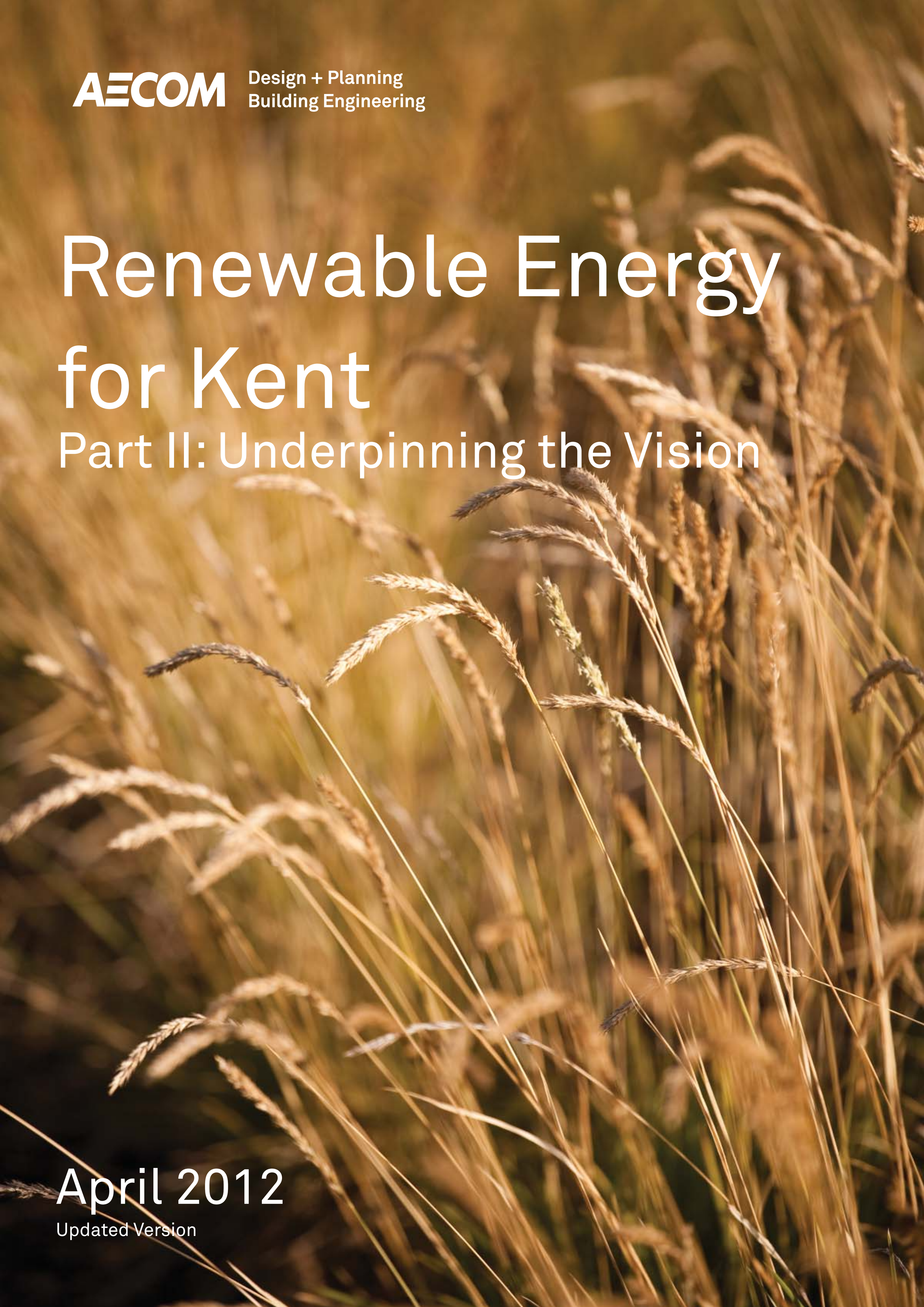


AECOM Design + Planning Building Engineering

Renewable Energy for Kent

Part II: Underpinning the Vision

April 2012

Updated Version

Part II: Underpinning the Vision

1 Introduction 2
1.1 The purpose of this report 2
1.2 Study Approach 2
1.3 Structure of this report 3
2 Existing and future carbon profile for Kent 5
2.1 Introduction to the chapter 5
2.2 Existing energy consumption and CO_2 emissions 5
2.3 Indicative Carbon Reduction Trajectory 8
2.4 Chapter Summary 10
3 Current renewable energy delivery profile for Kent 11
3.1 Introduction to the chapter 11
3.2 Audit Methodology 11
3.3 Renewable Energy Installed Capacity in Kent 11
3.4 Renewable Energy Approved and Awaiting Construction in Kent 13
3.5 Chapter Summary 17
4 The scale of opportunity: the physical potential 18
4.1 Introduction to the chapter 18
4.2 Renewable Energy Physical Capacity in Kent – An Overview 18
4.3 Wind 21
4.4 Biomass 26
4.5 Waste & Biogas 29
4.6 Hydro 30
4.7 Micro-generation 32
4.8 Combined Heat and Power and District Heating 32
4.9 Energy Opportunities Maps 45
4.10 Chapter Summary 54
5 The scale of opportunity: the delivery potential 55
5.1 Introduction to this Chapter 55
5.2 Introducing the Delivery Partners 55
5.3 Understanding Delivery Partners 55
5.4 Delivery Partner 1: Energy Developers 56
5.5 Delivery Partner 2: Housing Developers 60
5.6 Delivery Partner 3: Public Sector 63
5.7 Delivery Partner 4: Private Sector 67
5.8 Delivery Partner 5: Communities and Individuals 71
5.9 Stakeholder Perspectives: Delivery Impetus 73
5.10 Chapter Summary 74
6 Potential for a low carbon economy 75
6.1 Introduction to this chapter 75
6.2 Stimulating the development of a low carbon economy 75
6.3 Overview of Kent's economy 75
6.4 Potential economic benefits from renewable and low carbon energy delivery 77
6.5 Assessment of the low carbon economy potential in Kent 80
6.6 Supporting the transition to a low carbon economy 80
6.7 Chapter Summary 80
7 Taking advantage of the opportunities: delivery scenarios 81
7.1 Introduction to this Chapter 81
7.2 Methodology 81
7.3 Results from scenario development 82
7.4 Working up the delivery scenarios – what has been assumed? 88
7.5 What is missing from our delivery scenarios? 103
7.6 Understanding the cost-benefits of delivery of renewable energy technologies 106
7.7 Chapter Summary 112
8 Forging a Path: An Action Plan for Renewable Energy in Kent 113
8.1 Introduction to this chapter 113
8.2 Possible Actions to Increase Delivery 113
8.3 Stakeholder Perspectives: Driving Delivery through Actions 117
8.4 Existing Active Delivery Partners 118
8.5 Prioritising Actions: An Action Plan 119
Appendix A: Stakeholder Workshop Results 125
Appendix B: Glossary 134

1 Introduction

1.1 Background

There are a number of national drivers supporting the uptake of low carbon and renewable energy, including a UK target to reduce greenhouse gas emissions by 34% by the year 2020 and a separate target that 15% of all energy is sourced from renewable resources within the same timeframe. These targets require some interpretation at a local level considering both the physically available renewable resources, local constraints including landscape and local character and the appetite for delivery amongst the key local delivery partners. This local interpretation is even more critical given the Government's proposed new planning framework where there are fewer top down targets and more of the initiative for delivery will need to come from Local Authorities, either working individually or in partnership. This study builds on earlier renewable resource mapping undertaken at the regional level and through consideration – with stakeholders - of how this resource could be delivered in Kent provides an action plan to drive uptake or renewable energy.

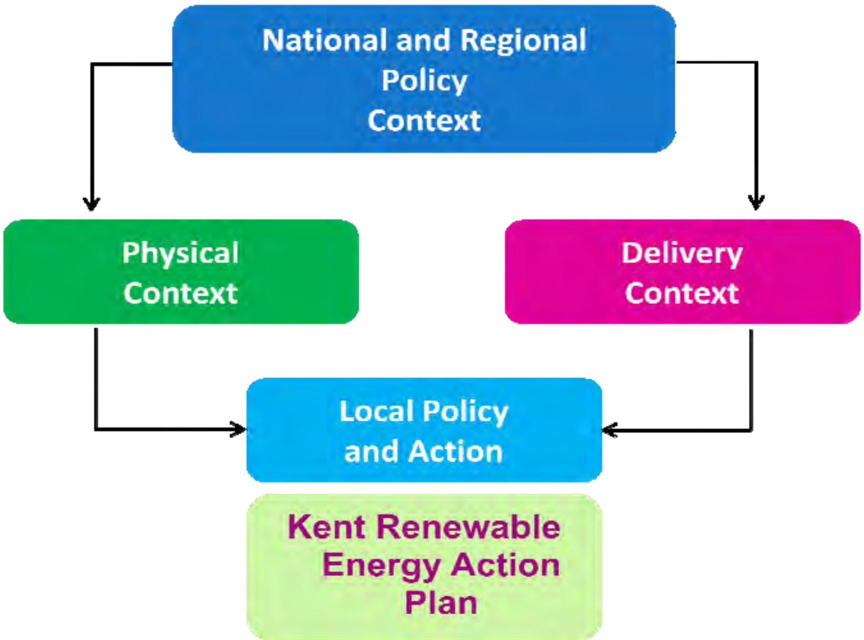


Figure 1: The study aims to bring together policy, physical and deliver context to provide a clear action plan to drive the uptake of renewable energy in Kent.

1.2 Study Approach

In establishing the potential renewable resource for Kent we have importantly taken a two pronged approach. We have tried to outline delivery scenarios with consideration to both *top down* resource potential (covered in section 4) and *bottom up* deployment potential and local ambition for delivery (covered in section 5).

The starting point for the top down approach is to review, check and update existing renewable capacity studies for the County. In the case of Kent and the South East the most recent capacity study is the study by TV Energy and Land Use Consultants for the South East England Region (June 2010) which is based on the nationally recognised methodology developed by the Department for Energy and Climate Change (hereby known as the 'DECC methodology').

There are a number of other studies which also provide very useful context and evidence in support of this renewable energy action plan for Kent. These include:

- An assessment of the South East's Renewable Energy Capacity and Potential to 2026, AEA/Savills, 2002
- Progressing Renewable Energy in the South East of England – Phases 1 & 2, TV Energy/SEEDA, 2008
- Kent County Council Micro-generation Scoping Study, ESD, September 2005
- Renewable Energy in Kent, Select Committee Report, 2010
- Kent Thameside Eco-Assessment, Scoping Study, PB Power, 2009
- Kent Thameside Eco-Assessment, AEA & Savills, September 2010

Where possible, information from existing capacity studies is built upon, rather than repeated. We have questioned some of the earlier calculation assumptions related to the physically available renewable resource and have included additional constraints as appropriate, aiming to cover both additional physical constraints and also deployment barriers around, for example, planning, manufacturing capacity and/or skills shortage.

We have tried to balance our study in terms of a top down review, compared with the consideration given to possible delivery routes, and ambition amongst the identified project delivery partners. The bottom up potential for delivery is equally, if not more, important and is also the key focus for this study which is a delivery action plan rather than a further renewable energy capacity assessment.

We have considered the key delivery partners with direct potential to act to install renewable energy technologies and those who have a role in co-ordinating and facilitating action. It is clear from our discussions with stakeholders that there is a significant gap between the theoretical resource potential and what is likely to be delivered in practice, once issues such as land ownership, ambition for renewable energy uptake, planning and funding limitations have been considered. Through our study we have aimed to identify this gap and consider potential approaches to facilitate greater and faster uptake for renewable technologies in Kent.

Figure 2: AECOM approach to considering renewable energy uptake potential for Kent (2011).

In addition to the stakeholder view it is also important that the delivery scenarios coming forward are resource effective for Kent, and deliver good value for money both from the point of view of energy and carbon saving and through spin off benefits such as job creation. We have considered the additional benefits of the various options assessed in section 6. This helps inform priorities within the Kent Renewables Action Plan.

1.3 Report structure

This 'Underpinning the Vision' document is a supporting document for the Renewable Energy Action Plan for Kent. It provides the reasoning and evidence that underpins the Action Plan.

- This document is structured into eight chapters:
- Chapter 2: Existing and future carbon profile for Kent

  This sets out existing energy use in the Kent, shows the spatial distribution of energy use across the County through maps and discusses appropriate targets for future CO_2 reduction.

- Chapter 3: Current renewable energy delivery profile for Kent

  Sets out an inventory of the renewable technologies that are installed or planned for installation in Kent.

- Chapter 4: The scale of opportunity: the physical potential

  This chapter reviews the most recent renewable energy capacity study for Kent and summarises how much of each key renewable energy technology could be installed in Kent from a theoretical perspective. This analysis provides a relative scale of opportunity and also spatially highlights promising areas for delivery of renewable energy.

- Chapter 5: The scale of opportunity: the delivery potential

  Introduces the likely delivery partners, presents case studies and opportunities and constraints for each partner.

- Chapter 6: Driving a low carbon economy in Kent

  This chapter discusses the potential for the development of a low carbon economy in Kent, which realises the wider economic effects of delivering renewable energy. The chapter includes a review of existing evidence, the predominant sectors in Kent and the possible effect of delivery of different technologies on wider economic benefits.

- Chapter 7: Taking advantage of the opportunities: delivery scenarios

  This chapter also looks at some example delivery scenarios – business as usual and 'all actions adopted'. The scenarios are only intended to show what partners and technologies should be prioritised and illustrate relative contributions that partners and technologies can make against the delivery of CO2 reduction targets.

- Chapter 8: Developing an action plan for delivery

  This chapter puts forward a number of possible actions that could be taken to drive delivery from each of the key partner types in Kent. It brings together stakeholder perspectives and considers the scale of impact each action could have to prioritise actions within the Action Plan.

2 Existing and future carbon profile for Kent

2.1 Introduction to the chapter

In order to understand the potential for contribution to energy supply and carbon reduction from the use of renewable energy, we first need to understand the baseline energy and carbon profile for Kent. Electricity and Heat demand varies significantly depending on a range of factors, including building quality, urban patterns, fuel availability and consumer behaviour.

Also, renewable energy is just one part of the carbon reduction solution. Simultaneously, there will be significant energy use reductions achieved through energy efficiency initiatives undertaken locally and nationally. This chapter estimates the current and future baseline based on expected changes to energy demand through those initiatives and examines how energy use varies spatially across Kent.

2.2 Existing energy consumption and CO_2 emissions

Energy demand baseline

A current energy use baseline for Kent can be derived from the latest DECC electricity and gas consumption figures, for 2009, published by Local Authority area:[1]

Energy use in Kent and Medway 2009 (GWh)	Commercial and Industrial [2]	Domestic
Gas	3,746	9,507
Electricity	4,362	3,137

The energy baseline reported above for domestic uses is similar to that reported in the Kent County Council Select Committee Report on Renewables (2010), the commercial and industrial demand figure reported here is lower, excluding gas consumption from two major power stations.

The maps below show how these electricity and gas demand are distributed across the County. The maps compare domestic energy use (per meter) compared with average use across the South East. A clear difference can be seen between urban and rural areas. There are hot spots of high electricity use in rural areas, which is probably due to houses being located off the gas grid and being reliant on electric heating. These are logical focus areas for improvement and promotion of a switch to renewable fuels such as biomass. Electricity use also varies in relation to the relative deprivation of areas. Gas demand shows a similar urban-rural split. Higher density housing development in urban areas naturally demand less heat per home due to the additional insulation provided by adjoining buildings in flats and terraced housing. There are also a number of other factors that influence gas (and heat) demand including occupancy, building quality, time at home and affluence. Comparison with the spatial analysis of fuel poverty (Figure 5) shows a correlation between fuel poverty and lower energy use. There is a general difference in energy use intensity between East and West Kent, with higher energy use in West Kent.

[1] http://www.decc.gov.uk/en/content/cms/statistics/energy_stats/regional/regional.aspx

[2] Note: Commercial and Industrial figures for gas use exclude 2 major power stations and 2 large industrial companies in the area. Also, since DECC's basis for assigning gas us between domestic and commercial and industrial assumes that all customers consuming 73,200kWh per year or lower are domestic consumers will mean that some smaller commercial and industrial consumers are included in the domestic gas use figure.

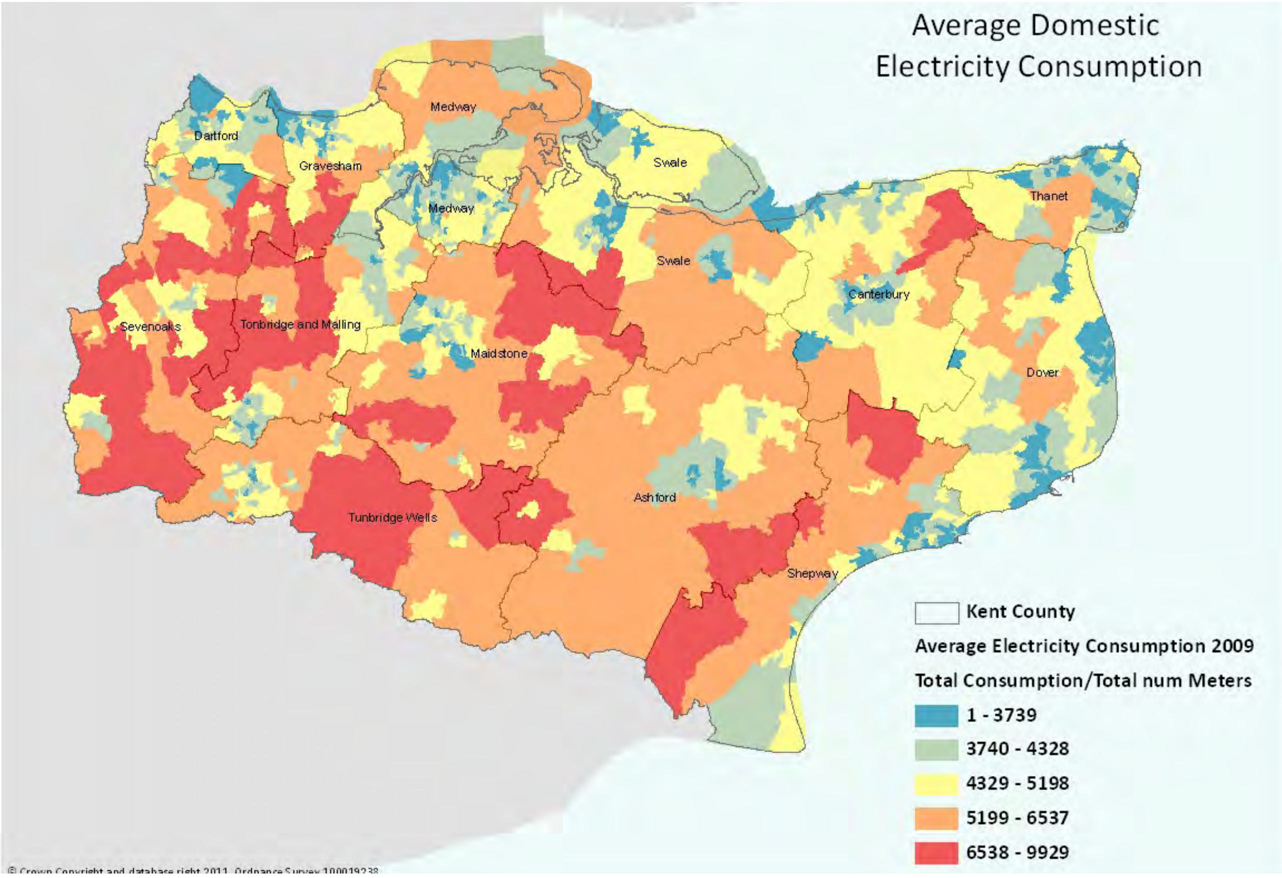


Figure 3: Average domestic electricity consumption for Kent (kWh)

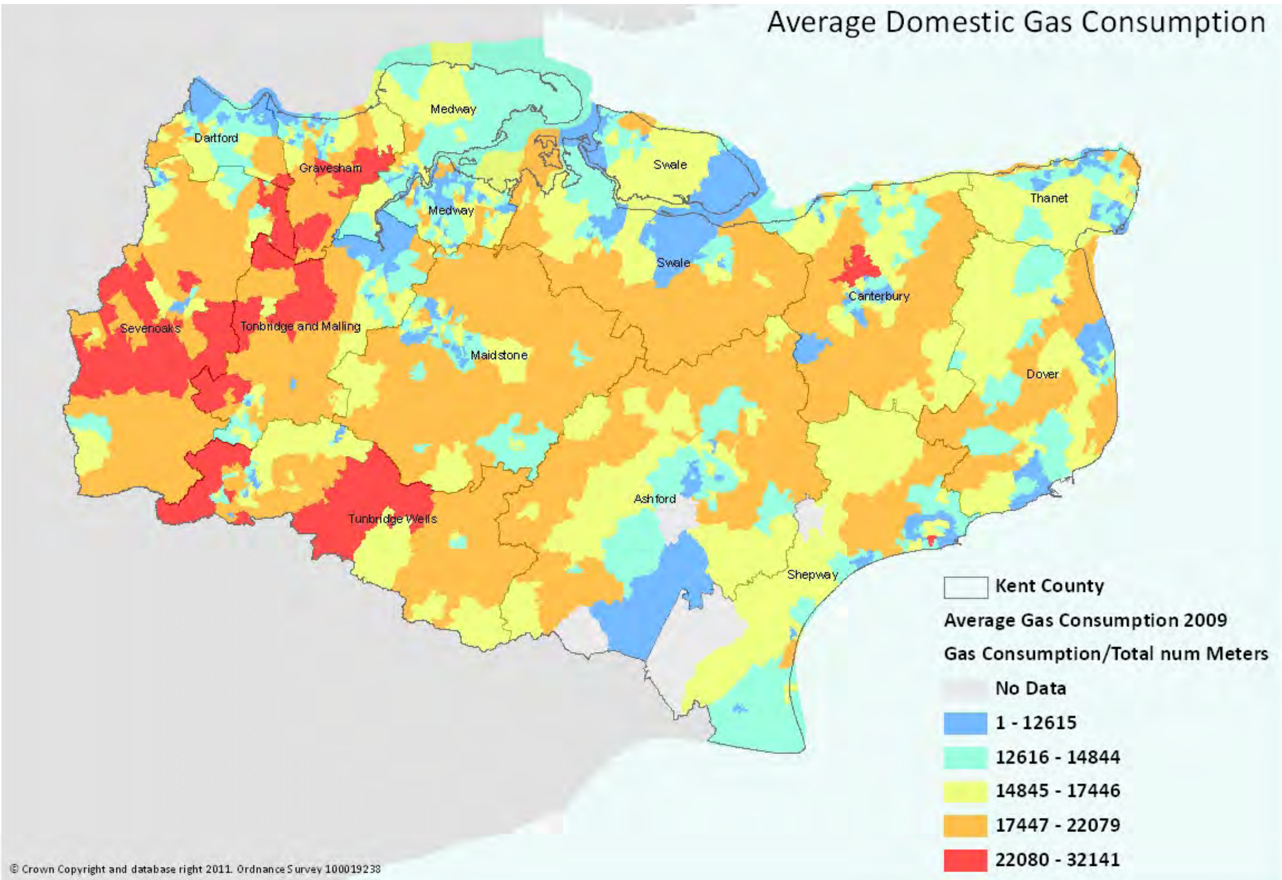


Figure 4: Average gas consumption for Kent (kWh)

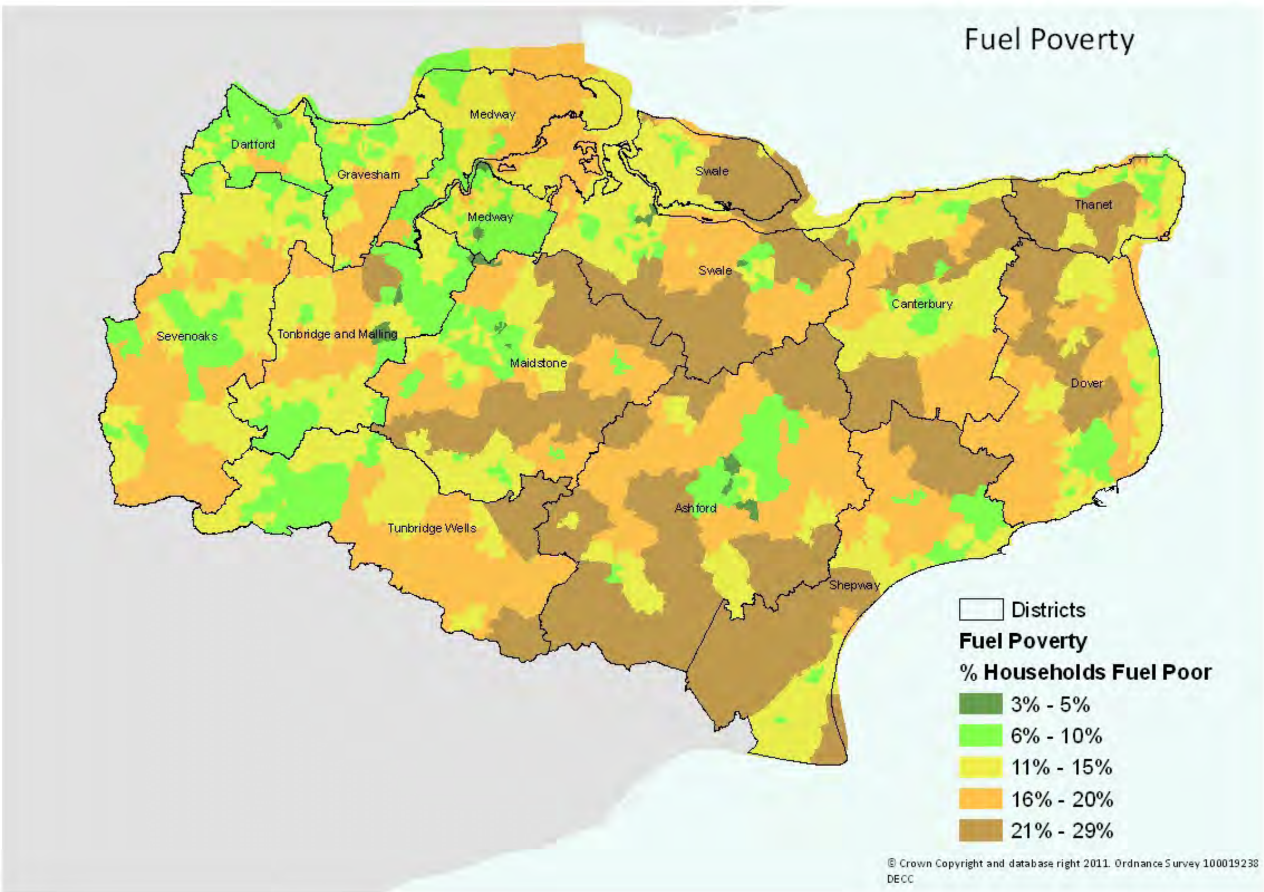


Figure 5: Fuel Poverty in Kent

Carbon baseline

A carbon baseline has been set for Kent and Medway, for carbon emissions by Local Authority area in 2009[3]. This shows the following breakdown in emissions associated with non-transport energy use by sector:

Carbon emissions for Kent and Medway 2009 (tonnes CO_2)	Commercial and Industrial	Domestic
Emissions associated with gas use	694,950	1,561,540
Emissions associated with electricity use	2,171,110	1,763,780
Total gas and electricity	2,866,060	3,325,320
Total gas and electricity both sectors	**6,191,380**	

As electricity is a higher carbon fuel than gas, its contribution to the carbon profile is much greater than the proportion indicated by looking at energy demand (in terms of GWh).

The spatial distribution of CO_2 emissions is shown in the figure overleaf.

[3] http://www.decc.gov.uk/en/content/cms/statistics/climate_stats/gg_emissions/uk_emissions/2009_laco2/2009_laco2.aspx

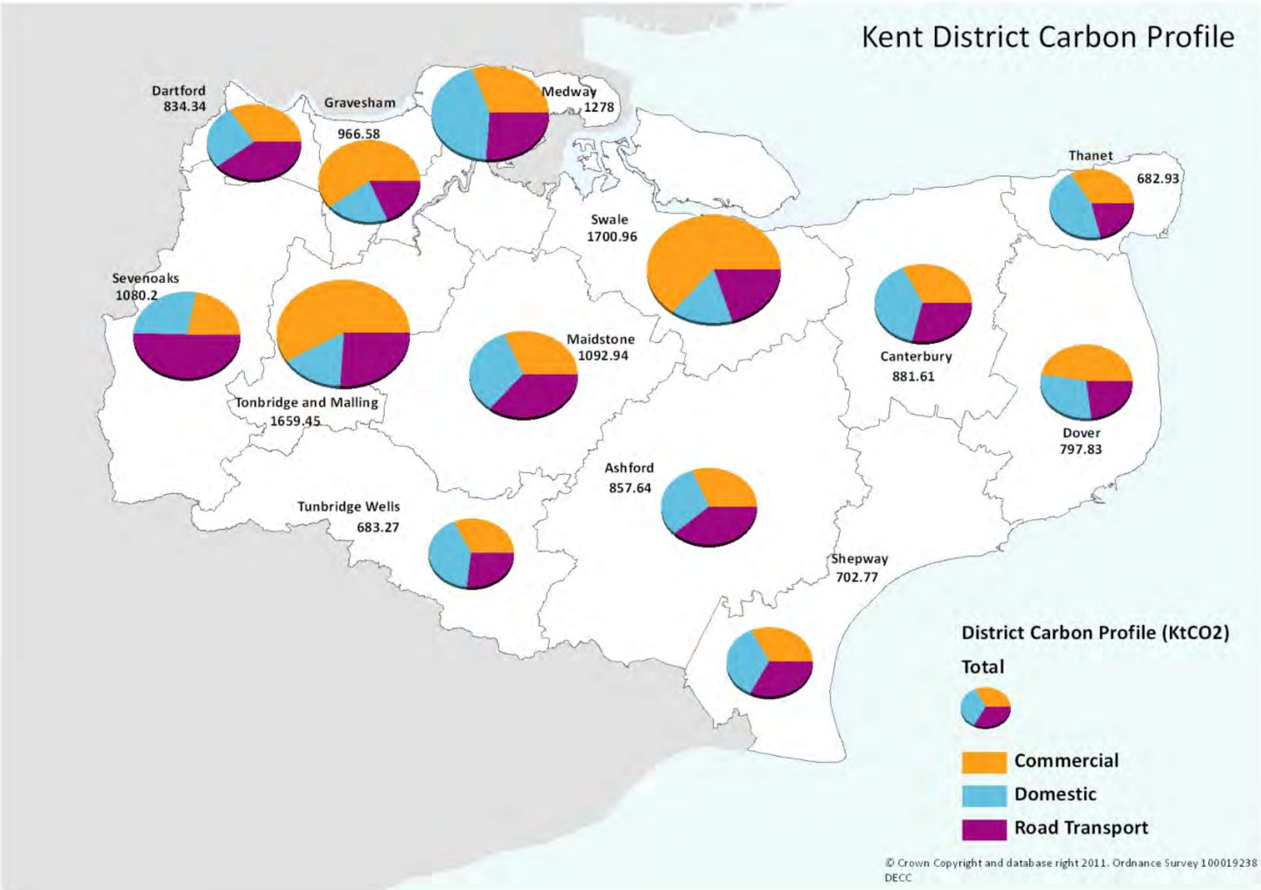


Figure 6: Kent district carbon profile

Future energy demands

Future energy demands have not been estimated as part of this study. Work has been undertaken to review potential for new residential development based on available plans, but this has not extended to updating the energy baseline.

New development is likely to increase energy demands, although this could be balanced to some extent by measures to reduce energy use in existing buildings and to improve efficiency in central power generation. In addition to the actions to promote uptake of renewable energy action will also be required to promote energy efficiency and drive sustainable behaviour. The energy baseline for Kent should be reviewed as new data becomes available.

2.3 Indicative Carbon Reduction Trajectory

The carbon reduction trajectory set out in the UK Low Carbon Transition Plan,[4] which corresponds to levels of emission reduction required by the UK's carbon budgets, is shown below for the period 2009-2020. This shows one potential trajectory for meeting the UK's target of a 34% reduction in carbon emissions by 2020 on 1990 levels (equivalent to an 18% reduction on 2009 levels), with different sectors making different levels of contribution – the reality is likely to be different, and to vary across different areas of the UK.

[4] The UK Low Carbon Transition Plan, 2009

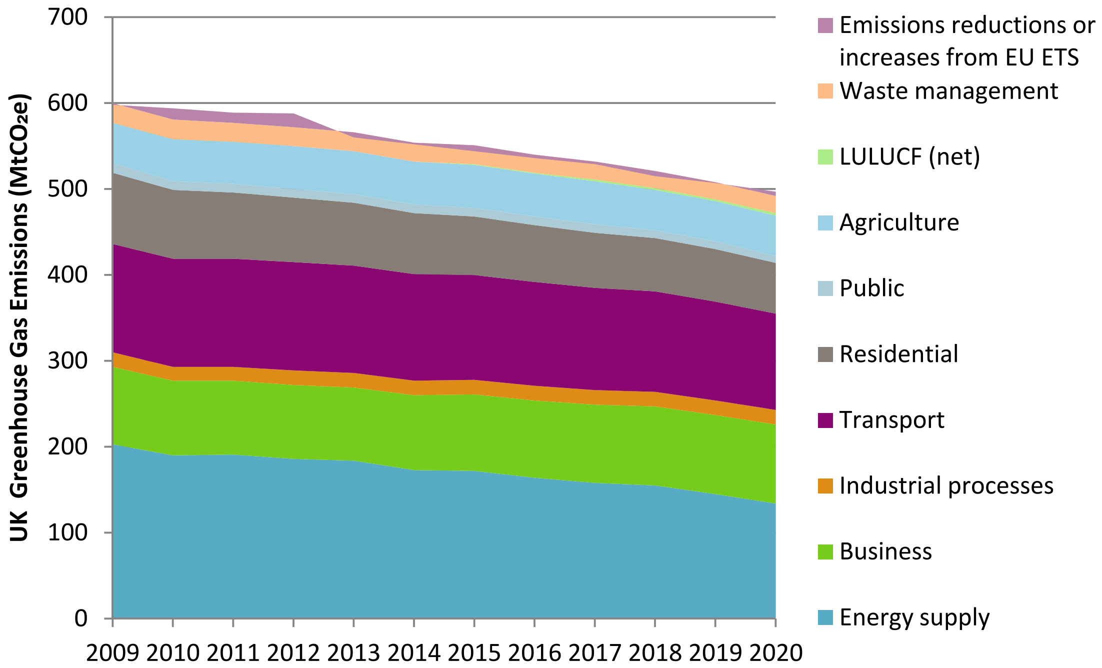


Figure 7: UK Low Carbon Transition Plan Greenhouse Gas Reduction Trajectory 2009-2020

As Kent County Council also committed in its Environment Strategy 2010-13 to applying the UK national targets for greenhouse gas emission reduction to Kent (34% by 2020 and 60% by 2030 over 1990 levels), the above trajectory in the Low Carbon Transition Plan can be applied to Kent and Medway's carbon emissions from gas and electricity to give an indication of their decarbonisation trajectory to 2020.

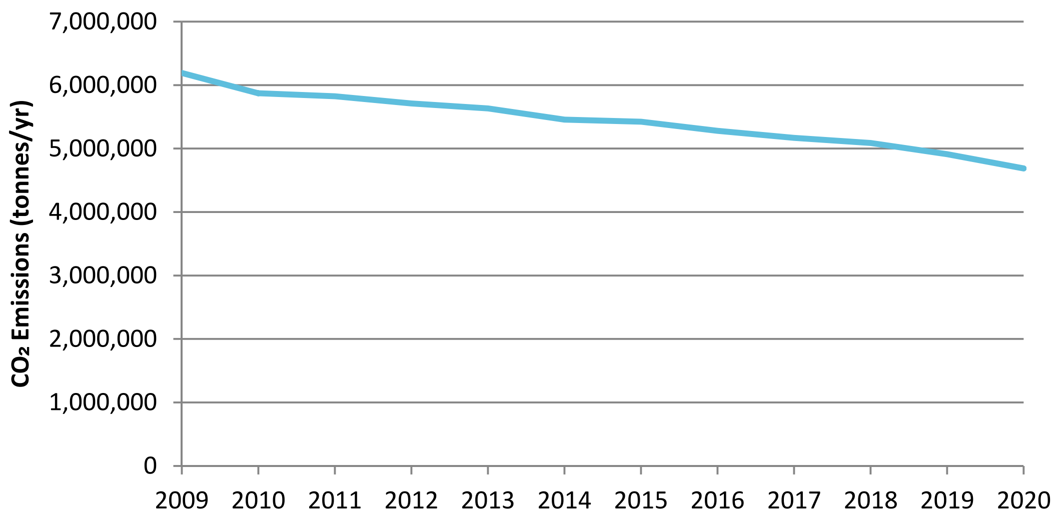


Figure 8: Indicative Reduction Trajectory for Kent and Medway Carbon Emissions from Gas and Electricity Use 2009-2020

The above baselines and reduction trajectory are not intended to set a definitive trajectory for Kent, but are used in the renewable energy delivery scenarios set out in this report to provide a basis for evaluating the impact of increasing renewable energy generation on Kent's overall carbon reduction target for 2020.

2.4 Chapter Summary

- **CO_2 emissions from Kent are just over 6,000,000 tonnes per annum for energy uses from the commercial and industrial and domestic sectors, excluding transport.**
- **The split of heat and electricity demand in the domestic sector is fairly even, whereas in the commercial sector electricity demand far outstrips demand for heat.**
- **The spatial distribution of electricity and gas in heat shows considerable variation between urban and rural areas, and areas of deprivation and affluence.**
- **To contribute its share towards UK targets for CO_2 reduction Kent's CO_2 emissions need to be in the order of 4,700,000 by 2020. This means that a cut in CO_2 emissions of around 22% is required by 2020 through investment in energy efficiency and low and zero carbon energy supply technologies.**

3 Current renewable energy delivery profile for Kent

3.1 Introduction to the chapter

The delivery of renewable energy is an essential part of the carbon reduction strategy for the UK, and for Kent. Regional spatial strategies were effectively abolished in 2010, meaning that there are no longer regional targets for delivery of renewable energy. The national targets prevail and Counties and Local Authorities are tasked with contributing to these targets. At the national level there are targets for a 15% contribution from renewable sources by 2020 and an 80% overall CO_2 reduction by 2050, with interim targets in place to mark a roadmap to 2050. The overall target of 15% renewable energy translates to 30% of electricity demand and 12% of heat demand being met by renewable sources. 'Business as usual' will fall along way short of meeting these targets so it is important that Kent and the individual local authorities within Kent consider how they can promote faster deployment of renewable energy technologies and meaningfully contribute to meeting the UK's ambitious targets for CO_2 reduction.

Before we can understand the future delivery potential, it is important to understand the level of delivery that has been achieved so far across the County. This chapter contains the results of an inventory of renewable and low carbon energy installations in operation or planned in Kent.

3.2 Audit Methodology

Without one comprehensive and up-to-date database for renewable energy installations in the UK, developing one for Kent required drawing on a number of resources. The databases consulted include:

- Renewable Energy Statistics Database for the UK (RESTATS)
- Department of Energy and Climate Change (DECC)
- UKRenewable (Previously BWEA)
- International Small Hydro Atlas
- British Hydro Power Association
- Natural England
- Non-fossil Purchasing Agency (NPFA)
- British Bioenergy Map
- CO_2 Sense
- The Forestry Commission
- Ofgem Feed-in-Tariff

Combined, these databases have provided a robust baseline of renewable energy projects in operation, as well as in planning in Kent.

It should be noted that because it is difficult to determine an exact amount of energy produced from micro-generation installations, an estimate had to be calculated. As the majority of micro-renewables do not require planning permission, records of their installations are imprecise. While uptake has been modest historically, it has substantially increased since April 2010, when the feed-in tariff financial incentives began. The feed-in tariff has particularly encouraged solar energy technology, which has resulted in a large increase in these installations; however, it still represents a valuable estimate of micro-renewables for each local authority. For all installations existing prior to feed-in tariff, a UK-wide estimate of households served by micro-generation was used and apportioned based on population[5].

3.3 Renewable Energy Installed Capacity in Kent

Overall, Kent currently produces over 640GWh of renewable energy annually. More than half (59%) of that energy is from energy from waste plants[6], the largest of which is located in Maidstone and alone is responsible for 56% of renewable energy for the county. Shepway's Little Cheyne Court Wind Farm is Kent's only onshore wind farm in operation. With 26 wind turbines, it produces nearly 160GWh of electricity – enough to power approximately 32,000 homes. The Kent coast is home to a substantial number of offshore wind turbines, this

[5] Environmental Change Institute. Oxford University. Available: http://www.eci.ox.ac.uk/research/energy/downloads/bmt-evidence-microgeneration.pdf

[6] The DECC methodology makes an assumption about the fraction of waste streams that can be considered renewable – these assumptions have also been used for this study (see section 4.5 for more information).

contributes to national targets, but is not included in local authorities' contribution. The other major renewable resource currently being exploited onshore is biomass. Of the 13 local authorities in Kent (including Medway), nine include biomass schemes. The figure shows the contribution to renewable energy targets within each local authority area.

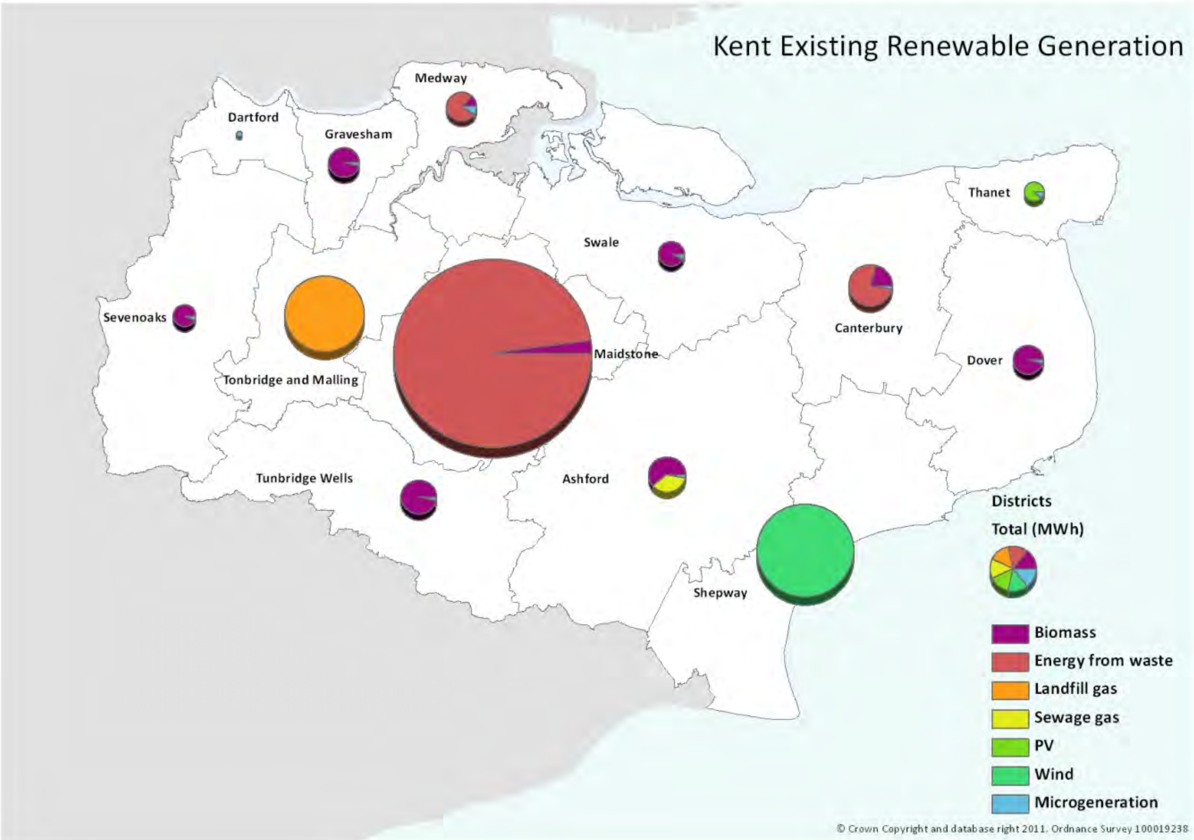


Figure 9: Breakdown of Renewable Energy in Kent

The one low carbon energy source not included in the renewable energy calculation for Kent is gas-fired Combined Heat and Power (CHP). While a CHP plant is a viable low carbon, energy efficient alternative to conventional energy production, it still usually uses a non-renewable resource as its input. For this reason it has not been included as a renewable resource. However, the Ridham gas CHP plant in Swale produces more than 200GWh of energy, representing approximately 20% of all low carbon energy produced in the region.

It is also important to draw the distinction between capacity and generating potential. While capacity suggests the maximum amount of energy that can be produced in a given moment, generating potential takes into account a load factor, which is the average amount of energy produced over a period of time divided by its capacity. This load factor differs across renewable energies. Capacity is expressed in unit of energy (e.g., mega-watt), while generating potential considers a unit of energy over a period of time (e.g., mega-watt-hour). Figure 10 refers to the difference between existing capacity and the existing generating potential in Kent.

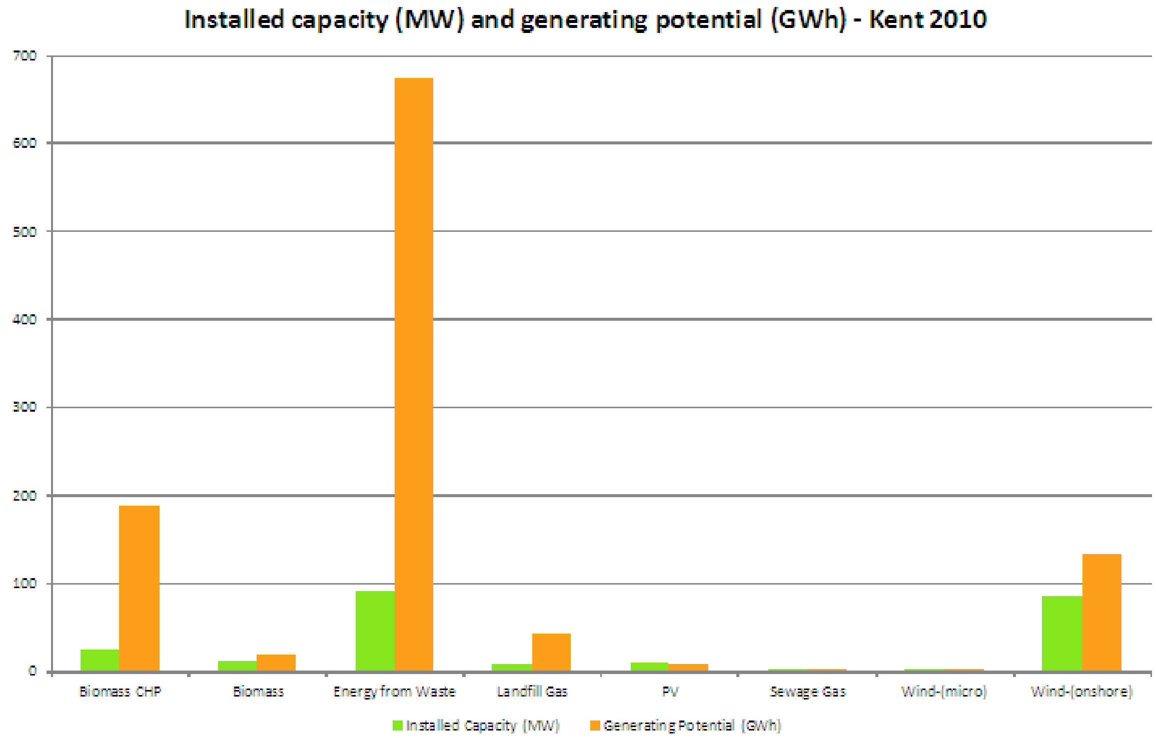


Figure 10: Installed capacity and generating potential for various renewable energies in Kent

3.4 Renewable Energy Approved and Awaiting Construction in Kent

When considering the amount of renewable energy in Kent, including installations that are on the verge of being delivered might provide a more accurate picture of the County's ambitions. Looking at Kent's renewables that have been approved and awaiting construction, nearly 40GWh of renewable energy is expected to be delivered in the near future.[7] The majority of this increase will be realised if all three of Swale's approved wind farms on the Isle of Sheppey are eventually built, as combined, they represent 38GWh of electricity. Figure 11 and Table 1 show the breakdown for installed renewable energy by local authority, while Figure 12 and Table 2 include all installations which are installed, have planning approval, or are awaiting construction. Figure 13 presents this information as a graph. As energy from waste is the only renewable source that is operated at a county level, it has not been included in the charts below; however, it is responsible for two-thirds of renewable energy generation in Kent.

[7] This number represents projects that, given the most reliable and recent information, are thought to have a reasonable chance of being delivered. Therefore, projects such as the wind farm on the Isle of Grain, which has planning permission but the developer has since abandoned, have not been included.

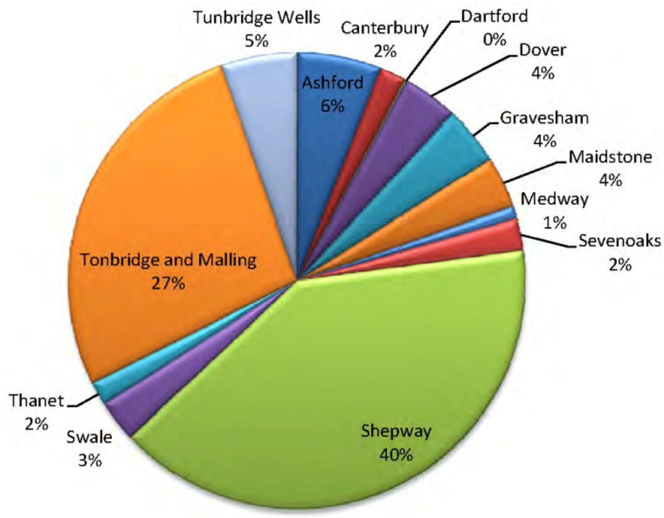


Figure 11[8]: Renewable Energy Installed in Kent (measured in MWh – as of September 2011)

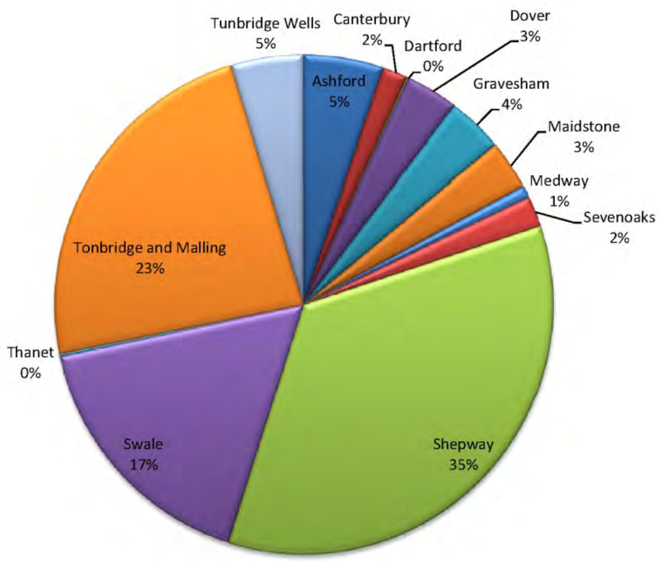


Figure 12[9]: Renewable Energy installed, approved or awaiting construction in Kent (measure in MWh – as of September 2011)

[8] As it is controlled at the county level, energy from waste is not included/allocated
[9] As it is controlled at the county level, energy from waste is not included/allocated

Table 1: Renewable energy generation from installed capacity in Kent by Local Authority, September 2011

Renewable energy Installed in Kent (MWh)														
	Ashford	Canterbury	Dartford	Dover	Gravesham	Maidstone	Medway	Sevenoaks	Shepway	Swale	Thanet	Tonbridge and Malling	Tunbridge Wells	**Kent**
Anaerobic Digestion	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Biomass	8,475	3,880	-	8,890	9,417	8,061	1,205	4,897	-	6,404	-	-	12,355	63,584
Energy from Waste	-	14,615	-	-	-	384,214	7,232	-	-	-	-	-	-	406,061
Landfill gas	-	-	-	-	-	-	-	-	-	-	-	62,748	-	62,748
Sewage Gas	5,118	-	-	-	-	-	-	-	-	-	-	-	-	5,118
PV Farms	-	-	-	-	-	-	-	-	-	83	3,504	-	-	3,587
Wind	-	-	-	-	-	-	-	-	93,977	-	-	-	-	93,977
Micro-generation	384	507	312	362	332	492	858	388	339	447	440	397	364	5,621
Total (MWh)	13,978	19,002	312	9,252	9,749	392,767	9,296	5,285	94,316	6,850	3,944	63,144	12,719	**640,696**

Table 2: Renewable energy generation from installed capacity, in planning or construction in Kent by Local Authority, September 2011

Renewable energy installed and planned in Kent (MWh)														
	Ashford	Canterbury	Dartford	Dover	Gravesham	Maidstone	Medway	Sevenoaks	Shepway	Swale	Thanet	Tonbridge and Malling	Tunbridge Wells	**Kent**
Anaerobic Digestion	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Biomass	8,475	3,880	-	8,890	9,417	8,061	1,205	4,897	-	6,404	-	-	12,355	63,584
Energy from waste	-	14,615	-	-	-	384,214	7,232	-	-	-	-	-	-	406,061
Landfill gas	-	-	-	-	-	-	-	-	-	-	-	62,748	-	62,748
Sewage gas	5,118	-	-	-	-	-	-	-	-	-	-	-	-	5,118
PV	18	-	-	26	-	-	-	53	18	83	3,504	105	-	3,806
Wind	-	-	-	-	-	-	-	-	93,977	38,316	-	-	-	132,294
Micro-generation	384	507	312	362	332	492	858	388	339	447	440	397	364	5,621
Total (MWh)	13,995	19,002	312	9,278	9,749	392,767	9,296	5,338	94,334	45,250	3,944	63,250	12,719	679,232

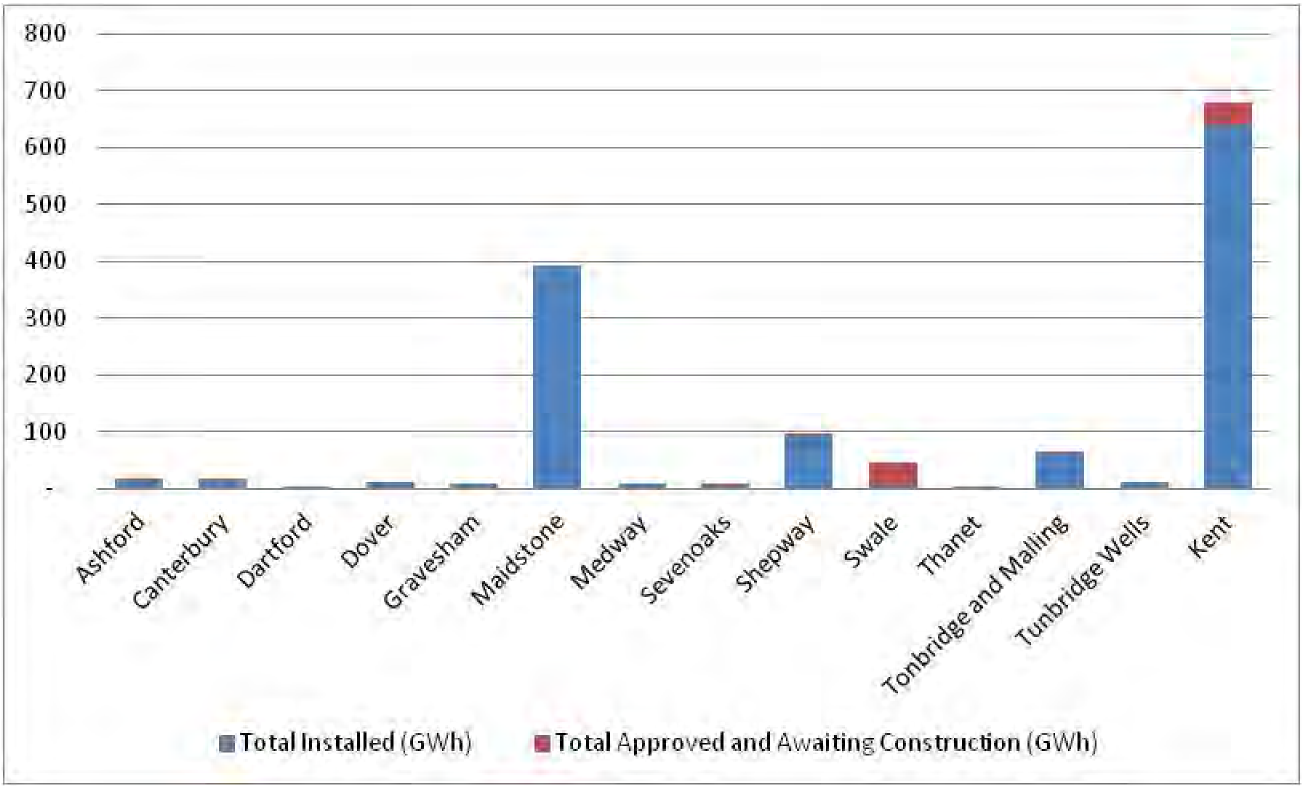


Figure 13: Renewable energy installed compared to amount approved and awaiting construction in Kent

3.5 Chapter Summary

- **A substantial amount of renewable energy has been delivered in Kent, though the majority of renewable generation is due to energy from waste installations. These installations are classified as renewable under the DECC methodology which makes an assumption about the proportion of waste which is renewable. Kent stakeholders have raised concerns over these assumptions.**
- **Delivery of renewable energy is set to increase by 39MW (6%) in the near future due to planned installations.**
- **The types of technologies and the amount delivered varies considerably across Kent, with larger contributions in central Kent.**
- **This inventory of renewable energy provides an important baseline to be considered when predicting future scenarios and ambitions for delivery.**

4 The scale of opportunity: the physical potential

4.1 Introduction to the chapter

This section examines the physical potential for renewable energy in Kent. In estimating potential for renewable energy, the DECC methodology has been developed to give consistency for local estimations on a UK-wide scale. The DECC methodology sets out a number of steps for a resource assessment and provides detailed assumptions and calculations for some of these steps along with recommended data sources. The methodology is based around a sequential constraint analysis, where constraints are progressively applied to reduce the natural resource (i.e. the maximum theoretical potential) to what is practically achievable. The stages in the methodology are numbered from 1 to 7, with stages 1 to 4 representing physical, technical, and regulatory constraints and stages 5 onwards representing delivery constraints such as supply chains and the economies of provision and operation. Figure 13 shows the various the various stages.

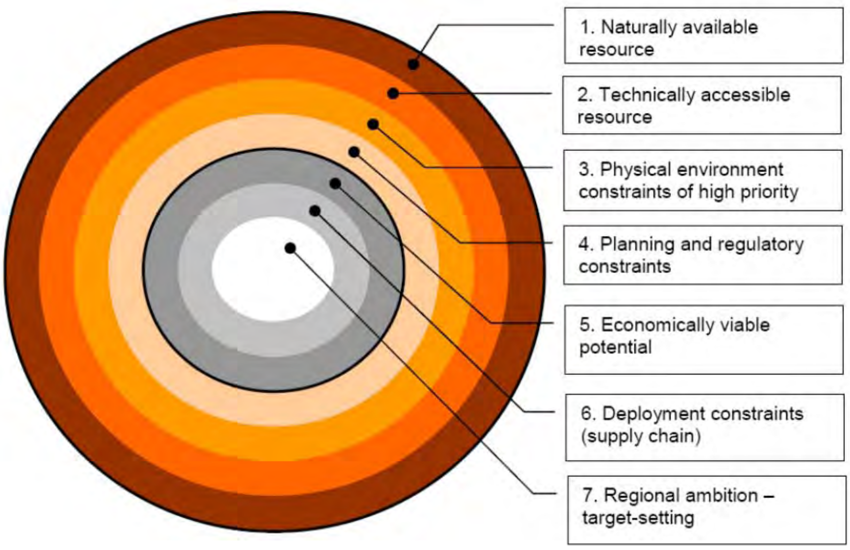


Figure 14: Stages for developing a comprehensive evidence base for renewable energy potential (Source: Renewable and Low-Carbon Energy Capacity Methodology for the English Regions, SQW Energy, January 2010)

The DECC methodology was used as the basis for the 'Review of Renewable and Decentralised Energy Potential in South East England' (TV Energy and Land Use Consultants, June 2010) which includes Kent. This study will hereby be referred to as the 'South East Study'. The DECC methodology only provides method statements for stages 1 to 4, and the South East study completed the methodology up to stage 4. Local resource assessments are therefore required to set out their own assumptions for stage 5 onwards.

The South East Study report includes a section reviewing each of the technologies and setting out the assumptions that have been used to calculate the potential uptake. Assumptions generally follow those recommended in the DECC methodology. A later section of the report (section 3) provides the results of these calculations at County scale which are further broken down to local authority level within the report appendices. Some GIS mapping was undertaken for the South East study but maps were not included within the final report, thus making it hard to visualise opportunities in terms of their spatial distribution. Kent County Council has provided AECOM with this mapping data for separate review.

The next section of this report provides a high level review of the physically available renewable resource as defined by the South East Study carried out using the DECC Methodology.

4.2 Renewable Energy Physical Capacity in Kent – An Overview

The high level results from the South East Study at local authority level show Ashford has the greatest potential for renewable energy, followed by Medway and Maidstone. Ashford and Maidstone are the two largest local authority areas in Kent (by land area) and a significant proportion of their potential capacity is derived from commercial wind. Shepway and Dover also have significant potential for commercial wind. Medway's potential is derived from significant assumed co-firing of biomass with coal in existing power stations in Medway, specifically the 2GW dual fired Kings North power station on the River Medway, near Rochester; however this plant is now due to close in 2016 in accordance with EU pollution regulations. The assumed uptake of heat pumps, based on the DECC assumptions appears high across all local authority areas. This is due to an optimistic assumed viability of installing heat pumps in 100% of off-grid existing homes and 75%, 50% and 25% for detached/semi detached, terrace homes and flats respectively as well as other assumptions for uptake in new development and commercial/business property. The potential for renewable heat will be mainly limited to the main conurbations/urban areas and to specific and appropriate buildings, such as for example, schools, university or community buildings, farms and estates which are off the gas grid.

The overall renewable energy potential for Kent (as estimated by the existing capacity study) is summarised in the table and figures below. Individual technologies (or technology groups) are then discussed with further review and analysis of constraints and uptake assumptions. For simplicity renewable resources and technologies are reviewed in the order they were presented in the South East capacity study, although some groupings are simplified for the purpose of this report.

Table 3: Renewable heat and electricity potential for Kent by 2031 (Review of Renewable and Decentralised Energy Potential in South East England, June 2010)

Renewable Electricity Potential for Kent (2031)			
Technology	**Technology Sub-Type**	**Installed capacity (MW)**	**Generated capacity (GWh)**
Wind	Onshore, commercial scale	3351.8	5285
Wind	Onshore, small scale: less than 100kW	340.3	477
Biomass	Managed Woodland	8.6	65
Biomass	Energy Crops (medium scenario chosen)	15	113
Biomass	Waste Wood	7.8	59
Biomass	Agricultural Arisings	129.6	977
Biomass	Poultry Litter	0.3	1
Biomass	Co-Firing (Biomass with Coal)	480.4	2020
Waste	Municipal Solid Waste	1016	3917
Waste	Commercial and Industrial Waste	2493	9609
Biogas	Wet Organic Waste	567.7	2934
Biogas	Landfill Gas	3.9	22
Biogas	Sewage Gas	12.1	45
Hydro	Small scale	1.5	8
Solar	PV	586.1	462
Renewable Heat Potential for Kent (2031)			
Technology	**Technology Sub-Type**	**Installed capacity (MW)**	**Generated capacity (GWh)**
Biomass	Managed Woodland	169.7	297
Biomass	Energy Crops (medium scenario chosen)	195.6	343
Biomass	Waste Wood	107.4	188
Solar	Solar Thermal	516.4	226
Heat Pumps	Ground Source	2937.5	6690

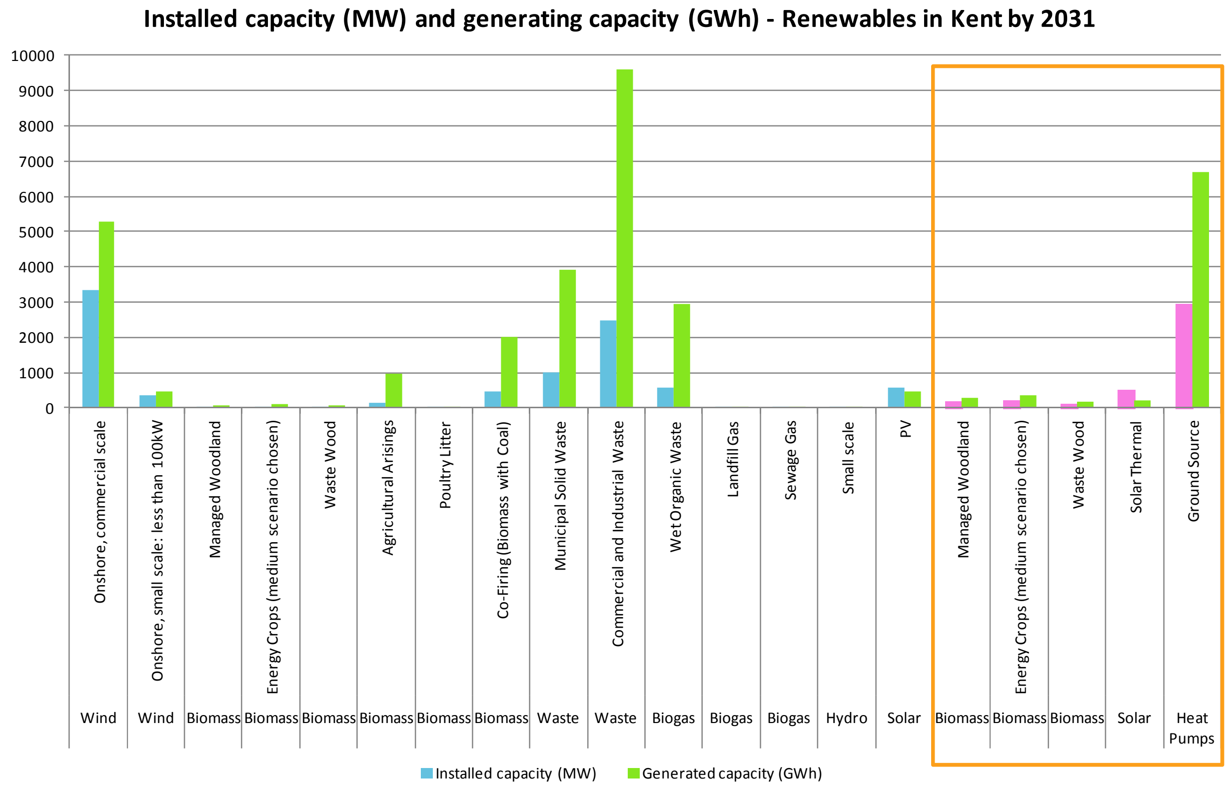


Figure 15: Graph to show potential renewable energy installed capacity and energy generation potential by technology (split for heat and electric) for Kent by 2031 (TV Energy/Land Use Consultants, June 2010).[10] Note: It is AECOM's view that energy from waste and heat pumps are overestimated by the South East Renewables Study.

[10] The generating capacity takes into account load factors for different technologies. The load factor (also known as the capacity factor) is the average amount of energy produced over a period of time divided by its installed capacity. This is further explained in the Glossary in Appendix B.

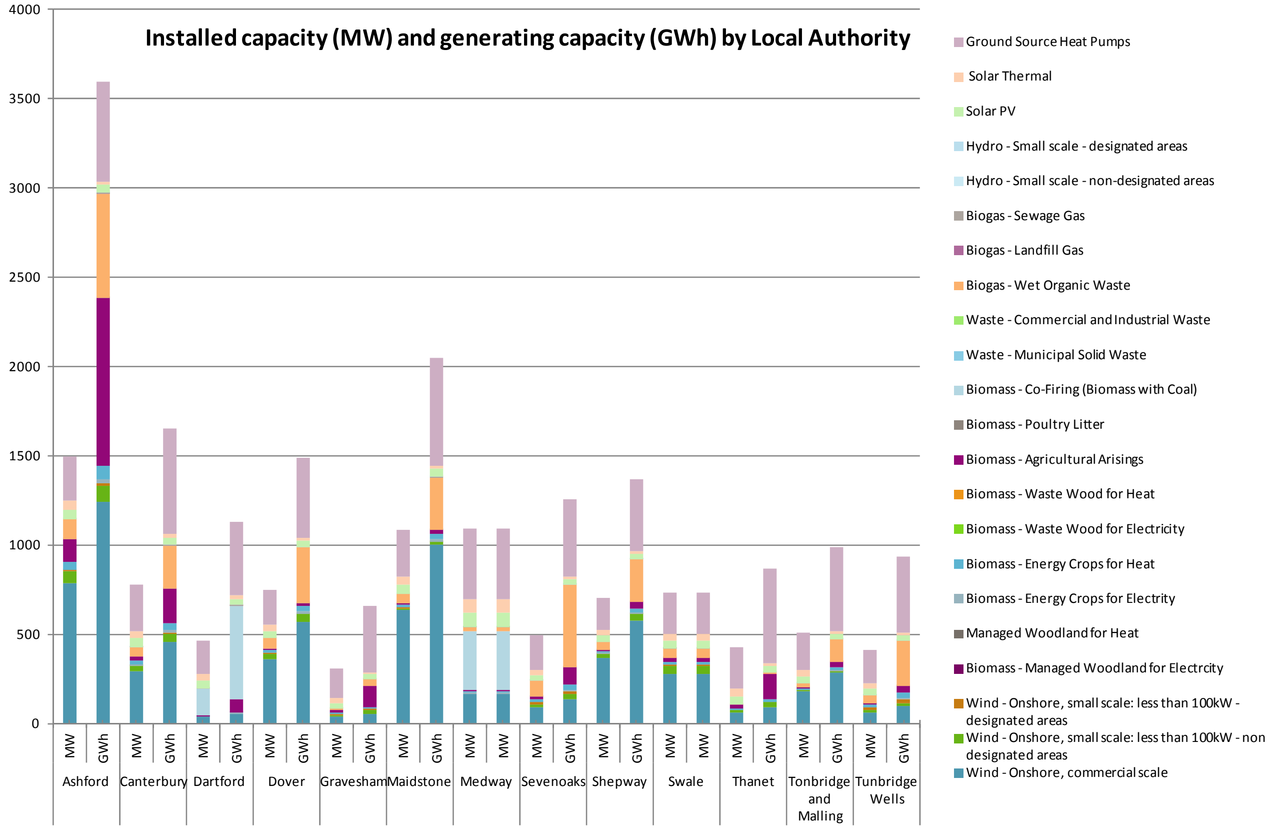


Figure 16: Graph to show potential renewable energy installed capacity and energy generation potential for Local Authorities in Kent by 2031 (TV Energy/Land Use Consultants, June 2010)

4.3 Wind

Wind opportunities maps have been created for the region, using a series of constraints and designations to map where large scale wind may be viable. The mapping completed through the DECC methodology does not consider visual impact or landscape (apart from blocking out some landscape designations) or cumulative impact. These constraints can also be important in determining the capacity of the landscape to deliver wind generation.

In reality there are a range of constraints on wind development all of which need to be treated with varying degrees of certainty by planners and developers. There are many that are fixed and unarguable but there are also a vast number of constraints which are subjective and which may be able to be overcome on a case by case basis through good design and collaboration. The availability of land for development of wind, when mapped at a regional level is likely to vary significantly depending on the assumptions taken in respect of land availability. Regardless of the 'physically available' land resource for wind, it is likely that potential (i.e. installed capacity) will be still further reduced by non physical constraints such as land ownership, ambition, funding, commercial attractiveness etc. It is hence important where wind is concerned, that maps are treated as indicative only and greater effort is made to unlock some of the delivery barriers on a case by case basis.

Table 4: Varying constraints layers for Wind development

Fixed constraints	Possible additional constraints	Deployment constraints
For example: ▪ Roads ▪ Railways ▪ Inland waterways ▪ Built up areas ▪ Airports ▪ Ancient woodland ▪ Sites of historic woodland ▪ International and national nature designations *(buffers around above where applicable)*	***For example:*** ▪ National Parks and Local Nature Designations, Kent Downs AONB *(with buffers)* ▪ Green Belt ▪ Proximity to National Grid ▪ Radar ▪ Bridleways and footpaths buffer	***For example:*** Planning barriers Funding Economic viability (commercially attractive wind speeds) (Note: Not all of the above can be mapped)

Figure 17 below shows the wind energy potential estimated spatially through the South East study. A single wind speed is used (5m/s), and all constrained areas are greyed out. Landscape designations are shown in yellow with buffers from these designations in light green, and areas of bird sensitivity in red. Further assumptions are made in the South East Study in respect of turbine density, to predict energy generation potential. Figure 18 shows a revised analysis by AECOM, where landscape designations as shown as hatched areas to highlights differences in annual wind speed across the County and give a broader opportunity for site-specific discussions over wind energy feasibility. Differences in wind speed are also indicated to show more feasible sites for wind development. Wind speeds of over 6m/s are typically more attractive for commercial operators, and not all designations signify a blanket ban on wind development – applications should be considered on a case by case basis.

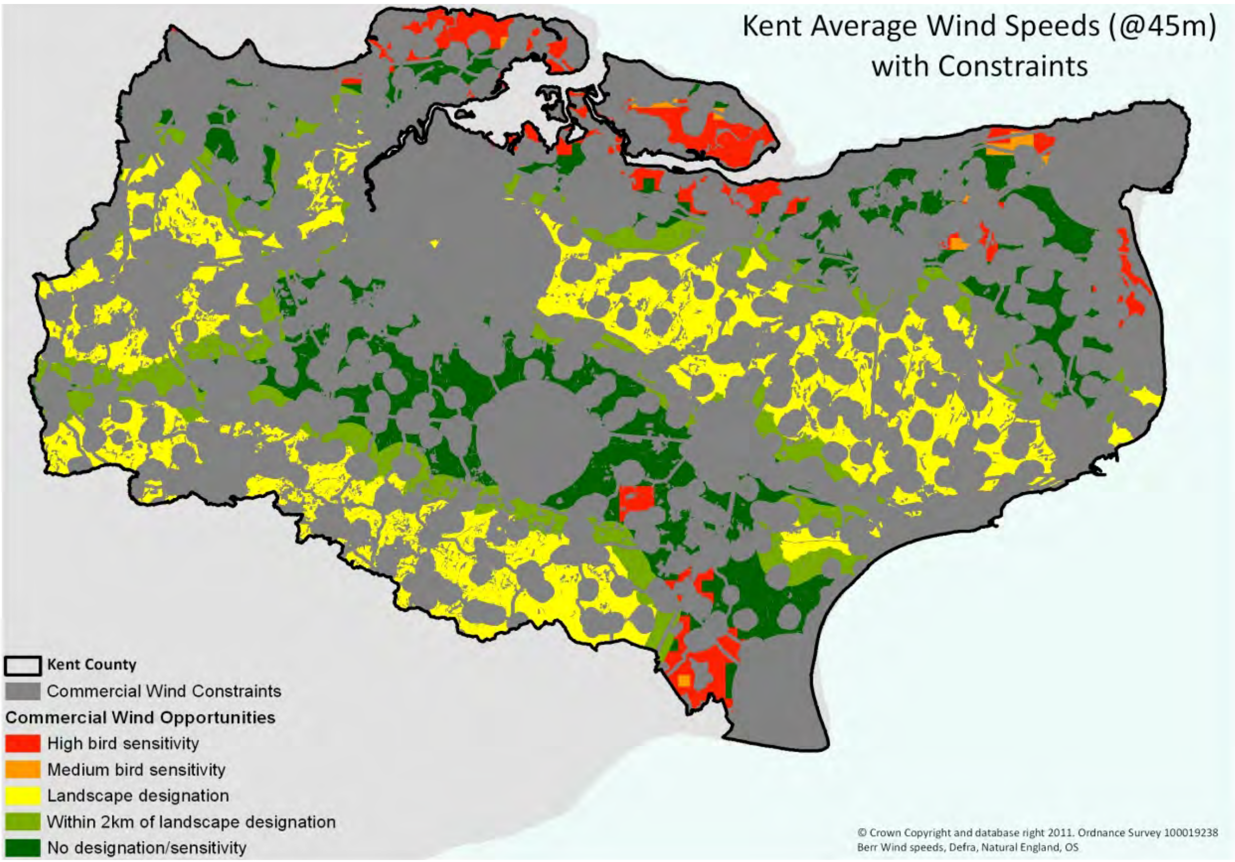


Figure 17: Average wind speed with constraints at 45 metres[11]

[11] **Reproduced based on data from the existing capacity study for the South East Study**

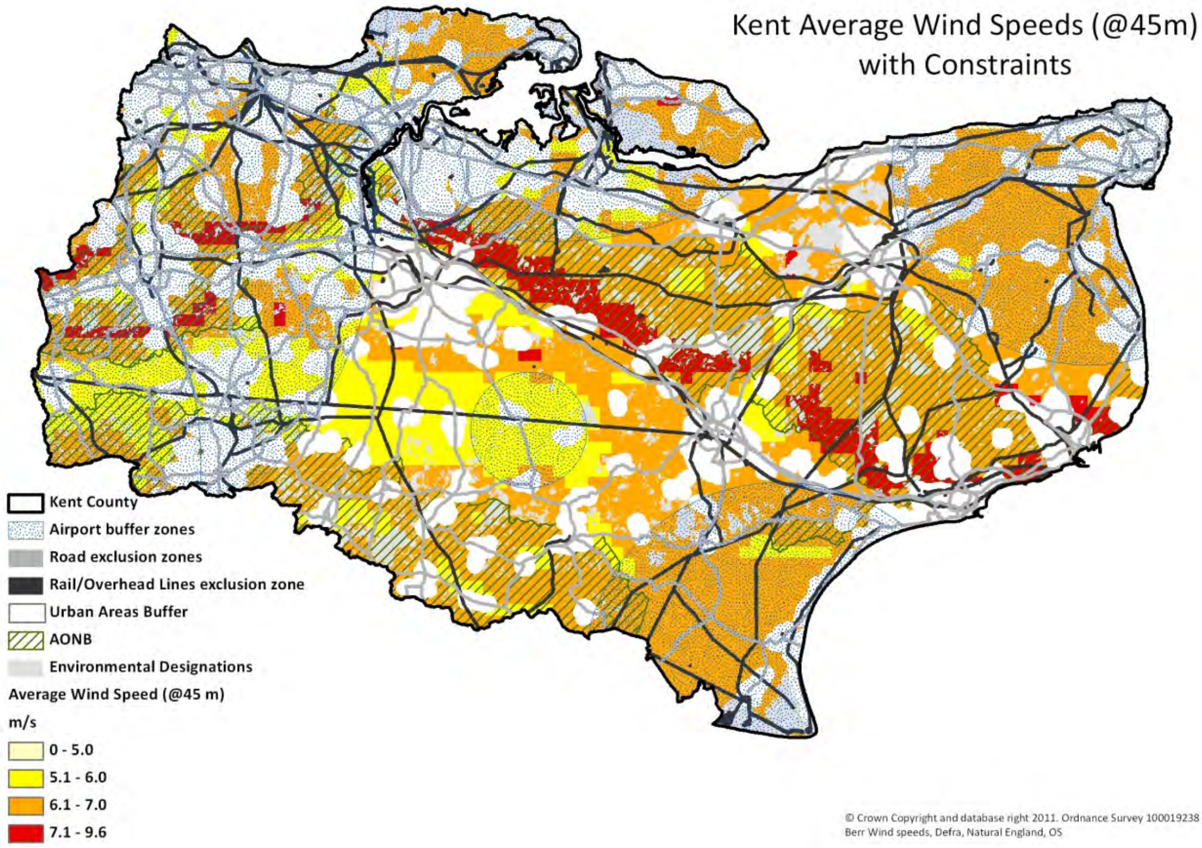


Figure 18: AECOM analysis of wind potential showing landscape constraints and wind speed

It can be seen in Figure 18 that the highest wind speeds (over 7.1m/s) run east to west through the Kent Downs AONB (shown in Figure 19). The Kent Downs AONB authority has conducted a review of landscape impacts of all renewable technologies will generally oppose large scale wind in and around the AONB favouring other technologies instead, and difficulties were identified even with smaller turbines – a recent planning application for a 5kW turbine was rejected. However, the Renewable Energy in Kent Select Committee Report highlights that earlier work commissioned for the AONB has indicated that single (not multiple) turbines up to 500kW could be appropriate is come cases. At the time of writing Ecotricity are beginning the planning of a possible wind farm (6 turbines, total installed 13.8MW, power equivalent 10,000[12] homes) at Harringe Brooks, near Sellindge and within close proximity to the Kent Downs AONB. Given the landscape importance of the AONB, the energy opportunity maps produced in this study highlight this area as an opportunity for smaller-scale wind development rather than large scale installations.

The local authorities in Kent with significant apparent potential for commercial scale wind are Ashford, Canterbury, Maidstone, Dover, Shepway and Swale. These authorities – based on the regional resource assessment – could accommodate between 100 and 300 2.5MW turbines. Each of these turbines – using an 18% capacity factor in line with the South East Study assumptions - can produce 3942MWh per year. Assuming a typical electrical consumption for a dwelling of 5000kWh a single 2.5MW turbine could power 788 homes. Ashford has 40,000 homes so would require 51 2.5MW turbines to meet its total domestic electricity demand.

[12] Note: 10,000 figure taken directly from Ecotricity website. Using the more conservative DECC capacity factors for wind turbines (18%) and AECOM conservative assumptions for dwelling electricity demand (5,000kWh) – this installation would power the equivalent of 5000 homes.

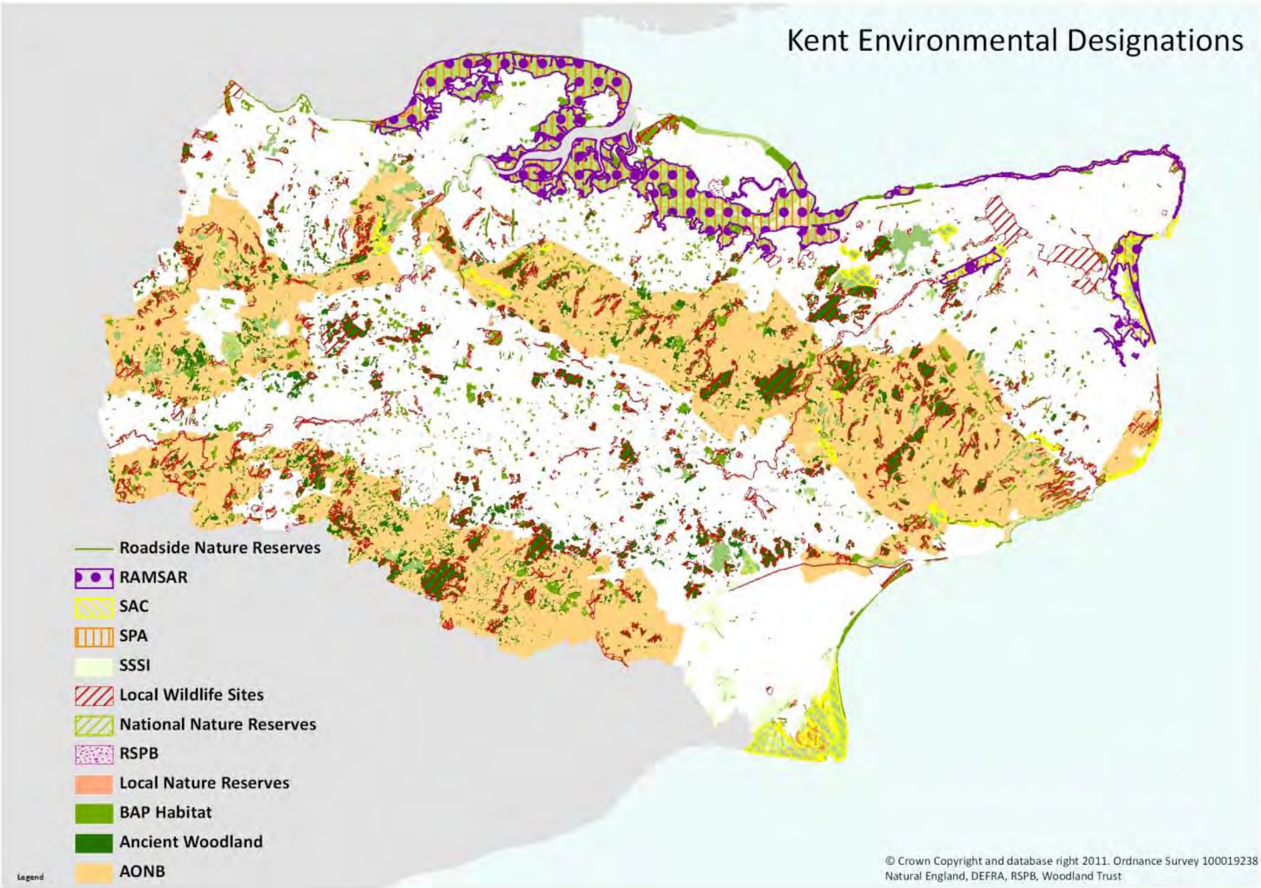


Figure 19: Environmental and Landscape Designations in Kent

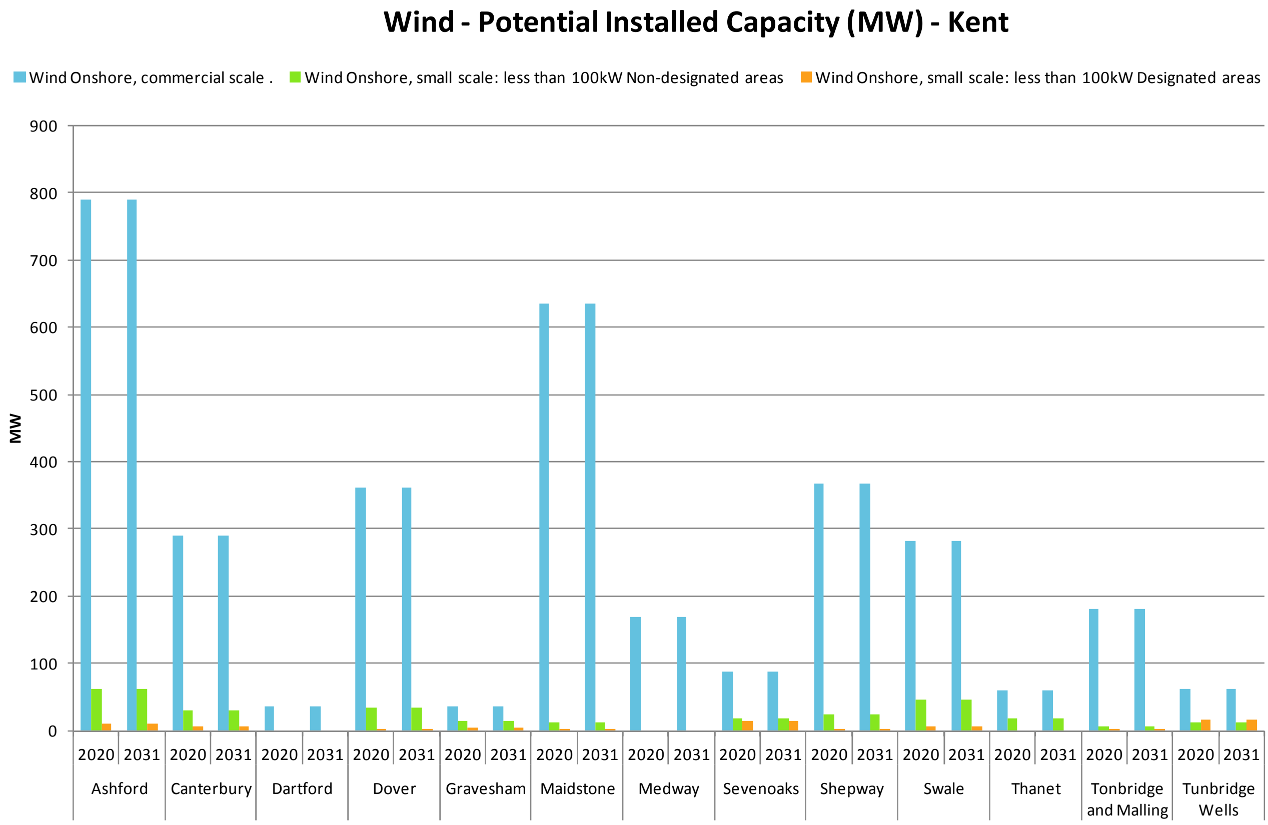


Figure 20: Graph to show potential wind energy (commercial, small scale and micro) installed capacity and energy generation potential for Local Authorities in Kent by 2031 (TV Energy/Land Use Consultants, June 2010)

The South East study also assesses the potential for medium and small scale wind. There has been much debate on the quality of the DECC methodology at the small scale and the estimates resulting from the methodology are wildly optimistic in many cases. The DECC methodology assumes that all small scale wind turbines will be 6kW in size and could be applied at every address point that has a wind speed over 4.5m/s. A scaling factor is applied to reduce potential energy outputs based on likely obstructions (i.e. urban, sub-urban and rural). Overall, using these assumptions, it has been calculated that 340MW of small scale wind generating 477GWh could be accommodated within Kent, of which only 66MW is within designated areas. This energy output could power the equivalent of around 95,000 homes. In practice, a large number of rural properties would not be able to accommodate a small wind turbine due to physical constraints and competing land uses. As with heat pumps these levels of deployment are considered overly optimistic.

Local assessment will clearly need to examine the realistic potential for small scale wind in more detail, and the capacity of the landscape to deliver this. Wind speeds are generally lower at reduced heights (where small turbines might be placed) and it is suggested that small turbines should only really be promoted where wind speeds are good and the site is not obstructed by trees and other buildings. The figure below shows wind speeds for Kent at 10m hub height which indicates the most promising areas for investigation.

It is useful to consider wind in terms of the turbine scale because different actors have potential to deliver different scales of turbines. Medium scale wind turbines can be delivered in rural areas by farmers, land owners and communities. Small scale turbines are likely to come forward for school and community buildings and for business centre developments. Micro turbines could be fitted by a private individual. Turbines of this scale are (or have been) marketed by DIY chain stores and are eligible for the Feed in Tariff. Energy Saving Trust guidance should be followed to help ensure they are installed appropriately.[13] The balance between smaller scale wind and large commercial wind turbines is important. It is true that medium and small scale turbines are less efficient and proportionally to energy output are more expensive; however they have fewer barriers for deployment and can help raise awareness of the importance of low carbon energy. The review of the physical wind resource and the delivery scenarios point to the energy generation from large scale turbines dwarfing anything that might be generated through installation of small and micro wind turbines. In the following sections of this report small and medium scale wind are presented together as 'small wind' (under 100kW), as opposed to 'large wind' (over 100kW).

[13] http://www.energysavingtrust.org.uk/Generate-your-own-energy/Wind-turbines

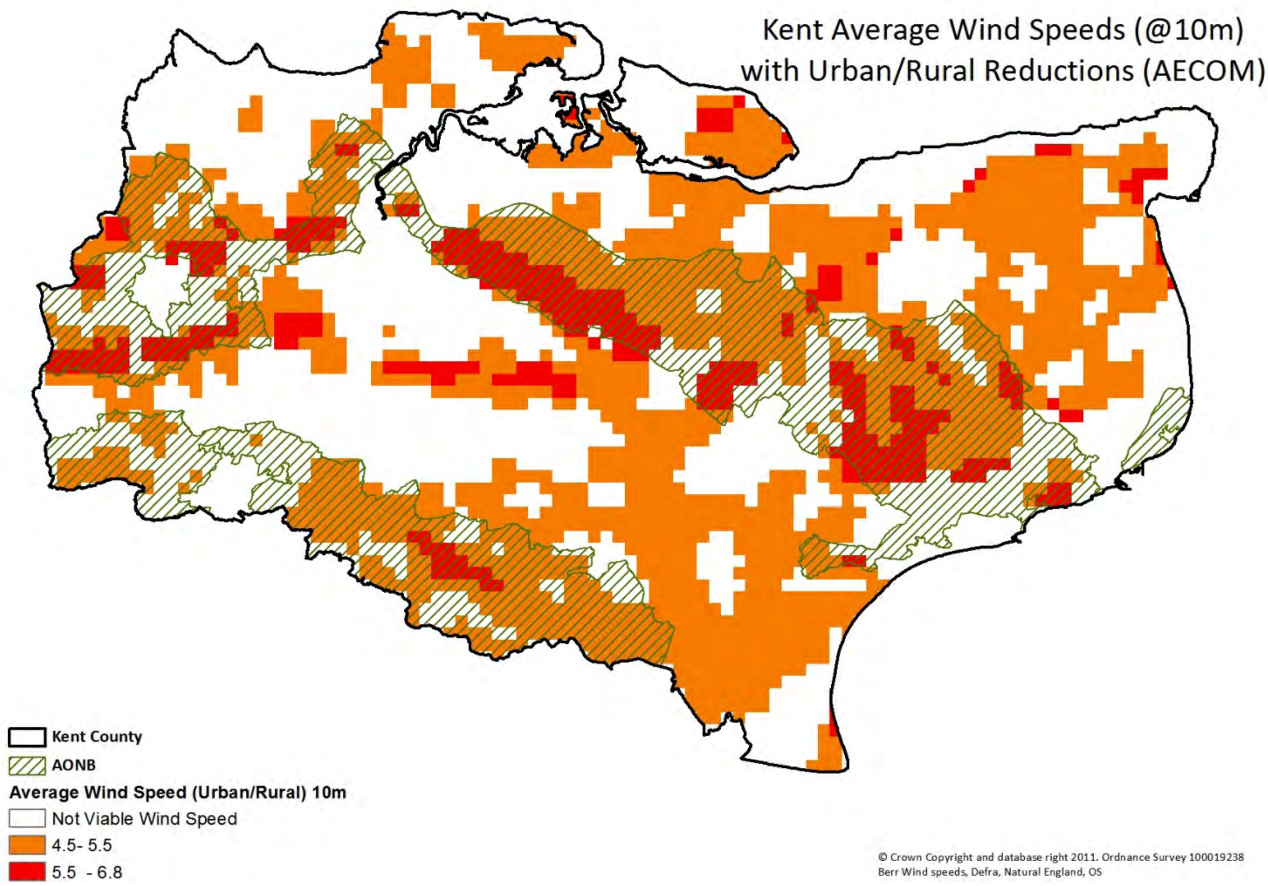


Figure 21: Kent Wind speeds at 10m hub height – as may be more appropriate for small and micro wind turbines

4.4 Biomass

Biomass comes in a number of forms and can be used in a number of ways to generate energy. The biomass categories covered by the South East capacity study are; managed woodland, energy crops, waste wood, agricultural arisings (including straw and other waste animal feedstock) and separately poultry litter. These different biomass resources can be used to generate energy in a variety of ways ranging from fuelling small scale domestic boilers for generation of heat only to use as a feedstock for co-firing in large power stations to reduce the carbon content of generated electricity. The DECC methodology assumed biomass resource would be used either to generate heat or electric and makes no allowance for combined heat and power (CHP). This technology could be appropriate in a number of commercial or community developments across Kent, and may make more efficient use of the limited biomass resource. AECOM understands from discussions with the Forestry Commission that companies are positioning themselves to construct and run local biomass CHP plants making use of sustainable forestry woodfuel in Kent. (e.g. http://www.estoverenergy.co.uk/index.asp)

The South East study highlights all land holdings that in theory could be used to grow biocrops based on soil conditions. In reality bio-crops are unlikely to be delivered on such a large scale at any one time, as land-owners will ultimately respond to market demands, and will change crops as such. There is some concern that growth of biocrops could endanger local food production capability, and hence lower grades of land (grades 3 and 4) should be favoured for biocrop farming. The most favourable land areas for the growth of biocrops have been included in the energy opportunity maps for each local authority area at the end of this chapter.

It can be seen in Figure 22and Figure 23 below that the South East capacity study broadly assumed that biomass resource from managed woodland and energy crops would be used primarily for heating, with agricultural arisings the main source of biomass fuel for electricity production. It is important to note that in most cases the fuel availability is the starting point for assessing the physically accessible resource. Co-firing is an exception to this.

The calculation for co-firing is based on an assessment of the number and capacity of existing power stations with the ability to co-fire biomass. It is assumed that up to 10% of combustible fuel can be biomass and that co-firing will continue until 2031. The financial incentives through the renewable obligations will remain until 2027. Co-firing in Kent will require significant biomass resource, and although it can take a wider range of fuel types and quality this should be considered in developing actions to drive the uptake of smaller scale biomass installations. AECOM has not made any investigations for this study as to which of the existing power stations are co-firing biomass, or to where any fuel for this purpose originates. However, as noted previously, the coal power station at Medway is due to close in 2016, limiting opportunities here.

The South East study estimated that combined biomass resources could fuel circa 470MW installed plant for heating only, and generate in the region of 820GWh (heat). This is equivalent to heating around 160,000 homes (around 22% of the homes in Kent) assuming 3kW per home. It is worth noting that (aside from stoves and back boilers) biomass boilers generally start from around 10kW so are not typically suited to single detached dwelling applications. The 3kW assumption above would assume homes connected to a block or district wide network using a single larger boiler.

In addition it was estimated that Kent's own biomass resource (from woodland, energy crops, waste wood and agricultural arisings) could power 161MW of electrical generating capacity giving rise to a predicted 1215GWh of power on an annual basis. This is sufficient to power around 240,000 homes (33% of homes in Kent) assuming an average 5000kWh per dwelling. Co-firing of biomass was estimated to be able to provide a further 2000GWh of energy, although it remains unclear as to whether co-firing in Kent is using Kent derived fuels.

In cross checking the South East resource assessment it has been established that the South East region can deliver a sustainable woodfuel resource of 0.5 million tonnes per year (Forestry Commission). Kent has 12% of this resource - 60,000 tonnes per annum. Currently only 10% of the available resource in the South East is being utilised. 60,000 tonnes of woodfuel would represent in the order of 42,000 oven dried tonnes at 30% moisture content.

Using DECC rules of thumb 6,000 odt is required per MWe of installed capacity. The woodfuel (forestry) arisings from Kent are therefore sufficient to sustain a 7MWe plant. Assuming a load factor of 86% this would produce 52,735MWh (electricity). This would be sufficient to power around 10,000 homes. Heat would be produced simultaneously and could be used to heat buildings in the vicinity. Typically heat is produced at a ratio of between 1.5 – 2kWh for each kWh of power. Therefore it can be assumed that a 7MWe plant could heat around 15,000 homes, provided it is suitably located and connected to a district heating network.

This same wood fuel could alternatively be used in conventional biomass boilers. The South East Renewables Study states that 'Good Grade' woodfuel has an energy value of 18GJ/odt. 30,000 odt would deliver 756,000 GJ or 210,000 MWh. Installed capacity to deliver this heat output using a load factor of 30% would be in the region of 80MW. There would be some efficiency losses but this level of heat output could heat in the order of 20,000 - 40,000 homes. This assumes average house type energy demand of between 5,000 and 10,000kWh.

In addition to the forestry woodfuel resource there are other arisings from agricultural arisings, energy crops and waste wood. We have assumed within our scenario testing (for biomass power stations) that Kent could install up to 10MWe of biomass power plant. It should be borne in mind that some of the waste wood is likely to also be counted in the estimates of waste arisings (from Municipal Solid Waste/Commercial and Industrial). The scenario testing related to uptake of biomass boilers in homes and businesses is based on a bottom up assessment of the number of boilers, although in practice these boilers would rely on the same sources of wood fuel.

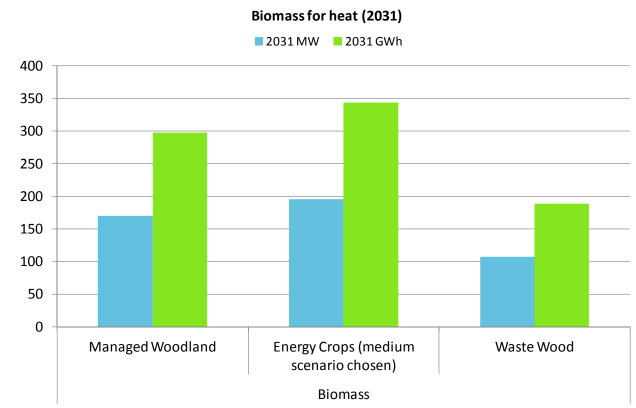


Figure 22: Graph to show biomass installed capacity and generation potential for heat only. (TV Energy/Land Use Consultants, June 2010)

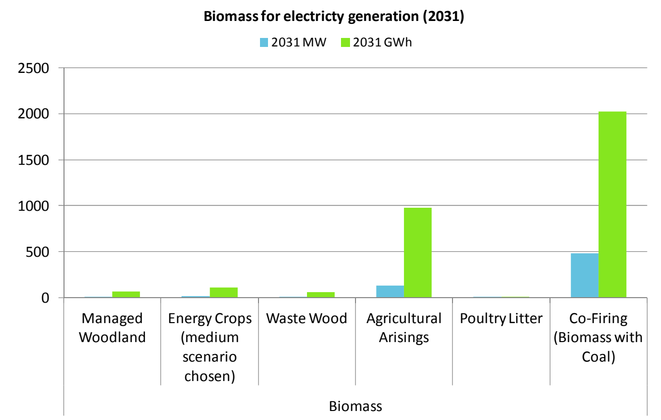


Figure 23: Graph to show biomass installed capacity and generation potential for electricity generation. (TV Energy/Land Use Consultants, June 2010)

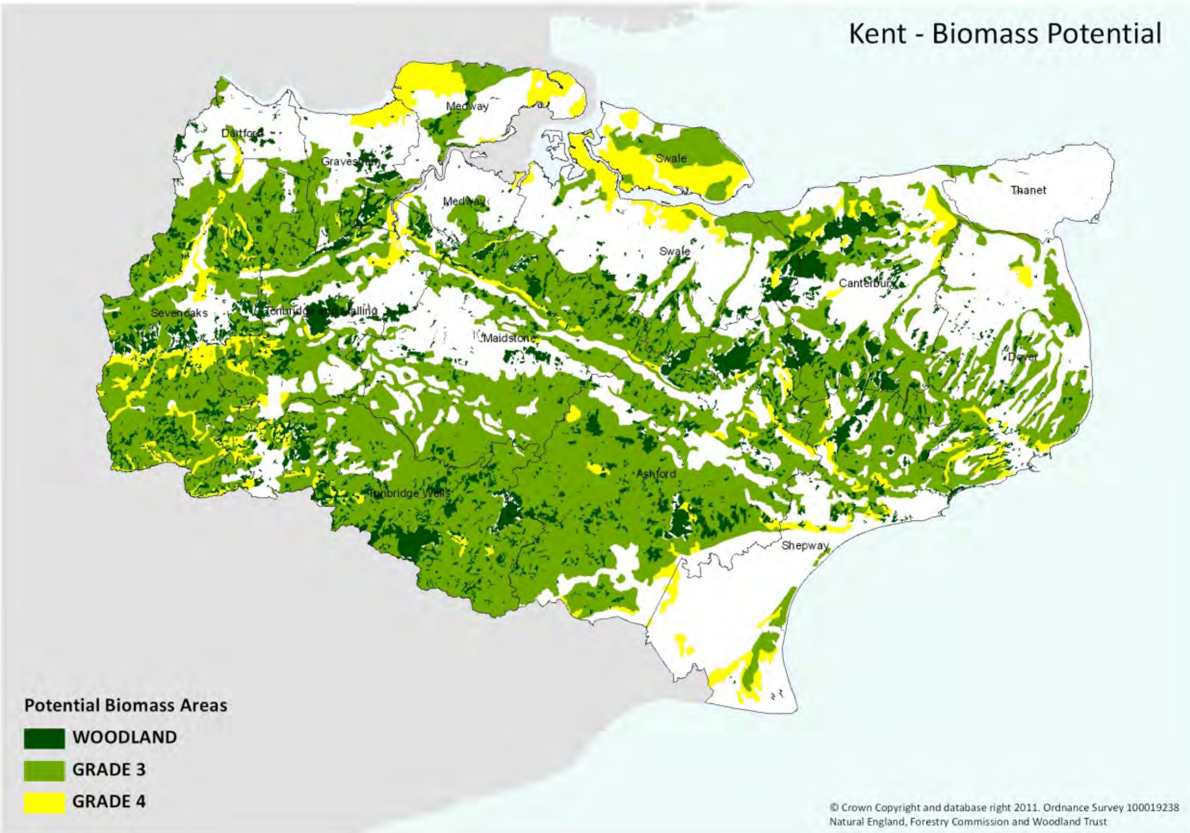


Figure 24: Main areas of biomass potential for managed woodland (woodland) and land with potential to grow energy crops without competing with food production (Grade 3 and 4 agricultural land)

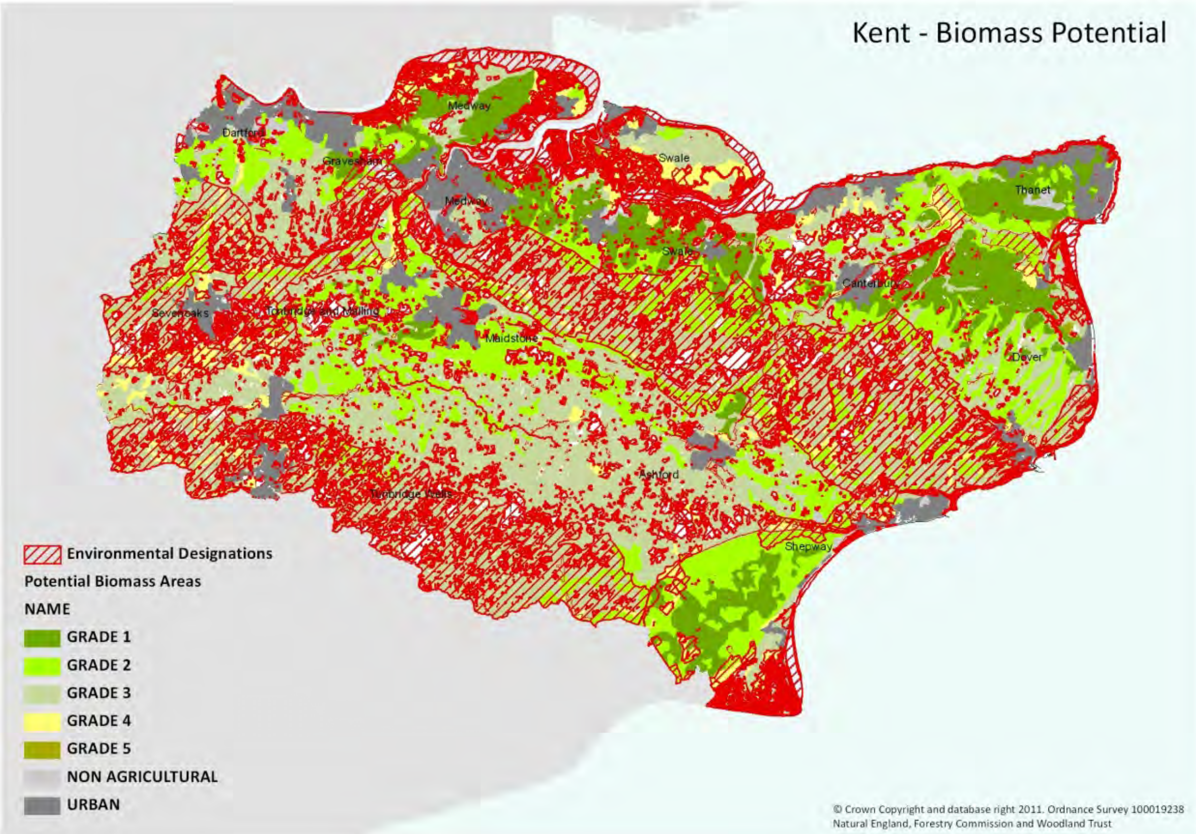


Figure 25: Map showing all grades of agricultural land, including environmental designations

4.5 Waste & Biogas

Waste covers municipal solid waste (MSW) and commercial and industrial (C&I) waste. In both cases 10,000 tonnes of waste are considered to be equivalent to approximately 1MW of installed renewable energy capacity. This is a rule of thumb derived from the DECC methodology, although it should be noted that in practice different waste streams will include different renewable energy components.

Kent County Council Waste Management Unit figures [14] predict that around 756,000 tonnes of MSW will be produced in Kent in 2020. Of this, Kent aims to recycle or compost 50%. A significant proportion of the remainder is contracted to the existing EfW plant at Allington and in total around 40% of Kent's MSW (equivalent to around 300,000 tonnes per year) is planned to go to 'other recovery' (principally energy from waste) in 2020.

There is also potential for other waste streams to be directed to energy from waste generation. In the consultation documents for Kent's Minerals and Waste Core Strategy, Kent County Council recognises that Kent has potential for diverting more C&I waste from landfill than is currently the case, and more than is assumed in the South East Plan.15 1,139,000 tonnes of C&I waste is estimated to be produced in Kent in 2020, based on Kent County Council low growth projections, of which around 20% may go to energy from waste in 2020 if South East Plan waste management routes are followed.

According to Kent County Council's Minerals and Waste Core Strategy consultation document at Strategy and Policy Directions stage, May 2011, additional EfW facilities will be required over the period up to 2030 to deal primarily with the volumes of C&I waste arisings in Kent which are currently sent to landfill. Draft Policy CSW7 states that under the RSS high growth scenario additional energy recovery capacity of 600,000 tonnes per annum will be required by 2020.

If waste is imported from London or if the proportion of waste going to landfill is decreased even further the energy from waste figures may be higher. However, the figures will be lower if Kent's waste production growth rates are in line with the lower growth rates which are considered by KCC to be more likely than the high growth projections. Potential Energy from Waste sites are currently being investigated by various private developers as well as Kent County Council as part of their Minerals and Waste Core Strategy.

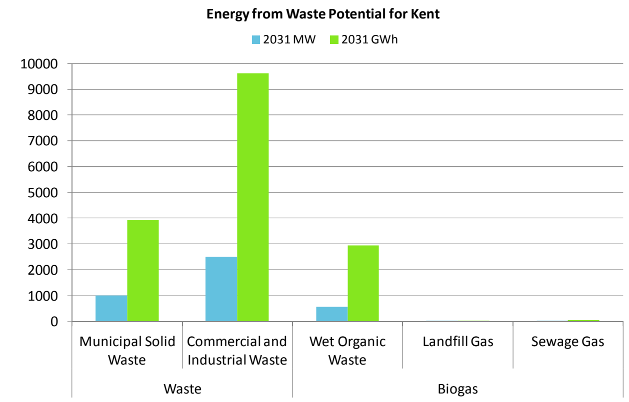


Figure 26: Graph showing installed and generating capacity for Energy from Waste in Kent. (TV Energy/Land Use Consultants, June 2010). As noted above the potential for energy generation from MSW and C&I waste seems to be an over estimate considering the level of predicted waste arisings in Kent.

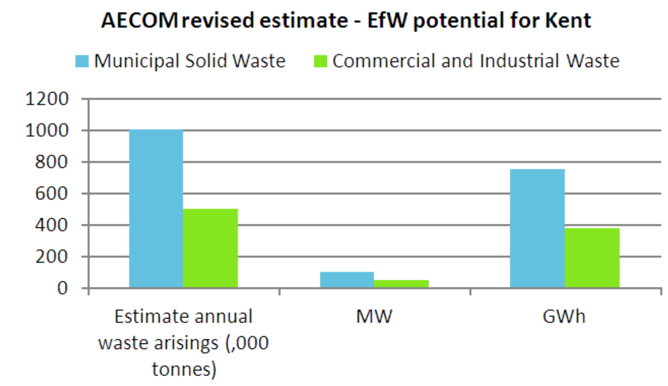


Figure 27: AECOM revised estimate of Energy from Waste potential for Kent

Biogas

Biogas covers landfill gas and anaerobic digestion using sewage gas. The former is expected to reduce as increasing level of waste is diverted away from landfill.

Methane-rich gas from landfill sites has been commercially exploited in the region since the early 1990s. These are almost all using electricity-only gas turbines or internal combustion engines. The gas originates from the putrescible or organic content of the municipal waste that has been disposed of in the landfill. Estimates suggest that biogas production builds up

[14] Kent County Council, *Minerals and Waste Core Strategy consultation document at Strategy and Policy Directions stage* , May 2011
[15] *Minerals and Waste Core Strategy – Strategy and Policy Directions Consultation*, May 2011

to peak around 10 years after sites are closed to new waste, and may continue at a falling rate for as long as 50 years afterwards.

In a similar way to landfill gas, sewage gas is naturally created through anaerobic digestion where these conditions occur. This has been systematised by the waste water treatment companies in the region (Thames and Southern) to provide biogas for electricity to help power the sewage plant itself. There are 21 waste treatment works in the South East of England operating this technology.

The estimated installed and generating capacity from biogas in Kent is summarised in the table below.

Table 5: Biogas resource potential for Kent

Gas Source	Installed capacity (MW) (2020)	Generating potential (GWh) (2020)
Landfill Gas	12	55
Sewage Gas	11	42

It has been assumed that whilst gas arisings from sewage may rise a little with population, landfill gas is likely to decline. The biogas sector is unlikely to have a significant impact on delivering Kent's renewable energy and CO_2 reduction targets.

Most sewage treatment works and landfill sites recover gas for energy production either for their own use of for export and probably do not require special focus within an action plan for delivery of renewable energy for Kent. On farm anaerobic digestion and digestion of food waste from large kitchens or food factories may be worthy of promotion, especially as commercially available anaerobic digestion (AD) plants reduce in scale and given the support from the Feed in Tariff and RHI, and given the large areas of farmland present in Kent. Although no significant AD installations have been identified in Kent to date, and currently uptake in the UK is low compared to some other countries such as Germany, AD is currently being investigated by Hadlow College and considered at the Otterpool Quarry site. Local Authorities have a role in promoting the use of food waste and in promoting schemes to farmers, as well as providing support through the planning system. Recent revisions to the revisions to the English Town and Country Planning Order mean that from April 2012 small-scale energy installations in England built on agricultural or forestry land will be exempt from planning permission. Planning permission will no longer be required for farmers and landowners who install AD or any associated storage buildings with a ground area of less than 465 square metres on farming or non-domestic land.

WRAP and NNFCC produced a baseline report which found that there were 241 AD facilities in the UK in September 2011, of which 24 are farm-fed plants processing a mix of feedstock types.[16] The potential to increase this capacity has been recognised by the National Farmers Union, who have a vision of 1000 farm-based AD plants by 2020, plus 200 larger facilities processing waste. Benefits to farmers include increased energy self-sufficiency, income from renewable energy incentives, the use of by-products as fertilisers (the process increases the fertiliser value of slurry), and reduction in odour emissions. Farming projects could be small-scale on a single farm, or could process waste from a number of sources. Useful information for farmers considering AD is provided by organisations such as BusinessLink,[17] and sector-specific guidance is given on DECC's official information portal for AD.[18] AD at a larger scale using food waste would need to be linked to Kent's waste strategy and could potentially contribute to Kent's wider targets for reducing diverting biodegradable municipal waste from landfill.

4.6 Hydro

The DECC methodology recommends the use of the results of the Environment Agency's (EA) report 'Mapping Hydropower Opportunities in England and Wales' (2009) to identify the total regional resource and the portion of that resource which is accessible and viable. Using this resource the South East renewable study estimates the physical resource at between 0.36 and 1.1MW (installed) giving rise to between 2 and 6 GWh of generating capacity. The variation depends on whether schemes come forward on all available sites, or are restricted only to non-designated areas.

The Environment Agency has classified opportunities as low, medium or high environmental sensitivity based on the fish species likely to be present and whether the site is in a designated area. This is a basic assessment that does not consider the full suite of environmental impacts, and is therefore indicative only. Figure 28 and Figure 29 below show the identified hydro sites for Kent and their sensitivity categorisation.

Hydro power has not been considered further in this report as overall potential for hydro power in Kent is low. Projects are likely to be brought forward by land owners and business, although only in the relatively few locations where Hydro is appropriate.

[16] *Anaerobic digestion infrastructure in the UK*, September 2011
[17] http://www.businesslink.gov.uk/bdotg/action/detail?itemId=1086234405&type=RESOURCES
[18] http://www.biogas-info.co.uk/

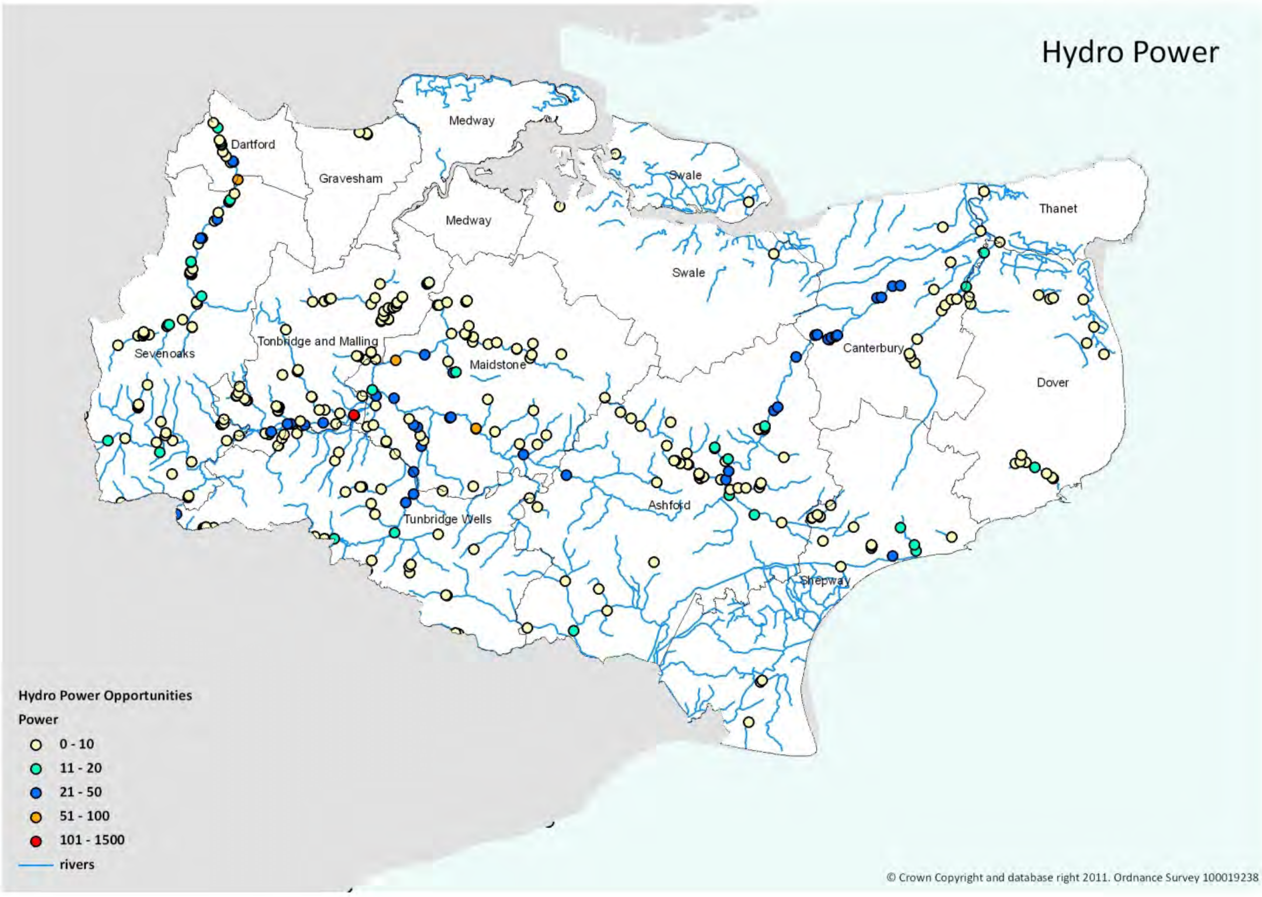


Figure 28: Map showing hydro power opportunities in Kent by size (installed capacity)

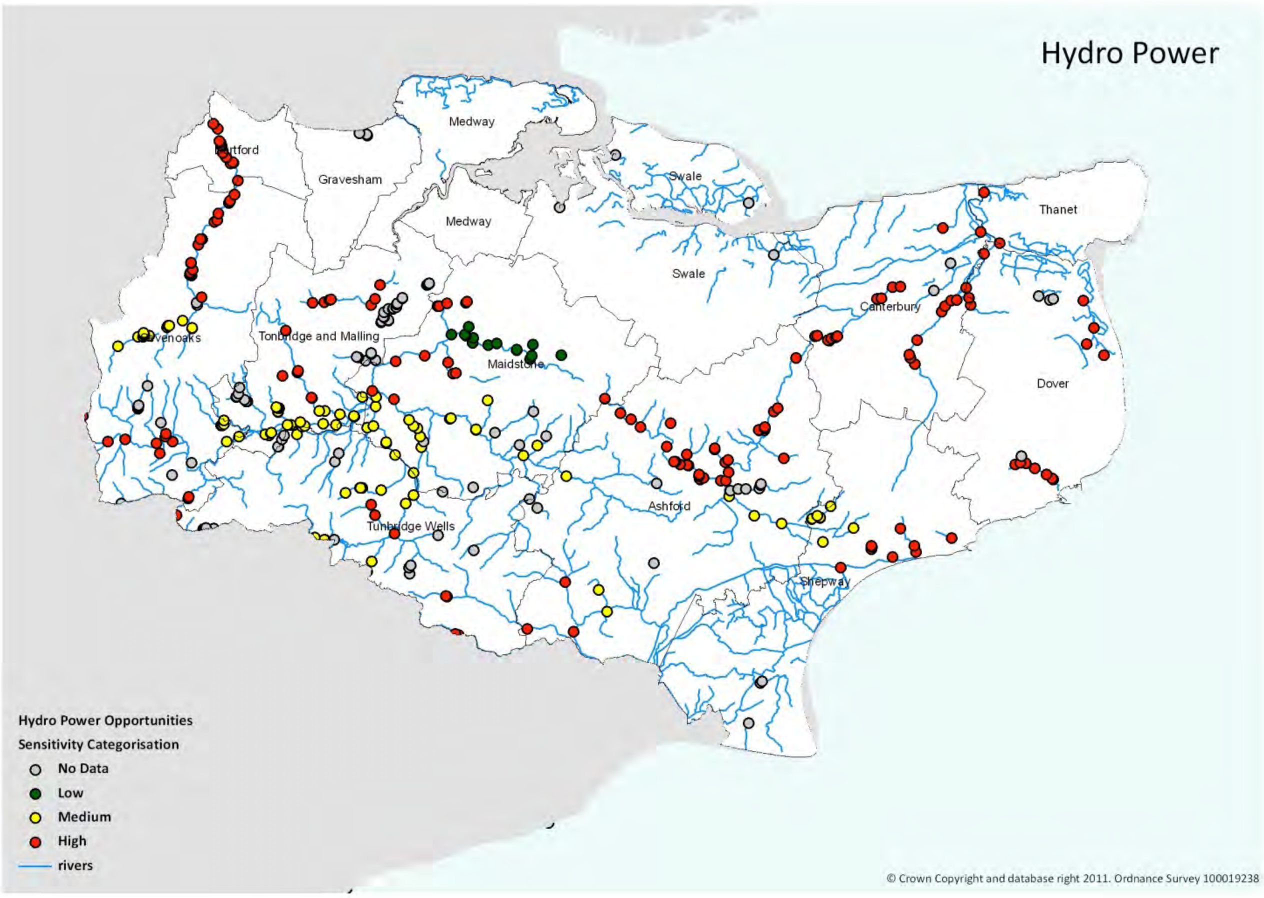


Figure 29: Map showing hydro power opportunities in Kent, highlighting their indicative environmental sensitivity

4.7 Micro-generation

The final technologies fall into the micro-generation category and include heat pumps, solar thermal, and photovoltaics (small wind is discussed earlier). These types of technologies are generally directly linked to buildings both physically and in terms of energy supply. They are not heavily influenced by geographic location or climate variations across the UK. The potential is therefore defined by the number and type of buildings. The DECC methodology uses overly optimistic assumptions on heat pumps and does not consider adequately the type and appropriateness for different building types.

Further work will be needed to assess the realistic potential based on a more detailed analysis of the building stock and considering the likely uptake by home owners and businesses – considering ambition, commercial attractiveness under RHI and practical barriers for integration on buildings. This study begins to consider this for a range of the technologies in section 6. Market sizes, appropriate installed capacities and uptake assumptions are included within section 6.

It should be noted that although using a micro-generation technology (photovoltaics) solar farms are considered separately within the later scenario testing due to their large scale application potential.

4.8 Combined Heat and Power and District Heating

While not a renewable energy resource itself, the distribution of heat through a district heating system (and capture of waste heat from Combined Heat and Power plants) is an important strategy to deliver renewable heat and lower carbon emissions associated with energy use in urban areas in particular, or in non-urban areas off the gas grid and with a suitable density and mix of buildings. The South East Study did not explicitly consider the potential for district heating networks, and heat maps that show the density of heat demand across the County have been produced by AECOM. Heat maps are useful in identifying areas that could be retrofitted with district heating networks in a cost-effective manner.

The figures below are heat maps of Kent County based on heat demand data[19] which highlights areas where a commercially viable heat network could be investigated. Due to the high level nature of the maps, they are intended for guidance only, and may include spatial inconsistency. These inconsistencies are the result of high heat demand on individual sites being spread across the super output area in the mapping. ,We have reviewed areas showing high heat demand density existing outside urban boundaries have been investigated to check for anomalies. The table below lists these areas where possible anomalies were investigated, and the likely reason for their high heat demand.

Table 6: Sites outside urban boundaries containing high heat density

Site outside urban area	Most likely reason for high heat demand
South of Canterbury	The industrial area along Station Road in Chartham,
Eastern boundary of Ashford	Wastewater treatment plant and industrial land to the west of Willesborough Road
West of Thanet	Kent International Airport and RAF Manston
Northwest Sheerness	Industrial land
East Queenborough	Klondyke Industrial Estate and Queenborough Business Park
East of Sittingbourne	Eurolink Industrial Estate; industrial site west of Bayford Meadows Kart Circuit; and wastewater treatment plant

It should be noted that this is high level heat mapping, and individual address point data should be used to plan networks in detail as part of feasibility studies for delivery of heat networks.

Opportunities for district heating networks should also be analysed particularly when undertaking regeneration and new development projects, for example in the Thames Gateway, Sittingbourne Town Centre, Connaught Barracks, Chilmington Green urban extension plus other areas. District heat network opportunities are discussed further in section 7.5.

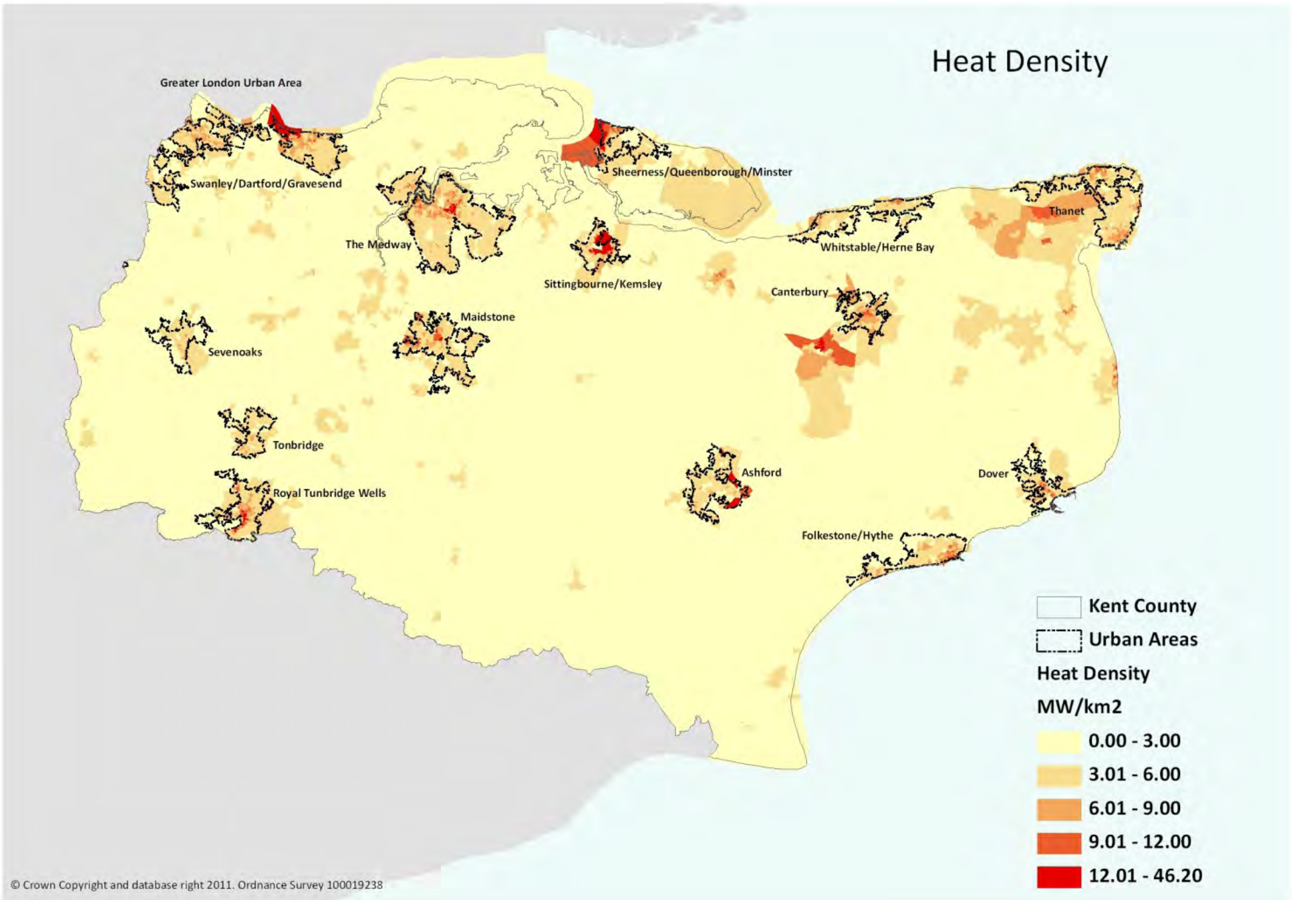


Figure 30: Map showing heat density for Kent

[19] Available from DECC at a middle super output level, and proportioned to lower super output using land use statistics

Large energy users, or 'anchor loads' are an essential part of a district heating network to provide a base heat demand that will allow a system to run efficiently. Anchor loads could be large energy users such as industry, schools, hospitals or leisure centres with heated swimming pools. Using available data, heat maps have been developed for all of the main urban areas in Kent showing Hospitals, Schools and Leisure Centre locations. These heat maps can be used as the starting basis for planning of a heat network. Other important spatial layers for planning (which were not available to this study) include major industry heat users, new development/regeneration locations that could drive change in the area and council owned properties that could form the basis of a network.

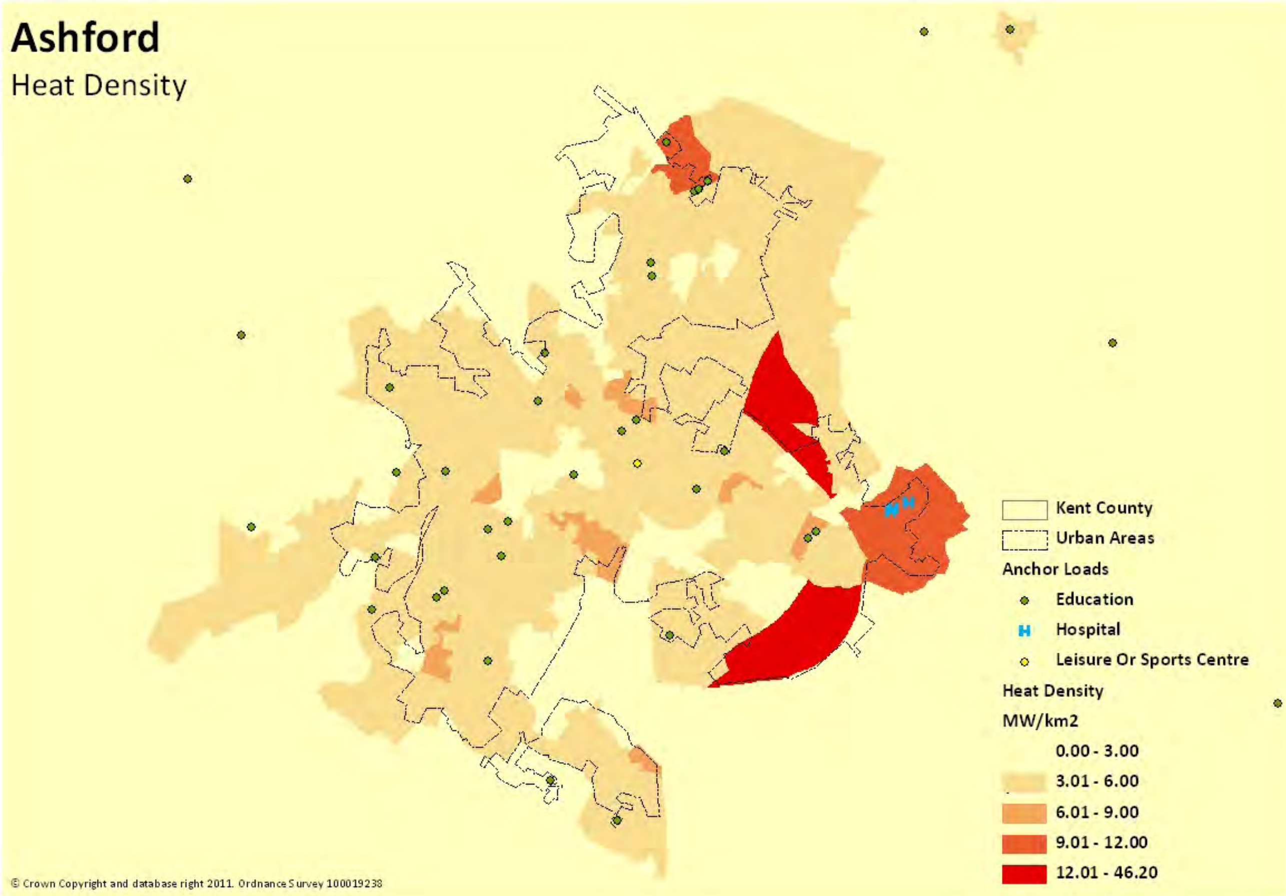


Figure 31: Heat map for Ashford[20]

[20] As per Table 6, the high heat density outside the Ashford urban boundary is likely due to the wastewater treatment plant and industrial land to the west of Willesborough Road.

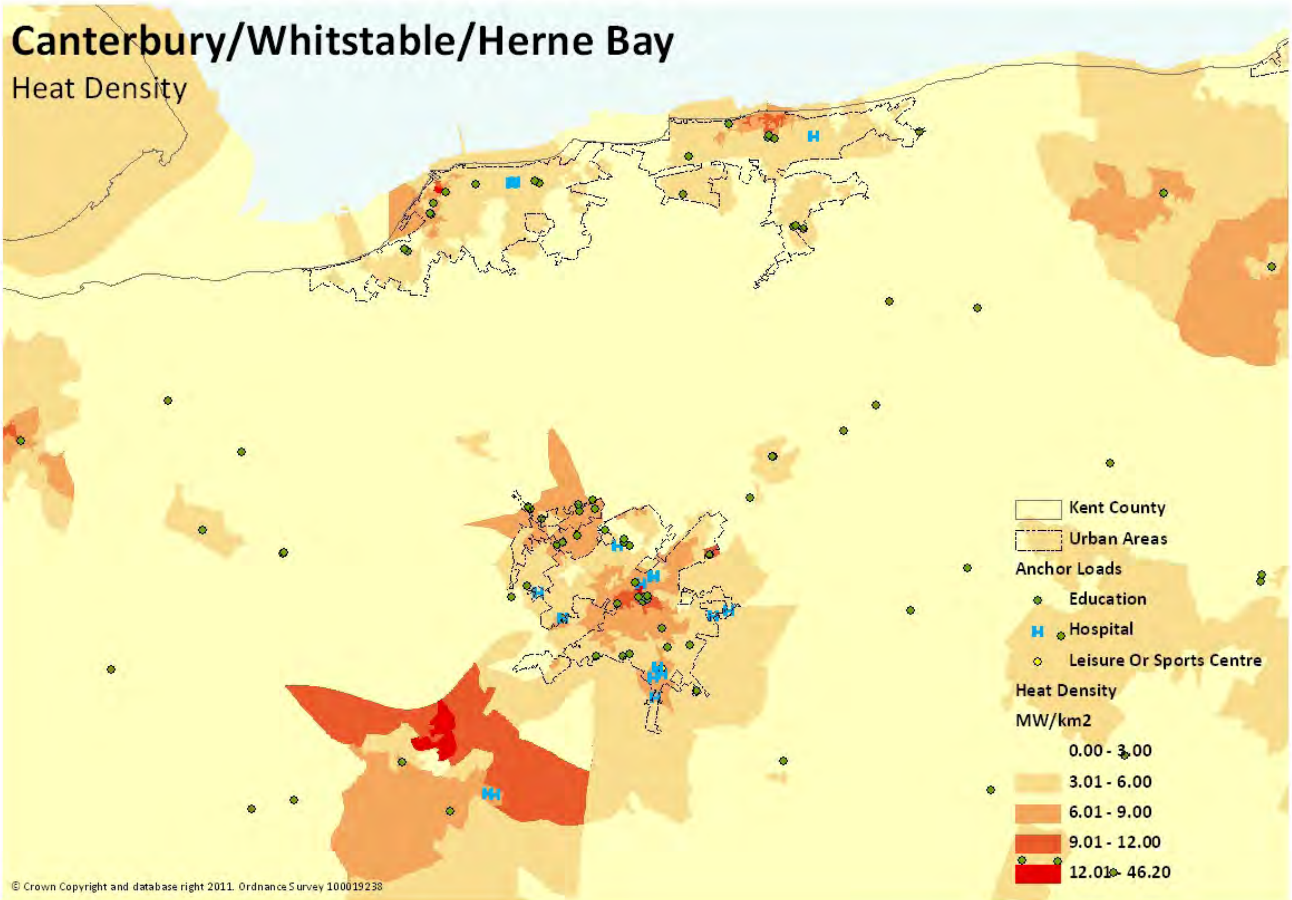


Figure 32: Heat map for Canterbury/Whitstable/Herne Bay[21]

[21] As per Table 6, the high heat density outside the Canterbury urban boundary is likely due to the industrial area along Station Road in Chartham,

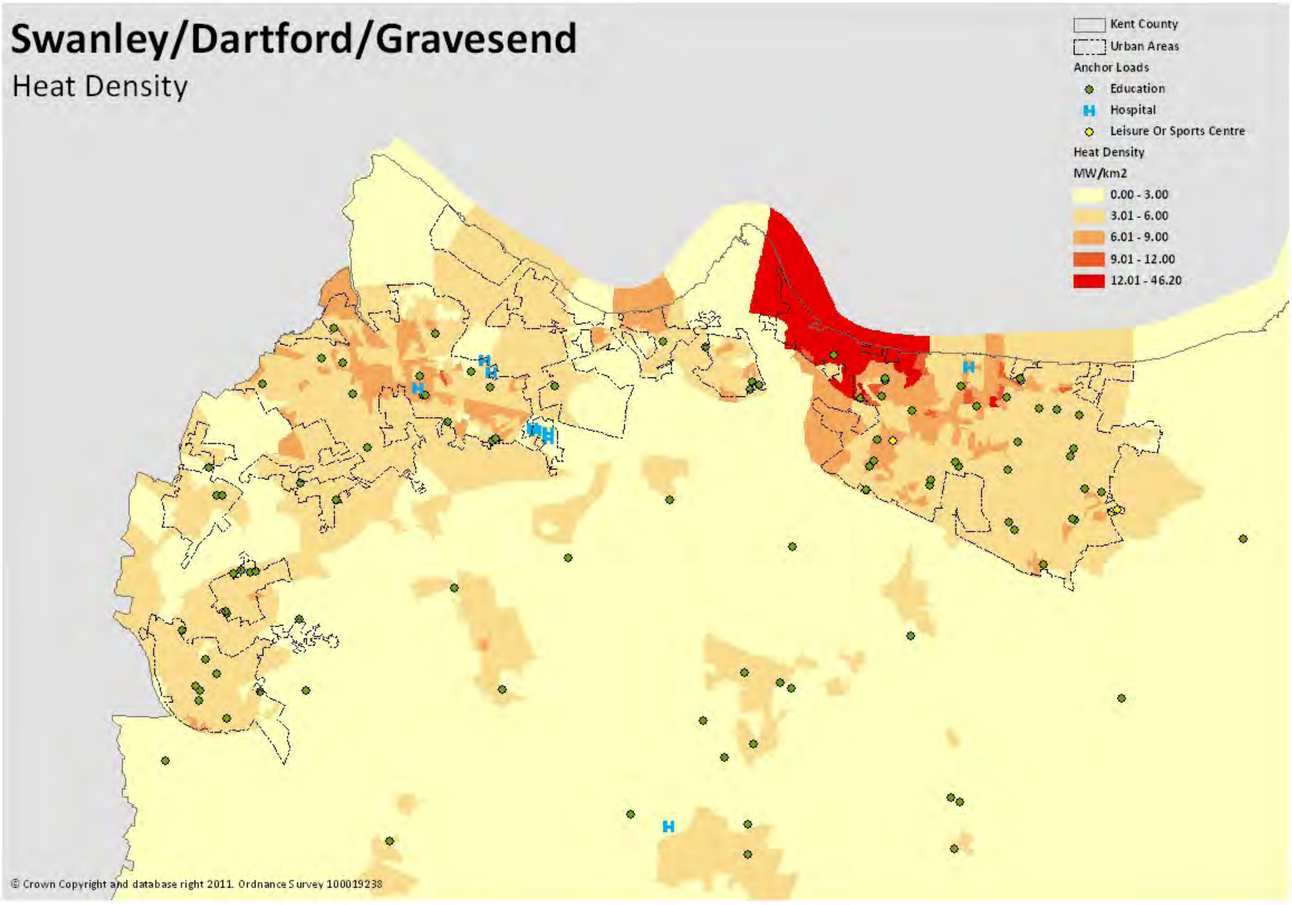


Figure 33: Heat map for Swanley/Dartford/Gravesend

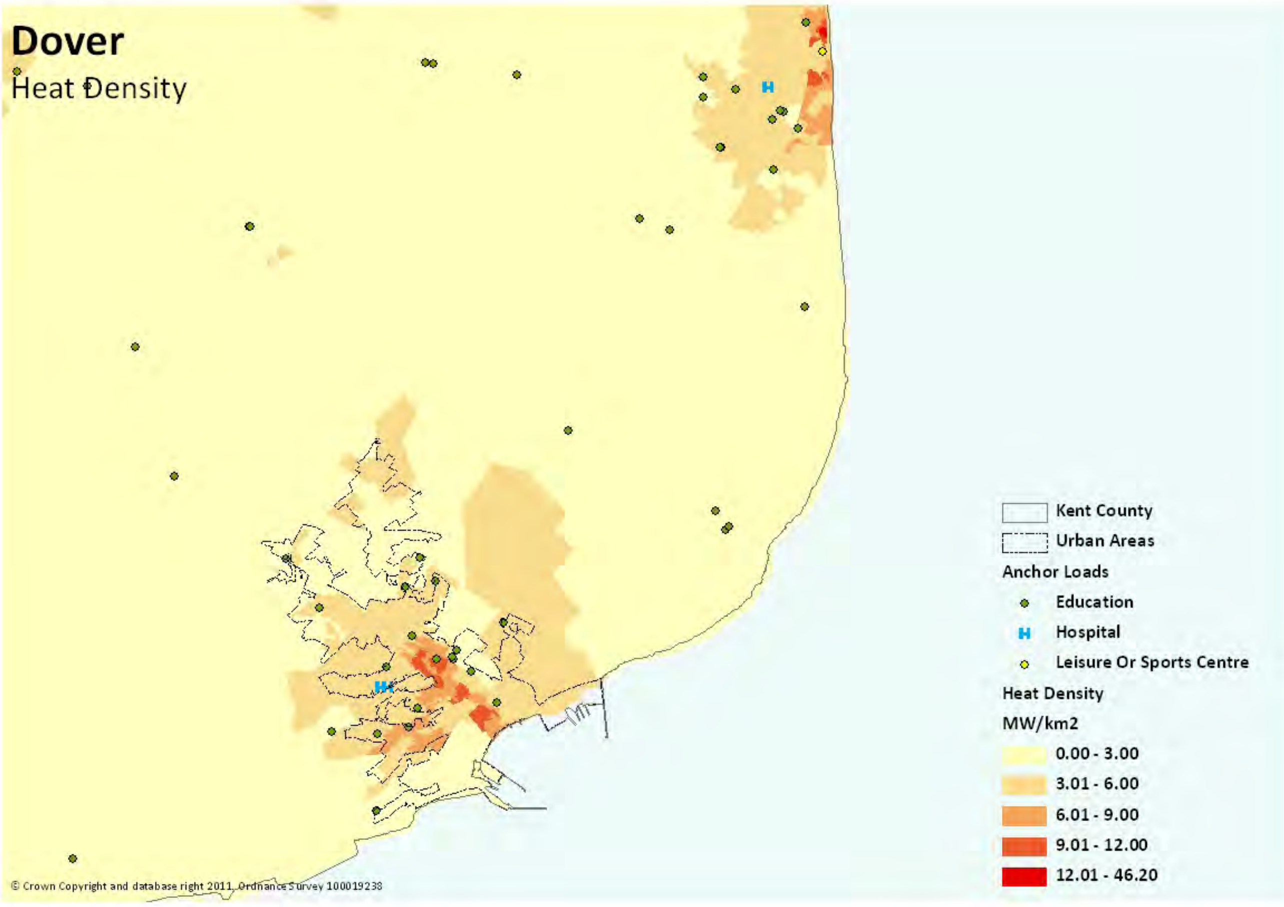


Figure 34: Heat map for Dover

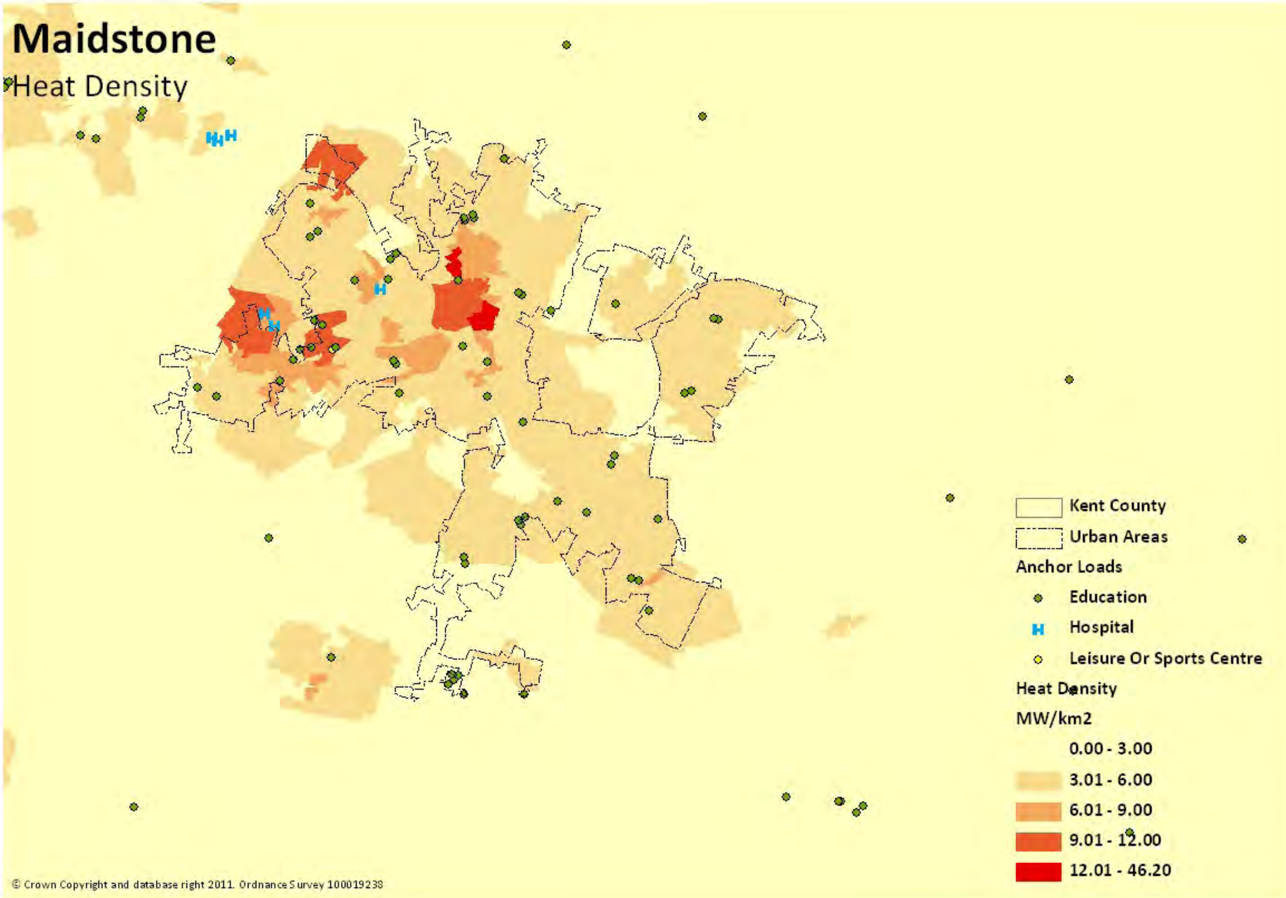


Figure 35: Heat map for Maidstone

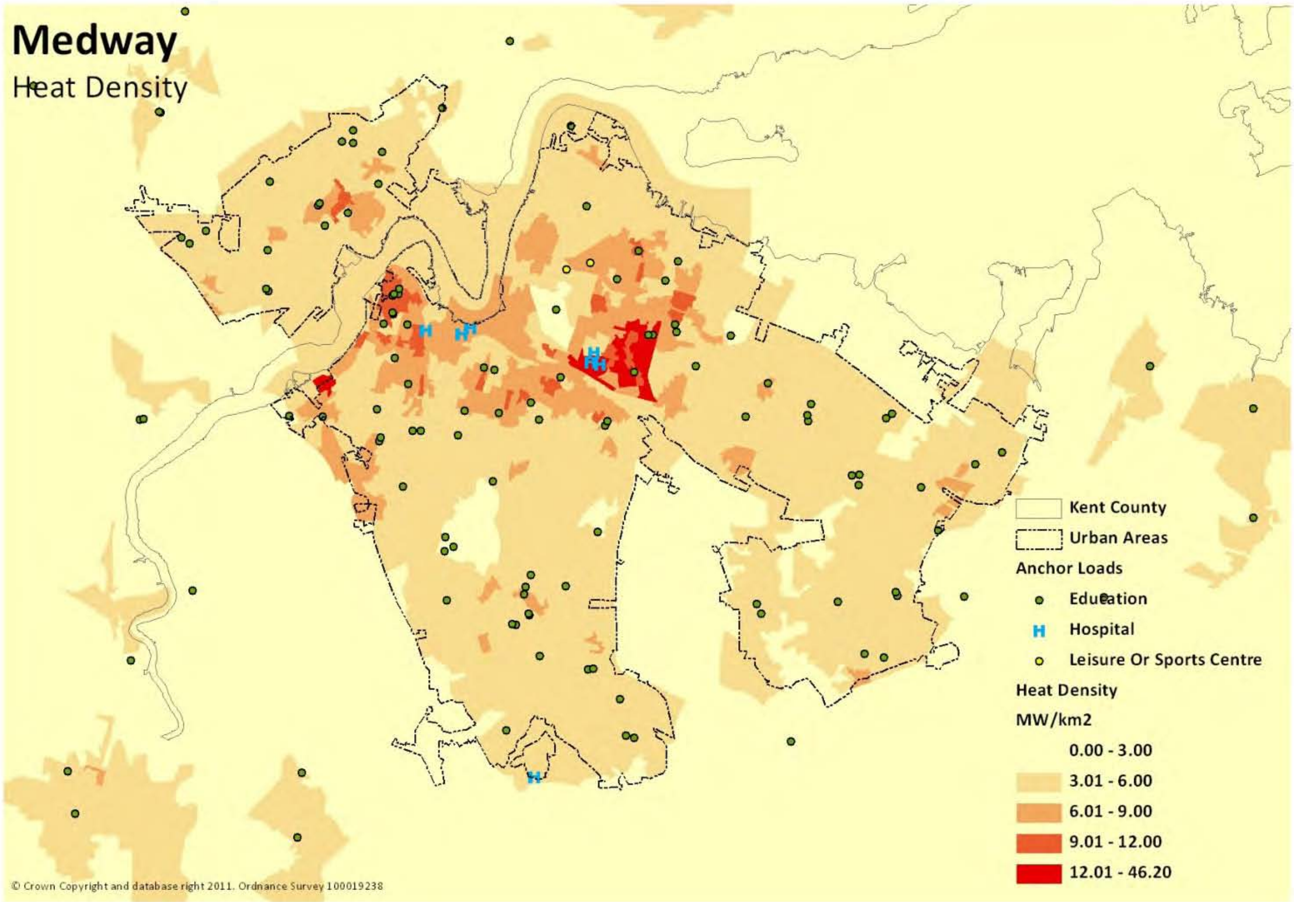


Figure 36: Heat map for Medway

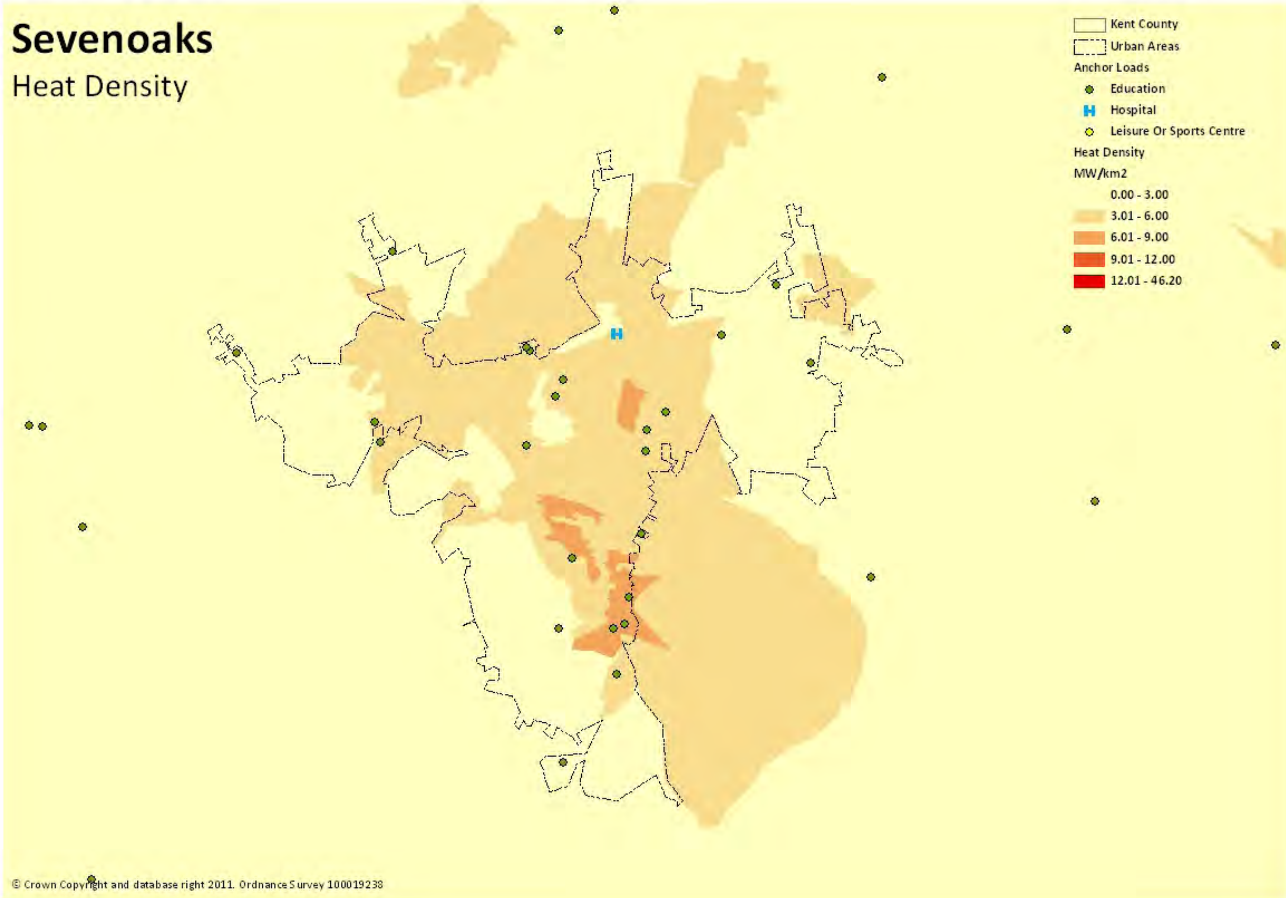


Figure 37: Heat map for Sevenoaks

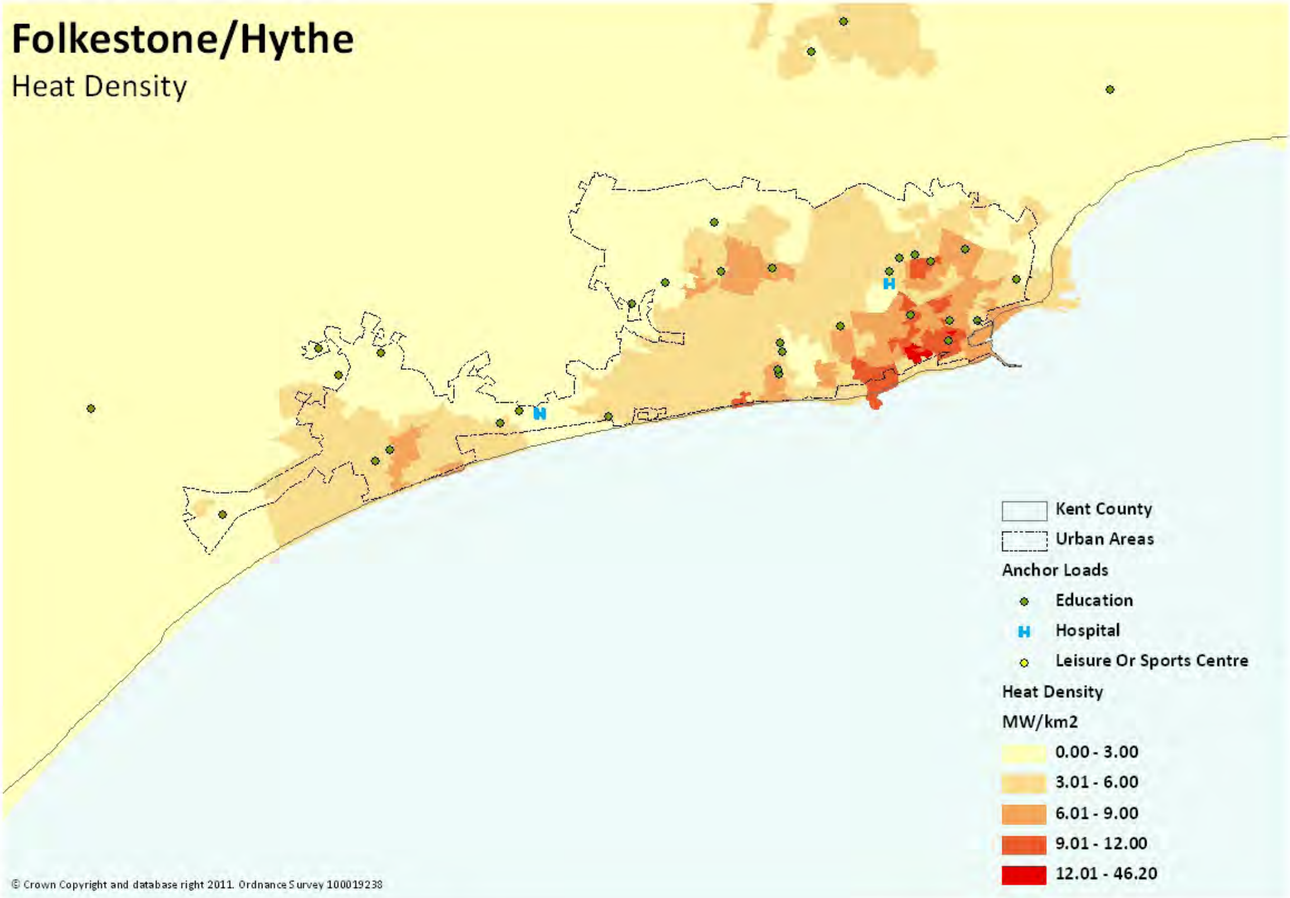


Figure 38: Heat map for Folkestone

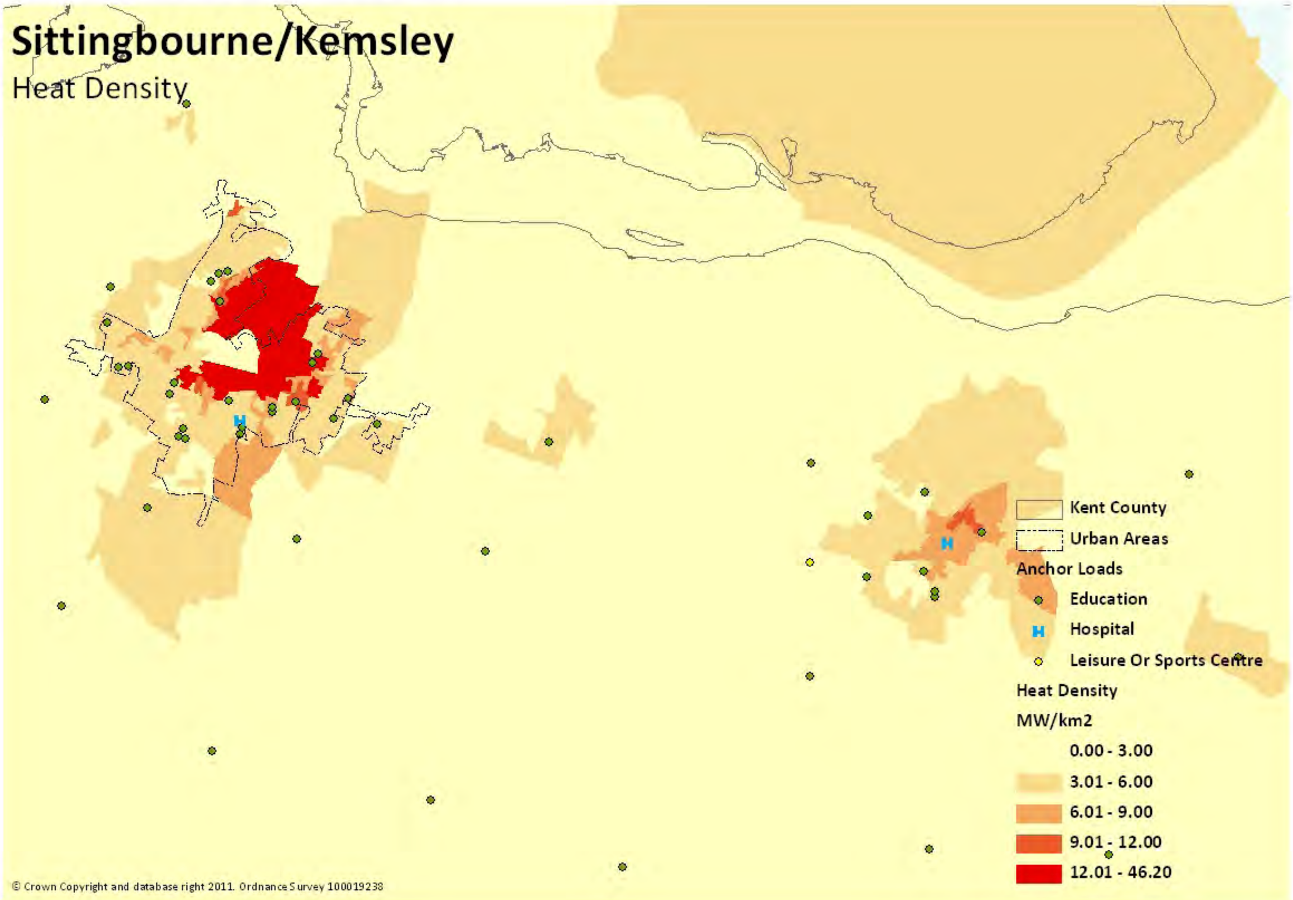


Figure 39: Heat map for Sittingbourne/Kemsley

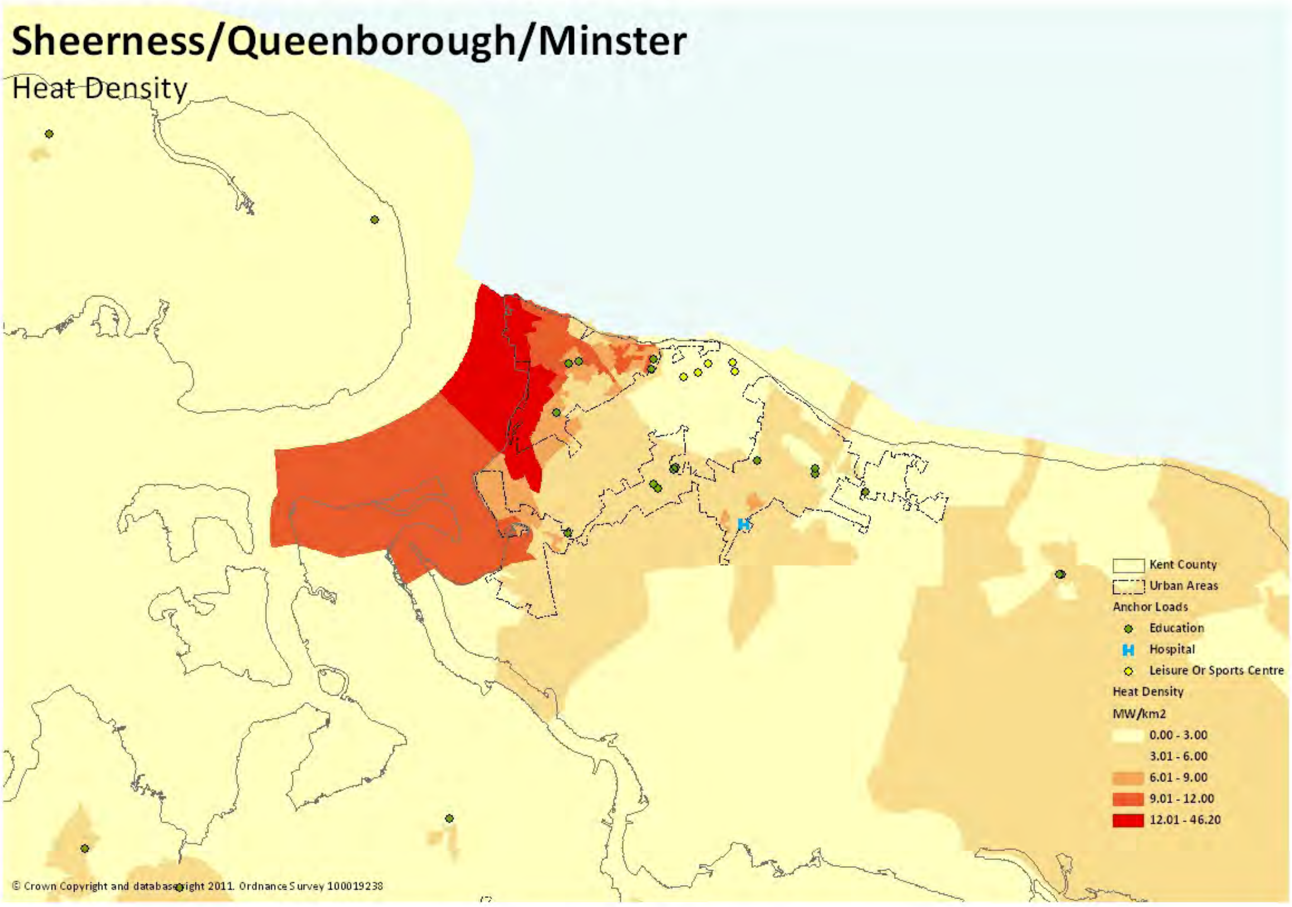


Figure 40: Heat map for Sheerness/Queenborough/Minster[22]

[22] As per Table 6, the high heat density outside the Queenborough and Sheerness urban boundaries is likely due to the Klondyke Industrial Estate, Queenborough Business Park, and additional industrial land northwest of Sheerness.

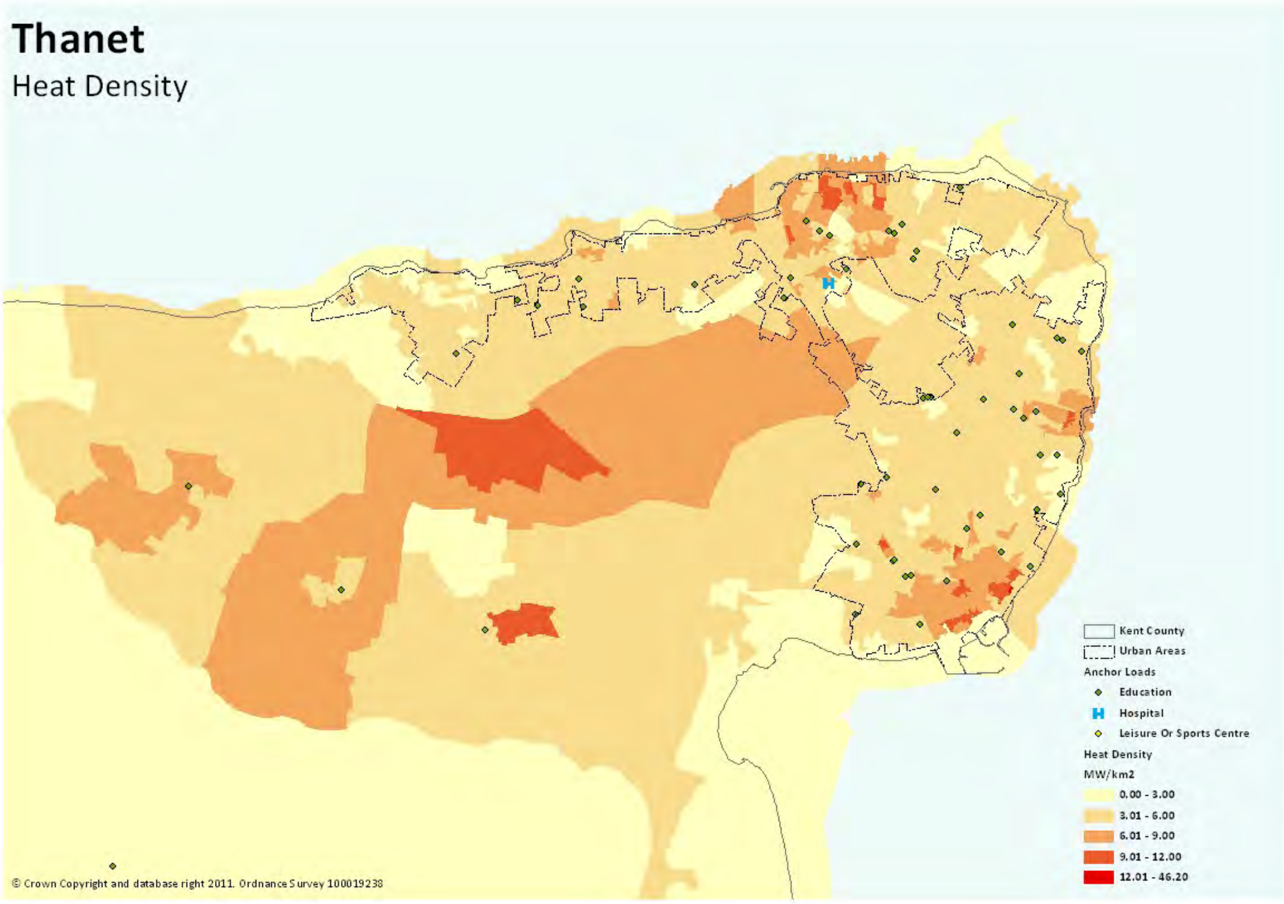


Figure 41: Heat map for Thanet[23]

[23] As per Table 6, the high heat density outside the Thanet urban boundary is likely due to the Kent International Airport and RAF Manston.

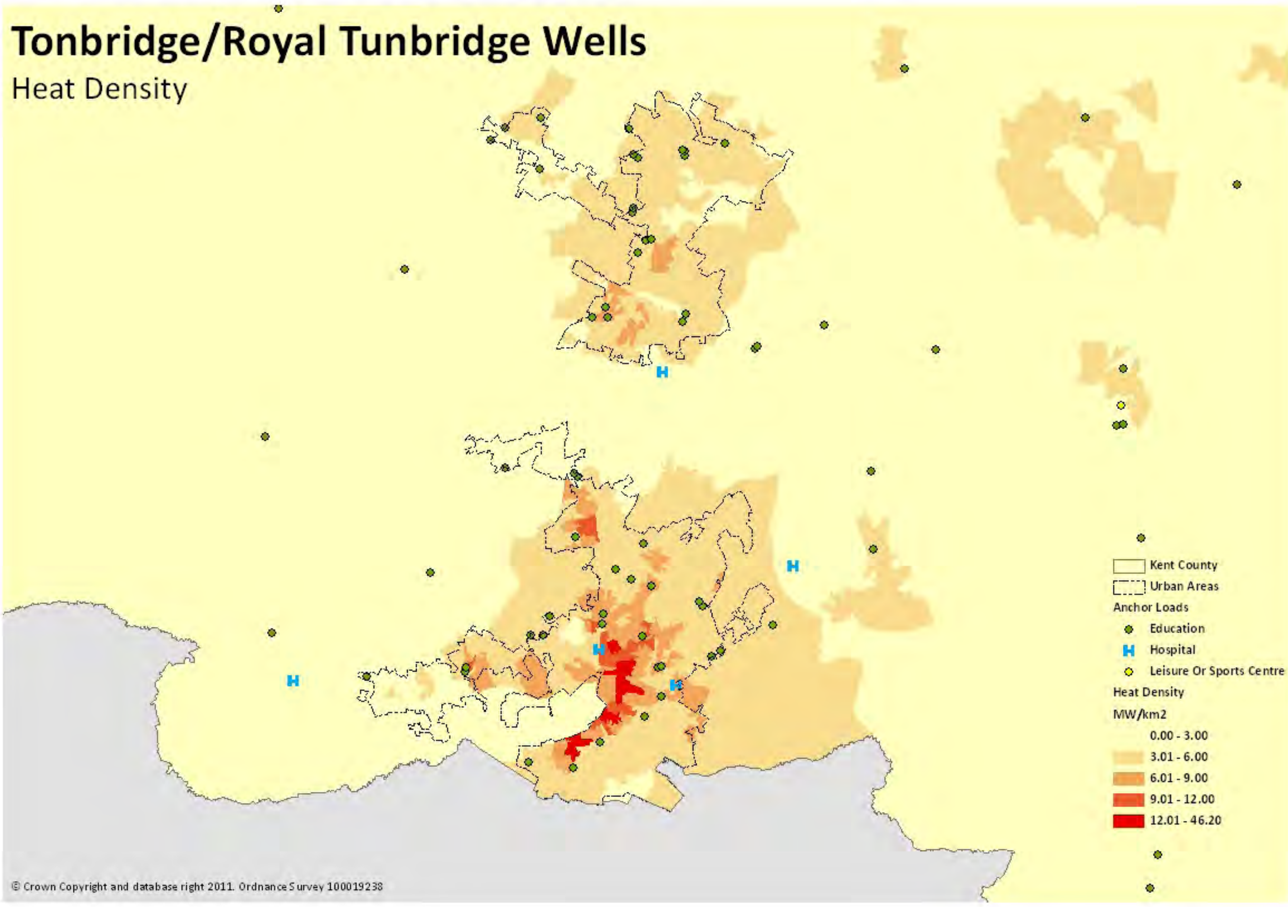


Figure 42: Heat map for Tonbridge/Tunbridge Wells

4.9 Energy Opportunities Maps

The Energy Opportunities Maps shown over the following few pages are intended to highlight key opportunities for a range of renewable technologies spatially at local authority level. These maps can be used as a resource in agreeing local actions and priorities. They are also a useful planning tool to inform spatial planning and policy. The following explains each of the various renewable energy sources shown in the maps.

- Landscape designations – Outline areas that are protected. AONBs are identified in hashed purple on the maps, while other ecological designations (SSSIs, Ramsar and SACs, and SPAs) have been "removed" from the map, and illustrated in white. These should not be viewed as restricted areas, but rather as more challenging to deliver some forms of renewables.
- High potential areas for growth of biocrops – There are areas noted for their potential to deliver bio-crops and are intended to make use of land that is not of a high enough quality to support agricultural purposes, and therefore do not represent a challenge to food crops.
- High potential for biomass from forest management – Woodland, if managed effectively could become as source of woody biomass.
- High potential for district heating – This refers to the existing heat density. Generally, higher population densities in more urban areas are more capable of supporting heat networks
- High potential for large scale wind energy – Areas where wind speed and spatial or designation constraints are such that large scale wind turbines might be accommodated.
- High potential for small scale wind energy – Areas where wind speed is not strong enough to support large scale wind turbines, or where restrictions make them unlikely to be adopted, but which are likely to be able to support medium and smaller scale wind turbines.
- No renewable energy potential – Areas of the maps which are constrained, and as a result do not represent potential to deliver renewables are shown in white.

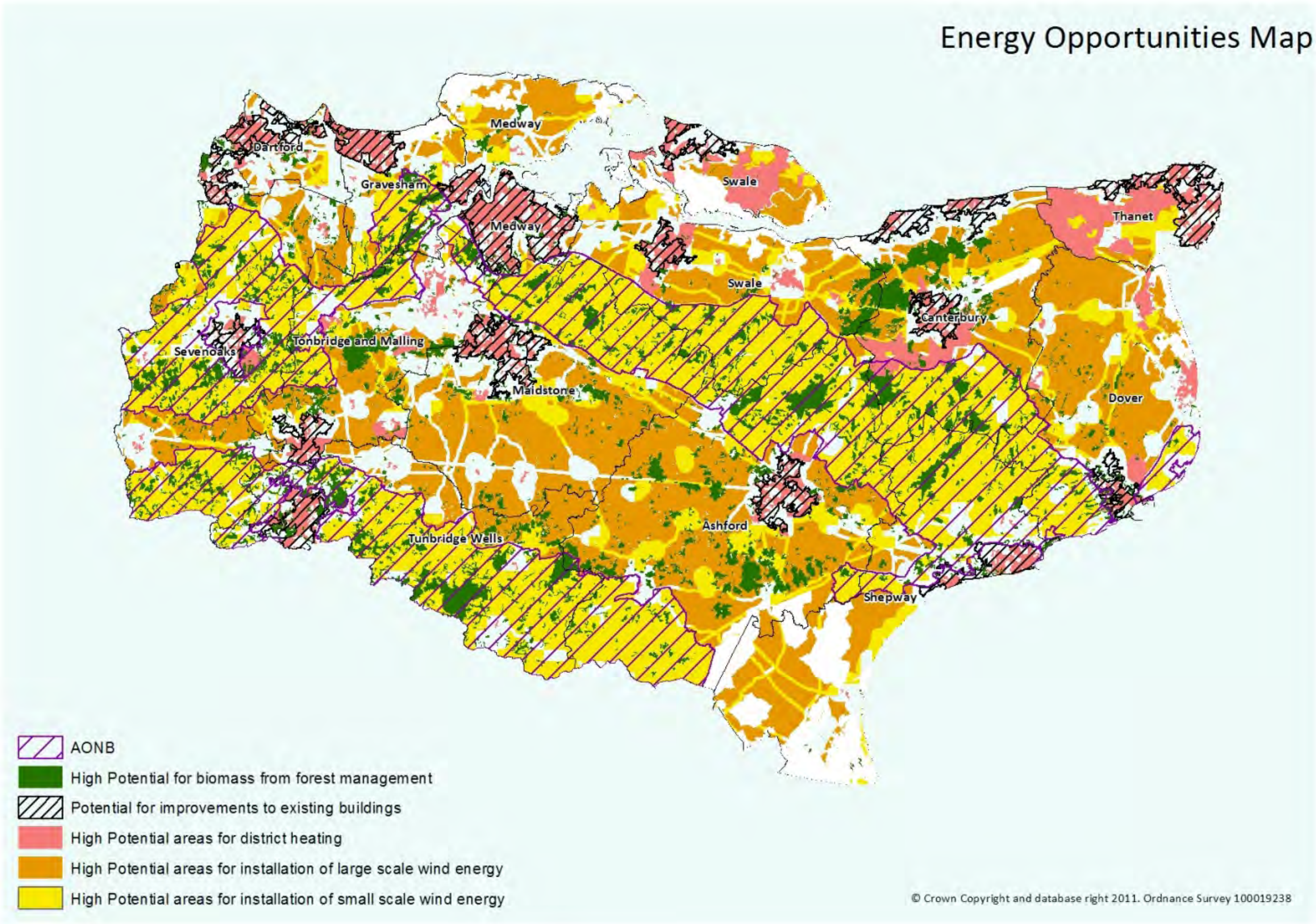


Figure 43: Energy Opportunities Map for Kent

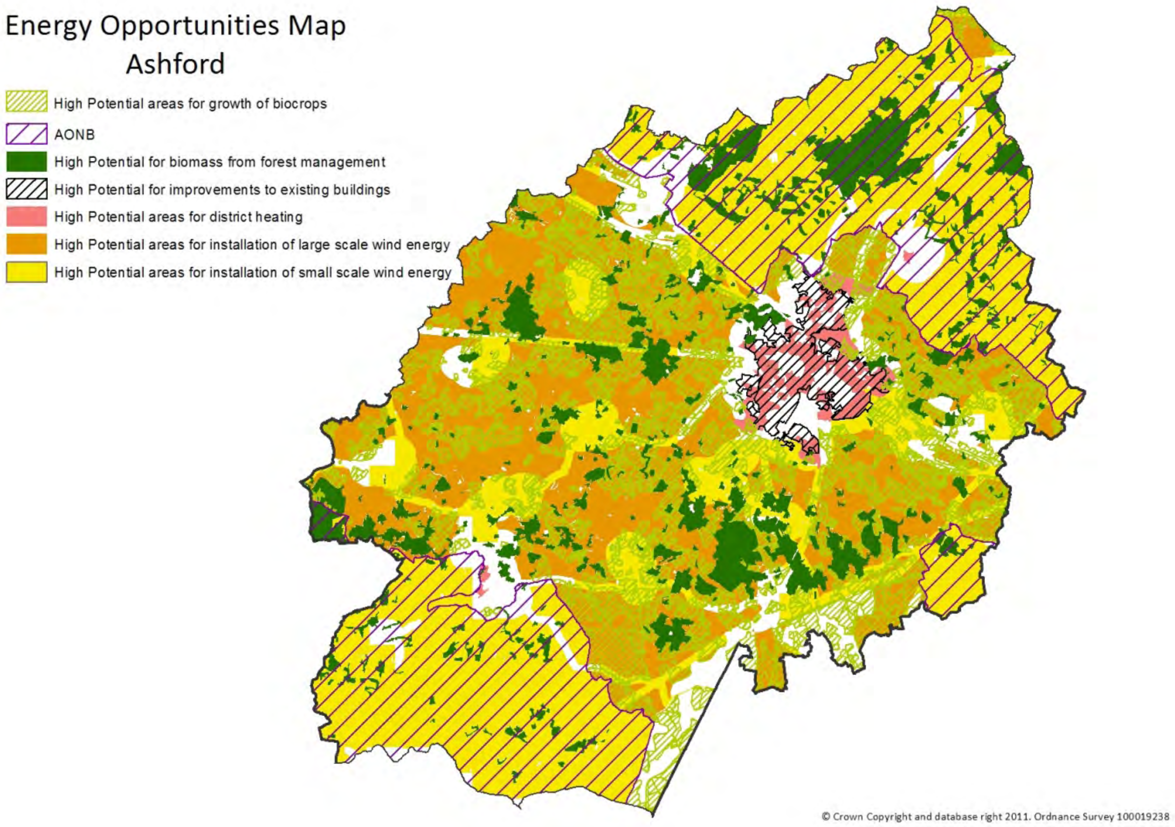


Figure 44: Energy Opportunities Map for Ashford

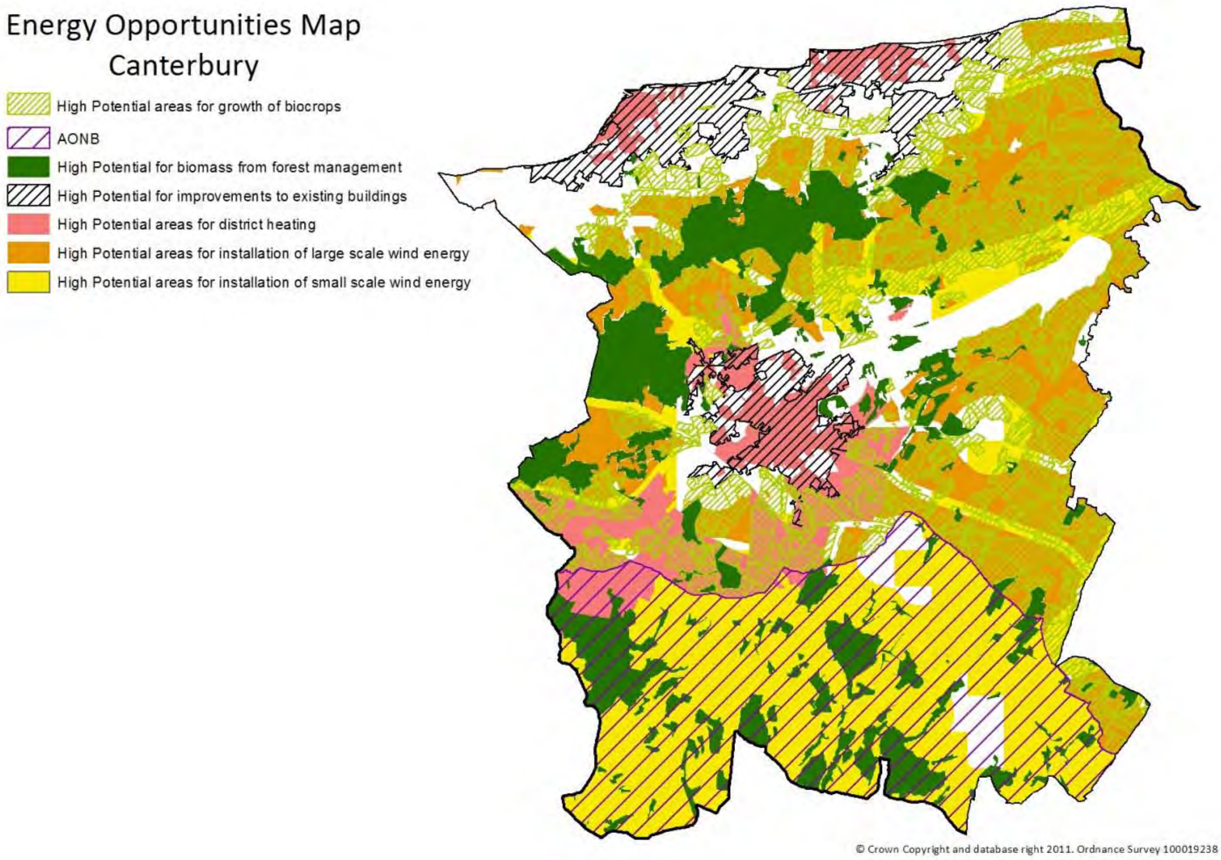


Figure 45: Energy Opportunities Map for Canterbury

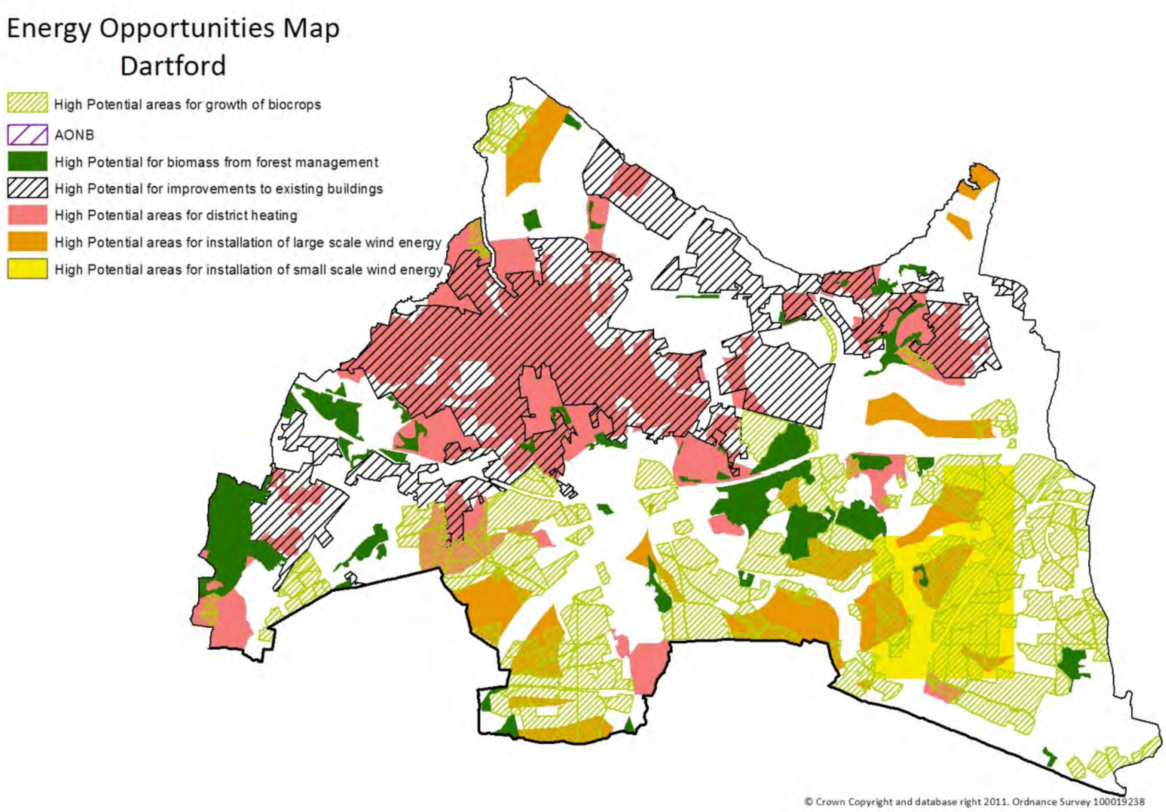


Figure 46: Energy Opportunities Map for Dartford

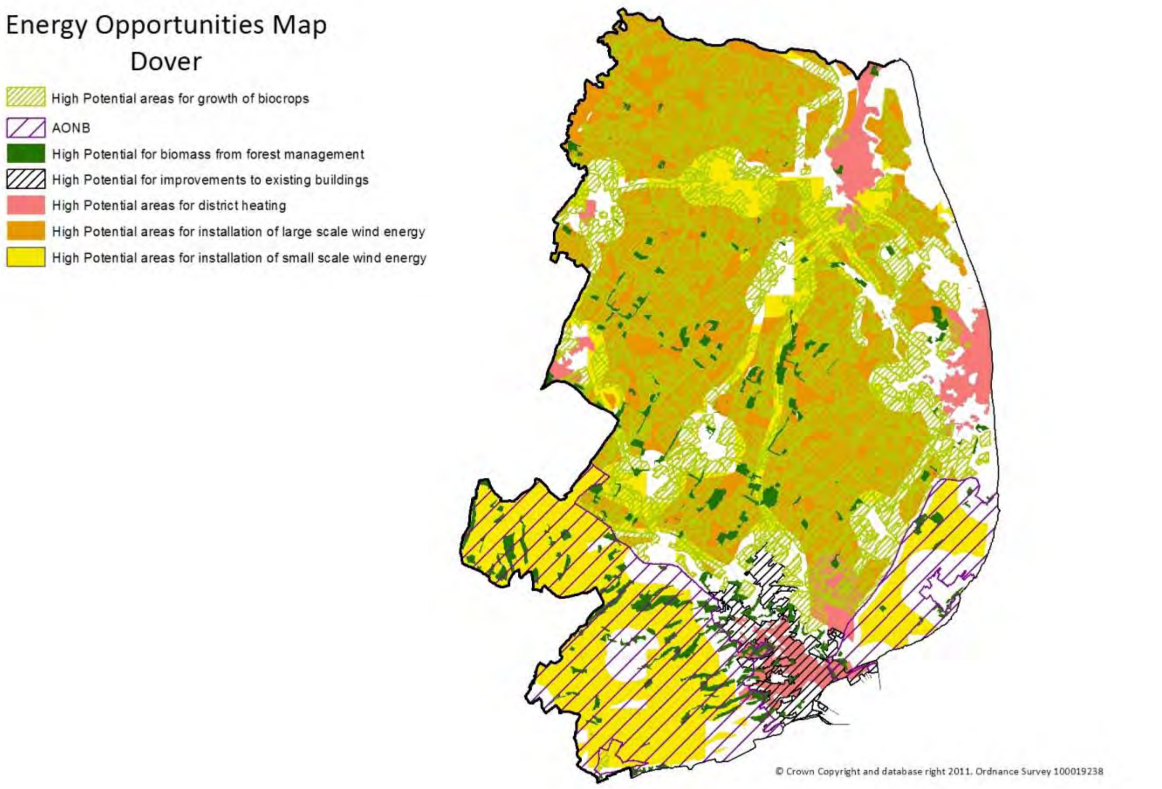


Figure 47: Energy Opportunities Map for Dover

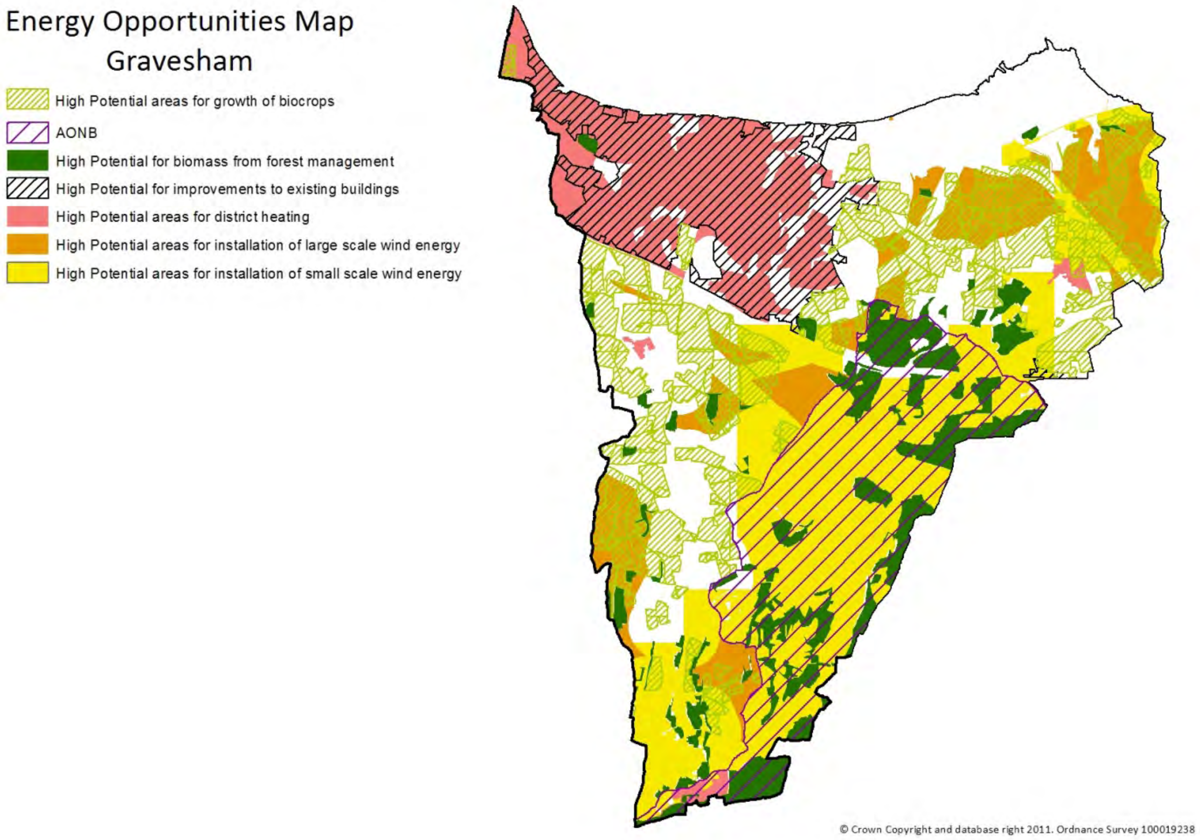


Figure 48: Energy Opportunities Map for Gravesham

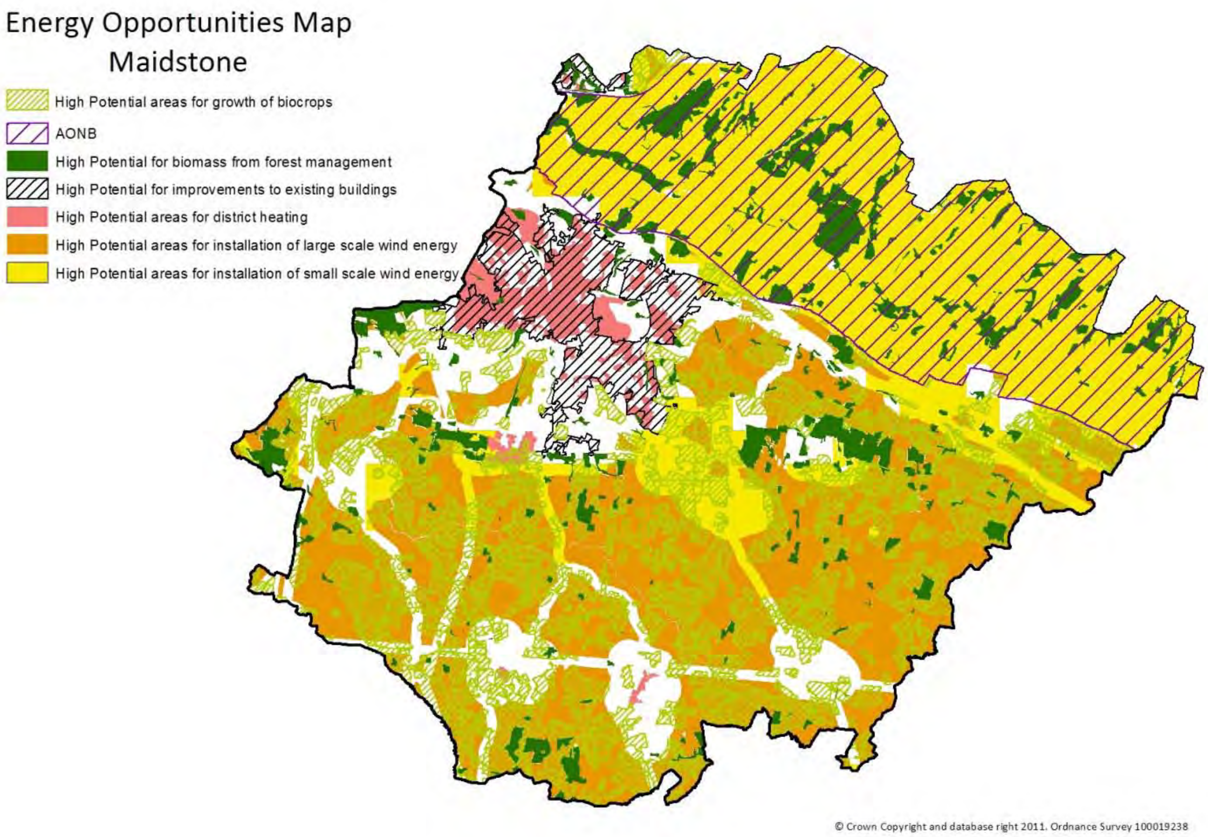


Figure 49: Energy Opportunities Map for Maidstone

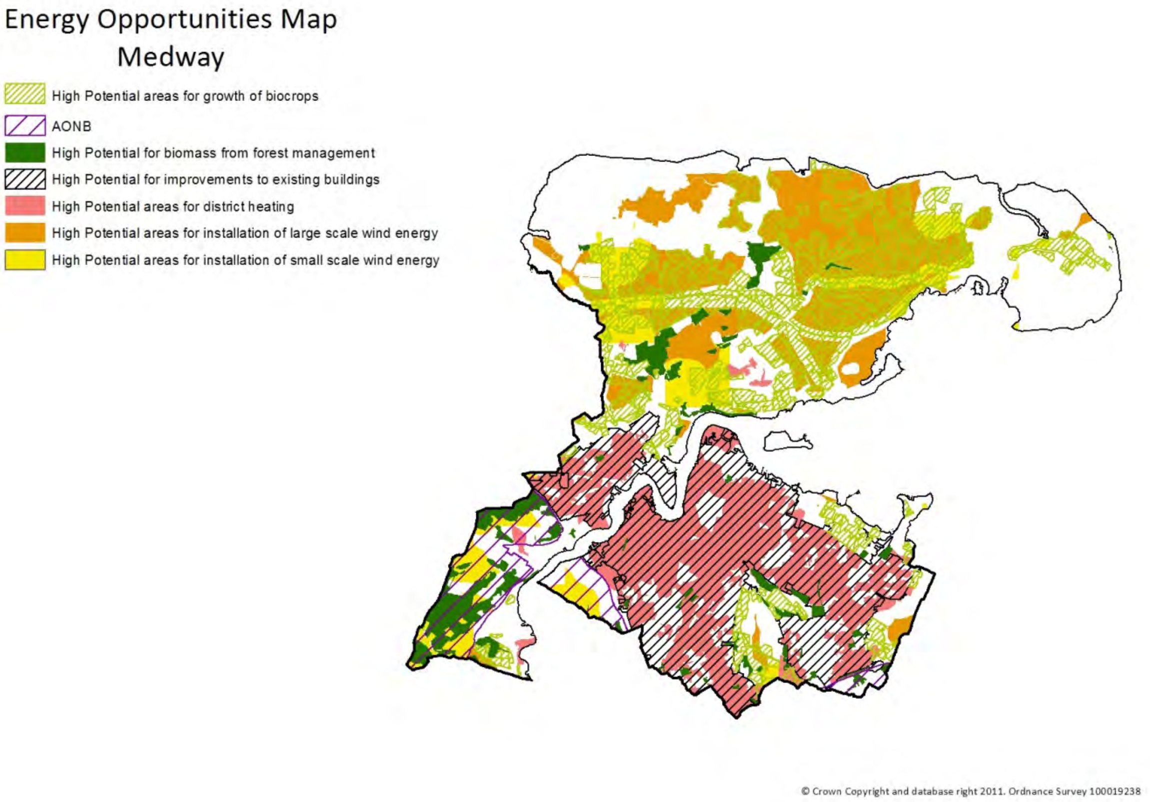


Figure 50: Energy Opportunities Map for Medway

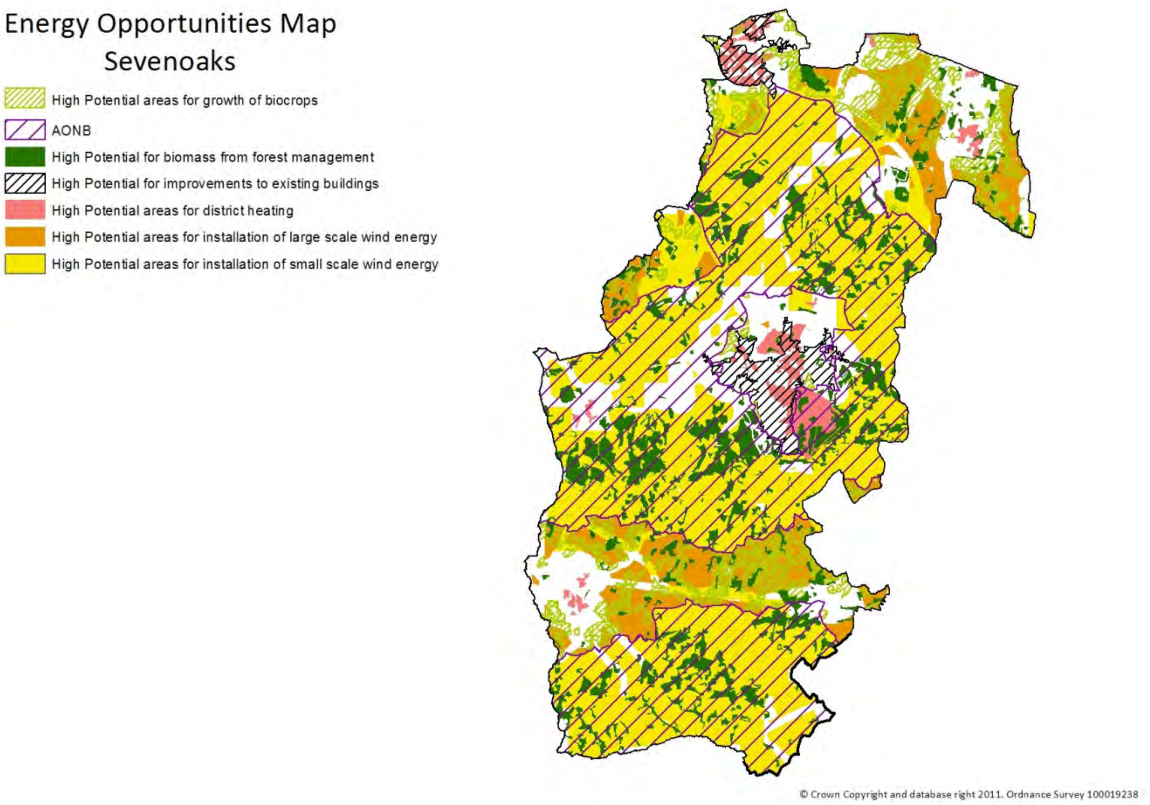


Figure 51: Energy Opportunities Map for Sevenoaks

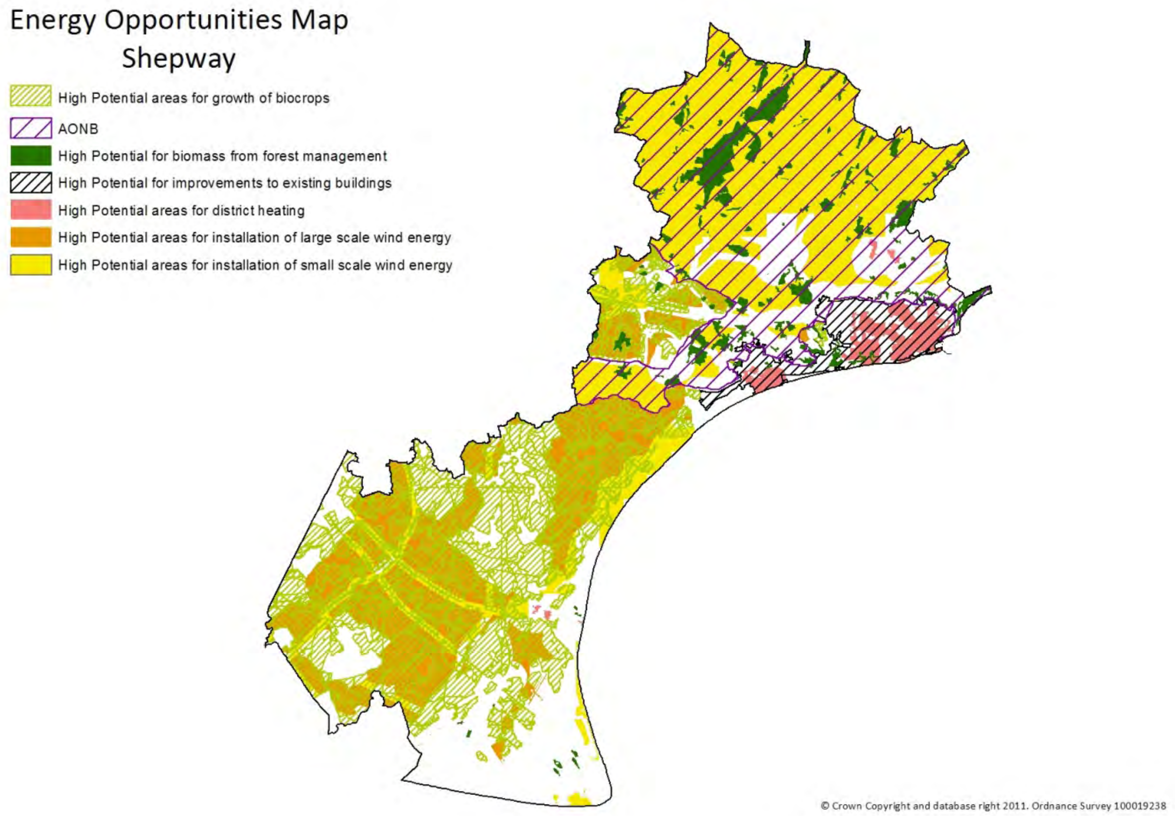


Figure 52: Energy Opportunities Map for Shepway

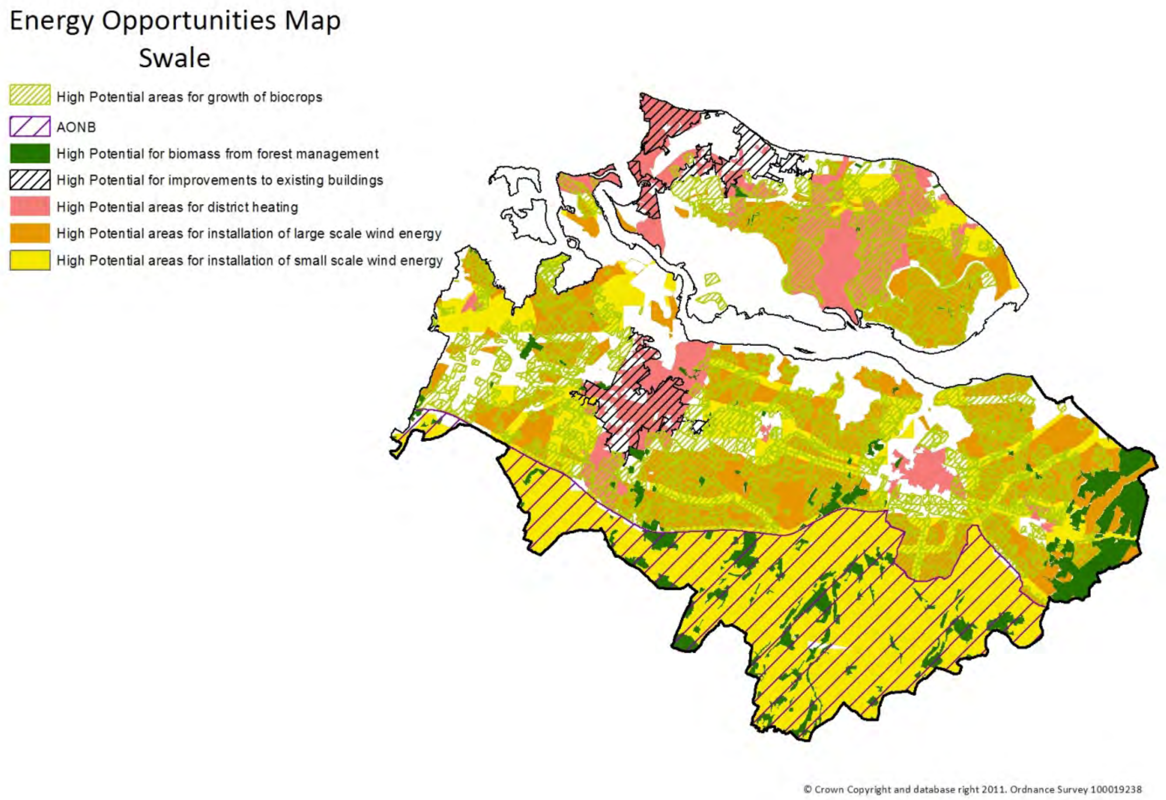


Figure 53: Energy Opportunities Map for Swale

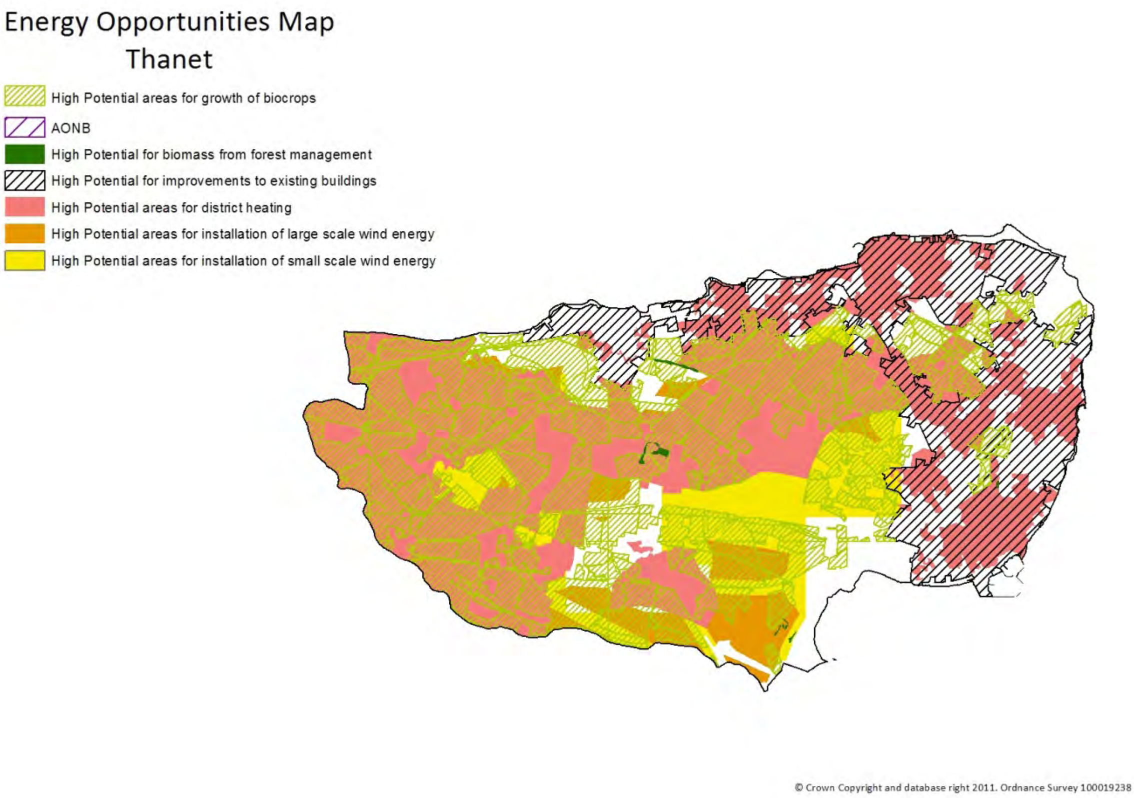


Figure 54: Energy Opportunities Map for Thanet

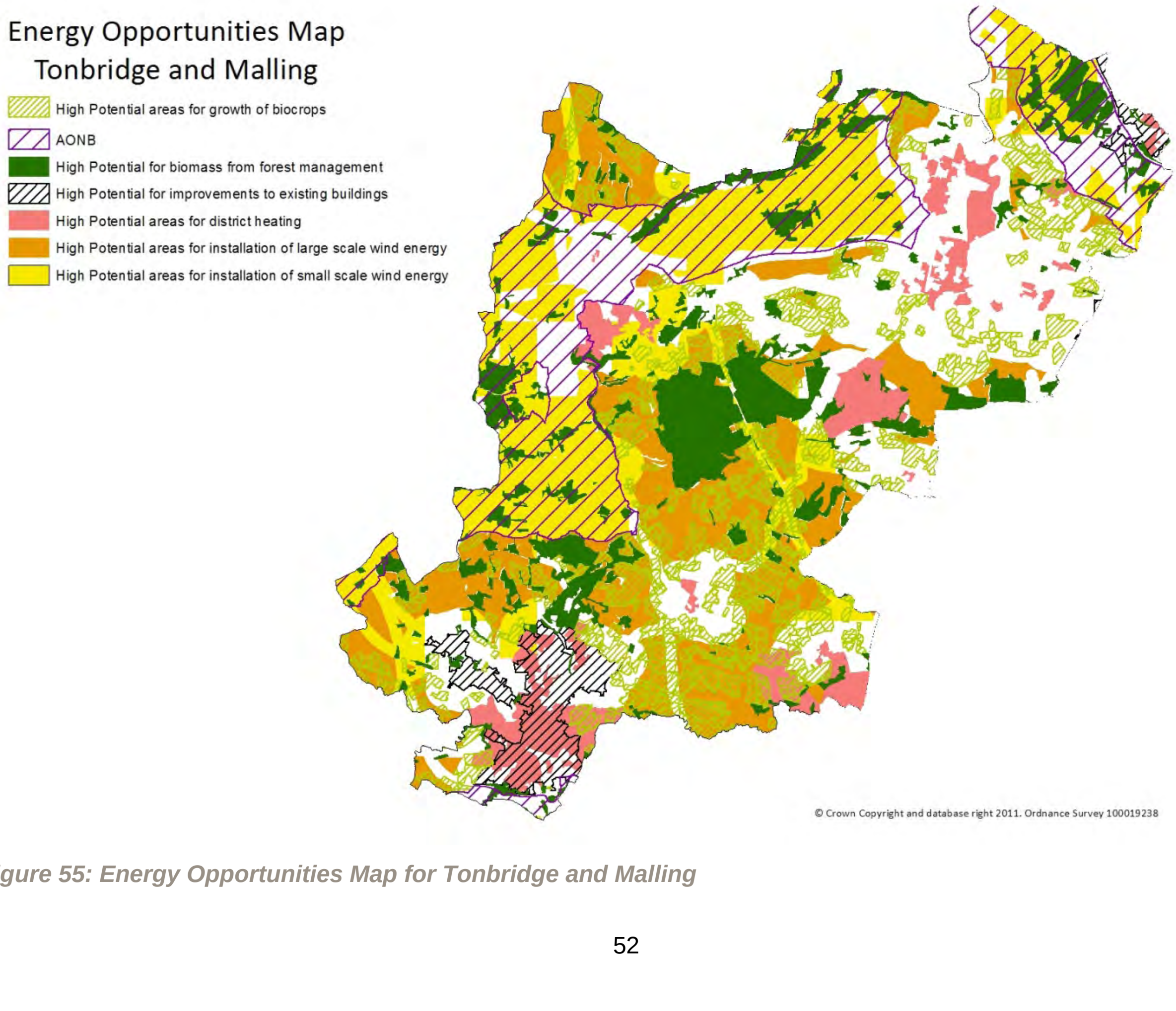


Figure 55: Energy Opportunities Map for Tonbridge and Malling

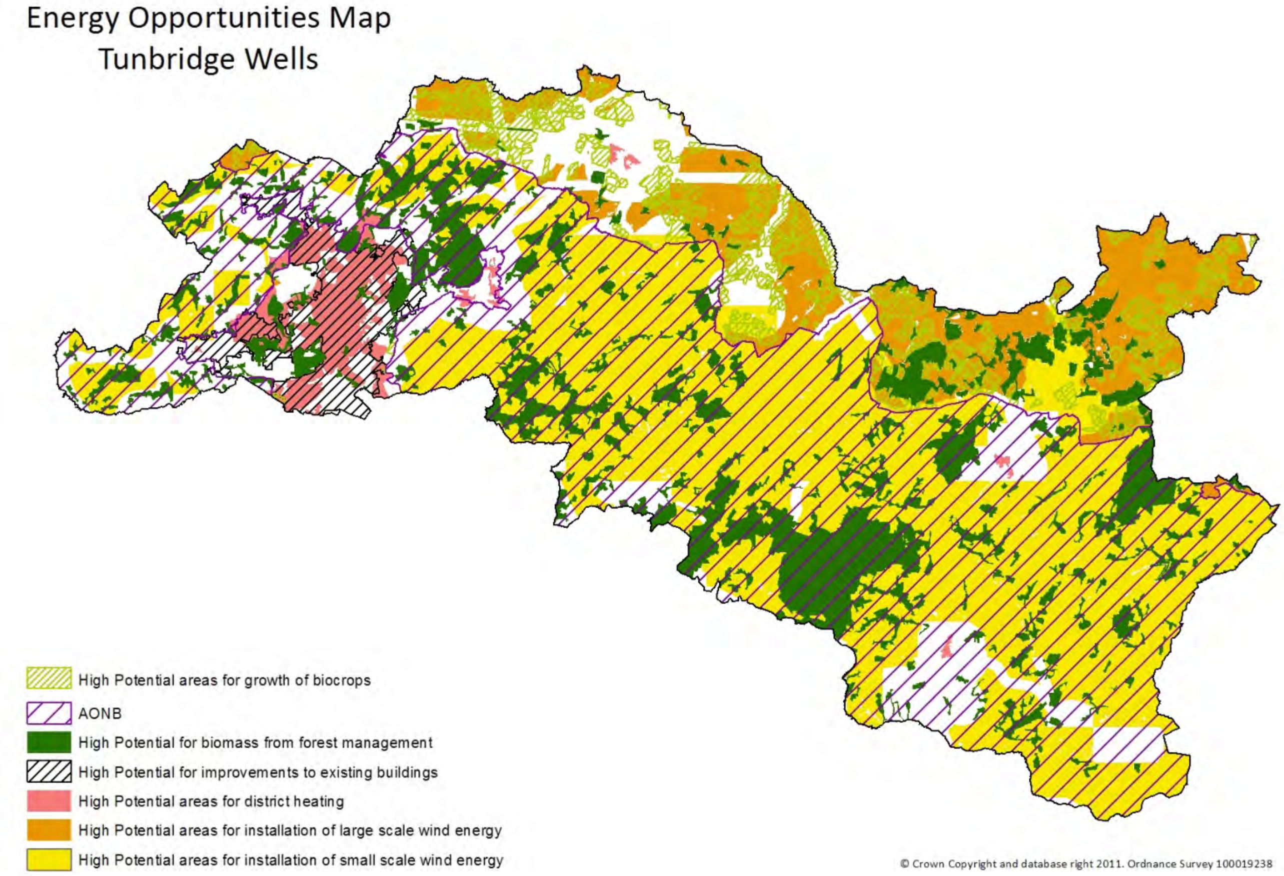


Figure 56: Energy Opportunities Map for Tunbridge Wells

4.10 Chapter Summary

- **The DECC methodology and the subsequent South East Study that utilises the methodology aim to identify the physically available resource for all the key renewable energy technologies in the South East, including for Kent. It is accepted that there should be a gap between the physically accessible resource and what is practically deliverable. Later stages of the DECC methodology were intended to drill down to make an estimate of what could be delivered in reality considering constraints such as planning, finance, skills and other delivery constraints.**
- **A number of the assumptions used to define the physically accessible resource (based on DECC guidance) seem overly ambitious. This is particularly true for assumptions regarding property integrated renewables (e.g. heat pumps and small wind energy).**
- **The potential for energy from waste (EfW) seems to be overstated when cross checked with predicted waste arisings (MSW and C&I) for Kent. The South East study estimated 1000MW installed capacity EfW to treat MSW by 2031. This would require 10 million tonnes of MSW per year. The Kent Minerals and Waste Development, Waste Topic Paper (Scott Wilson, 2010) estimates MSW arisings for Kent at closer to 1 million tonnes per annum.**
- **A reduction in energy generation potential from EfW serves to highlight the importance of large scale wind in delivering energy and carbon targets for Kent.**
- **The local authorities in Kent with significant apparent potential for commercial scale wind are Ashford, Canterbury, Maidstone, Dover, Shepway and Swale. These authorities – based on the regional resource assessment – could each physically accommodate between 100 and 300 2.5MW turbines. Ashford has 40,000 homes so would require 51 2.5MW turbines to meet its total domestic electricity demand.**
- **Biomass is also a good opportunity for Kent. There is significant amount of potential for biomass resource from a range of sources including managed woodland, energy crops, waste wood and agricultural arisings. The Forestry Commission is actively promoting good forestry management and uptake of biomass boilers in Kent. The annual available sustainable wood fuel supply from managed woodland is 60,000 tonnes. This could be sufficient to heat between 15,000 and 30,000 average homes.**
- **While not technically a renewable resource, district heating networks fed by Combined Heat and Power plants or other waste heat generators are an effective mechanism to deliver renewable heat and reduce carbon emissions associated with energy supply. High level heat maps have been produced to highlight areas with good potential for the installation of district heating networks.**
- **Spatially the renewable energy opportunities for Kent are shown in the 'Energy Opportunities Maps' above. There are opportunities for district heating in the more developed areas of Medway, Thanet, Maidstone and Dartford. The more rural areas of Tonbridge and Malling, Tunbridge Wells and Canterbury have the more prevalent opportunities for use of wind energy and biomass from sustainable woodland management.**

5 The scale of opportunity: the delivery potential

5.1 Introduction to this Chapter

Whilst spatial and numerical analysis and understanding of technical potential is important to understand the comparative scale of potential, ultimately the level of renewable energy delivered is dependent on ambition and abilities of the parties capable of delivering the opportunities. A 'bottom-up' understanding will give a much more realistic analysis of delivery potential. The only way to understand delivery ambition is to understand the drivers and the constraints experienced by different types of delivery 'partners'.

The following section examines the key delivery partners that are (or could be) involved in the delivery of renewable energy projects, providing an indication of their past contribution, the types of technologies they are likely to deliver, their drivers and opportunities and the constraints they face. This analysis has been used to shape the delivery scenarios in the next chapter and the recommendations for actions contained in the Action Plan.

The final section of this chapter shares results from a stakeholder workshop in Kent, where participants were asked for their perspective on delivery barriers and opportunities in Kent.

5.2 Introducing the Delivery Partners

Five types of delivery partner have been examined:

1. **Energy Developers**: Companies who specialise in renewable energy design and delivery at a large scale, including Energy Service Companies (ESCo) who install and operate energy infrastructure.
2. **Housing Developers**: Developers of land for residential and non-residential uses, who may also deliver on-site or off-site low carbon or renewable energy systems in order to meet Building Regulations and local planning requirements.
3. **Public Sector**: Partners that benefit from public funding and generally have a broad set of objectives for delivery (beyond financial benefit – though investment will require a strong financial basis). Includes local and county authorities, schools, hospitals and registered social landlords, universities and colleges.
4. **Private Sector**: Partners that are largely driven through economic and corporate social responsibility incentives, including industry, businesses, land owners.
5. **Communities and Individuals**: Partners including third sector groups, charities, community organisations and individuals who may choose to deliver renewable energy for community or personal benefit.

A partner may be a leader or a facilitator of delivery, or both.

5.3 Understanding Delivery Partners

To understand motivations and constraints, a series of core questions have been used to structure the analysis of the five delivery partners:

1. *What kind of projects is this partner delivering in Kent?*
2. *What can we learn about this partner from case studies?*
3. *Why would the partner choose to deliver in Kent?*
4. *What's stopping the partner delivering in Kent?*
5. *Can this partner influence delivery by other partners?*

The analysis draws on available research, information obtained from two stakeholder events held as part of this project and individual conversations with stakeholders, as well as other existing delivery strategy documents, including:

- Growing the Garden of England: A strategy for environment and economy in Kent, Kent County Council, 2011
- 21st Century Design: Delivering affordable low carbon development (SILCS report), Institute for Sustainability, 2011
- Low Carbon Opportunities for Growth, Kent County Council, 2010
- Renewable Energy in Kent, Select Committee Report, Kent County Council, 2010.

5.4 Delivery Partner 1: Energy Developers

What kind of projects is this partner delivering in Kent?

This partner consists of professional businesses who deliver renewable and low carbon energy as a commercial opportunity. With strong delivery experience and understanding of funding mechanisms and delivery routes, this partner focuses on large-scale projects that are often delivered on a single site. The technologies this partner focuses on are those which can be delivered within a reasonable timescale, present a strong business case and are of a scale likely to provide significant financial return. Typical technologies delivered include:

- Large scale wind energy (wind farms): Often one of the most commercially viable technologies, with economies of scale prevalent where are larger wind farm can be delivered on one site.
- Large scale solar energy (solar farms): Energy developers, particularly following initial stimulus from the feed-in tariff, have looked for opportunities for large photovoltaic installations on land or large roofs.
- Energy from Waste: Energy developers may develop energy from waste schemes, or partner with a county authority to deliver mutually beneficial waste and energy schemes.
- CHP and District Heating: For new development in particular, energy service companies (ESCo) seek commercial opportunities where heat sales can be guaranteed.
- Sole- or Co-firing Biomass: Large scale electricity generation using biomass fuel can attract commercial proposals.

Operating on a national scale, energy developers haven't specifically targeted delivery in Kent in the past. Little Cheyne Court wind farm is the largest renewable energy installation driven by an Energy Developer, though numerous other opportunities are currently being investigated or planned.

Table 7: Project Examples for Energy Developers

Project Examples in Kent *Technology Type*	*Local Authority*
Onshore Wind	
• Little Cheyne Court • Isle of Sheppey *(planned)* • Harringe Brooks *(planned)*	Shepway Swale Shepway
Offshore Wind	
• Kentish Flats *(extension planned)* • London Array *(phase 2 planned)* • Thanet	Canterbury Thanet Thanet
CHP	
• Ridham Dock: biomass *(planned)* • Richborough Energy Park: biomass *(planned)*	Swale Dover, Thanet
Energy from waste	
• Richborough Energy Park *(planned)*	Dover, Thanet

What can we learn about this partner from case studies?

Little Cheyne Court Wind Farm

A wind farm owned by RWE npower renewables, consisting of 26 2.3MW turbines, was installed in 2009 in the Romney Marshes, Shepway, at a project cost of £60million. The project is estimated to save 64,500 tonnes of CO_2 per year. It is one of England's largest wind farms, powering equivalent of 33,000 homes.

Opposition was encountered within local and neighbouring councils, and from the Romney Marsh Nature Reserve management, with visual impact and impact on bird populations being seen as issues – Little Cheyne Court wind farm adjoins a Site of Special Scientific Interest. A community liaison group of local residents was established and a Habitat Management Group including English Nature and RSPB was set up.

Lessons learnt include:

- Importance of community engagement;
- Scale of carbon savings achieved by projects of this type of renewable energy;
- Opportunities for communities to benefit: RWE npower renewables have set up a grant scheme of £60,000 per year to support community and voluntary groups based within 10 km of the wind farm. The scheme is run independently by Community Foundations in Kent and Sussex, whose admin costs are also funded separately by RWE npower. It operates throughout the life of the wind farm and provides grants from £500 to £5,000 to support environmental, educational, community and charitable activities.

Other large onshore wind projects in Kent include: Sellindge Wind Farm (pending).

Allington Energy from Waste (EfW)

Photo Source: Kent County Council

Kent County Council contracted a Special Purpose Vehicle (SPV), Kent EnviroPower Ltd, to install and operate a 43MW Energy from Waste facility in Maidstone. The EfW facility uses landfill gas to generate electricity from Kent and surrounding areas' municipal solid waste. Over 40% of Kent's municipal solid waste is converted to energy at Allington. Waste is taken from Maidstone, Sevenoaks, Tunbridge Wells, Tonbridge and Malling, Dartford, Gravesham and Swale.

The project cost around £150million, funded by a consortium of private sector funders. It was conceived in the 1990s and commenced operation in 2008. It has created around 100 ongoing jobs, and made Kent a leader in reducing its dependency on sending waste to landfill.

The plant doesn't use the heat generated during the production of electricity. There isn't an immediate potential user nearby, as the plant is situated on an industrial estate consisting mainly of warehouses with low heat requirements. It was felt that the project was initially sufficiently challenging without a heat network element; however this could be considered in the future as a retrofit option.

Lessons learnt include:

- Project required joined-up working between Local Authorities, through Kent Joint Municipal Waste Management Strategy;
- Other attributes needed included vision and strategic planning, market knowledge, financial acumen, negotiation skills, communication and influencing skills, and procurement expertise;
- The planning process is extensive and opposition is always strong to this type of project. Significant local opposition was met - issues of air quality, traffic, health and visual impacts were raised, as well as what benefits the community would receive;
- Demonstrating environmental and social commitments is important for this type of project: in this case, a significant nature conservation area has been created on site and community grants are provided by the company to local causes. A Community Liaison Committee has been meeting since 2004, including the local community, local government and the Environment Agency, to discuss the facility's operation;
- Entering into long term contracts is always a risk, and it's hard to find the right balance between risk transfer and cost;
- Energy from Waste plants are very difficult projects to undertake politically, requiring long term and difficult decisions;
- Projects will never be set up in an ideal way, and at some stage the decision to go ahead needs to be made.

Other energy from waste projects in Kent are Stangate; Shelford - heat used by Canterbury Cathedral-owned building; Offham; Blaise Farm, West Malling; Richborough Energy Park (planned); and Otterpool Quarry (planned).

Why would the partner choose to deliver in Kent?

- **Significant wind, solar and biomass resource** – There are significant opportunities for renewable energy projects in Kent. The current installed projects represent only a fraction of the county's technical potential.
- **Location** – Kent's location as a 'gateway to Europe' with important ports and rail connections, as well as growth areas suggest that Kent is a strategic location for trade and economic growth. Energy developers might stand to benefit from establishing themselves in the area.
- **Formation of ESCos** – There is an opportunity for the community to partner with an energy developer. This can work to deliver projects that might present some challenges that would otherwise deter energy developers.
- **Community investment** – Delivering projects, which benefit the local community, can help to establish goodwill among residents. Fostering opportunity to bring benefits to local communities will likely increase the acceptability of other schemes.
- **Local skills and employment** – There is an opportunity to support local communities through local employment and working with local colleges and training programmes. The support for local skills and employment will help promote a working relationship with local communities and assist with the acceptance of projects.
- **Finance** – Energy developers have the financial expertise and access to capital, which enable them to take a lead in renewable energy generation projects.
- **Allowable solutions** – With the drive to low/zero carbon energy, additional funding will be generated through the Allowable Solutions mechanism. There is an opportunity for energy developers to speak with the Council to gain insight into their strategy, and understand which projects they are likely to fund.

What's stopping the partner delivering in Kent?

- **Planning** – Without a clear and supportive policy for renewable energy in Kent's local authorities, energy developers face greater risks that their projects will encounter extensive opposition.
- **Local opposition** – although surveys have found that the majority of the public are generally supportive of wind farm developments,[24] often those who oppose schemes are more vocal than those who support them. Misconceptions, particularly in relation to wind energy, are prevalent and addressing them is important to gather support from local authorities and residents.
- **Supply chain and grid connections** – Currently, there are no established supply chains in Kent. However, opportunities to establish biomass supply chains do exist in Kent, and should be further investigated – as the Kent Downs 'Woodfuel Pathfinder' project is currently doing. For electricity grid connection, there exists a need for upgrades in parts of Kent to support large increases in renewable energy installations and high costs can be charged for these.

Can this partner influence delivery by other partners?

The scale of the projects typically undertaken by energy developers means that the economic development opportunities associated with renewable energy for Kent are potentially largest here; however work needs to be done to ensure these opportunities bring benefits to local communities and businesses. The investment brought to the area by developers should be linked to local skills development at every opportunity; Kent has a good resource base to build upon in this area. The connection of energy developers to the communities they work in is very important for building the acceptability of renewables in the longer term, including through programmes of community engagement and investment, and the development of delivery models which involve community ownership. Developers need to build good working relationships with local authorities and stakeholders, who can also learn a lot from their expertise.

[24] For example, the Kent County Council Public Perceptions Survey: Renewable Energy, 2008, found that 67% of those surveyed supported the Little Cheyne Court wind farm which was being planned at the time.

5.5 Delivery Partner 2: Housing Developers

What kind of projects is this partner delivering in Kent?

In recent years there has been a strong focus on delivery of low carbon and renewable energy through new development. Planning has strongly driven on-site requirements through 'merton-rule' style policies that require a proportion of energy demand to be met by renewable energy. Planning policies across Kent have varied, with strong Code for Sustainable Homes and BREEAM targets being set in some authorities, including Dover District and Ashford, while other local authorities have been operating without specific renewable energy requirements. On a nation-wide scale, the emphasis has been removed from planning, and instead it is proposed that more stringent carbon reduction is driven through changes to Building Regulations. The current government proposals work towards enforcement of 'zero-carbon' standards in all new housing development by 2016, public sector buildings by 2018, and non-residential development by 2019.

As a result of the evolution of on-site energy and carbon reduction targets for new development, housing and commercial developers have become very familiar with low carbon and renewable energy technologies, and have delivered a range of solutions across the country. Due to cost efficiencies and the ease of delivering solutions on a plot-by-plot basis, micro-generation technologies have been popular. Some examples of site wide Combined Heat and Power (CHP) and district heating schemes have also been planned for larger urban extensions and new settlement areas where the density and size of development can make large-scale solutions commercially viable.

Table 8: Project Examples for Housing Developers

Project Examples *Technology Type*	*Local Authority*
Micro-generation (various)	
• West Kent Housing Association: solar thermal	Sevenoaks
• Amicus Group Chilham Close: PV	Swale
• Canterbury Eco Homes: solar thermal and PV	Canterbury
• Kent Thameside *(planned)*	Dartford, Gravesham
CHP and District Heating	
• Kent Thameside *(planned)*	Dartford, Gravesham
• Queensborough and Rushenden *(planned)*	Swale

What can we learn about this partner from case studies?

Kent Thameside Micro-generation

Specific micro-generation and CHP opportunities have been identified for Kent Thameside, the largest brownfield regeneration project in Europe. An Eco-Assessment Scoping Study was undertaken for the Kent Thameside Regeneration Partnership 2009; and a detailed Eco-Assessment produced 2010. Micro-generation in the form of small scale solar, heat pumps and biomass has been identified as a major opportunity, with the potential to achieve savings of 17.8% on the 2008 baseline for the area. Potential barriers include the capital costs and need for new delivery mechanisms; but these are balanced against opportunities brought by the Renewable Heat Incentive and Feed in Tariffs, Local Authorities' ability to set supportive planning policy in their Local Development Frameworks, local employment and skill development opportunities, and the use of the local training centre at SUSCON.

Lessons learnt include:

- Local Planning Authorities need to take a proactive approach;
- Work with developers needs to happen at an early stage to set energy requirements in masterplans and development briefs, and then in energy strategies, and to agree targets;
- Planning Authorities and regeneration partnerships should provide clear guidance to developers in key areas.

Other micro-generation projects in Kent include: Swale Skills Centre; Wildwood Wildlife Centre; Eastchurch School; Churchill School; Leigh Primary School; Church Hougham School; Vattenfall O&M Centre Port of Ramsgate; West Kent Housing Association; Kenward Trust; St Nicholas Church Rochester; Birchington Community; The Care Fund.

Why would the partner choose to deliver in Kent?

- **Level of control** – While not necessarily unique to Kent, housing developers have the ability to design renewable technologies into their property developments.
- **Growth areas** – Given that parts of Kent, such as Ashford and the Thames Gateway, are designated for growth, there is a great opportunity for housing developers in the area which should not be missed.
- **Economies of scale** – With opportunities for large amounts of growth, there is an opportunity to take advantage of bulk purchasing and reduce the cost per unit of renewable technology.
- **May help sell homes** – With rising energy costs and concern over environmental issues, home buyers are becoming sophisticated about their carbon footprint. Housing that is more energy efficient, and uses renewable energy for power will have a high demand, and justify a higher selling price.

What's stopping the partner delivering in Kent?

- **Expertise** – The lack of understanding in dealing with renewable energy might be a barrier to increasing uptake in new developments.
- **Payback** – Renewable energy tends to have a high up-front capital cost, which pays off over the life of the technology in lower operating costs. Because housing developers do not stand to benefit from the operating costs, they are less inclined to undertake increased financial risk in the building phase.
- **Skills in construction sector** – There is currently a dearth of technological skills in the construction sector in renewable energy and require further development.

Can this partner influence delivery by other partners?

While housing developers will generally only deliver solutions within the red-line boundary of a development, there are two ways in which housing developers can drive delivery of solutions on a wider geographic scale:

- **Impetus for strategic opportunities**: Change and development in an area provides a strategic planning opportunity to influence neighbouring areas and to extend infrastructural solutions. Where, for example, a large development plans to install a district heating system, this can be designed to be extended and retrofitted into surrounding communities. Separate developments in a similar area can also be coordinated to deliver strategic infrastructural solutions that may not have been viable on one site alone. Local authorities and Energy Service Companies (ESCo) are important delivery partners to work with housing developers to deliver strategic solutions.
- **Funding contributions**: Housing developers can directly drive delivery of off-site low carbon and renewable energy by other delivery partners through funding contributions. In the past, Community Energy Funds have been set up by planning authorities where developers can contribute funding in lieu of making carbon reductions on the development sites themselves. Ashford has made provision for a carbon offset fund of this type in its Core Strategy, for example. In the future, similar mechanisms are likely to be required through the Government's Allowable Solutions proposals under their proposed trajectory to zero carbon. To meet future building regulations, developers will need to contribute funding (on a £ per tonne of carbon basis) to 'top-up' the carbon reductions that cannot be met on site. Local Authorities are likely to have a strong role in coordinating and directing delivery using allowable solutions funding, and may themselves be the delivery partner. Alternatively, local energy developers, community groups or private sector partners may be chosen to deliver projects funded by allowable solutions.

5.6 Delivery Partner 3: Public Sector

What kind of projects is this partner delivering in Kent?

The public sector has made in-roads into delivery in Kent by working with their own properties first. Micro-generation installations on public buildings and in schools have been popular across the county. Driven by waste policies and regulation, the Allington Energy from Waste scheme has also been delivered, along with a number of landfill gas capture schemes. However, public sector partners in Kent are yet to deliver large-scale schemes or take a role equivalent to an energy supply company following other public sector models set by pioneers including Woking Borough Council and Sheffield City Council. The technologies that the public sector favours include micro-generation and biomass boilers. Local authorities and Registered Social Landlords (RSLs) are well placed as a lead delivery partner for the retrofit of district heating across strategic areas, beginning with connection of their own properties. Due to their long-term vision and coordination ability, local authorities also play an important role in facilitation and promotion of opportunities.

Table 9: Project Examples for Public Sector

Project Examples *Technology Type*	*Local Authority*
Micro-generation (various)	
• Council-owned buildings: offices, museums, care homes etc. • Schools • Retrofit programmes e.g. Rushenden: PV *(ongoing)*	Various
Onshore wind	
• White Cliffs Business Park	Dover
Energy from waste	
• Allington	Maidstone (waste taken from: Maidstone, Sevenoaks, Tunbridge Wells, Tonbridge and Malling, Dartford, Gravesham, and Swale)

What can we learn about this partner from case studies?

Kent Schools Biomass Projects

St Augustine's Catholic Primary School in Tunbridge Wells and Valley Park Community School in Maidstone have both installed woodchip boilers, replacing oil as their fuel source. In the period 2006-8, Valley Park installed one 500kW biomass boiler (and one 500kW gas boiler) at a cost of £415k, and St Augustine's installed one 150kW biomass boiler (and one 200kW gas boiler) at a cost of £192k (£81k additional cost for biomass elements). Funding was provided by the schools and by grants from Kent County Council and other sources. Fuel is sourced locally from Torry Hill farm and the Neville Estate in Kent. Pupils were engaged through launch activities and use of the boilers as a learning resource, including visits to wood suppliers. The projects have resulted in a reduction of CO_2 emissions from heating by around 90% in participating schools. Valley Park is projected to save around 114 tonnes of CO_2 per year, and St Augustine's around 43 tonnes of CO_2 per year.

These projects were used as pilots to trial use of biomass and examine the benefits for schools and other benefits for Kent. Biomass boilers have since been installed in Bapchild and Tonge School, Chaucer Technology College, and 6 Building Schools for the Future programme (BSF) schools in North Kent. The majority of the projects were school-led with Local Authority support, and the BSF projects were undertaken using a PFI model. The Chaucer Technology College project has been able to qualify for SALIX funding as with the RHI it is projected to pay back within 5 years.

The projects complement Kent County Council's promotion of Kent as a biomass investment location under the Locate in Kent programme, and its aims of developing the local fuel supply chain, benefiting the rural economy and promoting better woodland management. Kent is in an unusual position as many of its schools currently use oil boilers – along with the availability of local sustainable sources of biomass, this makes the case for switching to biomass particularly attractive. Opportunities for adoption in other schools on case-by-case basis, particularly where they currently have oil boilers, should be considered, possibly using ESCo delivery models for schools out of Kent County Council control.

Lessons learnt include:

- Importance of project management expertise and experience of biomass projects;
- In-house expertise and knowledge sharing between schools has been developed through undertaking projects;
- The profile of schools is enhanced through such projects;
- Importance of external grants/incentives;
- Distance fuel travels and delivery method impact significantly on fuel cost at this scale;
- Biomass isn't feasible for all schools and factors such as access for fuel delivery vehicles, space for woodchip storage and space in boiler rooms for larger biomass boilers, as well as levels of interest from the schools need to be considered;
- Procurement and contract-writing lessons have been learnt by Kent County Council.

Other biomass projects in Kent include: Maidstone Borough Council offices; New Pembury hospital; Bedgebury Pinetum Visitor Centre; Pine Calyx Conference Centre; Torry Hill Farm; Amery Court Farm; Betteshanger Business Park; Godinton Park holiday homes; Hever Castle; Ridham Dock (pending); Scotney Castle; Wildwood Wildlife Centre; Singleton Environment Centre; and Commonwork/Bore Place.

Maidstone Museum Solar PV and GSHP

Maidstone Council has recently installed 18 solar PV panels (3kWp) and a ground source heat pump (GSHP) on the new East Wing of Maidstone Museum & Bentlif Art Gallery.

The project cost around £210k in total, with the majority of cost being for the GSHP. One of the 10 key objectives of the wider project was to reduce the Museum's carbon impact. The Local Authority also wanted to demonstrate its commitment to renewable energy. Estimates suggest the renewable installations will save around 15 tonnes of CO_2 per year. The project will also attract people to the Museum, which will educate visitors on the renewables installed, providing an important resource for the area. The existing building is Grade II Listed so the extension project had to be carried out sympathetically.

Lessons learnt include:

- Experience of writing successful grant applications was important to the project's success;
- Support was needed from external sources including expert advice from consultants covering renewables; experience of M&E contractors; and forward-thinking architects who suggested using renewables. It was seen as being important to appoint experts to get it right at start for project of this size, and to get advice independent of installers.
- Through carrying out a project of this kind the Council gained a greater understanding of renewable technologies and their appropriate application;
- The PV element of the project was seen as being easy compared to the GSHP;
- Be aware of running costs for heat pumps;
- Ongoing management is very important, as is having knowledge and training in-house – renewable technologies need to run properly to get benefits from them.

Why would the partner choose to deliver in Kent?

- **Leadership and coordination role** – With the ability to set policies and local targets, and to coordinate funding, including using allowable solutions, Kent local authorities are in a unique position to lead and coordinate renewable energy projects. They have the opportunity to work with energy and housing developers to explore renewable energy opportunities, and the role that ESCos and other delivery models such as social enterprises might play.
- **Planning role** – Setting supportive planning policies, helps to increase developer confidence. Planning also has the ability to set strategy for delivery at scale and in the most suitable areas.
- **Delivery of strategic opportunities** – Significant opportunities where local authorities must take a lead in coordinating and delivering projects. This is especially the case for projects, which are difficult to deliver, but have significant benefits, such as district heating networks in high density areas.
- **Piloting projects** – Public sector actors are in the unique positions where financial profits are not the only factor in delivering renewable energies. Pilot projects have the ability to prove technologies, while also acting as a catalyst in the delivery of renewables, establishing supply chains, and developing skills on a wider scale.

- **Education and promotion** – The public sector has the ability to disseminate information and facilitate the sharing of knowledge. Councils can highlight the importance of energy efficiency and renewable energy and signal these to community members, while schools and colleges can play an important role in educating students about energy.
- **Long term vision** – Public sector organisations have the ability to think and plan for the long term. As profit is not always their primary motivation, the public sector can also focus on projects which do not have a high return on investment, but do deliver other social and environmental benefits.
- **Public owned properties** – As the public sector owns a substantial number of properties in Kent, they could play an important role in retrofitting their own properties. This will likely first require an energy audit to inform which renewables work best on each property.

What's stopping the partner delivering in Kent?

- **Ambition** – There are various levels of ambition and commitment across the county. Ambition will play an important role, particularly with respect to coordination of more challenging projects, as they will likely need leadership from the local authorities. This also has some consequences for collaborating across borders on renewable energy projects.
- **Finance and resource constraints** – multiple budget commitments and current funding constraints are prevalent for many local authorities, and this is no different for those in Kent. However, there are funding options available. These include:
    - **Community Energy Saving Programme (CESP) –** This fund targets dwellings in areas of deprivation throughout the UK. CESP is funded by energy suppliers and generators. When this programme ends in 2012 it will be replaced by the Energy Company Obligation which will also target fuel poverty.
    - **Eaga Partnership Charitable Trust –** This fund focuses on relieving fuel poverty and improving energy efficiency, particularly in homes which are difficult to heat and in rural areas. The fund is not currently open for bids but is expected to re-open in 2012.
    - **Salix Finance –** Salix provides both grant funding to Local Authorities that manage to reduce CO2 in a cost effective manner. Funding typically ranges from £250,000 to £500,000.
    - **Renewable Heat Incentive** and **Feed in Tariff**
    - **Private funding –** various models are available and several banks and funds have renewable energy investment vehicles.
- **Expertise** – Local government officers may have limited renewable experience and expertise in relation to renewable energy. This can result in fostering misconceptions and potentially will have an impact on support for renewables.
- **Need for changes to legislation and regulation** – There will be a need to work with national government to increase investor certainty and confidence. There will likely also be a need to work with government and local conservation groups to address issues associated with protected areas to ensure that a suitable balance is drawn between conservation needs and sensitive use of renewable energy.

Can this partner influence delivery by other partners?

Local government has a key role in promoting the delivery of renewable energy, to meet the goals set in Kent's Environment Strategy: "to achieve the UK National Target of 15% of all energy from renewable sources by 2020", and: "to improve fuel security, [and] assist businesses to respond to the Government's Carbon Reduction Commitment." Local authorities have the potential to significantly influence renewable energy delivery, through their leadership, strategic and catalytic roles within their area and through putting their significant asset ownership to use. Their enthusiasm is important, and they can take important steps by training their councillors and planning officers, and by facilitating partnership working.

Setting a strong, clear and integrated vision for renewable energy is vital to build confidence in the sector. As planning authorities, local authorities also have a direct ability to influence the delivery all other partners, particularly housing developers and energy developers. By setting carbon reduction targets for strategic sites, where low carbon infrastructure could be installed for wider benefit, planning authorities can require housing developers to investigate and deliver feasible opportunities. Through spatial planning there is also an opportunity to locate growth to drive delivery of energy opportunities. Planning authorities can also develop a positive policy framework to support delivery of renewable energy.

Clear policy, guidance and implementation gives confidence to energy developers to take projects forward in Kent. The energy opportunities maps produced by this study can be used as a resource to identify promising locations.

5.7 Delivery Partner 4: Private Sector

What kind of projects is this partner delivering in Kent?

The private sector is actively involved in low carbon and renewable energy delivery across Kent, with a range of medium-scale examples of delivery. Significant CHP installations have been delivered by heavy industry in the interests of energy independence and cost-efficiency. Private land-owners and farmers have also been active in the area. The private sector is strongly aiding the development of a low carbon economy through the development of local skills and research. Farmers and estate owners have a unique opportunity to deliver wind energy, biomass and anaerobic digestion schemes in Kent.

This delivery partner has various drivers to undertake renewable energy projects, including diversification of income, increased self-sufficiency, improved use of existing resources and meeting of corporate or government targets for carbon emissions reductions. There is a need to promote opportunities to those land-owners, businesses or industries who are less aware of them to build confidence in the sector, for example through increasing take-up of business support programmes currently provided, and through use of existing networks.

Table 10: Project Examples for Private Sector

Project Examples *Technology Type*	*Local Authority*
CHP	
• Port of Dover: waste vegetable oil • Aylesford Newsprint Paper Mill • Kemsley Paper Mill	Dover Maidstone Swale
Energy from waste	
• Kemsley Paper Mill *(planned)*	Swale
AD	
• Otterpool Quarry *(planned)* • Hadlow College *(study)*	Shepway Tonbridge and Malling
Large scale PV	
• WireBelt Co. Ltd. • Mistletoe Cottage: freestanding • New Kaine Farm *(planned)*	Swale Canterbury Swale
Biomass	
• Torry Hill Farm • Amery Court Farm • Godinton Park • Hever Castle • Betteshanger Business Park • New Pembury Hospital	Swale Canterbury Ashford Tonbridge and Malling Dover Tunbridge Wells
Onshore wind	
• Castle Farm *(planned)*	Maidstone
Technology development	
• Kent Science Park • University of Kent	Swale Canterbury (also Tonbridge and Malling)

What can we learn about this partner from case studies?

Wire Belt Co. Ltd. Large Scale Solar PV

Photo Source: Wire Belt Co. Ltd.

Wire Belt Co. Ltd. has recently installed 420 (98.76 kWp) solar PV panels on its premises in the Eurolink Industrial Estate, Sittingbourne, Swale. Covering a surface area of 690m^2, the scheme is one of the largest solar PV installations in Kent. The project cost £277,500 plus VAT, and is projected to return £570,500 (calculated over 25 years, including Feed in Tariff), and to save 48 tonnes of CO_2 per annum, and to meet around 50% of the company's electricity demand. Reduction in energy costs will also allow finances to be directed to growing employment.

The project has been a long-term goal of the company, and is part of a wider environmental strategy. The environmental credentials and sustainability of the company are a priority for them and for their customer base.

Lessons learnt include:

- Senior management support was important throughout the project;
- Strong project management skills were required including running tender process, ordering equipment;
- The planning process was the most difficult element of the project, with incorrect initial advice being given. The need for going through the Planning process was slightly frustrating as in this application the panels are very low impact, not visible, on an industrial estate;
- It was felt that the domestic market has good sources of Planning guidance whereas this is not as good for the non-domestic market;
- Lack of prior experience was a problem and the company sought business/tax advice from experts. The company and the contractor were both learning during the project, as was the supplier;
- The project and the wider commitments of the company are seen as educating others in low impact lifestyles: Wire Belt are keen to use the project to help other businesses learn about renewable energy projects;
- The revision of the FIT for large scale PV is likely to be a significant barrier to others wanting to implement this type of project. There may be a need to train planning officers so they have knowledge of changes to government incentives for renewable energy and can advise applicants of these;
- At the time of the ordering PV panels for the project (2010), the company found there was a lack of evidence for a good UK source of panels at the required scale but there are now more companies manufacturing in the UK.

Other large scale solar PV projects in Kent include: Mistletoe Cottage Canterbury; Ebbsfleet Farm nr Richborough Energy Park; Lower Road Minster; Ham Lane Lenham; New Kaine Farm (planning granted).

Castle Farm Wind Turbine

Planning permission has been granted for a 225kW turbine planned to supply electricity to Castle Farm fruit farm in East Farleigh in Maidstone, which has a large electricity demand from cold storage. The scheme is a commercially-led joint commercial-community scheme. Energy company DistGen plans to finance the scheme, and cover costs including planning, the turbine and its installation, operation and maintenance. The farmer will enter into a land leasing agreement with the company. The scheme would be one of the first of this kind in the UK, and will bring several benefits to the local community:

- It is to run as a community investment model, as used frequently in Denmark: 49% of the shares are to be offered to local community, and the remainder divided between company and landowner.
- 6% gross annual income is to be granted freely to East Farleigh Parish Council for reinvestment into the community.
- There are plans to use it for educational purposes, establishing links with local schools
- Drivers for the scheme include the Feed in Tariff and diversification of income for the land owner.

Lessons learnt:

- There are opportunities for farmers and other land owners to diversify their income streams;
- Delivery models which benefit the community should be encouraged;
- Once turbine sizes reach commercial scale (>30m), planning requirements increase. This, along with the cost of planning, and long process of preparation before installation is achieved, may deter community schemes from being delivered;
- Misconceptions about renewable energy had to be addressed at Planning Committee – it is important to demonstrate the case for renewable energy projects to the community and planning committee at an early stage;
- There may be a need for renewable energy capacity training for Members involved in planning decisions, and for Local Authorities to promote schemes of this kind more strongly.
- Significant commitment is needed, plus sales skills and knowledge of renewable energy to gain landowner's and community's confidence; and
- Expertise is needed to get planning permission, including use of specialist software to generate noise reports and knowledge of planning law.

Other small onshore wind projects in Kent include: Isle of Sheppey prison; White Cliffs Business Park.

Why would the partner choose to deliver in Kent?

- **Level of control and availability of space** – Like local government, land owners in Kent have the advantage of a high level of control over significant assets. The potential exists to use these assets in generating renewable energy on their estates.
- **Diversification of income streams for farmers and other land owners and extent of farmland** – With over 2,500 commercial farms in Kent, their combined 225,000 hectares make up over 60% of the total area of Kent. Another approximately 3,000 non-commercial size small holdings can be added to this figure.[25] Farmers have an opportunity to investigate how they can use their land to contribute to renewable energy, while earning a second income stream in the process. This would often be through the installation of medium scale wind turbines, or growing biomass crops.
- **Funding for farmers** – With support from the National Farmers Union, Barclays launched a new renewable energy fund for farmers in August 2011. Initial estimates suggest that over a third of farmers in the UK want to invest in renewable energy, most within in the next year.
- **Waste reduction for industry** – Generating renewable energy from waste via biomass boilers, anaerobic digestion, or landfill gas, can be an alternative use of industrial waste streams. This also helps to reduce costs of production.
- **Marketing drivers** – Installing renewable energy and supporting energy efficiency measures can help establish an organisation's 'green' credentials, and help attract customers, visitors, funders in the process.
- **Research and Development** – There is an opportunity to further expand Kent's renewable energy research and development. The University of Kent, and Kent Science Park represent the beginnings of what could be a major growth industry in the area. Other organisations might want to co-locate in nearby areas.
- **Skills development** – Kent has strong opportunities to lead the way in developing local skills in the renewable sector, using local investment in renewable technologies, with existing centres of expertise at Swale, Thanet and Dartford and Sevenoaks Energy Academy. Private sector companies operating in the renewable energy space might view these centres as important 'feeder' programmes for their businesses and organisations.

What's stopping the partner delivering in Kent?

- **Planning process and expertise** – Uncertainty regarding the current planning process presents risks for the private sector in increasing uptake of renewables.
- **Funding for feasibility studies and installations** – Sourcing funds can be a barrier, particularly in the current economic climate. While larger enterprises are less at risk, small and medium enterprises will be the most challenged at securing funding. However, funding does exist, but access to it will require coordination.
- **Renewables expertise** – While many private sector organisations are interested in increasing their renewable energy uptake, few have the expertise to make decisions, and lack the resources to employ experts.
- **Uncertainty** – As illustrated with the recent cut to the feed-in tariff, the lack of certainty around government incentives might present a risk to installing renewable technologies.
- **Areas of Outstanding Natural Beauty** – There will be constraints where farmers' or others' land is included within the Kent Downs AONB, which covers a quarter of Kent, or in the High Weald AONB.

Can this partner influence delivery by other partners?

The private sector has a strong influence in Kent due to their 'on-the-ground' understanding of local economies and business opportunities. Through partnerships with either energy developers or the public sector, the private sector could influence delivery of larger-scale or strategic projects in Kent. Private sector land-owners or large businesses can also drive delivery through use of their own property through collaboration with local communities and other land owners.

[25] June Survey of Agriculture and Horticulture 2010, DEFRA http://www.defra.gov.uk/statistics/foodfarm/landuselivestock/junesurvey/ DEFRA define 'commercial' holdings as those exceeding certain areas for different use types – see their website for more detail. The estimate for non-commercial holdings comes from the 2009 dataset as DEFRA stopped collecting this data in 2010.

5.8 Delivery Partner 5: Communities and Individuals

What kind of projects is this partner delivering in Kent?

Through the transition town movement and other community initiatives, a number of community based environmental groups have formed in Kent who are interested in the delivery of renewable energy. Currently, most community-delivered projects are small-scale micro-generation projects. Following models elsewhere in the country where community members operate a share scheme, communities have the opportunity to deliver larger carbon reductions through installation of larger scale renewable energy, including large wind turbines.

Table 11: Project Examples for Communities and Individuals

Project Examples *Technology Type*	*Local Authority*
Micro-generation (various)	
• Wildwood Wildlife Centre • Singleton Environment Centre • St Margaret's Bay Trust Pine Calyx Centre • Commonwork at Bore Place • St Nicholas Church Rochester • Birchington Community • The Care Fund • Petham Village Hall	Various
Biomass	
• Scotney Castle	Tunbridge Wells
Hydro	
• Crabble Corn Mill Trust • Abbot's Mill *(planned)*	Dover Canterbury

What can we learn about this partner from case studies?

Pines Calyx Micro-generation

St Margaret's Bay Trust has installed a wind turbine, PV panels, biomass boiler, and solar thermal panels at the Pines Calyx Conference Centre in Dover. They supply the conference centre, office and cottages, saving 7.2 tonnes of CO2 per year and £900 per year in operational costs. The biomass installation was seen as a pilot project, introducing a new use for local wood, and developing the local economy. Fuel wood is sourced from on the site or from local woods managed by the Trust. The project supports the local village's aims of becoming a zero carbon community by the end of 2012.

Lessons include:

- Improved woodland management can provide sustainable local sources of biomass;
- Organisations' profiles are enhanced by installing renewable energy – the Pines Calyx Centre has won environmental awards and its sustainability credentials have attracted visitors;
- Renewable energy installations can support aims of environmental education, providing a resource for the local community and visitors, and promoting pride in the local community.

Why would the partner choose to deliver in Kent?

- **Active and enthusiastic communities** – Environmental groups are among the most enthusiastic and ambitious groups with respect to renewable. Kent benefits from several Transition Town groups, and other groups such as the St Margaret-At-Cliffe community, Elham Environment Group and Commonwork. These groups have combined to deliver a number of renewable energy projects, and could be viewed as a critical mass of support.
- **Local pride and cohesion** – Working together as a community to deliver projects can help to foster a tighter, more successful community, while at the same time making the community more resilient and self-sufficient.
- **Supporting and perception changing role** – Increasing the delivery rates of renewable energy within Kent can help to make renewables more acceptable, and increase delivery of micro-generation renewables in residences.
- **Incentives** – The introduction of Feed in Tariff has already significantly increased the amount of renewable energy installed in Kent. The introduction of Renewable Heat Incentive in 2012 is hoped to have a similar impact for renewable heating schemes.
- **Off-grid properties** – Renewable energy is particularly beneficial where rural communities are off-grid, providing increased carbon and financial savings. These communities will often have good access to space for installing renewable energy. Kent already has a large number of homes, which are primarily biomass-heated, with opportunities for greater uptake.
- **Revenue generation** – In addition to reducing costs and carbon emissions, larger scale installations present an opportunity for the community to generate a secondary income stream, which can support other community initiatives.

What's stopping the partner delivering in Kent?

- **Other priorities** – As the majority of community groups are volunteer based, members have many other demands – both financial and for use of time.
- **Lack of resource** – A lack of funding is often a concern for community groups; however, funding options do exist for community groups, particularly as funding organisations see value in providing resources to 'grass roots' projects.
- **Apathy** – The challenge of energy security can seem daunting, and sometimes overwhelm individuals and community groups.
- **Leadership –** Organising community groups can be time consuming and can quickly become an overbearing task when other members do not provide adequate support.
- **Levels of knowledge and trust** – The low level of projects delivered to date amongst some community groups might suggest that expertise in renewable energy projects needs cultivating. While some projects might be perceived as being complex, it is important for community groups to remember that what they might lack in expertise, they can make up for in passion.
- **Local opposition** – Local opposition to renewable energy schemes is often a case of a loud minority. Community groups need to support each others' projects to ensure all voices are adequately heard.
- **Coordination** – e.g. private ownership requires good understanding and buy-in from a large number of people.

Can this partner influence delivery by other partners?

The SILCS report[26] concludes that in order to bring benefits to communities and to build trust and support for renewable energy: "We need to listen to, work with, and engage communities over the whole project life – to understand the "DNA of place" - sharing the issues, the dreams and the solutions; identifying and working with local champions; and ensuring the community benefits from the legacy of infrastructure investments such as retrofit and renewables through stimulating local low carbon supply chains." The findings of the Renewable Study workshop held in July 2011 as well as those of the SILCS report indicate that renewable energy projects, led by any type of delivery partner, should have some form of community involvement or ownership to give benefits to community, promote cohesion and secure local support, increasing

[26] 21st Century Design: Delivering affordable low carbon development (SILCS report), Institute for Sustainability, 2011

acceptability for future projects. One model for this is demonstrated in the Castle Farm wind turbine project (profiled in the private sector section).

5.9 Stakeholder Perspectives: Delivery Impetus

A stakeholder workshop held in July 2011 brought together a range of Kent stakeholders, including representatives across the five delivery partner types. The workshop allowed stakeholders to share perspectives on delivery ambition in the County and also explore the opportunities and constraints affecting each partner type. Stakeholders also suggested a range of actions that could be taken to increase delivery and developed indicative delivery scenarios to show the scale of ambition of each partner type.

Workshop Results

All delivery partner groups present indicated particular support for solar, biomass, and wind energy generation in Kent. It is also supported by a survey conducted by ORC International for Kent County Council in 2008, which found that Kent residents' preferred alternatives to fossil fuels were wind power and solar power.[27] Other common themes have been identified across the partner groups, one of the most common being the perception of the planning process as a barrier and the need for increased training and engagement with those involved in the process, especially Councillors. Another was the need for knowledge-sharing amongst and between delivery partner sectors, to give partners confidence in their ability to deliver a successful project.

An impressive range of renewable energy projects have already been delivered across Kent, each showing the commitment and enthusiasm of those involved. Conversations held with individual stakeholders strongly reflected this sense of enthusiasm for renewable energy projects, and demonstrated a high level of knowledge gained from going through the delivery process. These assets should be recognised and drawn upon in the future.

The full write-up of the workshop including the opportunities, barriers and actions identified by each partner type, is included in the Appendix to this report.

5.10 Chapter Summary

- **An understanding of the true potential for renewable energy deployment can only come from a delivery perspective that considers the ambition, capability and will of local delivery partners. Five general types of delivery partner have been examined; energy developers, housing developers, public sector, private sector and communities.**
- **Energy developers are well placed to deliver large-scale energy opportunities in Kent, however unclear implementation of policy can detract from delivery. Strong partnership with other delivery partners, particularly communities and local authorities, will lead to local support for schemes and allow proposals to provide greater benefits for the local area.**
- **Housing developers have previously been a focus for delivery of renewable energy installations in new development. As carbon reduction requirements under Building Regulations under the zero carbon housing proposals for 2016, developers will increasingly contribute funding to a centralised fund under allowable solutions. Hence housing developers will become an important financial supporter for delivery by other partners. Local authorities will be charged with an important coordination role.**
- **Public sector partners are already actively delivering small installations across Kent, predominantly on their own properties. There is still a lot of scope for further projects, though leadership, skills and coordination is needed across the County. Local Authorities are yet to deliver more strategic schemes that will deliver more significant carbon reduction, though there are clear precedents to learn from elsewhere for local authority led energy companies delivering district heating systems in urban areas. Local authorities will play a crucial supporting and coordination role to foster delivery by other partners, including the development and implementation of clear policy.**
- **Private sector partners are also active in the area, with individual businesses and industry delivering a range of technologies. Drivers for these partners are often driven by a clear business case for energy savings and business credibility. Barriers for this partner include a lack of awareness and expertise to realise the opportunities which could be overcome through private sector leadership and coordination.**
- **Communities, charity groups and individuals are a significant collective force, capable of delivering small-scale micro-generation, but also collectively driving larger installations such as wind energy. The delivery path for communities is perhaps the least clear, with no clear source of advice or coordination meaning impetus is reliant on personal commitment.**
- **Local stakeholders in Kent show a high level of ambition to delivery renewable energy, particularly from community groups and the private sector. Feedback from stakeholders suggests that delivery of micro-generation could potentially be easier than large scale installations. The results of the workshop reinforced the need for better sharing of expertise, stronger leadership from all sectors, clear policy implementation and coordination of opportunities.**

6 Potential for a low carbon economy

6.1 Introduction to this chapter

As demonstrated by the previous chapter, each delivery partner has significant potential to lead the design, procurement, delivery and operation of renewable energy in Kent. If delivery is maximised, Kent could not only establish itself as a leader in renewable energy deployment, but also reap the benefits that this could bring to the local economy. There is significant potential for economic growth and job creation attached to renewable energy deployment, in design, manufacture, supply, and market attraction to green industries.

This chapter provides a rapid overview of the Kent economic sectors and considers how investment in renewable energy could stimulate wider economic benefits.

6.2 Stimulating the development of a low carbon economy

With the development of the draft *'Low Carbon Opportunities for Growth'* (Jan 2010) paper, and facilitation of the *Kent Economic Board Low Carbon and Energy Production´* business event in May 2011, Kent recognises the potential for increased competitiveness, job creation and business growth through the transition to a low carbon economy.

The economy is diverse, and defining the critical elements that will facilitate a successful transition to being low carbon is complex. These may however be distilled into three multifaceted and interrelated stages:

- Energy: Developing a viable low carbon and renewable energy sector – creating the conditions to reduce the carbon in energy production as the primary source of emissions
- Efficiency: Decarbonising wider business performance - Reducing the carbon embodied in the wider economy by increasing the carbon efficiency of industrial and commercial premises and in-house processes
- Infrastructure: Establishing facilitating infrastructure and services – such as developing low carbon transport, supply chains and communication networks.

Within all of the above there also needs to be a focus on the people that will facilitate the transition. This requires adequate levels of skill, training and education to capitalise on diversifying existing industries and create new economic opportunities.

As the focus of this report is on the opportunities for low carbon and renewable energy, this chapter takes the low carbon economy to be discretely those industries primarily engaged in the low carbon and renewable energy sector. Within this however, it also looks at the wider economy, identifying high level opportunities that already exist on which to build, and gaps that need to be filled.

6.3 Overview of Kent's economy

As highlighted in the table below, Kent's economy is dominated by the health (13.9%), retail, (12.6%) and education (10.9%) sectors; all of which are higher than the south east and national averages. Kent also has a higher than average proportion of the economy within the construction industry (6.7%), transport and storage (5.3%) and motor trades (2.1%) sectors.

Kent has proportionally less than the rest of the south east, and wider Great Britain in the manufacturing (7.4%) and primary industry (1.3%). This could be particularly relevant as Kent may be a disadvantage in this instance for indentifying transferable skills for developing renewable and low carbon technology.

There are however significant exceptions as might be expected across such a diverse county. One of the most notable is in Swale, where at 14.2%, the level of manufacturing is considerably higher than the national average, 9%, and nearly double the Kent average of 7.2%. Similarly, construction in Sevenoaks is particularly high 10.3%, compared with the 4.8% national average. Given this concentration of building skill, and the potential solar resource in Kent, this could be a particular opportunity for becoming a leader in building-integrated micro-generation.

	Primary Industry	Manufacturing	Construction	Motor trades	Wholesale	Retail	Transport & storage	Accommodation & food services	Information & communication	Financial & insurance	Property	Professional, scientific & technical	Business administration & support services	Public administration & defence	Education	Health	Arts, entertainment, recreation & other services
Ashford	1.2%	9.2%	7.0%	2.6%	5.7%	11.8%	7.0%	6.1%	2.3%	2.2%	0.9%	4.9%	8.1%	2.9%	7.9%	15.5%	4.7%
Canterbury	1.1%	3.5%	3.9%	2.2%	2.8%	13.8%	2.1%	6.7%	2.1%	1.9%	1.0%	5.1%	4.5%	5.7%	**20.8%**	17.8%	4.9%
Dartford	1.1%	8.2%	9.3%	1.7%	3.8%	**20.9%**	5.9%	5.6%	2.0%	1.9%	1.0%	5.6%	9.0%	1.8%	7.1%	13.0%	2.1%
Dover	0.6%	8.4%	4.8%	2.4%	1.5%	9.4%	**9.8%**	7.3%	0.7%	1.3%	0.8%	10.6%	6.4%	7.1%	10.5%	14.7%	3.8%
Gravesham	0.6%	7.9%	8.1%	2.0%	2.0%	13.3%	6.5%	6.9%	1.4%	1.8%	1.1%	3.9%	**9.8%**	8.2%	13.2%	9.5%	4.0%
Maidstone	0.8%	5.2%	7.6%	2.3%	3.3%	10.1%	4.8%	6.0%	2.4%	2.7%	1.2%	5.3%	8.6%	**13.0%**	7.9%	15.2%	3.6%
Sevenoaks	0.9%	7.2%	**10.3%**	2.0%	5.5%	10.2%	1.8%	7.4%	**4.4%**	2.6%	**2.2%**	**11.5%**	7.8%	1.5%	9.5%	9.1%	**6.1%**
Shepway	**3.4%**	4.9%	4.9%	1.6%	1.6%	12.0%	5.9%	7.3%	1.1%	5.5%	1.0%	3.9%	8.4%	10.0%	10.3%	14.5%	3.7%
Swale	1.1%	**14.2%**	6.9%	1.9%	3.8%	10.1%	8.4%	6.1%	1.6%	1.4%	1.3%	4.5%	7.9%	5.4%	9.9%	11.8%	3.9%
Thanet	2.0%	8.6%	5.6%	1.0%	1.6%	15.7%	3.8%	**8.1%**	1.4%	2.3%	1.2%	3.3%	4.5%	3.2%	13.9%	**19.7%**	4.0%
Tonbridge & Malling	1.9%	7.5%	7.5%	**2.7%**	**6.1%**	9.7%	7.8%	4.7%	4.1%	5.1%	1.0%	6.1%	8.7%	5.9%	9.5%	7.9%	3.8%
Tunbridge Wells	1.0%	6.2%	4.3%	2.3%	4.6%	14.1%	2.3%	6.4%	4.2%	**6.0%**	1.5%	7.5%	5.5%	2.4%	10.2%	15.8%	5.7%
Kent	1.3%	7.4%	6.7%	2.1%	3.7%	12.6%	5.3%	6.4%	2.4%	2.9%	1.2%	6.0%	7.4%	5.7%	10.9%	13.9%	4.2%
Medway	2.3%	8.5%	7.3%	1.6%	3.3%	12.2%	4.5%	6.0%	1.5%	3.0%	1.2%	3.2%	6.6%	5.3%	12.3%	16.0%	5.1%
South East	2.1%	7.1%	5.2%	1.8%	4.6%	10.6%	4.3%	6.4%	5.5%	3.3%	1.4%	7.9%	7.7%	4.3%	10.2%	12.7%	4.8%
Great Britain	2.0%	9.0%	4.8%	1.7%	4.1%	10.5%	4.6%	6.7%	3.7%	3.9%	1.5%	7.0%	7.7%	5.7%	9.5%	13.1%	4.5%

Source: ONS BRES
Presented by: Research & Intelligence, Kent County Council
Note: Figures exclude farm agriculture (SIC subclass 0100)

Figure 57: Economic Sectors in Kent

Recent employee growth has been focused on the health, education, professional scientific and technical, property, information and communication and construction sectors. There has also been a large growth in the agricultural forestry and fishing industry, although this is recorded differently and not directly comparable. All the other sectors saw employee decline. It is important to note, however, that the manufacturing industry in Kent is not different from the rest of the country in its decline. In addition, as manufacturing output has not decreased, part of decline in employment can be attributed to a more efficient manufacturing process rather than an industry in decline. Looking ahead, the *State of Kent's Economy* indentifies further growth in construction, distribution, hotels and catering, transport and communications, financial and business services and public services[28]. Other areas that might be more consistent with establishing renewable and low carbon industrial activity are expected to decline.

[28] This might be expected to tail off given current cuts to public sector budgets.

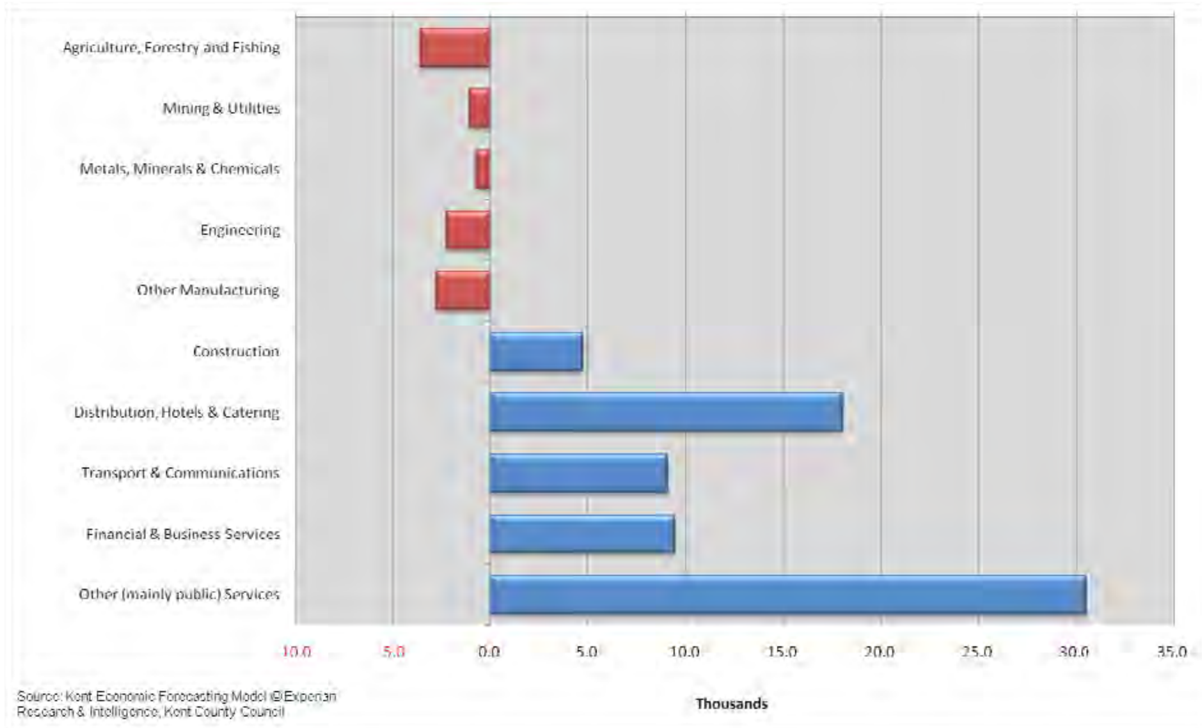


Figure 58: Predicted Economic Change by Sector (2010 – 2025)

The vast majority of businesses in Kent are small; with 72% employing less than 5 people. These businesses might be more flexible to take advantages of emerging opportunities but equally potentially lack liquidity for capital and training costs, which will influence strategies for business support.[29] These businesses, however, only account for 13.7% of all Kent's employees. Those firms employing 100 or more employees may only account for 1.3% of all businesses but employ 36.1% of all Kent's employees.

6.4 Potential economic benefits from renewable and low carbon energy delivery

Looking at the composition of Kent's economy can only provide a high level overview of potential transferability. Further analysis would need to be undertaken to identify specific skills. It was highlighted at the *Low Carbon and Energy Production Business Growth Event* that out of the 117,000 people employed across the South East within the 23 sub-sectors of the 'complex' low carbon energy production industry, a disproportionally small proportion of this was based in Kent. In a preliminary estimate, *Low Carbon Opportunities for Growth* calculates this to be approximately 19,600 people – although this accounts for a sizable £1.75bn in sales. Nationally, this sector is one of the few that is bucking current economic trends, growing at a rate of about 5% a year. As such there is clearly an opportunity area for Kent. Renewable energy is identified as one of the 3 largest industries within the sector in the South East, along with alternative fuels and building technologies; and as the fastest growing area in terms of employees and market value, with wind, biomass, solar and ground source technologies performing strongly. There are also a large number of companies in the waste sector.

With the low carbon and renewable energy looking set to be one of the only growth sectors, at 4-5% per annum throughout the economic downturn, what opportunities are there to capitalise on this in Kent? A key conclusion coming out of the *Low Carbon and Energy Production Business Growth Event* was that to capitalise on opportunities, Kent needs to be focused in identifying and deciding upon which areas within the wide and diverse low carbon energy sector to support. Building on *Low Carbon Opportunities for Growth*, the *Low Carbon Kent Programme* and this study, a strategy for renewable energy and low carbon economic development is being developed as part of the *Low Carbon Kent* programme.

Low Carbon Opportunities for Growth provides an overview of the key opportunities and constraints for some of the main technological options including, offshore wind, community heating systems and biomass. In addition they focus on low carbon building and contracting as well as a range of other associated infrastructure for decarbonising the wider economy. There are, however, some notable omissions.

[29] Vision for Kent, Consultation Draft, 2011: "Kent has a highly diversified and entrepreneurial economy, made up of 50,000 VAT registered businesses, 98% of which have fewer than 100 employees. 71.8% of Kent businesses employ less than 5 people."

Solar – With some of the best solar resource in the country, and with 25 year feed-in tariff commitments, there is significant potential to develop this market further. With a higher than average concentration of construction specialists, and suitable entry market for SMEs, supporting the development of a network of solar specialists within the construction industry could perpetuate an incremental shift towards widespread micro-generation. Delivering significant carbon reduction through solar PV and other micro-generation technology would, however, require widespread deployment across existing homes and businesses, as well as new build. As this would be largely reliant on a large number of relatively small scale initiatives, the potentially significant economic impact would be dispersed. With a relatively healthy construction industry in Kent, the benefits are likely to be retained within the county.

Solar Photovoltaics

Economic Impact – Dispersed, but potentially significant and retained within the County

Jobs created – Opportunities for construction based SMEs to diversify into solar installation

Delivery Partners – Housing developers, Industry, business and landowners, third sector and community.

Synergies between onshore and offshore wind - Kent's proximity to planned offshore wind expansion along the UK's east and south coasts as well as its proximity to continental Europe may be an advantage in many ways. Whilst the wind sector is much more advanced in parts of Northern Europe turbine manufactures are starting to be attracted to Britain to capitalise on Europe's biggest and fastest growing market. Ports in Kent, including Sheerness have been identified as part of a central hub for offshore wind manufacture and support activities. Vestas, the largest turbine manufacturer in the world, has proposed a new plant at Sheerness which could in turn offer great potential for Kent business to support and be part of a growing UK supply chain. The proximity of the County to the centre of installation suggests it is very competitively placed to act as a distribution and support hub to the sector.

Offshore wind

Economic Impact – Primary activities are likely to be concentrated around the ports and current projects in the Thames Estuary and in the future linked to Round 3 projects off the east and south coasts. Supporting industries are likely to be more dispersed. Sector growth has the potential to revive declining manufacturing industry. *Jobs created* – Initially high throughout construction but contracting sharply once in wind farms in are in operation. The creation of a manufacturing hub and local supply chain could bring significant new job numbers in the future.

Delivery Partners – Energy developers and Industry, business and landowners

With the potential to become a strategic centre for the offshore wind sector, both in terms of engineering and manufacturing as well as knowledge, there is a natural link with promoting onshore wind. There are however evidently differences in terms of market size and technology. The scale of onshore wind is obviously smaller in terms of both, but this lends itself towards community scale delivery ownership. As such the direct economic impact is likely to be significantly less and concentrated around the communities in which they are deployed. Larger schemes may also be viable, and incorporating an element of community ownership may help facilitate development. Although larger schemes may employ a larger number of people, the economic benefits will go mostly to the energy developer, which may not be Kent based.

Onshore wind

Economic Impact – Secondary to the offshore wind industry. Likely to be localised, but could bring wider community benefits

Jobs created – Relatively high throughout construction but contracting sharply once in operation, As for offshore wind, the creation of a manufacturing hub and local supply chain could bring significant new job numbers in the future.

Delivery Partners – Energy developers and Industry, business and landowners, Third sector and communities.

Biomass – Although *Low Carbon Opportunities for Growth* acknowledges that biomass is an available resource, it does not recognise the scale of potential. Stimulating a market for biomass will be critical to establishing it as a low carbon fuel source for individual or communal biomass heating schemes or for aerobic digestion installations. There are three main streams potentially worth considering:

- Wood fuel – It is recognised that there is considerable potential in Kent to develop the wood fuel market. The Forestry Commission estimate that if just half the estimated annual growth in the Kent Downs AONB was harvested from the 15,000 hectares of woodland each year, this would produce 40,000 tonnes of wood. This has been recognised through the establishment of the Kent Downs Woodfuel Pathfinder. This pilot scheme is designed to support the government's Renewable Heat Incentive by working with forestry owners to install appropriate management techniques and associated infrastructure to help create a viable, co-ordinated wood fuel supply.
- Energy crops – The delivery of miscanthus and short rotation coppice offer opportunities for farm diversification in to energy crops. However, at present, competition with the food crop and straw market makes this less financially attractive. In addition, there is a carbon, as well as economic and social, argument for locally produced food – particularly in a county such as Kent which has such a food growing pedigree. Energy crops should therefore be supported on land which is less suitable for food crops to keep the markets distinct.
- Organic waste – Waste food and agricultural products could also provide source material for energy production as well as soil improvement. For example, New Earth Solutions, who treat about 50,000 tonnes per annum of Kent's waste, extracts high value recyclate and using the green waste to develop compost which returns the biogenic carbon to the soil. However, as facilities improve they are looking to manufacture top soil and use the woodier elements of the waste to produce energy. They are also looking to develop smaller modular 'thermal conversion technology' to allow waste to be treated, and provide energy, closer to the source.

Although supply material is evidently there, and there is a potential use, the problem is in unlocking this demand - there is no market until biomass supply chains and supporting infrastructure are in place. Establishing these supply chains and infrastructure requires investment and support. A specific fund for biomass boilers might help to create the demand required. Once installed biomass can offer longer term cost savings and additional economic benefits including attracting developers who will meet their building regulations requirements on carbon savings more cost effectively by 'plugging-in' to a local district heating scheme. As such, and set out elsewhere in this report, local authorities can take the lead by connecting publicly owned property can create the network spine for others to build upon.

Biomass

Economic Impact – Stimulus in the form of demand creation is probably needed to help the market become viable.

Jobs Created – Moderate number of jobs in growing, managing and distributing biomass. Construction related employment from establishing heating systems and attracting development to the area.

Delivery Partners – Housing developers, local authorities, third sector and communities.

Micro-generation Technologies – With significant national programmes in place to incentivise delivery of building based renewable energy technologies, there is strong potential for delivery growth. Driven by individuals, businesses and local authorities, support will be needed from local installers utilising skills associated traditional industries such as plumbing and electricians. With additional support and training, locally employed specialists could be developed in Kent. Where local authorities are taking a lead by retrofitting their own properties, an apprenticeship programme could be set up where local people have the opportunity to train alongside trained specialists.

Micro-generation

Economic Impact – Kent-wide due to existing building retro-fits and in growth areas due to new development

Jobs created – Significant opportunities to up-skill traditional plumbing and electricians

Delivery Partners – Housing developers, individuals, businesses, local authorities and the public sector.

6.5 Assessment of the low carbon economy potential in Kent

This rapid analysis has highlighted a number of strengths and weaknesses in Kent's potential to establish itself as a leading economy in the low carbon and renewable energy sector. Delivery of the economic potential should be a strong consideration in the delivery strategy for renewable energy in Kent. Conclusions from this analysis have been considered in prioritising actions in the proposed Action Plan.

Table 12: Strengths and Weakness Analysis of a Kent Low Carbon Economy

Strengths	*Weaknesses*
• Significant offshore wind farm investment. • Port facilities and connection to European market • Strong construction industry that could be a stimulus for generating a local centre of excellence for building integrated micro-generation • Large wood fuel and biomass resource to create local supply chains • Strong solar resource to support large scale deployment • Large levels of housing growth are planned in Kent	• Declining and proportionally small manufacturing sector – potentially limited transferable skills • Relatively small proportion of existing market and expertise within Kent • Competition from more established European markets

To develop a deeper understanding of the economic potential of low carbon and renewable energy in Kent further work could be done emulating that undertaken for the Yorkshire Cities. This pioneering project undertook a detailed analysis of the employment structure based on locally defined skills, sector-based and occupational profile. This was then compared with the local economic base to try to identify supply chain / procurement opportunities. Combining this with a review of higher and further education / training offered locally indentified skill gaps and shape policy decisions.

6.6 Supporting the transition to a low carbon economy

Central to the development of any market will be having the right people with the right knowledge and skills. Universities and colleges have a key enabling role to play in this area. There are opportunities to build upon existing links between universities and businesses, such as the University of Kent's Kent Innovation and Enterprise programme, which has sustainability as one of its key themes. With the abolishment of Regional Development Agencies, such links are increasingly important. At present Kent also has a good resource in its skills centres and colleges offering teaching on sustainable energy technologies, notably at Swale Skills Centre, SusCon and Thanet College. Other initiatives such as the skills exchange programme run by Unipart, and the wind turbine technologies apprenticeships being provided by DONG Energy at Swale Skills Centre should be implemented more frequently.

Kent will need to ensure that supporting the transition is a key objective of the new Local Enterprise Partnership and other strategic bodies.

6.7 Chapter Summary

- **Wider economic benefits can be realised alongside the delivery of renewable energy in Kent, including job creation, market reputation enhancement and sector stimulation.**
- **A range of renewable technologies have the potential for much wider economic benefits. Particularly beneficial technologies include solar photovoltaics, micro-generation installations, on-shore and off-shore wind and biomass.**
- **Training and skill development will be needed to position local employment sectors to support renewable energy delivery.**
- **Kent is well positioned to transition to a low carbon economy due to its high proportion of jobs in the construction sector, the large scale of planned growth, its geographical location, its potential for port areas to support off-shore wind farms and its rich renewable resources. However, the opportunity is one which in a competitive market where other areas in the UK and Europe are fast developing. The wider economic benefits are yet another impetus for a rapid increase in delivery of renewable energy in Kent.**

7 Taking advantage of the opportunities: delivery scenarios

7.1 Introduction to this Chapter

The insights provided in the stakeholder workshop along with the analysis of delivery partner opportunities and barriers have been used to develop two delivery scenarios – 'business as usual' (baseline) and 'all actions adopted' (optimised). These delivery scenarios help to prioritise the relative importance of the actions set out in section 8.

To reason and test the validity of the scenarios, the delivery capability of each partner was tested against what has been observed in other areas of the UK, providing an additional layer of analysis for a more robust idea of which types of technologies and resources show the most significant potential, and which delivery mechanisms are best placed to deliver them. This section presents some simple analysis of uptake scenarios for Kent, enabling future actions to focus on the schemes with the best potential, and on supporting the correct types of organisations and people for delivering them.

It is important to note:

There are numerous approaches that can be taken to developing scenarios for uptake of renewable energy, with varying degrees of complexity and therefore uncertainty. Tailored approaches to cover stage 5 to 7 of the DECC methodology have for example been developed for the South West, Yorkshire and Humber, London and East of England. This study for Kent is narrower in scope has a greater focus on consultation and identifying the actions to facilitate delivery, we have therefore needed to adopt a much more simplistic approach to considering potential uptake.

All background analysis and assumptions used to define the various technology opportunities, for each of the delivery partners is presented at the end of this section.

7.2 Methodology

The methodology used aims to assess potential uptake scenarios using simple assumptions. The results are necessarily high level and should not be used to imply a degree of accuracy that does not, and cannot exist.

The assessment is based on taking delivery partners, examining the types of schemes and technologies which each of these are likely to bring forward, and then estimating the potential uptake for each. Where possible these uptake assumptions are reasoned, based on precedents from other regions, countries or industries.

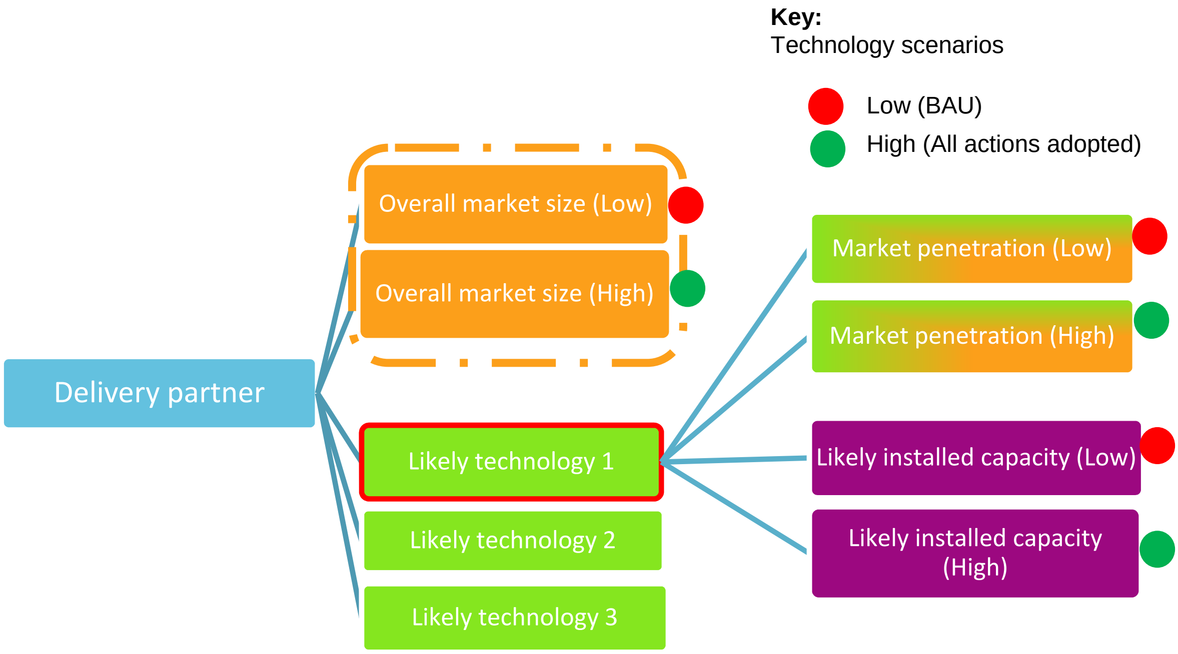


Figure 59: Diagram to show simplistic approach taken to estimating renewable uptake for each of the identified deliver partners

Notes:

1. **Technology types** - Between 3 and 4 prevalent technologies have been selected for delivery by each partner type. Technologies have been selected based on existing case studies and consultation with stakeholders

2. **Overall market** represents the size and type of the market for each delivery partner. It can cover, depending on the partner type, for example: number of homes, split of house types, number of buildings, number of schools, community groups, businesses, farms etc. Sometimes the market is fixed (i.e. existing homes) but in other areas (e.g. new development) it may change. We have considered only a single rate of growth (planned) for new development markets. In the working of the scenarios additional steps have been applied across a number of the markets to allow for a further degree of sub-division (i.e. farms of different size ranges, different sizes of home or building, different scales of community group etc). Some of this detail has been removed for simplicity in the final analysis.

3. **Market penetration/uptake** makes an assumption about the spread of technologies within each market type. (e.g. of 100 business's 50 will install PV, 10 ground source heat pumps etc) and the number of standalone renewable installations that may come forward.

4. **Installed capacity** sets out our assumptions in respect of scale of technology.

5. For each delivery partner and each technology delivered by that partner we have ended up with two simplistic scenarios. These are:

   Business as Usual (BAU): Aiming to reflect what would be delivered under a business as usual scenario

   All actions adopted (AAA): Aiming to highlight how much renewable energy could be delivered in a maximum (optimised) delivery scenario, where all recommended actions in the implementation plan have been adopted.

   Following this scenario testing stage we have then summed the installed capacity for each technology across each of the delivery partners and cross checked the results with the predictions for physically accessible resource arising from the SE renewable capacity study.

The delivery partners include those described in the preceding sections:

- Energy Developers
- Housing Developers
- Public Sector (including Local government, Schools, Libraries, RSLs, Hospitals, Universities and Colleges etc)
- Private Sector (including Industry, Business, Land Owners)
- Individuals and Communities

The list of delivery partners is not exhaustive, but is designed to represent the vast majority of options. For each partner, a number of likely renewable technologies and schemes are identified. These may be linked to existing buildings (for example micro-generation), or be stand-alone energy schemes, such as an energy from waste plant.

For each scheme, two sets of uptake by 2020 are selected to represent the Business as Usual (BAU) case and an 'All Actions Adopted' (AAA) case, representing what may happen if each partner takes the actions suggested in the final chapter of this report.

By summing the energy output and CO_2 savings across different delivery partners and resources or technologies, it is possible to gain an understanding of:

- The relative impact of intervention and actions from different sectors. This can be used to highlight where further support is needed and where incentives may be most effective;
- The relative importance of different technologies and resource streams; and
- Approximately how much low and zero carbon energy can contribute and reduce emissions across Kent by 2020 under these scenarios.

7.3 Results from scenario development

The scenario analysis clearly shows that sustained action will be required on all fronts if Kent is going to deliver its share of the UK's carbon reduction and renewable energy targets.

The following results show the outputs from the scenario development in terms of CO_2 savings and energy capacity and generation. The baseline energy and CO_2 emissions include all fuel and electricity in buildings and commercial uses, but exclude transportation.

The potential CO_2 savings are shown in Figure 60 and Figure 61 split to show CO_2 reductions by delivery partners and technology types. This potential reduction shown as a percentage of the Kent baseline CO_2 emissions is shown in Figure 62 and Figure 63. The uptakes represent the lead delivery partner, although in reality more than one partner will be involved in many of the schemes. This means that whilst the outcome may be shown under one sector, other partners will be required to take actions to support this sector.

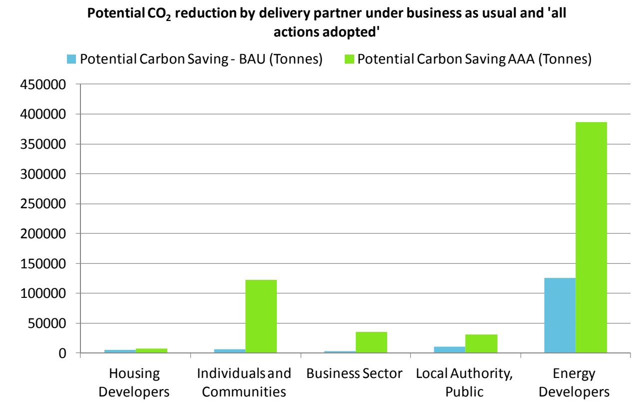


Figure 60: Potential CO_2 reduction (tonnes) by delivery partner by 2020

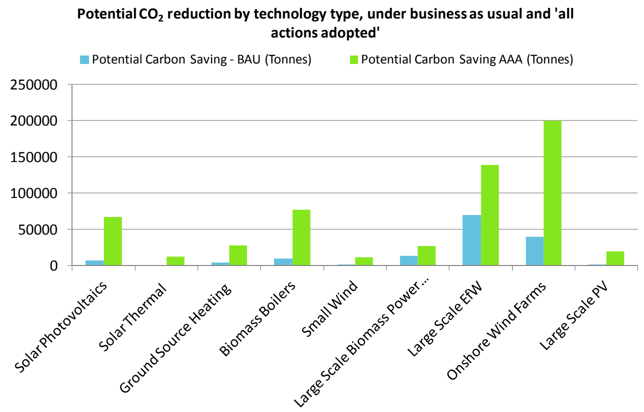


Figure 61: Potential CO_2 reduction (tonnes) by technology type by 2020

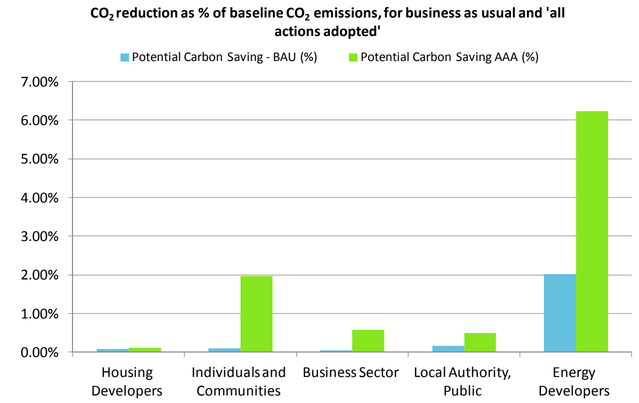


Figure 62: Potential CO_2 reduction (% against baseline) by delivery partner by 2020

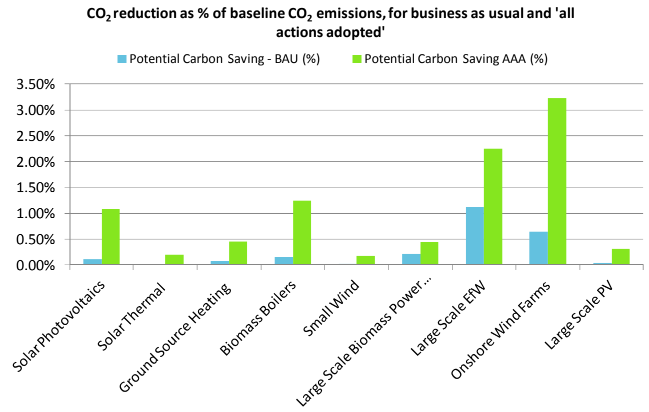


Figure 63: Potential CO_2 reduction (% against baseline) by technology type by 2020

Public Sector

The public sector is shown to provide savings of less than 1% for both scenarios. This relatively low uptake is unsurprising considering that the public sector is unlikely to commence large scale energy generation development in the same scale as commercial suppliers. The majority of public sector investment considered in the analysis is on building and site related technologies, and is therefore fundamentally limited by the public sector building stock.

Local Authorities have potential to lead by example through exemplar schemes in community and education buildings (the AAA scenario assumes solar technologies installed on 50% of buildings) but the more significant opportunity is perhaps in their role as facilitators. Helping, for example, to plan for and raise funding for the roll out of district heating networks and to ensure planning guidance related to wind turbines is clear and provides industry confidence is perhaps a more important priority for local authorities in promoting the renewable energy agenda. This facilitation role has not been accounted for within the delivery scenarios presented above. The potential for local authorities to deliver district heating in Kent is discussed in a following section below. Local Authorities could substantially increase their delivery of renewable and low carbon energy by becoming an energy company themselves following the example of Working Borough Council, however the ambition to follow such a path amongst the Kent local authority stakeholders seems uncertain at this stage.

Private Sector

The private sector shows a large increase from the baseline to the All Actions Adopted (AAA) scenario, although the maximum potential is still less than 1% against Kent's carbon baseline. The change in uptake can be partially attributed to economic drivers. Where suitable incentives are provided, there is likely to be a strong uptake if a business case can be proven. The proliferation of large scale PV planning applications is one example of this following the Feed in Tariff introduction. However the subsequent collapse of interest following the review of tariffs (rendering large scale PV uneconomic) shows the high degree of sensitivity and the future uncertainty.

Housing Developers

The smallest uptake is in the housing developer group. This is despite the fact that per building uptake of renewables in this sector is expected to be significant – driven by the tightening of Part L of the building regulations. The number of proposed new homes relative to the opportunities that exist in existing homes and business sector render the housing developer partner relatively insignificant in respect of driving overall uptake of renewable energy in Kent. This sector however is likely to have potential to raise funds through the proposed 'allowable solutions' (a buyout fund for developers who are unable to meet the 2016 zero carbon policy within the development site). This money can then be diverted by Local Authorities to push forward in other areas of renewable energy delivery. Dover is in the process of establishing a carbon fund similar to those proposed for allowable solutions. Other local authorities in Kent might be able to draw on lessons learnt in setting up this fund.

Communities and Individuals

The individuals and community delivery partner has great potential by virtue of the number of existing homes and communities in Kent. However the baseline (BAU) for this partner is extremely low. Individuals are typically capital constrained and lack interest in measures which are likely to incur a degree of hassle and deliver returns over a long time horizon. Based on uptake of the feed in tariff in Kent so far uptake in the existing homes sector could run into many thousands, but due to the likely size of installation the overall impact will still be small. For example, to save the same CO_2 as one large wind turbine, many thousands of domestic PV installations would be required.

Energy Developers

It is very clear from the uptake analysis that the most significant potential is shown by the commercial energy developers, with between 2% and 6% CO_2 reduction potential. That this is the leading sector is not surprising – energy developers are the most suitable organisation for delivering large scale energy schemes, and by virtue of the scale, any partner delivering these schemes will be an energy developer. The savings in this sector are mainly derived from large scale biomass power generation and onshore wind developments such as the example at Little Cheyne Court.

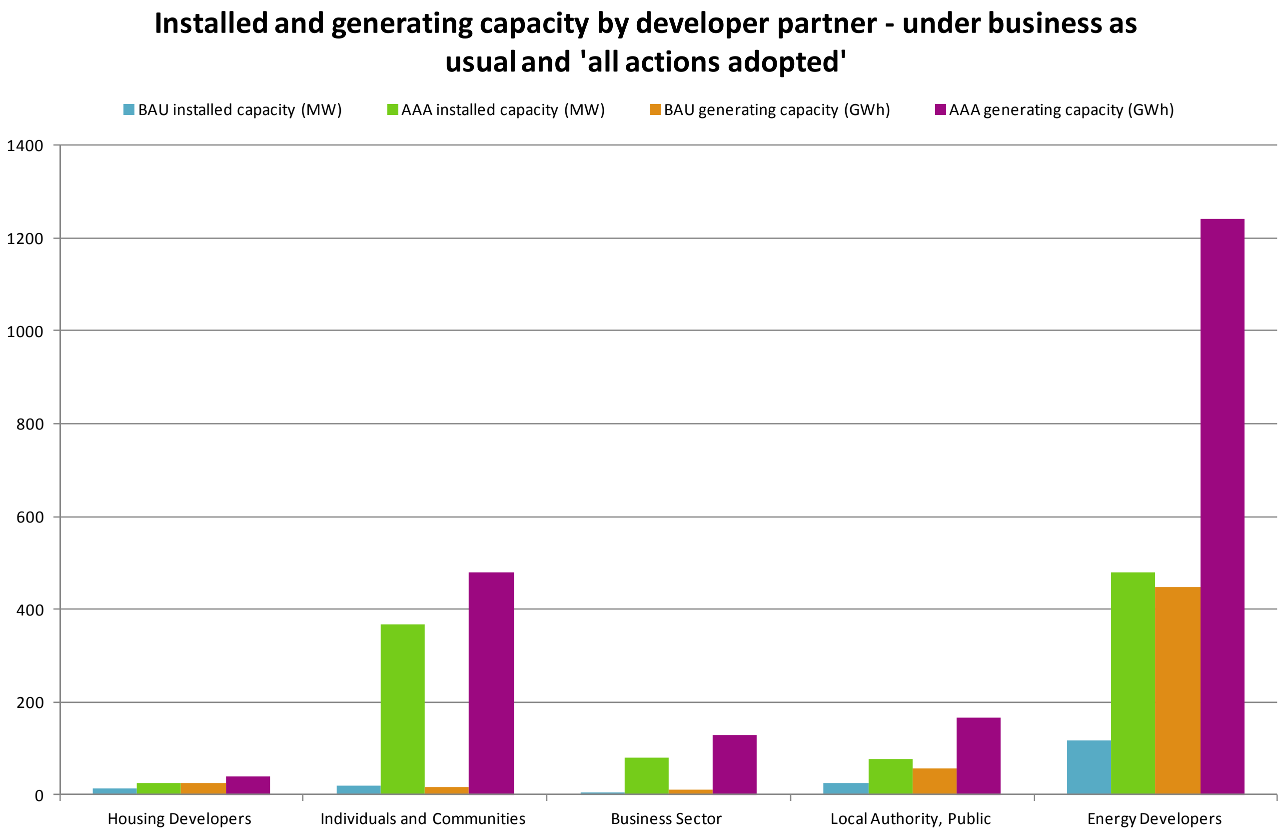


Figure 64: Installed and generating capacity by delivery partner for the business as usual and 'all actions adopted' scenarios

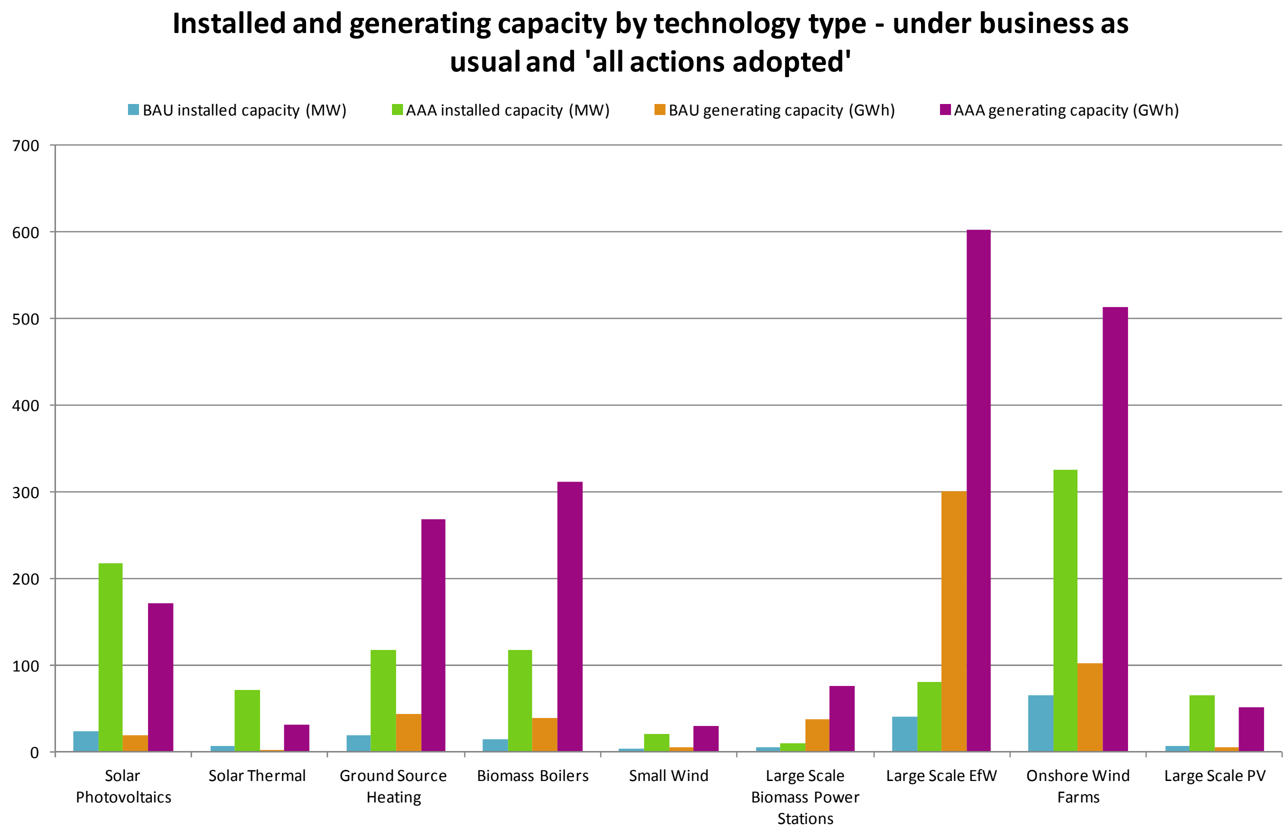


Figure 65: Installed and generating capacity by technology type for the business as usual and 'all actions adopted' scenarios

Table 13: Tables showing installed and generating capacity under both business and usual and 'all actions adopted' split by top, delivery partner and bottom, renewable technology. The data in these tables is consistent with figures presented in Figure 64 and Figure 65.

	BAU installed capacity (MW)	AAA installed capacity (MW)	BAU generating capacity (GWh)	AAA generating capacity (GWh)
Housing Developers	15.20	24.12	25.35	38.73
Individuals and Communities	19.29	367.31	16.18	478.96
Business Sector	6.55	79.07	10.23	128.78
Local Authority, Public	26.14	76.02	56.49	166.55
Energy Developers	116.50	480.00	446.63	1241.73

	BAU installed capacity (MW)	AAA installed capacity (MW)	BAU generating capacity (GWh)	AAA generating capacity (GWh)
Solar Photovoltaics	24.05	217.34	18.96	171.35
Solar Thermal	6.09	71.96	2.67	31.52
Ground Source Heating	18.83	118.13	42.89	269.06
Biomass Boilers	14.75	117.57	39.01	311.44
Small Wind	3.26	20.70	4.56	29.02
Large Scale Biomass Power Stations	5.00	10.00	37.67	75.34
Large Scale EfW	40.00	80.00	301.34	602.69
Onshore Wind Farms	65.00	325.00	102.49	512.46
Large Scale PV	6.50	65.00	5.12	51.25

	BAU installed capacity (MW)	AAA installed capacity (MW)	BAU generating capacity (GWh)	AAA generating capacity (GWh)
Solar Photovoltaics	24.05	217.34	18.96	171.35
Solar Thermal	6.09	71.96	2.67	31.52
Ground Source Heating	18.83	118.13	42.89	269.06
Biomass Boilers	14.75	117.57	39.01	311.44
Small Wind	3.26	20.70	4.56	29.02
Large Scale Biomass Power Stations	5.00	10.00	37.67	75.34
Large Scale EfW	40.00	80.00	301.34	602.69
Onshore Wind Farms	65.00	325.00	102.49	512.46
Large Scale PV	6.50	65.00	5.12	51.25

The following points can be drawn from Figure 65:

- The biomass capacity represents between 1 and 2 plants of circa 5 MW, typical of the current small scale plants small scale being developed. This level of uptake is consistent with sustainable production of local woodfuel from sustainably managed forestry, together with waste wood arisings and other arboricultural arisings.
- The energy from waste potential generation is equivalent to between 1 and 2 plants of 40MW. This seems reasonable considering Kent's predicted waste arisings from municipal solid waste and commercial and industrial waste.
- Onshore wind has a significant potential across Kent with installed capacity potential up to 325 MW in the AAA scenario, representing an assumed 13 wind farms (1 per Local Authority Area) each consisting of 10 x 2.5MW turbines. This is less than 10% of the technical potential identified in the South East Study, so in reality under the correct conditions, the uptake of wind could be much greater.
- Large scale PV and building integrated PV can makes a significant contribution, although the uptake of this will be heavily dependent on future incentive schemes.

It is important to note that the outputs presented in Figure 64 and Figure 65in general represent a large uptake of the technologies, compared with the existing baseline. Under the 'all actions adopted' scenario the expected carbon saving is approximately 10%. . The baseline scenario is estimated to deliver a carbon saving of 3%. While these figures seem a far way off the 2020 emissions reduction target of 34%, for Kent, the 10% reduction represents a goal which is difficult but possible for the county to achieve. Some further reductions should be able to be achieved cost effectively through energy efficiency interventions and the role out of efficient district heating networks, but is it clear from our analysis that action will be required in all areas to maximise Kent's contribution to the UK's overall carbon reduction commitment. To deliver a significant portion of carbon reduction through renewable energy, serious focus will need to be placed on delivery.

The location of the capacity across Kent will depend on the technology. For the smaller scale systems connected with buildings, the installed capacity is likely to be evenly spread in proportion to population and the number of buildings. Energy opportunities plans in section 4 highlight the main spatial opportunities for Wind and Biomass.

7.4 Working up the delivery scenarios – what has been assumed?

Energy Developers

Technology Types

It has been assumed that the following technologies will be delivered by Energy Developers:

- Large Scale Biomass Power Stations
- Large Scale EfW
- Onshore Wind Farms
- Large Scale PV

Installed Capacities

Assumed capacities for this large scale energy plant are shown in the table below:

Table 14: Capacity Assumptions

Technology	Capacity	Precedent installation
Large Scale Biomass Power Stations	5MWe	e.g. Ridham Dock Biomass CHP (25MWe)
Large Scale EfW	40MWe	Allington Energy from Waste (51MWe)
Onshore Wind Farms	25MW	Little Cheyne Court (59.8MWe)
Large Scale PV	5MW	Ebbsfleet Farm

Market Size

The market size for Energy Developers cannot be defined in the way we have defined the market size for other delivery partners (see below). Delivery potential for this partner will ultimately be contingent on a range of factors such as:

- Availability of suitable sites
- Ease of planning
- Access to finance and funding
- Local and public sector appetite
- Availability of resources (wind speeds, certainty on resource streams (e.g. biomass and waste)

We have established our business as usual scenario (BAU) broadly based on what has been delivered over the last 10 years and what we know is in planning. The optimised scenario represents the maximum number of installations we believe could be delivered, considering issues around acceptability, visual impact etc. Stakeholder workshops highlighted that although this partner clearly has potential to deliver the greatest renewable energy contribution there is low ambition for this type of large scale installation amongst public sector stakeholders in Kent.

Market Penetration and Uptake Assumptions

Table 15: Scenario Market Penetration and Uptake Assumptions for Energy Developers

Technology	BAU (#)	Reasons	AAA (#)	Reasons for increased uptake
Large Scale Biomass Power Stations	1	Assume 1 5WMe as the BAU scenario.	2	• Assumes projects being considered at Ridham Dock (25MW) and Richborough Energy Centre (10MW) are constructed. • Limited to 10MW total due to availability of sustainable wood fuel from within Kent. Figure could be higher if biomass supplies were imported.
Large Scale EfW	1	Assumes that the equivalent to one 40MWe EfW plant will be installed by 2020, e.g. a 40MWe EfW plant at Kemsley Paper Mill has received planning permission. If the EfW plant planned at Richborough Energy Centre or others are constructed this figure could be slightly higher.	2	• Assumes equivalent capacity of two large scale EfW facilities is installed, mainly for Commercial and Industrial Waste. • KCC plans for the provision of energy from waste facilities to process an additional 600,000 tonnes of waste per annum by 2020, based on the South East Plan high growth projections for waste arising rates and KCC assumptions on waste management routes. It should be noted that lower growth rates are considered more likely by KCC.
Onshore Wind Farms	3	Broadly assuming Wind farm applications in planning can gain approval and be constructed before 2020.	13	• Assume 1 per local authority (on the scale of Little Cheyne Court) by 2020
Large Scale PV	1	Thanet (Ebbsfleet Farm) is installed. Other solar farms are in planning but may not survive changes to Feed in Tariff rates	13	• Assume 1 per local authority by 2020 • Investors regain confidence in Feed in Tariff – PV costs reduce sufficiently to deliver reasonable returns on investment

Individuals and Communities

This delivery partner group includes private homeowners and occupiers, local community groups who might be seeking to install renewable energy generation on homes or public buildings or land in their area, and landlords and housing associations who might also install renewable energy on existing properties. It also covers third sector organisations who might install slightly larger-scale renewable energy generation on their land or buildings.

Technology Types

As with Housing Developers, the majority of activity by this delivery group in Kent to date has been focussed on micro-generation technologies – with solar thermal and photovoltaics being the most commonly implemented technologies, reflecting take-up in the domestic sector nationally. With the introduction of Feed in Tariffs (FITs) in April 2010, solar PV has seen a surge in installations, with 1173 domestic installations under FIT in Kent and Medway between April 2010 and June 2011. This is in comparison with much lower take-up of the FIT for wind, hydro and anaerobic digestion technologies, which have had 13, 1 and 0 installations in Kent respectively, over the same period.

In addition to solar technologies uptake of ground and air source heat pumps and biomass boilers at domestic scale can be expected. Air source heat pumps are not currently included in the RHI but may be introduced at a later date. The view presented by NERA in their February 2010 *Design of the Renewable Heat Incentive* study for DECC, is that heat pumps are likely to make a more significant contribution to the delivery of renewable heat in the domestic sector in the future, alongside solar thermal technology.

For the purpose of testing alternative scenarios for uptake of renewable technologies a simplistic assumption has been made that the likely technologies to be used predominantly in the domestic sector will be:

- Solar thermal water heating
- Solar photovoltaics
- Ground/air source heating (Heat pumps)
- Biomass boilers

In addition to the potential renewable technologies installed on existing homes this section includes an estimate of installed capacity and generating potential that may arise through community projects. The technologies assumed most likely for local community projects were assumed to be:

- Small wind
- Community PV

Installed Capacities

The following technology installed capacities have been assumed for existing homes. Note that the biomass assumptions are based on a communal system rather than individual boilers in each dwelling.

Table 16: Capacity Assumptions

Technology	Typical Installation Size	
	Flats	Houses
Solar Thermal	2kW	3kW
PV	0.3-0.5kW	0.5-3kW
Heat Pumps	2kW	5kW
Biomass boilers	2kW	5kW

Installed capacities for community installation were assumed to be:

- Small wind – 20kW
- Community PV – 10kW

Baseline Estimation

It is difficult to set a baseline for the delivery of micro-generation within Kent, and the UK as a whole, because small scale installations are not formally monitored and, due to the classification of the majority of micro-generation installations as permitted development, are not recorded in planning applications. The data sets which are available provide an incomplete picture and are often not broken down to the county level.

However, there are some sources of information which can be used to form a rough picture of the current level of micro-generation technologies installed in Kent, which have been used to inform a 'Business as Usual' scenario for renewable energy up-take:

- Data gathered by Element Energy in 2008 on a national basis on the levels of installation of various micro-generation technologies, from public grant initiatives records and from industry associations – Numbers of micro-generation units installed in England, Wales, Scotland and Northern Ireland, Final Report for BERR, November 2008
- More recent data on the Low Carbon Buildings Programme – Low Carbon Buildings Programme 2006-11 Final Report, DECC, Energy Saving Trust, BRE, Carbon Trust, August 2011;
- Projections on the national impact of the FIT – Impact Assessment for the Feed-In Tariffs Order 2011, DECC, April 2011; Design of Feed-in Tariffs for Sub-5MW Electricity in Great Britain, Element Energy, July 2009;
- Recently published data on installations under the Feed in Tariff which reports installations on a Local Authority basis – Ofgem website, July 2011;
- Projections on the national impact of the RHI - Design of the Renewable Heat Incentive, Study for DECC – NERA, February 2010; RHI Impact Assessment, DECC, March 2011;
- Heating system information - Homes Energy Efficiency Database (HEED) Area Summary Report, Energy Saving Trust, provided by Kent County Council, November 2010

Compared to some of the other delivery partners, the total potential capacity installed by this partner is likely to be relatively small due to the small size of installed technologies. For example, NERA's *Design of the Renewable Heat Incentive* report anticipates that domestic installations will account for 14% of the total additional renewable heat resource supported by the RHI, though this is subject to variation when the scheme is implemented.

The baseline for community group projects is assumed to be low as there is little evidence for existing community group projects in Kent of the kind where a local group comes together to install micro-generation on domestic properties or land in their area. Under the Low Carbon Buildings Programme, only 15 'community group' projects received grants in the whole of the South East. Under the Feed-in Tariff, a total of 11 community installations of solar PV and 2 installations of wind turbines have taken place in Kent to date. However, there are a number of micro-generation installations by third sector organisations in Kent, which often form an educational resource for the community.

Market Size

The housing allocations within the South East Plan for the authorities within Kent and Medway equate to an increase of around 1% to the stock of homes in Kent and Medway each year. Projecting this increase forward, the current existing homes stock will account for approximately 90% of housing in 2020, with new homes built between now and 2020 accounting for approximately 10%. Whilst new build housing has regulatory drivers which mean that the uptake rate of renewables will tend to be higher in that sector, existing properties, because of the absence of regulatory drivers, and because it accounts for such a large proportion of the stock, obviously needs to be targeted with measures to improve uptake. There are currently a total of approximately 725,000 homes within Kent and Medway[30].

The Kent & Medway Strategic Housing Market Assessment is covered in more detail in the housing developers section. Some of its analysis is useful for applying to a consideration of the market for micro-generation in Kent; as noted above, the mix of dwelling types and densities has a significant impact on which low carbon and renewable energy technologies are most feasible and viable. Demographic analysis may also show whether the Kent population has characteristics which are seen as being favourable for renewables uptake, e.g. a higher proportion of owner-occupied properties. The broad split of existing homes in Kent (i.e. detached, semi detached, terraces etc) is set out in the housing developer section. The Strategic Housing Market Assessment also provides a split of tenure types of existing housing in Kent and Medway. 84% of homes are owner occupied, 7% privately rented. The remaining 9% is made up of 4% Local Authority Rented, 4% Social Housing with 1% classified as 'other'.

[30] Source: HEED District Summary Report, provided by Kent County Council, November 2010

Tenure splits are fairly similar to those reported by HEED for England, but with a higher than average proportion of owner occupied properties (also higher than the SE average) and lower than average proportion of social housing. This is likely to be favourable rather than otherwise to the market for renewables, as despite the introduction of the Green Deal in 2012 - which is intended to address some of the problems of landlords and tenants being disincentivised to invest in rented properties – it is expected by that take up in rented properties will be relatively low.[31] For example, within the main domestic grants stream under the Low Carbon Buildings Programme (LCBP), the majority of grant recipients were owners of detached housing (houses and bungalows), which accounted for 73% of grants. The majority of these grants went to 3-5 bedroom houses, indicating that the more affluent, larger housing groups were more likely to take up renewable energy technologies. On the other hand, a lower than national average proportion of social housing in Kent means that opportunities for investment at scale by housing associations and local authorities are more limited.

In government-funded renewable energy programmes in England to date, including the LCBP and FITs, the South East and West have historically been the regions showing the highest uptake of incentives for renewable technologies. Whilst this is likely to be in part due to resource potential factors, i.e. sunnier climates, it promises well for a greater level of uptake of renewable energy in the future.

In addition to the residential market, there are a large number of active community and third sector groups in Kent. Those most likely to be early adopters of renewable energy are organisations who have a remit involving environmental activities, and Kent has a number of existing renewable energy installations of this kind, for example at visitor centres in nature areas, and in heritage properties owned by conservation trusts.

In building scenarios a simplistic estimate of renewable potential has been made based on the number of wards in Kent and the split within these for urban and rural. There are 305 Wards in Kent made up of 202 urban and 103 rural. A simplistic assumption was made that rural wards may have potential for small wind turbines, and urban wards would be more suited to community PV projects such as the community project at Pines Calyx Conference Centre in Dover (St Margaret's Bay Trust).

[31] See for example *Energy Bill: Green Deal Impact Assessment*, DECC, December 2010.

Market Penetration and Uptake Assumptions

In the table below common barriers for uptake of renewable energy are analysed in respect of their potential to alter the deployment of renewables specifically in the individuals and communities sector. Barriers are ranked according to their perceived impact on uptake.

Table 17: Scenario Market Penetration and Uptake Assumptions for Individuals and Communities

	Technology	BAU (%)	Reasons	AAA (%)	Reasons for increased uptake
Existing Homes	Solar Thermal	0.02%	UK market size thought to be between 2000 and 4000 installations annually. Assume around 100 in Kent based on population. Around 1000 in Kent by 2020 (0.02% of homes)	3%	• Technology costs and willingness to pay are likely to be major barriers for individuals. Costs not predicted to fall at the same rates as for PV. PV is also improving in efficiency. • Renewable Heat Incentive will support uptake of solar water heating.
Existing Homes	PV	1%	Ofgem reported 1.6MW domestic retrofit PV installed 2010 – 11 on 728 projects (typically between 1.5 and 3kW per installation). 728 homes is approx 0.01% of stock. Should this level of uptake continue until 2020 approx 1% of homes would have PV.	10%	• Installation costs may reduce as the local supply chain learns and grows. • Trigger points – companies may begin to offer reduced hassle installation with supportive finance packages.
Existing Homes	Heat Pumps	0.1%	AECOM assumption	2%	• Renewable Heat Incentive
Existing Homes	Biomass boilers	0.1%	AECOM assumption	2%	• Renewable Heat Incentive • Local awareness raising – Forestry Commission, Kent Downs Woodfuel Pathfinder • Supply chain development
Community Projects	Community Wind (Rural)	5%	15 community projects of this nature have taken place in Kent to date – assume same number again by 2020 (30 projects) 10% of wards (split between wind and solar). Note: Only 3 wind turbine applications came forward 2010 – 11 under the FITs.	20%	Assume community wind projects in 60 rural wards due to - • Feed in Tariff • Local share schemes • Allowable solutions funds

	Community solar PV (urban)	5%	See above	20%	Assume community PV projects in 60 urban wards due to - • Feed in Tariff • Local share schemes • Allowable solutions funds • Public/community buildings made available

What would 100% uptake represent for this delivery partner?

For existing homes 100% uptake would be an installation on every home. In reality physical constraints (orientation, access etc) would prevent this. The uptake percentage aims to account for these physical restrictions as well as market and other limitations. For community projects 100% uptake is capped at 1 project per ward. Wind projects are restricted to the rural wards; urban wards assumed use of PV on community buildings.

Private Sector (including Offices, Retail, Factories and Warehouses and Farms)

This partner will predominantly install renewable technologies on buildings. The data for commercial and industrial buildings covering offices, retail and industrial is from the Valuations Office Agency (VOA). This data set provides a total number of buildings and total floor areas for each Kent local authority.

It has been assumed that farms also offer some potential for installing renewable technologies. Wind and Solar PV have been assumed potentially attractive to farmers under the Feed in Tariff. The data for number and size of farm holdings in Kent is taken from Defra's June survey of Agriculture and Horticulture. (http://www.defra.gov.uk/statistics/foodfarm/landuselivestock/junesurvey/)

Technology Types

Building integrated technologies are the same as assumed applicable in the housing sector, albeit at different scales. These are solar water heating, solar photovoltaics, ground source heat pumps and biomass boilers. Small scale wind was assumed appropriate for some warehouse/industrial buildings – assuming in industrial or out of town trading estates. Small scale wind and PV were assumed applicable for farm applications.

Installed Capacities

Table 18: Installed capacity assumptions

<table>
<tr><th>Building Type</th><th>PV</th><th>Ground Source Heating</th><th>Biomass Boilers</th><th>Small Wind</th></tr>
<tr><td>All Offices</td><td rowspan="4">Calculated based on floor and roof areas. Assumed 50% of roof area (max) usable and 7m^2 panel per kWp</td><td>Average installation size 20kW</td><td rowspan="4">Sized to deliver 50% heat demand where peak is calculated based on 60W/m^2 floor area</td><td rowspan="2">n/a</td></tr>
<tr><td>Retail</td><td rowspan="4">n/a</td></tr>
<tr><td>Warehouses</td><td>20kW per warehouse</td></tr>
<tr><td>Factories</td><td>20kW per factory</td></tr>
<tr><td>Commercial Farms</td><td>Assumed 1 20kW installation possible per farm (max)</td><td>n/a</td><td>Assumed 1 20kW installation possible per farm (max)</td></tr>
</table>

Market Size

Table 19: Market Size Assumptions

Building/Land holding Type	Count	Total Floor Area (m^2)	Average Floor Area (m^2)	Assumed storey height
All Offices	17,000	3,885,000	246	Between 2 – 4 depending on office type
Retail	15,500	3,250,000	209	1
Warehouses	6,750	3,888,000	798	1
Factories	6,400	5,066,000	620	1
Commercial Farms	3,000	-	-	-

Market Penetration and Uptake Assumptions

Table 20: Scenario Market Penetration and Uptake Assumptions for Private Sector

Technology		BAU (%)	Reasons	AAA (%)	Reasons for increased uptake
PV	Offices	0.2%	Close to zero uptake to date in this sector for all technologies. Assumed a bit higher for farmers and land owners due to Feed in Tariff and easy access to space. Few companies own their premises, and might another reason for depressed uptake rates.	5%	▪ Simplicity of installation ▪ Feed in tariff revenues ▪ Attractive on factories and warehouses and farms due to large barn roof space ▪ Can also reduce electricity demand from these buildings helping to deliver further savings ▪ Marketing and publicity
	Retail				
	Factories and Warehouses				
	Farms	5%		20%	
Heat Pumps	Offices	0.2%		3%	▪ Renewable Heat Incentive ▪ Industry lobbying/ marketing and publicity ▪ Uptake slowed (relative to PV) due to complexity of installation and running costs.
	Retail				
	Factories and Warehouses				
Biomass boilers	Offices	0.2%		3%	▪ Renewable Heat Incentive ▪ Pushed for rural businesses by programmes/support from Forestry Commission, Kent Downs Woodfuel Pathfinder ▪ Support local forestry management and employment – links to Countryside stewardship ▪ Supply chain development
	Retail				
	Factories and Warehouses				
	Farms	5%		20%	▪ Renewable Heat Incentive ▪ Industry lobbying/ marketing and publicity
Small Wind	Factories and Warehouses	0.2%		3%	▪ Feed in Tariff ▪ Industry lobbying/ marketing and publicity
	Farms	5%		20%	

What would 100% uptake represent for this delivery partner?

For the building integrated technologies (aside from on farm PV) 100% uptake represents the maximum possible renewable installation on every available building. In reality physical constraints (orientation, access etc) would prevent this. The uptake percentage aims to account for these physical restrictions as well as market and other limitations. For farm projects 100% uptake is capped at 1 installation per farm (wind or PV).

Public Sector (including Schools, Libraries, Council offices etc)

This partner is likely to have a role installing renewable energy technologies on public sector buildings including schools, hospitals and local authority buildings. Data on type and size of buildings in these categories varies in quality. Key assumptions are listed below.

Technology Types

As for other sectors where uptake is assumed to be largely building integrated. Technologies considered appropriate include: solar water heating, solar photovoltaics, ground source heat pumps and biomass boilers.

Installed Capacities

Table 21: Installed capacity assumptions

Building Type	Solar Water Heating	PV	Ground Source Heating	Biomass Boilers
Primary Schools	Calculated based on areas and energy benchmarks 47kW	125kW	652kW	256kW
Secondary Schools	Calculated based on areas and energy benchmarks 233kW	250kW	946kW	2,328kW
Universities	Calculated based on areas and energy benchmarks 3,516kW	9,430kW	6,960kW	13,920kW
Hospitals	300kW	300kW	7,000kW	10,000kW
Community Buildings	10kW	5kW	10kW	10kW
Libraries/Sports/Emergency Services	10kW	5kW	10kW	10kW

Market Size

Table 22: Market size assumptions

Building Type	Count	Assumed average floor area (m^2)	Assumed roof area (m2)
Primary Schools	543	2,000	2,000
Secondary Schools	153	10,000	2,000
Universities	2	22,5000	56,250
Hospitals	8	-	-
Community Buildings	Assumed 100 based on KCC listings	-	-
Libraries/Sports/Emergency Services	Assumed 500 based on KCC listings	-	-

Market Penetration and Uptake Assumptions

Table 23: Scenario Market Penetration and Uptake Assumptions for Public Sector

Technology	Buildings	BAU (%)	Reasons	AAA (%)	Reasons for increased uptake
Solar Thermal	Education buildings	5%	Assumed some installation under BAU – exemplar schemes	10%	• If large scale installation was planned and delivered under Renewable Heat Incentive
	Hospitals	10%	Assume 1 hospital with PV	30%	• Assume 3 hospitals with PV
	Libraries & Emergency Services etc	10%	Assumed some installation under BAU – exemplar schemes	50%	• Assume higher uptake due to community share schemes and public sector support
PV	Education buildings	5%	Assumed some installation under BAU – exemplar schemes	10%	• If large scale installation was planned and delivered under Feed in Tariff
	Hospitals	10%	Assume 1 hospital with PV	30%	• Assume 3 hospitals with PV
	Libraries & Emergency Services etc	10%	Assumed some installation under BAU – exemplar schemes	50%	• Assume higher uptake due to community share schemes and public sector support
Heat Pumps	Education buildings	1%	Assumed some installation under BAU – exemplar schemes	2%	• AECOM assumption
	Hospitals	10%	Assume 1 hospital with heat pumps	30%	• Assume 3 hospitals with heat pumps
Biomass boilers	Primary Schools	3%	Assumed 22 schools recommended by CEN with boilers approaching end of life convert to biomass	6%	• If large scale installation was planned and delivered under Renewable Heat Incentive
	Secondary Schools	3%		6%	• If large scale installation was planned and delivered under Renewable Heat Incentive
	Universities	0%	Assume zero uptake under BAU	33%	• Assume 1 of the 3 Kent Universities switches to biomass
	Health and Hospitals	0%	Assume zero uptake under BAU	25%	• Assume 2 of the 8 Kent Hospitals switch to biomass
	Community Buildings	10%	Assume 10 community buildings switch to biomass	20%	• Assume 20 community buildings switch to biomass

Housing Developers

Technology Types

AECOM's work reviewing the activity of key delivery partners in Kent has shown that until now most case studies demonstrating uptake of renewable technologies in the new homes sector are focused on micro-generation technologies – primarily solar water heating and photovoltaics. These technologies also came out most favourably within the multi-criteria analysis undertaken as part of the Kent Thameside Eco-Assessment. (AEA, Savills, September 2010) and it was the view of the attendees of the Kent Developers Forum (8th September 2011) that these technologies will continue to prevail in the new homes sector.

In addition to solar technologies some uptake of ground and air source heat pumps and biomass boilers at domestic scale can be expected, depending on local circumstances (i.e. off gas network homes), regulatory and financial drivers and density and design of new development. Large single rural new homes, for example, could be well suited to the use of small scale biomass boilers. Heat pumps are currently given an advantage for new homes because the building regulations assessment/calculation procedure does not take full account of carbon associated with electricity they consume (a fuel factor is used to compensate). This may change in future, although it is also hoped that emissions from grid electricity will decrease overtime. Uptake of heat pumps could also be improved by the launch of the Renewable Heat Incentive (RHI) for homes and the Green Deal. It is likely that some new homes will be connected to district heating networks – which may ultimately be scaled up sufficiently to utilise waste or renewable heat. (e.g. Kent Thameside) although in the interim stages these embryonic networks are likely to use gas fired combined heat and power and as such would not be considered renewable.

For the purpose of testing alternative scenarios for uptake of renewable technologies an assumption has been made that the predominant technologies to be used in the new homes sector will be:

- Solar thermal water heating
- Solar photovoltaics
- Ground/air source heating
- Biomass boilers

Installed Capacities

Table 24: Installed capacity assumptions

Technology	Low (BAU)		All actions adopted (AAA)	
	Flats	Houses	Flats	Houses
Solar Thermal	2kW	3kW	2kW	3kW
PV	0.3kW	0.5kW	0.3kW	1.2kW
Heat Pumps	2kW	5kW	2kW	5kW
Biomass boilers	2kW	5kW	2kW	5kW

Market Size and Type

Figures for new homes built in Kent since 2006 for each of the Kent local authorities are set out in the Housing Information Audit 2009/10, together with projections of housing supply required to deliver on the South East Plan Targets. The South East Plan has now been revoked but the housing targets have been used in the absence of any revised targets or projections on the delivery of new housing in the Region.

The total number of dwellings completed in the county (KCC area) on all sites in the year ending 31st March 2010 was 4,086 units, bringing the total number of dwelling completions since the beginning of the SE Plan period to 24,269. This consists of an average annual completion rate of 6,067 units. In order to meet the SE Plan target of 123,120 dwellings by 2026 a further 98,851 dwellings are required to be built during the next 16 years; an average of 6,178 dwellings a year. This equates to an additional c. 1% to the stock of homes in Kent and Medway each year.

Whilst there is considerable uncertainty that the targeted number of new homes will be delivered in practice there is further uncertainty about the types and scale of development that might come forward. Population in Kent and Medway has grown by one quarter in the 25 years up until 2006, indicating that there is significant scope for demographic and economic change between now and 2031. The greatest demand for new homes is expected to be for single person and multi-person households (i.e. where the occupants are not related). A significant proportion of the growth in single person households will be driven by older people living alone. Growth in the population aged 75+ is projected to grow by around 86% in Kent and Medway between 2006 and 2031. The mix of dwelling types and densities of development that will come forward in Kent will impact on which low carbon and renewable energy strategies and technologies are most feasible and viable.

The broad split of existing house types in Kent is as follows:

- Detached homes: Between 13% for Dartford, Gravesham and Medway to over 30% in Ashford, Canterbury and Sevenoaks.
- Semi-detached and terraces: Between 50% and 70%
- Flats, maisonettes and other (excluding mobile homes): Between 10% and 23% with the lowest proportion in Ashford and highest in Thanet, Shepway and Tunbridge Wells.

The Kent & Medway Strategic Housing Market Assessment provides a useful overview of the housing market in Kent considering issues such as; ageing population, household income (and inequality), affordability and accessibility of housing, housing need, delivery of housing, regeneration and renewal and sustainability (cross cutting). It sets out that there are 4 housing markets within Kent (i.e. areas where 70% of moves are contained – which typically correspond to areas where the majority of people both live and work). These are set out in the table below together with an overview of key issues and key strategic site allocations. This analysis has been used to inform the likely mix of dwelling types that may come forward in each market.

Table 25: Housing Market Summary

Housing Market	Characteristics and expected future growth
North Kent	• Traditional older terraced properties • North Kent has a relatively younger population. • Close proximity to London • Good access to Universities and colleges in Medway • Lower proportion of detached properties • Generally relatively high density development proposed – infill. • **50,000 new homes planned by 2030.** ***Strategic sites*** • 17 sites within Kent Thameside **(Gravesham and Dartford)** catering for 25,000 new homes and 50,000 new jobs over the next 20 years. Assumed to be mostly medium to high density. Many of these sites already have existing planning permissions or are already in construction although the Kent Thameside Eco-Assessment sets out that few have made commitments in respect of binding energy or sustainable development targets. • **Medway** - Numerous sites identified through the Strategic Land Availability Assessment (May 2011). Significant sites include Lodge Hill, Rochester Riverside and Chatham Waterfront. Overall 16,000 homes, 23,000 jobs and 1 million sq ft of commercial space are planned over the next 20 years. • **Swale** - 8,000 new homes, 12,000 jobs and over five million sq ft of commercial development planned with support of the new Northern Relief Road and expansion of the Kent Science Park.
East Kent	• Characterised by older smaller size housing • Highest proportions of single person living (31%) • East Kent had the highest proportion of completions of small (1 and 2 bed) properties in 2007/08 (76% of completions) ***Strategic sites*** • **Canterbury** – numerous sites listed and mapped in the Canterbury SLAA – sites at

	various stages of assessment. Little indication provided of possible dwelling numbers. • **Dover** - Dover Waterfront, Mid Town (100 homes plus commercial), Connaught Barracks (500 homes), Whitfield Expansion (400 homes). • **Thanet** – Manston Park, Westwood (1,600 homes) • **Shepway** – Folkstone, West Hythe, New Romney, Sellinge, Stanford and Lympne and Hawkinge.
Ashford	• Higher than average detached homes • Rural, attractive family living – 31% family living • With the exception of Tunbridge Wells, West Kent's housing stock has a lower proportion of flats than the rest of Kent and Medway and is composed of predominantly detached and semi detached housing built between 1964 and 1995. • Predominantly lower density housing ***Strategic sites*** • Sites split – rural, urban and town centre. Urban sites include Chilmington Green (over 6,000 homes) and Cheseman's Green (over 6,000 homes).
West Kent & Maidstone	• Higher than average detached homes • High incidence of family living • Tunbridge Wells has the highest proportion of houses (45%) built pre 1919 in the County. • 66% of all completions 2007/8 were 1 and 2 bed homes ***Strategic sites*** • **Sevenoaks** – Residential sites identified in Sevenoaks (e.g. Rye Lane, Hitchin Hatch Lane), Swanley (e.g. Goldsel Road (c. 100 homes), Nightingale Road (128 homes), Bevan Road, Bus Garage), Edenbridge (e.g. West of Station Road (260 homes) and other settlements. With exception of sites noted above sites typically between 10 and 50 homes. • **Tunbridge Wells** – Number of sites at c. 10 – 50 homes. Potential for 95 homes at Oakbeam Carpark and 279 homes at Caenwood Farm. • **Maidstone** – Housing demand assumed to be delivered through existing permissions, SHLAA sites, town centre sites, accepted sites within rural service centres, greenfield sites on the edge of Maidstone and an allowance from windfall sites. (Maidstone Urban Extension – 13 sites/11,000 homes) • **Tonbridge and Malling** – Sites will be released to enable delivery of 6000 new homes by 2026. Majority of new homes will be in the main urban areas.

Assumed New Housing Split

Table 26: Housing Type Split

Housing Market	Assumed housing split		
	Detached	Semi/terrace	Flats/other
North Kent	15%	60%	25%
East Kent	25%	50%	25%
Ashford	30%	60%	10%
West Kent & Maidstone	25%	60%	15%

Market Penetration and Uptake Assumptions

The most recent proposals for zero carbon in new homes, currently scheduled as the minimum standard from 2016, is that the 'carbon compliance' target (i.e. what must be delivered by developers as an integrated part of the development) will be set between a 44% and 56% reduction on regulated emissions (against Part L 2006) depending on the house type. This will be combined with a minimum standard for fabric energy efficiency (FEES). In most cases these targets can be delivered using PV, or with a variety of other technologies. Where solar thermal or heat pumps are used some PV may also be required as a top up to deliver the higher targets.

Aside from the building regulations, planning policy and financial drivers such as FiT and RHI could increase uptake in new homes in the future, especially in self builds or the housing association sector where the benefits can be more easily recouped. It is proposed that the RHI will be extended to homes in October 2012. It will cover most heat producing technologies, although it is not clear whether it will be extended to cover air source heat pumps. Possible barriers to uptake may be concerns around technology life and maintenance (real or perceived) – this was a concern for housing associations represented on the Kent Developers Forum.

In the table below common opportunities and barriers for uptake of various renewable energy are analysed in a multi criteria analysis to help determine appropriate assumptions for deployment of renewable, specifically in the new homes sector. Barriers are ranked according to their perceived impact on uptake.

Table 27: Scenario Market Penetration and Uptake Assumptions for Housing Developers

Technology	BAU (%)	Reasons	AAA (%)	Reasons for increased uptake
Solar Thermal	20%	It is assumed that in order to meet Part L 2010 and beyond 20% of new homes would have solar water heating installed.	35%	• Renewable Heat Incentive • Reduced running costs • Simple proven technology • Uptake capped as technology (alone) cannot deliver against future Part L targets
PV	30%	It is assumed that in order to meet Part L 2010 and beyond 30% of new homes would have solar PV installed.	50%	• More challenging planning policy – in advance of regulation. • Feed in Tariff • Reduced running costs • Simple proven technology • Free solar schemes
Heat Pumps	20%	It is assumed that in order to meet Part L 2010 and beyond 20% of new homes would have solar PV installed.	30%	• Renewable Heat Incentive
Biomass boilers	10%	It is assumed that 10% of new homes would have a biomass boiler installed – uptake is assumed lower than for other technologies due to concerns over air quality and fuel supply. Also the technology is not well suited to individual homes.	15%	• Forestry Commission push in Kent • Increased uptake in rural areas or as part of community district heating schemes. • Renewable Heat Incentive • Uptake capped due to uncertainty over future fuel costs

7.5 What is missing from our delivery scenarios?

As stated at the beginning of this section we did not set out with our delivery scenarios to capture all potential technologies or delivery routes. Our approach was intended only to outline the potential scale of impact that actions may have on possible uptake.

Some gaps in our approach include:

- **District heating networks:** Most district heating networks in the short term are likely to rely on gas fired combined heat and power and so will not be renewable. In the future these networks may switch to biomass CHP or fuel cells and could then be considered renewable networks. It is not really clear who is likely to drive the installation of these networks. Small scale networks could be delivered by developers but this is likely to require facilitation by local authorities and eventually engagement with energy service companies (energy developers) as the embryonic networks begin to grow in size and potentially begin to realise benefit from diversity of loads and waste heat from power stations.
- **New development (commercial):** Housing developers are listed above as a delivery partner. We have not considered new development in the non domestic sector. As for new domestic development this is not likely to be a major contributor in terms of potential for overall reduction of carbon emissions. Quantum of new non domestic development is less well defined than for the residential sector and uptake of renewable in this sector is likely to be driven by the proposed tightening of Part L of the building regulations.
- **Allowable solutions:** the potential impact of allowable solutions, which are likely to include the option for developers to meet zero carbon targets through contributing to renewable energy installations outside their development site, has not been considered here.
- **Building types:** We have tried to identify numbers for key building types in Kent. Buildings include homes, offices, retail, warehouses and factories. KCC have provided lists of public sector buildings. It is likely that this is an incomplete list and that there are buildings in the public sector category that have not been properly considered within our scenario testing.
- **Hydro:** Hydro power has not been considered for any of the identified development partners. Overall potential for Hydro power in Kent is low. Projects are likely to be brought forward by land owners and business, although only in the relatively few locations where Hydro is appropriate (see chapter 4).
- **Co-firing of biomass**: We have considered biomass power stations under the energy developer partner group but have not specifically identified the potential for co-firing of biomass in existing power stations. The previous South East Study made some assumptions for the contribution from co-firing.
- **Anaerobic digestion**: The study has not considered in depth the potential for anaerobic digestion from on farm sewage or food waste.

The delivery potential for District Heating in Kent

District heating networks are not necessarily renewable but can deliver energy efficiency and carbon savings by taking advantage of the diversity of demand that typically exists across a large energy network. All networks require a ‘plug in’ fuel source.

Biomass networks deliver the greatest carbon saving, but significant savings can also be made using gas-fired CHP because waste heat from power generation is captured and distributed for heating. This waste heat is conventionally lost where power generation takes place centrally in power stations.

District heating is most attractive where there is a high density of built development, and especially where there is a mix in building types. This diversity of energy demand helps to keep combined heat and power (CHP) or boiler plant running in a more steady state for longer – which is more efficient. Biomass boilers are sometimes installed alongside ‘buffer vessel’ which further help to regulate the demands placed on the boiler plant.

For Kent is has been assumed district heating networks may come forward as follows:

- **Small local networks:** Typically between 10 and 50 homes in a street or a block. Gas fired boilers or biomass boilers supplying heat only
- **Medium size networks:** Typically over 200 homes and normally with an ‘anchor building’ (i.e. a school, hospital or leisure centre)
- **Large networks** – A number of small and medium sized networks linked up and perhaps taking heat from a large biomass or energy from waste power station.

Heat mapping for Kent has identified significant heat clusters in 9 locations:

- Swanley/Huxtable
- Medway
- Maidstone (perhaps more than 1 network)
- Sittingbourne/Kemsley
- Ashford
- Canterbury
- Tunbridge Wells
- Tonbridge
- Thanet (perhaps more than 1 network)

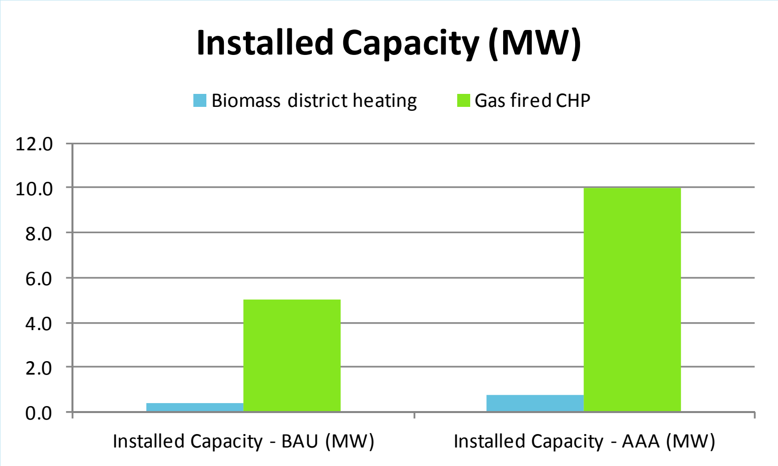
For the purpose of high level scenario testing the following has been assumed for the ‘All Actions Adopted scenario’:

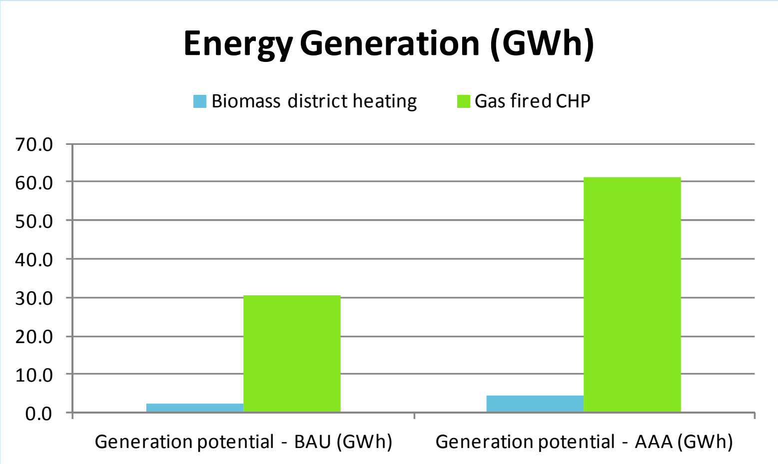
- 40 biomass district heating networks comprising c. 50 homes each will be installed by 2020 (Assume 100 kW per installation)
- 15 gas fired CHP networks, each of c. 2,000 homes and associated ‘anchor’ demands will be realised by 2020. (Assume 2MWe per installation)

Notes: 1. The business as usual (BAU) scenario assumes 50% of the above

2. The district heating potential is not included in the earlier scenario modelling as it is not clear which of the identified delivery partners would take responsibility for the delivery of the networks

The results for the BAU and AAA adopted scenarios for district heating are shown in the figures below. The AAA scenario would deliver a saving of 0.45% against Kent’s carbon baseline.





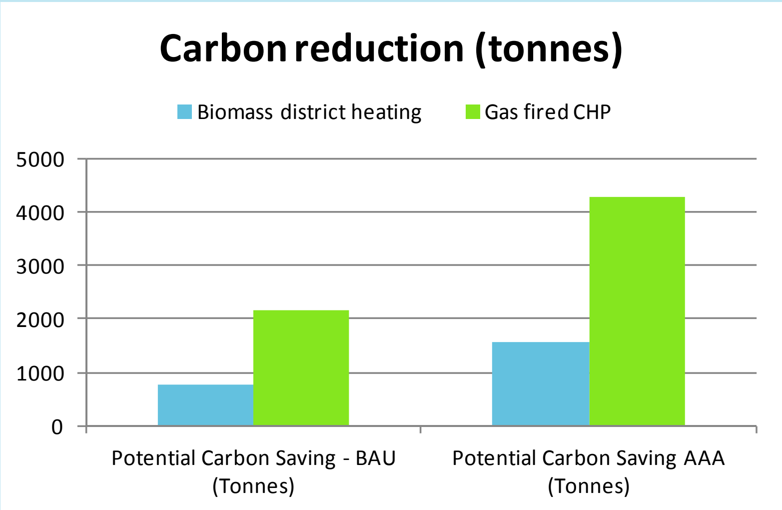


Figure 66: An assumed potential for district heating with biomass and gas fired CHP in Kent

Based on the assumptions made:

- 40 x biomass networks each with 100 kW boiler gives 4 MW under AAA. BAU is 2 MW.
- 15 x gas fired CHP networks each powered by a 2MW gas CHP engine gives 30MWe.

- Both technologies are assumed to have a load factor of 70%.
- The energy generation for gas CHP is expressed as electrical however heat will also be provided through DH networks connected to the CHP engine rooms.

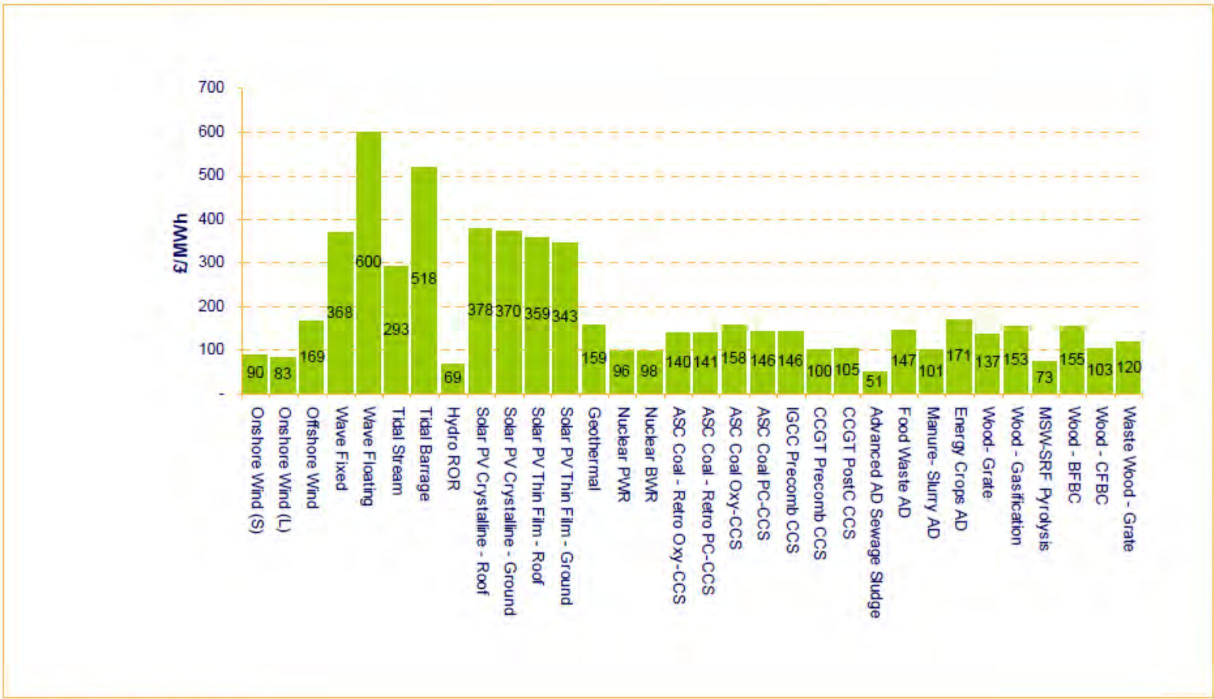
- Per kW installed biomass systems deliver greater carbon savings due the low carbon biomass fuel.
- Larger urban networks are considered more likely to be connected to gas –fired CHP networks. The greater scale of these systems means that overall they are likely to deliver more carbon savings.
- Under the AAA scenario the carbon reduction from biomass and gas CHP combined equates to 0.45% of Kent's carbon baseline.

7.6 Understanding the cost-benefits of delivery of renewable energy technologies

This study highlights that for Kent to deliver its proportion of the UK's required carbon emission reduction, action will be required in all areas. Despite this, it is worth considering the business case of the various available options in order to prioritise early spending in the areas that will deliver greatest benefit for Kent. Benefits from renewable energy deployment typically can be wide ranging but will include; energy and carbon saving, job creation, awareness raising and community engagement.

Costs

The Climate Change Commission report: 'Costs of Low Carbon Generation Technologies' (Mott Macdonald, May 2011), provides a high level summary of costs for a range of key low carbon generation, covering both capital costs and levelised costs. This information has been used together with estimated installed and generating capacities for the renewable energy deployment scenarios considered for Kent to provide an indicative cost for a range of renewable technology options.

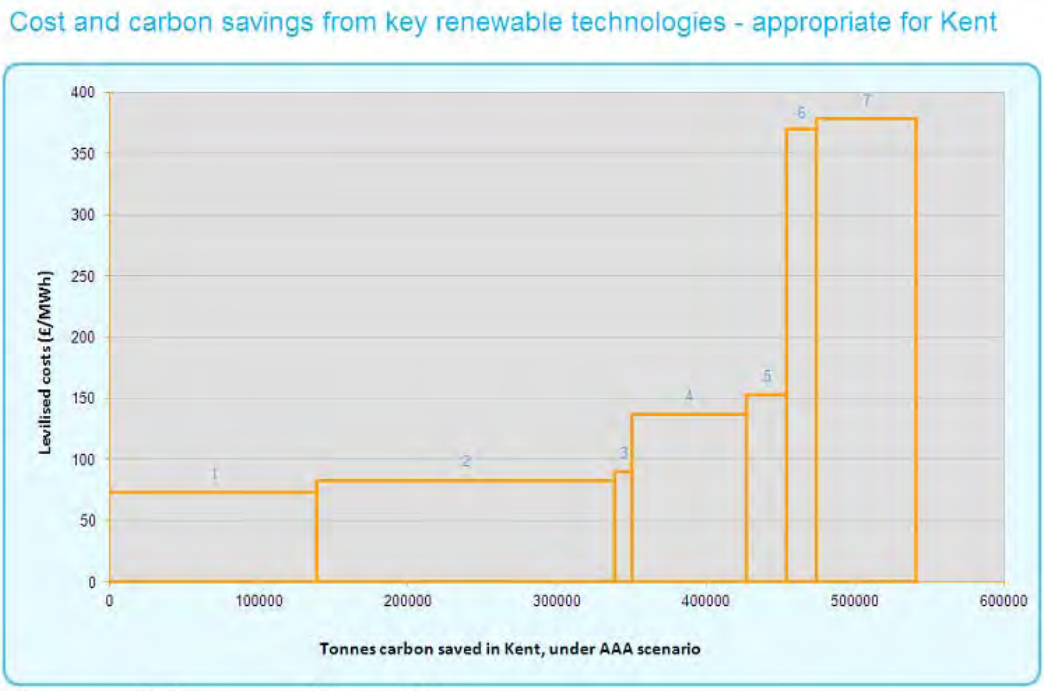


Source: Mott MacDonald

Figure 67: Levelised costs for a range of Low Carbon generation technologies

Table 28: Technology costs for Kent – generating by combining the 'all actions adopted' technology uptake with cost benchmarks from the Climate Change Commission report: 'Costs of Low Carbon Generation Technologies' (orange shading shows the relative cost level)

	Cost benchmarks			
	Capital costs '000 £/kW	Levelised Costs £/MWh	Total capital costs (£)	Levelised costs (£)
Solar Photovoltaics	2.90	378	630,289,132	64,770,945
Biomass Boilers*	3.40	137	399,752,722	42,667,025
Small Wind	1.50	90	31,053,000	2,611,433
Large Scale Biomass Power Stations	4.30	153	344,000,000	92,211,264
Large Scale EfW	3.10	73	248,000,000	43,996,224
Onshore Wind Farms	1.40	83	455,000,000	42,534,180
Large Scale PV	2.80	370	182,000,000	18,961,020



ID	Name	Cost (£/MWh)	saving (tonnes)
1	Large Scale EfW	73	139110
2	Onshore Wind Farms	83	199859
3	Small Wind	90	11316
4	Biomass Boilers*	137	76881
5	Large Scale Biomass Power Station	153	27121
6	Large Scale PV	370	19986
7	Solar Photovoltaics	378	66827

Figure 68: Marginal abatement cost curve showing carbon savings as estimated under the Kent 'all actions adopted' scenario using levelised costs data taken from a national study completed by Mott MacDonald (Costs of Low Carbon Generation Technologies - May 2011)

Capital costs:

Capital costs for renewable technologies vary significantly according to what is included in the cost figure, technology scale, time etc. The cost data shown above is taken directly from a national level study. The bullets below describe how the costs have been worked up.

- The Mott Macdonald work for the Climate Change Committee estimates current capital costs using an engineering cost approach, typically comprising six to seven line items, specified for each technology group.
- Costs were taken from actual recent projects where possible. In other areas the study relied on tender prices and supplier quotes.
- For early stage technologies with no commercial scale deployment the study used estimates based on comparator technologies and engineering studies.
- The estimates also include a market "congestion premium" (or discount) in the case where prices differ from the level that would return a normal profit to equipment and service providers. This market price "distortion" (mark-up/ discount) has been estimated by Mott MacDonald on the basis of their knowledge of recent transactions, reference to comparator technologies and discussions with the Original Equipment Manufacturer (OEM) and developer community.
- All costs figures are based on 2010 prices.
- Costs rely on numerous assumptions meaning they are uncertain.

Levelised costs: The capital cost, financing and operating cost assumptions are brought together in the levelised costs analysis. The levelised costs reflect the differentiated effects of OPEX and fixed cost dilution arising from plant and energy availabilities. Discount rates for low carbon technologies established by Oxera

Consulting as part of a parallel study for the Climate Change Commission are used within this levelised costs analysis. As above this work was done by Mott MacDonald and has been reused for this study.

Caveat: The costs used here have been published by the Climate Change Commission. They are worked up based on numerous assumptions in respect of scale of deployment, deployment speeds, technology learning etc. AECOM has not checked these assumptions in detail. Costs are only intended to illustrate an order of priority for spending on renewable technology in Kent. The cost for biomass boilers is based on a commercial scale installation and will vary for smaller scale installations as may come forward in Kent. No costs for Solar Thermal of Ground Source Heat Pump systems were provided in the Climate Change Commission report.

Energy and carbon saving potential versus costs

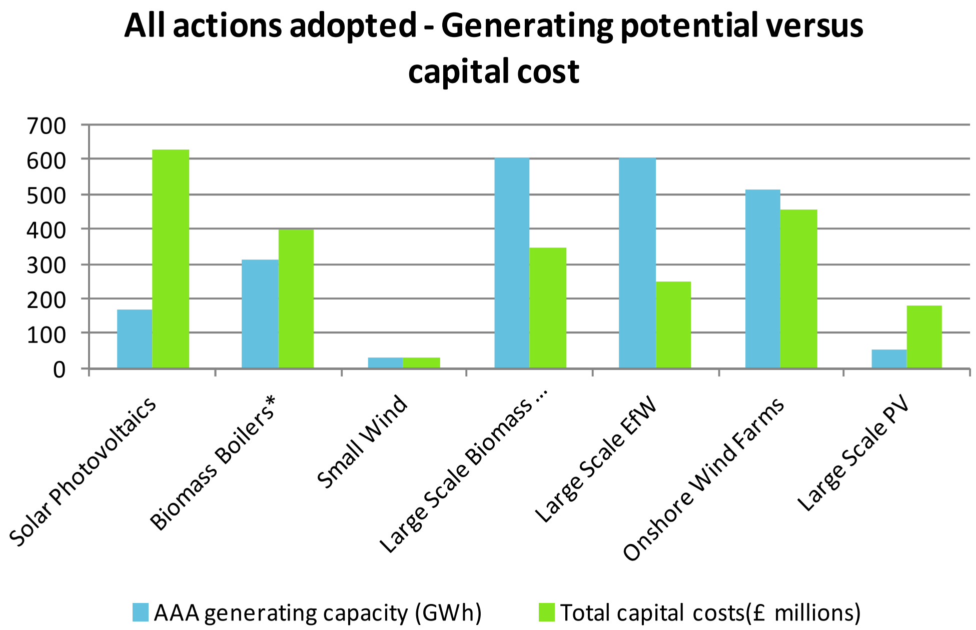


Figure 69: Energy generation potential versus costs for key renewable technologies under the 'all actions adopted' scenario for Kent

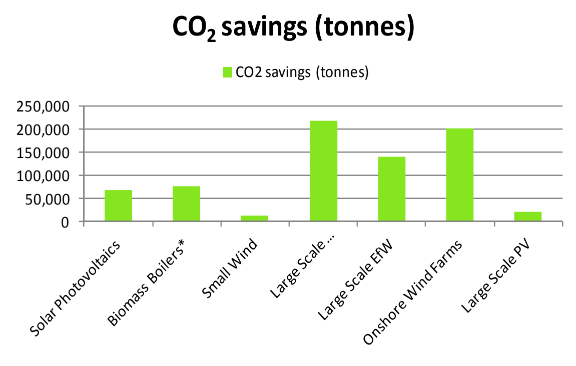


Figure 70: CO_2 reduction potential for key renewable technologies under the 'all actions adopted' scenario for Kent

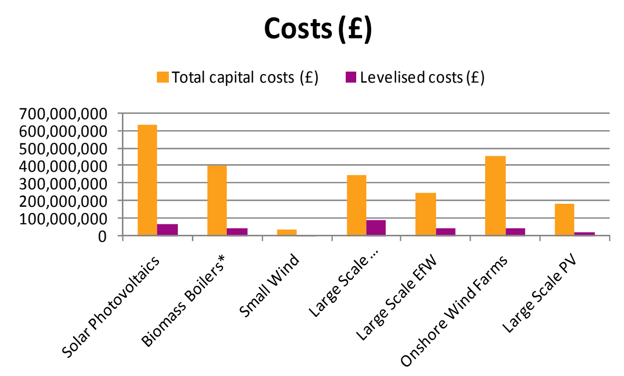


Figure 71: Capital and levelised costs for key renewable technologies under the 'all actions adopted' scenario for Kent

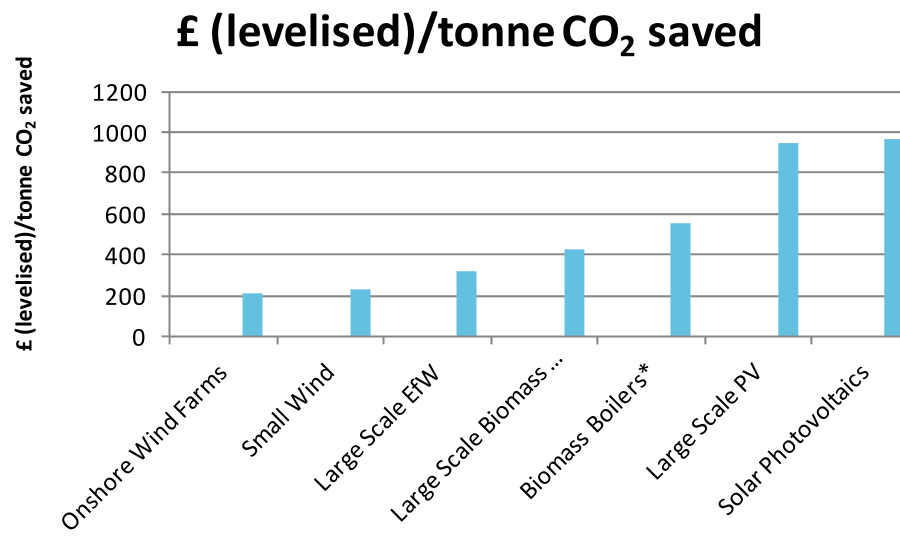


Figure 72: Ranks technologies in terms of cost per tonne CO_2 saved. Large scale wind turbines are the most cost effective investment where CO_2 saving is the goal

Assessment of Total Benefits

The tables below provide an assessment of the costs and benefits increased delivery by the five partner types. While from a purely carbon or cost perspective, energy developers are highlighted as the key delivery partner, through a comparison of the wider benefits, delivery by other partners also becomes important. Public sector, Private Sector and Community driven delivery is likely to accrue a range of wider benefits in terms of job creation, community support and direct financial benefits to the partners. Housing developers are the only partner that drive a relatively low benefit overall.

Table 29: Total benefit analysis for Energy Developers

Energy Developers		
Cost Efficiency	High	• Large scale renewable energy, particularly onshore wind has a low levelised cost
Job Creation	High	• Job creation could be achieved through local development of manufacturing supply chains, and establishment of Kent as a low carbon economic hub. Support for offshore wind farms using Kent's ports as well as onshore technology delivery could develop a renewable energy specialist economy.
Local Community Benefits	Medium	• Through partnership business models, local communities can directly profit from renewable energy developments. Some energy developers are actively looking at PV share schemes where dividends are offered to community member who buy a stake in the installation – typically on school or community buildings.
Partner benefits	High	• Financial benefit and business development.

Table 30: Total benefit analysis for Housing Developers

Housing Developers		
Cost Efficiency	Low	• Micro-generation technologies have a high levelised cost. • The sector is small. Regulation may mean that technologies are selected primarily to meet carbon reduction targets.
Job Creation	Low	• Individual installations across Kent will lead to high demand for skilled workers. However this sector is small by comparison to other sectors identified for Kent.
Local Community Benefits	Low	• Delivery of local micro-generation will reduce energy bills for consumers (new residents)
Partner benefits	Medium	• Reputational benefit – developing sustainable homes • Perhaps a premium on 'Green Homes' – or just a competitive advantage in the market place.

Table 31: Total benefit analysis for Public Sector

Public Sector		
Cost Efficiency	Medium	• Micro-generation technologies have a high levelised cost. However there is a greater opportunity to achieve scale in this sector due to land ownership or ownership of portfolios of buildings. This scale can reduce costs.
Job Creation	Medium	• As for other delivery partners. Individual installations across Kent will lead to high demand for skilled workers.
Local Community Benefits	High	• Delivery of local micro-generation will reduce energy bills for consumers.
Partner benefits	High	• In delivering renewable energy, communities will see wider educational and community cohesion benefits that arise from communal projects. • Local Authorities have a key role as a facilitator/co-ordinator of action in this sector – they need to be seen to be leading by example. • Deliver on energy and carbon targets for the local authority and region

Table 32: Total benefit analysis for Private Sector

Private Sector		
Cost Efficiency	Medium	• Micro-generation technologies have a high levelised cost. However there is a greater opportunity to achieve scale in this sector due to land ownership or ownership of portfolios of buildings. This scale can reduce costs.
Job Creation	High	• Individual installations of micro-generation across Kent will lead to high demand for skilled workers. • Business involvement in renewable energy delivery will foster a low carbon economy
Local Community Benefits	Low	• Unless accompanied by wider community initiatives and education, wider community benefits are likely to be limited
Partner benefits	Medium	• Reduced running costs – but likely to be a lower order driver for business • Possible Corporate Social Responsibility/Brand benefits • Economic benefits derived through establishment of Kent as a low carbon economic hub

Table 33: Total benefit analysis for Communities and Individuals

Communities and Individuals		
Cost Efficiency	Low	• Micro-generation technologies have a high levelised cost.
Job Creation	High	• Individual installations across Kent will lead to high demand for skilled workers. (Electricians/Installers). This sector offers a big market – even relatively low uptake can generate significant numbers of installations. Feed in Tariff and Renewable Heat Incentive will help.
Local Community Benefits	High	• In delivering renewable energy, communities will see wider educational and community cohesion benefits that arise from communal projects.
Partner benefits	High	• Delivery of local micro-generation will reduce energy bills for consumers. • Individuals and communities will also be able to generate financial revenue stream through Feed in Tariff and Renewable Heat Incentive.

7.7 Chapter Summary

- **Reflecting on the physical capacity review conducted in Chapter 4, the partner analysis in Chapter 5 and the low carbon economy assessment in Chapter 6, this chapter analyses two scenarios – 'business as usual' and 'all actions adopted' where delivery by each partner is optimised.**
- **Under the 'all actions adopted' scenario it is assumed that the action plan proposed within this report is taken forward. It is believed a 10% reduction in carbon emissions can be achieved by 2020 in Kent under this scenario. The business as usual scenario delivers a 3% reduction in carbon emissions. Further reductions can be delivered from energy efficiency and combined heat and power, where appropriate.**
- **The carbon reduction figures stated above (3% and 10%) are based on a generation capacity from renewable resources in the BAU scenario 554GWh, and in the AAA scenario of 2054GWh. This renewable resource will displace both existing grid electricity and gas. The current energy demand for Kent across both electric and gas is around 21,000GWh.**
- **The most important delivery partner is energy developers, as they are geared up to deliver large installations efficiently. However, energy developers cannot deliver alone and crucially need support from other delivery partners. Energy developers can also partner with communities and public sector to enhance delivery.**
- **The technologies that can be delivered that will achieve the greatest carbon savings include large scale wind, energy from waste and biomass power stations. Biomass boilers, solar power and ground source heat pumps also make a significant contribution.**
- **District heating potential has not been included within the renewable energy scenarios, but it will be a significant strategy for reducing carbon through low carbon heat supply. Actions should also support the delivery of district heating infrastructure and Combined Heat and Power plants.**
- **While energy developers can achieve the greatest carbon reduction with the highest cost efficiency in terms of capital and operational cost, other partners will achieve wider economic and community benefits through delivery. Hence renewable energy is a strong business case for all partner types (with housing developers being a low benefit delivery partner).**

8 Forging a Path: An Action Plan for Renewable Energy in Kent

8.1 Introduction to this chapter

This chapter considers the conclusions from previous chapters and develops an action plan for delivery of renewable energy in Kent. In determining possible actions, and prioritising those actions, both the technical capacity of various technologies and the delivery capacity of various partners in Kent has been examined. The intention of the action plan is to provide a framework to bring stakeholders together with a common vision to drive the most beneficial delivery routes to realise carbon reduction, economic gain and community benefit.

This chapter firstly summarises possible actions that could be taken to increase delivery by each partner, and also suggests how these partners can come together to create a low carbon economy. 'Business as usual' will fall short of meeting carbon targets and creating a strong and sustainable low carbon economy, so it is important that delivery partners in Kent consider how they can promote faster deployment of renewable technologies. The chapter examines the views of local stakeholders on priority actions, highlighting possible delivery partners in the area and options for a low carbon economy before discussing and prioritising a range of actions to be taken forward.

8.2 Possible Actions to Increase Delivery

Based on the opportunities and constraints outlined for each delivery partner in chapter 5, actions that will foster greater delivery of renewable energy by each partner have been developed. Actions have also been suggested that could aid the development of a low carbon economy in Kent. In this section, the actions are grouped based on the delivery partner they will impact, rather than who could necessarily undertake the action. The actions were developed in consultation with stakeholders at a workshop held by Kent County Council in September 2011.

Actions influencing energy developers

1. **Consistent planning guidance and policy** – Local authorities setting clear and supportive policies regarding renewable energy has a significant impact on the amount of renewable energy that gets delivered in Kent. Favourable policies will help mitigate risks for energy developers and can act to encourage them to develop projects in the county. Consistent implementation of policy is essential.

2. **Early engagement and consultation** – A transparent and open process to planning projects in Kent can help garner community buy-in. Beginning the process early, and inviting community and council input can work to gain vocal supporters.

3. **Improve infrastructure** – As some areas of the County lack the required energy distribution infrastructure to handle additional renewable energy, upgrading infrastructure capacity will be required before large scale renewable projects can be accommodated.

4. **Public-Private partnership to deliver difficult projects** – Public sector actors often benefit from having many properties and land holdings which allows them to make strategic interventions. The public sector can be an important catalyst in adopting difficult to deliver technologies such as district heating schemes, using lower rates of borrowing capital (usually with lower required returns on investment). Once the delivery risk has been dissipated these strategic schemes can be commercially viable for energy developers.

5. **Establish community investment partnerships** – There is an opportunity to create new models of financing renewable energy, where the community stands to receive some financial benefits from renewable energy sales. This can go a long way to improving energy developers' image in the community as residents might see them as part of the community rather than external entities only in Kent to make a profit. This also increases the likelihood that they will be able to install and deliver additional projects in the future.

Actions influencing housing developers

6. **Identify deliverable local Allowable Solutions** – In line with emerging government guidance, housing developers will contribute to an allowable solution fund. Local authorities can scope possible local projects to receive contributions and develop an Allowable Solutions policy. By developing a clear policy and funding structure early, Kent can attract developers to the area and give them confidence in the costs associated with meeting zero carbon requirements. This could be an opportunity for housing developers to receive funds to deliver more strategic opportunities in growth areas.

7. **Marketing of Kent as low carbon living** – Undertaking a public relations campaign that advertises Kent as a hub for low carbon living can have the advantage of increasing the demand for low carbon housing and encourage developers to deliver greater amounts of renewable energy in the area.

8. **Set planning standards for strategic sites** – As some sites are more suited to some types of renewable energy, such as wind or district heating, local authority planners can establish these sites as priority areas, to require housing developers to explore and deliver these technologies within the site.

Actions influencing public sector and schools

9. **County-wide expertise network** – As resources are tight, local authorities can work together and with other delivery partners to improve their understanding of renewable energy and the best way to implement it. This might take the form of renewable energy training, or improved communication with respect to sharing of policies and best practices. For example, knowledge sharing and engagement can occur along the lines of Ashford's Rural Round Table for housing.

10. **Create public sector energy company through partnership** - Work with development control planners, enthusiastic residents, and businesses to establish a council led energy company to lead delivery of energy projects that are in the interest of the wider community and the council.

11. **Cross-boundary planning strategy** – It is important for local authorities to develop and enforce policies consistently across Kent. Knowledge sharing and communication will be important to ensuring sensible and effective renewable energy delivery. This can be achieved through a working group to ensure policy enforcement and guidance is delivered. Officers and members involved in planning decisions should receive training on renewable energy.

12. **LEP and Kent Forum set vision and lobby for funding** – Making renewable energy a high priority for Kent should be established as a priority for the LEP, Kent Forum, Kent Economic Board, Locality Boards, local plans, LSPs, Sustainable Community Strategies, other regional and sub-regional partnerships. All of the groups can be used to lobby for additional funds from European and National bodies.

13. **Conduct feasibility studies to deliver strategic projects** – Particularly relevant to projects that are considered difficult to deliver, such as district heating networks. While district heating can provide significant energy and CO_2 reduction in areas of higher density, coordinating connections across public and private sector developments, which can provide the necessary diversity for a successful district heating network, can be a challenge. Coordinating the various parties, conducting feasibility studies, and developing a delivery plan with partners will be important roles for the public sector. In this regard, the Carbon Trust offers support and funding to Local councils to conduct feasibility studies. Specific project ideas include:

- Local assessment of the realistic potential for small scale wind and the capacity of the landscape to deliver this, based on opportunity areas indicated by maps.
- Quantify and assess the various waste wood waste streams and understand how they could be put to better use in Kent?
- Build on heat mapping in report to create more detailed heat mapping and feasibility for opportunities in urban locations and in regeneration areas, also off-gas opportunities. Further work will be needed to assess the realistic potential based for district heating based on a more detailed analysis of the building stock and considering the likely uptake by home owners and businesses – considering ambition, commercial attractiveness under RHI and practical barriers for integration on buildings.

14. **Public property and school installations** – Conducting a renewable energy audit of council buildings, surrounding property and assets should uncover the most valuable energy efficiency and renewable energy technologies Based on this assessment, identifying funding schemes will be critical to the undertaking the recommended improvements to council and school assets.

15. **Funding coordination** – There are a number of sources of funding for public sector projects. As discussed in previously, these funding sources include: CESP, Eaga Partnership Charitable Trust, and Salix. Investigating opportunities with these funds and others will be key to developing energy projects in the public sector.

16. **Education and Promotion** – The public sector has an important role to play in promoting energy efficiency and renewable and low carbon energy to homes and businesses. Information from the public sector can be seen as objective and not driven by commercial needs. The local authorities in Kent need to continue and expand the range of promotional work, including educating the public about the wider low carbon agenda and providing accurate and useful information which can help dispel myths (for example around wind turbines).

Actions influencing private sector

17. **Develop private sector champions** - Currently, there are a number of private sector actors that have successfully contributed to an increase in renewable energy in Kent. However, there is currently no coordinated network of champions to target the private sector. There is an opportunity for a private sector stakeholder to lead the cause in this sector, and gain a competitive advantage in the process.

18. **Independent advice to de-risk projects and provide business case** – Seeking independent external advice can help private sector actors to develop the most effective strategy to decreasing costs with relation to renewable energy and energy efficiency.

19. **Perform energy life cost analysis** – Energy savings and new technologies can have a high up-front capital cost; however, when considered throughout their life in operation, they are often much more economical. Private sector actors need to understand their own energy lifecycle costs, including how rising energy costs and potential future carbon taxes might play a role. The positive impact on their brand of becoming “greener” if they were to Implement renewable forms of energy should also be considered.

20. **Develop Kent development capital fund** – There will be a need to source capital funding to kick-start projects, as this can often be the factor that makes private schemes viable. Funding could be made available through a revolving public-private sector development capital fund. Such options are currently being investigated by Kent County Council. There are similar precedents existing in Kent including the Ashford Low Carbon Fund, or rolling investment funds such as Kent County Council Energy and Water Investment Fund. On a national level there will also be capital fund opportunities coming forward through the Green Investment Bank.

21. **Support network for evolving renewable energy start-ups** - Build on existing work helping businesses in the renewable energy sector in Kent to develop, by providing extra support, training and intelligence in partnership with business support networks and providers. Some examples of possible business support networks and providers include Business Link, Envirobusiness South East, Backing Kent Business, Business Support Kent, and South East Business Carbon Hub.

22. **Establish a database of private sector case studies** – There are a number of private organisations, which have implemented renewable energy and improved energy efficiency standards. Establishing a database of these case studies for other organisations to draw on will help make the process more effective.

Actions influencing communities and individuals

23. **Fund feasibility studies for local schemes** – While there is often the ambition and will to deliver from community groups, they often cannot get projects off the ground as they are missing technical advice. Feasibility studies for community group projects could be funded or coordinated by a single body for the area, linking communities with the appropriate expertise.

24. **Pilot projects with self-selecting communities** – To foster local communities that are in favour of installing renewable energy, pilot projects could be delivered in these areas. Communities could put themselves forward for pilot projects through a Kent wide completion. This could be carried out in tandem with neighbourhood planning initiatives and community vanguard projects. Delivering renewable energy where it is wanted should be the primary priority.

25. **Support community champions** – As many community groups operate on a voluntary basis, and work on behalf of the community, other delivery partners can improve their own image simply by financially supporting the efforts of community champions. Considering that this money would go directly to projects, as opposed to salaries, funding can deliver significant benefits at low costs.

26. **Provide guidance on technologies and funding for communities** – Providing guidance on renewable technology design and funding sources can help ensure that communities feel more confident in delivering renewable energy. Identify projects which have been planned and not taken forward and see if can be supported.

27. **Identify promising areas for community schemes** – Helping communities to understand where the best opportunities to deliver renewables are ensures their efforts are focused on the right initiatives. This can be as simple as providing community groups with wind maps, or guidance on biomass schemes, for example.

28. **Disseminate delivery models and case studies** – Through investigating and disseminating how other communities have successfully delivered renewable energy projects, communities in Kent can gain an understanding of what actions and projects they might be able to emulate.

29. **Establish a community ESCo or partner with energy developers** – Community groups can work with the local councils to establish an energy services company. This will allow the development of smaller local projects which may benefit the community financially. ESCos can benefit from the local knowledge and vast range of expertise available within local communities.

Actions influencing a low carbon economy

30. **Develop a Low Carbon Economic strategy** – With the growing focus on renewable energy and technology, there is an opportunity to foster a low carbon economy. As industries contribute to carbon reduction will help to diversify Kent's economy, while contributing to environmental purposes at the same time, there is a need to focus on establishing a strategy for how Kent can modify its current economy to attract these industries to the County. With the high potential for a variety of renewable energy in the county, it is sure to be of growing interest. Building upon the work of 'Locate in Kent' and other projects such as Thanet Earth/The Green Isle Proposal to bring opportunities to market and attract inward investment will be important to the economic evolution in Kent.

31. **Develop low renewable energy installation skills** – Employing residents and working with local colleges to build upon local skills centres in Swale and Thanet, where wind technology skills are being developed with links to local offshore wind projects. It might also be advantageous to build upon SusCon, where sustainable construction skills are being developed with links to the major development opportunities in the Thames Gateway. Housing developers and the private sector can help by providing apprenticeships and work experience programs for trainees. Local authorities can require training of local employees alongside installation on public buildings.

32. **Establish local biomass supply chains** – Coordinating the numerous suppliers of wood fuel, wood waste, and energy crops to deliver a consistent supply of biomass at strategic locations would improve the visibility and access to biomass as a source of energy. It will also stimulate a number of local job opportunities in growing, harvesting, processing and supplying biomass.

33. **Develop approach to research and development** – The research and innovation of new sources of energy is an ongoing process. Kent Science Park is one example of local research and innovation, which fosters renewable energy development. Increasing the focus of such research in Kent has benefits for the local economy as well as the science of renewable energy as a whole.

34. **Positioning marketing Kent's Port areas as renewable energy hubs** – Kent's geographic position and large sea ports places it at a strategic advantage to service some of the country's largest offshore wind farms. A strategy focused on developing renewable energy expertise to service these turbines will not only create additional jobs, but could result in other types of renewable energy companies being drawn to the county.

8.3 Stakeholder Perspectives: Driving Delivery through Actions

A second workshop was held with stakeholders in Kent in September 2011. Here, groups representing each delivery partner type (Energy Developers, Housing Developers, Public Sector, Private Sector, Communities and Individuals) reviewed and discussed prioritisation of a range of actions.

Figure 73: Communities and Individuals Group prioritising actions

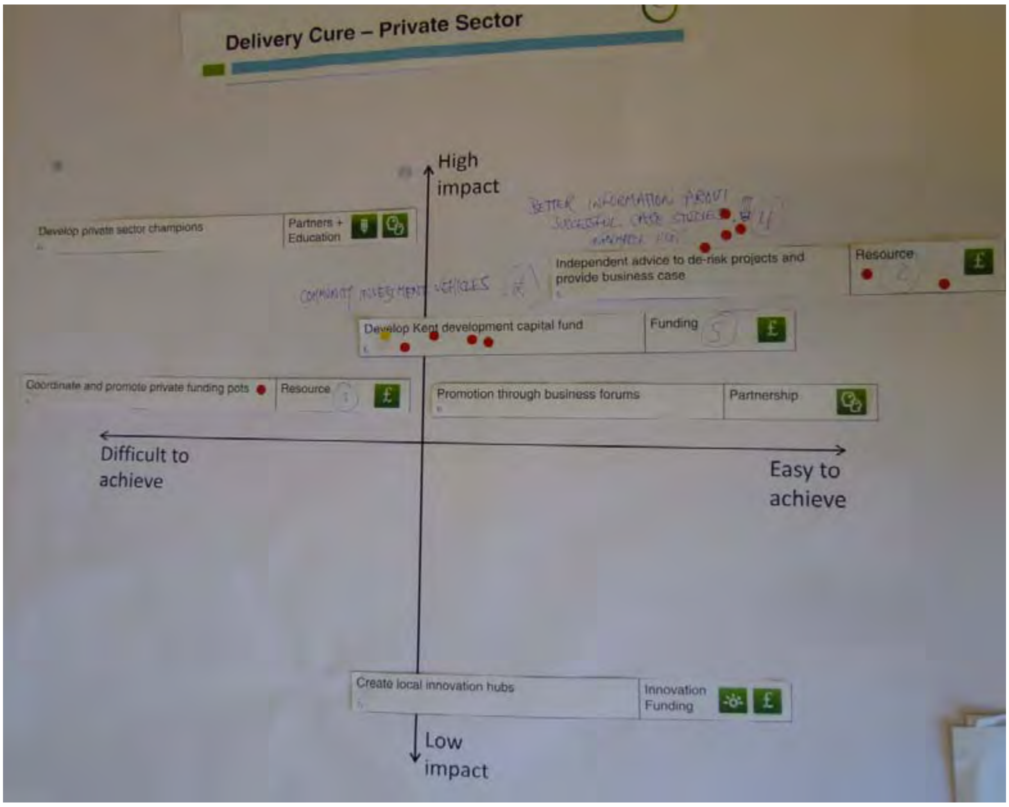


Figure 74: Action prioritisation for private sector delivery

Communally, a list of high priority actions was developed based on consideration of the impact the action would have as opposed to the effort and resources needed to undertake that action. Given that the scenario results from the study highlighted energy developers and communities as key delivery partners with the potential to drive the highest carbon reduction, actions that could aid these delivery partners were given focus. The top eight actions identified by stakeholders were:

1. Development of consistent planning policy and guidance (and corresponding engagement with members and officers)
2. Funding for feasibility studies for local communities and businesses interested in delivering schemes
3. Development of pilot community projects
4. Guidance on technologies and funding streams for local communities
5. Develop a county-wide network of expertise
6. Retrofit renewable energy installations on public properties and schools
7. Develop a capital investment fund
8. Create a public sector led energy company

8.4 Existing Active Delivery Partners

There are a range of delivery partners who are either actively involved in the delivery process, or well positioned to become involved. The following table indicates some of the organisations which are already active in delivering or facilitating renewable energy in Kent.

Table 34: Possible Delivery Partners in Kent

Delivery Partner Type	Examples
Public Sector	Kent County Council
	Kent Design Initiative
	Kent Forum
	Local Enterprise Partnerships
	Kent Council Chief Executives Group
	Ashford Council
	Dartford Council
	Maidstone Council
	Shepway Council
	Swale Council
	Thanet Council
	Canterbury Council
	Dover Council
	Gravesham Council
	Sevenoaks Council
	Tonbridge and Malling Council
	Tunbridge Wells Council
	Medway Council
	Kent Downs AONB
	High Wield AONB
	Forestry Commission
	Environment Agency
	Energy Saving Trust
	Carbon Trust
	Schools
Energy Developers	EON
	DONG
	RWE Innogy

	Vattenfall
	CountySide Recycling
	Npower Renewables
	Ecotricity
	Kent EnviroPower Ltd
	Estover
	LC Energy
	Richborough A Ltd
Housing Developers and Regeneration	Kent Thameside
	Kent Developers Group
	Kent Architecture Centre
Community Groups and Third Sector	Finance South East
	Transition Towns: Faversham, Tunbridge Wells, Tonbridge, Whitstable, Sevenoaks, Hythe, Deal, and Canterbury
	Elham, Hadlow, St Margaret-At-Cliffe, Eastchurch (low carbon pilots)
	Commonwork at Bore Place
Industry and Business	Renewable technology companies
	Locate in Kent (KCC)
	Kent Science Park
	South East Business Carbon Hub (KCC)
Universities and Colleges	University of Kent
	Swale Skills Centre
	Thanet College
	SusCon
	Hadlow College
Landowners	Estate owners
	Farmers

8.5 Prioritising Actions: An Action Plan

As resources and capacity are limited, it is important to prioritise actions which are likely to have the greatest effect on delivery. With the knowledge of how different actions can improve delivery rates for various partners established in the previous section, the table below sets out the actions based on priority. The table includes the actions, along with the main actors, the expected timeframe for delivery, what support could increase the likelihood of success, and the priority and taking action. The main actors are the people who are viewed as those who should take responsibility for delivering a specific action. Timeframes are listed as short-term, medium-term, and long-term – referring to the length of time before an action will have an impact. Support is classified as any person or group, or action that can facilitate the action being delivered effectively. Priority is listed as either high, medium, or low based on its likely impact on carbon reduction and achievement of wider benefits.

The action plan separates actions based on five broad categories that describe the type of action:

1. Planning and Strategy: Actions that require new policy or strategy
2. Partnership Working: Actions concerning coordination and cross-partner activities
3. Education and Empowerment: Actions designed to promote skills and leadership
4. Investment and Resources: Actions that require direct funding or resources
5. Innovation: Actions that require further knowledge

Action numbers have been included in the first column and relate to the action numbers and additional information in the above section.

Table 35: Increasing Renewable Energy Uptake – Setting Priorities in an Action Plan

Action #	Action Description	Main actor(s)	Timeframe	Support required from	Priority
	Planning and Strategy				
	Develop Vision and Direction	Kent Districts/ Medway Council	Short-term		High
32	Develop a strategy to establish a low carbon economy	KCC	Long-term	LEP Industry and business	Medium
6	Identify deliverable local Allowable Solutions	Kent Districts/ Medway Council	Long-term	KCC	High
34	Establish a renewable energy economic hub in Kent, initiated by development and servicing of offshore wind farms	KCC Kent Districts/ Medway Council	Long-term	Renewable energy technology companies	High
8	Set planning standards for sites which have a significant ability to deliver renewable energy	Kent Districts/ Medway Council	Long-term	KCC	Medium
27	Identify promising areas for community energy schemes	Kent Districts/ Medway Council	Medium-term	Community groups	Medium
11	Establish cross boundary planning strategy with surrounding local authorities	Kent Districts/ Medway Council KCC	Long-term	KCC	Low

	Partnership Working				
9	Create county-wide expertise network	Kent Districts/ Medway Council	Short-term		High
10, 29	Establish public sector or community based energy services company (ESCo) for Kent	Kent Districts/ Medway Council KCC Community groups	Long-term	Energy developers Community groups	High
5	Establish community investment partnerships for large-scale schemes	Energy Developers	Medium-term	Leadership within community	High
4	Public-private partnerships to deliver difficult renewable energy projects, such as district heating	Energy Developers Kent Districts/ Medway Council	Long-term	Renewables champion on local authority council	Medium
25	Provide support for community champions	Kent Districts/ Medway Council Private sector Energy developers	Short-term		Medium
17	Develop private sector champions	Private sector	Medium-term	Industry and business	Medium

	Education and Empowerment				
26	Provide guidance on appropriate technologies and funding sources to community groups	Energy developers Kent Districts/ Medway Council	Medium-term	KCC – low carbon communities	High
16	Educate and promote the importance of renewable energy to community members	Community groups	Short-term	Kent Districts/ Medway Council	High
31	Develop renewable energy installation skills locally	Local colleges Energy developers Housing developers	Long-term		Medium
28	Disseminate renewable energy delivery models and case studies for local communities	Community groups	Medium-term		Medium
22	Establish a database of case studies detailing experience with renewables	Community groups Kent Districts/ Medway Council	Medium-term	Industry and business Renewable technology companies	Medium

Investment and Resources

14	Install renewable energy on all public council and school properties	Kent Districts/ Medway Council/Schools	Long-term	Energy developers	High
15	Coordinate funding pot for public sector	KCC Kent Districts/Medway Council/Universities	Medium-term		High
20	Develop Kent development capital fund for private sector investment in renewables	KCC	Medium-term	Private sector funding	High
24	Pilot projects with self-selecting communities interested in renewable energy	Community groups KCC	Long-term	Community groups and	High
23	Fund feasibility studies for local energy schemes	Kent Districts/ Medway Council	Medium-term	CIL Finance South East EU funding	High
13	Conduct feasibility studies to decide which strategic projects are worthwhile investing in	Kent Districts/ Medway Council	Medium-term	Carbon Trust	High
12	Set vision and lobby for funding	LEP KCC	Long-term	Kent Forum	Medium
3	Improve energy infrastructure to provide additional grid capacity	Energy Companies	Long-term	Kent Districts/ Medway Council	Medium
21	Establish support network for evolving renewable energy start-ups	Locate in Kent Business Forums	Medium-term	Local renewable technology companies	Medium
32	Establish local biomass supply chains	Forestry Commission Biomass producers	Medium-term	Farmers AONB Kent Districts/ Medway Council	Medium

	Innovation				
18	Provide independent advice to private sector to provide business case for energy projects	Large energy users	Medium-term	Industry and business	Medium
33	Create local innovation hubs, focusing on researching renewable energy	Energy focused companies Kent Districts/ Medway Council	Long-term	Locate in Kent	Medium
19	Perform energy life cost analysis	Large energy users	Medium-term	Industry and business	Medium
7	Market Kent as a place for low carbon living and working	Locate in Kent	Long-term	KCC	Low

Appendix A: Stakeholder Workshop Results

This appendix provides more detail on the stakeholder workshop summarised in Section 5.

A stakeholder workshop held in July 2011 brought together a range of Kent stakeholders, including representatives across the five delivery partner types. The workshop allowed stakeholders to share perspectives on delivery ambition in the County and also explore the opportunities and constraints affecting each partner type. Stakeholders also suggested a range of actions that could be taken to increase delivery.

Testing Delivery Ambition

Each stakeholder group was asked to comment on their own level of ambition for delivering renewable energy in Kent. The results of the 'ambition-o-meter' showed very strong ambition from community groups, particularly Transition Town representatives in the area. Groups concerned with quality of our built and natural environment including Kent Downs AONB and Kent Architecture Group also indicated they were actively looking for opportunities to deliver renewable energy. The ambition of local authorities in Kent was thought to be varying according to capacity and political will, with some authorities keenly looking for opportunities while others preferred to take a supporting role in delivery.

Testing Delivery Ability

Stakeholders were asked to think about what opportunities and barriers they faced in delivering renewable energy and possible actions that could stimulate a higher rate of delivery. The tables below record the results from each focus group.

Table 36: Results from the Yellow Group (Kent County Council, Kent University and Kent Fire and Rescue)

Opportunities	Barriers	Actions	Support Needed
• Wind - onshore • Solar • Biomass • Waste	• Planning • Councillors • Community Trust and understanding • Lack of leadership and champions • Lack of personal ownership and social responsibility • Scale - individual or group • How to store energy • Installer and technology trust and knowledge • Finance • Business models • pre-planning costs • Lack of legislation and industry regulation • Lack of joined-up-ness • Noise perception • Visual impact	• Create social enterprises in partnership cross-sector (private, public, communities) • Identify champions in different sectors e.g. Community, business, LA. Create leadership group partnership to take action • Raising education - sharing of ideas and mutual understanding. Neighbourhood planning. Visioning. • Accreditation • Use LEP, Kent Forum to lobby	• Third Sector and social enterprises. Info to identify win-win local opportunities • Develop a campaign, drive it forward. • Neighbourhood planning and spatial planning / vision e.g. 10 pilots across Kent

Table 37: Results from the Blue Group (Local Authorities)

Opportunities	Barriers	Actions	Support Needed
• Solar - especially for off-grid properties • Wind • Biomass - especially off-grid. Kent Downs Pathfinder Project. SE Woodfuels.	• Uncertainty around FITs • Legal Agreements in social housing • Trust and understanding • Unknown maintenance costs and longevity of kit • Conservations areas etc - planning and BC • AONB • Manston Airport, RSPB reserves • Not enough wind • Noise issues • Natural Environment White Paper 'protect people's views' • Consistency and location of supply, and delivery • Air quality • Retrofit is challenging • Caution in urban areas	• Planning policy - engagement in planning process is crucial. More interaction with developers - involve Las at the beginning to help to shape projects. • Cross partner working and networking - case studies that are relevant and not from authorities that are from huge urban centres and unitary!	• Noise guidance etc - standard independent technical environmental codes to work to for wind • Positive publicity and public engagement and education • Financial and legal frameworks

Table 38: Results from the Green Group (Local Authorities, Transition Towns, Kent Downs AONB, Architecture and Design Group)

Opportunities	Barriers	Actions	Support Needed
• Fast-tracking of community-led projects that are viable • Village-scale projects: off grid, farming sector AD and biomass • Public sector to make opportunities available e.g. Roofs for community projects • Public sector micro-generation • High electricity consuming commerce and industry micro-generation • Farmers - AD, PV farms, Biomass/fuels • Tidal • Community - wind • Biomass - 12% woodland cover in Kent • Heat pumps	• Apathy, lack of volunteers • Lack of political will • Need feasibility study and £ for pump priming • lack of political will • Lack of focus • Connection charges • NIMBYism • Energy company interests • Stability in government support • Wind - too many barriers • 40% woodland unmanaged	• Locate and study opportunities • Broker - find investors • Mainstream support • Political will building • Engage and educate • Social networking and grassroots campaigns to force political hands • Community brokering service • How to fast track viable low carbon community schemes	• Technical, financial • Introductions • Support from councillors • Better relationships • Localism • Funding and financing • Energy share • Community groups de-risking opportunities • Top-down meeting bottom-up approach to identify opportunities • Local MPs

Table 39: Results from the Red Group (Local Businesses)

Opportunities	Barriers	Actions	Support Needed
• Onshore Wind Large Scale - best ROI; commercial investment • Micro-generation (electricity) - revolving investment funds (PV FIT, business, institution) • Biomass, CHP	• NIMBYism, Planning, understanding, funding for planning costs • Planning - need for clear framework, policies, directives • Lack of free capacity to set up projects • Competencies • Long term commitment • Technical • Regulation, red tape • Lack of woodland management • Energy storage needed	• Education, raising awareness • Tariffs fund • Policy framework • Build skills • Woodland management increased • Develop technology for energy storage	• Clear support body, long term direction • Development of community owned schemes

Testing Delivery Possibilities

Each stakeholder group was provided with a number of playing cards each representing different types and scale of renewable technology. Each group was asked to create two scenarios for each technology type, 1 for 'business as usual' and 1 for 'most ambitious' in terms of the amount of they felt could be delivered in Kent by the various delivery partners. This was intended to provide a stakeholder view of what might be deliverable in practice taking a bottom up view. Stakeholders were also asked to use additional playing cards to highlight were support was needed (i.e. facilitation role) or where technologies would have positive or negative impact beyond potential for energy generation. (i.e. jobs creation, visual impact, air quality). The results of the scenarios for each group are shown in the following graphs. All stakeholder groups indicated a high delivery potential for micro-generation installations. Some groups indicated that large scale wind energy may play a role, particularly those representing local businesses.

Figure 75: Delivery Scenario Game Pieces

Figure 76: Participants in the first workshop estimating delivery scenarios

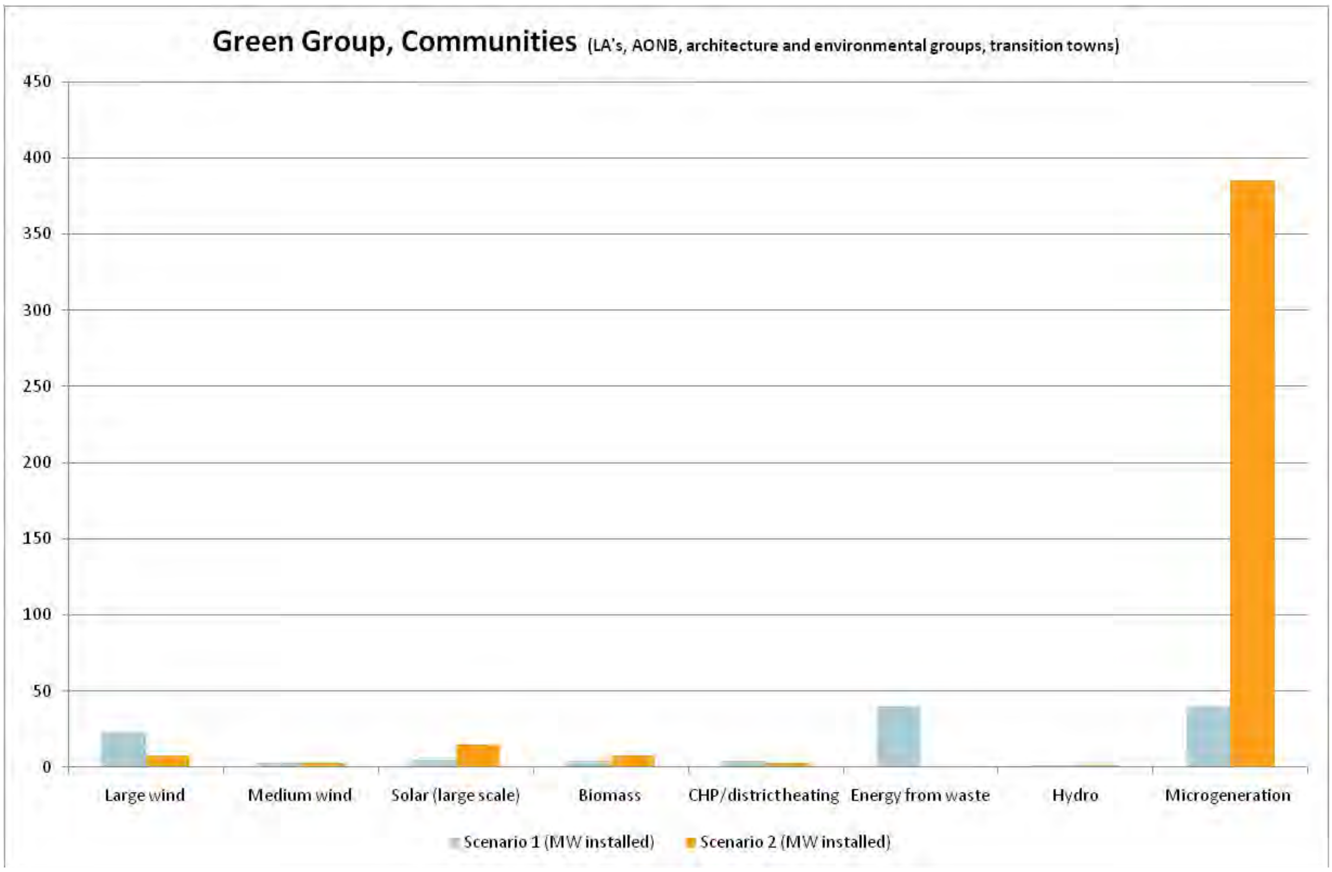


Figure 77: Results of the delivery scenario game (Green Group)

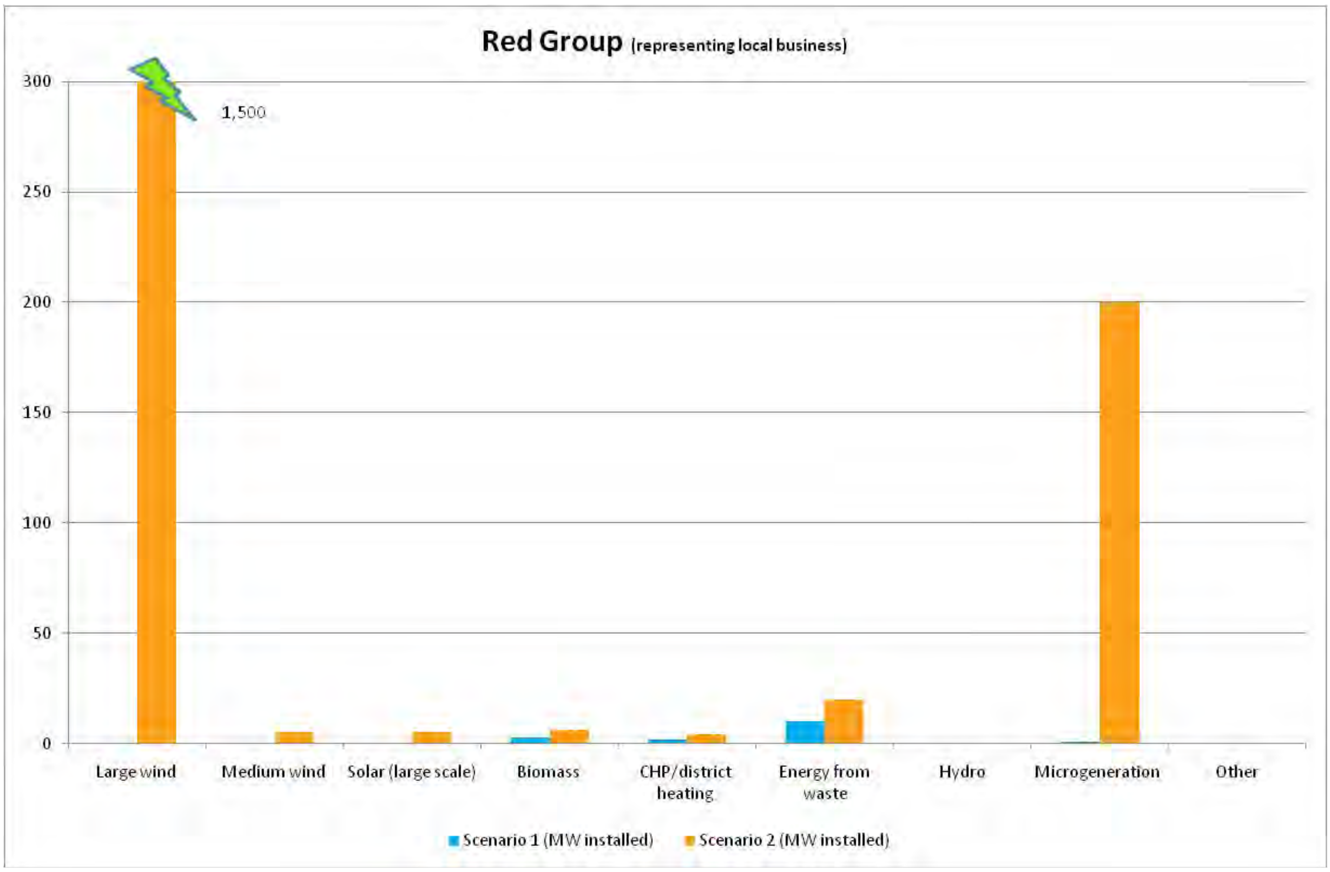


Figure 78: Results of the delivery scenario game (Red Group)

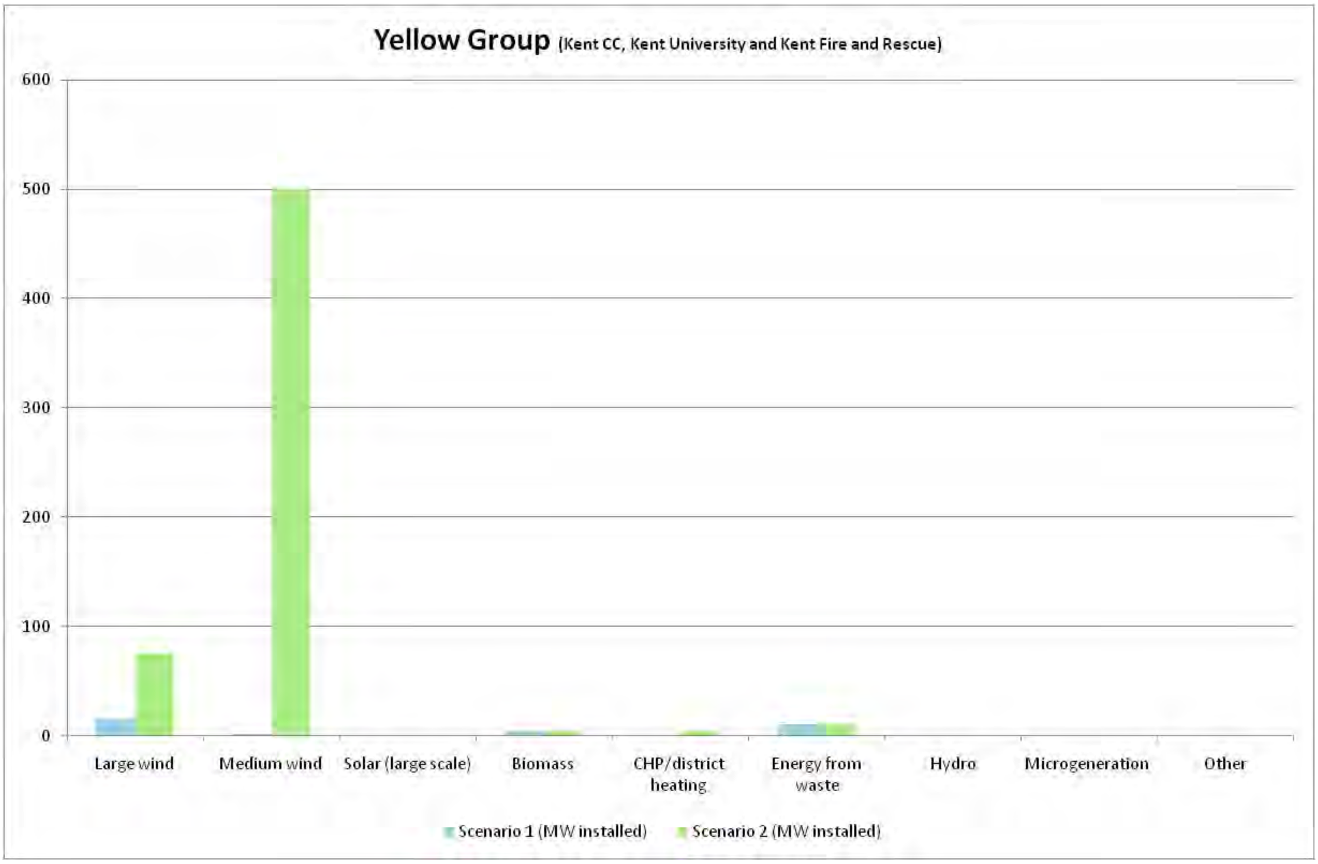


Figure 79: Results of the delivery scenario game (Yellow Group)

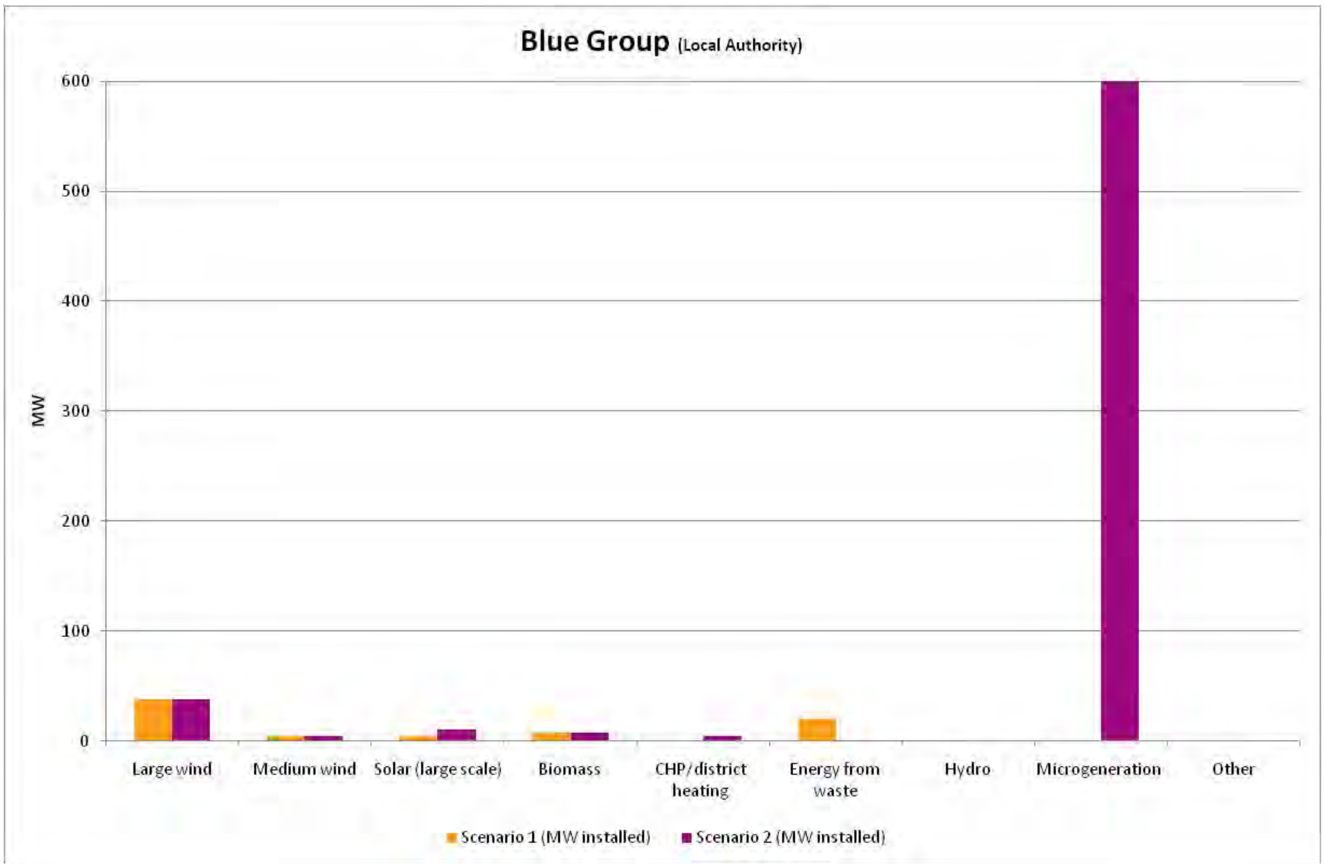


Figure 80: Results of the delivery scenario game (Blue Group)

Workshop Results

All delivery partner groups present indicated particular support for solar, biomass, and wind energy generation in Kent. It is also supported by a survey conducted by ORC International for Kent County Council in 2008, which found that Kent residents' preferred alternatives to fossil fuels were wind power and solar power.[32] Other common themes have been identified across the partner groups, one of the most common being the perception of the planning process as a barrier and the need for increased training and engagement with those involved in the process, especially Councillors. Another was the need for knowledge-sharing amongst and between delivery partner sectors, to give partners confidence in their ability to deliver a successful project.

An impressive range of renewable energy projects have already been delivered across Kent, each showing the commitment and enthusiasm of those involved. Conversations held with individual stakeholders strongly reflected this sense of enthusiasm for renewable energy projects, and demonstrated a high level of knowledge gained from going through the delivery process. These assets should be recognised and drawn upon in the future.

Workshop attendees (July)

The list below shows the groups attendees were placed in – representative of the key energy delivery partners

Communities

First Name	Last Name	Organisation
Paul	Bright	Elham Environment Group
Sue	Delling	Deal Town Council
Chris	Jelly	Elham Environment Group
Matthew	Morris	Kent Downs AONB
Rosie	Rechter	Deal Environmental Group
Irene	Seijo	Kent Architecture Centre
Ian	Smith	Transition Town Sevenoaks
Susan	Westlake	Transition Town Tunbridge Wells

Business

First Name	Last Name	Organisation
Jeff	Dober	Finance South East
Martin	Hart	Pentland Homes
John	Hurst	Estuary Energy
Georgi	Ivanov	Business Support Kent
Phil	Jackson	Daedalus Environmental
Karl	Jansa	Enevis
Jon	Leigh Pemberton	Torry Hill Farm
Megan	McKibbin	Kent Economic Board
Derek	Smith	Estuary Energy
Roger	Gabriel	Kent Economic Board

County

First Name	Last Name	Organisation
Nicholas	Abrahams	Kent County Council
Peter	Austen	Kent Fire & Rescue Service
Carole	Barron	University of Kent
Lucy	Breeze	Kent County Council

Sue	Dunn	Kent County Council
Carolyn	McKenzie	Kent County Council
Ed	Metcalf	Institute of Sustainability
Andy	Morgan	Kent County Council
Kathy	Putnam	Kent County Council
Mark	Styles	Kent County Council

Local Authority

First Name	Last Name	Organisation
Jillian	Barr	Canterbury City Council
Shaun	Cline	Dover District Council
Helen	French	Sevenoaks District Council
Karin	Grey	Tunbridge Wells Borough Council
Janet	Hill	Swale Borough Council
Jennifer	Hunt	Maidstone Borough Council
Amanda	Martin	Dover District Council
Gavin	Missons	Sevenoaks District Council
Rob	Newman	Gravesham Borough Council
Dipna	Pattni	Gravesham Borough Council

Workshop 2

A further stakeholder workshop was held in September 2011 to provide an update on project progress and agree actions for each of the partner groups.

Workshop attendees (September)

Renewable Energy Workshop 2

Delegate List

Sharon Thompson KCC

	First Name	Last Name	Organisation	Signature
P	John	Allen	Swale Skills Centre	
	Sarah	Anderson	Kent County Council	
	Peter	Austen	Kent Fire and Rescue	
E	Steve	Baggs	Kent County Council	
	Jillian	Barr	Canterbury City Council	
	Carole	Barron	University of Kent APOL.	
	Jenny	Bate	Kent Downs AONB Unit	
	David	Brazier	Kent County Council - Member	
	Lucy	Breeze	Kent County Council	
	Shaun	Cline	Dover District Council	
C	Sue	Delling	Deal Town Council	
P	Jeff	Dober	Finance South East	
	Helen	French	Sevenoaks District Council APOL.	
P	Roger	Gabriel	Kent Economic Board	
	Ross	Gill	Kent County Council	
	Wayne	Gough	Kent County Council	
C	Alistair	Gould	The Bay Trust (St Margarets Bay)	
	Keith	Grimley	Maidstone Borough Council	
H	Martin	Hart	Pentland Homes	
	~~Christopher~~ Jo	~~Hazelton~~ HODGSON	Environment Agency	
	Janet	Hill	Swale Borough Council	
P	Phil	Jackson	Daedalus Environmental	
E	Nick	Johannsen	Kent Downs AONB Unit	
E P	Howard	Lee	Hadlow College	
	Amanda	Martin	~~Folkestone~~ Dover District Council	
P	Richard	Matthewman	Locate in Kent	
	Steve	Moore	Thanet District Council	
E	Andy	Morgan	Laser – KCC APOL.	
	Rob	Newman	Gravesham Borough Council	
HP	Kathy	Putnam	Kent County Council	
C	Rosie	Rechter	Deal Environmental Group	
E	Melanie	Rogers	Vattenfall Wind Power	
P	Paul	Sharpe	Paul Sharpe Associates	
H	Irene	Seijo	Architecture Centre APOL.	
C	Ian	Smith	Transition Town Sevenoaks	
P	James	Speck	Kent Science Park	
C	Susan	Westlake	Transition Town Tunbridge Wells	
	Katy	Wiseman	Ashford Borough Council	
E	Matthew	Woodcock	Forestry Commission	
	Louise	Woollen	Tunbridge Wells Borough Council	
	Chris	Jelley	Elham Environmental	

Energy developers

Housing Developers

Communities + Individuals

Public Sector

~~Private sector~~ Business + Industry (Private sector)

Appendix B: Glossary

Term	Explanation
All Action Adopted (AAA)	Refers to a scenario where all recommended actions in the implementation plan of this report have been adopted. This aims to highlight how much renewable energy could be delivered in a maximum (optimised) delivery scenario.
Allowable Solutions	A proposed mechanism for reducing carbon emissions off site as part the Government's definition of Zero Carbon Policy
Anchor Load	Used to describe buildings which could provide significant heat demands to help support a heat network.
Area of Outstanding Natural Beauty (AONB)	An area of countryside considered to have significant landscape value which has been specially designated by the Government.
Business As Usual (BAU)	For the purposes of this report, what would be delivered if no major changes to the current system were made.
BREEAM	The Building Regulations Establishment Environmental Assessment Method. It measures the environmental performance of a building.
Carbon Compliance	The minimum reduction in carbon emissions to be delivered on site as part of the Government's proposed Zero Carbon Policy.
Code for Sustainable Homes	This is an environmental assessment method which attempts to rate the sustainability of residential dwellings by assessing them against nine key criteria including water, energy and CO_2 emissions.
Combined Heat and Power (CHP)	This system works by generating electricity near or on-site, capturing the heat for space and water heating.
Commercial and Industrial (C&I) Waste	Waste produced by the commercial and industrial sectors which is usually managed separately from municipal waste.
Constraints	Factors which may limit the full theoretical potential of an energy resource from being used, for example spatial constraints such as water bodies where certain technologies could not be constructed; or protected areas which have policies limiting certain technologies; or non-spatially defined constraints such as planning and funding barriers.
CO_2	Carbon Dioxide
DECC	Department of Energy and Climate Change
District Heating Network (DHN)	This term is generally given to a system where a centralised heat generating plant (using any one of a range of technologies) provides heat to surrounding buildings in the area by means of a network of pipes carrying hot water or steam.
EfW	Energy from Waste
Energy Supply Company (ESCo)	A commercial entity which typically operates and maintains the generating plant associated with energy technologies.
FITs	Feed in Tariffs. Government incentive paid for electricity generated from renewable sources
Fuel Poverty	Households are considered by the Government to be in 'fuel poverty' if they would have to spend more than 10% of their household income on fuel to keep their home in a satisfactorily heated condition.
Generating Potential or Capacity	The generating potential of a technology takes into account a load factor, which is the average amount of energy produced over a period of time divided by its installed capacity. This load factor differs across renewable energies, and will for example be lower if a technology depends on an intermittent energy source. It is measured as a unit of energy over a period of time (e.g. megawatt-hour).
Geographic Information System (GIS)	Visual representations in map form so that relationships of physical location can be observed.
Green Deal	The Government's proposed programme to establish a framework to: enable private firms to offer consumers energy efficiency improvements to their homes, community spaces and businesses at no upfront cost; and recoup payments through a charge in instalments on the energy bill.
GWh	Gigawatt hour, unit of energy consisting of 1000 megawatt hours.
Heat Density Mapping	A visual representation of the heat demand in a given area, shown as thermal energy demand per km.
Installed Capacity	The installed capacity of a technology is the maximum amount of energy that can be produced by the technology at any given time. Capacity is expressed in unit of energy (e.g. megawatt).
KCC	Kent County Council

kWh	Kilowatt hours, unit of energy
Low Carbon Buildings Programme (LCBP)	A government grant programme for low carbon technologies which ran from 2006-2010.
Low Carbon Energy	Energy which is generated in a way that involves lower carbon emissions than traditional energy generation such as fossil fuelled power stations, for example CHP where heat is used as well as power.
Low Carbon Transition Plan	The UK's strategy for climate and energy which sets out a trajectory for achieving the UK's carbon reduction targets as set in the Climate Change Act 2008.
Micro-generation	These types of technologies are generally directly linked to buildings both physically and in terms of energy supply. They are not heavily influenced by geographic location or climate variations across the UK.
Municipal Solid Waste (MSW)	Waste collected by local authority from households and some small businesses – excludes sewage and agricultural, commercial, or industrial waste.
MWh	Megawatt hour, unit of energy consisting of 1000 kilowatt hours
Part L 2006	Building Regulations for Conservation of heat and power, Approved Documents, in place from April 2006.
Part L 2010	Building Regulations for Conservation of heat and power, Approved Documents, in place from October 2010
PV	Solar Photovoltaic panels that convert sunlight to electricity
Regulated Emissions	CO_2 emissions resulting from energy uses currently regulated by Part L1a or L2a of Building Regulations, these include CO_2 emissions resulting from space heating, space cooling, water heating, auxiliary energy for pumps and fans and some allowance for fixed lighting. They exclude energy use and emissions associated with domestic appliances, decorative lighting and equipment in non-domestic buildings.
Renewable energy	Energy derived from sources which are replenished within the lifecycle of their consumption and involve zero, or near zero, carbon emissions over this lifecycle
RHI	Renewable Heat Incentive. Government's proposed fiscal incentive for sale of heat from renewable sources
SHLAA	Strategic Housing Land Availability Assessment – carried out by Local Planning Authorities.
SLAA	Strategic Land Availability Assessment – carried out by Local Planning Authorities.
South East Study	The name used in this report for the 'Review of Renewable and Decentralised Energy Potential in South East England' study conducted by TV Energy and Land Use Consultants, June 2010
Zero Carbon Policy or Targets	Government policy that all new homes built from 2016 and all new non-domestic buildings built after 2019 will have zero net CO_2 emissions. Work is still underway on this definition but the current indication is that this will cover only regulated emissions.