study by Creative Environmental Networks (CEN) on behalf of West Sussex County Council is currently being undertaken to look at the supply and demand of woodfuel in the county and is expected to examine this in more detail.

Table 19 presents the results split by local authority area.

Table 19: Energy crop areas and yields under various constraint scenarios split by local authority

		Land area [ha]		Yield [odt/yr]		Capacity [MWe]		Energy [MWh]	
Local authority	**Land-take scenario**	**Misc**	**SRC**	**Misc**	**SRC**	**Misc**	**SRC**	**Misc**	**SRC**
Arun	S1	6,442	90	103,072	720	13.7	0.1	122,508	856
	S2	6,438	90	103,008	720	13.7	0.1	122,432	856
	S3	3,008	0	48,128	0	6.4	-	57,204	0
	S4	322	5	5,150	36	0.7	0.0	6,122	43
Chichester	S1	21,196	205	339,136	1,640	45.2	0.2	403,087	1,949
	S2	20,976	205	335,616	1,640	44.7	0.2	398,904	1,949
	S3	5,460	0	87,360	0	11.6	-	103,834	0
	S4	1,049	10	16,781	82	2.2	0.0	19,945	97
Horsham	S1	8,020	110	128,320	880	17.1	0.1	152,517	1,046
	S2	8,015	110	128,240	880	17.1	0.1	152,422	1,046
	S3	5,198	0	83,168	0	11.1	-	98,851	0
	S4	401	6	6,412	44	0.9	0.0	7,621	52
Mid Sussex	S1	3,139	0	50,224	0	6.7	-	59,695	0
	S2	3,139	0	50,224	0	6.7	-	59,695	0
	S3	1,242	0	19,872	0	2.6	-	23,619	0
	S4	157	0	2,511	0	0.3	-	2,985	0
Worthing	S1	33	0	528	0	0.1	-	628	0
	S2	33	0	528	0	0.1	-	628	0
	S3	10	0	160	0	0.0	-	190	0
	S4	2	0	26	0	0.0	-	31	0

Figure 17 below compares the potential energy yields from the four 'land-take' scenarios (S1-S4) from the energy crops and woodland residue resource across the study area.

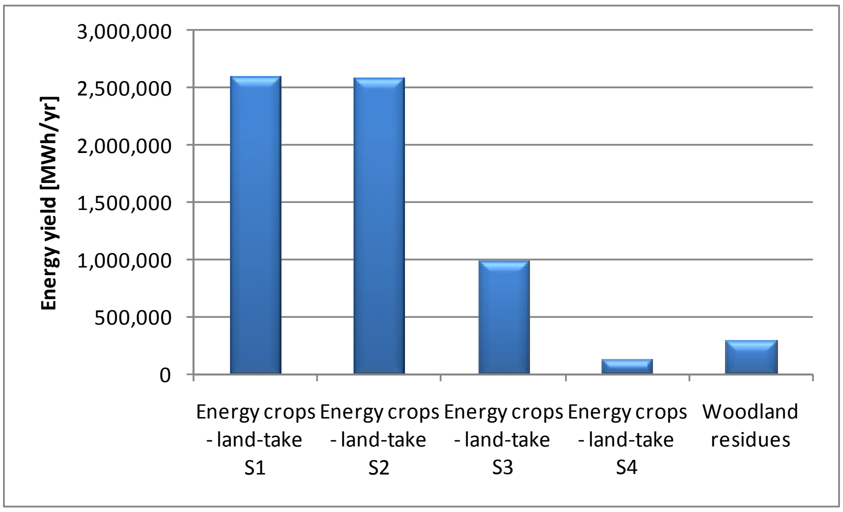

Figure 17: Summary of virgin woodfuel and energy crops resource across study area

3.2.5 Waste

a) Overview

Energy recovery from waste (EfW) provides a double environmental benefit - firstly, the diversion of waste from landfill and, secondly, the recovery of energy, displacing fossil fuel alternatives and reducing CO_2 emissions. Energy plants can generate electricity or both electricity and heat (known as Combined Heat and Power); the generated heat can also be used to drive a cooling process (this is known as Combined Cooling, Heat and Power).

At present the Renewables Obligation Certificates (ROCs) system provides support for electricity produced from the biomass content of waste treated in gasification, pyrolysis, anaerobic digestion and good quality combined heat and power plants. Energy from waste plant is also exempt from the Climate Change Levy, recognising the renewable fraction of waste.

An alternative option to energy recovery from waste plant is to process waste streams into Refuse Derived Fuel (RDF). In this process, non-combustibles, hazardous, and valuable recyclable materials are normally removed before a shredding and/or steam pressurised treatment converts the material to the RDF product, which usually consists of a mix of unrecyclable waste plastics and biodegradable waste. This fuel can then be used to fuel CHP plants.

Waste management is strategically addressed at county level in West Sussex and is currently guided by the Joint Materials Resource Management Strategy (JMRMS) for West Sussex (2005-2035). This strategy is being developed and implemented by the County Council, the Borough and District Councils, and the Environment Agency to meet European obligations and national long-term targets regarding waste reduction, recycling and other aims.

Although there are a number of landfill sites and waste treatment facilities in the county, there is an urgent need to expand new waste management facilities. The JMRMS outlines a number of scenarios for deployment of waste technologies to help meet targets. These scenarios put forward options for centralised and/or decentralised plants employing a range of technologies.

b) Technical constraints and limitations

The Waste Strategy for England 2007 recommends use of a waste management hierarchy as follows:

1. Reduce
2. Re-use
3. Recycle
4. Recover
5. Dispose

It also sets the following targets in relation to the treatment of waste:

- recycling and composting of household waste – at least 40% by 2010, 45% by 2015 and 50% by 2020; and
- recovery of municipal waste – 53% by 2010, 67% by 2015 and 75% by 2020.

Energy recovery from waste must therefore be considered in the light of the hierarchy above in terms of priorities. Many local authorities currently practice the recycling of paper, card, textiles, plastics, metals and glass and the composting of food and garden waste.

In evaluating the resource a number of data sources have been used to establish tonnages that could potentially be converted to energy (see section on potential energy yield below). However, the majority of the raw resource is shown in Table 20, which indicates the total controlled waste arisings in West Sussex for 2004/05.

Table 20: Total controlled waste arisings in West Sussex (source: JMRMS 2004/05 figures)

Waste stream	Quantity [tonnes/yr]
Municipal Solid Waste	464,341
Commercial and industrial waste	819,425
Construction and demolition waste	1,447,652

Agricultural waste also represents a significant resource. Defra statistics on animal numbers[34] for 2007 suggest a total yield of 650,197 tonnes/yr from cattle and pig slurry and 27,006 tonnes/yr from poultry litter.

Waste wood

Varying amounts of wood waste will be included within all of the controlled waste streams. This will comprise of a range of materials from a variety of sources and, as discussed in the woodfuel section above, will contain a mixture of clean and contaminated wood which will influence the type and scale of energy plant in which it can be used. Contaminated wood is classified under stricter pollution control legislation and suitable energy plants tend to be larger scale in order to justify the more costly and complex emission control technology required. Separating clean from contaminated wood can be a costly and difficult process and is unlikely to be viable unless there is an efficient way of undertaking this at source.

Typical sources of waste wood are as follows:

- Packaging waste
- Construction and demolition waste
- Secondary wood processing industry waste e.g. off cuts from furniture manufacturing, joinery, wood shavings, sawdust or similar
- Municipal/household waste including civic amenity (CA) sites

The mixed content of waste streams therefore makes it difficult to quantify the waste wood resource, although it is considered to be significant. Figures from a regional study by WRAP[35] suggest that the total waste wood arising in the South East has been estimated to 950,000 tonnes per year with 35% arising from the construction and demolition sector, 30% from packaging, 25% from municipal waste, 5% from secondary wood processing industries and up to 5% from other minor sources. About 650,000 tonnes of this is thought to end up in landfill with the remainder going to such uses as the panelboard industry, mulch, animal bedding, wood recycling, etc.

Taking a pro rata figure (on population) for the study area, a broad estimate of landfilled wood waste would be 60,729 tonnes per year. A significant proportion of this will be counted within the MSW and commercial/industrial waste resource assessment, however wood waste from construction and demolition can be considered separately. Applying similar assumptions to the regional resource from this waste stream results in an estimated total of 21,255 tonnes per year in the study area.

[34] Figures quoted from the Agricultural and Horticultural Survey – England (June 2007), Defra, for the five LAs involved in this study
[35] Wood Recovery Infrastructure in South East England, WRAP (2005) (Page 7)

c) Landscape and visual impact

Energy plants vary in their appearance depending on technology and scale, but normally comprise a number of buildings, which can be several storeys high, to house equipment and sufficient surrounding space to accommodate waste transfer vehicles and deliveries. Incineration, gasification and pyrolysis plants are more common at the larger scale and will also incorporate a chimney of varying height depending on the scale of the plant. Anaerobic digestion is more common at the smaller scale and is normally used to process food and agricultural waste.

d) Potential energy yield

Table 21 below summarises the estimated resource potentially available from the above waste streams for energy recovery processes. Due to the county-wide structure of waste management and the data sources used, the resource is evaluated for West Sussex as a whole but has also been assessed per local authority on a demographic pro rata basis (Table 22). Figure 18 below summarises the potential energy yields across the study area.

Table 21: Estimated quantities, capacities and energy yields of waste available for energy recovery across study area

Waste stream available for energy recovery	Quantity [tonnes/yr]	Generation capacity[a] [MW_e]	Total energy yield[b] [MWh/yr]
Commercial and industrial waste[c]	245,828	24.6	678,337
Municipal Solid Waste[d]	95,190	9.5	262,667
Agricultural waste[e]	677,203	4.0	110,459
Waste wood - Construction & Demolition	21,255	2.8	88,422
Food waste – commercial and industrial[g]	98,331	0.5	14,627
Food waste – Municipal Solid Waste[h]	83,581	0.5	12,433
Total	**1,221,388**	**41.9**	**1,166,944**

Notes:

a) MSW and commercial/industrial waste have a lower calorific value than wood and in estimating potential plant size, a figure of 10,000 tonnes per year is assumed for each MWe of electrical generation capacity.[36]

b) Assumes that plants are operated as Combined Heat and Power (CHP) units with an electricity:heat output ratio of 1:2.5

c) Assumes 30% of resource available for energy recovery (minus food waste)

d) Figures shown are residual amounts of combustible materials after recycling and organic fractions have been diverted

e) Assumes anaerobic digestion is employed for cattle and pig waste. 30 cattle = 1 tonne slurry/day; 275 pigs = 1 tonne slurry/day; 50% is collected. 10,000 poultry birds = 365 tonnes litter/yr.[37]

f) See section on waste wood above.

g) Assumes 12% of total commercial and industrial waste is food waste[38]. Assumes anaerobic digestion is employed.

h) Assumes 18% of total MSW is food waste[39]. Assumes anaerobic digestion is employed.

[36] Based on Municipal Solid Waste with a calorific value of 14 GJ/tonne (source – *Stepping Forward – a resource flow and ecological footprint analysis of the South West of England; Scenarios Report* (2005).
[37] Assumptions taken from *REvision 2020 – South West Renewable Electricity, Heat and On-site Generation Targets for 2020* – see http://www.oursouthwest.com/revision2020
[38] Environment Agency: Commercial and Industrial Waste Survey 2002/03
[39] UK Energy Strategy 2007, Annex C1

Table 22: Estimated quantities, capacities and energy yields of waste available for energy recovery per local authority

Local authority	Waste stream available for energy recovery	Quantity [tonnes/yr]	Generation capacity [MWe]	Total energy yield [MWh/yr]
Arun	Commercial and industrial waste	48,091	4.8	132,702
	Municipal Solid Waste	19,280	1.9	53,202
	Agricultural waste	69,262	0.2	6,787
	Waste wood - Construction & Demolition	4,305	0.6	17,909
	Food waste – commercial and industrial	19,236	0.1	2,861
	Food waste – Municipal Solid Waste	16,929	0.1	2,518
	Total	**177,104**	**7.8**	**215,980**
Chichester	Commercial and industrial waste	60,953	6.1	168,195
	Municipal Solid Waste	13,941	1.4	38,469
	Agricultural waste	267,823	1.1	30,223
	Waste wood - Construction & Demolition	3,113	0.4	12,950
	Food waste – commercial and industrial	24,381	0.1	3,627
	Food waste – Municipal Solid Waste	12,241	0.1	1,821
	Total	**382,453**	**9.2**	**255,284**
Horsham	Commercial and industrial waste	18,958	1.9	52,313
	Municipal Solid Waste	15,424	1.5	42,562
	Agricultural waste	232,196	2.3	63,483
	Waste wood - Construction & Demolition	3,444	0.5	14,328
	Food waste – commercial and industrial	7,583	0.0	1,128
	Food waste – Municipal Solid Waste	13,543	0.1	2,015
	Total	**291,149**	**6.3**	**175,828**
Mid Sussex	Commercial and industrial waste	64,025	6.4	176,671
	Municipal Solid Waste	15,721	1.6	43,380
	Agricultural waste	107,922	0.4	9,966
	Waste wood - Construction & Demolition	3,510	0.5	14,603
	Food waste – commercial and industrial	25,610	0.1	3,809
	Food waste – Municipal Solid Waste	13,804	0.1	2,053
	Total	**230,592**	**9.0**	**250,483**
Worthing	Commercial and industrial waste	15,670	1.6	43,241
	Municipal Solid Waste	13,348	1.3	36,832
	Agricultural waste	0	0.0	0
	Waste wood - Construction & Demolition	2,980	0.4	12,399
	Food waste – commercial and industrial	6,268	0.0	932
	Food waste – Municipal Solid Waste	11,720	0.1	1,743
	Total	**49,987**	**3.4**	**95,147**

Note: figures may not sum to totals due to rounding

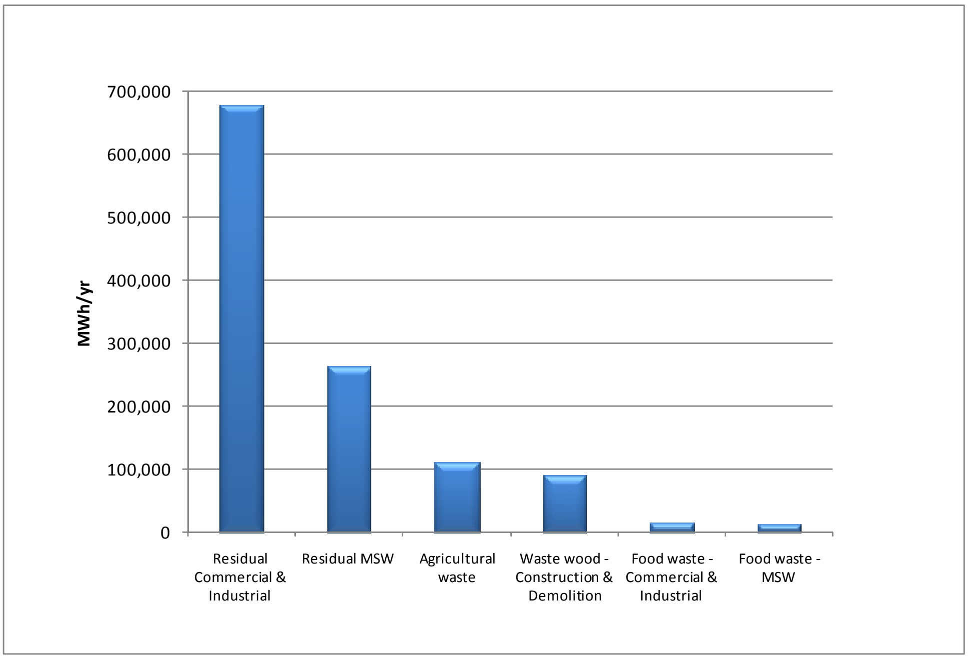

Figure 18: Summary of energy yields from waste resource across study area

3.2.6 Solar

a) Overview

The two main solar technologies comprise solar photovoltaics (PV) for electricity generation and solar water heating. Both use a form of panel or array to harness energy in sunlight. The vast majority of installations are on the roofs or façades of buildings and are usually either retrofit to existing buildings or integrated within new build.

Solar PV is often favoured by developers as it is simple to install, can form part of a building's structure (often offsetting costs of conventional materials) and is currently the most accessible (but more expensive) alternative to wind power for generating zero carbon electricity. Solar water heating is also straightforward to install, is much cheaper and typically requires less roof space than PV. However solar water heating saves considerably less carbon than solar PV per square meter installed.

b) Technical constraints and limitations

Both solar photovoltaics and solar water heating are inextricably linked to buildings in the vast majority of applications in that they require roof or façade space for unshaded access to sunlight. The technical resource is therefore vast and is dependent on south-facing unshaded roof areas. The extent to which these solar technologies are exploited on new development will therefore depend on the preferred mix of technologies a developer will choose to meet a particular emissions target – usually based on the least cost option.

In order to meet more demanding carbon reduction targets on new development, both technologies will in most cases need to be implemented alongside other measures. Solar water heating is limited to supplying a proportion of a building's hot water demand, which in itself may comprise a relatively small proportion of total energy demand, whilst PV can be limited in its capacity to meet electricity demand by lack of roof space, particularly on larger multi-storey buildings.

High capital costs, particularly for PV, severely limit their application on existing development and rate of uptake therefore tends to be linked to availability of grants and other financial incentives.

c) Landscape and visual impact

Solar systems can have a modernising effect on buildings and there are certain constraints on their use in conservation areas and on listed buildings. Generally they have no other significant visual impact other than more site-specific issues such as the impact of glare on adjacent buildings.

d) Potential energy yield

The solar resource in this study has been evaluated by considering the total number of buildings i.e. roofs in the study area and applying assumptions regarding the applicability of appropriately sized solar energy systems. Table 23 and Table 24 below indicate the resource per local authority. Figure 19 shows the estimated annual energy yields for each technology.

Table 23: Solar PV resource

District	No. of residential buildings[a]	No. of non-residential buildings[a]	Total capacity[b] of residential 2kW systems [MW]	Total capacity[c] of non-residential 5kW systems [MW]	Total energy yield [MWh/yr]
Arun	13551	4008	7	10.02	13,242
Chichester	15847	5080	8	12.7	16,260
Horsham	15493	1580	8	3.95	9,222
Mid Sussex	12771	5336	6	13.34	15,552
Worthing	7125	1306	4	3.265	5,383
Total	64787	17310	**32**	**43.275**	**59,657**

Table 24: Solar water heating resource

District	No. of residential buildings	No. of non-residential buildings	Total capacity[d] of residential 2.1kW systems [MW]	Total capacity[e] of non-residential 5kW systems [MW]	Total energy yield [MWh/yr]
Arun	13551	4008	7	2.505	6,337
Chichester	15847	5080	8	3.175	7,605
Horsham	15493	1580	8	0.9875	5,766
Mid Sussex	12771	5336	7	3.335	6,741
Worthing	7125	1306	4	0.81625	2,937
Total	**64787**	**17310**	**34**	**10.81875**	**29,386**

Notes:

a) The number of buildings has been calculated from Local Land and Property Gazetteers, provided by each individual local authority
b) Assumes 25% of residential roofs will be suitable for 2kW systems having a load factor of 0.09
c) Assumes 50% of non-residential roofs will be suitable for 5kW systems having a load factor of 0.09
d) Assumes 25% of residential roofs will be suitable for 2.1kW systems having a load factor of 0.07. This size system is approximately equivalent to a typical 3m^2 panel domestic installation.
e) Assumes 50% of non-residential roofs will be suitable for 5kW systems having a load factor of 0.07, but only 0.25 of these would have compatible solar water heating requirements

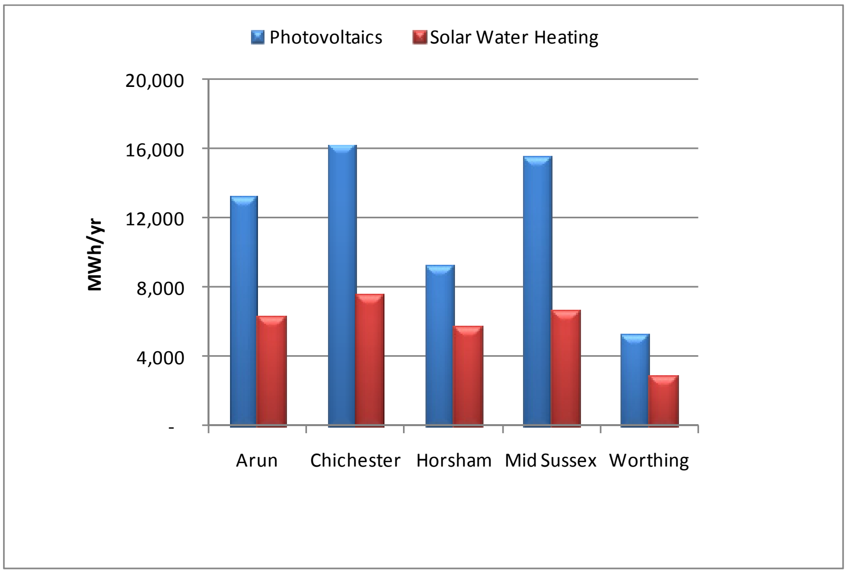

Figure 19: Solar energy resource across the study area

3.2.7 Heat pumps

a) Overview

Heat pumps extract heat from the ground, air or bodies of water so in an urban environment the medium of ground and air are of most relevance. The technology works by using an electrically-driven pump and compressor to drive a heat carrier around a condensing/evaporating circuit, similar to a standard refrigeration system. For ground source heat pumps, the heat required for the evaporation stage is obtained from a ground loop buried in the ground. The condensing stage then delivers heat to a distribution system within a building. The cycle can also be designed to provide cooling.

The efficiency of the system (Coefficient of Performance) depends on the number of units of heat that are transferred (usually 3 to 4) as a result of each unit of electricity input. Although not strictly a renewable technology where mains electricity is used, the system can still offer significant carbon savings over certain conventional fossil fuel systems.

b) Technical constraints and limitations

Due to the heat sources considered, the potential resource for this technology is extremely large as in theory almost every building could have either an air or ground source system. However a number of technical constraints limit the use of heat pumps. For ground source systems, the availability of space around buildings for ground loop installations is a constraining factor. Ground loops can be either laid in trenches or boreholes and although the latter require less space, they involve greater cost. Whilst air source systems are cheaper, simpler to install and do not require any groundworks, they rely on ambient air temperature to provide heating and so operate at reduced efficiencies during winter periods.

Installations in older existing buildings are very limited as the technology works best in highly insulated buildings with low temperature heat distribution systems such as underfloor heating. The building heating demands and load profile needs to be well understood in order to optimise the design of a system. Heat pumps are rarely designed to provide 100% of heat requirements as capital costs are then likely to be excessive. They are instead usually sized to provide a proportion of heat requirements with back-up being provided by conventional systems such as gas boilers or electric immersion heaters for very cold periods.

Emission savings will vary depending on type of building, the fuel displaced and the proportion of total heat demand supplied. Take up rates are mostly driven by new development and the likely technology mix chosen by developers in meeting emissions targets. On the basis of capital cost per tonne of carbon saved, heat pumps are currently a relatively expensive low carbon technology and in general developers are less likely to choose them over more cost effective options such as biomass heating.

c) Landscape and visual impact

Once installed ground source heat pumps are not visible externally as the ground loop is hidden under the ground and the heat pump unit is located within the building. Their visual impact is therefore minimal. Air source heat pumps are aesthetically similar to standard air conditioning units seen on the external walls of buildings and will therefore have a limited visual impact.

d) Potential energy yield

As heat pump installations will tend to be limited to new development it is difficult to quantify the resource for the reasons described above. The analysis presented in Section 6 assumes a least-cost approach to the choice of technologies in meeting specific targets and therefore, for the purpose of modelling, heat pumps are excluded due to their relatively high capital cost.

3.3 Summary

Figure 20 below summarises the resource assessment by comparing the technical resource, in terms of installed MW capacity, of the technologies considered. Also shown are the capacities for wind and energy crops when a set of constraints are applied i.e. designated areas and areas of high landscape sensitivity for wind, and a 5% land-take of suitable arable land for energy crops (see previous sections). Figure 21 presents the same information but in terms of the potential carbon savings from each resource when compared with the overall area-wide carbon emissions from the five districts under study (see Section 1.2).

It can be seen that although the large scale wind resource is virtually eliminated when the constraints are applied, there still remains a significant medium/small-scale wind resource. However, much higher numbers of (smaller) turbines would be required to realise this resource when compared to the equivalent capacity of large-scale turbines.

The two graphs serve a purpose in highlighting the difference between installed capacity and annual energy yield – the latter of which equates to annual carbon emissions. For example, one MW of wind capacity does not produce the same annual electricity yield as one MW of biomass CHP, as wind turbines are more intermittent in their operation and hence have lower load factors. Additionally, the energy crop and waste resource capacity are expressed separately in terms of their electrical and heat output from CHP plant. The actual resource becomes much more significant when expressed in terms of total energy yields or carbon reduction potential from the combined production of heat and electricity.

Figure 22 to Figure 26 present the resource assessment results in terms of potential carbon savings for each local authority. The results are also tabulated in Annex A.

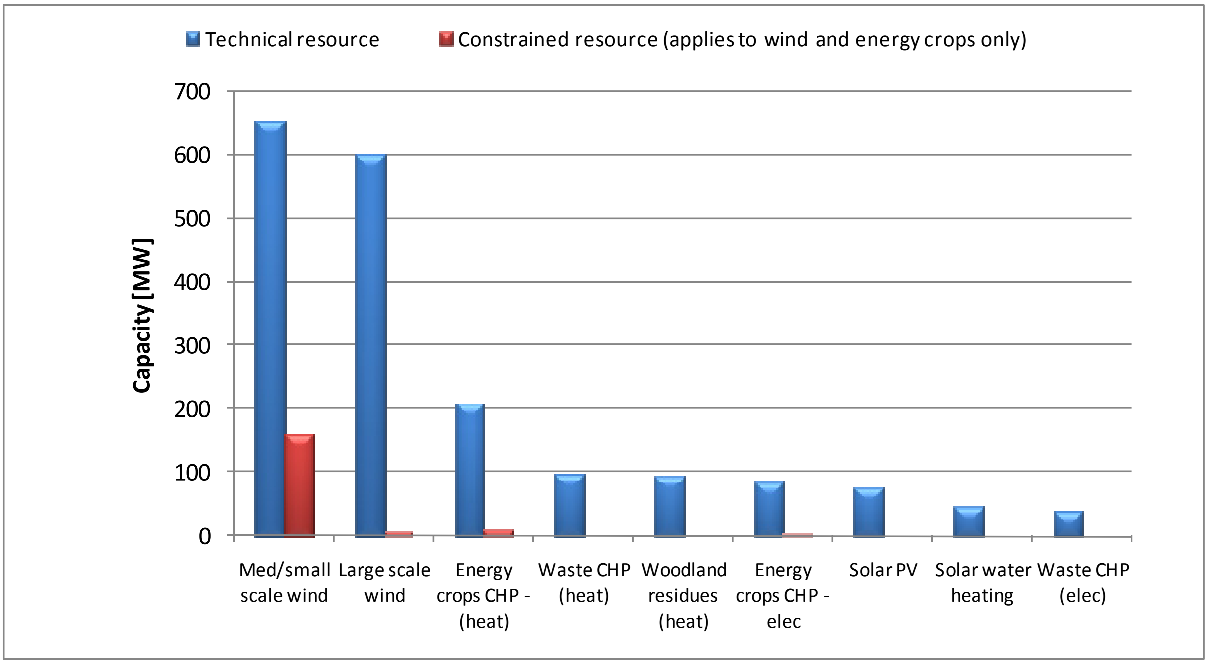

Figure 20: Summary of resource assessment for study area showing the technical resource as installed capacity for each technology. Also shown is the installed capacity from the constrained resource for wind and energy crops (i.e. constraint 'C' for wind and 5% land-take for energy crops).

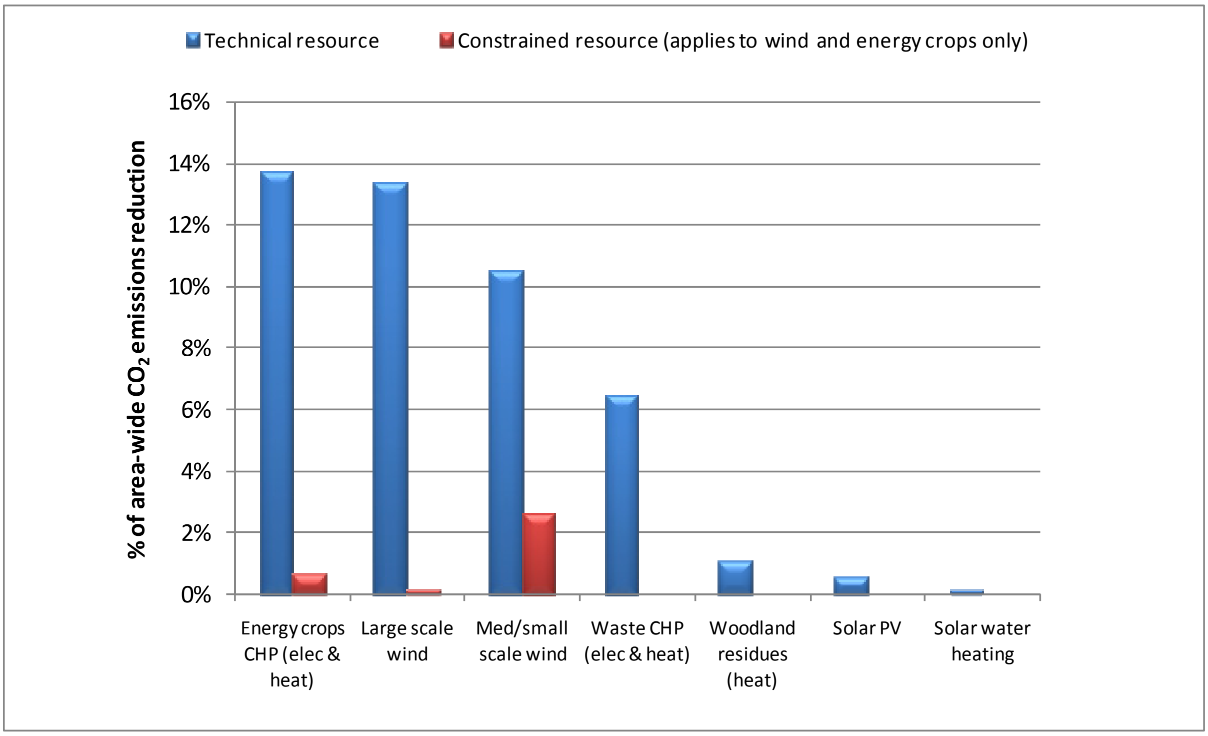

Figure 21: Summary of resource assessment for study area showing the potential proportional contributions from each technology to savings of area-wide carbon emissions. Also shown is the emissions reduction from the constrained resource for wind and energy crops (i.e. constraint 'C' for wind and 5% land-take for energy crops).

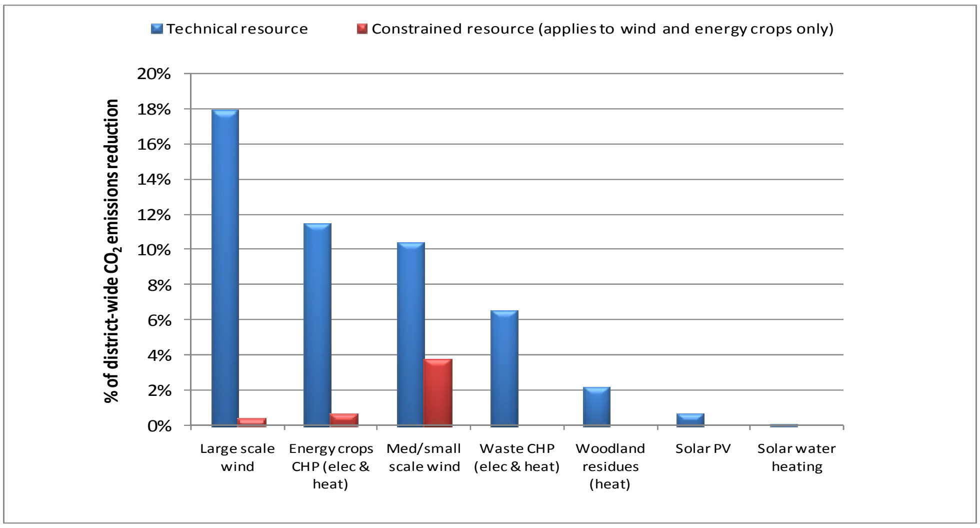

Figure 22: Summary of resource assessment for Arun

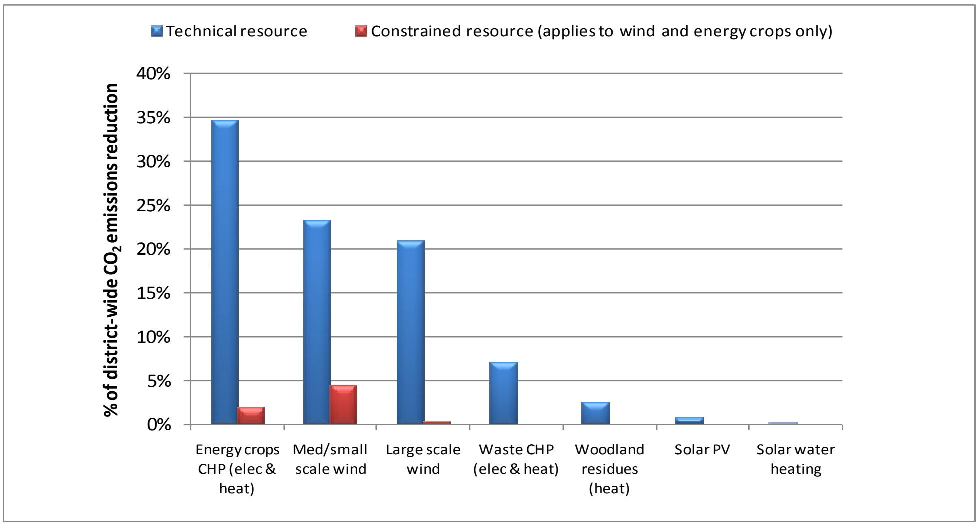

Figure 23: Summary of resource assessment for Chichester

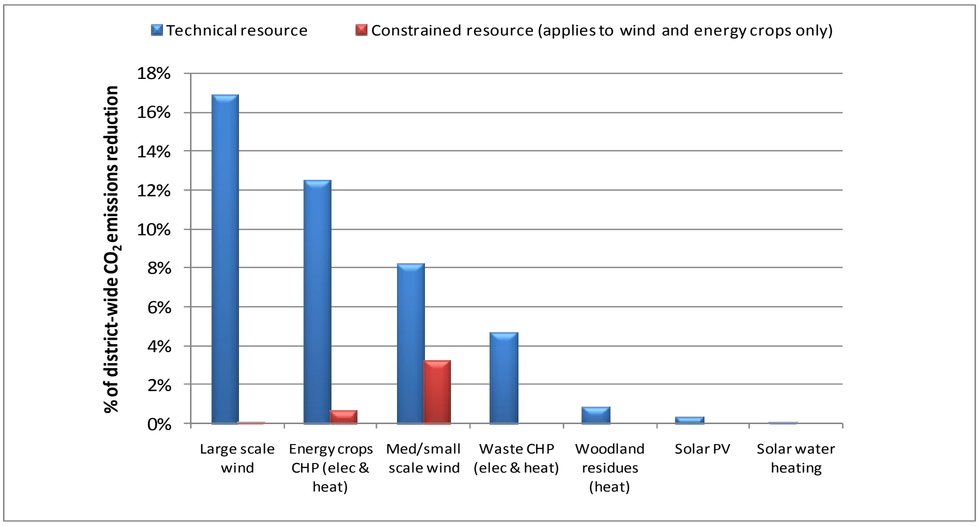

Figure 24: Summary of resource assessment for Horsham

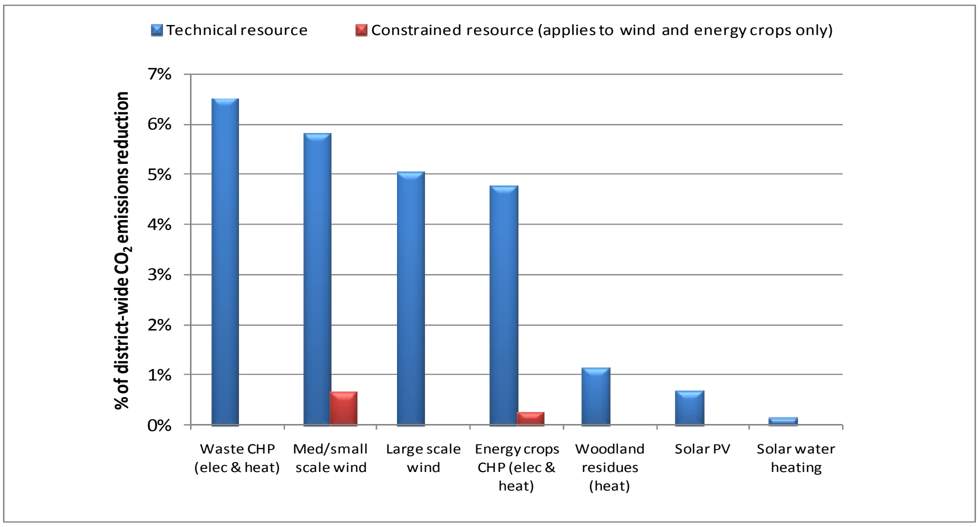

Figure 25: Summary of resource assessment for Mid Sussex

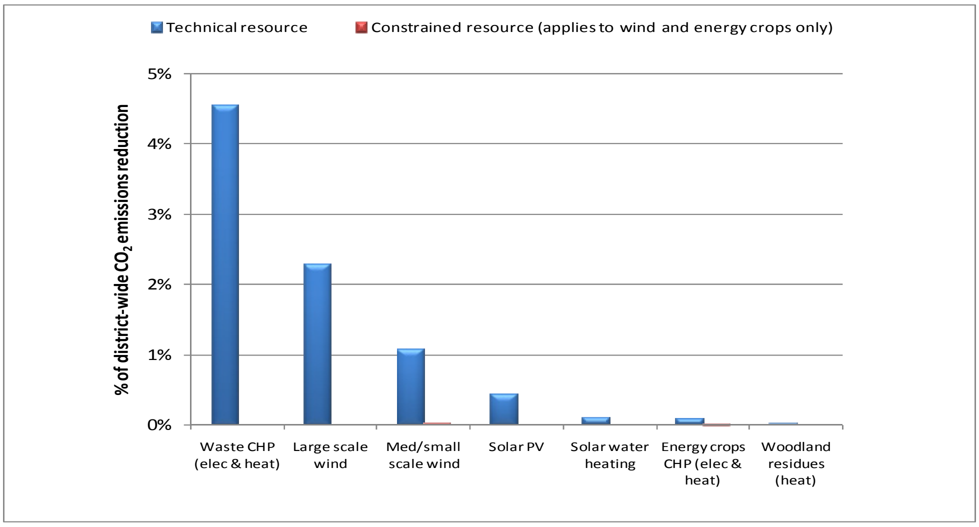

Figure 26: Summary of resource assessment for Worthing

4 Application of technologies – scale and hierarchy

4.1 Scale of technology

Micro-scale options for local low or zero carbon energy supply can generally be considered as technologies that can be applied to individual buildings. These include:

- Small and micro-scale wind
- Solar photovoltaics (PV)
- Solar water heating
- Ground and air source heat pumps
- Biomass heating
- Micro CHP

Macro-scale options for local low or zero carbon energy supply to developments are generally limited to:

- Medium/large scale wind turbines
- gas/wood/waste fired CHP plants coupled to district heating systems
- anaerobic digestion plants.

An example of where the macro-scale approach may be more appropriate concerns denser urban areas with larger-scale mixed use developments. Where commercial buildings are present, micro-scale options tend to have less potential in meeting higher carbon reduction targets due to the energy usage profiles, which, due to cooling requirements, mean that the electrical load is often considerably larger than the heat load. To achieve higher carbon reduction targets, the bulk of carbon savings therefore need to come from electricity, which, when considering micro-renewables, effectively leaves wind and photovoltaics. Although both can have applications in urban settings, they are limited in their ability to achieve drastic carbon savings.

The main reasons for this are that all scales of wind power are limited by the lower wind speeds (and lack of space) encountered in built up areas, and that the limited areas of roof and façade space available for PV installations tend to constrain the savings that can be achieved. Whilst there could be opportunities for small-scale biomass heating (subject to sufficient space being available for plant room, fuel storage and access for fuel deliveries), only a small proportion of savings would be achieved due to the relatively low heat demands. With little hot water demand solar thermal generation is also significantly constrained. Using a combination of micro-scale technologies may achieve higher carbon savings but would be considerably less cost-effective than a macro-scale approach, such as CHP with district heating (see Section 5).

Nevertheless micro-scale solutions have many applications – particularly for small-scale developments, rural communities or where lower targets apply i.e. during the earlier phases of the policy scenarios considered in this report or in meeting Merton-style on-site generation targets.

4.2 Energy hierarchy

Defining a hierarchical approach to the application of technologies can be a useful way to make the most appropriate choice. An energy hierarchy is a simple conceptual tool which can be used as an organising and justifying principle in energy policy development, including in the context of planning policy. The hierarchy states the priority order to be adopted when matching energy demand with supply as follows:

1. apply energy efficiency measures to reduce demand as far as possible
2. meet the reduced demand with as much renewable energy as is practical
3. meet any residual demand using the lowest carbon non-renewable energy sources

Following this hierarchy ensures that the lowest-carbon outcomes are achieved in a given context. It is of course important to note that in real-world situations (such as planning negotiations), the cost and practicality of measures in these three categories will have a significant bearing on the outcome.

Heating systems installed in new developments are significant enough to warrant specific attention in planning policy for two main reasons. Firstly, space and water heating contributes around 40-50% of total carbon emissions from new buildings, and there are significant carbon savings available by using more efficient and/or low carbon heating systems.

Secondly, in urban areas, large scale heat distribution has a key role to play in reducing emissions both from new and existing buildings. New development can facilitate both the creation and extension of heat distribution networks – either through the installation of a new site-wide heat network supplied from on-site heating plant, or by connecting as extensions to existing networks, thereby improving their economics and spatial coverage.

The specific heat source is independent of the need for a heat distribution network, which itself will facilitate emissions reductions through allowing the use of larger scale (and hence more efficient) heat sources. In addition, heat networks have much longer lifetimes than the boiler plants that supply them – hence, over time a heat distribution network could facilitate a move from gas, to combined heat and power, or biomass etc.

There is therefore an order of preference for heating systems in new developments, which embodies the issues discussed above – i.e. maximising the opportunities for large-scale heat distribution and minimising site emissions from heat consumption. Because emissions from existing buildings far exceed those from new development, it is appropriate to prioritise support for the creation of new/development of existing heat distribution networks. The following hierarchy takes this into account:

1. Connection to existing heat/cooling networks
2. Site wide renewable CCHP (combined cooling, heat and power)
3. Site wide gas-fired CCHP
4. Site wide renewable community heating/cooling
5. Site wide gas-fired community heating/cooling
6. Individual building renewable heating

Note that this hierarchy excludes electrical heating altogether. There are three reasons for doing this: (1) electrical heating is the most carbon intense way to heat space or water; (2) electrical heating is the most expensive way to heat space or water; and (3) it is expensive to connect electrically heated buildings to a district heating network, because the entire heating system would need to be replaced with a 'wet' system to do so.

5 CHP/district heating and building energy demand

5.1 CHP/district heating

Decentralised energy systems used to directly serve buildings usually provide heat and power (combined heat and power - CHP), or just heat (district heating). The most common form of decentralised energy supply is community or district heating. This is where space heating and hot water is delivered to multiple occupants from a local plant via a network of insulated pipes buried in the ground. The pipe network can be installed at the same time as other services (water, drainage, etc.) to minimise costs in new developments. This type of system is also suitable for existing buildings, although a programme of works would be required for retrofitting.

Another option is to use a combined heat and power (CHP) system as part of a district heating scheme. A CHP system generates electricity and uses the heat produced during this process in a productive way, e.g. for local heat loads. It can also be used to deliver cooling through a process known as adsorption chilling. Remote electricity generation is often only around 30% efficient, compared to 75% or more for Combined Heat and Power[40], which as well as utilising the 'waste' heat also avoids the losses incurred when electricity travels large distances over transmission and distribution networks. A local decentralised community energy system can help tackle these issues through decreased transmission and distribution losses and by capturing and using the waste heat in buildings in a variety of ways.

In the UK, most district heating networks are either linked to a gas-fired CHP system, or use waste heat already generated from industry. Whilst gas-CHP is a low carbon technology due to its high efficiency, biomass-CHP offers even greater carbon savings as the fuel is close to being carbon neutral.

Biomass CHP is still an emerging technology and several high profile, large-scale schemes have experienced teething problems. However, reliability appears to be increasing, and attention has recently turned towards smaller plants. For example, the Government is funding five new biomass CHP plants through its Bioenergy Capital Grants Scheme – in Somerset, Wiltshire, Devon and Staffordshire. Although capital costs associated with biomass boilers are generally much higher than fossil fuelled boilers with a similar output rating, the Renewable Heat Incentive that will come into play in 2011 is likely to increase commercial interest in biomass-fired district heating/CHP projects.

Recent years have seen a number of heat-only networks being created that are powered by biomass, mostly in off-gas areas where the high cost of electric, oil or LPG heating makes district heating more financially attractive.

Larger-scale anaerobic digestion plant can also potentially be operated as a CHP system. However, these plants are usually located in less-developed areas and the challenge of identifying a suitable heat load tends to restrict their use.

The size of district heating and CHP systems should be determined by the heat and electrical loads of the site in which they are to be installed. This can range from a few kilowatts up to several megawatts. As a general rule, systems become more economic the larger they are.

Systems can be installed as follows:

- Block-by-block – each block in a development has its own communal energy installation and distribution system. This would usually only apply to larger tower blocks;

[40] Defra: www.defra.gov.uk/environment/climatechange/uk/energy/chp/.

- Site-wide – a single energy generation source serves several buildings connected by a district heating network (more generation sources can be added as demand changes, for example in phased developments); or
- City-wide – where larger units are used to supply heat and power to whole areas, not just individual developments, as seen in Woking, Southampton, Nottingham and Sheffield.

District heating and CHP systems have received bad publicity in the past. This is because some early technologies were found to be inefficient and unreliable and they could often not be controlled on an individual household basis. However, several systems did work effectively and still do, and modern system designers have benefited from lessons learned from the experience of their predecessors, with heat now controlled and metered.

Historically, schemes have only been considered financially viable in large scale, high density developments with a good balance of heat load (e.g. residential mixed with leisure, schools, hospitals, businesses, etc.). However, with the drive for lower emissions from new buildings, it is anticipated that CHP/district heating will become more common in smaller, lower density developments.

The key benefits and barriers to the deployment of larger scale CHP/district heating can be summarised as follows:

Table 25: Key benefits and barriers to larger scale CHP/district heating

Benefits	Barriers
a) Allows the use of larger scale, higher efficiency, lower unit cost, and lower carbon heat sources; b) Biomass-burning systems can approach carbon neutrality (and bring other related benefits, such as creating new jobs in the biomass supply chain); c) Excess electrical production can be exported back to the grid if it is not sold directly to the local community via a private wire network; d) Fuel flexibility: while hot water is the energy carrier, the heat itself can be derived from a wide range of fuel, plant and conversion process types, including traditional gas boilers, biomass boilers, gas or biomass CHP systems, and importantly, waste heat from existing processes such as power generation and waste incineration; e) Potential for significant carbon reductions from heat use in existing buildings; f) Long lifetime (decades) and low maintenance costs.	a) The technology is only suitable for higher density developments - the Energy Saving Trust recommends that housing developments using CHP meet a minimum density of 50 dwellings per hectare; b) Biomass systems require reliable fuel supply (and storage space), while non-renewable systems will need to be connected to the national gas grid; c) There is a high initial cost of the infrastructure – particularly the pipe network d) The need for long term commitment to the development and running of a network. The UK's energy policy is based on choice whereas CHP/district heating developments require long term commitment by consumers if the network is to remain economic; e) The need to identify a balanced heat load that has varied demand patterns and peaks – mixing domestic, commercial/industrial, institutional loads is desirable; f) The technology has received bad publicity in the past, including reliability and controllability issues. Whilst these have been overcome, public resistance may remain

To investigate measures such as CHP/district heating that may be appropriate in reducing CO_2 emissions from buildings, it is important to establish energy demands – both for existing and new buildings over the period of study. Electricity and heat demands and their spatial distribution will influence the choice of technologies and hence the viability of reaching specific emission reduction targets.

Heat demand density maps are a useful way to evaluate the scale, magnitude and density of heat demand for specific groups of buildings or larger areas. They can be used to assess the impact of applying certain threshold criteria for district heating systems and for prioritising areas of high heat demand density that hold most potential for district heating. Importantly, they also indicate areas most appropriate for the deployment of combined heat and power systems, which offer significant carbon savings when compared with heat- or power-only generation technologies.

5.2 Heat demand from existing buildings

In addressing carbon emissions from buildings, two key approaches must be exploited. The first is demand reduction through a combination of increased energy efficiency and behaviour change, and the second is the utilisation of low or zero carbon sources of heat and electricity. The focus of this project is on the potential for decentralised sustainable energy supply alongside building standards for new development, and the potential for the local supply of low or zero carbon heat is particularly relevant to existing buildings through the deployment of district heating networks and combined heat and power (CHP) systems.

As discussed above, district heating in urban areas has a key role to play in facilitating a shift from the current predominant use of gas and electricity for space heating, towards lower carbon heat sources and CHP, in both new and importantly, existing buildings.

A number of factors influence the viability of district heating networks. Among the most important of these is heat demand density – i.e. units of heat demand per square metre over a year. Heat density maps are therefore used to evaluate the location and scale of opportunities for district heating.

Another important factor is the potential for connecting new development to existing district heating networks, or for establishing new district heating networks at new development sites. An initial assessment of the areas of highest potential for district heating can therefore be carried out by mapping density of existing heat demand alongside the expected locations of new developments.

To achieve this for West Sussex, spatial data on energy consumption from existing development in the study area were obtained from BIS (formerly BERR) local energy consumption statistics, which provide electricity and gas consumption data at Middle Layer Super Output Area level. For non-metered fuels, BIS provides data at local authority level.

Consumption of heating fuels was calculated from this data and reprocessed in a 50m grid GIS database model, using data from local authorities' Local Land and Property Gazetteer data to determine the locations of buildings. Consumption of non-metered heating fuel was then distributed based on the locations of buildings in areas identified as not being served by the gas distribution network.

The resulting spatial demand for heat is shown in the figure below.

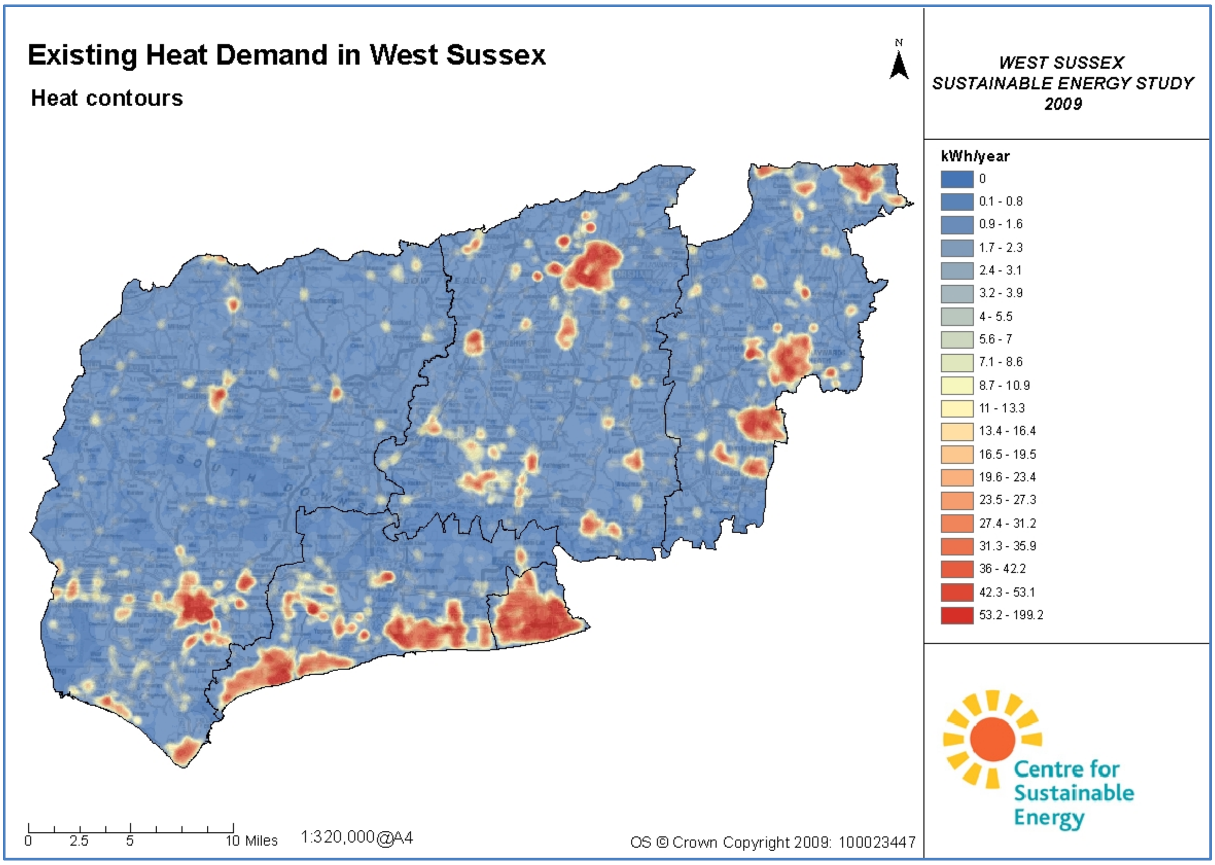

Figure 27: Heat demand in West Sussex from existing development

Table 26 shows total building-related electricity and gas consumption split between domestic and industrial / commercial users.

Table 26: Energy consumption statistics for Arun, Chichester, Horsham, Mid Sussex and Worthing[41]

Sector	Electricity [MWh/yr]	Gas [MWh/yr]	Other [MWh/yr]	Total [MWh/yr]	CO_2 emissions [tonnes/yr]
Domestic heat	523,879	3,941,040	471,591	4,936,509	1,143,398
Domestic power	830,720	–	–	830,720	446,097
Total domestic	***1,354,599***	***3,941,040***	***471,591***	***5,767,230***	***1,589,494***
Industrial / commercial heat	–	1,737,139	102,651	1,839,791	353,435
Industrial / commercial power	568,240	–	–	568,240	305,145
Total industrial / commercial	***568,240***	***1,737,139***	***102,651***	***2,408,030***	***658,580***
Total	**1,922,838**	**5,678,179**	**574,242**	***8,175,260***	***2,248,074***

Note that these figures are not exactly the same as the local area carbon emission statistics given in Table 3. This is because the two datasets cover different years, only building energy use is included

[41] Source: DECC regional and local energy consumption statistics www.decc.gov.uk/en/content/cms/statistics/regional/regional.aspx The latest data available for electricity and gas is for 2007, while the data on other fuels covers 2006.

in the above table, and some large industrial energy users are excluded from the above statistics for reasons of commercial confidentiality.

The figure for gas consumption in the domestic sector is likely to decrease slightly over the next decade due to energy efficiency initiatives, although other changes in factors such as comfort levels and electricity consumption may reduce or reverse the effect on overall carbon emissions.

5.3 Heat and power demand in potential new residential development

In predicting emissions from any potential new development, the effect of any proposed carbon reduction targets on both heat and power demands needs to be considered. More specifically, the proportional reduction that energy efficiency measures are likely to contribute in meeting the targets in comparison to that from low or zero carbon energy generation is of particular interest as it is the former that will influence energy demands.

For the purpose of estimating projected energy demands, baseline heat and power demands for a range of housing types were first identified using those typical of Part L 2006 Building Regulations. One level of energy efficiency 'backstop' was then assumed up to 2026. This level is approximately equivalent to that associated with Level 3 of the CFSH, i.e. an achievement of 25% reduction in CO_2 over the Part L 2006 Target Emission Rate (i.e. 25% of regulated emissions). As indicated in EST Guide CE290, this level of reduction is readily achievable using energy efficiency measures without the need for on/offsite generation.

The above assumptions were applied to each local authority's Strategic Housing Land Availability Assessment (SHLAA) data set in order to model carbon reduction scenarios up to 2026. The dataset comprises 553 potential sites with a total of 53,573 dwellings.

Note - although this process was undertaken jointly by the five authorities, it is essential to note that each authority is currently at a different stage in its SHLAA process and as such not all identified sites are likely to be developed. At the time of the preparation of this report, Chichester's SHLAA data was not sufficiently developed to use in the dataset and the other local authority SHLAA data used in this report should be considered as potential sites only.

Additionally, Horsham's SHLAA data was not finalised and it was therefore not clear which sites would be taken forward to form part of the development plan. Nevertheless it is important to gain an understanding as to whether the potential for decentralised energy is feasible within the Horsham district. Therefore for modelling purposes only, one of many potential development scenarios was used to provide an indication of the suitability of this resource. It is important to clarify that the results of this assessment will not influence policy decisions. As a move is made towards a Preferred Strategy, further analysis will be undertaken to model a more likely future heat demand scenario for the Horsham district.

The table below summarises the dataset and Figure 28 indicates the location of the potential SHLAA sites along with existing heat demand.

Table 27: SHLAA dataset summary table used for modelling (note - does not indicate finalised SHLAA data)			
Local authority	**Total number of potential housing sites**	**Total area (ha)**	**Estimated total number of dwellings**
Arun	89	1,325	18,252
Chichester	No data available		
Horsham	93	758	12,213
Mid Sussex	203	931	15,793
Worthing	168	223	7,315
Total	**553**	**3,237**	**53,573**

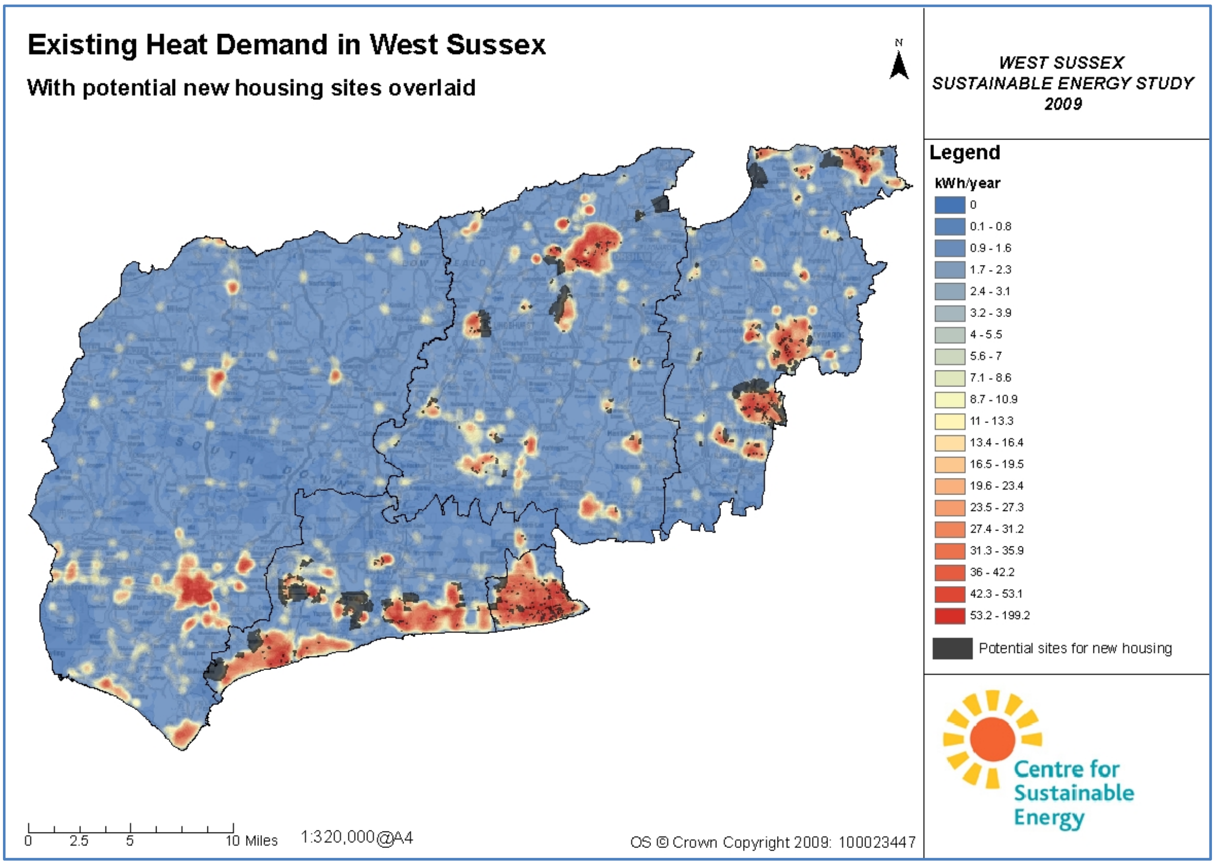

Figure 28: Heat demand in West Sussex from existing development with potential new housing sites overlaid

For modelling purposes, a specific mix of housing types has been assumed, based on the density of the individual site (calculated by dividing the predicted number of dwellings by the area of the site in hectares). The majority of potential sites in Horsham, Mid Sussex, Chichester and Arun will come forward at around 30dph, with the odd exception (generally town centre sites will be higher). The mix is illustrated in Table 28 below.

Table 28: Assumed mix of dwelling types for density bands					
Density band	Density [dph]	Dwelling type mix			
		flat	terrace	semi	detached
Rural	30	14%	17%	29%	40%
Suburban	35	16%	16%	31%	37%
Urban Growth Areas	70	18%	30%	27%	25%
Town Centre	100	32%	21%	24%	23%

The mix has been calculated using the Housing Type Profile information presented in the West Sussex Northern and Coastal Area Strategic Housing Market Assessments (SHMAs). These have been used to assume a dwelling type mix which is appropriate to the West Sussex area, based roughly on local calculations.[42]

In order to determine these loosely based figures, the Worthing figures (from the Coastal SHMA) were equated to a Town Centre example, Horsham (from the Northern SHMA) to a rural example and Mid Sussex to a Suburban example. The same figures were then used to calculate a rough estimate of figures for the 'Urban Growth Areas'.

Energy demands and resulting emissions accounting for reductions due to the energy efficiency backstop were then calculated. Table 29 shows modelled energy consumption and CO_2 emissions from the SHLAA sites.

Table 29: Modelled energy consumption and CO_2 emissions from potential SHLAA sites (Part L 2006 baseline)				
Local authority[1]	Number of sites	Electricity demand (MWh/year)	Heat demand (MWh/year)	CO_2 emissions (tonnes/year)
Arun	89	52,797	80,938	38,405
Horsham	93	35,291	54,090	25,669
Mid Sussex	203	45,193	69,193	32,856
Worthing	168	20,175	30,740	14,639
Total[2]	**553**	**153,457**	**234,962**	**111,569**

[1]Figures may not sum due to rounding

[2]No data available for Chichester

Note - it has not been possible to predict increases in energy demand and CO_2 emissions from new non-residential development due to insufficient data being available.

5.4 Potential for CHP/district heating and identification of Heat Priority Areas

Historically, there have been three rules of thumb to consider when identifying developments where large-scale CHP may be viable.

1. **Size of development**. For CHP to be commercially viable, there need to be sufficient customers to make the scheme profitable. 100 dwellings is generally considered the absolute minimum (and at this size of development, there would need to be a substantial amount of complementary heat load). Ideally a development would have 350 or more dwellings.

[42] See http://www.midsussex.gov.uk/page.cfm?pageid=3641

Developments of around 200 or more houses may be an attractive commercial proposition for an Energy Services Company (ESCo), with one company taking on responsibility for maintaining the scheme and billing residents.

2. **Dwelling density**, or dwellings per hectare (dph). For CHP to be technically viable, a minimum heat density of 3,000 kW/km^2 is required[43]. In terms of buildings built to current Building Regulations Part L1 standards, this generally requires at least 50 dph[44]. In a very few cases, with the right balance of heat load, 35 dph may be sufficient (this is only slightly above the 30 dph target that PPS3 has [specified as a minimum standard in most cases[45]).

3. **Proximity of other, non-residential development**, located within 1km of the new development, which would have a higher and more continuous demand for heat and power (e.g. leisure centres, schools, care homes, industrial estates, retail areas and offices, or large existing housing sites) will also be necessary to make a scheme viable (these are referred to below as 'complementary heat load'). Because the demand for heat from residential areas fluctuates throughout the course of a day and night, developers may favour sites where this can be balanced with complimentary loads.

Similar rules of thumb apply for district heating in terms of dwelling density and proximity to non-domestic heat load, although it has been associated with smaller scale developments, generally in off-gas settings.

The move to low carbon homes is encouraging wider consideration of district heating and CHP, even where these rules of thumb are not met. This is the case despite the fact that, with higher requirements for energy efficiency, the heat load of developments will be reduced, thus requiring a higher density of developments to provide the same heat load. By striving to encourage developments that meet these rules of thumb wherever possible, local authorities will be making it more financially viable for developers to include CHP/district heating within developments.

In order to assess key sites with potential for CHP/district heating systems, individual SHLAA sites were first assessed against the first two 'rules of thumb' outlined above, i.e. development size and yield density factors concerning dwelling density. For the purpose of this analysis, this translates to sites with more than 100 units and greater than 2 hectares (which, given the generally lower densities of developments outside of urban areas would probably be the minimum size required to accommodate 100 houses) or those sites which have a density over 50 dwellings per hectare (dph).

The third 'rule of thumb' was then applied by identifying any existing heat loads in the near vicinity. These complementary heat loads will have a higher and more continuous demand for heat and power, thus increasing the chances of the development's viability for decentralised heat and power systems. Sites were then categorised according to 'high', 'medium' and 'low' potential for CHP/district heating and are shown in Table 30 below.

[43] CLG, Heat and Energy Saving Strategy Consultation, 2009.
[44] See for example Cyril Sweett, A cost review of the Code for Sustainable Homes, Report for English Partnerships and the Housing Corporation, February 2007.
[45] PPS3 specifies that "*30 dwellings per hectare (dph) net should be used as a national indicative minimum to guide policy development and decision-making, until local density policies are in place. Where Local Planning Authorities wish to plan for, or agree to, densities below this minimum, this will need to be justified.*"

Table 30: Potential SHLAA sites meeting 'rules of thumb' criteria for CHP/district heating				
Local Planning Authority[1]	**No. of sites meeting yield, density criteria and proximity to existing heat load factors**	**Ranking of sites according to yield, density criteria and proximity to existing heat loads**		
		High potential	**Medium potential**	**Low potential**
Arun District Council	23	5	16	2
Mid Sussex District Council	22	10	8	4
Worthing Borough Council	18	11	2	2

[1]No suitable data was available for Chichester or Horsham.

An analysis of the viable potential SHLAA sites in the three local authorities assessed can be found in Annex F. Please note that these sites include phased developments. This may therefore require the phased planning and development of decentralised systems.

Figure 29 and Figure 30 illustrate a number of Heat Priority Areas (HPA) where heat demand is more than 45 kWh/m^2/year. This represents a large proportion of heat demand (28%) in a small area of land (1.3% of the study area) and is consistent with estimates of the minimum heat demand density required for district heating evident in other studies. It is important to note however that there is no fixed threshold and that lower densities can be served by extending existing systems, which tends to be more economic than the establishment of new systems.

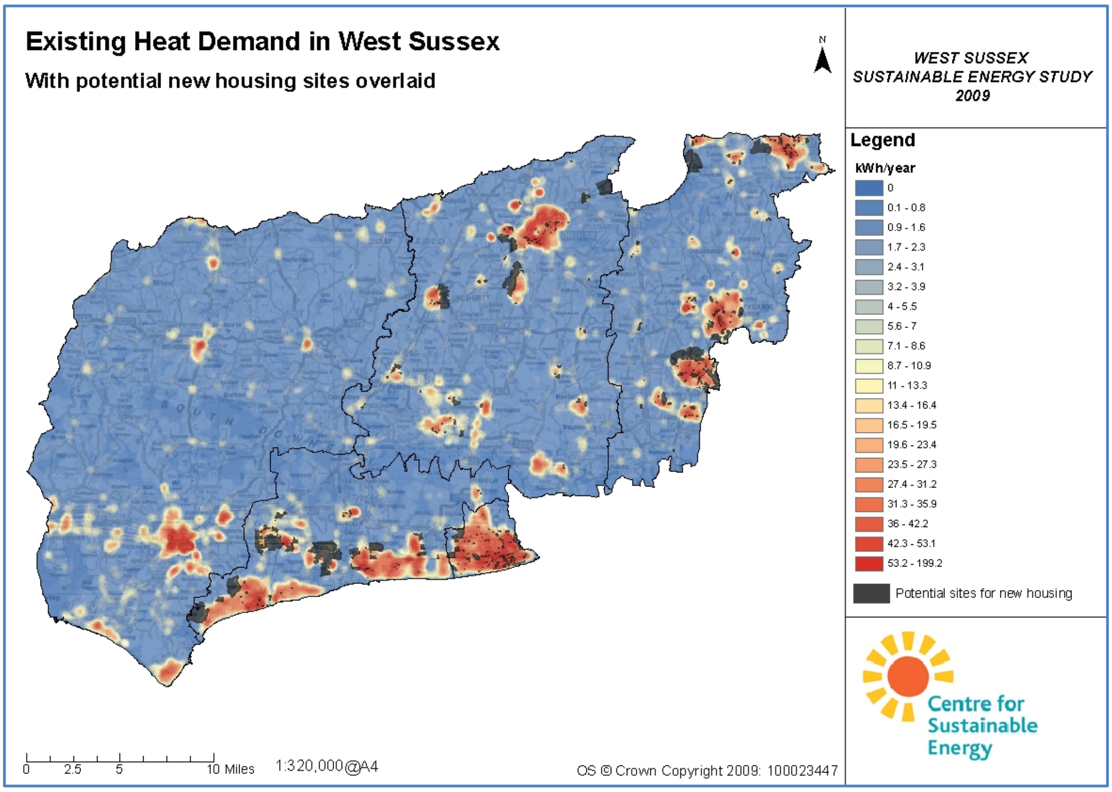

Figure 29: Heat demand in West Sussex from existing development with potential sites for new residential development

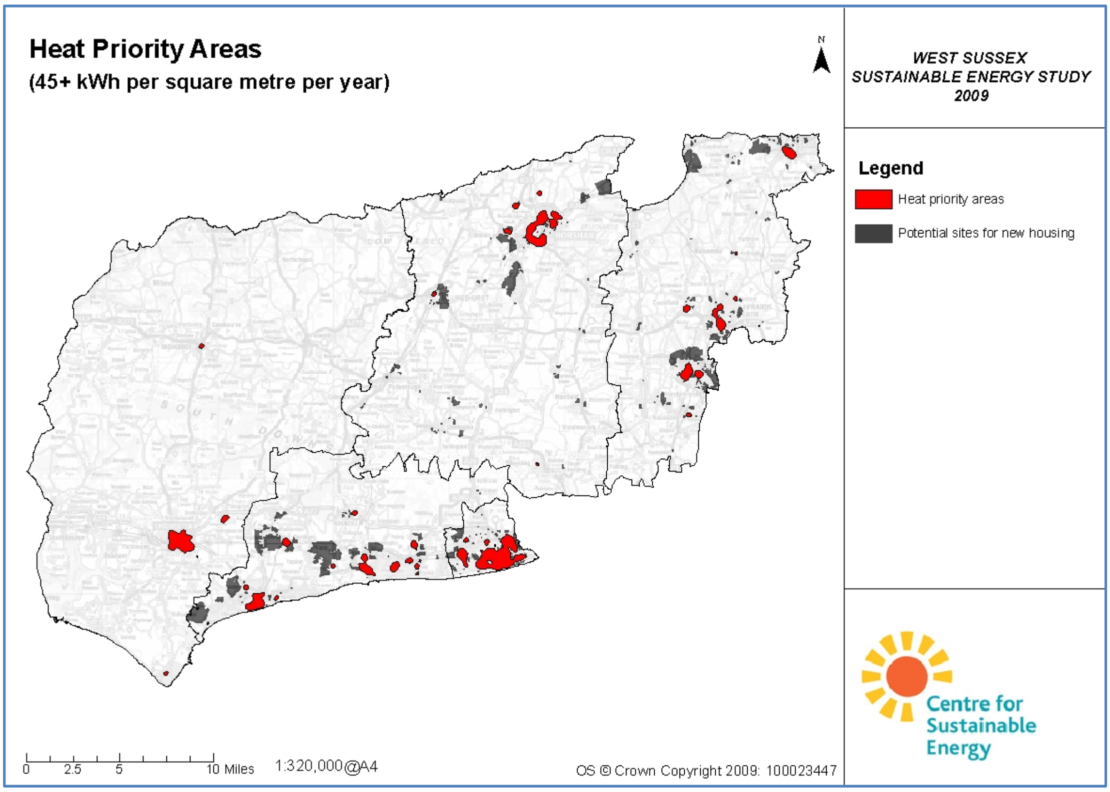

Figure 30: Heat Priority Areas and potential sites for new residential development

6 Planning policy scenarios

6.1 Scenarios for new development

A set of planning policy scenarios (Table 31) were constructed to examine different standards and timescales for 'energy efficiency' and 'carbon compliance' requirements that developers would need to satisfy in each case alongside 'allowable solutions' to deal with residual emissions (as set out under the proposed definition of zero carbon homes).

6.1.1 Residential

Scenario 1 effectively assumes that the local authorities impose minimum standards for new developments as currently expected through future changes to Building Regulations (see Section 2). Scenario 2 introduces a more demanding target for Phase 3 and Scenario 3 brings forward the expected national targets to an earlier date. Scenario 4 represents a combination of Scenarios 2 and 3 and is the most ambitious scenario in terms of carbon reductions.

Table 31: Planning policy scenarios for new development

		Phase 1 (2010-2012)	Phase 2 (2013-2015)	Phase 3 (2016 on)
Scenario 1 (baseline)	CO_2 reduction target relative to Part L 2006	25% of regulated[46] emissions through energy efficiency and carbon compliance measures	44% of regulated emissions through energy efficiency and carbon compliance measures	**Zero carbon:** 70% of regulated emissions through energy efficiency and carbon compliance measures plus 'allowable solutions' for residual emissions
	Equivalent level of the Code for Sustainable Homes[47]	Level 3	Level 4	Level 4/5
Scenario 2	CO_2 reduction target relative to Part L 2006	25% of regulated emissions through energy efficiency and carbon compliance measures	44% of regulated emissions through energy efficiency and carbon compliance measures	**Zero carbon:** 100% of regulated emissions through energy efficiency and carbon compliance measures plus 'allowable solutions' for residual emissions
	Equivalent level of the Code for Sustainable Homes	Level 3	Level 4	Level 5
Scenario 3	CO_2 reduction target relative to Part L 2006	44% of regulated emissions through energy efficiency and carbon compliance measures	**Zero carbon:** 70% of regulated emissions through energy efficiency and carbon compliance measures plus 'allowable solutions' for residual emissions	
	Equivalent level of the Code for Sustainable Homes	Level 4	Level 4/5	
Scenario 4	CO2 reduction target relative to Part L 2006	44% of regulated emissions through energy efficiency and carbon compliance measures	**Zero carbon:** 100% of regulated emissions through energy efficiency and carbon compliance measures plus 'allowable solutions' for residual emissions	
	Equivalent level of the Code for Sustainable Homes	Level 4	Level 5	

Although there are obviously a number of alternative scenarios that could also be considered, the three presented above have been chosen for modelling purposes to illustrate the likely implications on

[46] Regulated emissions only include those associated with space heating, ventilation, hot water and fixed lighting. Total emissions include regulated emissions plus those associated with cooking and other appliances.
[47] The level shown refers to the carbon reduction achieved through energy efficiency and carbon compliance (onsite generation or direct connection of low or zero carbon heat) measures only.

technology mix and cost in relation to new development within the study area, as modelled using SHLAA data.

6.1.2 Non-residential

The above scenarios specifically concern residential development, as phased standards for non-residential development have yet to be proposed by Government. However, the table below outlines the Government's intentions with regard to achieving a zero carbon standard for non-residential buildings from 2016 onwards and suggests a range of standards for each category prior to the zero carbon standard, or until the results of Government consultations are known. The definition of zero carbon and the trajectory leading up to these milestones have yet to be defined by Government and currently there is very little evidence with regard to cost and viability issues, mainly due to the many different types and uses of buildings in the non-residential sector. Additionally, the five local authorities hold no SHLAA-equivalent data for non-residential buildings. For these reasons non-residential developments have not been modelled.

The Government is currently consulting on these issues and until this is concluded most local authorities are referring to BREEAM ratings when setting standards for new developments.

Table 32: Standards for non-residential buildings

<table>
<tr><th></th><th>2010</th><th>2013</th><th>2016</th><th>2018</th><th>2019</th></tr>
<tr><td>Schools and colleges</td><td colspan="2">BREEAM Very Good/Excellent/Outstanding</td><td>Zero carbon</td><td>Zero carbon</td><td>Zero carbon</td></tr>
<tr><td>Public buildings</td><td colspan="3">BREEAM Very Good/Excellent/Outstanding</td><td>Zero carbon</td><td>Zero carbon</td></tr>
<tr><td>All other non-domestic buildings</td><td colspan="4">BREEAM Very Good/Excellent/Outstanding</td><td>Zero carbon</td></tr>
</table>

6.1.3 Scale of development

Due to economies of scale, the financial burden of carbon reduction targets on developers will tend to be greater for smaller sites. For this reason many sustainable energy policies in place throughout the country have applied a threshold of development to which the policy applies e.g. larger than 10 dwellings and 1,000 m^2 of non-residential floorspace.

However, a scale threshold is not applied in the above scenarios. This follows the approach being taken in London, which is moving away from these thresholds towards policy which applies to development of all scales. The 2008 Consolidated London Plan Policy 4A.7 which requires 20% carbon reduction from renewables just refers to "developments" and does not include any scale thresholds, but there is a feasibility 'opt-out' clause. As PPS22 paragraph 8 tests of viability and undue burden are still relevant, a suitable degree of flexibility is therefore required where scale thresholds are not specifically stated.

6.2 Results of modelling

The DCLG's consultation on the *Definition of Zero Carbon Homes and Non-domestic Buildings* includes lists of low carbon technology mixes and costing data tested against a range of targets for a range of housing development types. For each target of interest, the least-cost technology mix was identified (see Annex B) and applied to SHLAA data for the study area[48] using a database model. The generation technologies therefore selected included photovoltaics (PV), biomass community heating (BCH) and biomass CHP. Solar water heating, heat pumps and gas-fired CHP were also included in the DCLG study, but are not considered here as they do not occur within the 'least-cost' technology mixes for the targets considered. Wind power is excluded from the DCLG analysis as technical viability is significantly more dependent on site-specific factors than other technologies.

Although these have currently been modelled as the least cost options for specific housing development types, it should be noted that future changes in costs and technological advances may well dictate different optimum mixes with regard to technical and economic viability. Developers, therefore, may select different technologies from those modelled here.

The model is mainly designed to assess the likely technology mix and associated costs resulting from the application of the three scenarios described in Section 6. The charts below present the main findings, as modelled for the local authority SHLAA sites as a whole across the study area. Results for individual local authorities are summarised in Section 8.3.

Note – the 'Multiphase' x-axis category refers to the situation where the modelled scenario occurs throughout Phase 1, 2 and 3, i.e. for each site, a linear build out rate is assumed between 2010 and 2026, meaning targets are progressively increased. The 'Phase 1', 'Phase 2' and 'Phase 3' category results show the effect of building all sites during one particular phase i.e. a single phase target applies to all sites.

[48] Note – the 'study area' analysed includes Horsham, Worthing, Mid Sussex and Arun. SHLAA data for Chichester was not available at the time of study.

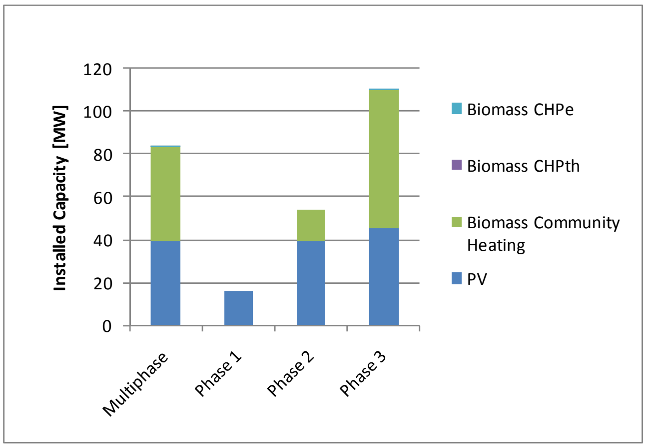

Figure 31: Scenario 1 – installed capacities

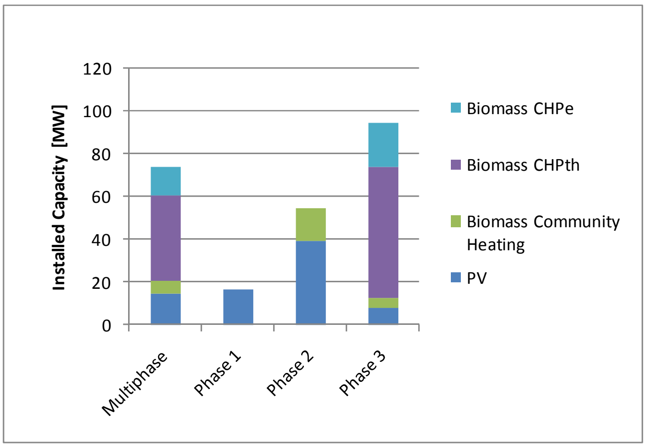

Figure 32: Scenario 2 – installed capacities

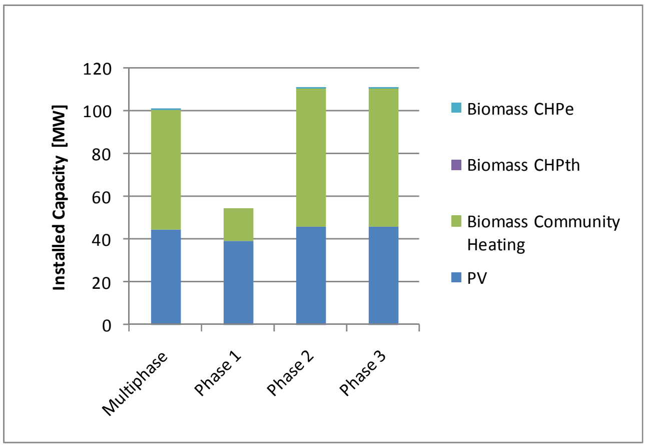

Figure 33: Scenario 3 – installed capacities

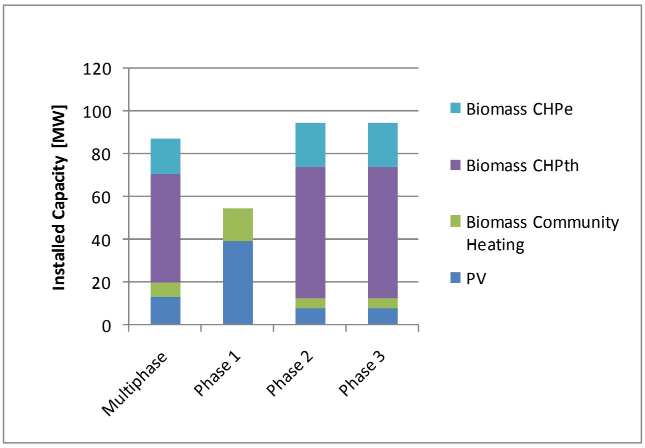

Figure 34: Scenario 4 – installed capacities

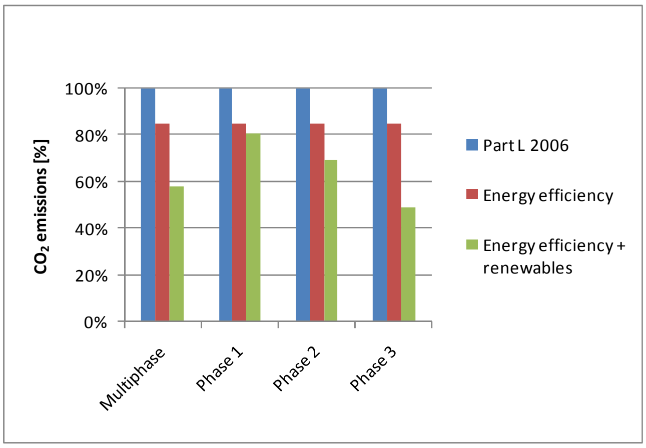

Figure 35: Scenario 1 – total emissions reductions

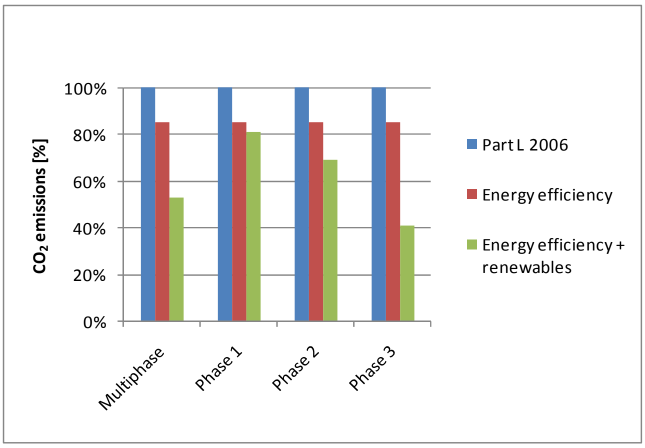

Figure 36: Scenario 2 – total emissions reductions

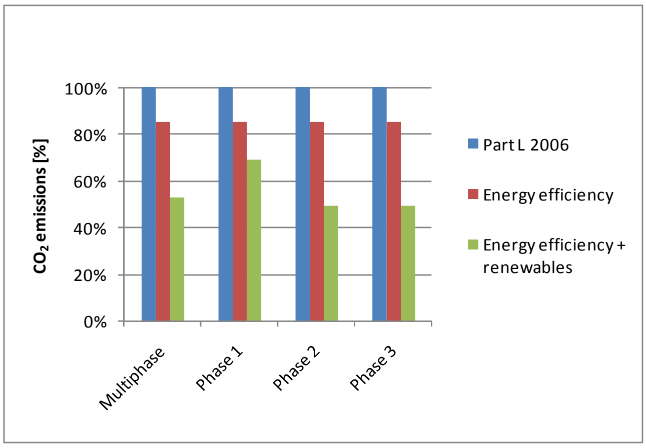

Figure 37: Scenario 3 – total emissions reductions

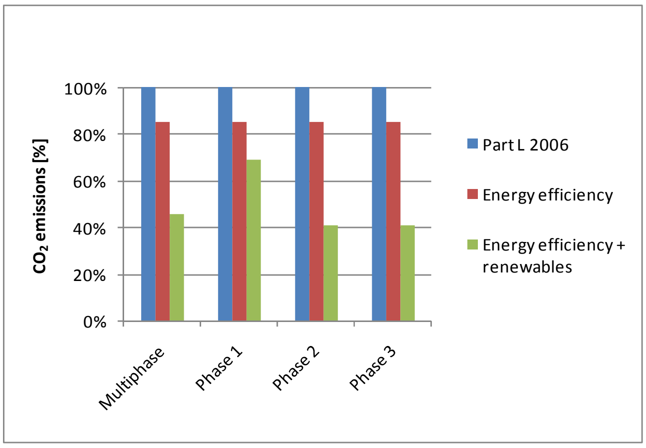

Figure 38: Scenario 4 – total emissions reductions

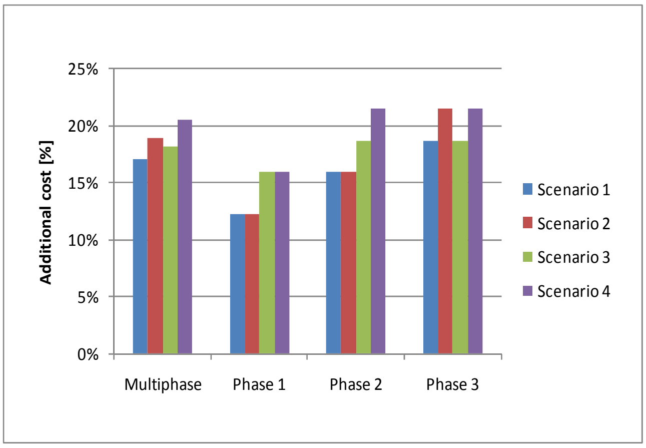

Figure 39: Additional costs over Part L 2006 for each scenario

Table 33: Summary of on-site generation capacities as modelled on SHLAA sites

Generation technology	Generation capacity [MW]			
	Scenario 1 (multiphase)	**Scenario 2 (multiphase)**	**Scenario 3 (multiphase)**	**Scenario 4 (multiphase)**
Biomass CHP (electricity)	0	13	0	17
Biomass CHP (heat)	0	40	0	51
Biomass community heating	45	6	56	6
Solar PV	39	15	44	13

Figures 31 to 34 show the modelled take-up of generation technologies for the scenarios (as applied after energy efficiency measures). The multiphase figures are also shown in Table 33 above. The results for individual phases indicate that PV is predominantly used to meet the lower targets, with biomass heating or CHP required alongside PV for the higher targets.

Figures 35 to 38 indicate the emission reductions relative to Part L 2006 (total emissions) resulting from the modelling of each scenario, assuming a constant level of energy efficiency and varying amounts of renewables required to approach the target.

Figure 39 shows the additional costs over base build (Part L 2006 levels) associated with the emissions reduction measures considered. This is discussed further in Section 6.3 below.

6.3 Financial implications of policies for new development

6.3.1 Cost of carbon reduction standards

Scenario 1 models the trajectory of Building Regulation changes expected up to 2016 and beyond. These changes will impose additional build costs on new developments, which will need to incorporate a range of low or zero carbon energy measures to meet the targets. Research commissioned by the Government has indicated that the average construction cost premium for delivering zero carbon homes entirely within the development site could be between 17 – 24% over current build costs by 2016, but would decrease from this peak as the costs of key technologies fall.[49]

The analysis for the current study as applied to new residential development (SHLAA sites) proposed across the study area considers a range of on-site carbon reduction targets up to 100% of regulated emissions, rather than the on-site 'zero carbon' standard referred to above. Results are shown for the four scenarios in Table 34 below. As mentioned above, the analysis is based on data from the Government study described in Annex B.

Table 34: Increase in additional build cost (relative to the Part L 2006 standard)

	Range of additional build costs for each phase [%]	Multiphase average [%]
Scenario 1	12 – 19	17
Scenario 2	12 – 21	19
Scenario 3	16 – 19	18
Scenario 4	16 – 21	20

6.3.2 Costs of Code for Sustainable Homes standards

Whilst the above analysis is concerned with the costs of meeting carbon reduction standards only, the government's *Cost Analysis of the Code for Sustainable Homes* (CLG, 2008) estimates the costs for meeting the various levels of the Code, which also considers standards for water use and other sustainability factors. Costs are given for different housing types and development scenarios and an example for an end-terrace dwelling is shown in Annex B.

6.3.3 Financial implications of district-wide renewable energy targets

It is likely that revised regional/sub-regional targets for carbon reduction and renewable energy capacity and/or generation will be proposed in the near future (see Section 2). These would need to reflect Government targets such as the intention to source 15% of total energy supply from renewables by 2020 and to achieve 34% carbon dioxide reductions (over 1990 levels) also by 2020.

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[49] *Research to Assess the Costs and Benefits of the Government's Proposals to Reduce the Carbon Footprint of New Housing Development*; DCLG Sept 2008

The potential renewable energy resources of a particular area may go some or all of the way in meeting these targets. The resource assessment undertaken in Section 3 presents the estimated potential for each technology in terms of capacity (MW), energy generation (MWh) and the resulting carbon reduction on area-wide emissions. The results in Annex A give an indication of the proportional contribution of each district's resource towards a 15% renewable energy supply target by considering energy generation potential. A basic evaluation of capital costs associated with MW targets for each technology could potentially be undertaken by considering the general costs of technologies on a '£ per MW' capacity basis. Table 2.2 in Annex B contains approximate costs for technologies should this analysis be required in the future. However, in light of the discussion in Section 8.3 this would be more appropriately undertaken on a '£ per tonne of carbon saved' basis.

7 Implementation

7.1 Finance mechanisms

The feasibility review of renewable energy and low carbon technologies presented earlier in this report shows that the West Sussex area has significant potential for incorporating renewable energy and low carbon technologies into developments.

While individual technologies on single dwellings will be applied to many developments across the sub-region, an alternative option would be to develop site-wide, council-wide or even sub-regional strategic energy facilities. This could be implemented either by developers on larger development sites, or by the five LPAs themselves.

The Councils should prepare for the development of strategic energy facilities. For example, by mapping out areas of undeveloped land or highlighting areas where large-scale growth is planned within their Local Development Frameworks. Areas of land could be retained for larger-scale renewable energy and low carbon technologies, such as biomass- or gas-fired district heating/CHP systems.

The project team have therefore considered the options for how both developers and the Councils could finance such facilities below.

There are a number of finance mechanisms that the LPAs could use to fund strategic energy facilities, or even improvements to existing housing. These include:

- Section 106 agreements (S106);
- The Community Infrastructure Levy (CIL);
- Energy Service Companies (ESCos); and
- Carbon offset funds
- Land values

An overview of these finance mechanisms is given below:

7.1.1 Section 106 agreements

Section 106 (S106) of the Town and Country Planning Act 1990 allows LPAs to enter into a legally binding agreement or planning obligation with a landowner in association with the grant of planning permission. This obligation is termed a Section 106 agreement and is a way of delivering or addressing matters that are necessary to make a development acceptable in planning terms. They are increasingly used to support the provision of services and infrastructure, such as highways, recreational facilities, education, health and affordable housing.

Section 106 agreements are a commonly used tool and have been used by a large number of LPAs (including the five LPAs involved in this study) to require that developers meet 'Merton Rule' policies. It has been suggested that this type of agreement will be replaced by the Community Infrastructure Levy (CIL) (see below).

7.1.2 Community Infrastructure Levy

The Community Infrastructure Levy (CIL) was introduced in Part 11 of the Planning Act (2008). Local authorities will be able to charge the CIL on most types of new local development and use the money raised to provide the local or sub-regional infrastructure needed to support local growth.

The definition of 'infrastructure' being used by the Government is already very broad and is expected to be flexible and able to accommodate local needs. Priorities for infrastructure are expected to vary from location to location. The definition of 'infrastructure' given in Section 209 of the Planning Act does not mention strategic energy facilities but it does state that this definition can be amended. Given that the Planning Act also puts a duty on local authorities to use their development plans to take action on climate change, it can be assumed that strategic energy facilities could be included in the definition of 'infrastructure' in the future.

Waste management facilities are also included in the literature on the CIL as examples of sub-regional infrastructure – infrastructure likely to serve several local authority areas. There is no apparent reason why these cannot be energy from waste plants. Local authorities are asked to be innovative in their approach to identifying infrastructure needed to cope with pressures placed on natural resources – for example water supplies and waste production.

It is also important to highlight that the government is considering including the CIL as an 'allowable solution', as set out in the *Definition of Zero Carbon Homes and Non-Domestic Buildings* consultation.

Please note that local authorities will still be able to enter into negotiated planning obligations using Section 106 of the 1990 Town and Country Planning Act (Section 106 agreements) alongside use of the CIL. In addition, the 2009 Budget announcement delayed the implementation of the CIL until 2010[50].

7.1.3 Energy Service Companies (ESCos)

The ESCo (Energy Service Company) model is based around an energy service provider installing low carbon energy generation or energy saving equipment and charging consumers for the use of their service over a defined contract period. Companies would own and maintain the technology in exchange for consumers signing up to a service contract. There are a number of different types of energy service schemes such as:

- Preferred supplier partnerships/affinity deals;
- Housing energy clubs; and
- Energy supply schemes.

There are many options for who could provide energy services or elements of such, including energy suppliers, third parties working with energy suppliers or bodies which have a permanent connection or relationship to properties such as Distribution Network Operators, gas distributors and water companies. Additionally, the Local Government Act 2000 enables local authorities to set up ESCos either on their own or in partnership with a private company, as Woking, Birmingham, Aberdeen and Southampton have done. Further information is available from the Energy Saving Trust's Directory of Energy Services[51] which contains a range of guidance and case studies.

There is increasing evidence that more local authorities are taking initial steps to develop an overarching ESCo which can take on the management of district heating/CHP schemes from private developers across the council area. Plymouth City Council, for example, is currently considering options for an ESCo partnership for the redevelopment of the city centre involving CHP/district heating infrastructure.[52]

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[50] www.planningportal.gov.uk/england/professionals/en/1115316678349.html.
[51] http://www.energysavingtrust.org.uk/business/Business/Local-Authorities/Your-Sustainable-Energy-Strategy/Energy-Services-Packages
[52] See Policy/Proposal CC5 – City Centre and University Area Action Plan – Pre Submission http://www.plymouth.gov.uk/pages_from_part_1_city_centre_aap.pdf

In addition, research[53] suggests that ESCos can be used to ensure that smaller-scale renewable energy technologies, such as a PV system on an individual dwelling, continue to generate their maximum energy generation potential once the developer has completed a site.

The London Energy Partnership's publication, *Making ESCos Work: Guidance and Advice on Setting Up and Delivering an ESCo* (Feb 2007)[54] found that in the UK there are a variety of models being used for the delivery of energy projects by public authorities. This is due to differences in each authority's attitude to risk and the degree to which they want to involve the private sector in the project, but it is also due to the lack of a well developed standard model for ESCo contracting in the UK.

This lack of standardisation and funding in the UK for ESCo projects has meant that some have been set up through Private Finance Initiatives. Many projects are financially marginal and one of the significant issues has been persuading the private sector to accept sufficient financial and other risk in projects. For example, in the case of heat and power networks, the report found that the private sector is less willing to build a network to distribute heat and power than is it to build and operate the plant itself. This has led to difficulties in some projects due to a funding gap in relation to construction of the network. Developers are more likely to be willing to have district heating networks serving their sites when an ESCo will take some or all of the upfront financial risk for the project.

However, with some of the measures proposed in the Government's Heat and Energy Saving Strategy Consultation Document, there are potentially ways in which risks could be reduced and incentives provided to encourage an increased level of activity regarding ESCos and their successful implementation. For example, by packaging different Government subsidies, including CERT and the RHI, Energy Performance Contracting (EPC) arrangements are more likely to be viable for ESCo bodies.

Heat sales would, of course, be subject to regulatory controls which should include quality and continuity of service (including protections for consumers during supply outages), the basis for setting prices in the long term, metering and billing and dispute resolution.

Finally, it is important to highlight that ESCos are being considered as an 'allowable solution' by Government.

7.1.4 Carbon offset funds

A carbon offsetting scheme can be used to help reduce emissions from both new and existing developments. Some LPAs operate a carbon offset fund requirement for carbon neutrality to be met on-site in new developments. For example, on small developments of fewer than 10 dwellings and less than 1000m^2 of non-residential floorspace, financial Carbon Offset Contributions are accepted and can be used to towards sustainable energy delivery elsewhere within the area.

While many consumer and business orientated carbon offset schemes support international projects abroad, local authorities can promote local carbon offset schemes. Such schemes use funds to develop local projects and may find it easier to demonstrate to investors that actual carbon savings are being made. For example, funds can be used to develop locally based strategic energy facilities, which can be a very visible use of this financing stream.

Larger scale projects will require more upfront investment and will therefore require larger amounts of money to be raised. Projects will also take longer to come to fruition. Schemes such as those adopted by Milton Keynes and Ashford Borough Councils (discussed below), which put an obligation

[53] Munro, D., 'How to keep domestic PV systems working in the long term', Energy World, February 2009, p 10-11.
[54] http://www.london.gov.uk/mayor/environment/energy/partnership-steering-group/docs/making-escos-work.pdf

on developers to pay into a carbon neutrality fund, may raise larger amounts of money due to the large growth forecasted in their areas.

However, several smaller scale local carbon offsetting schemes operating in England demonstrate the advantages of taking smaller scale actions. For example, Eastleigh Borough Council (discussed below) was keen for its offsetting scheme to remain competitive with the consumer based alternatives that local residents may wish to invest in. The Council is therefore using the funds raised to operate an insulation programme for loft and cavity wall insulation. Supporting the installation of measures such as insulation also helps Councils achieve targets such as those set in their Local Area Agreements (LAA) including NI 186[55].

Several Councils are introducing offsetting schemes as part of sustainable planning policies. These include Eastleigh Borough Council, Ashford Borough Council and Milton Keynes Council. Such schemes can be used to support carbon neutrality in new build developments or in existing properties, and the funds raised can be used in a number of ways. This is discussed further in Annex C.

It should be noted that although 'Buy out funds' were considered as part of the definition of zero carbon consultation there is currently no indication that they will be included as an 'allowable solution'.

7.1.5 Land values

The extent to which additional build cost for developers can be factored into the price paid for the land can be a vital issue affecting viability. The higher the proportion of extra build cost that can be compensated within the initial land value, the less burden placed on developers, and the less risk of additional costs being passed on to the building end-user. However, it is important that any pressure on land values does not significantly impact on the quantity of land being brought forward for development, which could potentially jeopardise the ability to meet wider housing targets.

It is important to recognise that the economic recession has had considerable effect on the construction industry with development levels significantly reduced across the whole of the UK. Land values in particular are expected to fall further or even become negative, which could result in landowners choosing not selling land for development. While anecdotal evidence from developers across England suggests that they have access to enough land for development within their short term plans, this issue could become more apparent in the medium- to long-term should land values continue to decline. In addition, house and commercial property prices continue to fall, while costs of construction materials such as steel have increased, thus reducing the potential profit value of a development, or in extreme cases making the development unviable.

In light of these circumstances it is imperative that the issue of financial viability of any policy proposals is given adequate consideration. However, it is also important to highlight that even if the five local authorities in West Sussex were not to require any advanced sustainability standards, the construction industry operating in across the sub-region would not simply return to the levels of development seen before the recession.

7.2 Monitoring and enforcement

In implementing the trajectory of targets expected through the Building Regulations, and in particular a hierarchy of measures, there is a risk of placing undue burden on local authorities to enforce compliance and administer the system. In particular, there may be concerns that:

- Building Control Bodies are not well placed to examine circumstances outside the boundaries of the development; and

[55] NI 186 - a percentage reduction of the per capita carbon dioxide emissions in the local authority area. This requires a Council to take actions to reduce carbon dioxide emissions across the area, including those emissions from housing.

- Local Planning Authorities lack the capacity and expertise to ensure that house builders are dealing correctly with residual emissions.

The *Definition of Zero Carbon Homes and Non-Domestic Buildings* consultation illustrates one approach to address these concerns that could potentially apply in the future:

- Planning applications would set out the allowable solutions that the developer proposes in order to reach the zero carbon homes standard.
- The LPA would satisfy itself, as part of the approval process, that the allowable solutions are in line with local plans and policies (eg S106) but would not otherwise seek to micro-manage the approach proposed by the developer. The allowable solutions would then be reflected, as necessary, in the planning conditions.
- Carbon compliance would be certified to and checked by Building Control Bodies (this would also show any over-compliance to the extent that going beyond the minimum level is chosen as an allowable solution); and the developer would retain the services of an appropriate accredited body (to be selected) to check that the allowable solutions that are being taken forward add up to the residual emissions of the home. That body would certify this to the local authority, at which point the planning conditions would be discharged.

The above approach should mean that LPAs are able to concentrate their development control activities on ensuring that the developer abides by local plans and policies, rather than checking the detailed calculations underpinning allowable solutions. It allows Building Control Bodies to concentrate on the circumstances within the development itself rather than verifying allowable solutions which might pertain across a much wider area.

There are a number of mechanisms to monitor and certify that the renewable energy and low carbon technologies incorporated within a development are fulfilling the council's planning policy requirements. Clearly to ensure compliance with policy recommendations this needs to be done on an on-going basis and in a way which is consistent and not prohibitively complicated or costly to the local authority.

The Councils could consider specifying within the sustainable development planning policy that developers take on this cost. Since this is an emerging issue, there are currently very few local authorities who have included this requirement within policies. It is therefore difficult to determine what level of additional cost would be placed on developers.

There are a number of different monitoring systems available and these generally involve fitting some form of data logger to the renewable energy technology to record the heat or electricity produced. This data can then be downloaded from a fixed data logger, or more commonly sent via a wireless data logger, to a central database. This is then used to collate and analyse the results over the lifetime of the installation.

In addition to monitoring the outputs from the system, some form of protocol is needed to ensure that outputs are monitored consistently and a fair comparison can be made between systems and sites. This particularly applies to systems producing heat as opposed to electricity. It is therefore important that policies are framed and worded such that monitoring systems installed are appropriate to the application and that the appropriate methodology is applied.

Several companies are now in the process of producing both the protocols and the technical systems required to monitor the output of renewable energy systems in order to ensure compliance with 'Merton style' policies. For example, the London Borough of Merton is working with Metropolis

Green[56] to develop a Planning Obligation that will require developers to install data loggers and pay a fee to monitor technologies in situ.

[56] www.metropolisgreen.com/.

8 Conclusions

8.1 Policy review

A number of national policy drivers now call for ambitious sustainability planning policies from local planning authorities. Such policies will need to address sustainability and climate change targets at national and regional level through a range of measures including a drive towards energy efficient buildings and low and zero carbon energy generation.

Through the PPS1 supplement on Planning and Climate Change the Government stresses that new homes offer a real opportunity to assist in achieving the UK's strategy to cut carbon emissions and reduce fuel poverty. Planned changes to the Building Regulations will result in a tightening of carbon emission standards up to a 'zero carbon' homes standard from 2016.

Both national planning policy guidance and the South East Plan place a responsibility on local authorities to consider setting low carbon building standards in advance of Building Regulations where local circumstances allow. In particular, South East Plan policy NRM11 allows local authorities to require higher levels of decentralised and renewable or low-carbon energy in new development. This is reiterated in the Planning & Energy Act (2008) which enables Local Planning Authorities to include in their LDDs policies imposing reasonable requirements for "*development in their area to comply with energy efficiency standards that exceed the energy requirements of building regulations.*"

Currently there are a number of issues under discussion relating to future Building Regulation standards, the Code for Sustainable Homes and the definition of zero carbon homes and buildings. This creates a degree of uncertainty on the full implications of local planning policy regarding new development and local planning authorities should therefore be prepared to review Local Development Framework (LDF) policies as and when appropriate. Nevertheless, local authorities are obliged to formulate sustainable energy and climate change policies according to the timescale set by the LDF process.

In setting policies for new homes, there is a question of whether standards are defined according to separate carbon reduction requirements alongside Code for Sustainable Homes ratings. In addition to carbon the Code covers a range of environmental issues, such as water, waste and materials whilst the mandatory Building Regulations standards relate only to carbon performance. As viability issues clearly need to be considered for all elements, there is merit in setting a specific Code level but with a separate higher carbon target where this can be justified. This approach has also been taken by Chichester District Council with regard to water use, where there is a current requirement for Code Level 2 on all housing developments, plus the water requirements set out in Code Level 3.[57]

With regard to the emerging definition of zero carbon homes and 'allowable solutions' it is also important to highlight the innovative approaches around carbon offsetting schemes set out by a number of local authorities across England, including Milton Keynes Council and Ashford Borough Council. The introduction of allowable solutions will be a key factor in providing flexibility for developers in meeting targets and will help to avoid 'undue burden' issues.

National planning guidance is pointing in the direction of more specific spatial guidance at the local level. However, it is important to highlight that the South East Partnership Board's guidance '*Climate Change within Local Development Frameworks*' warns against being overly specific in spatial terms within Core Strategies. It states:

> *"Locational policies in the core strategy should not identify specific locations. This level of detail should be in other DPDs and SPDs, as viable schemes in areas excluded may come*

[57] Note that this is a Local Plan Policy but has not yet been formulised in the Council's Core Strategy

forward with suitable mitigation measures . A spatially specific policy may result in some opportunities being dismissed at the outset."

However, including some specific guidance in the core strategy would allow the Councils to adopt a strategic approach to stating their preferences, rather than simply responding to developer choices. In addition, given the opportunities for large scale renewable and low carbon energy developments in the sub-region, identifying spatial preferences will help to enable the most to be made of those opportunities. In doing so, this will help to demonstrate conformity with the sub-regional renewable energy targets in the South East Plan.

Lastly, experience from London strongly suggests that a hierarchical approach should be adopted in energy policy development, which should include a heating and cooling hierarchy alongside an explicit energy hierarchy. Experience also suggests that there is merit in requiring explicit policy clauses to address feasibility and viability issues and a Site Energy Strategy/Sustainability Statement to accompany development proposals.

This approach is also relevant to 'Merton Rule' on-site generation targets, which, considered as part of a hierarchy, should be expressed as a requirement to reduce site residual emissions by (at least) a certain proportion, after the inclusion of energy efficiency, CHP and communal heating. Although these types of policies will ultimately be overtaken by Building Regulations, their continued use in the short term will serve to achieve additional carbon savings and help to stimulate the local skills market and supply chains for the renewable energy sector.

8.2 Resource assessment

West Sussex currently hosts a number of renewable/low carbon energy installations ranging in both scale and type from large landfill gas generation plant to small scale wind turbines. Based on the number and type of installations, it is estimated that these currently comprise a capacity of approximately 23MW electricity generation and 12MW heat generation. The figures for electricity can be compared with renewable energy sub-regional targets for East and West Sussex in the South East Plan i.e. 57MW by 2010 and 68MW by 2016. Taken as a proportion of the total annual 2006 carbon emissions for the five districts under study, the existing annual carbon saving resulting from the above installations is estimated at 2.4%.

The resource assessment undertaken in this study has identified a range of low and zero carbon energy resources or technologies that could be exploited. As part of the work, a landscape sensitivity assessment was undertaken to consider those technologies that have the potential, in the wrong location, to have significant impact on landscape character – namely wind energy developments and biomass planting.

The potential of each resource has been calculated in terms of a technical resource i.e. the theoretical maximum, but with additional constraining factors also applied to some in order to illustrate a more practical resource estimate. The table below summarises the results:

Table 35: Summary of resource assessment across study area			
Resource	**Technical capacity**		**Proportion of potential annual carbon savings relative to 2006 area-wide total emissions [%]**
	Electricity [MWe]	**Heat [MWth]**	
Onshore wind	1,255 (168)	–	23.9 (2.8)
Woodfuel (energy crops)	83 (4)	208 (10)	13.7 (0.7)
Waste (Industrial &commercial)	27	69	4.6
Waste (Municipal Solid Waste)	10	24	1.6
Local Biomass (woodland residues)	–	94	1.1
Waste (Agriculture & food)	5	12	0.8
Solar photovoltaics	76	–	0.6
Solar Water Heating	–	45	0.1
Total	**1,456 (290)**	**452 (254)**	**46.4 (12.3)**

Notes:

- Figures in brackets refer to the constrained resource. For wind this excludes designated areas and areas of high landscape sensitivity; for biomass (energy crops) this assumes 5% of suitable land is planted.
- Assumes energy crops and waste are used in CHP plant; woodland residues used in heat only plant
- The solar resource relates to roof space on existing buildings. In some cases the two solar technologies may compete for this roof space, so the combined resource may in practice be lower.

Although some resources are not specifically quantified and would in practice be expected to add to the overall resource e.g. natural gas for CHP and biomass from outside West Sussex, the analysis highlights the scale of the challenge presented by the Government's national target of an 80% emissions reduction by 2050 over 1990 levels. The significant shortfall will have to be addressed by measures including absolute demand reduction through behaviour change, increased energy efficiency in existing buildings, low carbon transport measures, and decarbonising the national grid.

The key issue for exploiting the wind resource concerns its impact on designated areas and landscape character. Much of the resource for large scale wind is located within the South Downs, which will soon receive National Park designation. Although wind power is not formally prohibited in these areas there will be significant constraints to deployment, particularly for large and medium scale installations. Due to the potential impact on landscape character, a strategy to accept landscape character change in some areas may be needed if large/medium scale wind is to significantly contribute to renewable electricity generation in the study area. Planning can be used to guide renewable energy proposals so as to spread them apart to avoid cumulative issues, or to cluster them in certain parts of the landscape & keep other areas free of development.

Although the development of energy crops is less constrained by landscape issues, the key challenges will be convincing farmers to invest in this crop by offering long-term supply contracts tied to its end-use, and factoring in the time needed to establish energy crop plantations before harvesting.

A key area to address in exploiting the woodfuel resource will be the establishment of a network of local biomass supply chains in parallel with demand creation strategies. However, future Building Regulations and the policy scenarios considered in this study are likely to instigate a step-change in demand by placing heavy reliance on biomass to meet carbon reduction targets. This is especially true considering the zero carbon requirements on residential developments from 2016, when the constraints with on-site wind power will in many cases require an alternative biomass solution.

The development of the waste and biomass resource will be largely influenced by the identification and implementation of macro-scale district heat networks requiring heat-only or CHP energy plant. These technologies will be increasingly drawn upon to meet post-2016 targets, again due to the constraints placed on wind power.

Although the solar resource represents the technical potential on existing buildings, only a fraction of this would be realised due to the capital cost constraints in today's economic climate. Solar has much larger potential for new developments where its ease of application at the design stage can make it a viable proposition to developers to meet earlier lower targets or as part of an appropriate technology mix to meet later higher targets.

8.3 Potential for sustainable energy supply on new development

Table 36 summarises the heat and electricity renewable generation capacities and resulting emission savings for the three policy scenarios considered in this study. The scenarios have been modelled on the combined SHLAA data available from the local authorities. The capacities indicated are made up of various combinations of biomass heat/CHP with district heating and solar PV, as these technologies have been shown to be the least cost options for the targets modelled. The analysis does not include wind power due to the inherent site-specific constraints with this resource which cannot be modelled at this level.

The results highlight that, although new development up to 2026 will clearly result in a net increase in district-wide emissions, the proposed building regulation standards (Scenario 1) will limit this increase to approximately 60% of the equivalent Part L 2006 emissions i.e if all development is built to Part L 2006 standards. The results also compare the relative additional costs of Scenarios 2, 3 and 4 against the gains in carbon savings they are likely to achieve.

Table 37 compares the renewable energy resources available at district-level (as estimated in the resource assessment) against the potential capacities required on new residential development (as modelled using SHLAA data for Scenario 4). It can be seen that the constrained resource is larger than the estimated requirement on new residential development in each case. However, the constrained resource includes wind power where locational constraints will still apply in relation to developments. It should be noted that the MW capacities for power and heat do not necessarily increase overall when considering a higher target e.g. moving from Scenario 3 to Scenario 4. This is largely due to the differing load factors of each of the technologies and the fact that CHP tends to displace PV at higher target levels. Comparison of costs on a £ per MW installed capacity basis should therefore be approached with caution as these will not necessarily correlate with resulting carbon savings.

Table 36: Carbon impacts of new residential development

Local authority	Scenario	Generation capacity [MW] Power	Generation capacity [MW] Heat	Gross emissions, Part L 2006 standards [tonnesCO_2/yr]	Gross emissions from new development before adding renewables [tonnesCO_2/yr]	Emissions savings from renewables [tonnesCO_2/yr]	Net emissions from new development [tonnesCO_2/yr]	Net scenario increase in emissions (%), as proportion of district-wide emissions (2006)	Net increase @Part L 2006 Standards (%)	Average cost increase over Part L 2006 standards (%)
Arun	Scenario 1 (multiphase)	14.64	15.53	45,243	38,405	12,483	25,922	3.1%	5.4%	17.0%
	Scenario 2 (multiphase)	9.54	15.56			14,511	23,984	2.9%		18.8%
	Scenario 3 (multiphase)	16.38	19.52			15,009	23,395	2.8%		18.1%
	Scenario 4 (multiphase)	9.9	19.57			17,590	20,815	2.5%		20.4%
Horsham	Scenario 1 (multiphase)	9.65	10.34	30,239	25,669	8,285	17,384	1.8%	3.1%	17.0%
	Scenario 2 (multiphase)	6.42	10.4			9,688	15,980	1.7%		18.8%
	Scenario 3 (multiphase)	10.86	13.01			9,985	15,684	1.6%		18.1%
	Scenario 4 (multiphase)	6.75	13.07			11,771	13,897	1.4%		20.4%
Mid Sussex	Scenario 1 (multiphase)	11.48	13.01	38,703	32,856	10,246	22,610	2.3%	3.9%	17.0%
	Scenario 2 (multiphase)	8.5	13.33			12,378	20,479	2.1%		18.9%
	Scenario 3 (multiphase)	13.02	16.45			12,397	20,459	2.1%		18.1%
	Scenario 4 (multiphase)	9.23	16.75			15,110	17,747	1.8%		20.5%
Worthing	Scenario 1 (multiphase)	3.54	5.73	17,236	14,639	3,995	10,644	2.0%	3.2%	16.9%
	Scenario 2 (multiphase)	3.66	5.99			5,361	9,278	1.7%		18.9%
	Scenario 3 (multiphase)	4.24	7.19			4,939	9,700	1.8%		18.0%
	Scenario 4 (multiphase)	8.43	7.51			6,677	7,961	0.9%		20.5%

Table 37: Comparison of renewable energy resources with potential capacities required on new residential development				
	Renewable energy resource* (from resource assessment – see Annex A)		Indicative renewable energy capacities required on new residential development (Scenario 4)	
Local authority	Power [MW]	Heat [MW]	Power [MW]	Heat [MW]
Arun	323 (73)	102 (69)	9.9	19.6
Horsham	326 (68)	87 (46)	6.8	13.1
Mid Sussex	177 (39)	72 (56)	9.2	16.8
Worthing	32 (10)	13 (13)	8.4	7.5

*Main figures refer to technical resource; bracketed figures refer to constrained resource

8.4 Heat Priority Areas and district heating

An analysis of existing heat loads throughout the five districts alongside those expected from new development has led to the identification of Heat Priority Areas, in which conditions are likely to favour larger scale, more economic and effective forms of sustainable energy generation such as CHP with district heating (and/or cooling).

The combined Heat Priority Areas identified for each district are shown in Table 38 along with their relative size and heat demand. Also shown are the resulting emission savings if these heat demands were supplied from biomass fuel, offsetting natural gas.

Table 38: Heat demands within districts showing Heat Priority Areas (HPA)						
		% of area	Heat demand (GWh/year)	% of total heat demand	Potential emission savings if heat demand within HPAs met using biomass heat-only plant (tonnes CO_2/yr)	% of district-wide emissions
Arun	Total area	100%	1,529	100	67,969	11.3
	Area within HPA	2.2%	374	24%		
	Area outside HPA	98%	1,155	76%		
Chichester	Total area	100%	1,389	100	60,336	10.4
	Area within HPA	0.5%	332	24%		
	Area outside HPA	99.5%	1,057	76%		
Horsham	Total area	100%	1,431	100	62,154	9.9
	Area within HPA	0.9%	342	24%		
	Area outside HPA	99.1%	1,088	76%		
Mid Sussex	Total area	100%	1,412	100	53,794	9.7
	Area within HPA	1.2%	296	21%		
	Area outside HPA	98.8%	1,116	79%		
Worthing	Total area	100%	1,003	100	95,230	17.9
	Area within HPA	23.0%	524	52%		
	Area outside HPA	77.0%	479	48%		

Additional carbon savings would be achieved if the heat was produced in biomass CHP plant(s). Assuming the use of steam turbine technology, and considering all HPAs, nearly 747GWh of zero carbon electricity would be generated along with the heat. This could save a further 284,000 tonnes of CO_2 by offsetting electricity supplied from the national grid – equivalent to a further 7% reduction in area-wide emissions. However, this would require a very large supply of biomass fuel – around 628,000 tonnes of woodfuel per year – equivalent to the entire unconstrained energy crops resource.

The savings from heat supply could potentially be achieved by gas-fired CHP also. This assumes that the carbon intensity of electricity from gas-fired CHP (assuming all the carbon is allocated to the electricity) is equal to or lower to that for grid electricity. Where this is the case, the CHP heat output will effectively be zero carbon.

8.5 Viability of targets for new development

Targets proposed through future Building Regulation changes will impose additional build costs on new developments, which will need to incorporate a range of low or zero carbon energy measures to meet the targets. The analysis undertaken on new residential development (SHLAA sites) proposed in West Sussex suggests additional cost ranges relative to Part L 2006 for Scenarios 1, 2, 3 and 4 of 12-19%, 12-21%, 16-19% and 16-21% respectively. It should be noted however that considering Scenario 1 is a 'baseline' scenario, i.e. which will happen anyway through the proposed building regulations, the costs of the other scenarios could be considered relative to Scenario 1. This would result in additional costs of Scenarios 2, 3 and 4 being around 2-4%.

Additional costs associated with the Code for Sustainable Homes are well-documented in theory, although have yet to be fully tested in practice. There is a significant step-change in cost in achieving Code level 6 over level 5, although it is likely that the definition of Code level 6 will change following the Government's consultation on the *Definition of Zero Carbon Homes and Non-Domestic Buildings*. Additional costs resulting from BREEAM standards on non-residential development are much less defined.

A range of existing and emerging institutional and financial mechanisms can assist in the successful delivery of carbon reduction targets. Management and operation of district heating systems will need tailored arrangements such as the formation of an Energy Service Company (ESCo). Although no standard 'model' currently exists for ESCos, there are increasing numbers now being established for a variety of applications. Initiatives such as the Community Infrastructure Levy may also assist in establishing sustainable energy infrastructure through up-front funding.

As mentioned above, the set of allowable solutions being proposed by the Government to be implemented from 2016 will offer developers a certain degree of flexibility in meeting the zero carbon requirements on new homes where zero carbon cannot be achieved solely through on-site measures or by directly connected heat. Opportunities therefore exist for local planning authorities to introduce locally tailored allowable solutions in advance of Building Regulations, which could include off-site contributions for local district heating infrastructure.

9 Recommendations

9.1 Policy recommendations

The following policy recommendations are made to the five local authorities:

Recommendation 1

Prepare an overarching statement on climate change in line with national policy on emissions and renewable energy targets. For example:

"XXX Council is committed to reducing total CO_2 emissions in line with the Climate Change Committee's recommendation for an 80% cut by 2050, relative to the year 1990"

To justify and contextualise the development specific policies, each local authority should prepare an overarching statement at the outset focused on climate change, CO_2 reduction targets and renewable and low carbon energy targets. An overall greenhouse gas reduction target of 80% by 2050 and 34% by 2020 is recommended, in line with the latest UK policy set out in the Climate Change Act (2008). Both these targets are set against a 1990 baseline. Area or district-wide targets for renewable and low carbon energy technologies and how they may relate to an appropriate trajectory of CO_2 reduction towards the 2050 target should be the subject of further study and consultation. These should be informed by the results of the renewable energy resource assessment presented in this report.

Recommendation 2

Evaluate whether local conditions and local authority in-house capacity (such as the measures stated in Recommendations 8 -11 below) could be developed sufficiently to justify the adoption of Scenario 4 in this study for new residential development, expressed in terms of the Code for Sustainable Homes; that is:

- ***Code level 4 (44% reduction on regulated emissions) from 2010***
- ***Code level 5 (100% reduction on regulated emissions) from 2013 onwards***

As a fall-back option, set policies for carbon emission standards on new residential development according to a minimum of Scenario 2 in this study, expressed in terms of the Code for Sustainable Homes; that is:

- ***Code level 3 (25% reduction on regulated emissions) from 2010***
- ***Code level 4 (44% reduction on regulated emissions) from 2013***
- ***Code level 5 (100% reduction on regulated emissions) from 2016***

Following the consultation on the *Definition of Zero Carbon Homes and Non-Domestic Buildings*, the Government has indicated a preferred set of standards for new homes which sets a trajectory of carbon reduction targets up to 2016. These standards are represented in Scenario 1 of this study: 25% reduction on regulated emissions from 2010, 44% reduction on regulated emissions from 2013 and zero carbon from 2016, with the latter target made up of a carbon compliance level of 70% of regulated emissions plus allowable solutions for residual emissions. Future consultations on Building Regulations will establish more detail on these targets, such as the minimum level of energy efficiency to be achieved.

The analysis[58] behind this announcement suggests that these standards can generally be applied to all housing types without placing undue burden on developers regarding technical or economic viability. Where these standards are exceeded, there should be sufficient evidence to justify their technical and financial viability for the majority of developments. Clearly there will be some cases where a degree of flexibility is required whereby developers can be offered alternative 'allowable' solutions if standards can be shown to be technically or financially unviable.

By offering allowable solutions to allow a degree of flexibility on certain developments where targets are shown to be unviable e.g. small scale developments, planning departments should therefore still be able to 'set the bar high' in order to maximise carbon savings on the majority of developments regardless of scale or location. For this reason, and considering the importance of ensuring the earliest possible action on climate change, each local authority should first consider bringing forward and increasing such standards for earlier implementation as proposed in Scenario 4, i.e. 44% reduction on regulated emissions from 2010 and 100% from 2013 onwards.

The analysis has shown that the average additional cost per dwelling (over Part L 2006 standards) associated with this scenario are minimal (around 20.5%) when compared with proposed Building Regulation standards up to 2016 (around 17%). Additionally, the analysis shows that the area's renewable energy resources could potentially support the energy generation requirements on new residential development (as modelled on the SHLAA data set) that this scenario (and the other scenarios) would require (see Table 37). However, this includes the wind resource where locational constraints will still apply in relation to developments. In most cases, the majority of electricity demand could potentially be met by solar PV in conjunction with biomass CHP.

The adoption of Scenario 4 will raise the immediate challenge of ensuring that the delivery structures required to implement standards proposed by Building Regulations from 2013 are in place three years earlier i.e. from 2010. The viability of this would therefore depend on each local authority's view of how quickly supply chains, infrastructure, council in-house capacity and resources etc could be established.

Scenario 2 in this report should be considered the fall-back *minimum* standard by each local authority, which increases the 2016 carbon compliance level to 100% of regulated emissions. The analysis has shown that the average additional cost burden associated with this standard is marginal, around 18.9%, compared with proposed Building Regulation costs of 17%, relative to Part L 2006 costs. As per Scenario 4, the area's resources could potentially meet the demand. For example, under Scenario 2, new residential development would need around 25% of the combined biomass and waste resource in the study area.

Although the focus of this study concerns sustainable energy, the broader scope of environmental benefits resulting from sustainable design and construction also needs to be considered. Areas such as water use, the life cycle of materials, biodiversity, waste recycling and sustainable drainage systems are covered within the Code for Sustainable Homes and BREEAM, so unless otherwise specified, the use of these standards to express CO_2 emissions targets will also imply certain standards for other aspects of sustainable design and construction. Water conservation has particular implications in the South East region where water scarcity and waste water treatment capacity concerns are resulting from growing demands from planned development.

[58] See http://www.communities.gov.uk/publications/planningandbuilding/zerocarbondefinition

An advantage of expressing carbon savings as Code for Sustainable Homes and BREEAM targets is that scheme Assessors would be employed to assess the development (funded by the developer), avoiding further burden on Council Officer resources.

However, unlike the Code standards, the carbon reduction levels corresponding to the various BREEAM categories are less explicit but will be subject to review once the outcomes from the Government's consultation on the Code for Sustainable Buildings are known.

Recommendation 3

Targets for non-residential development should be considered in the context of the Government's proposed timeline for zero carbon buildings within this sector (Table 32 of this report). This should use the BREEAM rating system for non-residential buildings.

A baseline overall standard of BREEAM 'Very Good' should be set from 2010, with scope to upgrade this to 'Excellent' or 'Outstanding' for schools and public buildings. In parallel with this, non-residential development should be required to achieve an energy-specific BREEAM rating of Excellent or Outstanding.

There is currently very little evidence available on cost and viability issues to inform the choice of targets for non-residential developments. This is mainly due to the many different types and uses of buildings in the non-residential sector. The definition of zero carbon within this sector and the trajectory leading up to this standard have yet to be defined by Government. The Government is currently consulting on these issues and until this is concluded it is recommended that BREEAM 'Very Good' is used as a general baseline from 2010. However, BREEAM 'Excellent' or 'Outstanding' could potentially be considered for schools and public buildings where there are opportunities to do so. In parallel with this, non-residential development should be required to achieve an energy-specific BREEAM rating of Excellent or Outstanding.

All targets and standards should be revised and updated periodically as national policy, sustainability best practice and low and zero carbon technologies develop.

Recommendation 4

Local authorities should consider varying targets and assessment criteria on development in specific areas where opportunities for greater carbon savings have been shown to exist.

For example, in Heat Priority Areas, a flexible approach should be taken to ensure maximum uptake of district heating and related technologies, while in other areas the focus should be on low/zero carbon heat from biomass, solar hot water, and ground-source heat pumps.

Each local authority should consider the application of higher targets to localised areas where greater carbon saving opportunities have been shown to exist, such as the Heat Priority Areas identified in this study.

Across the West Sussex districts there is naturally some variation in terms of resources, land types and uses. The low and zero carbon energy resource assessment indicates the spatial distribution of resources, particularly in terms of wind and woodfuel, but there is little evidence to suggest that local sustainable energy targets for new development (Recommendations 2 and 3) should in general differ across the districts.

It is recommended that any site-specific targets should be based on the spatial distribution of new and existing development. Districts with higher proportions of Heat Priority Areas, for example, could adopt a flexible approach to ensure maximum uptake of district heating and related technologies. CHP/district heating for new development within these areas could be encouraged by encouraging developers to consider the 'rules of thumb' criteria for district heating and by following the heating/cooling hierarchy (Recommendation 6). In other areas, including most rural locations, the focus should be on other types of low/zero carbon technologies such as heat from biomass, solar hot water, and ground-source heat pumps.

Recommendation 5

Require an explicit site Energy Strategy based on an Energy Hierarchy to accompany development proposals.

Example:

"Proposals should be accompanied by an Energy Strategy which should be consistent with the priorities set out in the following Energy Hierarchy:

(1) Energy Efficiency (minimise demand)

(2) Zero carbon energy sources (use renewables)

(3) Low carbon energy sources (use CHP and community heating)"

Recommendation 6

In addition, policy should include reference to an explicit Heating/Cooling Hierarchy such as the following:

"New development will be expected to demonstrate that the heating and cooling systems have been selected according to the following hierarchy :

(1) Connection to existing (C)CHP distribution networks

(2) Site wide renewable (C)CHP

(3) Site wide gas-fired (C)CHP

(4) Site wide renewable community heating/cooling

(5) Site wide gas-fired community heating/cooling

(6) Individual building renewable heating"

Note that the above hierarchy would have the effect of implicitly banning electric heating in new developments.

Including these hierarchies will ensure that the lowest-carbon outcomes are achieved in a given context and will require developers to put forward valid justification for deviating from the preferred approach e.g. where small, low density developments in rural areas may not warrant CHP or district heating solutions.

Recommendation 7

A 'Merton'-style on-site generation policy should be included in the context of the hierarchies mentioned above.

Example:

"New development will be required to include sufficient on-site renewable energy generation to reduce total CO_2 emissions by at least 20% after the accounting for energy efficiency and low carbon energy sources, wherever feasible"

Whether or not already in place, 'Merton'-style on-site generation targets should be considered as part of a hierarchy, and should be expressed as a requirement to reduce site residual emissions by (at least) a certain proportion. Although the default level recommended at regional level in the South East is 10%, the London Plan now requires a 20% emissions reduction through on-site renewables considered within a hierarchy, that is, to tackle residual emissions after the inclusion of energy efficiency, CHP and communal heating.

The modelling undertaken in this study has shown that Scenario 2 alone would be likely to result in around 5% on-site renewables from 2010, rising to 18.5% by 2013 and 52% by 2016. With Scenario 4 alone, the figures would be 18.5% from 2010 and 52% from 2013 onwards. A stand-alone on-site renewables policy target of 20% reduction in total emissions would therefore encourage additional savings in the short term, particularly for Scenario 2, before being superseded by Building Regulations in later phases. Additionally, their use in the short term may help to stimulate the local skills market and supply chains for the renewable energy sector.

Recommendation 8

Consider developing Supplementary Planning Documents to provide detailed guidance on meeting carbon reduction targets for new developments.

Further consideration should be given to material to be included within Supplementary Planning Documents (SPD), such as detailed criteria-based policies, additional details on the required structure and content of proposals for sustainable energy supply (site energy strategies) submitted as part of planning applications, and details on any 'allowable solutions' offered to developers. These should include increased flexibility to encourage the development of district heating in Heat Priority Areas and could be developed in collaboration across the West Sussex local authorities. SPD will also provide the opportunity to include guidance on other carbon reduction measures such as encouraging behaviour change, increased energy efficiency and low carbon transport.

Recommendation 9

Develop in-house capacity to facilitate the implementation of planning policy targets through planning decisions. These should include:

- ***The provision of detailed information on the Code for Sustainable Homes and BREEAM assessment process to officers in both Planning and Building Control, and other officers involved in sustainability issues***
- ***The provision of detailed information on renewable energy and low carbon technologies to officers in both Planning and Building Control***
- ***The inclusion of wording within planning policies to ensure that the monitoring systems are installed and that data is collected***
- ***The development of a methodology/protocol for monitoring***
- ***Measures to ensure that the cost of monitoring is not prohibitive and is carried by the developer***
- ***Measures to ensure that the information is provided in a format which can be used by the local authority (for other activities including NI 186 and renewable energy generation reporting); and***
- ***Measures to ensure that the monitoring systems and associated protocol are designed such that the role of the local authority is to review and if necessary check the data, and that the local authority is not required to collect and analyse data from multiple systems on an on-going basis.***

In implementing the trajectory of targets expected through LDF targets and the Building Regulations, and in particular a hierarchy of measures, there is a risk of placing undue burden on local authorities to enforce compliance and administer the system. It is therefore recommended that the local authorities consider implementing these and other in-house capacity-building measures.

9.2 General recommendations

The following other recommendations are made to the five local authorities:

Recommendation 10

Local authorities should develop an Energy Strategy for West Sussex which builds on the resource assessment presented here, and formally prioritises the key carbon reduction opportunities within the five local authorities and the county. This should cover the following issues as a minimum:

- ***Energy efficiency in buildings and transport (not part of the evidence base)***
- ***Wind power***
- ***CHP and district heating***
- ***Biomass and woodfuel***

There is a significant opportunity to reduce carbon emissions across West Sussex using local sustainable energy resources. As demonstrated by the resource assessment undertaken in this study, a theoretical saving of some 46% of area-wide emissions could potentially be achieved. A further recommendation of this report is therefore for each local authority to develop an energy strategy to prioritise the key carbon reduction opportunities in the study area, including but going beyond opportunities related strictly to new development sites.

Such an approach could use the findings of the resource assessment presented in this report to identify and promote opportunities to exploit onshore wind power, biomass and waste, and CHP/district heating. Including some specific spatial guidance in Core Strategies would allow local authorities to adopt a strategic approach to stating their preferences, rather than simply responding to developer choices. In addition, given the opportunities for large scale renewable and low carbon energy developments in the sub-region, identifying spatial preferences will help to enable the most to be made of those opportunities.

The timetable for the implementation of strategy measures i.e. an action plan will largely depend on which policy scenario and/or district-wide targets are adopted. However, once policies are finalised, the measures given in Recommendations 9 and 11 should all be considered as urgent i.e. they should be initiated as soon as possible.

Recommendation 11

In support of the Energy Strategy recommended above, local authorities should:

- ***Adopt a facilitating and coordinating role in planning and delivering the key priorities in the West Sussex Energy Strategy. This may include establishing Energy Service Companies (ESCos) and identifying opportunities to use the Community Infrastructure Levy (CIL)***
- ***Build on the CHP/district heating analysis undertaken on the SHLAA data within this study and examine in more detail the opportunities available***
- ***Develop a strategic plan to establish woodfuel supply chains across West Sussex***
- ***Coordinate further discussion on wind power development and the level of landscape-type constraints that should be applied in light of the setting of area-wide carbon reduction or renewable energy targets***

In order to deliver macro-scale energy supply solutions such as district heating in Heat Priority Areas, early intervention is needed to develop the necessary commercial and physical infrastructure. This is less likely to occur without significant involvement from local authorities and, in some cases, the public sector, particularly in implementing the Community Infrastructure Levy (CIL) to provide up-front finance and in facilitating an ESCo partnership.

A coordinating role by local authorities will help facilitate multi-sector partnerships – especially for large scale mixed-use developments, where renewable energy infrastructure may be shared between different building types and potentially both new and existing development. It will also help to ensure a unified area-wide approach is adopted rather than piecemeal, and should serve to maximise carbon savings and benefit overall viability through economy of scale.

The local authorities should investigate the CIL and determine whether this will be taken forward. Should a council decide to implement the CIL in their area, they will have to:

- Produce up to date development plan, so that a clear idea can be given of how the funds raised might be spent. As part of this, the relationship between the CIL and local development plans must be made clear;
- Identify gaps where funding will be needed to support infrastructure development and to set the charge at a level that reflects the extent of these gaps; and
- Issue a 'charging schedule', clearly showing the criteria that will be used to determine the amount of the CIL to be charged for different types of local development.

The local authorities should build on the CHP/district heating analysis undertaken on the SHLAA data and examine in more detail the opportunities available. They should ensure at the earliest opportunity (re: phasing of developments) that developers meeting existing planning policies relating to renewable energy do not invest in systems that would be incompatible with connection to a future heat network, where this would be appropriate.

There is a strong argument for bringing forward and implementing macro-scale solutions as soon as possible to minimise the implementation of less cost effective micro-renewables and to potentially exceed Building Regulation targets. Planning policy will therefore need to prioritise the development of CHP and district heating networks over micro-renewables from the earliest opportunity, on sites and in areas where these technologies are appropriate. Examples of this approach could be to actively discourage the use of micro-scale heat generation where district heat networks are available, and ensuring that new buildings are compatible with and able to connect to the network in the future.

A key area to address in exploiting the woodfuel resource will be the establishment of a network of local biomass supply chains in parallel with demand creation strategies. Future demands on the wood fuel resource in the South East are expected to significantly increase in light of future national, regional and local carbon reduction targets. A longer term reliance on wood fuel to supply developments across the districts will therefore require a strategic plan to establish adequate supply chains from a variety of sources, including forestry residues, energy crops and waste wood. These supply chains will be particularly important to spatially constrained boroughs/districts such as Worthing, which has a very small woodfuel resource. Local authorities should also consider the development of a strategic partnership between regional, sub-regional and local government bodies, along with biomass suppliers and landowners.

The constraints applied to wind power within the resource assessment undertaken in this study are considerable and the stakeholder consultation events revealed that there are mixed views over their appropriateness. The use of wind power to meet the on-site generation requirements of new development is clearly limited by a number of constraints associated with built-up areas and the legitimacy of linking carbon savings from off-site wind power to particular developments is currently unclear with regard to forthcoming Building Regulations. Large scale stand-alone wind farms could therefore play a vital role in helping to meet district-wide targets on carbon emissions reduction. The main constraining factor of landscape sensitivity should therefore be discussed further with stakeholders to establish the acceptable levels of impact in light of such targets, which may require a strategy to accept landscape character change in some areas through wind power deployment.

Annex A – Resource assessment summary by district

Table A1: Resource assessment summary for Arun

Resource/technology		Capacity [MWe]	Capacity [MWth]	Annual electricity yield [MWh]	Annual heat yield [MWh]	Emissions reduction potential [tonnes CO_2/yr]	Emissions savings as proportion of district 2006 total emissions [%]	Proportion of district 2006 total energy use [%]
Large scale wind	Unconstrained by windspeed & proximity to infrastructure only	160	–	350,893	–	150,884	17.9%	11.4%
	Unconstrained by windspeed, proximity to infrastructure and designated areas	10	–	21,188	–	9,111	1.1%	0.7%
	Unconstrained by windspeed, proximity to infrastructure, designated areas and landscape sensitivity	3	–	7,391	–	3,178	0.4%	0.2%
Med/small scale wind	Unconstrained by windspeed & proximity to infrastructure only	125	–	204,577	–	87,968	10.4%	6.6%
	Unconstrained by windspeed, proximity to infrastructure and designated areas	43	–	72,112	–	31,008	3.7%	2.3%
	Unconstrained by windspeed, proximity to infrastructure, designated areas and landscape sensitivity	44	–	74,652	–	32,100	3.8%	2.4%
Solar PV		*17*	–	13,242	–	5,694	0.7%	0.4%
Solar Water Heating		–	10	–	6,337	1,172	0.1%	0.2%
Woodland residues		–	38	–	118,807	18,485	2.2%	3.9%
Energy crops	All suitable land	14	35	123,364	308,411	96,610	11.5%	14.0%
	5% of suitable land	0.7	1.7	6,164	15,411	5,468	0.6%	0.7%
Waste (MSW)		1.9	4.8	15,201	38,002	13,567	1.6%	1.7%
Waste (Ind &Comm + wood from construction & demolition)		5.4	13.5	43,032	107,579	38,406	4.6%	4.9%
Waste (Agr, food)		0.4	1.1	3,476	8,691	3,103	0.4%	0.4%

Table A2: Resource assessment summary for Chichester								
Resource/technology		**Capacity [MWe]**	**Capacity [MWth]**	**Annual electricity yield [MWh]**	**Annual heat yield [MWh]**	**Emissions reduction potential [tonnes CO_2/yr]**	**Emissions savings as proportion of district 2006 total emissions [%]**	**Proportion of district 2006 total energy use [%]**
Large scale wind	Unconstrained by windspeed & proximity to infrastructure only	203	–	445,556	–	191,589	20.9%	13.0%
	Unconstrained by windspeed, proximity to infrastructure and designated areas	14	–	31,481	–	13,537	1.5%	0.9%
	Unconstrained by windspeed, proximity to infrastructure, designated areas and landscape sensitivity	3	–	5,694	–	2,448	0.3%	0.2%
Med/small scale wind	Unconstrained by windspeed & proximity to infrastructure only	312	–	497,618	–	213,976	23.3%	14.5%
	Unconstrained by windspeed, proximity to infrastructure and designated areas	56	–	90,009	–	38,704	4.2%	2.6%
	Unconstrained by windspeed, proximity to infrastructure, designated areas and landscape sensitivity	58	–	94,119	–	40,471	4.4%	2.7%
Solar PV		*21*	–	16,260	–	6,992	0.8%	0.5%
Solar Water Heating		–	11	–	7,605	1,407	0.2%	0.2%
Woodland residues		–	50	–	153,811	23,931	2.6%	4.5%
Energy crops	All suitable land	45	114	405,037	1,012,592	317,194	34.6%	41.4%
	5% of suitable land	2	6	20,043	50,107	17,778	1.9%	2.0%
Waste (MSW)		9.2	23	10,991	27,478	9,810	1.1%	1.1%
Waste (Ind &Comm + wood from construction & demolition)		6.5	16	51,756	129,389	46,192	5.0%	5.3%
Waste (Agr, food)		1.3	3.2	10,191	25,479	9,096	1.0%	1.0%

Table A3: Resource assessment summary for Horsham								
Resource/technology		**Capacity [MWe]**	**Capacity [MWth]**	**Annual electricity yield [MWh]**	**Annual heat yield [MWh]**	**Emissions reduction potential [tonnes CO_2/yr]**	**Emissions savings as proportion of district 2006 total emissions [%]**	**Proportion of district 2006 total energy use [%]**
Large scale wind	Unconstrained by windspeed & proximity to infrastructure only	173	–	378,323	–	162,679	16.9%	11.0%
	Unconstrained by windspeed, proximity to infrastructure and designated areas	8	–	17,465	–	7,510	0.8%	0.5%
	Unconstrained by windspeed, proximity to infrastructure, designated areas and landscape sensitivity	1	–	2,354	–	1,012	0.1%	0.1%
Med/small scale wind	Unconstrained by windspeed & proximity to infrastructure only	118	–	184,896	–	79,505	8.3%	5.4%
	Unconstrained by windspeed, proximity to infrastructure and designated areas	56	–	87,690	–	37,707	3.9%	2.5%
	Unconstrained by windspeed, proximity to infrastructure, designated areas and landscape sensitivity	48	–	73,407	–	31,565	3.3%	2.1%
Solar PV		*12*	–	9,222	–	–	0.4%	0.3%
Solar Water Heating		–	9	–	5,766	1,067	0.1%	0.2%
Woodland residues		–	19	–	57,766	8,988	0.9%	1.7%
Energy crops	All suitable land	17	43	153,563	383,909	120,259	12.5%	15.6%
	5% of suitable land	0.9	2	7,673	19,184	6,807	0.7%	0.8%
Waste (MSW)		1.5	3.9	12,160	30,401	10,853	1.1%	1.2%
Waste (Ind &Comm + wood from construction & demolition)		2.4	5.9	19,040	47,600	16,993	1.8%	1.9%
Waste (Agr, food)		2.4	6.0	19,036	47,590	16,990	1.8%	1.9%

Table A4: Resource assessment summary for Mid Sussex

Resource/technology		Capacity [MWe]	Capacity [MWth]	Annual electricity yield [MWh]	Annual heat yield [MWh]	Emissions reduction potential [tonnes CO_2/yr]	Emissions savings as proportion of district 2006 total emissions [%]	Proportion of district 2006 total energy use [%]
Large scale wind	Unconstrained by windspeed & proximity to infrastructure only	53	–	115,358	–	49,604	5.1%	3.5%
	Unconstrained by windspeed, proximity to infrastructure and designated areas	0.1	–	219	–	94	0.0%	0.0%
	Unconstrained by windspeed, proximity to infrastructure, designated areas and landscape sensitivity	0	–	0	–	0	0.0%	0.0%
Med/small scale wind	Unconstrained by windspeed & proximity to infrastructure only	89	–	132,445	–	56,951	5.8%	4.0%
	Unconstrained by windspeed, proximity to infrastructure and designated areas	10	–	15,032	–	6,464	0.7%	0.5%
	Unconstrained by windspeed, proximity to infrastructure, designated areas and landscape sensitivity	10	–	14,773	–	6,352	0.6%	0.4%
Solar PV		*20*	–	15,552	–	6,687	0.7%	0.5%
Solar Water Heating		–	10	–	6,741	1,247	0.1%	0.2%
Woodland residues		–	23	–	71,395	11,108	1.1%	2.1%
Energy crops	All suitable land	7	17	59,695	149,237	46,748	4.8%	6.3%
	5% of suitable land	0.3	1	2,985	7,462	2,648	0.3%	0.3%
Waste (MSW)		1.6	3.9	12,394	30,986	11,062	1.1%	1.3%
Waste (Ind &Comm + wood from construction & demolition)		6.9	17	54,650	136,624	48,775	5.0%	5.7%
Waste (Agr, food)		0.6	1.4	4,522	11,306	4,036	0.4%	0.5%

Table A5: Resource assessment summary for Worthing

Resource/technology		Capacity [MWe]	Capacity [MWth]	Annual electricity yield [MWh]	Annual heat yield [MWh]	Emissions reduction potential [tonnes CO_2/yr]	Emissions savings as proportion of district 2006 total emissions [%]	Proportion of district 2006 total energy use [%]
Large scale wind	Unconstrained by windspeed & proximity to infrastructure only	13	–	28,361	–	12,195	2.3%	1.5%
	Unconstrained by windspeed, proximity to infrastructure and designated areas	0	–	0	–	0	0.0%	0.0%
	Unconstrained by windspeed, proximity to infrastructure, designated areas and landscape sensitivity	0	–	0	–	0	0.0%	0.0%
Med/small scale wind	Unconstrained by windspeed & proximity to infrastructure only	8	–	13,285	–	5,712	1.1%	0.7%
	Unconstrained by windspeed, proximity to infrastructure and designated areas	0.2	–	171	–	73	0.0%	0.0%
	Unconstrained by windspeed, proximity to infrastructure, designated areas and landscape sensitivity	0.2	–	171	–	73	0.0%	0.0%
Solar PV		7	–	5,383	–	2,315	0.4%	0.3%
Solar Water Heating		–	5	–	2,937	543	0.1%	0.2%
Woodland residues		–	0.2	–	526	82	0.0%	0.0%
Energy crops	All suitable land	0.07	0.18	628	1,569	491	0.1%	0.1%
	5% of suitable land	0.004	0.009	31	78	28	0.0%	0.0%
Waste (MSW)		1.3	3.3	10,523	26,309	9,392	1.8%	2.0%
Waste (Ind &Comm + wood from construction & demolition)		2.0	4.9	15,897	39,743	14,188	2.7%	3.0%
Waste (Agr, food)		0.1	0.2	765	1,911	682	0.1%	0.1%

Annex B – Costing data from Government research

Definition of Zero Carbon Homes and Buildings: Consultation (DCLG, Dec 2008)

The following table has been compiled from Annex E of the above document, which presents a series of technology combinations modelled by Cyril Sweett/Faber Maunsell to achieve a range of carbon reduction targets on homes. Shown here are four dwelling types modelled within an 'urban regeneration' scenario, which assumes a development of 750 dwellings with an overall average density of 160 dwellings per hectare. The combinations shown below represent the least-cost combinations modelled in achieving each target reduction, apart from the 'Zero C' target (100% reduction on total emissions) where the modelled combination which achieved the highest CO_2 savings has been selected. Wind power is excluded from the analysis as technical viability is significantly more dependent on site-specific factors than other technologies

	Target CO_2 reduction (% 2006 TER)	Carbon reduction (vs Part L 2006)	Residual CO_2 - elec (tpa)	Residual CO_2 - other (tpa)	total residual CO_2 (tpa)	Capital cost premium	Base build cost (2006)
Urban Regeneration - flat							
PV + BPEE	25%	27%	0.81	1.15	1.96	£3,392	£73,611
Biomass heating 80% + BPEE	44%	68%	0.84	0.55	1.38	£4,938	£73,611
Biomass heating 80% + PV + BPEE	70%	81%	0.66	0.55	1.21	£6,592	£73,611
Biomass CHP 80% + BPEE	100%	118%	0.02	0.68	0.7	£7,916	£73,611
Biomass CHP 80% + PV + BPEE	Zero C	152%	-0.46	0.68	0.22	£12,566	£73,611
Urban Regeneration - mid-terrace							
PV + BPEE	25%	26%	1.02	1.23	2.25	£4,977	£65,825
Biomass heating 80% + BPEE	44%	67%	1.04	0.59	1.62	£6,264	£65,825
Biomass heating 80% + PV + BPEE	70%	79%	0.86	0.59	1.44	£8,330	£65,825
Biomass CHP 80% + BPEE	100%	116%	0.16	0.73	0.88	£9,471	£65,825
Biomass CHP 80% + PV + BPEE	Zero C	173%	-0.73	0.73	0	£18,499	£65,825
Urban Regeneration - end-terrace							
PV + BPEE	25%	26%	1.04	1.34	2.38	£5,063	£71,816
Biomass heating 80% + BPEE	44%	68%	1.04	0.63	1.66	£6,993	£71,816
Biomass heating 80% + PV + BPEE	70%	79%	0.86	0.63	1.49	£9,043	£71,816
Biomass CHP 80% + BPEE	100%	117%	0.05	0.78	0.83	£10,695	£71,816
Biomass CHP 80% + PV + BPEE	Zero C	166%	-0.78	0.78	0	£19,231	£71,816
Urban Regeneration - detached							
PV + BPEE	25%	25%	1.28	1.77	3.04	£5,964	£94,255
Biomass heating 80% + BPEE	44%	68%	1.24	0.79	2.03	£9,065	£94,255
Biomass heating 80% + PV + BPEE	70%	76%	1.06	0.79	1.85	£11,069	£94,255
Biomass CHP 80% + BPEE	100%	118%	-0.13	1	0.87	£14,205	£94,255
Biomass CHP 80% + PV + BPEE	Zero C	155%	-1	1	0	£23,131	£94,255

PV = photovoltaics

BPEE = Best Practice Energy Efficiency

Biomass heating 80% = 80% of heat load supplied by biomass heating plant

Biomass CHP 80% = 80% of heat load supplied by biomass heating plant

Cost Analysis of the Code for Sustainable Homes (CLG, 2008)

The following tables are extracts from the above report showing estimated costs for achieving the various levels of the Code for Sustainable Homes and costs of individual technologies. The figures in the first table assume that no wind power is available at any scale.

Table 4.2: End terraced house

CSH Level	Mandatory (£)	Energy (£)	Water (£)	Flexible (£)	Total cost (£)	Cost £ per m²	Percentage Increase on 2006 Building Regs
Best Case (Market Town scenario with low ecological value and low flood risk)							
1	£490	£275	£0	£10	**£775**	£8	1%
2	£490	£1,648	£0	£220	**£2,358**	£23	3%
3	£490	£3,692	£125	£620	**£4,927**	£49	7%
4	£490	£7,115	£125	£1,270	**£9,000**	£89	12%
5	£490	£12,353	£2625	£2,060	**£17,528**	£174	23%
6	£490	£24,822	£2625	£3,270	**£31,207**	£309	41%
Medium Case (Market town scenario with medium ecological value and low flood risk)							
1	£490	£275	£0	£30	**£795**	£8	1%
2	£490	£1,648	£0	£460	**£2,598**	£26	3%
3	£490	£3,692	£125	£720	**£5,027**	£50	7%
4	£490	£7,115	£125	£1,760	**£9,490**	£94	13%
5	£490	£12,353	£2625	£3,270	**£18,738**	£186	25%
6	£490	£24,822	£2625	£3,310	**£31,747**	£314	42%
Worst Case (Small scale scenario with high ecological value and medium/high flood risk)							
1	£490	£275	£0	£120	**£885**	£9	1%
2	£490	£1,648	£0	£745	**£2,883**	£29	4%
3	£490	£3,916	£125	£1,270	**£5,801**	£57	8%
4	£490	£5,880	£125	£1,920	**£8,415**	£83	11%
5	£490	£13,292	£2625	£3,810	**£20,217**	£200	27%
6	£490	£29,393	£2625	£5,160	**£37,668**	£373.0	50.07%

Table 2.2: Carbon Saving Technologies

Technology option	Scale (if applicable)	£/unit (minimum)	£/unit (maximum)	Unit
Solar Water Heating	Generally 2.8m² of flat panel collector per dwelling	£850	£850	m²
PV	Scaled from 0.25kWp to 4kWp per dwelling	£4,200	£4,800	kWe
Biomass Heating	Scaled on biomass boiler capacities from 25kW to 1,000kW	£200	£600	kWth
Ground Source Heat Pumps	Scaled on GSHP capacities from 250kW to 500kW	£800	£2,750	kWth
Biomass CHP	Scaled for biomass CHP capacities (large sites)	£3,500	£3,500	kWe
	Scaled for biomass CHP capacities (small City Infill sites)	£16,000	£16,000	kWe
Gas Fired CHP	Scaled on CHP capacities from 8kWe to 40kWe	£1,200	£3,400	kWe
	Scaled on CHP capacities over 400kWe	£650	£1,200	kWe
Micro Wind	Generally based on 1.5kW unit per dwelling	£2,500	£2,500	kWe
Medium Wind	Scaled on basis of units of size 150kW to 600kW	£1,250	£1,500	kWe
Large Wind	Scaled on basis of units of size 600kW to 1,200kW	£900	£1,250	kWe

Annex C – Examples of local authority carbon offset funds

Milton Keynes City Council

Milton Keynes Council has agreed an aim to achieve carbon neutral growth. The city is forecast to grow substantially in the future, which will inevitably increase carbon dioxide emissions across the area. The Council therefore requires developers working on projects of a certain size to reduce emissions as far as possible on site and to offset all unavoidable emissions. Residential developments with more than five dwellings and all developments over 1000m^2 must meet specified levels of the Code for Sustainable Homes or BREEAM standards and generate a specified percentage of renewable energy on-site. These new developments are also expected to be carbon neutral overall i.e. there is to be no net increase in emissions as a result of energy used to run the new buildings. Developers that cannot achieve this through the use of technologies on-site must pay into a carbon neutrality fund. The Council currently imposes the requirement to pay into this fund using a section 106 agreement.

Under the Council's 'D4' planning policy, developers must pay £200 for every tonne of carbon dioxide their development will emit in its first year of use. This figure is to increase annually based on the building cost inflation. For a new house, achieving carbon neutrality should currently cost around £400.

Money raised by the carbon neutrality fund is used to reduce carbon emissions from other local sources. Funds support the generation of renewable energy and the installation of energy saving measures in existing homes. Initially money raised was also used to pay for tree planting but the Council has recently shifted the focus onto energy saving applications. The money received from ten new developments reportedly totals £250,000 so far, enough to insulate 1,000 existing homes. Ultimately the Council expects to be able to raise around £800,000 a year but this will depend on the type and size of developments as well as variations in the national economy.

As well as offsetting carbon dioxide emissions, the actions supported by the fund are allowing Milton Keynes Council to reduce fuel poverty locally, create jobs, stimulate the local economy and develop an experience and technology base locally for low carbon technologies.

Having the ability to pay into this fund enables the construction of developments that cannot easily or affordably comply with the Council's carbon neutrality policy on-site. Growth should, therefore not be held up by the existence of a sustainable planning policy.

Ashford Borough Council

As with Milton Keynes Council, Ashford Borough Council is classified as a major growth area, and has introduced a number of policies designed to ensure this growth can be as sustainable as possible. Ashford also wants to achieve zero carbon growth. Policy CS10 – Sustainable Design and Construction[59] expects all major developments to "incorporate sustainable design features to reduce the consumption of natural resources and to help deliver the aim of zero carbon growth in Ashford".

Major residential developments are defined as those with ten or more dwellings or which are greater than 0.5 hectares in area; major non-residential developments are those with more than '1000m^2 gross external floorspace'; the policy also covers all developments with an area over 1 hectare. These dimensions were determined using the thresholds for the suggested inclusion of renewable energy included in the draft South East Plan.

[59] Ashford Borough Council's Local Development Framework: www.ashford.gov.uk/ashfordgov1.1/pdf/Housing%20Background%20Document.pdf.

Developers must achieve certain standards of energy and water efficiency, use sustainable construction materials and facilitate waste reduction. The Council has specified which level of the Code for Sustainable Homes or the Building Research Establishment's Environmental Assessment Method (BREEAM) new developments should meet. Developers must also reduce CO_2 emissions by a specified percentage through the use of sustainable energy technologies on-site. Overall each new development is required to be carbon neutral, with any remaining CO_2 emissions being offset via payments into a carbon offsetting fund.

Both Milton Keynes and Ashford Councils' policies set on-site renewable energy and efficiency targets that strengthen over time so that carbon emissions from new developments will reduce gradually. The requirements that developments meet certain carbon emission reduction levels through activity on site, means developers will be unable to rely solely on carbon offsetting to achieve carbon neutrality.

Eastleigh Borough Council

In contrast to Milton Keynes City Council and Ashford Borough Council, which are using offsetting to enable new developments to achieve carbon neutrality, Eastleigh Borough Council, in Hampshire, is using its own offsetting fund CarbonFREE (Carbon Fund for Reducing Emissions in Eastleigh) to enable existing buildings to achieve carbon neutrality. The Council intends to become carbon neutral by 2012. It will be reducing the emissions from its own buildings and activities as far as possible between now and that time, but has chosen to create a carbon offsetting scheme as well, to allow it to compensate for unavoidable CO_2 emissions. Existing schemes were not trusted to achieve real carbon dioxide savings; the Council also wanted to support local action to tackle climate change, so it opted to set up its own local scheme.

The Council is investing £50,000 a year into CarbonFREE, and is also helping local householders and businesses to calculate their carbon emissions and allowing them to pay into the fund as well. For the 12 months from December 2008, local bus companies will also donate 1p from every bus ticket sold on Thursdays in the Borough into the fund. This initiative is expected to raise as much as £6,000 before December 2009.

Money raised is used to fund the installation of insulation in local households and community buildings – particularly where householders are ineligible for existing national insulation schemes. These measures were chosen for support because they are cost-effective and the Council wanted CarbonFREE to remain competitive with existing schemes. As well as reducing carbon emissions, this scheme is helping the Council meet targets set for national indicators 186 and 188 as agreed in its LAA.

Prior to creating its own carbon offsetting scheme, Eastleigh Borough Council carried out market research to investigate local residents' likely willingness to pay to offset their carbon emissions. While only 2% of those asked claimed to be paying into offsetting funds already, 36% said they would be interested in principle in doing so. Of the interested individuals, 26% said they would be willing to pay £10 or more per tonne of CO_2 saved.

CarbonFREE meets the best practice criteria for offsetting schemes as defined by the Government's Quality Assurance Scheme[60].

[60] The UK Government's Quality Assurance Scheme for Carbon Offsetting: http://offsetting.defra.gov.uk/. This scheme, run by the Department for Energy and Climate Change (DECC) helps raise awareness about carbon offsetting and awards a quality mark to approved schemes. Approved schemes will use accurate emission calculations and have to prove that money is used to achieve verifiable emissions reductions.

Annex D – Consultation with local stakeholders and neighbouring councils

The five planning authorities undertook a series of consultation exercises as part of this project. This involved both internal and external stakeholders, including representatives from regional government, neighbouring planning authorities, Parish Councils and developers.

The consultation exercises took place in two phases. The first was a series of telephone interviews with representatives from neighbouring authorities to highlight any cross boundary development issues. The second phase involved three facilitated workshops to give stakeholders the opportunity to discuss development issues and pressures, and to give feedback on our initial findings and feasibility of our draft policy recommendations.

These exercises have enabled the project team, on behalf of the partner authorities, to engage with stakeholders and begin to achieve 'buy-in' as early as possible.

Interviews with neighbouring authorities

Prior to any formal consultation events, we conducted a series of telephone interviews with neighbouring authorities, and Parish and County Councils. The purpose of these interviews was to explore the position and progress of these authorities with respect to developing planning policies which support sustainable energy, and to discuss expectations regarding specific development sites which span boundaries.

Representatives from the following organisations were contacted:

- Adur District Council;
- Brighton and Hove City Council;
- Crawley Borough Council;
- East Hampshire District Council;
- Havant Borough Council;
- Lewes District Council;
- Reigate and Banstead Borough Council;
- Tandridge District Council;
- Waverley Borough Council;
- Wealden District Council;
- West Sussex County Council;
- East Sussex County Council;
- Surrey County Council;
- South Downs AONB Joint Board;
- High Weald AONB;
- South East England Partnership Board; and
- Broadbridge Heath Parish Council.

Overall, the outcomes of this task were extremely positive. Local planning authorities across the South East are implementing sustainable development planning policies within their Core Strategies, although some councils are much further forward than others in this process. All organisations that were interviewed demonstrated broad level support for the introduction of sustainable development planning policies by the five planning authorities.

Cross boundary issues and potential conflicts

A key aspect of this consultation exercise was to determine any cross-boundary development issues and any other potential conflicts. The majority of those individuals contacted did not foresee any issues associated with the introduction of such policies in the five planning authorities. A summary of the responses from the organisations contacted can be found below.

It is also important to note that while many representatives highlighted potential cross boundary development issues and other conflicts, they also commented that councils within the area have existing working relationships and that any issues would be likely to be resolved cooperatively.

For example, representatives from **Adur District Council** and **Brighton and Hove City Council** highlighted that they are already working closely with neighbouring councils in relation to the Shoreham Harbour development, while **Crawley Borough Council** are already working in partnership Horsham and Mid Sussex District Councils on developments within boundary areas. **Lewes District Council** representatives highlighted that they will have to work closely with Mid Sussex District Council in particular, due to the future development sites in Burgess Hill and Haywards Heath.

The representative from **Reigate and Banstead Borough Council** commented that developers were more likely to build in those areas where sustainable development planning policies had not been implemented. Although it is important to draw attention to anecdotal evidence that suggests that does not actually occur in practice.

The **Tandridge District Council** representative drew attention to the fact that their council has a Green Belt Policy, while neighbouring Mid Sussex District Council does not. They suggested that there could be potential issues should any development be planned between the two councils where this policy would apply, but concluded that this would be dealt with co-operatively should this issue ever arise.

Waverley Borough Council representatives highlighted that developers responding to the Council's issues and options consultation were in favour of a consistent approach by all authorities across the region.

The **Wealden District Council** representative thought that the impact of neighbouring authorities' policies or cross boundary development had not been considered by their own council during the development of their own policies, however it could be that such issues were dealt with separately.

A number of representatives from **West Sussex County Council** were interviewed. One representative could foresee a number of potential problems. While they were positive regarding the introduction of sustainable development policies, they added that it would invariably create "more hurdles and expense", especially in relation to the extra detail required at the outline planning stage. In addition, this representative commented that the introduction of these types of policies will add a layer of complexity for both local planners as well as the County Council planning team.

Another representative commented that there will always be potential cross boundary issues, yet the good working relationship between the District and Borough Councils means that these will be resolved. In addition, they felt that this type of policy should be replicated across the whole area and that the County Council should conduct a County wide large-scale wind study. This study would help local councils determine where such large-scale strategic energy facilities should be placed.

Another representative commented that there is an energy from waste (EfW) policy in the Waste Local Plan (policy U6), and that this had been adopted for development control purposes. There should be the potential to work jointly on cross-border issues, including energy from waste.

The final representative that we spoke to, who works on meeting the carbon dioxide emissions reduction targets within the LAA (NI 186), commented that the policy should help to reduce carbon emissions from new build developments in the area.

A representative from **East Sussex County Council** highlighted that there could be potential conflicts in relation to Mid Sussex District Council's Core Strategy regarding housing allocations and cross-border transport issues. There a number of emerging issues and points of tension. For example, the County Council will need to see how growth in West Sussex as a whole, including Mid Sussex, can be accommodated in relation to the highway network. The representative could not however foresee any conflicts with the introduction of sustainable development planning policies in the five planning authorities other than in Area of Outstanding Natural Beauty (AONB) and the emerging South Downs National Park, and pointed out that the South East Plan states that there is limited potential for strategic wind facilities across Sussex.

The representative from **Surrey County Council** commented that renewable energy may be a 'sensitive issue' within their own organisation. The Council have discussed the potential for wind technologies but have not yet put the question to its elected members, and it is likely to be an emotive issue.

A representative from the **South Downs Area of Outstanding Natural Beauty (AONB) Joint Board** highlighted the development of the South Downs Management Plan[61], which was adopted by the five partner authorities. They also commented that large scale wind turbines are likely to be unacceptable in the AONB, and that there could be potential for wind turbines depending on outcomes of the landscape sensitivity analysis.

A representative from the **High Weald Area of Outstanding Natural Beauty (AONB)** commented that there are likely to be potential conflicts in relation to location and impacts of large scale energy infrastructure, such as wind turbines. However, this would be considered on a case by case basis. The representative pointed out that the AONB has recently published a report on the technical constraints of wind technology in the High Weald AONB[62], which concluded that the cumulative impacts of the range of constraints imposed on this heavily populated rural landscape, criss-crossed by communication routes and within the zone of influence of the UK's second busiest airport, suggest that the High Weald is unlikely to be suitable for large scale wind energy projects. The area may be more suitable for single turbines or small clusters of up to three turbines in the 0.75 - 2 MW range, however site selection and layout may be extremely sensitive and problematic.

The representative from the **South East England Partnership Board** highlighted the recently published climate change guidance[63], which looks at the requirements of PPS1 that need to be addressed by LPAs and provides examples of good practice.

Finally a representative from **Broadbridge Heath Parish Council** commented that cross boundary links between councils were essential when viewed in terms of transport links or sustainable energy

[61] South Downs Management Plan: www.southdowns.gov.uk/rte.asp?id=7.
[62] Wind Energy Assessment for the High Weald: www.highweald.org/text.asp?PageId=175.
[63] Climate change within Local Development Frameworks: www.southeast-ra.gov.uk/planning_development.html.

generation. As for potential conflicts with development, they commented that there will always be conflict, but hopefully positive aspects can be established and agreed.

Local stakeholder workshops

First Stakeholder Workshop (Internal: representatives from local authorities within the study area)

The first stakeholder consultation workshop was held at Worthing Borough Council Town Hall on Monday 22 June 2009. The event was attended by 24 individuals, including five councillors, from the five local planning authorities, with officers from the Planning, Building and Development Control and Environmental departments.

The objective of the workshop was to identify current examples of good practice in the county, the authorities' aspirations for sustainability planning policies and the local circumstances that could justify enhanced planning standards. The event was also designed to determine any potential conflicts that the authorities foresee.

Examples of good practice

The aim of this workshop session was to ascertain examples of sustainable construction and renewable energy good practice across the study area, to help the project team determine the capabilities of local installers and developers. A number of examples of good practice were identified, which indicate that:

- There are developers operating in the area who are capable of building to various levels of the Code for Sustainable Homes. Examples of these include:
  - **Code level 4**: Horsham – Abbey House, Storrington, Greenoak 12 flats and 8 houses - all affordable dwellings.
  - **Code level 4**: Chichester – Planning permission granted for 700+ homes, Graylingwell, second phase of development will include homes meeting Code Level 6 (tenure not specified).
  - **Code level 5**: Horsham – Saxon Weald (RSL), Arun Road, Billingshurst, six units (social).
  - **Code level 6**: Mid Sussex – approved development at Randulphs pumping station, Hurstpierpoint.
- There have been numerous renewable energy and decentralised energy systems installed in the area; and
- Planning officers within the five authorities have some experience in specifying sustainable construction standards and Merton-rule type policies.

Aspirations and barriers

The aim of this workshop session was to ascertain the authorities' aspirations for sustainability and renewable energy planning policies and then to discuss the barriers surrounding their implementation. Participants took part in a voting exercise which revealed that there was a gap between the level of sustainability or renewable energy generation that participants would like to see included in their Council's policy, and the level of sustainability or renewable energy generation they think is feasible.

A discussion then followed about the barriers to achieving these aspirations. These barriers included the following:

- Many officers felt that the data provided by developers on renewable energy technologies reliability and efficiency were not robust and did not deliver carbon dioxide emission savings declared while planning the development.
- Concerns were raised about the marketability of homes that used community based heating networks.
- The preconception of different technologies: many participants agreed that the majority of residents remain 'silent' while a minority of residents are vocal in their opposition to such development.
- The use of renewable technologies in the new National Park and AONBs, including effects on bat migration routes.
- The viability of incorporating biomass technologies into developments, taking into account the CO_2 emissions of transport. It was considered that too many developers could focus on biomass to help them meet sustainable construction standards
- Whether local builders can build to higher CSM levels.
- Knowledge: Limited knowledge of sustainable construction standards and renewable energy among planning and building control officers.
- Strategic planning and 'Allowable Solutions':
- Local authorities' ability to monitor developments' continued compliance with standards after construction
- Concern about undue burden on developers

The outcome of the discussion was that the project team will provide:

- Advice on guidance for Planning officers on checking planning applications and ensuring that information submitted on renewable technologies is accurate, and on monitoring post-construction;
- Advice on training for Planning and Building Control Officers on renewable technologies and CHP; and
- Include any available information on bat habitats and migration routes in the study

The partner authorities need to:

- Make developers aware of the Councils' priorities in reference to s106 agreements.

Second stakeholder workshop: External stakeholders

The second stakeholder consultation workshop was held at Worthing Borough Council Town Hall on Thursday 23 July 2009. The event was attended by 24 individuals, including representatives from the Government Office for the South East (GOSE), the South East England Partnership Board, West Sussex County Council, neighbouring local planning authorities and County Councils, Parish Councils, Natural England and Saxon Weald (a local Registered Social Landlord - RSL).

The workshop followed a similar format to the first workshop.

Examples of good practice

A number of examples of good practice were identified, which indicate that there are developers operating in the West Sussex sub-region (and the South East region as a whole) who are capable of:

- Building to various levels of the Code for Sustainable Homes; and
- Applying sustainability standards in non-domestic buildings; and
- Incorporating both small- and large-scale renewable energy and low carbon technologies into buildings.

Aspirations and barriers

Participants took part in a voting exercise of the same format as the first stakeholder workshop. There was a gap between aspirations and feasibility for sustainability standards, but for renewable energy generation the voting results for aspiration and feasibility were similar.

Barriers between feasibility and aspirations were discussed, and the following points were raised (not all delegates agreed on these points):

- Data on renewable energy technologies provided by developers is not robust and does not deliver savings claimed
- Issues around the marketability of homes using district or community heating
- A vocal minority of residents that oppose development of large-scale renewable energy technologies
- Issues around the viability and technical feasibility of incorporating biomass technologies into developments
- Issues with the Code for Sustainable Homes in e.g. use of modern materials, changing design and visual nature of homes, scoring categories
- Visual appearance of modern homes
- Complexity of scoring for CSH
- Issues of enforcement capabilities of external Building Control companies and lack of skills of local builders and developers to build to higher standards
- Levels of cost that would be placed on developers and how these costs might change over time
- Price of land and whether increasing sustainability standards would reduce residual land value

Third Stakeholder Workshop: Final Consultation

The first half of the workshop presented the results of the study to date. In the second half of the presentation the delegates were presented with draft policy scenarios. These scenarios examine different standards and timescales for ‘energy efficiency’ and ‘carbon compliance’ that developers would need to satisfy in each case alongside ‘allowable solutions’ to deal with residual emissions (as set out under the proposed definition of zero carbon homes).

The scenarios specifically concern residential development, as standards for non-residential development have yet to be proposed by Government. However, existing standards for non-residential development and their viability were discussed during the presentation.
Delegates were split into groups and discussed the scenarios, recording their comments and whether they supported the scenarios.

While some individuals felt that introducing higher sustainability standards would inhibit growth due to additional costs, some participants felt that the baseline scenario did not go far enough and that higher targets should be specified by the local planning authorities.

Delegates were also split on the application of the policy scenarios. A small majority of groups and individuals wanted to see threshold levels applied to such policies to ensure that smaller developments do not bear the brunt of additional costs (which can be offset through economies of scale on larger sites).

A majority of delegate tables felt that the policy should not differentiate by type (e.g. privately vs. publically funded housing), while there was an even split between differentiating developments depending on location. Some delegates suggested that development on brownfield sites should have their planning obligations reduced, while other delegates thought that development on greenfield land should have their requirements enhanced.

Annex E – Summary of Planning Policy Statements related to climate change

Table E1: Planning Policy Statements that relate to climate change. Source: Working Draft of Practice Guidance to support the Planning Policy Statement: Planning and Climate Change[64].

Planning Policy Statement	Key policies relating to climate change
PPS1: Delivering Sustainable Development	• Address causes and potential impacts of climate change; • Reduce energy use; • Reduce emissions; • Promote renewable energy use; and • Location and design of development.
PPS3: Housing	• Delivery of well designed homes; • Making best use of land; and • Encouraging new building technologies to deliver sustainable development.
PPG4: Industrial, Commercial Development and Small Firms[65]	• Reduce the need to travel; and • Location of business development.
PPS6: Planning for Town Centres[66]	• Reduce the need to travel; • Encourage use of public transport; and • Facilitate multi-purpose journeys.
PPS7: Sustainable Development in Rural Areas	• Protect natural resources; and • Provide for sensitive exploitation of renewable energy sources.
PPS9: Biodiversity and Geological Conservation	• Account for climate change on distribution of habitats and species, and geomorphologic processes and features.
PPS12: Local Development Frameworks	• Act on a precautionary basis to reduce the emissions that cause climate change and to prepare for its impacts.
PPG13: Transport	• Reduce the need for travel, especially by car, by influencing the location of development, fostering development which encourages walking, cycling or public transport.
PPS22: Renewable Energy	• Increased development of renewable energy.
PPS23: Planning and Pollution Control	• Planning should reduce greenhouse gas emissions and take account of potential effects of climate change where possible.
PPS25: Development and Flood Risk	• Planning policies and decisions should reflect the increased risk of coastal and river flooding as a result of climate change.

The following paragraphs give an overview the key PPSs in relation to this study (PPS1, PPS1 Supplement and PPS22):

[64] Working Draft of Practice Guidance to support the Planning Policy Statement: Planning and Climate Change: www.erm.com/practiceguideance.
[65] The Department for Communities and Local Government is currently consulting on new PPS4: Planning for Sustainable Economic Development which, when finalised, will replace PPG 4.
[66] The Department for Communities and Local Government is currently consulting on proposed changes to PPS 6, as well as parts of PPS7 and PPG13.

Planning Policy Statement 1: Delivering Sustainable Development

In 2005, the Government launched a new strategy for sustainable development entitled 'Securing the Future'. The role of planning in delivering the aims of this strategy was then reflected in 'Planning Policy Statement 1 (PPS1): Delivering Sustainable Development'[67], which sets out generic policies on how planning should facilitate and promote sustainable development through high quality developments and the efficient use of resources.

The policies set out in the PPS need to be taken into account by regional planning bodies and local planning authorities. The PPS states that:

> "*Regional and local planning authorities should ensure that development plans contribute to global sustainability by addressing the causes and potential impacts of climate change - through policies which reduce energy use, reduce emissions and promote the development of renewable energy resources. In particular, development plan policies should seek to promote and encourage rather than restrict the use of renewable resources.*"

Planning Policy Statement 22: Renewable Energy

'Planning Policy Statement 22 (PPS22): Renewable Energy'[68] was issued in August 2004 and provides a much greater focus on the need to meet national and international targets for the reduction of greenhouse gas emissions. As with PPS1, the policies set out in PPS22 need to be taken into account by regional planning bodies and local planning authorities.

PPS22 states that regional and local planning policies should be designed to promote and encourage, rather than restrict, the development of renewable energy resources.

PPS 22 requires Regional Spatial Strategies to include:

- Renewable energy targets for electricity;
- Criteria-based policies for renewable energy developments; and
- The identification of broad areas at the regional/sub-regional level where development of particular types of renewable energy may be considered appropriate.

It also states that Local Development Documents can include on-site renewable energy policies ('Merton-rule').

> "*Local planning authorities may include policies in local development documents that require a percentage of the energy to be used in new residential, commercial or industrial developments to come from on-site renewable energy developments. Such policies:*
>
> > *(i) should ensure that requirement to generate on-site renewable energy is only applied to developments where the installation of renewable energy generation equipment is viable given the type of development proposed, its location, and design;*
> >
> > *(ii) should not be framed in such a way as to place an undue burden on developers, for example, by specifying that all energy to be used in a development should come from on-site renewable generation."*

In addition, Local Development Documents should:

- Include criteria-based policies for renewable energy developments to reflect local circumstances; and

[67] Planning Policy Statement 1: Delivering Sustainable Development: www.communities.gov.uk/planningandbuilding/planning/planningpolicyguidance/planningpolicystatements/planningpolicystatements/pps1/.
[68] Planning Policy Statement 22: Renewable Energy: www.communities.gov.uk/planningandbuilding/planning/planningpolicyguidance/planningpolicystatements/planningpolicystatements/pps22/.

- Only identify specific sites for renewable energy if a developer has already indicated an interest in the site and confirmed its viability.

Planning and Climate Change: Supplement to Planning Policy Statement 1

'Planning Policy Statement 1: Planning and Climate Change - Supplement to Planning Policy Statement 1'[69], issued in December 2007, supplements PPS1 by setting out how planning should contribute to reducing emissions and stabilising climate change, and to take into account the unavoidable consequences.

In order to deliver the Government's sustainable development objectives, regional and local planning authorities should prepare and manage the delivery of spatial strategies that contribute to delivering the Government's Climate Change Programme and energy policies.

The PPS specifically requires that local and regional planners:

- Ensure local plans have strong carbon ambitions and targets;
- Help to deliver decentralised renewable and low carbon energy;
- Speed up the shift to renewable and low carbon energy; and
- Create communities that are resilient to the effects of climate change.

The PPS1 supplement does not seek to assemble all national planning policy relevant or applicable to climate change and therefore should be read alongside the other Planning Policy Statements. However, the PPS1 supplement does states that:

> *"Where there is any difference in emphasis on climate change between the policies in this PPS and others in the national series this is intentional and this PPS takes precedence."*

The supplement aims to provide clarity on the relationship between planning policies, the Building Regulations and the Code for Sustainable Homes. These factors should complement and not duplicate each other and planners should work with developers to encourage sustainable buildings using the Building Regulations and the Code for Sustainable Homes, rather than designing their own standards.

In addition, Local Development Documents (LDD) should set policies on the provision of low carbon and renewable energy sources and this provision should be 'significant'. The supplement affirms that Local Planning Authorities should 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. Where there are opportunities for a greater use of such resources, planning authorities should set higher development area or site specific targets to achieve maximum potential.

Paragraph 26:

> *"Planning authorities should have an evidence-based understanding of the local feasibility and potential for renewable and low-carbon technologies, including microgeneration, to supply new development in their area. This may require them, working closely with industry and drawing in other appropriate expertise, to make their own assessments. Drawing from this evidence-base, and ensuring consistency with housing and economic objectives, planning authorities should:*

[69] Planning Policy Statement 1: Planning and Climate Change - Supplement to Planning Policy Statement 1: www.communities.gov.uk/planningandbuilding/planning/planningpolicyguidance/planningpolicystatements/planningpolicystatements/ppsclimatechange/.

(i) 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 avoid prescription on technologies and be flexible in how carbon savings from local energy supplies are to be secured;

(ii) where there are particular and demonstrable opportunities for greater use of decentralised and renewable or low-carbon energy than the target percentage, bring forward development area or site-specific targets to secure this potential;

and, in bringing forward targets,

(iii) set out the type and size of development to which the target will be applied, and

(iv) ensure there is a clear rationale for the target and it is properly tested."

The guidance stipulates that councils and developers should consider onsite renewables for all new developments and in addition, that they should also assess the potential for connecting developments to neighbouring community heating and power schemes that can serve an entire local community.

To assist practitioners in implementing the PPS on Planning and Climate Change, CLG has developed a good practice guidance and an on-line version of this is now available[70].

The working draft guidance specifically states that the Councils' Core Strategies:

"*should set out policies and proposals in line with the RSS and correspond with wider local authority strategies on climate change and those that have implications for the development and use of land, such as the local transport plan. Planning authorities need to develop a robust evidence base to support the core strategy and criteria based policies*". (Paragraph 1.10).

In addition, the working draft guidance states:

"*Local authorities have a wide ranging role in tackling climate change through their actions in planning and community strategies, urban regeneration, transport planning, education and procurement. Planning authorities, in particular, have a responsibility for managing and implementing measures on climate change through land use decisions at the local level. This will be underpinned by the duty on local planning authorities in the Planning Bill* [Planning Act 2008] *to take action on climate change, which will require them to include in their development plan documents, policies designed to secure that development and use of land in their area contributes to mitigating and adapting to climate change*". (Paragraph 3.2).

Finally, in relation to the evidence base required for local planning policy, the Government expects that:

"The key energy policies to be established through the Core Strategy need to be evidenced, and are likely to require analysis of:

- *The area's potential for accommodating renewable and low carbon technologies;*
- *The potential of existing decentralised energy infrastructure to provide heat and/or power to new developments; and*
- *Opportunities, particularly in association with major development projects, for the extension of district heating or other decentralised sources to neighbouring existing buildings and areas". (Paragraph 3.11).*

[70] http://www.hcaacademy.co.uk/planning-and-climate-change

Annex F – Detailed analysis of SHLAA sites for decentralised energy (district heating)

Arun District Council

There are 23 SHLAA sites within Arun District Council that have potential to incorporate decentralised energy systems. These sites have been highlighted in Table F1 below.

Table F1: Arun District Council SHLAA sites with potential for decentralised energy systems.

Site reference	Area (ha)	Yield	Density: dwellings per hectare (dph)	Proximity to heat priority areas (HPA)	Viability for decentralised energy
AR071	389	5,000	13	In close proximity to HPA (<500m)	**Medium** Very high number of dwellings. Very low density: should densities increase the development is of such a size to make decentralised systems viable. Within 500m of Heat Priority Area.
AR125	132	1,820	14	In close proximity to HPA (<500m)	**Medium** Very high number of dwellings. Very low density: should densities increase the development is of such a size to make decentralised systems viable. Within 500m of Heat Priority Area.
ARLU18	76	1,200	16	In close proximity to HPA (<500m)	**Medium** Very high number of dwellings. Very low density: should densities increase the development is of such a size to make decentralised systems viable. Within 500m of Heat Priority Area.
AR124	126	1,100	9	In close proximity to HPA (<500m)	**Medium** Very high number of dwellings. Very low density: should densities increase the development is of such a size to make decentralised systems viable. Within 500m of Heat Priority Area.
AR015	41	700	17	In close proximity to HPA (<500m)	**Medium** Very high number of dwellings. Very low density: should densities increase the development is of such a size to make decentralised systems viable. Within 500m of Heat Priority Area.
ARBA2	23	470	21	In close proximity to HPA (<500m)	**Medium** Very high number of dwellings. Low density: should densities increase the development is of such a size to make decentralised systems viable. Within 500m of Heat Priority Area.
AR117	208	380	2	In close proximity to HPA (<500m)	**Medium** Very high number of dwellings. Very low density: should densities increase the development is of such a size to make decentralised systems viable. Within 500m of Heat Priority Area.
ARLU12	11	300	29	In close proximity to HPA (<500m)	**Medium** High number of dwellings. Low density: should densities increase the development is of such a size to make decentralised systems viable. Within 500m of Heat Priority Area.
AR080	12	300	24	In close proximity to HPA (<500m)	**Medium** High number of dwellings. Low density: should densities increase the development is of such a size to make decentralised systems viable. Within 500m of Heat Priority Area.
AR082	15	300	21	In close proximity to HPA (<500m)	**Medium** High number of dwellings. Low density: should densities increase the development is of such a size to make decentralised systems viable. Within 500m of Heat Priority Area.
AR048	10	274	26	In close proximity to HPA (<500m)	**Medium** High number of dwellings. Low density: should densities increase the development is of such a size to make decentralised systems viable. Within 500m of Heat Priority Area.

AR105	11	260	24	In close proximity to HPA (<1km)	**Low** High number of dwellings. Low density: should densities increase the development is of such a size to make decentralised systems viable. Within 1km of Heat Priority Area.
AR116	9	230	26	In close proximity to HPA (<500m)	**Medium** High number of dwellings. Low density: should densities increase the development is of such a size to make decentralised systems viable. Within 500m of Heat Priority Area.
AR109	6	175	27	In close proximity to HPA (<500m)	**Medium** High number of dwellings. Low density: should densities increase the development is of such a size to make decentralised systems viable. Within 500m of Heat Priority Area.
ARBR19	2	160	94	In close proximity to HPA (<500m)	**High** High number of dwellings. High density on-site. Within 500m of Heat Priority Area.
ARLU4	2	122	56	In close proximity to HPA (<500m)	**High** High number of dwellings. High density on-site. Within 500m of Heat Priority Area.
ARBR20	3	114	39	In close proximity to HPA (<500m)	**High** High number of dwellings. Medium density on-site. Within 500m of Heat Priority Area.
ARBR10	1	110	92	In close proximity to HPA (<500m)	**High** High number of dwellings. High density on-site. Within 500m of Heat Priority Area.
ARFP1	5	110	21	In close proximity to HPA (<500m)	**Medium** High number of dwellings. Low density: should densities increase the development is of such a size to make decentralised systems viable. Within 500m of Heat Priority Area.
ARBR5	1	100	75	In close proximity to HPA (<500m)	**High** High number of dwellings. High density on-site. Within 500m of Heat Priority Area.
AR069	4	100	28	In close proximity to HPA (<1km)	**Low** High number of dwellings. Low density: should densities increase the development is of such a size to make decentralised systems viable. Within 1km of Heat Priority Area.
AR101	5	100	19	In close proximity to HPA (<500m)	**Medium** High number of dwellings. Very low density: should densities increase the development is of such a size to make decentralised systems viable. Within 500m of Heat Priority Area.
AR02	9	100	11	In close proximity to HPA (<500m)	**Medium** High number of dwellings. Low density: should densities increase the development is of such a size to make decentralised systems viable. Within 500m of Heat Priority Area.

We would particularly recommend that Arun District Council and the developer of sites ARBR19, ARLU4, ARBR20 and ARBR10 investigate the feasibility of incorporating decentralised energy systems. Please note that this is not to say that developers of other sites should not investigate decentralised energy systems on the basis of this desk top analysis.

Mid Sussex District Council

There are 22 SHLAA sites within Mid Sussex District Council that have potential to incorporate decentralised energy systems. These sites have been highlighted in Table F2 below.

Table F2: Mid Sussex District Council SHLAA sites with potential for decentralised energy systems.

Site reference	Area (ha)	Yield	Density: dwellings per hectare (dph)	Proximity to heat priority areas (HPA)	Viability for decentralised energy
MS493	203	3,250	16	In close proximity to HPA (<500m)	**Medium** Very high number of dwellings. Very low density: should densities increase the development is of such a size to make decentralised systems viable. Within 500m of Heat Priority Area.
MS485	29	720	25	In close proximity to HPA (<500m)	**Medium** Very high number of dwellings. Low density: should densities increase the development is of such a size to make decentralised systems viable. Within 500m of Heat Priority Area.
MS110	16	685	44	In close proximity to HPA (<500m)	**High** Very high number of dwellings. High density on-site. Within 500m of Heat Priority Area.
MS494	25	585	24	In close proximity to HPA (<1km)	**Low** Very high number of dwellings. Low density: should densities increase the development is of such a size to make decentralised systems viable. Within 1km of Heat Priority Area.
MS080	30	550	19	In close proximity to HPA (<500m)	**Medium** Very high number of dwellings. Very low density: should densities increase the development is of such a size to make decentralised systems viable. Within 500m of Heat Priority Area.
MS091	19	475	25	In close proximity to HPA (<500m)	**Medium** Very high number of dwellings. Low density: should densities increase the development is of such a size to make decentralised systems viable. Within 500m of Heat Priority Area
MS233	36	400	11	In close proximity to HPA (<1km)	**Low** Very high number of dwellings. Very low density: should densities increase the development is of such a size to make decentralised systems viable. Within 1km of Heat Priority Area.
MS557	16	384	23	In close proximity to HPA (<1km)	**Low** Very high number of dwellings. Low density: should densities increase the development is of such a size to make decentralised systems viable. Within 1km of Heat Priority Area.
MS111	3	275	81	In close proximity to HPA (<500m)	**High** High number of dwellings. High density on-site. Within 500m of Heat Priority Area.
MS246	15	275	19	In close proximity to HPA (<500m)	**Medium** High number of dwellings. Very low density: should densities increase the development is of such a size to make decentralised systems viable. Within 500m of Heat Priority Area
MS081	7	210	30	In close proximity to HPA (<500m)	**High** High number of dwellings. High density on-site. Within 500m of Heat Priority Area.
MS528	2	200	88	In close proximity to HPA (<500m)	**High** High number of dwellings. High density on-site. Within 500m of Heat Priority Area.
MS525	2	175	98	In close proximity to HPA (<500m)	**High** High number of dwellings. High density on-site. Within 500m of Heat Priority Area.
MS109	4	132	31	In close proximity to HPA (<500m)	**High** High number of dwellings. High density on-site. Within 500m of Heat Priority Area.

MS104	8	130	17	In close proximity to HPA (<500m)	**Medium** High number of dwellings. Very low density: should densities increase the development is of such a size to make decentralised systems viable. Within 500m of Heat Priority Area
MS090	5	123	25	In close proximity to HPA (<1km)	**Low** High number of dwellings. Low density: should densities increase the development is of such a size to make decentralised systems viable. Within 1km of Heat Priority Area.
MS137	3	120	35	In close proximity to HPA (<500m)	**High** High number of dwellings. High density on-site. Within 500m of Heat Priority Area.
MS345	2	115	70	In close proximity to HPA (<500m)	**High** High number of dwellings. High density on-site. Within 500m of Heat Priority Area.
MS093	3	105	31	In close proximity to HPA (<500m)	**High** High number of dwellings. High density on-site. Within 500m of Heat Priority Area.
MS479	8	105	13	In close proximity to HPA (<500m)	**Medium** High number of dwellings. Very low density: should densities increase the development is of such a size to make decentralised systems viable. Within 500m of Heat Priority Area
MS083	2	100	61	In close proximity to HPA (<500m)	**High** High number of dwellings. High density on-site. Within 500m of Heat Priority Area.
MS502	6	100	18	In close proximity to HPA (<500m)	**Medium** High number of dwellings. Very low density: should densities increase the development is of such a size to make decentralised systems viable. Within 500m of Heat Priority Area

We would particularly recommend that Mid Sussex District Council and the developer of sites MS110, MS111, MS081, MS528, MS525, MS109, MS137, MS345, MS093 and MS083 investigate the feasibility of incorporating decentralised energy systems. Please note that this is not to say that developers of other sites should not investigate decentralised energy systems on the basis of this desk top analysis.

Worthing Borough Council

There are 18 SHLAA sites within Worthing Council that have potential to incorporate decentralised energy systems. These sites have been highlighted in Table F3 below.

Table F3: Worthing Borough Council SHLAA sites with potential for decentralised energy systems.

Site reference	Area (ha)	Yield	Density: dwellings per hectare (dph)	Proximity to heat priority areas (HPA)	Viability for decentralised energy
WB08036	38	875	23	In close proximity to HPA (<500m)	**Medium** Very high number of dwellings. Low density: should densities increase the development is of such a size to make decentralised systems viable. Within 500m of Heat Priority Area.
WB08197	15	587	40	In close proximity to HPA (<500m)	**High** Very high number of dwellings. High density on-site. Within 500m of Heat Priority Area.
WB08037	10	375	36	In close proximity to HPA (<1km)	**Medium** Very high number of dwellings. High density on-site. Within 1km of Heat Priority Area.
WB08059	9	320	38	In close proximity to HPA (<500m)	**High** Very high number of dwellings. High density on-site. Within 500m of Heat Priority Area.
WB08039	2	260	145	In close proximity to HPA (<500m)	**High** High number of dwellings. High density on-site. Within 500m of Heat Priority Area.
WB08180	0.6	250	414	In close proximity to HPA (<500m)	**High** High number of dwellings. High density on-site. Within 500m of Heat Priority Area.
WB08053	6	233	36	In close proximity to HPA (<500m)	**High** High number of dwellings. High density on-site. Within 500m of Heat Priority Area.
WB08152	28	230	8	In close proximity to HPA (<500m)	**Medium** High number of dwellings. Very low density: should densities increase the development is of such a size to make decentralised systems viable. Within 500m of Heat Priority Area.
WB08207	1	170	158	In close proximity to HPA (<500m)	**High** High number of dwellings. High density on-site. Within 500m of Heat Priority Area.
WB08182	9	160	17	In close proximity to HPA (<1km)	**Low** High number of dwellings. Very low density: should densities increase the development is of such a size to make decentralised systems viable. Within 1km of Heat Priority Area.
WB08052	4	150	40	In close proximity to HPA (<500m)	**High** High number of dwellings. High density on-site. Within 500m of Heat Priority Area.
WB08163	4	150	34	In close proximity to HPA (<500m)	**High** High number of dwellings. High density on-site. Within 500m of Heat Priority Area.
WB08138	6	130	23	In close proximity to HPA (<1km)	**Low** High number of dwellings. Low density: should densities increase the development is of such a size to make decentralised systems viable. Within 1km of Heat Priority Area.
WB08055	6	124	22	In close proximity to HPA (<500m)	**Medium** High number of dwellings. Low density: should densities increase the development is of such a size to make decentralised systems viable. Within 500m of Heat Priority Area.

WB0804 9050051	1	114	92	In close proximity to HPA (<500m)	**High** High number of dwellings. High density on-site. Within 500m of Heat Priority Area.
WB08174	0.2	111	507	In close proximity to HPA (<500m)	**High** High number of dwellings. High density on-site. Within 500m of Heat Priority Area.
WB08044	3	106	42	In close proximity to HPA (<500m)	**High** High number of dwellings. High density on-site. Within 500m of Heat Priority Area.
WB08056	13	105	8	In close proximity to HPA (<500m)	**Medium** High number of dwellings. Very low density: should densities increase the development is of such a size to make decentralised systems viable. Within 500m of Heat Priority Area.

We would particularly recommend that Worthing Borough Council and the developer of sites WB08197, WB08059, WB08039, WB08180, WB08053, WB08207, WB08052, WB08163, WB08049050051, WB08174 and WB08044 investigate the feasibility of incorporating decentralised energy systems. Please note that this is not to say that developers of other sites should not investigate decentralised energy systems on the basis of this desk top analysis.

It is important to highlight that four of these sites - WB08039, WB08180, WB08207 and WB08174 – have heat density figures above the heat density threshold (45kWh/m^2/year), which makes them particularly good candidates to incorporate decentralised energy systems on-site.