AECOM

Renewable Energy and Sustainable Construction Study

Waveney District Council

November 2009

Executive Summary

STUDY OBJECTIVES

AECOM have been appointed by Waveney District Council to develop an evidence base to inform the development of sustainable construction and renewable energy policies to be included in their Development Management DPD to ensure that the objectives set out in the Core Strategy can be delivered in a more sustainable, carbon efficient way to meet the requirements of PPS1, which states:

"Planning authorities should have an evidence-based understanding of the local feasibility and potential for renewable and low carbon technologies, including micro-generation, to supply new development in their area."

This has been done by developing an understanding of the current situation in Waveney, reviewing policy direction and analysing the District's energy resource potential. Taking into consideration the availability of baseline information and the duration of growth projections in the District, modelling in this study covers a period from 2006-2025 broken into four growth phases.

GROWTH IN WAVENEY

Waveney's Core Strategy, adopted January 2009, sets out the spatial vision and objectives for growth within the District, along with the spatial strategy for delivery and core policies to guide development. It makes provision for 2200[1] homes in Lowestoft, 1500 of which in the Lake Lothing AAP area, and 375 homes in the District's market towns. There are also a number of dwellings which have planning permission, but are yet to be completed, that need to be taken into consideration when assessing growth and future energy demands. It has been assumed that these will come forward in the first 10 years, with the housing outlined in the Core Strategy delivered evenly over the plan period. The model also takes into consideration the potential housing mix, based on historic trends with an adjustment for increased one and two bed flats to take into account the findings of the Waveney Housing Market Assessment and the aspirations of the AAP area. Table ES1 summarises the proposed housing growth.

Table ES1: Housing Growth and Phases

	2007-2011	2011-2016	2016-2021	2021-2025	Total
Lowestoft	967	1426	825	715	**3933**
Beccles	97	97	62.5	62.5	319
Market Towns	150.25	150.25	93.75	93.75	488
Villages	88	87	0	0	**175**
Total	**1303**	**1760**	**981**	**871**	**4915**

The Core Strategy also highlights areas of employment growth, allocating up to 5ha of light industrial at Bungay and an 8ha 'Power Park' in Lowestoft (focused on energy-related employment). The preferred option-site Specific Allocation DPDs also provide an indication of employment land coming forward in other locations, and the Lake Lothing AAP provides some guidance as to proposed land uses, although this is currently being reviewed. As with housing, there are a number of development with planning permission but not yet built that need to be taken into consideration. Table ES2 summarises the proposed employment growth.

[1] Approximately 2200 new homes will need to be provided in Lowestoft between 2007 and 2025 taking into account existing completions and sites with planning permission. This has been incorrectly recorded as 2500 in Table 8 of the Core Strategy. Of these, 1500 will be located in the Lake Lothing Area Action Plan area of central Lowestoft.

Table ES2: Employment land projections

ha	Employment	Retail	Schools	Healthcare	Community
Lowestoft	57.79	0.53	0.17	0.22	0.22
Beccles	41.42	0	0	0	0
Market Towns	30.14	0	0	0	0

In addition to the residential and employment uses there is likely to be addition social infrastructure required, some of which will have relatively high energy demands. Assumptions have been made as to the education, health and community expected to come forwards set out in table ES3.

Table ES3: Community facility assumptions

Facility type	Area assumption	Total area required
Primary School	2230m^2 per 430 pupil population	6690m^2
Health Care	0.85m^2 per person	8859m^2
Community	0.84m^2 per person	8754m^2

Chapter 1: Key Policy Considerations

Significant growth is expected in Waveney District. Primarily, growth is expected within Lowestoft, with a large proportion of change expected in the AAP area. District-wide there is a large proportion of light industrial development expected, along with small-scale infill development. In response to PPS1, policy recommendations for renewable energy and sustainable construction should focus on key growth locations where key interventions need to be made, but District-wide targets should take into account the overall character of development and potential of the area.

EVIDENCE FOR SUSTAINABILITY CONSTRUCTION POLICIES

The importance of developing sustainably has been growing in momentum since the Rio Earth Summit in 1991 and the subsequent summit in Johannesburg in 2002. Building on these event latest UK Sustainable Development Strategy – Securing the Future (2005) sets out the UK's sets out five guiding principles for sustainable development with a focus on environmental limits. It also identifies four priority areas for the UK; sustainable consumption and production, climate change, natural resource protection and sustainable communities, as well as action the UK feels is needed internationally.

Both the East of England Plan and Waveney's Core Strategy both reiterate the commitments to the Sustainable Development Strategy and set out overarching sustainable development policies that set out broad expectations. They both also set out more specific policies on a range of sustainability related topics. This study analyses the sustainable construction baseline against key environmental aspects, and investigates where policy priorities and standards need to be applied for sustainable construction. Energy and carbon considerations are considered separately in the remainder of this report.

Climate Change is likely to have both global and local impacts. With medium emissions, the UK Climate Impacts Programme (UKCIP09) predicts that by 2050 there will be the following climatic changes in the East of England:

- Temperatures are likely to increase in winter temperature of 2.2ºC and summer of 2.7 ºC with maximum summer temperatures peaking some 3.4ºC higher than today
- Annual rainfall is likely to remain about the same but will fall at different times, with an increase in winter rainfall by 14% and a reduction in summer rainfall by 16%. Summer rainfall is also likely to be in hard, shorter bursts, with longer dry spells.
- Sea level rise of about 22cm in Lowestoft.

In addition to the policy direction provided by the East of England Plan and Waveney Core Strategy analysis of the current situation of sustainability issues in Waveney District identified two issues that require focused policy intervention:

- Water Supply – Water resources in Waveney are severely restricted, with over abstraction of the Waveney and limited ground water abstraction capacity. This is likely to be exacerbated by new development. Policies to reduce potable water consumption should be introduced to make more efficient use of water. This should also be supplemented by water use reduction measures and the implementation of water recycling infrastructure. Although minimising water resources is covered in Policy CS02 - High Quality and Sustainable Design of the Waveney Core Strategy, it is deemed of such significance, that targets are recommended through the Development Management DPD.
- Flooding – Although restricting development in areas of flood risk is covered by PPS25, and reflected locally through Waveney's Core Strategy, a significant area for redevelopment, the AAP area, has been made an exception. Although there are likely to be significant economic and social benefits from regeneration of the AAP, it will be important to ensure that these are not outweighed by the risk of coastal flooding, which is likely to increase with sea level rises and increases rainfall. Land raising is proposed to protect the area, but this needs to be supported by a District-wide effort to reduce flood risk through the wide spread introduction of sustainable drainage systems to capture, store and treat flood water. In addition, in areas where risk remains, it will be important to ensure that measures are taken to reduce the impact of any flood event, for example by designing properties to place living areas above the design flood level of the flood zone.

It has been deemed that the remaining sustainability related issues reviewed are adequately covered within existing policies and strategies or do not present specific issues. New development should support current performance, and enhance performance where possible.

- Materials and Waste – Waveney has made good progress towards recycling and composting targets, although, based on Suffolk wide performance, a significant amount of waste is still landfilled. Waste and recycling issues should be addressed through the Waste and Minerals Local Development Framework, Waveney's Waste Management Strategy.
- Environmental Sensitivity – Waveney is rich in biodiversity and important landscape features. The Appropriate Assessment screening accompanying the Core Strategy found, however, that as most development is directed to 'previously developed land within the existing boundaries of towns and larger villages' there will be no significant impact on European Designations. Other potentially sensitive areas, including those of local biodiversity interest and those of distinct quality and character are afforded protection through Policy CS16 – Natural Environment. Furthermore, particularly important areas, such as the Area of Outstanding Natural Beauty (AONB) and the Broads area are covered by their own planning rules.
- Pollution – Air quality is considered to be within Governments objectives and there is only one site requiring monitoring. There are no areas currently defined as contaminated land, although given the industrial historic uses within the District, some sites are being monitored.
- Quality of life – There is a deficit of open space in some areas. This is picked up in Policy CS04 – Infrastructure and Policy CS14 - Culture of the Core Strategy which places a requirement on developers to consider infrastructure requirements and address deficiencies.

Chapter 2: Key Policy Considerations

Along with energy and carbon, wider sustainable construction aspects should be considered in Policy. Waveney's Core Strategy has good coverage of most sustainable construction aspects on a District-wide scale, and these need to be supported by policy requirements for new development. Assessment tools including the Code for Sustainable Homes and BREEAM offer potential assessment methods for local authorities and developers, where there is a clear external and recognized assessment method and procedure that is simple to implement. The sustainable construction evidence based developed in this Chapter demonstrates that new development should prevent adverse effects and enhance performance against the range of sustainable construction aspects to support Waveney District Council's sustainable development objectives. Therefore the use of the Code for Sustainable Homes or BREEAM could be utilized within policy to ensure the effect of new development on the local environment and communities is managed. Financial implications relating to the full application of the Code for Sustainable Homes are expected to be manageable on most sites at Code Level 4 and below and expected to

not adversely impact on development potential. Above Code 4 costs for water recycling infrastructure become more substantial, and need to be considered in relation to the market delivery context.

Particular attention needs to be given to two aspects of sustainable construction; water demand reduction and flood protection. Water supply is severely restricted in Waveney. Sustainable construction standards should support high standards of water efficiency in new development to ensure water supply issues are not further increased. There may also be opportunities to implement water recycling measures on key sites. Flooding is a key risk for the area. Core Strategy policies already prevent development in the floodplain, with the exception of the AAP area where physical flood preventions measures will be made. The development of Sustainable Drainage Systems (SuDS) should be a priority across the District to reduce flood risk related to stormwater runoff in the AAP area and elsewhere.

BUILDING-RELATED ENERGY AND CARBON

The relationship between climate change and carbon dioxide emissions is now firmly established. At the international level, the Kyoto Protocol is currently being updated (using the "Bali Roadmap") and will be agreed in Copenhagen in December 2009. This will commit the UK to an updated carbon dioxide reduction path, as well as technology development and transfer and financial investment, which will need to be reflected in planning policy. The UK is also committed to meeting carbon reduction targets set out by the European Commission in the EU Renewable Energy Target which requires a 20% reduction on 1990 levels by 2020 this includes carbon from electricity, heating and transport. The UK is expected to meet 15% of this target, which equates approximately to 30% reduction in carbon dioxide from electricity production and approximately 12% from heating requirements as set out in the UK's Renewable Energy Strategy (2009).

Planning Policy Statement 1: Delivering Sustainable Development (PPS1) (2005) places an emphasis on promoting more sustainable development, with a supplement to PPS1 on climate change released in December 2007. It advised planning authorities to provide a framework to encourage low carbon and renewable energy generation in their local development documents and confirmed that there are situations where it is appropriate for LPA to expect higher standards than Building Regulations. Paragraphs 31-33 explain that the local circumstances that warrant higher standards must be clearly demonstrated, such that there are clear opportunities for low carbon developments or that without requirements, development would be unacceptable for the proposed location. Paragraph 32 suggests that local requirements should focus on the development area or site-specific opportunities and that the requirement should be in terms of achievement of nationally described standards such as the Code for Sustainable Homes. Paragraph 33 requires that decentralised energy or other sustainable requirements should be set out in a DPD. Care must also be taken to demonstrate that the requirements are viable, will not impact on the supply and pace of housing development and will not inhibit the provision of affordable housing.

The Government has also announced its intention for Building Regulations to cover new residential development's dwelling emission rate (DER) being 25% better than target emission rates (TER) in 2010, 44% better in 2013 and meeting a zero carbon target by 2016, with non-residential development expected to meet the zero carbon target by 2019.

Waveney domestic 2006 electricity use totalled 245GWh, which averages out at 4,549kWh per meter. This compares favourably with the East of England average, although is slightly behind the UK average. Gas use within the District is 713GWh, which is considerably lower, approximately 11%, than the UK average gas use. The total electricity consumption from non-residential users in Waveney was 404GWh. Approximately three quarters of this, 302GWh, was used by only 181 major energy users. This is an average of 1.6GWh per user. The remaining 102GWh was consumed by 4,577 users.

This study models the evolving energy profile of Waveney over time until 2025. The energy profile will change in three ways; firstly, due to the improvement and changes in consumer behaviour in existing buildings, secondly due to the addition of energy demand from new development in the area, and thirdly, due to expected fuel switches over time as rural energy users switch from the use of coal and oil fuels to electricity and gas.

Using the Domestic Energy Factfile developed by BRE for the Department of Energy and Climate Change (DECC), it is possible to model future domestic energy demand. This study has modelled various scenarios for

the improvement of existing stock based on expected changed in energy efficiency over time. In Waveney, electricity demand is likely to increase slightly, as demand for more energy intensive appliances outweighs energy efficiency measures. Gas demand on the other hand is likely to decrease as energy efficiency measures are applied. Similarly data from the Carbon Trust and in-house best practice the AECOM Carbon Management Team have been used to estimate energy efficiency improvement for non-residential buildings through expected changes in behavioural change and capital cost measures. This shows a gradual decline in both demand for gas and electricity.

New development will increase energy demands within the District. Part L of the Building Regulations requires that buildings meet minimum energy efficiency standards. These standards have been applied to the quantum and assumed mix of housing. In addition, increased energy performance in line with the proposed changes to Building Regulations Part L requirements which will take effect in 2010, 2013 and 2016 have been taken into consideration, along with the expected changes to Regulations affecting non-residential buildings leading up to zero carbon in 2019. Similarly, CIBSE TM46 benchmarks were used to model energy demand of future non-residential buildings, with a 25% reduction to account for the higher energy efficiency standards in new buildings compared to the existing buildings which the benchmark figures were derived from. Table ES4 summarises the total future energy demand taking into consideration improvements in existing stock, new demand and projected conversion from oil and coal to gas.

Table ES4: Expected Cumulative Energy Demand in Waveney over time (kWh)

	2006	2011	2016	2021	2025
Domestic Electricity Demand	245,081,483	250,931,496	258,528,265	263,653,517	282,561,225
Domestic Building Gas Demand	713,949,469	673,797,688	635,012,232	590,635,955	562,732,118
Domestic Oil Demand	54,880,495	54,880,495	54,880,495	54,880,495	54,880,495
Domestic Coal Demand	2,544,749	2,544,749	2,544,749	2,544,749	2,544,749
Non-Domestic Electricity Demand	403,828,510	420,330,145	436,846,927	453,525,828	470,610,868
Non-Domestic Gas Demand	223,366,783	316,770,080	394,948,589	412,451,309	430,847,496
Non-Domestic Oil Demand	229,730,421	229,730,421	229,730,421	229,730,421	229,730,421
Non-Domestic Coal Demand	9,626,822	9,626,822	9,626,822	9,626,822	9,626,822

Chapter 3: Key Policy Considerations

Policy development should consider the evolving energy demand profile for the District to ensure that energy efficiency measures and new development demand are taken into account when specifying renewable energy targets as a proportion of energy demand. New development will demand significant amounts of energy in Waveney District, particularly non-residential demand. Hence, policy measures should encourage significant reductions in energy demand from new development, through both energy efficiency and renewable energy measures.

RENEWABLE AND LOW CARBON POTENTIAL

Waveney already has some renewable energy infrastructure operational, with gas from the landfill site at Wangford captured and utilised in a 1.006MW generator to produce electricity and the 2.75MW wind turbine at Ness Point is the first commercial wind turbine in Suffolk and the largest wind turbine in Britain. In addition, there

are a number of wind energy developments planned and potentially online by 2015. These are outlined in Table ES5.

Table ES5: Energy infrastructure forecast

Technology	2010 Installed capacity MW	GWh p.a.
Landfill gas – operational	1.006	7.5
Onshore Wind – built	2.75	6.26
Onshore Wind – Approved – not built	6.25	14.24
Onshore wind – in planning	11.5	24.18
Total	**21.506**	**52.18**

The EU Renewable Energy Target which requires a 20% reduction on 1990 levels by 2020 of carbon from electricity, heating and transport. The UK is expected to meet 15% of this target, which equates approximately to around 30% reduction in carbon dioxide from electricity production and approximately 12% from heating requirements as set out in the UK's Renewable Energy Strategy (2009). These targets are UK wide, and the proportions of renewable energy generation should be tailored to the potential in each local area. Waveney District should aspire to meet at least its share of this target as set out in Table ES6. This study tests the potential for renewable energy generation within Waveney to determine whether the District is capable of meeting renewable targets in line with the national target proportions, or whether the District should have lower or higher targets according to the level of potential.

Table ES6: Waveney's renewable energy requirements 2020

Requirement	**Requirement in GWh**
Around 30% of annual electricity consumption	214
Around 12% of annual heat consumption	153

Waveney District has potential to support a significant range of renewable and low carbon infrastructure in order to meet, and potentially exceed these targets. Wind energy will play a particularly important role in meeting the renewable energy targets, and given the District's established connection to the wind energy industry, wind energy could be an important cornerstone of the economy in the future. Although there is potentially sufficient wind resource to meet Waveney's renewable electricity requirements, localised factors may limit deliverability and as such should not be solely relied upon. Biomass CHP could also be an important part of the renewables mix, particularly in Lowestoft where existing heat densities could be utilised to develop heat networks supplied by CHP units. In rural areas, biomass fuelled heating provides a potential opportunity to replace higher carbon fuels such as oil and coal. In addition, several other technologies will need to be utilised, each making a modest, but important collective contribution.

Compiling the various key energy opportunities across the District for renewable and low carbon energy, these have been used to create an 'Energy Opportunities Plan'. This can be used as a resource in policy and planning to guide key opportunities for consideration. The Energy Opportunities Plan (EOP) is shown in Figure ES1, with a zoomed in version of Lowestoft (Figure ES2).

Figure ES1: Energy Opportunities Plan

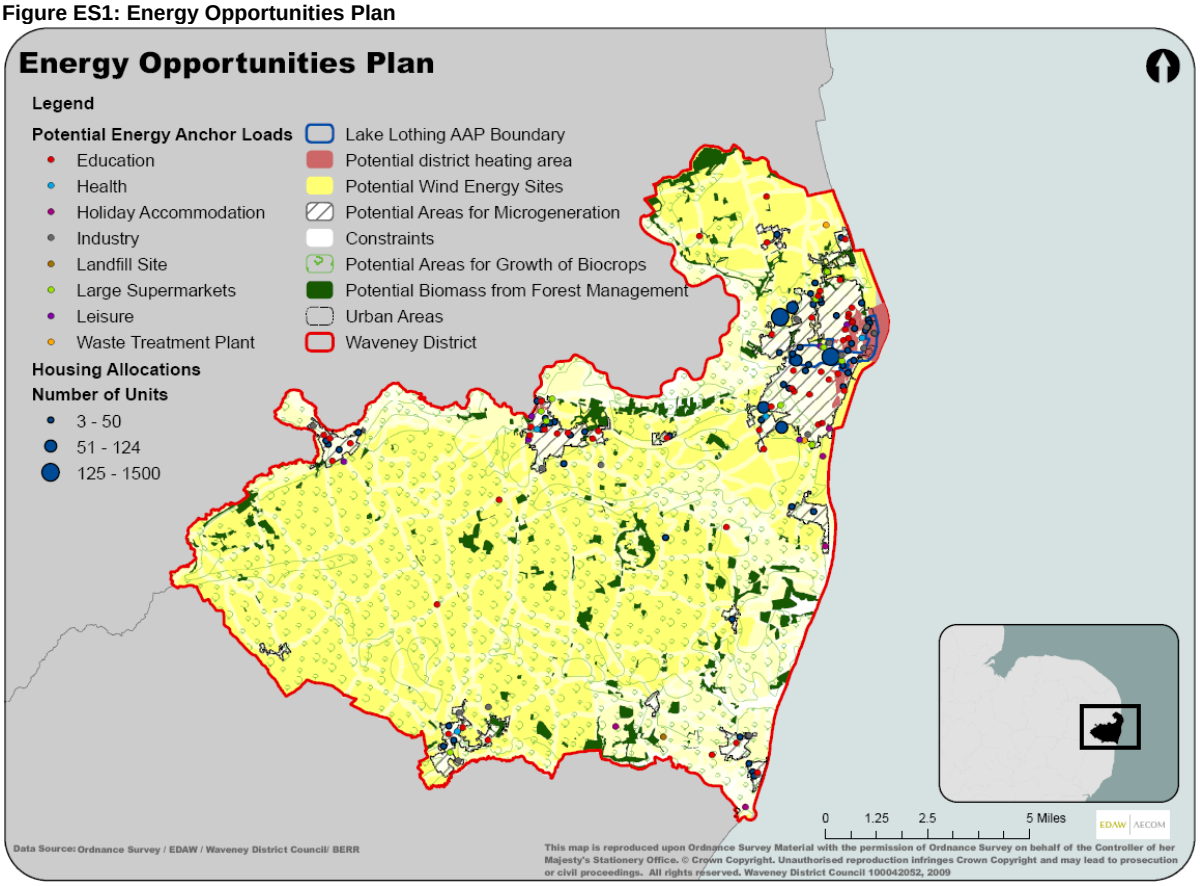
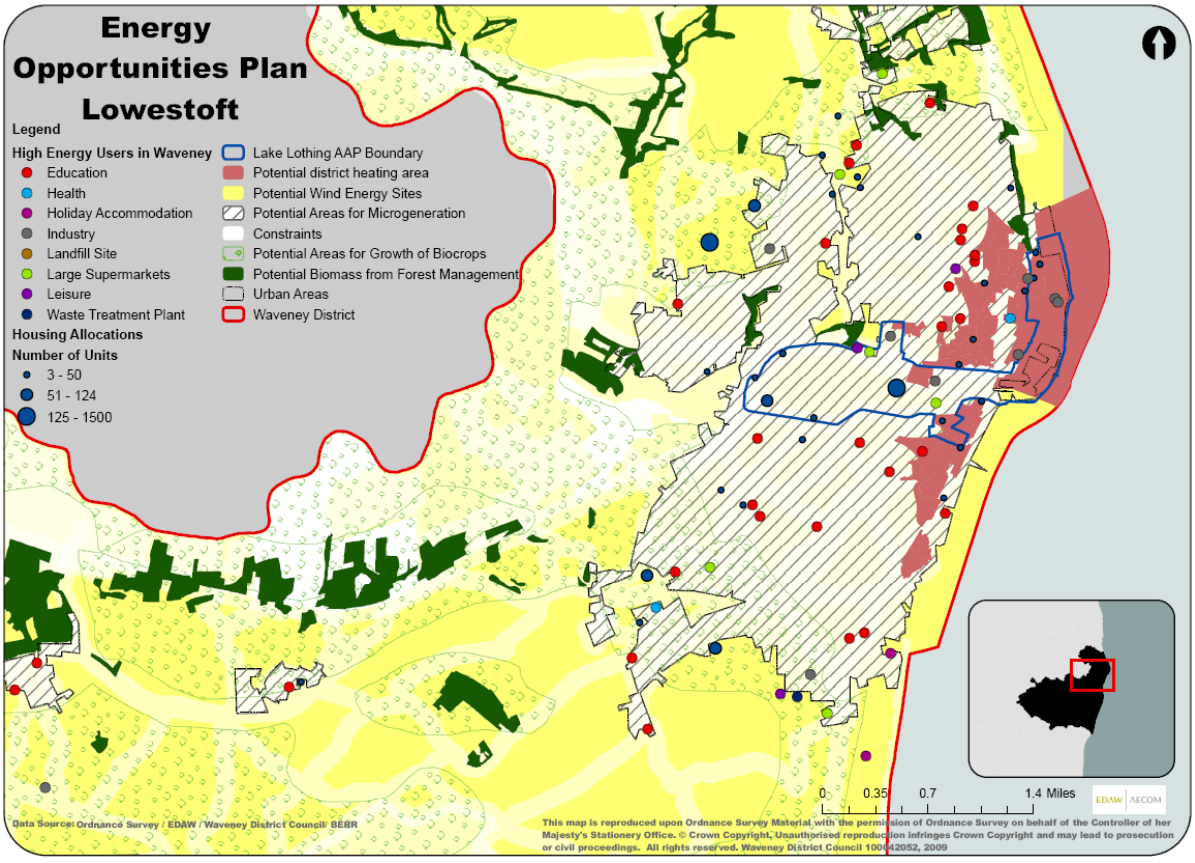


Figure ES2: Energy Opportunities Plan - Lowestoft



Chapter 4: Key Policy Considerations

The analysis of resource potential in Waveney District has shown that there is significant potential to be exploited, which will allow Waveney District to meet or exceed its proportion of the national renewable energy targets. Wind power and utilization of biomass for CHP or heating are highlighted as key opportunities. Policy should support the optimization of these opportunities. Policy recommendations should also identify mechanisms to deliver renewable and low carbon energy potential through new development, both on-site and off-site (through allowable solutions or otherwise).

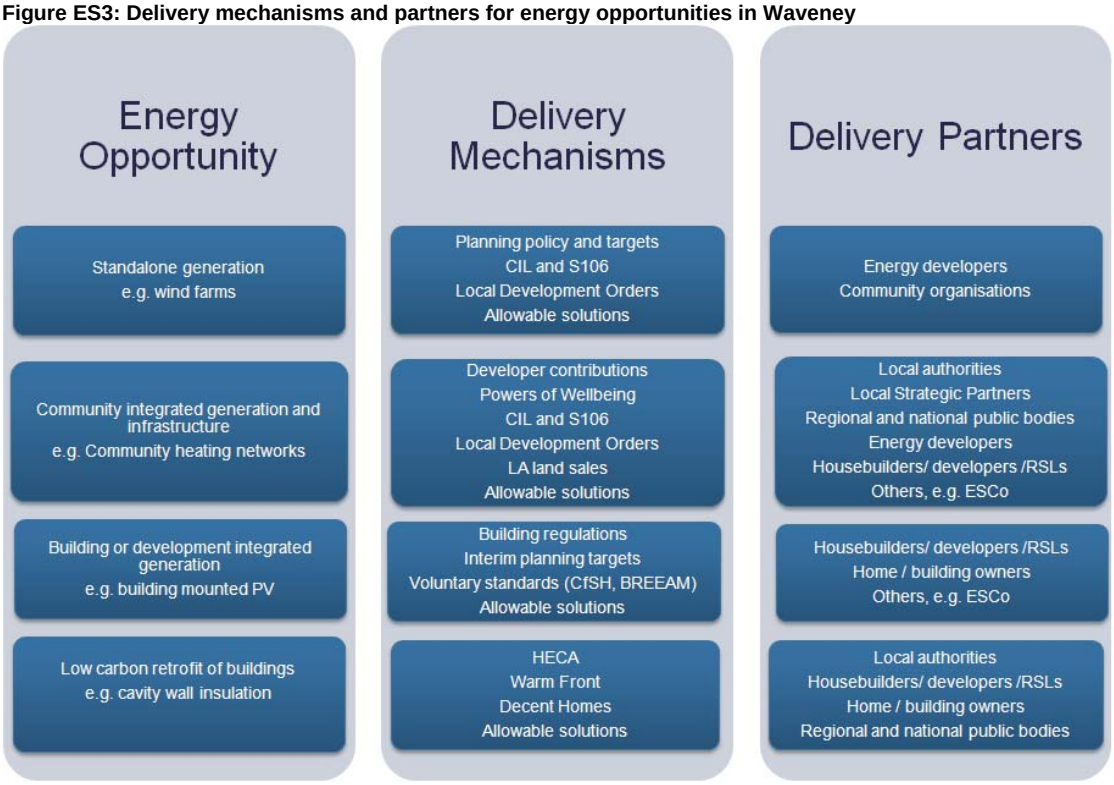
DELIVERING CHANGE IN WAVENEY

This section describes the opportunities and mechanisms available to Waveney to deliver, and potentially go beyond the national and regional carbon reduction targets. The proposed approach is designed to balance delivery of decentralised low carbon and renewable energy from proposed new development with the wider opportunities available to the local authority, drawing on:

- Improving the energy performance of existing buildings:
  - through energy efficiency; and
  - through micro-generation.
- Delivering carbon efficient new development:
  - through energy efficient new stock;
  - through on-site renewables; and
  - through development driven off-site renewables and low carbon infrastructure.
- Delivering stand alone renewable and low carbon infrastructure:
  - through private investment;
  - through community delivery;
  - through local government delivery; or
  - through a combination of the above through partnership.

The nature of planning for energy at the local level is such that the planning process cannot deliver the opportunities alone; it will require a collaborative approach between local authority departments, the Waveney Local Strategic Partnership (WLSP), private developers and the community. Figure ES3 summarises some of the mechanisms and partners required to deliver the change in Waveney.

Figure ES3: Delivery mechanisms and partners for energy opportunities in Waveney



Improving the energy efficiency of existing buildings

Improving the energy performance of existing buildings should be undertaken in three ways:

- Increase the uptake of energy efficiency measures with concentrated funding and a programme of improvement. The Council can encourage higher energy efficiency in existing buildings by working with partner organisations to distribute and focus funding.
- Converting properties that rely on oil, coal and electric heating to biomass. Efforts should be made to convert these systems to wood burning stoves and biomass boilers utilising wood as a lower carbon fuel.
- Installing micro-generation technologies to some existing properties. Delivery of low carbon and renewable technologies within existing buildings and communities cannot be required by planning, but can be encouraged by the Council.

Delivering carbon efficient new development

Carbon efficient new development will be delivered through a combination of energy efficiency measures and development driven renewable and low carbon energy infrastructure in-line with the Government's commitment to zero carbon development in 2016. This would require around a 70% reduction above the TER with the remaining 30% potentially picked up through a range of 'allowable solutions' to offset the remaining energy requirements.

As part of the allowable solutions, developers can look for opportunities to reduce carbon further either on-site or off-site. Generally, CHP and wind energy provide excellent opportunities for developers to reduce carbon associated with new development in a cost effective manner. Often the integration of these technologies cannot be delivered solely within the boundary of the site:

- there may be restricted space for integration of a wind turbine on-site, while there is space on adjacent property without turbulence issues created by development; and
- heat networks may be more viable when connecting into heat loads off-site, or a developer may see opportunity to invest in adjoining networks as part of their allowable solutions.

Therefore, it is important to realise the context for the expected development of large sites (100 homes+) to seek opportunities to deliver wind power or heat networks directly associated with new development.

The Council should highlight key possibilities to developers and require investigation of key opportunities as strategic sites come forward. The Council should take a leading role in highlighting and enabling the delivery of key 'allowable solutions' and look for opportunities to drive delivery of these solutions in conjunction with new development.

Delivering stand alone renewable and low carbon infrastructure

The principle stand alone renewable and low carbon infrastructure opportunities in Waveney come from large and medium scale wind turbines and district heating networks to provide community heat from biomass (preferably with CHP to provide electricity). These types of technologies are likely to come forward in one of two ways, through private commercial interest or through local authority /community investment. Where, market delivery isn't coming forward, Waveney District Council can lead delivery of energy infrastructure with support from private investors or communities. Communities may also want to join together to deliver energy infrastructure, investing and in capital cost and receiving income from selling energy. Generally, the largest opportunities regard the implementation of wind power and heat networks.

- Large Scale Wind – A significant number of the wind opportunity areas identified in EOP are likely to be attractive to commercial developers. Supportive planning policies and targets should be sufficient to deliver significant generation installations. However, there will also be sites that, once detailed constraints have been assessed, will be too small to attract the interest of commercial developers. Additionally, securing planning permission for the potential wind turbine locations in more constrained sites could prove difficult for commercial developers and projects may be constrained by local archaeological and hydro geological factors.

  The local authority could take forward less commercial opportunities in partnership with the community. Project finances could be raised by the issuing of bonds to residents and businesses by an Energy Services Company (ESCo) (see below) and giving returns based on energy sales, Renewables Obligation Certificates and feed-in tariffs. Further community incentives could include discounts on

council tax. A co-operative venture, possibly with the involvement of the local authority is another option that should be explored.

- District heating with CHP – The primary district heating opportunity area in Waveney is the Lake Lothing AAP area and this should be reflected in the AAP masterplan. An eventual aim could be to connect areas with sufficient heat density (primarily Lowestoft) but which lie outside the AAP to one overall network.

  Different elements of the network can be treated differently. The operating costs of the insulated pipes that move heat between the energy centre and customers are relatively low. The main cost is installing the pipeline at the start. This can be competitively tendered by a local authority ESCo and, since Waveney Council may have access to low interest rates and repayments over a long time period using Prudential Borrowing, capital costs can be kept to a minimum. Repayments could be serviced by energy sales and income from the renewable heat incentive and for a CHP system generating both heat and electricity, from ROCs (Renewables Obligation Certificate) and/or the proposed feed-in tariff.

  Energy centres tend to have lower upfront costs. The expense comes with ongoing operation and maintenance, a shorter life span (around 15 years) and exposure to fluctuations in energy prices. While ownership of the sites and buildings may be retained by the local authority, the plant itself could be operated by a private sector Energy Services Company (ESCo).

Delivery

There are a number of potential delivery options explored in this report including:

- Setting up an Energy Company in Waveney
- Community Infrastructure Levy (CIL)
  - Local Development Orders (LDO):
- Delivery of micro-generation technologies
  - Householder or business purchase
  - Householder or business hire purchase
  - Householder or business rental
- Sources of funding for public bodies
  - UK Green Stimulus Package Pre-Budget Report 2008
  - Salix Finance
  - Low Carbon Buildings Programme – Phase 2
  - Carbon Emission Reduction Target (CERT)
  - The Community Energy Saving Programme
  - Renewables Obligation Certificates (ROCs)
  - Feed-in tariffs
  - EDF Renewable Energy Fund
  - Intelligent Energy Europe

Chapter 5: Key Policy Considerations

There are a range of delivery priorities, mechanisms and partners. Waveney District Council has a key role to play in a number of district-wide carbon reduction initiatives. The delivery opportunities need to be further explored following this study. Key delivery priorities are large scale wind and CHP in the District. A key delivery opportunity is to drive the installation of infrastructure through new development in the area, utilizing the Community Infrastructure Levy.

DISTRICT-WIDE POLICY RECOMMENDATIONS

To meet the energy targets and sustainability priorities identified, four policy recommendations are made:

Recommendation for new Policy 1: Renewable Energy

Applications for standalone energy generation and other CO_2 reductions will generally be supported in the District. The District is seeking new renewable energy generation capacity to deliver an appropriate contribution towards the UK Government's binding renewable energy target. Therefore:

- **At least 214GWh of renewable electricity by 2020 (approximately 30% of total electricity demand in Waveney).**
- **At least 153GWh of renewable heat by 2020 (approximately 12% of total heat demand in Waveney).**

Recommendation for new Policy 2: Delivering the Energy Opportunities Plan

Decentralised, low carbon and renewable energy is a priority for Waveney Council. Planning applications for new development in Waveney will need to demonstrate how they contribute to delivery of the current 'Energy Opportunities Plan'. Delivery can take a number of forms:

- **"Carbon compliance" – this will require at least a minimum level of carbon reduction (compared to current Building Regulations) through a combination of energy efficiency measures, incorporation of on-site low carbon and renewable energy technologies and directly connected heat (heat source not necessarily on-site). (Policy 3).**
- **Payments into a 'carbon buyout fund', ideally through a Community Infrastructure Levy (CIL) (Policy 3).**

Recommendation for new Policy 3: Community Infrastructure Levy – Energy and CO_2

In order to contribute to the delivery of the Energy Opportunities Plan, all new buildings in Waveney will be required to either:

- **Be subject to a Community Infrastructure Levy, charged at £100 per tonne of CO_2 per building emitted over a 30 year period (or a one-off payment of £3,000 per tonne of CO_2 per building); or**
- **Achieve a 15% reduction in residual CO_2 emissions in all buildings after Building Regulations Part L compliance has been demonstrated. This can be achieved through "carbon compliance", i.e. a combination of energy efficiency measures, incorporation of on-site low carbon and renewable technologies and directly connected heat (not necessarily on-site).**

Planning approval will be dependent on the provision of design stage and as-built Building Control Compliance documentation clearly showing the Target Emission Rate (TER) and Dwelling Emission Rate (DER) / Building Emission Rate (BER).

More information and supporting guidance will be provided within the Sustainable Design and Construction SPD.

Recommendation for new Policy 4: Sustainable Design and Construction

All new residential developments in Waveney are required to meet full Code for Sustainable Homes standards or equivalent. These requirements will not come into effect until successive updates to Part L of the Building Regulations become mandatory:

- **At least Code level 3 will be required for all new homes once updates to Part L come into effect (currently scheduled for April 2010).**
- **At least Code level 4 will be required for all new homes once updates to Part L come into effect (currently scheduled for 2013).**

All new non-residential developments in Waveney over 1000 square metres gross are required to achieve the BREEAM the "Very Good" standard or equivalent, with immediate effect (relevant versions of BREEAM are available covering offices, retail, industrial, education and healthcare).

Planning applications will require submission of interim Code for Sustainable Homes certificates or design stage BREEAM certificates as appropriate, in order to demonstrate compliance. Planning

conditions will require submission of final Code certificates and post-construction BREEAM certificates, as appropriate. Conditions will not be discharged until compliance has been demonstrated in this way.

STRATEGIC SITES AND CHARACTER AREAS

Following PPS1, this study seeks opportunities to build an evidence base for strategic sites where increased energy and carbon targets can be applied to take advantage of key opportunities. The Lowestoft AAP area has been considered as the key strategic site in the District.

There will be significant change within the AAP area over the Core Strategy period. This provides a key vehicle for the delivery of renewable energy infrastructure due to the scale of change and the opportunity to cost-effectively integrate decentralised energy infrastructure into the town centre area. The AAP area also has two significant energy opportunities where District-wide targets could be exceeded if the technologies are proved to be viable and deliverable. These opportunities are for medium-large scale wind power and delivery of a heat network supplied by a combined heat and power system. Both of these energy options need to be seriously investigated and implemented (unless proven to be unviable) to seek larger carbon reductions in the AAP area.

In response to the severe water supply issues in Waveney, the Lowestoft AAP area provides a key opportunity to reduce water demand in the District. While currently on a home by home basis within small scale development there are significant financial implications associated with the installation of water recycling measures, there may be opportunities to introduce water recycling measures on a site-wide scale in a cost-effective and resource-effective manner. The development of the AAP should seek opportunities to install water recycling on a large-scale where viable.

Strategic Sites - Policy Recommendations

The Lake Lothing AAP is still in development. Once land uses and distribution of development is developed in further detail, it is recommended that an energy strategy and a water strategy for the whole AAP area is undertaken to identify infrastructure delivery needs and phasing to allow delivery of higher targets for energy and water. These strategies will give a site-wide overview and allow straight-forward delivery of opportunities by developers. Linked with these overall strategies, the following policies are suggested for inclusion in the AAP.

ENERGY

1. *Developers must explore the potential to bring on line large scale wind turbines and/or biomass combined heat and power (CHP) plant as part of development within the AAP. Unless these technologies can be proven technically unsuitable or commercially unviable developers must deliver the equivalent of the energy requirements of Code for Sustainable Homes Level 5 (in residential buildings) and BREEAM excellent (in other buildings). Investigations should be based on opportunities identified in the area-wide energy strategy for the AAP.*

2. *Opportunities should be sought to link together development within the AAP with district heating networks, taking advantage of the diversity of energy loads from the different proposed building uses. This process will be supported by 1st East and Waveney District Council. Where a CHP system is delivered on-site, all buildings are required to connect.*

3. *An energy strategy and delivery plan must be submitted alongside any planning application for development within the AAP area outlining expected carbon reductions and the viability of exceeding District-wide energy targets on-site.*

WATER

1. *Developers must explore the potential to implement water recycling measures on a building or site-wide scale to significantly reduce mains water demand as part of development within the AAP. Unless these strategies can be proven technically unsuitable or commercially unviable developers must deliver infrastructure to reduce mains water consumption to the equivalent requirement of Code for Sustainable Homes Level 5 (in residential buildings) and BREEAM excellent (in other buildings). Investigations should be based on opportunities identified in the area-wide water strategy for the AAP.*

2. *Opportunities should be sought to link together development within the AAP with site-wide recycled*

water networks, taking advantage of the diversity of water sources and uses on-site. This process will be supported by 1st East and Waveney District Council. Where a recycled water network is delivered on-site, all buildings are required to connect.

3. *A water strategy and delivery plan should be submitted alongside any planning application for development within the AAP area outlining expected mains water demand reductions and the viability of exceeding District-wide water targets on-site.*

While the AAP area is a key strategic site for Waveney District, this study also considers key character areas. Character areas help to demonstrate the potential for the inclusion of renewable energy and sustainable construction within different development types in the District, and in turn can support the setting of advanced targets for sites with good potential by the Council as those sites come forward. This study considered three character areas that encompass the broad types of development expected in Waveney District:

- **Residential development in Lowestoft of 10 dwellings or more** – It is proposed that there will be approximately 700 additional dwellings in Lowestoft over the growth period. Generally, there are a wider range of viable options for improving energy performance at a scale of 10 dwellings and above, through introduction of site-wide infrastructure.
- **Light Industrial** – A significant proportion of new employment development, particularly in the Market Towns is likely to be light industrial.
- **Dispersed residential development** – Outside of Lowestoft residential development is most likely to come forward through small scale windfall development.

Each character area can support delivery of the District-wide targets. There is also basis for increasing targets for sites coming forward where certain conditions exist:

- Due to the scale of the site (>500 homes), or proximity to existing areas of high energy demand, or the proximity of the site to an existing district heating network, there may be cause to require installation of district heating infrastructure and/or CHP.
- Where new development is planned near sites with potential for wind development, the investigation of the use of wind energy on-site or near-site should be required.
- Where large industrial development is proposed, and costs of increasing requirements to BREEAM 'excellent' will not threaten viability of development, this should be required.

Chapter 7: Key Policy Considerations

There is a key opportunity for higher policy requirements in the AAP area in Lowestoft, as supported by further investigations as development mix and spatial layout are investigated. The key development characters expected in Waveney District can viably meet the District-wide targets, but opportunities to exceed these targets should be exploited, particularly where development conditions exist that enable larger scale energy solutions to be implemented. It is recommended that an energy strategy and water strategy is undertaken for the AAP area to identify and coordinate delivery of site-wide opportunities.

Contents

1. Introduction

1.1 STUDY OBJECTIVES

AECOM have been appointed by Waveney District Council to develop an evidence base to inform the development of sustainable construction and renewable energy policies to be included in their Development Management DPD to ensure that the objectives set out in the Core Strategy can be delivered in a more sustainable, carbon efficient way. Planning Policy Statement 1 requires local authorities to understand the potential for incorporating renewable and low carbon technologies in their authority area:

"Planning authorities should have an evidence-based understanding of the local feasibility and potential for renewable and low carbon technologies, including micro-generation, to supply new development in their area." – PPS1.

Under PPS1 Local Authorities should:

1. Along with criteria based policies, identify suitable sites for decentralised and renewable or low carbon energy
2. Expect a proportion of energy supply for new development to be secured from decentralised and renewable or low carbon energy:
    - Set targets where necessary;
    - Where opportunities allow, bring forward development area or site-specific targets;
    - Set thresholds and development types to which the target will be applied; and
    - Ensure a clear rationale for the target and it is properly tested.

This study aims to provide a robust evidence base following PPS1 requirements to enable the delivery of carbon reductions associated with energy in Waveney. Through an understanding of the current situations in Waveney, review of policy direction and analysis of the District's potential, this report sets out the premise and justification for policies. Taking into consideration the availability of baseline information and the duration of growth projections in the District, modelling in this study covers a period from 2006-2025 broken into four growth phases.

1.2 REPORT STRUCTURE

The rest of this report is set out as follows:

- **Chapter 1: Introducing the Situation** – looks at the expected growth situation in Waveney, and considers the overarching policy context.
- **Chapter 2: Evidence for sustainable construction policies** – reviews the relevant policy and baseline situation covering a range of sustainability related issues.
- **Chapter 3: Building related energy and carbon** – focuses in on the energy and carbon from the built environment, reviewing relevant policy and analysing the current and future energy demands.
- **Chapter 4**: **Renewable and Low Carbon Energy Potential** – considers the renewable and low carbon resource potential within the District.
- **Chapter 5: Delivering change in Waveney** – develops a three strand approach for reducing the Districts carbon emissions including improvements to existing stock, requirements for new buildings and delivering stand-alone and community renewable and low carbon infrastructure.
- **Chapter 6**: **Policy Recommendations** – This chapter sets out policy recommendations on the District-wide scale and the rationale supporting those recommendations.
- **Chapter 7: Strategic Sites and Character Areas**- Analyses the potential of strategic development sites to achieve higher sustainability standards in accordance with PPS1. It also profiles the character areas in the District and looks at potential opportunities and constraints.

1.3 GROWTH IN WAVENEY

Residential

Waveney's Core Strategy, adopted January 2009, sets out the spatial vision and objectives for growth within the District, along with the spatial strategy for delivery and core policies to guide development.

The Core Strategy articulates the requirements for new housing as directed by the East of England Plan which requires 5800 dwellings to be built in Waveney between 2001 and 2021. Furthermore, PPS3 and the East of England Plan require that a 15 year supply of housing land is identified beyond the adoption of the Core Strategy. Therefore, provision will be made for approximately a further 1,160 dwellings for the period 2021 to 2025 to meet this need. A total of 6960 dwellings are therefore required to be delivered through existing commitments, strategic allocations and windfall between 2001 and 2025.

Taking into consideration existing commitments (completions and developments with planning permission), Waveney District Council have set out proposals within the Core Strategy Policy CS11 - Housing for an additional 2875 dwellings. 2200 of these dwellings will be delivered in Lowestoft, 1500 of which are to come forward within the strategic allocation of the Lake Lothing Area Action Plan (AAP) area at the heart of Lowestoft Town. The masterplan for the AAP is being co-ordinated by 1st East urban regeneration company (URC), with a preferred option published in 2007. These designs are currently being revisited, although the overarching development principles and parameters' are likely to remain. The remaining 375 dwellings will come forward within Waveney's market towns, 125 of which will be on allocated sites with the remainder coming forward as windfall. The majority of these (40%) are likely to be in Beccles, with the rest distributed between Bungay, Halesworth, and Southwold. It has been assumed that these dwellings will be delivered evenly throughout the growth period to 2025.

In addition to the dwellings projections set out by the Core Strategy, there were, at April 2007, 2040 dwellings with planning permission but not completed. For the purposes of this study, it has been assumed that these dwellings will be completed within the first 2 growth phases.

Table 1 summarises the number of new houses included in this study. Market towns include Bungay, Halesworth and Southwold.

Table 1: Housing growth 2007-2025

Location	Housing numbers
Lowestoft CS Allocation - AAP	1500
Lowestoft CS Allocation - Elsewhere	700
Lowestoft with Planning Permission	1433
Lowestoft Total	**3933**
Beccles CS Allocation	150
Beccles with Planning Permission	169
Beccles Total	**319**
Market Town CS Allocation	225
Market Town with Planning Permission	263
Market Town Total	**488**
Villages with Planning Permission	175
Total Housing 2007-2025	**4615**

Table 2 shows how housing growth has been phased for the purposes of this study.

Table 2: Housing Phases

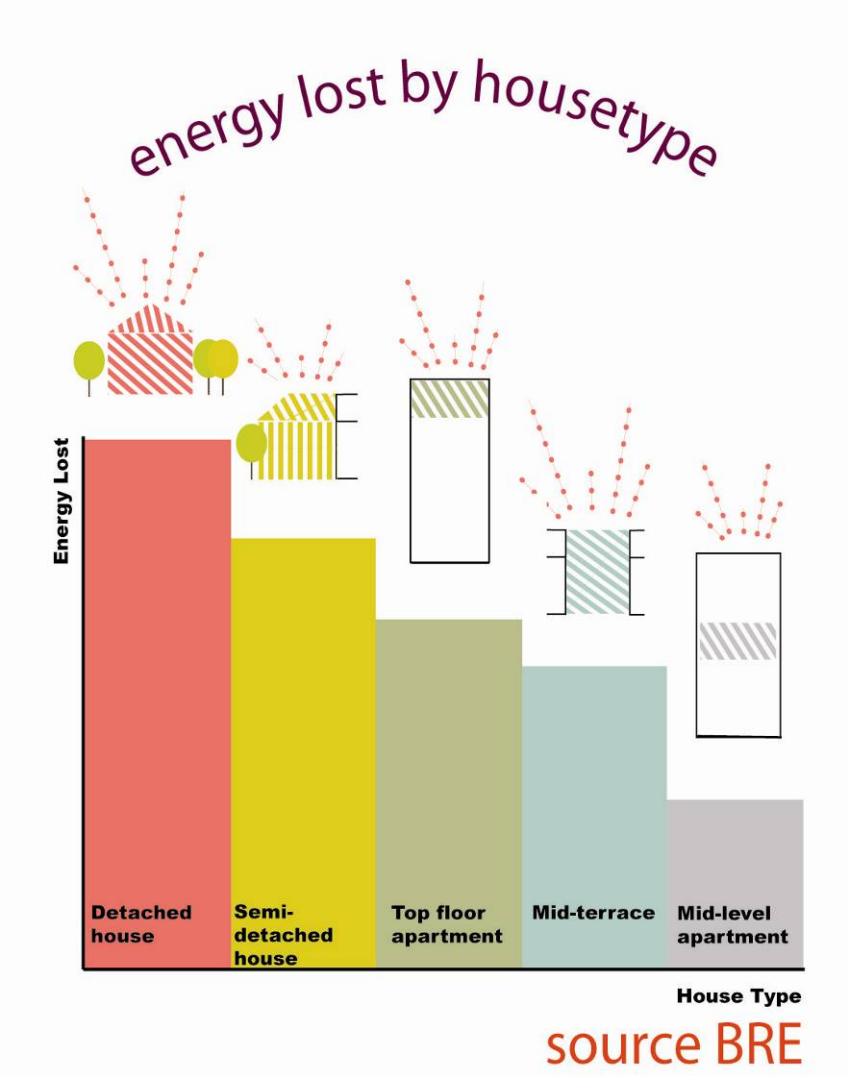
	2007-2011	2011-2016	2016-2021	2021-2025	Total
Lowestoft	892	1351	750	640	**3633**
Beccles	97	97	62.5	62.5	**319**
Market Towns (Bungay, Halesworth, Southwold)	150.25	150.25	93.75	93.75	**488**
Villages	88	87	0	0	**175**
Total	**1228**	**1685**	**906**	**796**	**4615**

Different dwelling types inherently have different energy requirements. For example, flats and terrace housing are generally more energy efficient as there is less exposed area of external walls from which heat can escape, as shown in Figure 1. As such, a potential housing mix for the new growth has been developed for the purposes of this study based on historic trends with an adjustment for increased one and two bed flats to take into account the findings of the Waveney Housing Market Assessment and the aspirations of the AAP area. These assumptions are set out in Table 3.

Table 3: Assumed housing mix

	Detached	Semi Detached	Terrace	Apartment
Lowestoft	29.50%	25.50%	31.50%	13.50%
Beccles	35.00%	29.00%	23.50%	12.50%
Market Towns	35.00%	29.00%	23.50%	12.50%
Villages	39.50%	31.50%	25.50%	3.50%

Figure 1: Energy efficiency of different housing hypes



Employment

The Core Strategy also sets out employment requirements for employment land. Policy CS07 – Employment sets out that the Lake Lothing AAP will be a strategic employment site. The Core Strategy does not set out proposed land uses within the area, but drawing on the Employment Land Study (2006) demonstrates that once the decline of some sectors is taken into consideration, there will only be a requirement for an additional 3ha of employment land over the plan period (2.25ha of which will be in the AAP area). The Lake Lothing AAP preferred option sets out the proposed land use mix, although this, at the time of writing, is subject to review:

- ~100,000sqm office
- ~20,000sqm retail
- ~125,000sqm mixed use (inc leisure, tourism, research, community)
- ~13ha port/light industrial

Policy CS07 also sets out an allocation for 5ha of light industrial in Bungay and Policy CS08 – Renewable Energy Cluster an allocation for 8ha at Ness Point to form a 'Power Park'. Policy GYL1 of the East of England Plan promotes the development of a renewable energy cluster in Lowestoft and Great Yarmouth to capitalise on the existing offshore engineering skills to support the growing offshore wind industry. Home to England's largest wind turbine, Ness point is already recognised for its renewable infrastructure. Renewable energy companies are also already established in Waveney, making a vital contribution to the local economy and employment opportunities. In addition, the OrbisEnergy centre at Ness Point will provide accommodation for more than 30 small and medium sized companies involved in offshore renewable energy, and be a centre of academic expertise. As such, renewable energy in Waveney is important not just to help reduce carbon emissions, but is also potentially a bedrock of the local economy.

Although the Core Strategy only makes strategic allocations for up to 5ha in Bungay and the 8ha Power Park, it is expected that there will be additional employment sites, principally light industrial, in Lowestoft and the market towns. These are currently set out in the Site Specific Allocations DPD Preferred Options, including in addition to the sites allocated in the Core Strategy:

- 18.5ha in Lowestoft
- 5.7ha in Beccles
- 20.7ha in the other Market Towns

As with the housing development, there are a number of employment sites that have been granted planning permission but are yet to be completed. These sites will also be included in the assessment of future development as they will contribute to future energy demands. These include

- 28.83ha Lowestoft
- 35.7ha in Beccles
- 6.81ha in Market Towns

Table 4 summarises the employment land assumptions.

Table 4: Employment land projections

ha	Employment	Retail	Schools	Healthcare	Community
Lowestoft	57.79	0.53	0.17	0.22	0.22
Beccles	41.42	0	0	0	0
Market Towns	30.14	0	0	0	0

Other

Given the projected growth in Waveney, there is likely to be a requirement for supporting infrastructure, such as schools, community and health care facilities which are relatively large energy users. For the purposes of this study, we have made assumptions as to area of these facilities required based on population yields generated from number of dwellings expected. These assumptions are based on AECOM standards used within our social infrastructure modelling. The area assumptions made are set out in Table 5.

Table 5: Yield assumptions

Facility type	Area assumption	Total area required
Primary School	2230m^2 per 430 pupil population	6690m^2
Health Care	0.85m^2 per person	8859m^2
Community	0.84m^2 per person	8754m^2

Strategic Sites and Character Areas

Planning Policy Statement 1 Climate Change Supplement recommends that where potential can be demonstrated, higher sustainability standards should be applied to strategic sites. The Lake Lothing AAP area is the only key strategic site in Waveney currently and opportunities to develop higher standards will be explored in more detail is chapter 7.

In addition to aid policy recommendations for new growth, proposed development has been grouped into three generic characterisations, which are:

- **Residential development in Lowestoft of 10 dwellings or more** – It is proposed that there will be 1000 additional dwellings in Lowestoft outside the AAP area over the growth period. There are a wider range of viable options for improving energy performance generally energy at a scale of 10 dwellings and above through introduction of site-wide infrastructure.
- **Light Industrial** – A significant proportion of new employment development, particularly in the Market Towns is likely to be light industrial.

- **Dispersed residential development** – Outside of Lowestoft residential development is most likely to come forward through small scale windfall development.

As with the strategic site, options for these characterisations are discussed in greater detail in chapter 7.

1.4 OVERARCHING POLICY CONTEXT

The importance of developing sustainably has been growing in momentum since the Rio Earth Summit in 1992 and the subsequent summit in Johannesburg in 2002. Building on these events, the latest UK Sustainable Development Strategy – Securing the Future (2005) sets out the UK's five guiding principles for sustainable development with a focus on environmental limits. It also identifies four priority areas for the UK; sustainable consumption and production, climate change, natural resource protection and sustainable communities, as well as action the UK feels is needed internationally (Chapter 2 provides greater detail on the broader sustainability policies relating to Waveney District, as well as detail on the current situation in the District and policy recommendations).

The challenge of climate change, and the need to reduce greenhouse gases and stabilise carbon dioxide in the atmosphere to 450ppm has intensified in particular. At the international level, the Kyoto Protocol is currently being updated (using the "Bali Roadmap") and will be agreed in Copenhagen in December 2009. This will commit the UK to an updated carbon dioxide reduction path, as well as technology development and transfer and financial investment, which will need to be reflected in planning policy. The UK is also committed to meeting carbon reduction targets set out by the European Commission in the EU Renewable Energy Target which requires a 20% reduction on 1990 levels by 2020. This includes carbon from electricity, heating and transport. The UK is expected to meet 15% of this target, and in response to this is anticipated that we should be generating approximately to 30% electricity energy and approximately 12% from heating energy from renewable sources as set out in the UK's Renewable Energy Strategy (2009).

In addition, the UK Government is committed to reduce greenhouse gas emissions by 80% from 1990 levels by 2050, and at least 26% of carbon emissions by 2020, through the Climate Change Act (2008). The Act is supported by the UK Low Carbon Transition Plan, National strategy for climate and energy, which sets out the Government's approach to meeting their carbon reduction commitments. As building related carbon emissions currently accounts for approximately 25% of all carbon emissions, improving the efficiency and supplying buildings with low and zero carbon is a priority. Furthermore, it is predicted that around two thirds of the current housing stock will remain in 2050, highlighting the importance of improving the existing housing stock as well ensuring new building are highly efficient. The Transition Plan includes commitments to reducing greenhouse gas emissions from existing housing stock by 29% on 2008 levels by 2020 and by 13% for places of work. It also responds to the EU Renewable Energy Target by including the provision for 40% of energy need to be met by low carbon energy sources, including nuclear power, although it is expected that around 30% will come from renewables.

In addition, The Draft Heat and Energy Saving Strategy (2009) aims to ensure that emissions from all existing buildings are approaching zero by 2050. Proposed mechanisms for achieving this include a new focus on district heating in suitable communities, removing barriers to the development of heat networks, encouragement of combined heat and power and better use of surplus heat through carbon pricing mechanisms.

Planning Policy Statement 1: Delivering Sustainable Development (PPS1) (2005) places an emphasis on promoting more sustainable development, with a supplement to PPS1 on climate change released in December 2007. It advised planning authorities to provide a framework to encourage low carbon and renewable energy generation in their local development documents and confirmed that there are situations where it is appropriate for Local Planning Authorities (LPAs) to expect higher standards than Building Regulations. Paragraphs 31-33 explain that the local circumstances that warrant higher standards must be clearly demonstrated, such that there are clear opportunities for low carbon developments or that without requirements, development would be unacceptable for the proposed location. Paragraph 32 suggests that local requirements should focus on the development area or site-specific opportunities and that the requirement should be in terms of achievement of nationally described standards such as the Code for Sustainable Homes (the Code, CfSH). Paragraph 33 requires that decentralised energy or other sustainable requirements should be set out in a DPD. Care must also

be taken to demonstrate that the requirements are viable, will not impact on the supply and pace of housing development and will not inhibit the provision of affordable housing.

The Government has also announced its intention for Building Regulations to require that the dwelling emission rate (DER) of new residential development to be 25% better than Target Emissions Rate (TER) in 2010, 44% better in 2013 and meeting a zero carbon target by 2016, with non-residential development expected to meet the zero carbon target by 2019.

The proposed residential Building Regulations correspond to the DER targets set out in the Code for Sustainable Homes for levels 3 (25% reduction) and level 4 (44% reduction), however the definition of zero carbon is likely to differ from the level 6 of the Code (the Code is discussed in greater detail in Chapter 2). The Government has recently undertaken a consultation on the Definition of Zero Carbon Homes and Non-Domestic Buildings (2008). The consultation proposes meeting part of the zero carbon requirement through off-site measures. The document suggests that between 44 and 100% of the carbon emissions reduction must be met on-site, and that for the remaining emissions a range of on-site and off-site solutions are possible. The consultation also proposes a maximum cost per tonne of carbon for off-site measures, which will be published in 2009 and updated in 2012, to give developers some certainty over the costs they face.

Circular 05/2005 (Planning Obligations) states that the objective of the planning system is to deliver sustainable development and that obligations are intended, among other things, to secure a contribution from a developer to compensate for loss or damage created by a development or to mitigate a development's impact.

The Energy Act (2008) gives power to the Secretary of State to establish or make arrangements for the administration of a scheme of financial incentives to encourage small scale low carbon electricity generation. The holders of distribution licenses may also be required under this Act to make arrangements for the distribution of electricity generated by small-scale low carbon generation and to make a payment to small-scale low carbon generators (or to the Gas & Electricity Markets Authority).

This act also allows the Secretary of State to make Regulations to establish a new scheme to facilitate and encourage renewable heat generation and to establish methods to administer and finance the scheme.

The Planning Act (2008) paves the way for a new planning system for approving nationally significant infrastructure projects, and introduces the concept of National Planning Statement (NPS). Twelve NPSs are envisaged including one covering renewable energy. The Act also adds a duty on councils to take action on climate change within their development plans.

In addition, the Planning and Energy Act (2008) enables local planning authorities to set requirements for energy use and energy efficiency in local plans, including:

- a proportion of energy used in development in their area to be energy from renewable sources in the locality of the development;
- a proportion of energy used in development in their area to be low carbon energy from sources in the locality of the development; and
- development in their area to comply with energy efficiency standards that exceed the energy requirements of Building Regulations

Alongside the drivers for carbon reduction and the inclusion of renewables, there are also targets and strategies in place to encourage the inclusion of Combined Heat and Power (CHP) schemes in new and existing neighbourhoods. In 2000 the Government set a new target to achieve at least 10,000MWe of installed Good Quality CHP capacity by 2010. In support of this target, the Government has set a target to source at least 15% of electricity for use on the Government Estate from Good Quality CHP by 2010. The Government released a ‘combined heat and power strategy to 2010’ in April 2004 which encourages a rapid increase in the implementation of CHP. Local authorities play a key supporting role in the implementation of CHP.

Table 6: Summary of target requirements

	Climate Change Act	Renewable Energy Strategy	Low Carbon Transition Plan	Building Regulations	East of England Plan
2010				25% improvement on TER	10% of regions energy from renewable sources
2013				44% improvement on TER	
2016				Zero carbon	
2020	26% reduction in carbon emissions on 1990 levels	30% renewable electricity production on 1990 levels	29% reduction in carbon emissions from existing housing stock on 2008 levels		17% of regions energy from renewable sources
		12% renewable heating production on 1990 levels	13% reduction in carbon emissions from places of work on 2008 levels		
2050	80% reduction in greenhouse gas on 1990 levels				

Chapter 1: Key Policy Considerations

Significant growth is expected in Waveney District. Primarily, growth is expected within Lowestoft, with a large proportion of change expected in the AAP area. District-wide there is a large proportion of light industrial development expected, along with small-scale infill development. In response to PPS1, policy recommendations for renewable energy and sustainable construction should focus on key growth locations where key interventions need to be made, but district-wide targets should take into account the overall character of development and potential of the area.

2. Evidence for Sustainability Construction Policies

This section outlines the evidence base for aspects of sustainable construction. As the examination of energy efficiency and low carbon energy generation forms the bulk of this study, the evidence base relating specifically to this element of sustainable construction is addressed separately in the following chapters.

2.1 POLICY CONTEXT

Reflecting the UK Sustainable Development Strategy and responding to the overarching policy set out in PPS1 to develop more sustainable communities, the East of England Plan Policy SS1: Achieving Sustainable Development provides the guiding principles as to how sustainable development is to be achieved in the region:

The strategy seeks to bring about sustainable development by applying:
(1) The guiding principles of the UK Sustainable Development Strategy 2005:

- *living within environmental limits;*
- *ensuring a strong, healthy and just society;*
- *achieving a sustainable economy;*
- *promoting good governance; and*
- *using sound science responsibly.*

(2) The elements contributing to the creation of sustainable communities described in Sustainable Communities: Homes for All:

- *active, inclusive and safe in terms of community identity and cohesion, social inclusion and leisure opportunities;*
- *well run in terms of effective participation, representation and leadership;*
- *environmentally sensitive;*
- *well designed and built;*
- *well connected in terms of good transport services;*
- *thriving in terms of a flourishing and diverse economy;*
- *well served in terms of public, private, community and voluntary services; and*
- *fair for everyone.*

Local Development Documents and other strategies relevant to spatial planning within the region should:
(a) help meet obligations on carbon emissions; and
(b) adopt a precautionary approach to climate change by avoiding or minimising potential contributions to adverse change and incorporating measures which adapt as far as possible to unavoidable change.
In particular, the spatial strategy seeks to ensure that development:

- *maximises the potential for people to form more sustainable relationships between their homes, workplaces, and other concentrations of regularly used services and facilities, and their means of travel between them; and*
- *respects environmental limits by seeking net environmental gains wherever possible, or at least avoiding harm, or (where harm is justified within an integrated approach to the guiding principles set out above) minimising, mitigating and/or compensating for that harm.*

The importance of the principles of sustainable development in underpinning the future growth in Waveney is articulated in Waveney's Core Strategy, which again reiterates the UK Sustainable Development Strategy (2005), and recognises its importance in delivering the spatial elements required by the Sustainable Communities Strategy (2007). Waveney's Core Strategy also provides more specific policy expectations on achieving good quality developments and sustainable design:

All development proposals must demonstrate a high quality and sustainable design that positively improves the character, appearance and environmental quality of an area and the way it functions. In particular, proposals should:-

- *create places and spaces for people*
- *reflect local character and distinctiveness*
- *protect local amenity*
- *consider opportunities for a mix of uses*
- *consider opportunities for public art*
- *create safe, healthy and accessible environments*
- *make good provision for access by all transport modes*
- *ensure accessible environments that give priority to pedestrian and cycle access and provide linkages and integration with surrounding housing, employment, services, facilities and spaces*
- *deliver higher densities in places with good public transport accessibility*
- *protect historic character and integrate historic buildings and features where these occur*
- *provide, conserve and enhance biodiversity and create linkages between green spaces and wildlife corridors*

All development proposals will be expected to seek to minimise carbon dioxide emissions through sustainable design and construction, energy efficiency and the incorporation of renewable energy technology as appropriate. Proposals should also seek to minimise the use of water resources and the production of waste. Most proposals, including all proposals dealing with historic sites, should be accompanied by a Design and Access Statement.

2.2 MEASURING SUSTAINABILITY

This section discusses the sustainable design standards contained in the Code for Sustainable Homes and BRE Environmental Assessment Method (BREEAM), which demonstrate the national push for the highest standards of sustainable design.

The Code for Sustainable Homes

The Code for Sustainable Homes, developed by BRE and supported by the Department of Communities and Local Government (DCLG), sets out a national rating system to assess the sustainability of new residential development, replacing the previous system 'Ecohomes'. The CfSH consists of a number of mandatory elements which can be combined with a range of voluntary credits to achieve a credit level rating of between 1 and 6 covering nine sustainability criteria including carbon reduction, water, ecology, waste, materials, management and pollution. If the mandatory elements for a particular level are not reached, irrespective of the number of voluntary credits, then that code level cannot be achieved. This means that to achieve a full code rating, a range of sustainability issues will have to be incorporated into the building and site design.

Table 7: Performance required to meet Code levels

	Minimum entry requirements		
Code Levels	**Energy** Improvement over TER	**Water** litres/person/day	**Total points** score out of 100
Level 1 (★)	10%	120	36
Level 2 (★★)	18%	120	48
Level 3 (★★★)	25%	105	57
Level 4 (★★★★)	44%	105	68
Level 5 (★★★★★)	100%	80	84
Level 6 (★★★★★★)	Zero Carbon	80	90

The PPS1 Supplement states that planning authorities should specify requirements for sustainable buildings "in terms of achievement of nationally described sustainable buildings standards, for example in the case of housing by expecting identified housing proposals to be delivered at a specific level of the Code for Sustainable Homes".

Where such local requirements go beyond national requirements including the Building Regulations, the evidence base must justify this based on local circumstances.

Since May 2008 it has been compulsory for new homes to have a CfSH rating. There is currently no national minimum requirement for the rating that they achieve, however proposed changes to the Building Regulations are expected to reflect the requirements of the Code for energy. However, residential developments supported by Homes and Communities Agency funding (i.e. affordable homes) are currently required to achieve Code level 3, expected to rise to Code level 4 from 2010.

Cost Implications of the Code for Sustainable Homes

Figure 2 and Figure 3 below shows the % increase over the base build cost to deliver Code targets 4, 5 and 6, broken down by the assessment category areas for a flat and a house. The graphs exclude the costs associated with credits ENE (Energy and Carbon Emissions) 1, 2 and 7 which are assumed to be covered in the costs discussed in Section 4 to deliver the mandatory energy requirements.

Figure 2: Costs (over base construction cost) for delivering Code credits as required to levels 4, 5 & 6 for a flat)

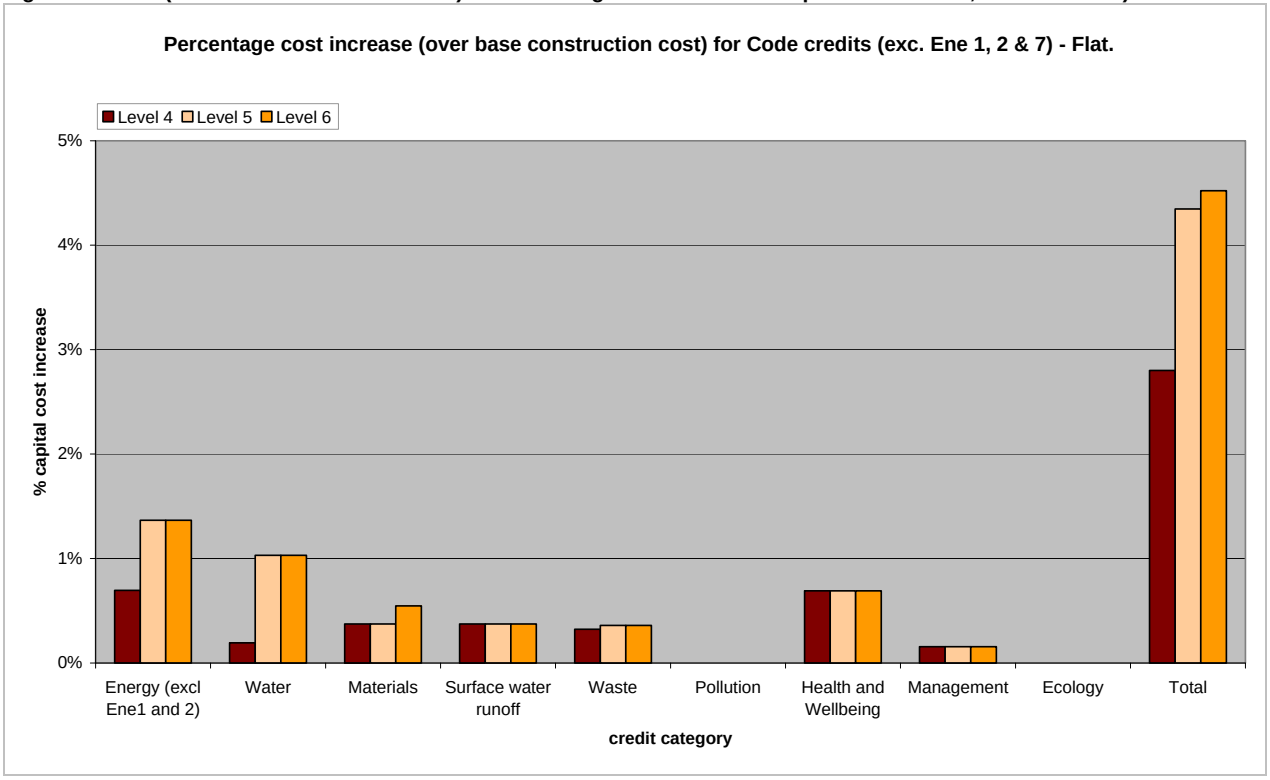
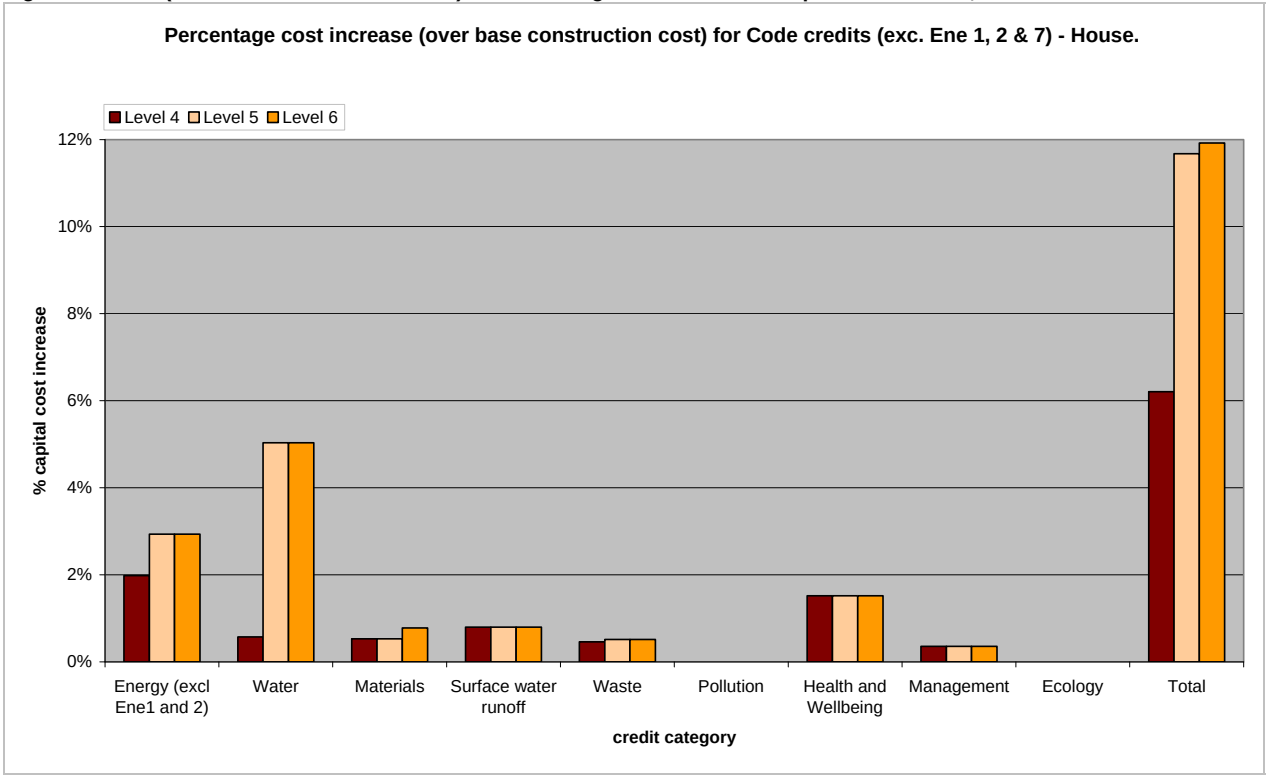


Figure 3: Costs (over base construction cost) for delivering Code credits as required to levels 4, 5 & 6 for a house.



Costs are taken from a Cyril Sweett report produced for Communities Local Government (DCLG) entitled: Cost analysis of the Code for Sustainable Homes, November 2007. These costs were predicted, and are not yet fully supported by the development industry. Only a 'handful' of real Code assessments have been completed so there is not yet sufficient final cost data to establish robust cost benchmarks.

BREEAM

BREEAM (Building Research Establishment Environmental Assessment Method) is a voluntary assessment scheme which aims to help developers minimise the adverse effects of new non-residential buildings on the environment. Like the Code, BREEAM allows the environmental implications of a new building to be assessed at the design stage by independent assessors to provide an easy to understand comparison with other similar buildings. An overall rating of the building's performance is given using the terms Pass, Good, Very Good, Excellent, or Outstanding (BREEAM 2008). The rating is determined from the total number of BREEAM criteria met, multiplied by their respective environmental weighting.

BREEAM was initially launched in 1990 as an environmental assessment methodology aimed specifically at office buildings (BREEAM Offices). Since then versions of the assessment have been developed for numerous other building types including schools, industrial, retail and healthcare. At the basic level the schemes for non-domestic buildings are all fairly similar in their approach and contain similar credit compliance criteria. Credits are typically grouped in to the following categories:

- Management
- Health and Well Being
- Energy
- Transport
- Water
- Materials and Waste
- Land Use and Ecology
- Pollution

Buildings which do not fall neatly under one of the established BREEAM schemes are able to be assessed using a bespoke methodology. In policy terms BREEAM is useful as it provides a single assessment method which covers a number of key topics relating to sustainable construction.

A properly conducted BREEAM assessment can influence design both in terms of the masterplanning process and detailed architectural and mechanical and electrical specifications.

Cost Implications of BREEAM Standards

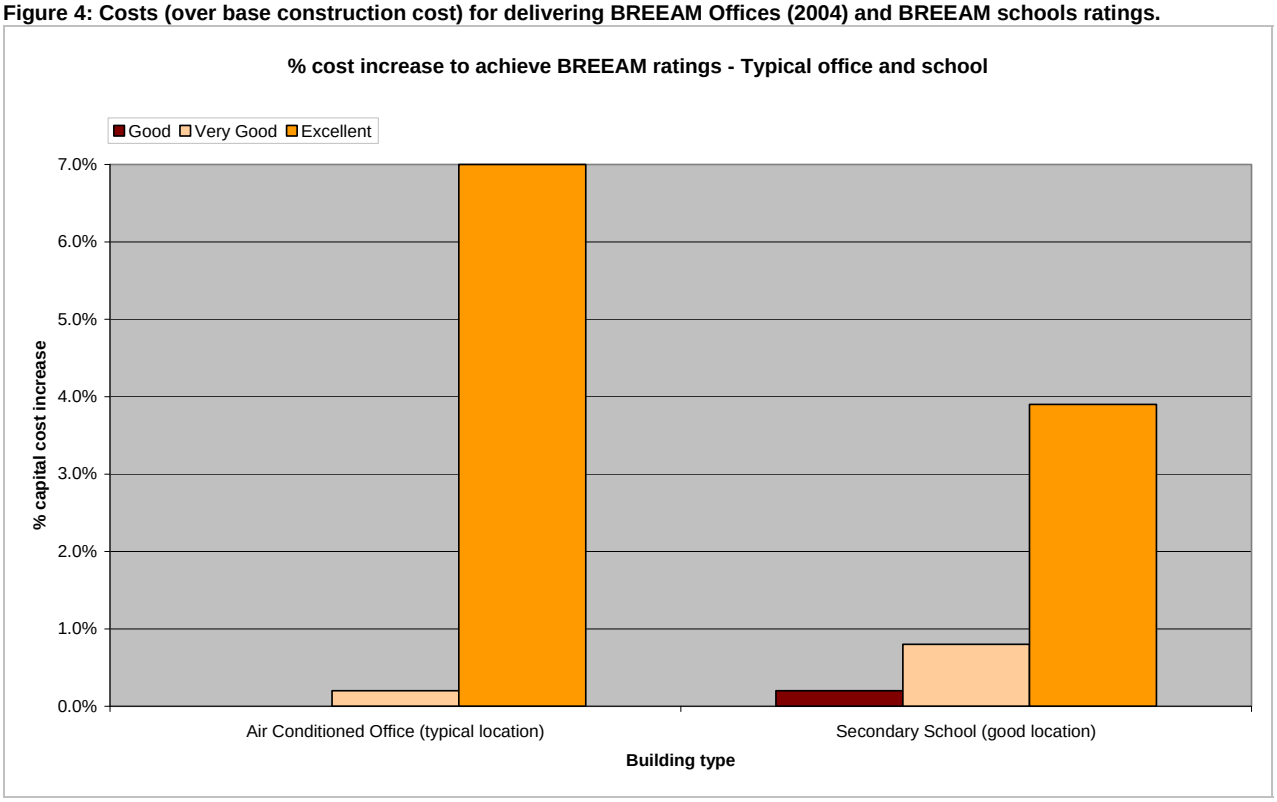
The Figure 4 below shows the % increase on the base build cost to deliver Good, Very Good and Excellent ratings under BREEAM Offices (2004) and BREEAM Schools. Both costing exercises were led by the BRE Trust. They were supported by Cyril Sweet for the Office costing exercise (Putting a price on sustainability, BRE Trust and Cyrill Sweett, 2005) and Faithful & Gould for the Schools work (Putting a price on sustainable schools, BRE Trust and Faithful & Gould, 2008). The costs shown in Figure 4 below under 'school' are for a secondary school block of 3,116m^2.

We are not aware of any published cost data on meeting BREEAM office targets since 2004, certainly none is yet available showing the costs of delivering BREEAM Offices 2008, which contains a number of fairly significant changes, compared with earlier BREEAM versions.

BREEAM 'very good' is commonly required in policy for non-residential buildings and can be a useful tool for authorities. The flexibility of credits within BREEAM, means that costs may vary but should be within the control of the developer where sustainable design measures are implemented early in the design process. Based on the cost data available, 'very good' is achievable without a significant increase in build cost, while 'excellent' may impact on financial viability.

Companies can claim both Enhanced Capital Allowances (ECA) and Carbon Trust grants to help them invest in Combined Heat and Power, renewables and other low and zero carbon technologies.

Figure 4: Costs (over base construction cost) for delivering BREEAM Offices (2004) and BREEAM schools ratings.



2.3 WAVENEY SITUATION

This section provides more detail on a range of sustainability related issues relevant to Waveney. Each sub-section starts with an overview of specific policies relating to the topic in question before providing an overview of the current situation and performance of Waveney.

2.3.1 WATER

Policy Context

Future Water, the Government's water strategy for England (February 2008) sets out expectations for water supply, water efficiency and water treatment to 2030. It sets out proposals to achieve an average water consumption of 120 litres per person per day, down from the current average of 150 litres. It also addresses water charging, surface water management and water pollution.

Defra is leading a cross-Government programme of work under the headline Making Space for Water, which is developing a strategy for flood and coastal erosion. This programme has more relevance to flood and erosion management infrastructure projects. PPS25: Development and Flood Risk advocates the use of sustainable drainage systems in new development proposals to reduce the risk of flooding, add biodiversity and amenity benefits to developments and to aid in pollution prevention and aquifer re-charge.

Defra and DCLG made a joint policy statement in July 2007 called Water efficiency and new buildings that made clear their intention to legislate on water efficiency through Building Regulations. It proposed a residential minimum standard of 125 litres per person per day (equivalent to the Code level 1-2, plus 4% to allow for external water use) and also fittings performance efficiency Regulations for toilets, urinals and taps to have an impact on the non-residential stock and an indirect effect on existing stock. It is understood that further proposals to introduce water efficiency measures into Building Regulations have not progressed at this stage. Local authorities can choose to go beyond Building Regulations on water efficiency if the local context supports it.

The East of England Plan contains a number of relevant policies at the regional level. As the driest and one of the fastest growing regions in England, water efficiency is a key sustainability issue in the East of England.

- *Policy WAT1: Water Efficiency. Seeks to deliver improvements in water efficiency resulting in a measurable reduction in per capita consumption rates.*
- *Policy WAT2: Water Infrastructure. Relevant authorities should ensure the timely provision of additional water supply and treatment infrastructure necessary to support the levels of development anticipated in the Plan without adverse environmental impacts. New developments should be located to maximise the potential of existing water/waste water treatment infrastructure and minimise the need for new/improved infrastructure.*
- *Policy WAT3: Integrated Water Management. The Environment Agency and water industry should work with local authorities and other partners to develop an integrated approach to the management of the water environment.*
- *Policy WAT4: Flood Risk Management. Encourages LPAs, through their LDDs to require that SuDS be incorporated in all appropriate developments.*
- *Policy CS02 - High Quality and Sustainable Design of the Waveney Core Strategy makes reference to the importance of water efficiency in that proposals should also seek to minimise the use of water resources, however it does not set out specific performance targets.*

The Code uses litres per person per day standards for internal water use as a mandatory element, with the aim of reducing potable water use. To achieve Code level 1 or 2, the home must achieve 120 litres. To achieve Code level 3 or 4, the maximum is 105 litres and for level 5 or 6 it is 80 litres. More credits can be achieved if these maxima are improved upon within Code levels 1-4. A further credit is available for external rainwater collection systems. It is generally considered possible to reach the mandatory water use reduction to 105 litres per person per day required to meet Code levels 3 or 4 relatively cheaply through the introduction of water efficient fixtures and fittings. To achieve higher potable water savings additional infrastructure is required including for example grey or black water recycling, dual water systems and/or rainwater capture/harvesting. These systems are

currently costly in most situations, though improvements are expected in the near future as technologies are tested and become more common place.

Waveney Situation

The Environment Agency has classified the area managed by Essex and Suffolk Water, which includes Waveney District as one of the most water stressed areas in England (joint first in order of most stressed). Receiving an average annual rainfall less than 600mm, the East of England is the direst region of England and Wales. In comparison, the national average is around 900mm. Taking evaporation into consideration, which can be as much 450mm, means that the level of rainfall restoring aquifers is limited, particularly in times of prolonged drought.

In 2004, the average water consumption per person in Waveney was 154lts per day. The Waveney DC & Great Yarmouth BC – Joint Water Cycle Strategy scoping report (2009) provides a useful baseline and summary of water resources in relation to the impact on proposed growth in the area.

The main water supply in Waveney is surface water abstraction from the River Waveney at Shipmeadow. This is supplemented by a number smaller of groundwater abstraction points. It is the Environment Agency's view that the River Waveney is over-abstracted and that there is no potential for increasing abstraction from the Chalk aquifer at depth and any abstraction from the shallower Crag layer will only be permitted for non-consumptive purposes such as spray irrigation. The potential for future ground water resource development in this area is therefore severely limited (Scott Wilson, 2009).

The Water Cycle Study concludes that 'overall the Resource Zone covering the Waveney and Great Yarmouth areas both have surplus resources until 2021. Beyond this date with the planned growth, the supply zones will go into supply deficit and this deficit will increase as growth continues until 2025. Therefore, further resources and/or demand management measures will be required beyond 2021.

2.3.2 FLOODING AND DRAINAGE

Policy Context

PPS25 is the current guide on development and flood risk. This is supplemented by 'Development and Flood Risk: A Practice Guide (Communities and Local Government, 2008). These documents guide planners on how to evaluate sites in respect of flood risk.

PPS25 requires the Flood Risk Assessment (FRA) to consider <u>all</u> potential forms of flooding and overland flows, including river, sea, estuarial, land drainage, groundwater, surface water run-off, flooding from sewer systems, flooding from reservoirs and canals, etc and should consider the impact of flooding on both the development and off-site parties and land.

There are four classifications for flood zones, as defined in PPS25 as set out in Table 8.

Table 8: Flood risk classification

Zone 1	Low probability (less than 1 in 1,000 annual probability of river or sea flooding in any year).
Zone 2	Medium probability (between 1 in 100 and 1 in 1,000 annual probability of river flooding or between 1 in 200 and 1 in 1,000 annual probability of sea flooding in any year).
Zone 3a	High probability (1 in 100 or greater annual probability of river flooding in any year or 1 in 200 or greater annual probability of sea flooding in any given year).
Zone 3b	High probability (1 in 20 or greater annual probability of flooding in any given year). This is also classified as functional floodplain.

PPS25 makes it a planning requirement to account for climate change in a proposed design. The recommended allowances are summarised in Table 9 below.

Table 9: Flood risk climate change assumptions

Parameter / Horizon	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
Sea Level Rise (mm/year) East of England, East Midlands, London, SE England (south of FlamDistrict Head)	4.0	8.5	12	15
Peak rainfall intensity	+5%	+10%	+20%	+30%
Peak river flow	+10%	+20%		
Offshore wind speed	+5%		+10%	
Extreme wave height	+5%		+10%	

The key planning objectives in PPS25 are to appraise, manage and where possible, reduce flood risk. Sustainable Drainage Systems (SuDS) provide an effective way of achieving some of these objectives, and PPS25 and Part H of the Building Regulations (DTLR, 2002) directs developers towards the use of SuDS wherever possible.

The DCLG are currently consulting on potential amendments to PPS25. Although no fundamental changes are proposed, the proposed revisions seek to clarify how the policy should be applied in light of practical experience, particularly in regard to essential infrastructure. It is proposed that 'wind turbines for generating renewable energy should be treated as 'essential infrastructure' and as such can be permitted in any of the flood zones highlighted in Table 8 (table D1 in PPS25), exception test before they can be permitted in high flood risk zones 3a or 3b. This test requires that any proposals for new infrastructure in these flood zones must demonstrate:

- *that the sustainability benefits they would provide would outweigh the flood risk;*
- *they would be built on developable previously developed land, unless there are no such sites reasonably available; and*
- *that they would be safe, without increasing flood risk elsewhere and, where possible, would reduce flood risk overall.*

The East of England Plan highlights the potential risk of coastal flooding and the need for appropriate consideration of defences as *'decisions will need to be made as to where and how much investment in coastal flood management should take place to protect communities and key infrastructure. Coastal towns and villages are likely to continue to be protected from flooding but, away from developed areas, there may be a need to relocate existing infrastructure and assets to less vulnerable zones.'*

Policy WAT4 provides direction on how flood risk in the region should be managed:

Coastal and river flooding is a significant risk in parts of the East of the England. The priorities are to defend existing properties from flooding and locate new development where there is little or no risk of flooding. Local Development Documents should:

- *use Strategic Flood Risk Assessments to guide development away from floodplains, other areas at medium or high risk or likely to be at future risk from flooding, and areas where development would increase the risk of flooding elsewhere;*
- *include policies which identify and protect flood plains and land liable to tidal or coastal flooding from development, based on the Environment Agency's flood maps and Strategic Flood Risk Assessments supplemented by historical and modelled flood risk data, Catchment Flood Management Plans and policies in Shoreline Management Plans and Flood Management Strategies, including 'managed re-alignment' where appropriate;*
- *only propose departures from the above principles in exceptional cases where suitable land at lower risk of flooding is not available, the benefits of development outweigh the risks from flooding, and appropriate mitigation measures are incorporated; and*
- *require that sustainable drainage systems are incorporated in all appropriate developments.*

The East of England Plan acknowledges that where there is a need 'for growth and regeneration' in coastal towns, 'new development may be acceptable' in areas at risk of flooding,' particularly on previously developed land' as long as defences are maintained.

Policy CS03: Flooding and Coastal Erosion within Waveney's adopted Core Strategy requires development proposals in Waveney to respect the local environment and have regard to the potential impacts of climate change. Sustainable design, and in particular, Sustainable Urban Drainage systems should be considered in all new developments.

Proposals should avoid high flood risk areas (as defined by PPS25 Flood Zones 2 and 3a) unless it can be demonstrated that:

- *appropriate land at a lower risk is not available;*
- *there are exceptional reasons for locating the development within such areas;*
- *the risk can be fully mitigated by engineering and design measures.*

Although land is not to be allocated within floodrisk zones 2 and 3a, the Core Strategy makes an exception for areas 'within the boundary of the 1st East Urban Regeneration Company area of Lowestoft when the development contributes to the delivery of regeneration objectives set out in Policy CS05 and the Lake Lothing and Outer Harbour Area Action Plan, and the above criteria can be met'.

The Code covers surface water management, and there are mandatory standards for peak flow and volume of runoff to be able to achieve any Code level. A further two credits are available for using Sustainable Urban Drainage Systems (SuDS) and for managing flood risk. Versions of BREEAM cover similar topics relevant to non-residential buildings.

Waveney Situation

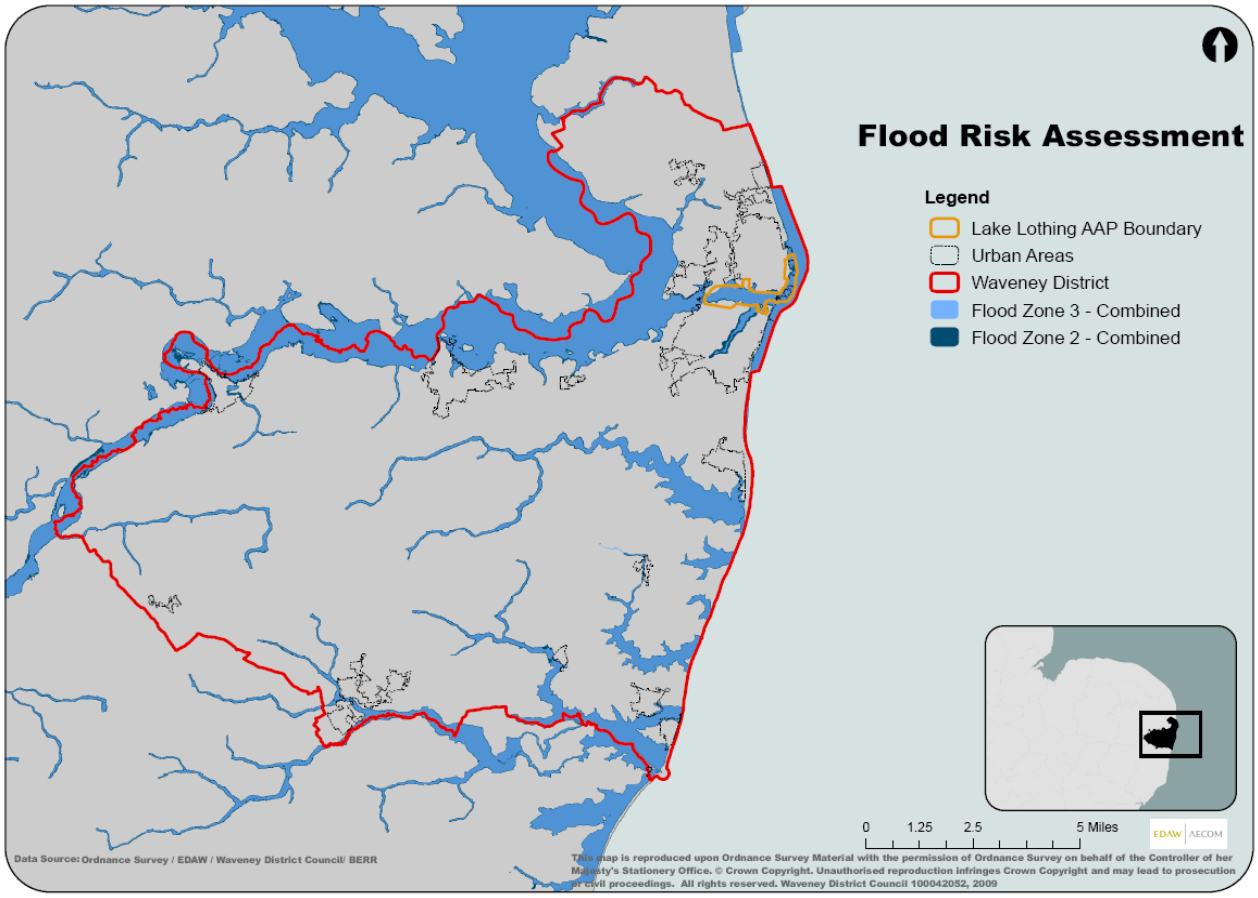
A strategic flood risk assessment (SRFA) was undertaken for Suffolk Coastal and Waveney District in February 2008. Its conclusions are summarised in the Water Cycle Study as 'the flood source that would result in the most significant consequences is overtopping from tidal flooding caused by storm surges coinciding with high spring tides. In addition, the rivers within the District pose some fluvial risk, particularly under tide-locking conditions, which occur when watercourses cannot discharge into estuaries or the sea at high tide, causing the river/stream water to 'back up' and reach high levels. Tide-locking has the greatest impact when tidal events coincide with high river flows'.

'Many of the defences in the Waveney area fall below the 1 in 200 year plus climate change standard and as a result may overtop during an event of this return period'.

Specifically, the SRFA noted that 'Lowestoft is particularly sensitive to flooding due to the situation of Lake Lothing and the surrounding developed areas. Flooding around the margins of the Lake occurs when gravity outfalls to Lake Lothing become tide locked and is a concern to both present and future developments. Flooding also occurs in the town following heavy rainfall due to limited sewer capacity and the tide locking of sewer outfalls. Developments within Lowestoft should therefore aim to mimic green field runoff rates by incorporating SuDS into development designs to limit runoff to surrounding areas. In addition, steps should be taken to improve the tidal outfall systems to limit tide locking'.

In other areas, the River Blyth presents a flood risk in Halesworth, where there are properties in unprotected areas, and Southwold/Reydon where there is also risk from their proximity to the coast. The flood risk areas in Waveney are shown in Figure 5 below.

Figure 5: Flood risk areas in Waveney



2.3.3 MATERIALS AND WASTE

Policy Context

The Waste Strategy for England (May 2007) provides an update of Waste Strategy 2000, still advocates the waste hierarchy, but setting new headline targets:

- *Household waste recycling and composting to 40% by 2010, 45% by 2015, 50% by 2020;*
- *Household residual waste reduced 29% by 2010, 35% by 2015 and 45% by 2020 from 2000 levels;*
- *Municipal waste recovery of 53% by 2010, 67% by 2015, 75% by 2020;*
- *Commercial and industrial waste landfilled reduced 20% by 2010 from 2004 levels.*

PPS10: Planning for Sustainable Waste Management promotes the principles of the waste hierarchy of reduction, re-use, recycling and composting, energy recovery and disposal.

Site Waste Management Plans Regulations (2008) requires that for a project on any one construction-site with an estimated cost greater than £300,000 a site waste management plan should be prepared. The plan, which focuses on the organisation and documentation of waste associated with construction provides an excellent opportunity for re-using, recycling and recovering material to maximise resource potential.

The East of England Plan supports, and in some cases exceeds the national targets through a number of policies, the most relevant being:

Policy WM1: Waste Management Objectives. Seeks to:

- *Reduce the quantum of waste imported into the region*
- *Minimise the impact of new development, particularly in key centres of development and change*
- *Minimise the environmental impact of waste management, including impacts arising from the movement of waste*
- *Promote responsible waste behaviour, maximising re-use recycling composting and energy recovery.*

Policy WM2: Waste Management Targets*. Encourages authorities and commercial waste producers to sets out targets for minimising waste as the basis for implementing the aim of recycling, composting and recovering value from waste. The Policy seeks to:*

- *Eliminate the landfilling of untreated commercial waste by 2021*
- *Secure municipal waste recovery of 50% by 2010, 70% by 2015*
- *Secure commercial and industrial waste recovery of 72% by 2010, 75% by 2015*

The Suffolk Waste Core Strategy (consultation draft, 2009) sets out how the County proposes to manage the regional waste arising apportionment set out by the East of England Plan to 2021, as set out in Table 10.

Table 10: Regional waste apportionment for Suffolk

'000 tonnes	**2010/11**	**2015/16**	**2020/21**
Municipal Solid waste	501	519	538
Commercial and Industrial Waste	1149	1320	1538
Imported Waste	220	107	106
TOTALS	1,870	1,950	2,180

The Waste Core Strategy also sets out a number of aims, which include:

- *To promote and encourage sustainable practices in the transportation and management of wastes – which includes providing the right infrastructure to allow reuse and recycling, efficient and sustainable transportation of waste and community responsibility.*
- *To assist in reducing the impacts of climate change upon the environment – through waste management operations that minimise emissions and capitalising on potential for energy from waste.*

The Joint Municipal Waste Management Strategy for Suffolk (JMWMS) (2003, amended 2008), updated to take account of the national Waste Strategy 2007, sets out the strategic framework for the management of municipal waste in Suffolk until 2020. The JMWMS is supported in Waveney through Waveney's Waste Management Strategy, which sets out the Districts strategy for dealing with waste up to 2010. Although somewhat dated, the both the JMWMS and Waveney's Waste Management Strategy make reference to the statutory performance standards for recycling and composting of household waste, which were 10% by 2003/04 and 18% by 2005/06.

The Code has three mandatory issues relating to waste and materials that have to be achieved for any Code level ratings of the environmental impacts of construction materials, provision of storage for non-recyclable waste and recyclable household waste, and construction-site waste management by using site waste management plans. Credits can be achieved, once the minimum performance is met, by improving performance in each of these areas, such as by providing space for composting and using responsible sources of timber. Versions of BREEAM cover similar topics relevant to non-residential buildings.

Waveney Situation

In 2001, the household waste recycling rate in Waveney was approximately 5%. The Audit Commission's Best Value Performance Indicators (2007/08) demonstrate the improvements that have been made since then as Waveney now recycles nearly 27% of waste, putting Waveney easily in to the top quartile for English authorities for recycling performance. Although data is not available for Waveney specifically, most household waste, around 54% in Suffolk is still landfilled. Waste across the country has however been lower than anticipated, at approximately 2%, which is lower than the rate of economic growth.

Table 11: Waste recycling and recovery rates in Waveney and Suffolk (2007/08)

	Waveney	Suffolk
Percentage household waste recycled	26.87%	25.63%
Tonnage of household waste recycled	13798t	94144t
Percentage household waste composted	24.75%	20.22%
Tonnage of household waste composted	12708t	74288t
Percentage household waste used to recover other energy sources	n/a	0.00%
Tonnage of household waste used to recover other energy sources	n/a	13.75t
Percentage household waste landfilled	n/a	54.14%
Tonnage of household waste landfilled	n/a	198883t

2.3.4 ENVIRONMENTAL SENSITIVITY

Policy Context

At the national level PPS9: Biodiversity and Geological Conservation sets out the main approach to ensure that the potential impacts of planning decisions on biodiversity and geological conservation are fully considered. Para 14 'Biodiversity within Developments' states, "Development proposals provide many opportunities for building-in beneficial biodiversity or geological features as a part of good design. When considering proposals, LPAs should maximise such opportunities in and around developments, using planning obligations where appropriate".

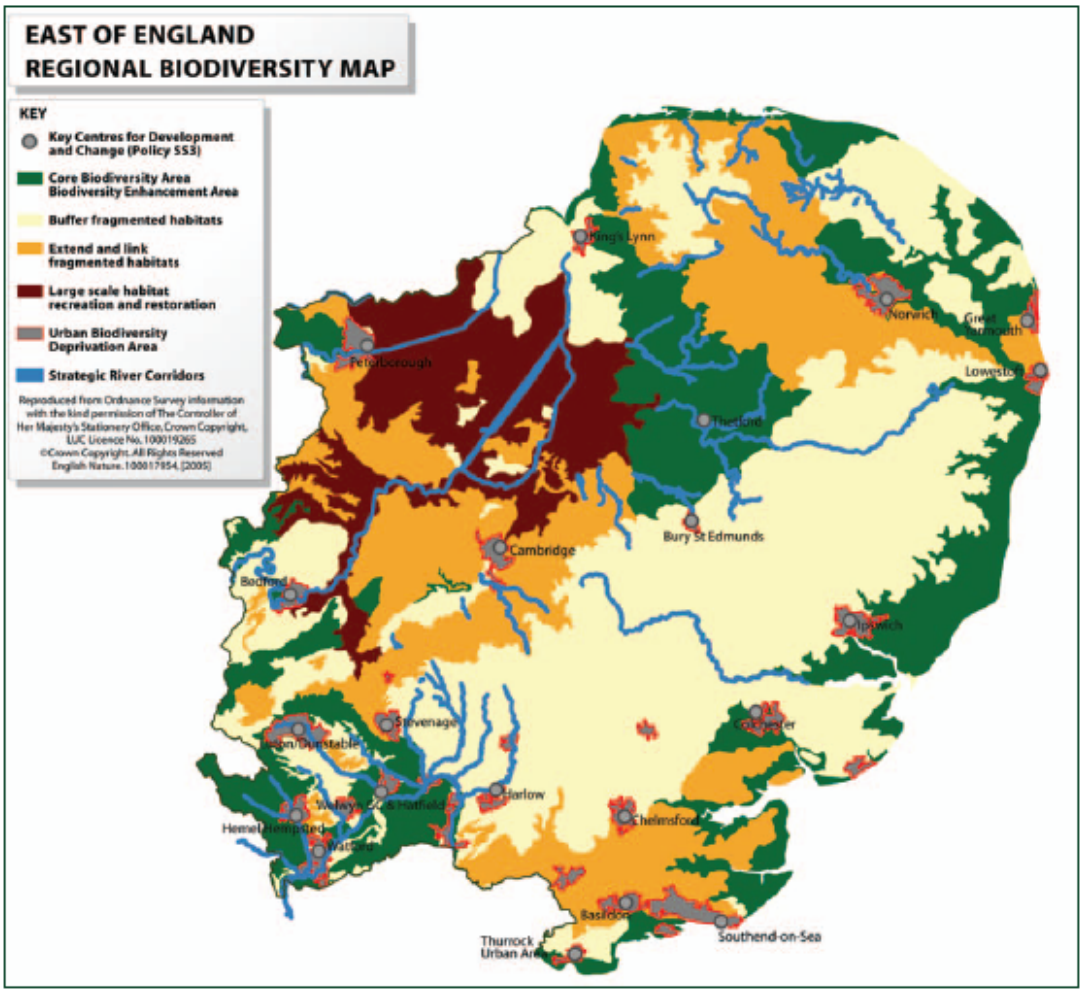
The region has defined some strategic opportunities for biodiversity improvement in the East of England Plan as demonstrated by the following policies:

Policy ENV1: Green Infrastructure. Recommends that green infrastructure be developed so as to maximise its biodiversity value, and as part of a wider package of measures, contribute to carbon neutral development and flood attenuation.

Policy ENV2: Landscape Conservation. LPAs' plans, policies and proposals should afford the highest levels of protection to the region's nationally designated landscapes and AONBs. Within the Broads and AONBs, priority should be given to conserving and enhancing natural beauty, wildlife and cultural heritage.

Policy ENV3: Biodiversity and Earth Heritage. Planning authorities and other agencies should ensure that the region's wider biodiversity, earth heritage and natural resources are protected and enriched through the conservation, restoration and re-establishment of key habitats in accordance with the East of England regional biodiversity targets and priority habitats identified in the East of England Biodiversity Map.

Figure 6: East of England Biodiversity Map



Policy ENV5: Woodlands. Through their plans, policies, programmes and proposals should seek to achieve a net increase in woodland cover by protecting and achieving better management of existing woodland whilst promoting new planting where consistent with landscape character. Woodland unavoidably lost to development should be replaced with new woodland of at least equivalent area and composition, preferably in the same landscape unit.

At the habitat and species level, a series of Biodiversity Action Plans set out what needs to be achieved in order to safeguard biodiversity in Suffolk. A series of 21 Suffolk Habitat Action Plans denote the importance of conserving, enhancing and restoring the natural condition of each. In addition, Suffolk Biodiversity Partnership has prepared individual species action plans for specific priority flora and fauna.

The Waveney Core Strategy recognises the importance of the District's biodiversity with the overarching spatial strategy policy asserting that 'an integral part of the strategy will be to protect and enhance local distinctiveness and the green infrastructure of the District, such as open space and biodiversity. Development should also 'provide, conserve and enhance biodiversity and create linkages between green spaces and wildlife corridors.'

Policy CS16 – Natural Environment also sets out that:
Proposals for development are expected to retain and add to local distinctiveness, retain tranquillity, avoid fragmentation of habitats and seek to enhance wildlife corridors and networks.

In addition, proposals should conserve and contribute towards the enhancement of the landscape character, biodiversity and geodiversity of the District, including those features listed below :-

- *the visual setting of the Norfolk and Suffolk Broads*

- *the Historic Parks and Gardens of Somerleyton, Henham and Belle Vue Park in Lowestoft, and their settings*
- *habitats and species in the Suffolk Biodiversity Action Plan*
- *sites and features in the emerging Suffolk Geodiversity Action Plan*
- *locally recognised sites of biodiversity and geodiversity importance, including County*
- *Wildlife Sites, Local Nature Reserves and Regionally Important Geological/Geomorphological sites*
- *wildlife and green corridors as identified in the biodiversity audits for Lowestoft, the market towns and Kessingland.*

The Code offers credits that reward use of a site with low ecological value, protection and enhancement of site ecology, careful planning of the building footprint and the overall change in the ecological value of the site. Versions of BREEAM cover similar topics relevant to non-residential buildings.

3.4.2 Waveney Situation

Waveney District is rich in ecological resources, supporting a range of wildlife including numerous habitats and species identified in the UK Biodiversity Action Plan, through a number of international and nationally ecological designations, regionally and locally important sites and a network of biodiversity corridors. Figure 7 shows the distribution of important areas across Waveney.

In line with the Habitats Regulations, a screening of potential impacts of Waveney's Core Strategy was undertaken. It concluded that, as the 'Core Strategy directs most new development to previously developed land within the existing boundaries of towns and larger villages' along with policies to reduce travelling and to support ecological corridors, the plan would not have any adverse impact on European designations.

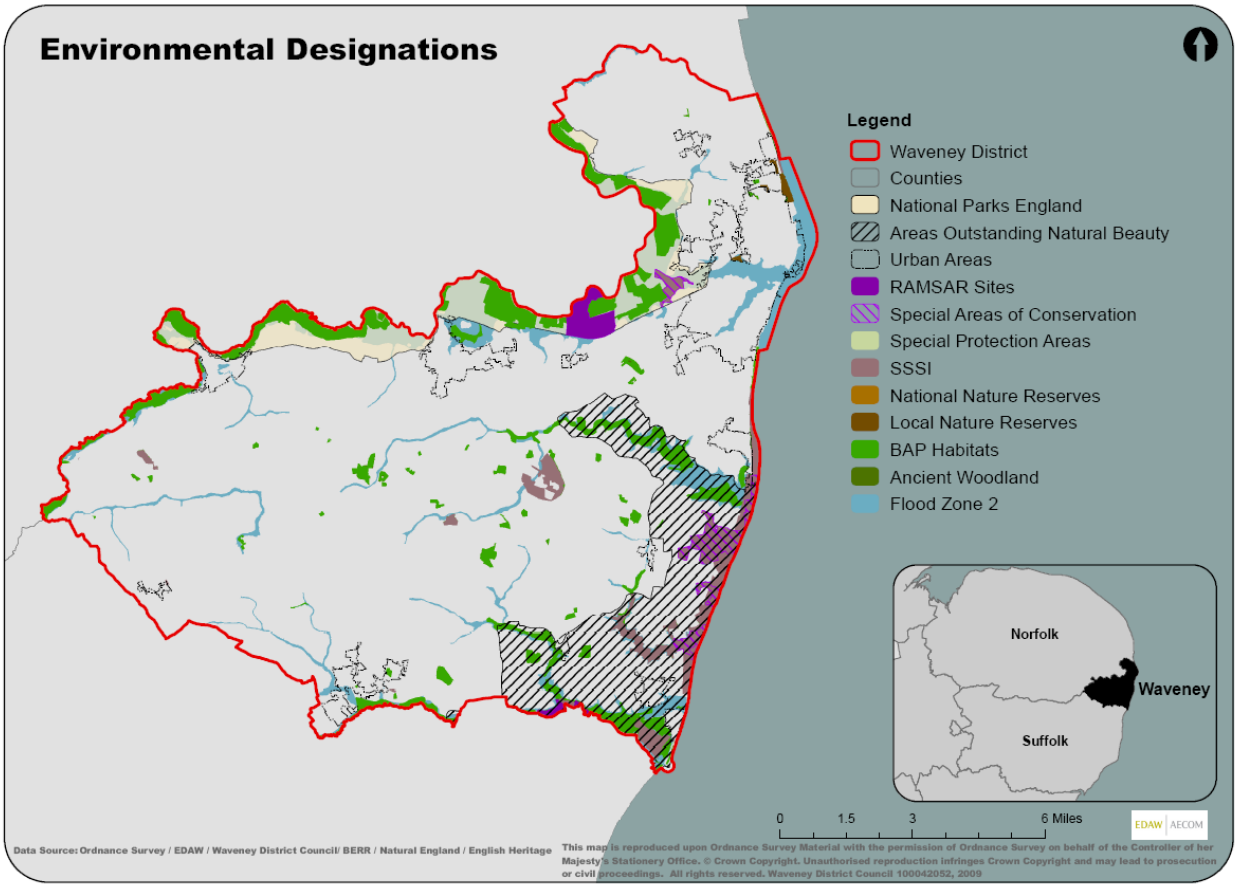
Suffolk Wildlife Trust, in collaboration with Waveney District Council have also produced a series of Biodiversity Audits to support the development of the Core Strategy, focusing on the nationally designated Sites of Special Scientific Interest (SSSIs), local designations and other areas of importance.

In addition to the areas of biodiversity importance, there are a number of other environmentally sensitive areas, including the Broads area, which has equivalent status as National Parks, and the Suffolk Coast and Heaths Area of Outstanding Natural Beauty. Furthermore, the Waveney Landscape Character Assessment has been undertaken to inform production of the Development Management Policies and Site Specific Allocations documents, and help guide the location of certain types of development (e.g. wind turbines) to less sensitive areas. It demonstrates the diversity of the District, dividing it into eleven landscape types:

- Rural Wooded Valley
- Rural River Valley
- Broads River Valley
- Coastal Broads and Marshes
- Dunes, Coastal Levels and Resorts
- Coastal Cliffs
- Settled Farmland
- Tributary Valley Farmland
- Farmed Plateau Clayland
- Estuarine Marsh
- Sandlings

Predominantly a rural district, Waveney has a large area of productive land. Nearly all the agricultural land within Waveney is of relatively good quality, with the vast majority classified as Grade 3 agricultural land. However, there are only limited areas of high quality Grade 1 and Grade 2 agricultural land.

Figure 7: Environmental Constraints in the Waveney District



2.3.5 POLLUTION

Policy Context

The National Air Quality Strategy (2007) sets out the air quality standards and objectives to be achieved for a range of key pollutants.

The issue of pollution cuts across a wide range of policies, including the water management and water quality policies quoted above. Air quality is the other major issue relevant to sustainable design and construction at a site level. Within the East of England Plan, Policy ENV7: Quality in the Built Environment stresses that new development should *reduce pollution, including emissions, noise and light pollution". Transport also has a determining role in terms of air quality management, as reflected in East of England Plan Policy T1 which sets out regional transport objectives and outcomes, including "improved air quality" and "reduced greenhouse gas emissions*. While it is important to acknowledge the role of transport in reducing pollution, this study focuses on the built environment and therefore transport management is a matter for the local transport plan and transport policies within the Core Strategy.

The Environmental Protection Act 1990: Part IIA - Contaminated Land sets out the priority that land contamination should be prevented via the pollution control regimes administered by Local Authority Environmental Health Officers and the Environment Agency. Furthermore, the Act advocates the removal of unacceptable risks to human health and the environment; to bring damaged land back into beneficial use; and to seek to ensure that the cost burdens faced by individuals, companies and society as a whole are proportionate, manageable and economically sustainable.

The Code uses credits to reward the use of the Considerate Constructors Scheme and other mitigation of construction-site impacts, which aim to reduce dust and other pollution among other outcomes. Versions of BREEAM include the same credits.

3.5.2 Waveney Situation

Under the Environment Act (1995), Local Authorities are required to undertake regular review and assessment of air quality. Waveney District undertook a detailed assessment air quality in 2003. In 2006 an update of the screening for pollutants was undertaken, finding that none exceeded the objectives of the National Strategy. Since this time, there have been annual update reports that have similarly concluded that air quality is within acceptable levels, except for a site on Mill Road where the nitrogen dioxide concentrations are over the air quality objectives. However, the reported concentrations derived from a small period of time. Therefore, further monitoring by diffusion tubes and traffic counts has been suggested in that area.

At present there are no sites within Waveney that are defined as contaminated and as such there are no remediation strategies sponsored by the local authority. The District Council do however take an active role in monitoring sites that due to historic and current uses might require some level of land remediation in relation to future development. Information on these sites is, however, considered potentially commercially sensitive and is not disclosed.

2.3.6 QUALITY OF LIFE

Policy Context

PPS1 explains that planning should be used to deliver: “a just society that promotes social inclusion, sustainable communities and personal well being” and “safe, sustainable, liveable and mixed communities with good access to jobs and key services for all members”. The Sustainable Communities Plan (February 2003) highlighted similar aims.

However further detailed planning policy is scant on issues about quality of life. The Eco-Towns Prospectus (July 2007) and Eco-Town PPS (July 2009) have sections on health and community empowerment through ownership and participation. The topics surrounding community empowerment have also been taken further by Communities in control: real people, real power (July 2008) which proposes changes to democratic decision-making at the most local level. Taken to a more physical level, quality of life as mediated by perceptions of local spaces feeling safe and attractive is dealt with by the Government’s ‘Cleaner, Safer, Greener’ programme.

The East of England Plan has at its heart a strategic objective of improving the quality of life for residents of the region. Policy SS2: Overall Spatial Strategy states that policies within Local Development Documents include policies which “ensure new development contributes towards the creation of more sustainable communities… and, in particular, require that new development contributes to improving quality of life, community cohesion and social inclusion”. Policy ENV7: Quality in the Built Environment sets out a number of high-level design principles which new development should adhere to in order to maximise quality of life.

Waveney’s Core Strategy advocates ‘Secure by Design’ principles ‘to reduce opportunities for crime and reduce the fear of crime’. Secure by Design is a crime prevention strategy that focuses on the design, layout and construction of developments to help deliver high security standards.

The Core Strategy also includes policies designed to preserve and enhance the character and setting of the built environment, as a good quality environment improves quality of life.

The Waveney Open Space Strategy (Dec 2007), supported by the Core Strategy, ‘sets locally determined standards of provision for different types of open space, and action points for addressing identified needs and deficiencies’. Provision of public open space is likely to be delivered as part of development.

Taking just the directly physical expression of measures to improve quality of life or well being within the home, the Code covers the level of daylighting, sound insulation, provision of private outdoor space, provision of a home user guide and Secured by Design status. A final standard is Lifetime Homes, a set of measures to ensure homes are adaptable to the changing needs of people during their life and in times of ill-health. Achieving Lifetime Homes is a mandatory element to achieving Code level 6. Considering Waveney District’s aging population, a Lifetime Homes requirement as part of the housing quality and density policies is recommended. Versions of BREEAM also cover health and wellbeing and management topics relevant to non-residential buildings.

Waveney Situation

Crime and the fear of crime in Waveney are low. The data recorded from the Home Office's British Crime Survey (2006/07) show that for most crimes and associated fears, Waveney falls within the lowest quartile when compared with the national picture.

There is some deficit in open space provision, principally parks and gardens and amenity greenspace. There is also an identified need for more children's play areas, particularly in north and south Lowestoft.

2.3.7 CLIMATE CHANGE IMPACTS

A vital part of the physical context for Waveney is how climate change is already affecting the District and will continue to impact on the people and natural systems of the District if it is not abated.

The Intergovernmental Panel on Climate Change (IPCC) was established by the United Nations to collate and digest the scientific consensus on climate change. A summary of their fourth report for policy makers was published in May 2007 and the final report was published in November 2007.

The report states that "Most of the observed increase in globally average temperatures since the mid-twentieth century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations." The current global average temperature rise is 0.5°C and this is due to the greenhouse gas emissions of previous generations, mainly from the burning of oil, coal and gas. Global average temperatures are predicted to increase further by 1.7 – 4.2°C by 2100. There is a scientific consensus that average temperature rise of more than 2°C constitutes a dangerous level of climate change. Waveney, as a coastal district and port, will be disproportionately affected by global impacts such as mass immigration and food shortages, and local impacts such as sea level rise, storms and lower rainfall.

Global Impacts

The "Stern Review: Economic Impacts of Climate Change" was commissioned by HM Treasury and published in October 2006. It was the first substantial assessment of the effects of climate change from an economic perspective. Some of the key conclusions are:

The impacts on global freshwater availability and temperatures are expected to have a significant impact on food production. Currently the UK is 60% food self-sufficient ('Ensuring the UK's Food Security in a Changing World, Defra 2008). Rising food prices and decreasing food quality and quantity are all concerns for the UK.

> "With 5-6°C warming models estimate an average 5-10% loss in global GDP, rising to 20% of GDP or more if a wider range of risks and impacts are taken into account…"

Climate change is already happening, increasing the frequency of extreme weather events and reducing food availability in some areas. The World Health Organisation estimates that climate change is already causing 150,000 deaths per year.

Local Impacts

The UK Climate Impacts Programme (2009) (UKCIP09) provides the most up-to-date projections of climate change. It uses three emissions scenarios to set out the potential changes in temperature and rainfall throughout the year for three levels of probability; 10, 50 and 90% at a national and regional level.

With medium emissions, the UKCIP09 predicts that by 2050 there will be the following climatic changes in the East of England:

- Temperatures are likely to increase by an average of 2.2ºC in winter and 2.7 ºC in summer, with maximum summer temperatures peaking some 3.4ºC higher than today
- Annual rainfall is likely to remain about the same but will fall at different times, with an increase in winter rainfall by 14% and a reduction in summer rainfall by 16%. Summer rainfall is also likely to be in hard, shorter bursts, with longer dry spells.

- Sea level rise of about 22cm in Lowestoft.

Changes such as those described above are likely to have a number of impacts. Hotter, dryer summers are likely to disrupt crop growing and could lead to increased numbers of heat related illnesses. Sea level rises, rapid rainfall and wetter winters are all likely to lead to increased flooding, with Lowestoft and sections of the Waveney and Blyth Rivers are already at risk. Buildings and other infrastructure may require more maintenance as the changes in weather increase wear and the possibility of damage through more extreme weather events.

The Suffolk Climate Change Partnership has developed the Suffolk Climate Change Action Plan (2009). It recognises the need to reduce the potential impacts of climate change through carbon reduction initiatives and improved building standards. It also acknowledges that there is a need to prepare and potentially adapt to be resilient to what are now inevitable climate change impacts. The Action Plan develops objectives and actions that cover twelve themes. The energy objectives focus on reducing energy wastage and decarbonising energy supply.

Within the objective for the built environment, 'promote sustainable communities' the action plan calls for 'ensuring the future building programmes of Suffolk Strategic Partnership' of which Waveney is a member 'meets highest environmental standards', advocating the use of benchmarking schemes to identify minimum building standards of BREEAM Excellent and Code for Sustainable Homes Level 4.

2.4 SUSTAINABLE CONSTRUCTION PRECEDENT IN WAVENEY

Waveney is home to two great exemplars of sustainable construction – the Adnams warehouse near Southwold. The building was built to meet BREEAM excellent standard and includes an extensive green roof to aid energy efficiency and to blend in with the landscape. Features include:

- Received BREEAM Excellent Rating
- Dynamic compaction used to remediate poor ground conditions. No new materials introduced onto site, increased allowable bearing pressure.
- Long span (35.5m) Glulam beams onto steel frame. Timber beams delivered to site as single units.
- Green Sedum roof construction includes root material and plants on the roof, which improves insulation and reduces rainwater run-off, attenuating drainage run-off. At 6,000m² is currently one of the largest green roofs in the UK.
- Lime/hemp blockwork, laid in traditional lime mortar. Low CO_2 solution by avoiding use of cement. Lime mortar absorbs CO_2 throughout its lifetime in a reversal of the manufacturing process. Lime/hemp infill provides insulation. Straw bale cladding considered early in design.
- Gabion basket retaining wall reduces concrete used.
- Rainwater harvesting collects water which will be used to flush toilets, etc. This system also collects and re-uses water from the vehicle wash.
- On-site foul treatment plant. All foul water treated on-site and discharged on-site.
- Low flush toilets, reduces the amount of water required.
- High specification industrial ground floor slab, very flat and durable.
- No mechanical cooling, warehouse will be cooled by incoming product and insulated by high thermal mass cladding. Offices have glazed south façade with 'Adnams' Brise-Soleil and large spaces to allow stratification of warm air in summer.
- 2 solar collector roof panels to provide up to 80% of the building's requirement for hot water from the sun's radiation.
- New building predicted to provide an energy saving in the region of 50% per unit floor area

Figure 8: Adnams Warehouse in Waveney

The OrbisEnergy Building, a centre for excellence in offshore wind energy technology, was rated 'very good' by BREEAM, include a biomass boiler fuelled by locally sourced woodchip and solar thermal energy to heat the building's water.

2.5 EMERGING POLICY RECOMMENDATIONS

Planning has an important role in meeting the sustainability ambition. The UK Sustainable Development Strategy is supported by PPS1 Delivering Sustainable Development and reflected in both the East of England Plan and Waveney's Core Strategy. Policies at a national, regional and local level are also being strengthened specifically for a range of sustainability related topics. The sections above outline the policy and contextual impetus for sustainable construction standards in Waveney across a range of criteria. All areas demonstrate that quality of environment in Waveney would either be retained or improved through the implementation of sustainable construction policies for new construction. Two clear areas of concern have emerged from the analysis where clear strategies and targets are needed to ensure the sustainable future of Waveney:

- Water Supply – Water resources in Waveney are severely restricted, with over abstraction of the Waveney and limited ground water abstraction capacity. This is likely to be exacerbated by new development. Policies to reduce potable water consumption should be introduced to make more efficient use of water. This should also be supplemented by water use reduction measures and the implementation of water recycling infrastructure.
- Flooding – Although restricting development in areas of flood risk is covered in PPS25, and reflected locally through Waveney's Core Strategy, a significant area for redevelopment, the AAP area, has been made an exception. Although there are likely to be significant economic and social benefits from regeneration of the AAP, it will be important to ensure that these are not outweighed by the risk of coastal flooding, which is likely to increase with sea level rises and increased rainfall. Land raising is proposed to protect the area, but this needs to be supported by a district-wide effort to reduce flood risk through the wide spread introduction of sustainable drainage systems to capture, store and treat flood water. In addition, in areas where risk remains, it will be important to ensure that measures are taken to reduce the impact of any flood event, for example by designing properties to place living areas above the design flood level of the flood zone.

It has been deemed that the remaining sustainability related issues reviewed are adequately covered within existing policies and strategies or do not present a specific problem.

- Materials and Waste – Waveney has made good progress towards recycling and composting targets, although, based on Suffolk wide performance, a significant amount of waste is still landfilled. Waste and recycling issues should be addressed through the Waste and Minerals Local Development Framework, Waveney's Waste Management Strategy.
- Environmental Sensitivity – Waveney is rich in biodiversity and important landscape features. The Appropriate Assessment screening accompanying the Core Strategy found, however, that as most development is directed to 'previously developed land within the existing boundaries of towns and larger villages' there will be no significant impact on European Designations. Other potentially sensitive areas, including those of local biodiversity interest and those of distinct quality and character are afforded protection through Policy CS16 – Natural Environment. Furthermore, particularly important areas, such as the AONB and Broads area are covered by their own planning rules.
- Pollution – Air quality is considered to be within Governments objectives and there is only one site requiring monitoring. There are no areas currently defined as contaminated land, although given the industrial historic uses within the District, some sites are being monitored.
- Quality of life – There is a deficit of open space in some areas. This is picked up in Policy CS04 – Infrastructure and Policy CS14 - Culture of the Core Strategy which places a requirement on developers to consider infrastructure requirements and address deficiencies.

The conclusions from the sustainable construction evidence base have informed the overall policy recommendations for the District described in Chapter 6.

Chapter 2: Key Policy Considerations

Along with energy and carbon, wider sustainable construction aspects should be considered in Policy. Waveney's Core Strategy has good coverage of most sustainable construction aspects on a district-wide scale, and these need to be supported by policy requirements for new development. Assessment tools including the Code for Sustainable Homes and BREEAM offer potential assessment methods for local authorities and developers, where there is a clear external and recognized assessment method and procedure that is simple to implement. The sustainable construction evidence based developed in this Chapter demonstrates that new development should prevent adverse effects and enhance performance against the range of sustainable construction aspects to support Waveney District Council's sustainable development objectives. Therefore the use of the Code for Sustainable Homes or BREEAM could be utilized within policy to ensure the effect of new development on the local environment and communities is managed. Financial implications relating to the full application of the Code for Sustainable Homes are expected to be manageable on most sites at Code Level 4 and below and expected to not adversely impact on development potential. Above Code 4 costs for water recycling infrastructure become more substantial, and need to be considered in relation to the market delivery context.

Particular attention needs to be given to two aspects of sustainable construction; water demand reduction and flood protection. Water supply is severely restricted in Waveney District. Sustainable construction standards should support high standards of water efficiency in new development to ensure water supply issues are not further increased. There may also be opportunities to implement water recycling measures on key sites. Flooding is a key risk for the area. Core Strategy policies already prevent development in the floodplain, with the exception of the AAP area where physical flood preventions measures will be made. The development of Sustainable Drainage Systems (SuDS) should be a priority across the District to reduce flood risk related to stormwater runoff in the AAP area and elsewhere.

3. Building-related Energy and Carbon

It should be noted that within this Chapter and following sections 'carbon' when quantified is equivalent to tonnes of carbon dioxide (CO_2) emissions.

3.1 POLICY CONTEXT

Paragraph 9.3 of the East of England Plan stresses that the combination of its vulnerability to the impacts of climate change and the scale of projected development in the region makes addressing climate change a particularly urgent challenge for the East of England. The Plan includes two policies relating specifically to carbon dioxide emissions and renewable energy. Policy ENG1 seeks to meet regional and national targets for reducing climate-change inducing emissions by stating that "new development should be located and designed to optimise its carbon performance".

Local authorities should:

- encourage the supply of energy from decentralised, renewable and low carbon energy sources and through Development Plan Documents set ambitious but viable proportions of the energy supply of new development to be secured from such sources and the development thresholds to which such targets would apply. In the interim, before targets are set in Development Plan Documents, new development of more than 10 dwellings or 1000m^2 of non-residential floorspace should secure at least 10% of their energy from decentralised and renewable or low carbon sources, unless this is not feasible or viable; and
- promote innovation through incentivisation, master planning and development briefs which, particularly in key centres for development and change, seek to maximise opportunities for developments to achieve, and where possible exceed national targets for the consumption of energy. To help realise higher levels of ambition local authorities should encourage energy service companies (ESCos) and similar energy saving initiatives.

Policy ENG2 encourages the development of new facilities for renewable energy generation with the aim that by 2010 10% of the region's energy should come from renewable sources excluding offshore wind power, rising to 17% in 2020. This is equivalent to:

- at least 1192 Megawatts by 2010 (820 MW excluding offshore wind); and
- at least 4250 Megawatts by 2020 (1620 MW excluding offshore wind).

Paragraph 9.7 states that *"for the purpose of this policy means of generating renewable energy include photovoltaic energy, solar-powered and geothermal water heating, wind, energy crops and biomass (such as wood from existing woodlands, sawmill co-products, and organic waste products that might otherwise be destined for landfill) and energy from agricultural, plant and animal, domestic and industrial waste. It includes energy generated as a product of anaerobic digestion and energy gained on-site and/or from a decentralised supply, including power from combined heat and power (but excluding renewable heat)".*

Waveney District's adopted Core Strategy includes a series of core policies which set out the spatial policy framework for delivering the objectives and vision articulated within the plan. Policy CS02: High Quality and Sustainable Design requires all developments to 'minimise carbon dioxide emissions through sustainable design and construction, energy efficiency measures and the incorporation of renewable energy technology'.

Waveney's Core Strategy places energy efficiency and renewable energy generation at the heart of the District's approach to urban regeneration. The area's largest regeneration scheme is focused on transforming the Lake Lothing and Outer Harbour area of Lowestoft, creating over 1000 new jobs and approximately 1500 homes. This employment-led regeneration will be guided by an Area Action Plan DPD, for which Policy CS05 of the Core

Strategy sets out objectives. Policy CS05 requires that the AAP facilitates the emergence of a high quality built environment that makes maximum use of renewable energy technologies and buildings minimise the use of resources.

In accordance with the East of England Plan (Policies E4 and GYL01), Core Strategy Policy CS08 sets out the Council's intention to promote a Renewable Energy Cluster and 'Power Park; at Ness Point within the outer harbour of Lowestoft.

3.2 BUILDING REGULATIONS AND THE TRAJECTORY TO ZERO CARBON

The Building Regulations first started to turn its focus towards reducing CO_2 emissions in the 2002 revision to Part L (Conservation of Fuel and Power). Further revisions to Part L in 2006 brought the UK Building Regulations in line with the EU's Energy Performance of Buildings Directive (EPBD), introducing amongst other things the requirement for Energy Performance Certificates (EPCs).

The current 2006 Building Regulations Part L requires that CO_2 emissions calculated for a new development should be equal to or less than a Target Emission Rate. This is generally in the region of 20% lower than CO_2 emissions from a building which complies with the 2002 Building Regulations, depending on the specific building type.

Following consultation, the Government's Building A Greener Future: Policy Statement announced in July 2007 that all new homes will be zero carbon from 2016. In the Budget 2008, the Government also announced its ambition that all new non-domestic buildings should be zero carbon from 2019 (with earlier targets for schools and other public buildings). The Government has also indicated that non-domestic buildings will be required to be zero carbon by 2019, again implemented through the Building Regulations.

The Definition of Zero Carbon Homes and Non-Domestic Buildings consultation in 2009 sought to clarify the definition of zero carbon that will be applied to new homes and buildings through proposed changes to the Building Regulations. A statement by John Healey, Minister for Housing and Planning, in July 2009 confirmed the policy to require all new homes to be zero carbon by 2016 and set out the proposals which will be taken forward to implement this policy. This addressed the concern that the original definition, which followed the definition of Code for Sustainable Homes Level 6, would not be feasible or viable on many sites.

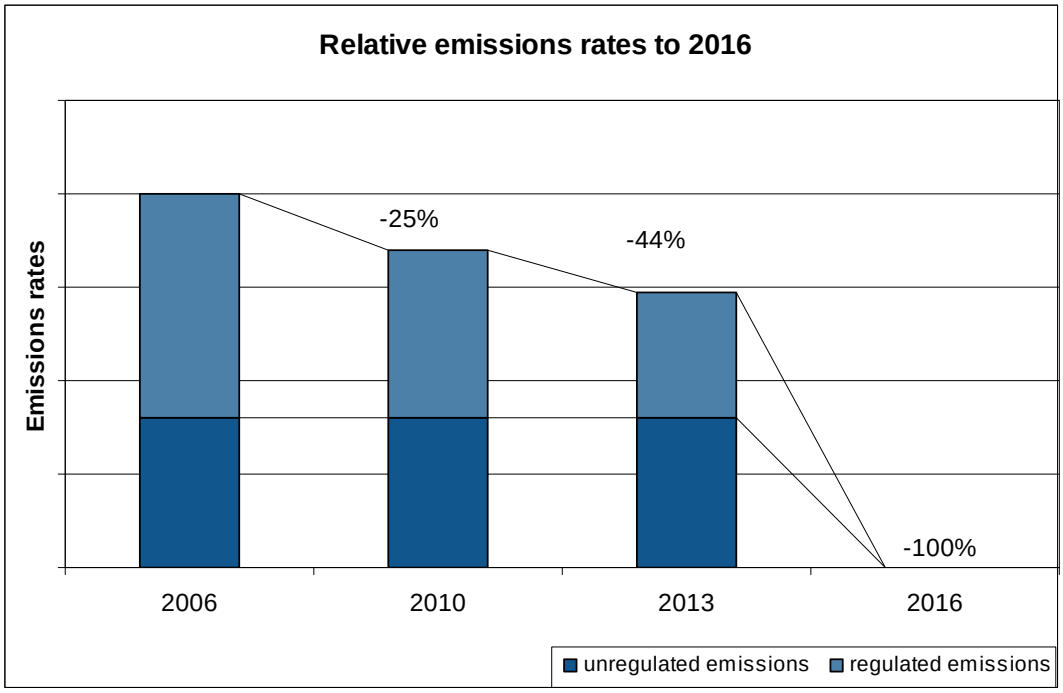
Prior to the introduction of the zero carbon requirement, the following intermediary step changes are proposed to the requirements of Part L of the Building Regulations for dwellings:

- 2010: 25% improvement in regulated emissions (relative to 2006 levels). This is expected to broadly correspond to the energy and CO_2 element of Level 3 of the Code for Sustainable Homes. The changes are being discussed as part of a current government consultation.
- 2013: 44% improvement in regulated emissions (relative to 2006 levels), corresponding to Code Level 4
- 2016: Zero carbon in terms of both regulated and unregulated emissions

Figure 9 illustrates the planned changes in the Building Regulations requirements for dwelling emission rates. One of the key points is that the requirements in 2010 and 2013 will only apply to the emissions that are currently

regulated, which are associated with energy use for fixed building services (heating, ventilation, cooling and lighting) inside the dwelling. From 2016, the requirements will apply to all emissions associated with energy use in the dwelling, including cooking and other appliances.

Figure 9: Incremental changes to Building Regulations Part L requirements for dwelling emission rates



The Government has published a hierarchy for how CO_2 emissions should be reduced to achieve the zero carbon emissions standard, as in Figure 10.

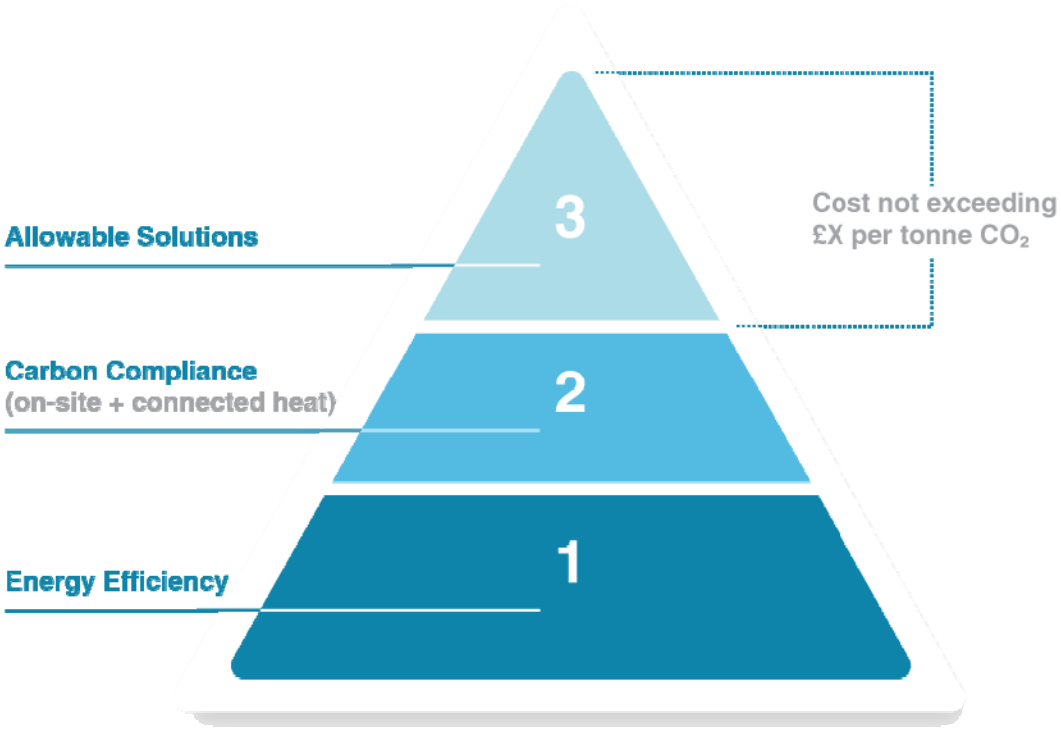


Figure 10: The Government's hierarchy for reducing CO_2 emissions

Developments will not be required to achieve zero carbon emissions entirely within the site boundary. There will be a minimum requirement for emissions savings through energy efficient design of the building services and building fabric; the amount is to be determined by the Government by the end of 2009. Further measures will be required to achieve "carbon compliance" on-site, bringing the regulated emissions savings on-site up to 70%.

These can include building integrated renewable energy, additional energy efficiency features and connection to a heat network.

The residual CO_2 emissions beyond carbon compliance are to be dealt with through "allowable solutions". Likely allowable solutions include:

- Further carbon reductions on-site
- Energy efficient appliances
- Advanced forms of building control system which reduce the level of energy use in the home
- Exports of low carbon or renewable heat from the development to other developments
- Investments in low and zero carbon community heat infrastructure

Other allowable solutions remain under consideration. A final Government announcement is expected at the end of 2009.

3.3 WAVENEY SITUATION – ENERGY DEMAND

Current Stock

Domestic

Waveney domestic electricity use totalled 245GWh (245,081,483kWh) which averages out at 4,549kWh per meter. This compares favourably with the East of England average, although is slightly below the UK average. Gas use within the District is 713GWh which is considerably lower, approximately 11%, than the UK average gas use. Table 12 shows a comparison between energy used in Waveney with neighbouring districts, the regional average and the national average.

Table 12: Energy consumption per consumer (BERR, 2006)

	Average electricity sale per home	Average gas sale per consumer
	Domestic kWh	Domestic kWh
Waveney	**4,549**	**16,330**
South Norfolk	5,435	17,554
Great Yarmouth	4,886	15,524
Suffolk Coastal	5,291	17,712
Mid Suffolk	5,812	16,548
East of England Average	4,873	18,032
UK Average	4,457	18,241

Figure 11 and Figure 12 show the average electricity and gas are uses per household across the District. Electricity consumption is generally higher in areas where gas consumption is low, indicating that electricity is probably used for heating (with the exception of the area south of Lowestoft including Southwold and Reydon). The average electricity and gas use is generally lower in Lowestoft, where higher density living often reduces energy demands.

In addition to the use of electricity and gas for heating, there are a relatively high use of oil, 54.8GWh, and coal, 2.5GWh, reflecting the rural nature of the District and potential limitations to the gas network.

Figure 11: Electricity Consumption per Household in Waveney

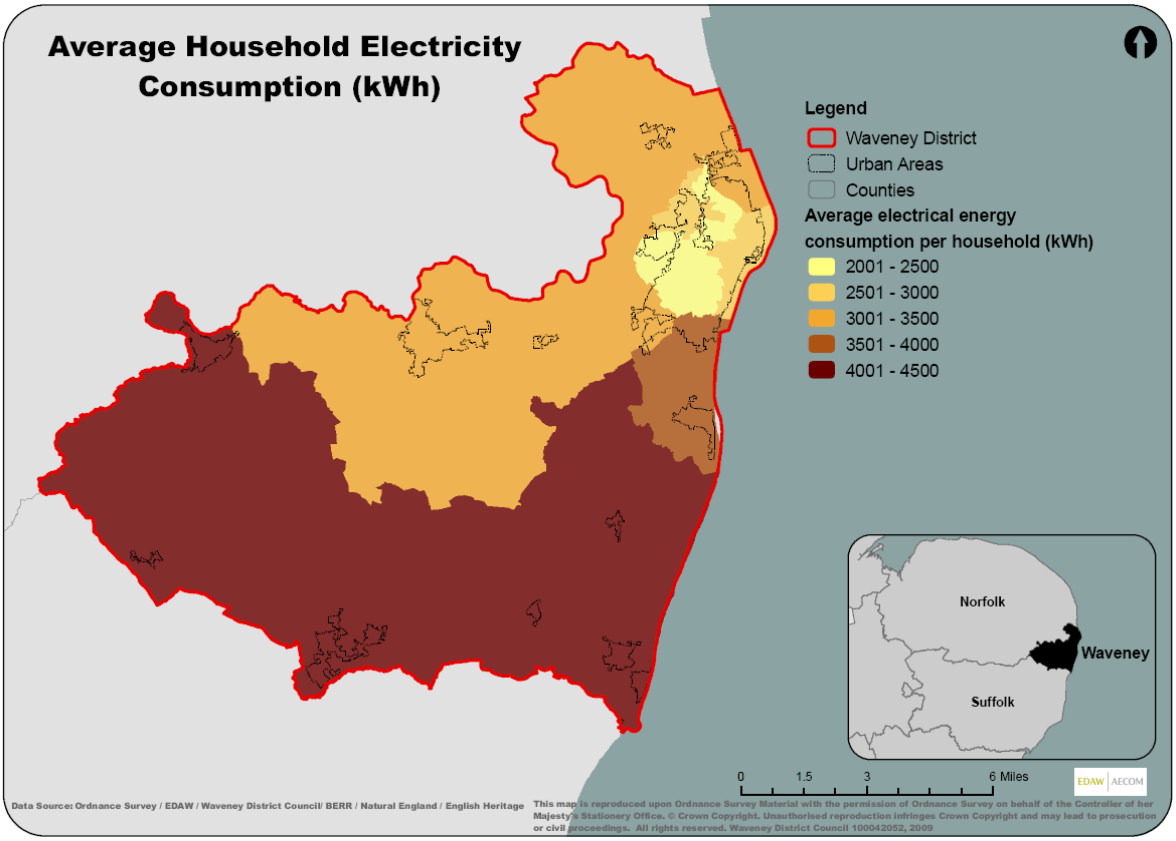
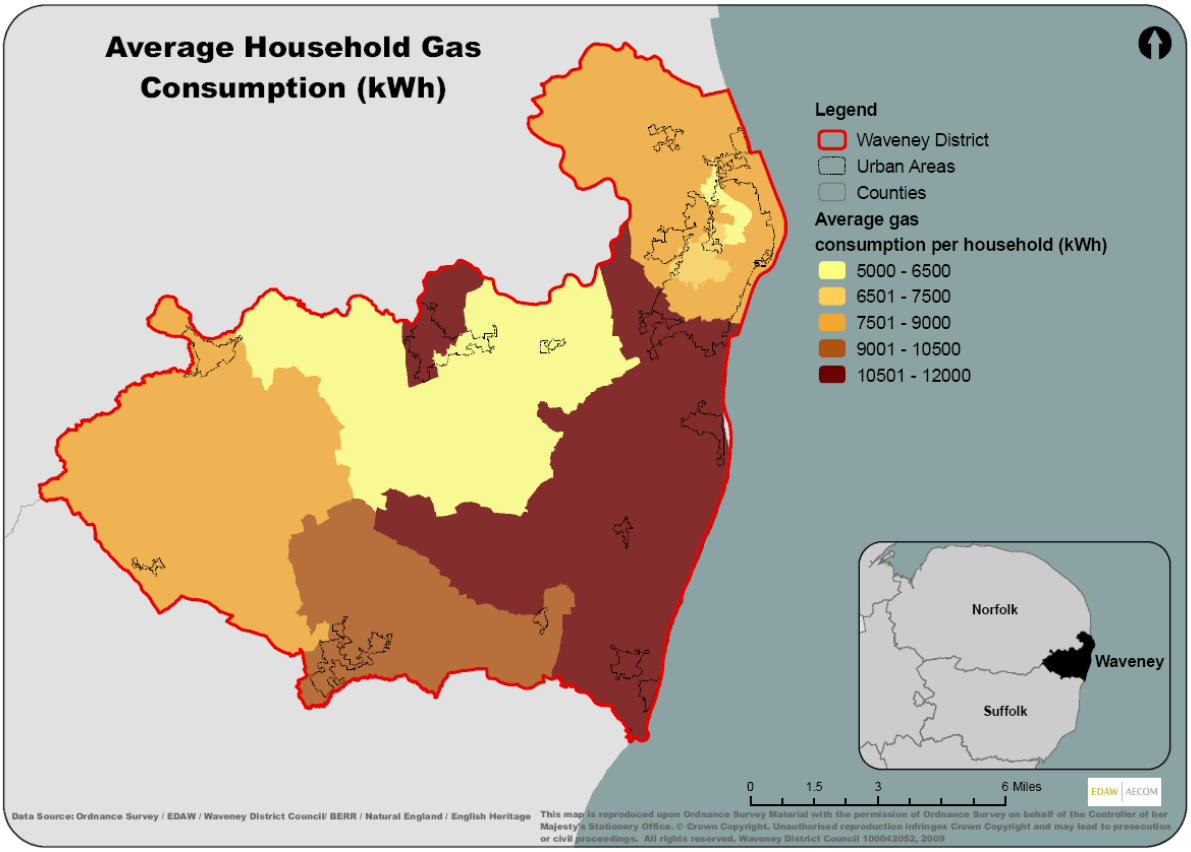


Figure 12: Gas consumption per household in Waveney



The electricity consumption in Waveney accounts for approximately 1.9 tonnes of carbon dioxide emissions for every home, with the gas consumption contributing 3.17 tonnes per home. Under the Home Energy Conservation Act 1995 obligations, Waveney have reported a 21.3% reduction in energy use since April 1996. The improvements are not however continuous, with peaks in 1999, 2001 and 2005. It is unclear as to why the earlier improvement peaks occurred, and some concern has been expressed as to the consistency in accounting,

however it is likely that improvement between 2004 - 2005 was due to improvements in accounting software and coincide with a programme of loft/cavity insulation and boiler upgrades.

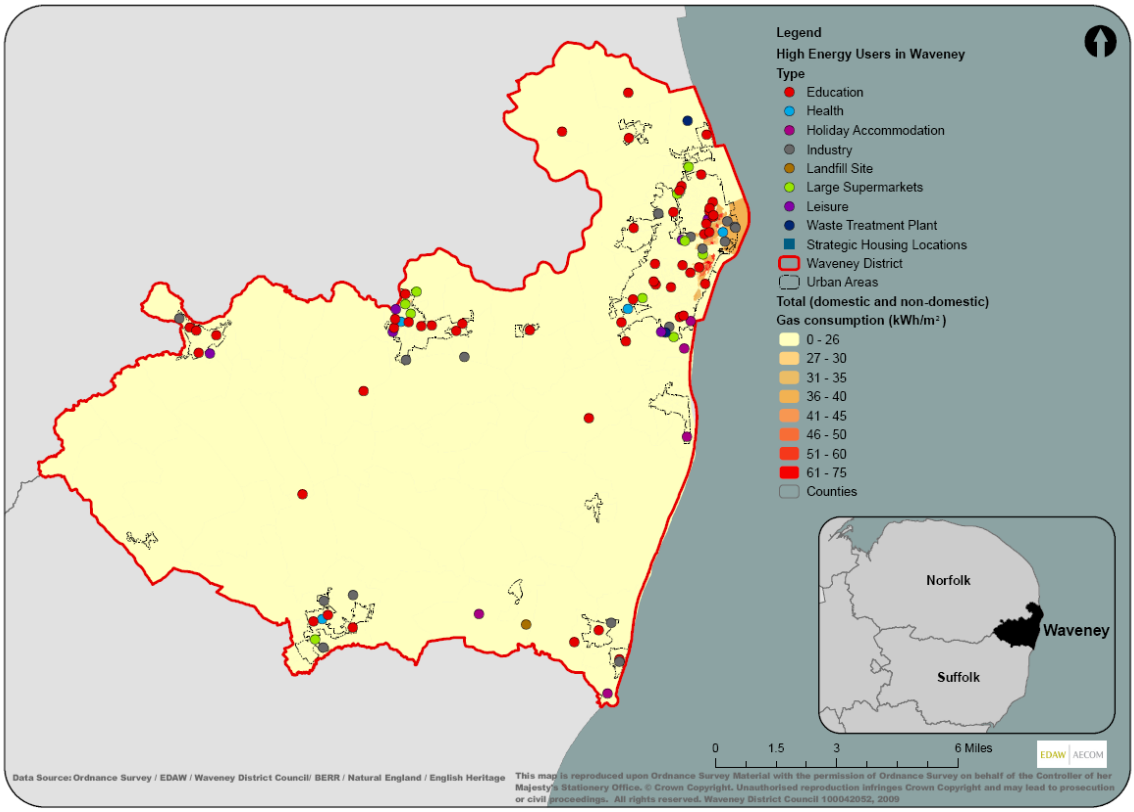
As part of their responsibility for a housing stock of 4619 properties, Waveney District Council has made efforts to improve the energy efficiency of the properties under their control. Significant efforts have been made to ensure that 94% of homes meet Decent Homes standards with an average SAP (Standard Assessment Procedure) rating of 81%, which requires homes to be warm, waterproof and have relatively modern facilities. The Council have also undertaken a number of more direct efficiency saving initiatives including, installing double glazing to properties in 2000, cavity wall infill was undertaken in the 1980s and they have just completed a full loft insulation programme to all the stock, except for the hardest properties to access and a PVCu (Polyvinyl Chloride un-plasticised) exterior door programme.

In addition, the Council have installed seven Ecodan air source heat pumps and two Ecodan air source heat pumps with solar thermal heating, and are currently seeking grant funding for a further fourteen.

Commercial and Industrial

The UK Department for Business, Innovation and Skills (BERR) publish commercial and industrial energy consumption collectively. In 2006, the total electricity consumption from non-residential users in Waveney was 404GWh. Approximately three quarters of this, 302GWh, was used by only 181 users. This is an average of 1.6GWh per user. The remaining 102GWh was consumed by 4,577 users. BERR do not provide a geographical breakdown that includes these high energy users as it is potentially possible to identify individual businesses, contravening privacy policies. However, Waveney District Council have produced a list of potentially high energy consumers based on use type. As shown in Figure 13, these users are congregated around Lowestoft, and this is where the highest density of energy use is likely to be.

Figure 13: Expected high energy users



Future Trends - Existing Development

In order to evaluate the effectiveness of interventions to improve the energy performance of the existing housing stock it is important to establish what the likely future energy demands will be based on current trends.

Domestic

Although Waveney's HECA (Home Energy Conservation Act) reporting provides some context, there is concern regarding the accuracy of reporting under the HECA scheme on a nationwide scale. 'Delivering Cost Effective Carbon Saving Measures to Existing Homes' by BRE for DEFRA provides a more comprehensive summary of energy efficiency trends, including the rate of uptake of basic energy efficiency measures. Extrapolating these from the 2006 energy demand baseline, as shown in Figure 14 and Figure 15, it can be seen that electricity demand is likely to increase slightly, as demand for more energy intensive appliances outweighs energy efficiency measures. Gas demand on the other hand is likely to decrease as energy efficiency measures are applied.

Two scenarios are tested in the graphs below demonstrating the expected reduction in electricity and gas consumption over time in line with low or 'business as usual' rates of improvement of existing buildings:

- Scenario 1: No change of fuel sources: This assumes that all buildings retain the same fuel sources as the current situation – i.e. those supplied by electricity and gas remain the same, as do those rural properties supplied by oil and coal.
- Scenario 2: Switch of oil and coal users: Over time it is likely that rural properties will change their fuel source. It has been assumed that conversion from coal will be immediate and constant due to ease of retrofit, but due to technical viability, it is assumed oil conversion will not begin until 2021.

Figure 14: Comparison of Electricity Use under Scenarios 1 and 2

Scenario 1 *Scenario 2*

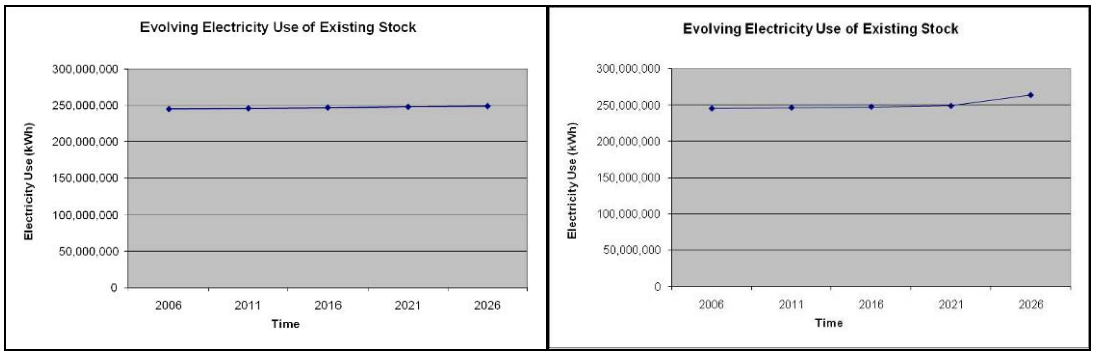
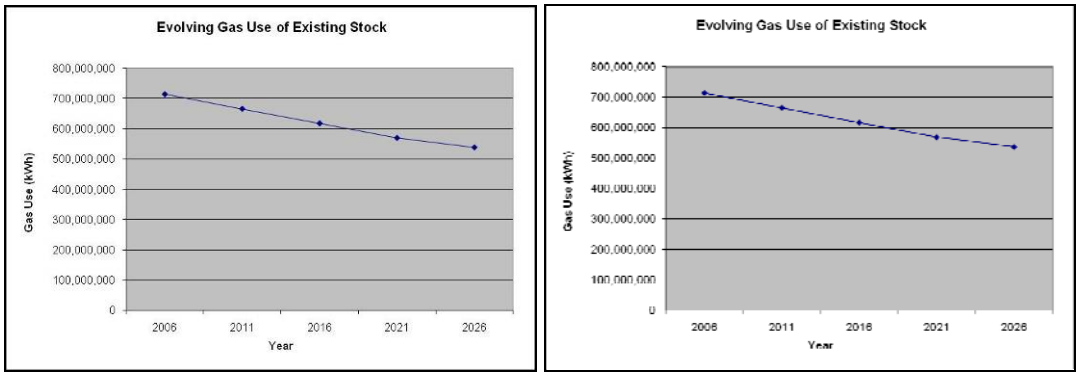


Figure 15: Comparison of Gas Use under Scenarios 1 and 2

Scenario 1 *Scenario 2*



The switch of oil and coal users is likely to have a significant effect on the electricity demand of the District. Conversion to gas is unlikely to be an option for many rural properties as there is no gas infrastructure in place. As grid electricity is currently a high carbon source of energy for heating, other the use of other renewable or low carbon fuels should be a priority in rural areas. Options are discussed further in Chapters 5 and 6.

Commercial and Industrial

The assessment of energy efficiency in the non-domestic sector is difficult due to the range of building forms, construction, and usage types. A large amount of advice is available from bodies such as the Carbon Trust on reducing building and process energy, but it is not simple to quantify the UK potential, or uptake rates due to lack of data at a national scale. Based on this information and in-house best practice the AECOM Carbon Management Team, have developed estimates for energy efficiency improvement through behavioural change, and through capital cost measures. The trend for commercial and industrial development is one of increased efficiency as set out in Figure 16 and Figure 17.

Figure 16: Predicted Change in Electricity Demand of Non-Residential Buildings

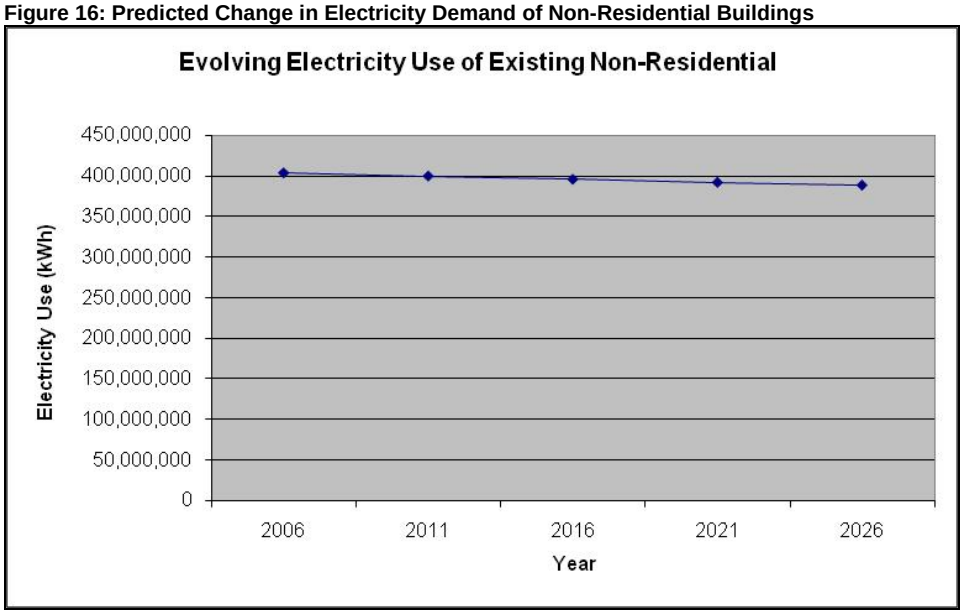
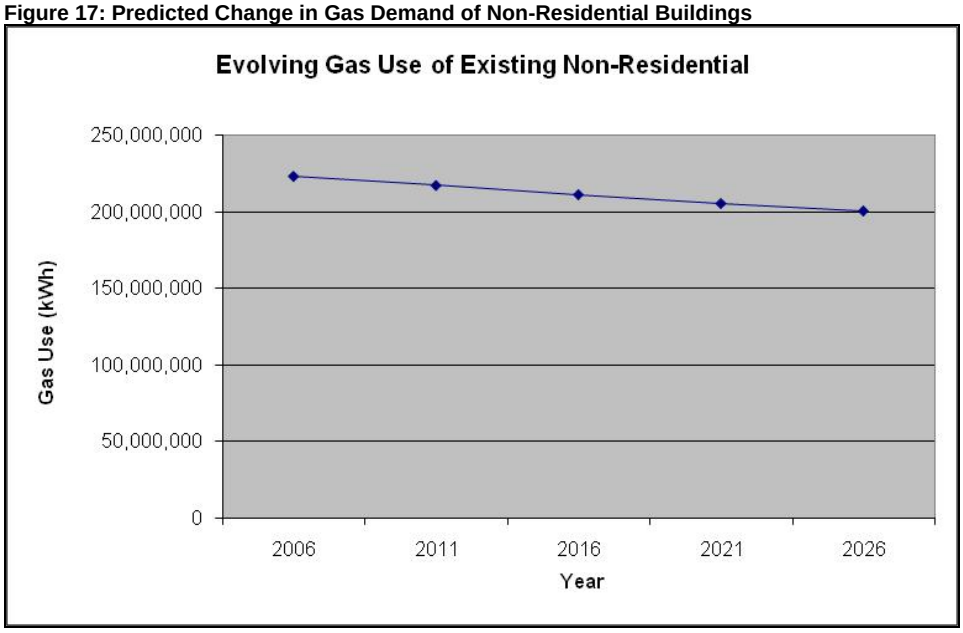


Figure 17: Predicted Change in Gas Demand of Non-Residential Buildings



Enabling a Higher rate of Improvement in Buildings

The estimations in the change in performance of existing buildings above show a 'business as usual' estimation, where energy efficiency measures continue to be encouraged on a national scale with existing measures and initiatives undertaken by the Local Authority. This estimation reflects an expected uptake in energy efficiency measures based on which measures are most cost-effective and most easily retrofitted. A higher up-take of energy efficiency measures may be possible with targeted funding and initiative. Table 13 compares the expected carbon saving of a 'high rate' of energy efficiency improvement (as predicted using studies by BRE), compared to the baseline situation outlined above. The carbon savings that can be achieved through improvement of existing buildings are very substantial and this should be a priority for change in the District.

Table 13: Comparison of carbon dioxide reduction due to higher energy efficiency levels being applied in existing stock in Waveney

Energy Demand (kWh)	2006	2011	2016	2021	2025
Baseline Scenario					
Residential Electricity Demand	245,081,483	246,022,387	246,963,291	247,904,194	248,845,098
Residential Gas Demand	713,949,469	665,456,691	616,963,913	568,471,134	536,890,669
Non-Residential Electricity Demand	403,828,510	399,767,126	395,705,742	391,745,893	388,192,182
Non-Residential Gas Demand	223,366,783	217,224,196	211,081,610	205,162,390	200,136,638
High Reduction Scenario					
Residential Electricity Demand	245,081,483	243,215,904	241,350,325	239,484,745	237,619,166
Residential Gas Demand	713,949,469	650,797,155	587,644,840	524,492,526	483,652,953
Non-Residential Electricity Demand	403,828,510	394,690,396	385,552,282	377,023,375	370,931,299
Non-Residential Gas Demand	223,366,783	211,081,610	198,796,437	186,957,997	176,906,492
Potential Carbon Saving through increased energy efficiency (tonnes CO_2)	0	7,675	15,350	22,761	28,002

Future Trends - New Development

New development will increase energy demands within the District. Part L of the Building Regulations requires that buildings meet minimum energy efficiency standards. These standards have been applied to the quantum and assumed mix set out in section 1.2 with modelled using AECOM residential profiles prepared for DCLG, and CIBSE industry benchmarks for non-residential development. In addition, increased energy performance in line with the proposed changes to Building Regulations Part L requirements which will take effect in 2010, 2013 and 2016 have been taken into consideration, along with the expected changes to Regulations affecting non-residential buildings leading up to zero carbon in 2019. The expected additional energy demand is set out in the tables below.

Table 14: Cumulative electricity demand from new residential development (kWh)

	2007-2011	2011-2016	2016-2021	2021-2025
Lowestoft	3,368,370	8,468,313	11,726,000	14,549,329
Beccles	355,684	721,189	982,005	1,242,821
Market Towns	550,944	1,117,099	1,508,323	1,899,547
Villages	329,822	665,010	665,010	665,010
Total	**4,604,820**	**10,971,611**	**14,881,338**	**18,356,706**

Table 15: Cumulative gas demand from new residential development (kWh)

	2007-2011	2011-2016	2016-2021	2021-2025
Lowestoft	5,826,905	13,329,435	16,525,495	19,295,414
Beccles	634,558	1,186,472	1,444,800	1,703,128
Market Towns	982,911	1,837,808	2,225,300	2,612,792
Villages	592,334	1,101,240	1,101,240	1,101,240
Total	**8,036,708**	**17,454,955**	**21,296,835**	**24,712,574**

CIBSE TM46 benchmarks were used to model energy demand of future non-residential buildings, increased energy efficiency measures mirroring expected changes to building regulations for non-residential buildings. This is illustrated in the Tables 16 and 17 below.

Table 16: Cumulative electricity demand from new commercial and industrial development (kWh)

	2007-2011	2011-2016	2016-2021	2021-2025
Lowestoft	9,829,019	19,623,093	29,277,384	38,931,675
Beccles	6,213,000	12,454,994	18,812,964	25,170,934
Market Towns	4,521,000	9,063,098	13,689,588	18,316,078
Villages	0	0	0	0
Total	**20,563,019**	**41,141,185**	**61,779,936**	**82,418,687**

Table 17: Cumulative gas demand from new commercial and industrial development (kWh)

	2007-2011	2011-2016	2016-2021	2021-2025
Lowestoft	45,875,884	84,820,783	96,041,743	107,262,703
Beccles	31,065,000	57,329,422	64,391,532	71,453,642
Market Towns	22,605,000	41,716,774	46,855,644	51,994,514
Villages	0	0	0	0
Total	**99,545,884**	**183,866,979**	**207,288,919**	**230,710,859**

The scale of energy demand predicted for future development in Waveney is much higher for non-residential growth than residential growth. While strong residential growth is expected in Lowestoft in particular, there is major delivery of commercial and industrial uses expected in the Lowestoft AAP area along with light industrial development expected in the market towns.

Future Trends – Total

The following table summarises the combined energy demand profile of Waveney District. Energy efficient new residential development is expected to make relatively little change to the energy profile. However, the strong growth in commercial and industrial buildings creates substantial additions to the energy profile over time.

Table 18: Expected Cumulative Energy Demand in Waveney over time (kWh)

	2006	2011	2016	2021	2025
Domestic Electricity Demand	245,081,483	250,931,496	258,528,265	263,653,517	282,561,225
Domestic Building Gas Demand	713,949,469	673,797,688	635,012,232	590,635,955	562,732,118
Domestic Oil Demand	54,880,495	54,880,495	54,880,495	54,880,495	54,880,495
Domestic Coal Demand	2,544,749	2,544,749	2,544,749	2,544,749	2,544,749
Non-Domestic Electricity Demand	403,828,510	420,330,145	436,846,927	453,525,828	470,610,868
Non-Domestic Gas Demand	223,366,783	316,770,080	394,948,589	412,451,309	430,847,496
Non-Domestic Oil Demand	229,730,421	229,730,421	229,730,421	229,730,421	229,730,421
Non-Domestic Coal Demand	9,626,822	9,626,822	9,626,822	9,626,822	9,626,822

Chapter 3: Key Policy Considerations

Policy development should consider the evolving energy demand profile for the District to ensure that energy efficiency measures and new development demand are taken into account when specifying renewable energy targets as a proportion of energy demand. New development will demand significant amounts of energy in Waveney District, particularly non-residential demand. Hence, policy measures should encourage significant reductions in energy demand from new development, through both energy efficiency and renewable energy measures.

4. Renewable and Low Carbon Potential

4.1 EXISTING SITUATION

The major low carbon and renewable energy technologies in Waveney currently are wind energy and landfill gas. Landfill gas is expected to make a continuing contribution to low carbon energy in Waveney, though no new developments are planned. Several planning applications for wind energy are in process, and this capacity is expected to increase over time with some certainty.

Landfill Gas Existing Capacity

Gas from the landfill site at Wangford is captured and is burnt in a 1.006MW generator to produce electricity. Landfill off-gases for up to 40 years, consequently power generation from this site is assumed constant over the lifespan of this review, as shown in Table 19.

Table 19: Landfill gas in Waveney

Technology	2010 Installed capacity MW	GWh p.a.
Landfill Gas	1.006	7.5

Wind Energy Existing Capacity

The 2.75MW wind turbine at Ness Point is the first commercial wind turbine in Suffolk and the largest wind turbine in Britain, capable of supplying more than 1,500 homes and reducing annual carbon dioxide emissions by 6000 tonnes. The 2.75MW turbine, nicknamed ‘Gulliver’ by locals, has been providing renewable electricity since January 2005. It is also the only core renewable technology currently operational in Waveney.

Figure 18: The existing 2.75MW wind turbine in Lowestoft, known as 'Gulliver'

Wind Energy Forecast to 2015

There are two proposed commercial wind energy developments in Waveney. A two turbine, 6MW scheme at Africa Alive has been granted permission, with construction likely to start in 2010. A temporary planning permission has also been granted for a 250kW turbine to power Harrod UK Ltd. Planning permission is also sought for a five 2.3MW turbine scheme at Upper Holton. If granted, it is expected that each turbine would generate around 4,836MWh per annum. This is summarised in Table 20.

Table 20: Onshore wind forecast

Technology	2010 Installed capacity MW	GWh p.a.
Onshore Wind - built	2.75	6.26
Onshore Wind – Approved – not built	6.25	14.24
Onshore wind – in planning	11.5	24.18
Total	**20.5**	**44.68**

The British Wind Energy Association (BWEA) consider that around 60% of recent UK onshore wind applications have been successful. It is assumed that an equivalent number of turbines located within the District will be granted planning permission and constructed by 2015.

Plans are also progressing for a further 12 3MW Vesta turbines proposed to be built near to Beccles in the north of Waveney District. Proposed locations are for 3 turbines at:

- Devonshire Farm
- Granary Farm
- Laurel Farm
- Ringsfield Hall Farm

The scheme is being proposed by Stamford Renewables Ltd -www.stamfordrenewables.com

4.2 THE RENEWABLE ENERGY CHALLENGE

The EU Renewable Energy Target requires a 20% reduction on 1990 levels by 2020 of carbon from electricity, heating and transport. The UK has committed to achieve a 15% reduction, which equates approximately to around 30% reduction in carbon dioxide from electricity production and approximately 12% from heating requirements as set out in the UK's Renewable Energy Strategy 2009. This Chapter tests whether Waveney District could at least meet its share of this target as set out in Table 21.

Table 21: Waveney's renewable energy requirements 2020

Requirement	Requirement in GWh
Around 30% of annual electricity consumption	214
Around 12% of annual heat consumption	153

This section discusses the resource potential of different energy options before going on to provide a potential scenario to meeting the requirements.

4.3 ESTIMATING DISTRICT-WIDE LOW CARBON AND RENEWABLE ENERGY POTENTIAL

Before estimating the potential for the delivery of low carbon and renewable energy associated with future development, it is important to understand the opportunities and constraints around the use of different generation technologies in the District.

A renewable energy potential study was conducted in 2007/8 for the East of England Assembly covering the whole of the East of England Region to inform the further review of the East of England Plan. The study tested 2020 targets set out in the proposed changes to the draft RSS (Dec 2006), and proposed an interim target for 2015. This strategy builds on that analysis, and looks at the specific potential within Waveney District.

As identified in the regional study, the greatest opportunities for renewable energy in the Region are large (i.e. at least 80m hub, 3MW turbines) onshore wind power and biomass (from energy crops, imported biomass, agricultural wastes and managed woodland). Anaerobic digestion of waste, and sewage by-products also contributed. The study did not address wave power, tidal stream, or landfill gas as these are regarded as 'national renewables' rather than regionally delivered renewables influenced by local authorities. This study focuses on the potential for renewables and low carbon technologies associated with wind, biomass, anaerobic digestion, district heating and combined heat and power and (with the planned introduction of feed-in tariffs) large scale Photovoltaics. Other low carbon and renewable technologies that are applied at a smaller site scale associated with existing and new development are discussed later in this Chapter. The following renewable technologies are excluded from the District-wide analysis for reasoning as follows:

- **Offshore wind power**: The generation of energy by offshore wind installations have not been considered as a contributing renewable source within this study as the targets for the East of England specifically split offshore and onshore wind and the offshore resource does not fall within the jurisdiction of Waveney District Council. However, as offshore wind is important to the economic base in Waveney, it is important to understand the scale of potential. Figures 19A and 19B demonstrates the potential for offshore wind in terms of wind speed. Other considerations including grid connections, sea depth and ground conditions also factor in offshore wind turbine siting.
- **Wave energy**: The area off of the coast of Waveney has the lowest power waves in the UK due to predominant westerly origin of waves being shielded by landmass and from the relatively low fetch on waves driven across the North Sea. Due to the potential damage of wave energy infrastructure, calmer areas may become viable in the future. However, it is considered wave energy is unlikely to be a source of significant power generation in the 2010-2025 period. This is demonstrated by Figure 20 below.
- **Tidal stream**: Waveney is a centre for the development of tidal stream energy generation and has a reasonable tidal stream off of its coast which is ideal for testing innovative technologies. Tidal stream generation, as offshore wind and wave power does not however fall within the jurisdiction of Waveney District Council and is excluded from this study. Work is currently being undertaken to trial tidal power installations at Waveney with the potential for long term energy generation. The calm conditions in the area mean there is less risk of damage to equipment. The tidal potential is demonstrated in Figure 21.

- **Energy from sewage**: Energy from sewage needs to be taken forward at a wider-scale and is very dependent on existing infrastructure. Opportunities for this could be explored in partnership with other neighbouring districts.
- **Energy from waste**: Waste is managed at a county level and there is no significant waste management centres in Waveney currently. Potential for energy from waste should be considered at a regional or county level, but is considered outside the influence of Waveney District Council alone.
- **Hydropower**: Hydropower has been excluded from this study as there are no significant sources of hydropower in Waveney District. Waveney is a relatively flat area with limited potential head or velocity of flow to be captured by hydro schemes.
- **Geothermal energy**: There is no geothermal resource for large scale installations in Waveney District. Ground source heat pumps are viable on a site scale and are considered in the micro-generation and new development sections of this report.

Figure 19A: Offshore Wind Speeds in the Waveney Area

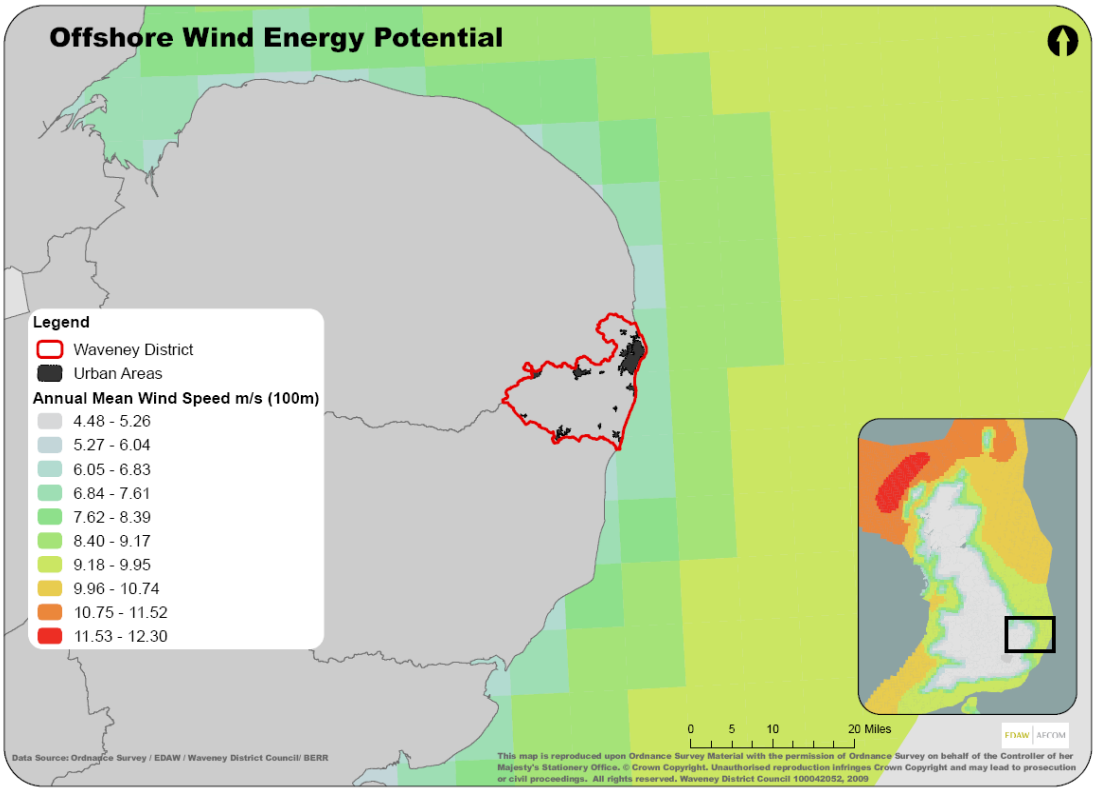


Figure 19B: Planned offshore energy development in the East of England

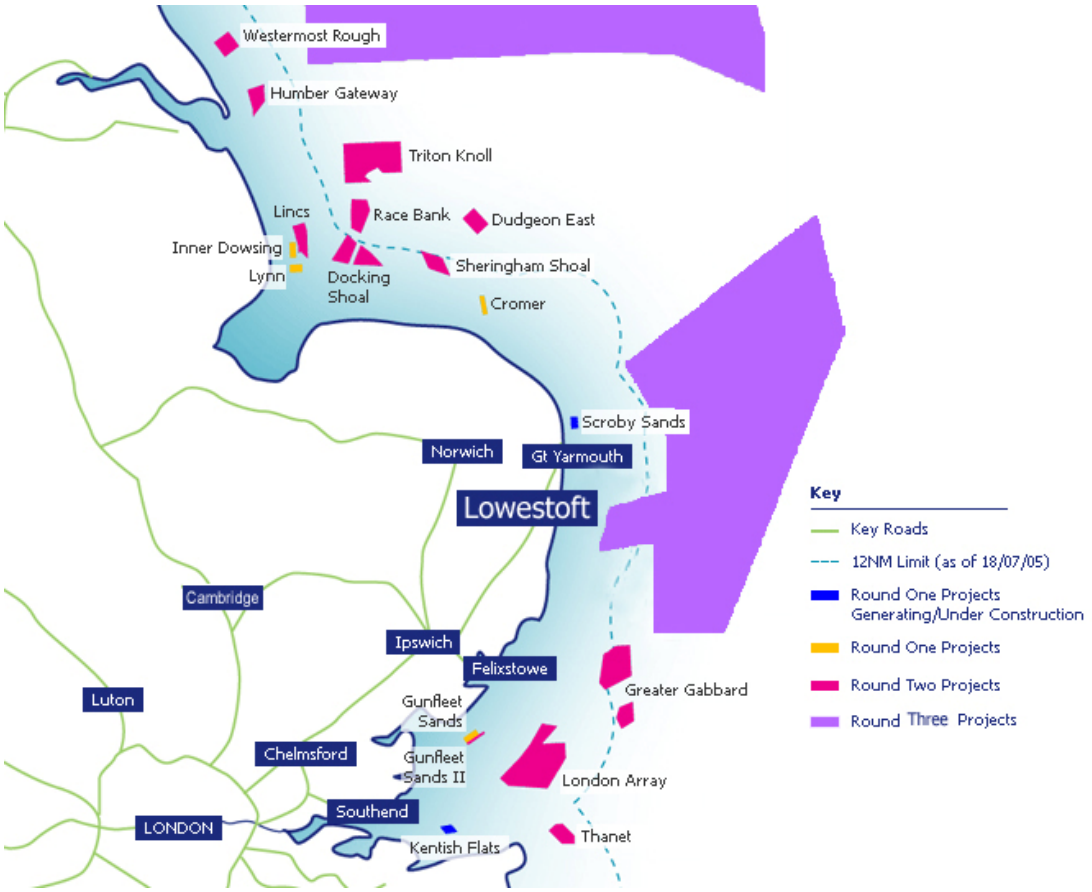


Figure 20: Wave Energy in the Waveney Area in kW/m

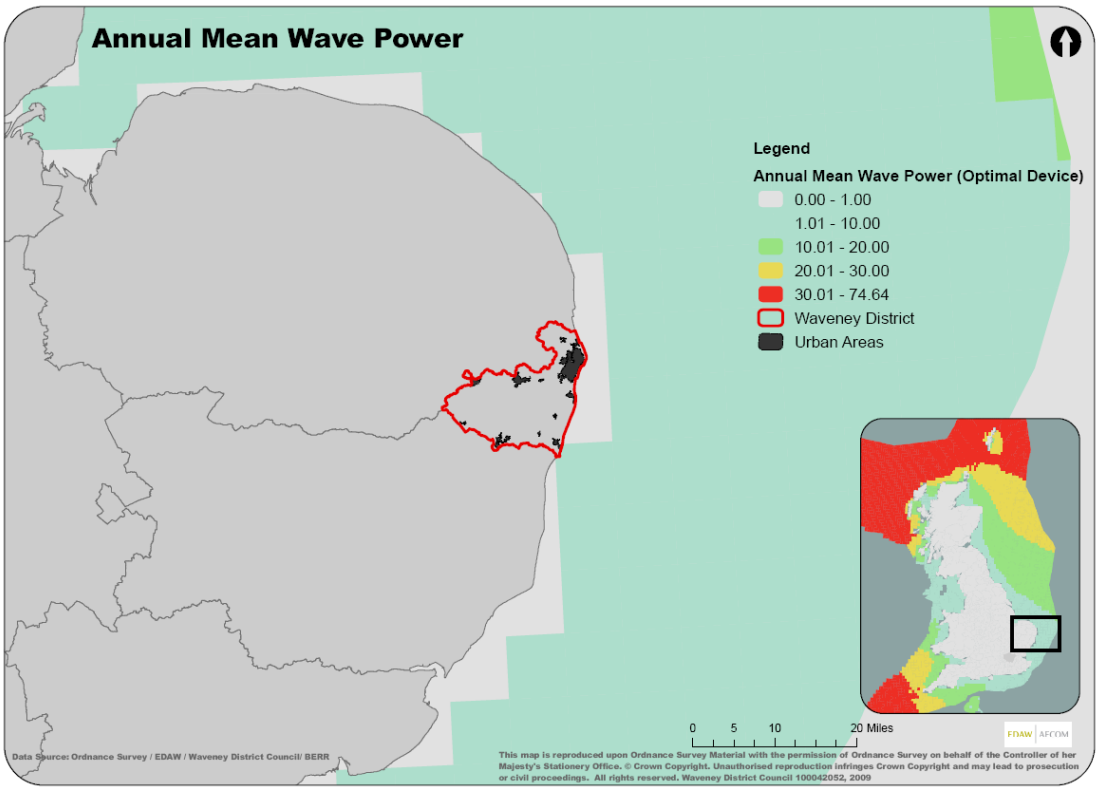
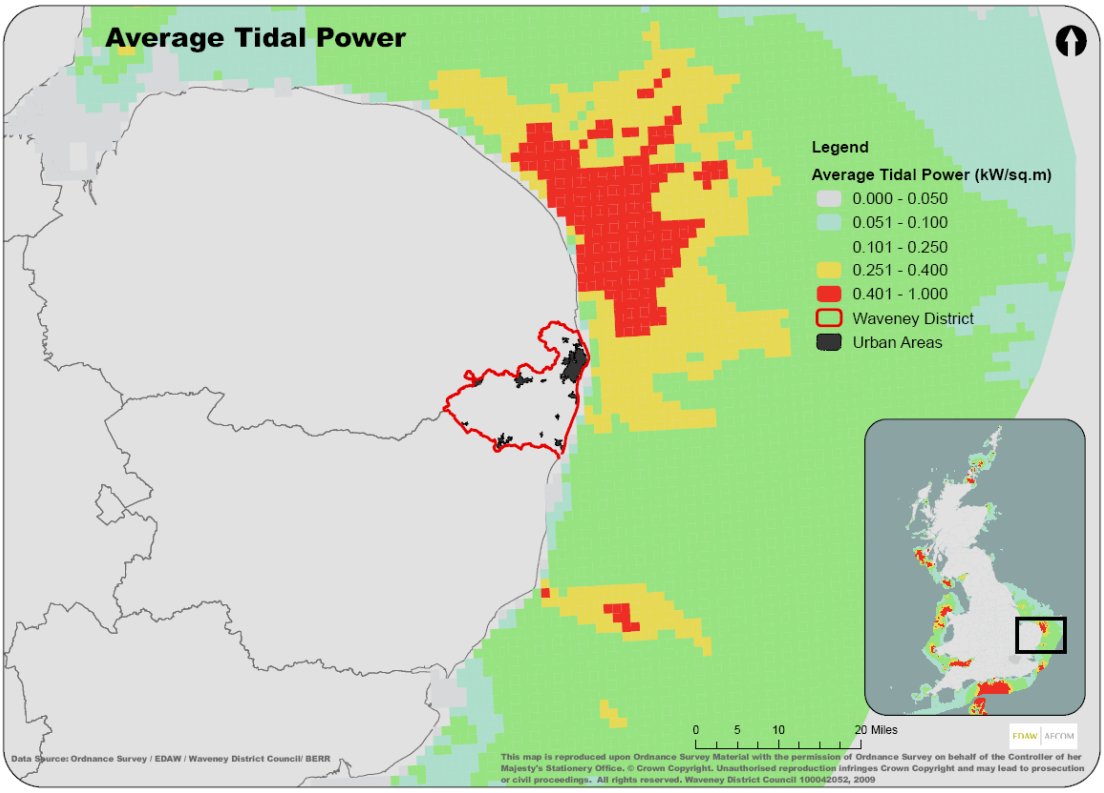


Figure 21: Tidal Energy in the Waveney Area



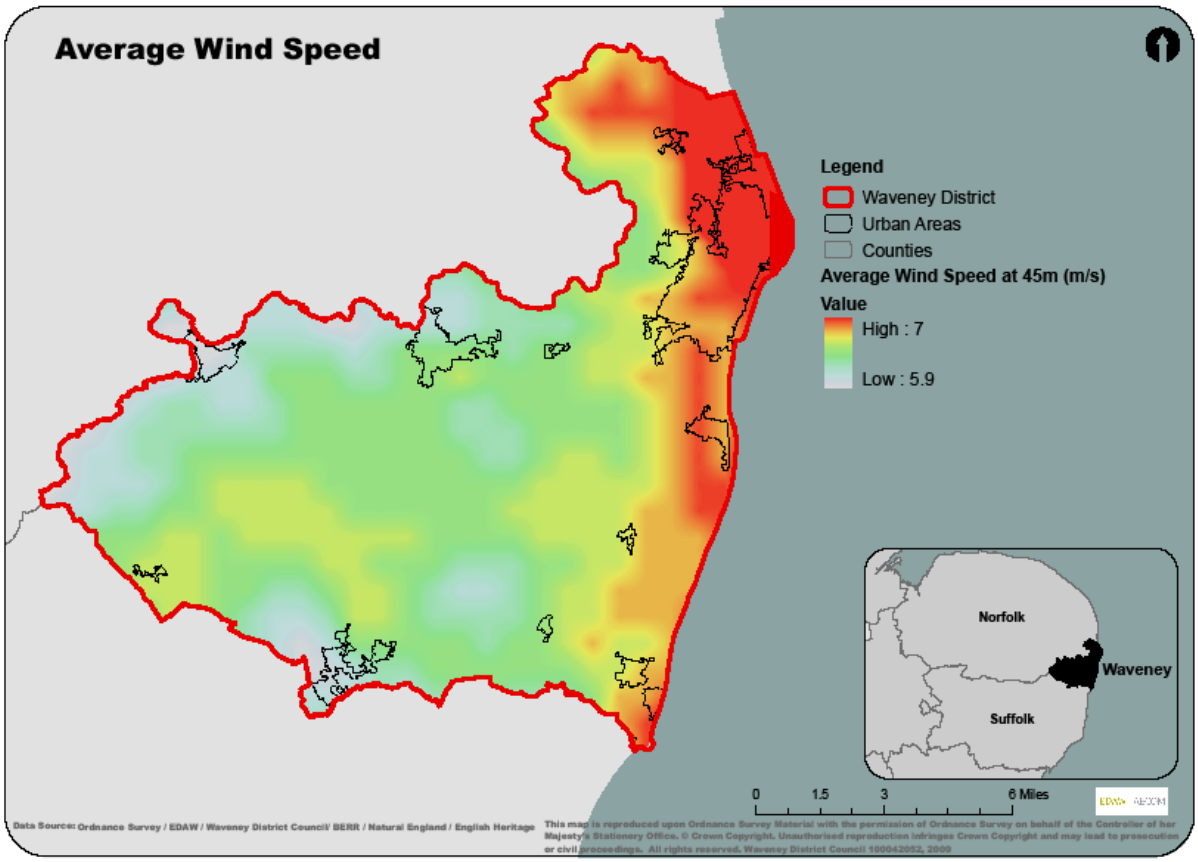
4.4 LARGE-SCALE WIND ENERGY POTENTIAL

Waveney is a relatively flat district situated on the east coast of Suffolk with a large available wind resource. Consequently wind energy offers the greatest opportunity for renewable energy generation in Waveney, an opportunity that has already begun to be realised with the development of the Ness Point turbine and a number of further wind turbines approved or in planning. This study considers the wind energy potential of Waveney District specifically from a desk-top study based on GIS modelling using data available. **It should be noted that this study is not a sufficient evidence base for the actual siting and delivery of wind turbines, but it gives a high level assessment of promising areas to look into further.**

Potential and Constraints to Large-Scale Onshore Wind Development in Waveney

In considering the potential for further development of wind energy in Waveney District it is first important to understand the available wind resource and where the optimum locations for generation might be. Figure 22 below shows the range of wind speeds across the District at 45m above ground level. Generally, the wind speeds are high enough to ensure that wind power is efficient and feasible and thus worth detailed consideration. Wind speeds can be seen to be highest along the coast especially in the areas of Lowestoft and surrounds. The wind power potential estimations in this study consider all areas highlighted in the figure below as having an average wind speed of 6m/s or above at 45m. From industry knowledge, this scale of wind speed is likely to be commercially viable. **Higher wind speeds, above 7m/s at 45m, will be more desirable as available power from the wind is a cube function of wind speed velocity power output, and the potential of these sites should be investigated first.**

Figure 22: Wind speed distribution in Waveney



A process of physical constraint mapping has been used to identify which sites are likely to have potential for large wind turbine location. Through GIS analysis, the following constraints have been included:

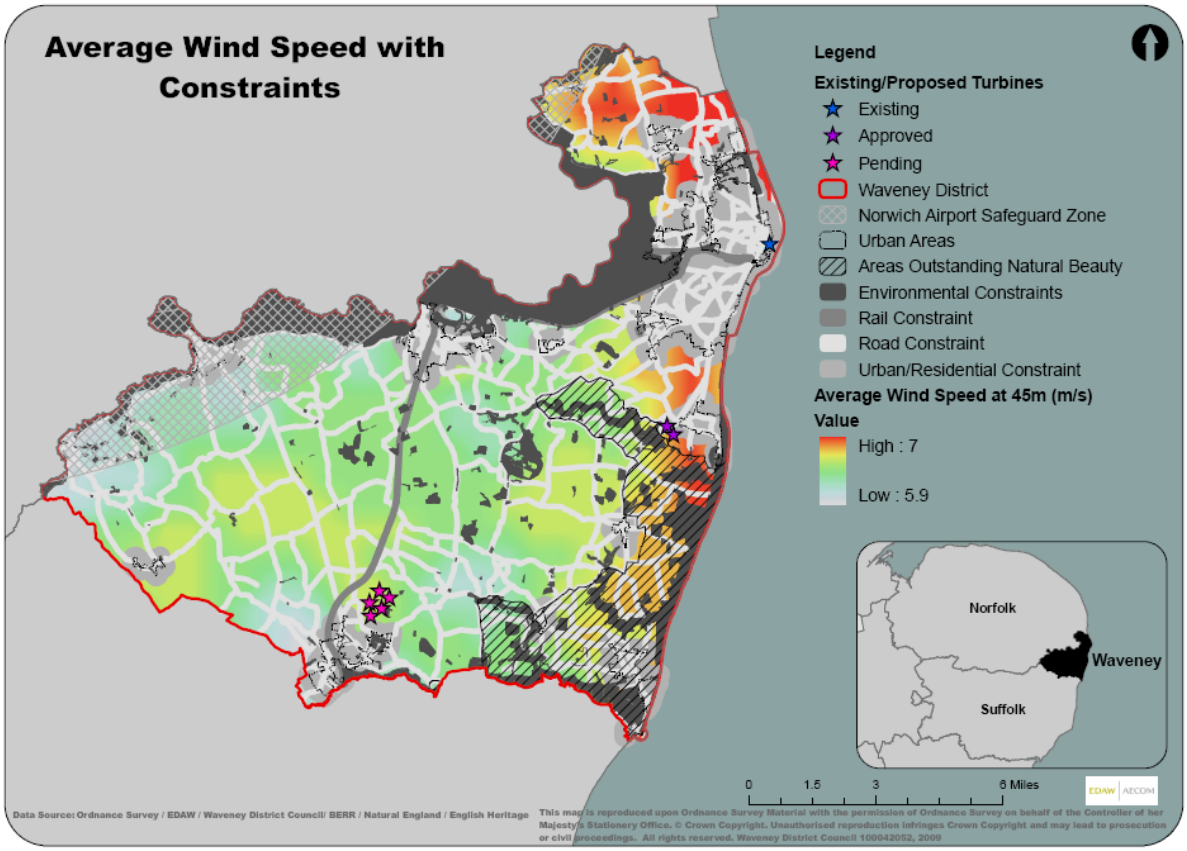
- Safety Buffer of 100m from roads, rail and major overhead transmission lines (approximate for a large turbine to safeguard from toppling);
- 400m noise buffer from urban settlements;
- Exclusion of designated sites of ecological or landscape significance; and
- Exclusion of un-designated woodland and forest.
- Locations of existing turbines
- Airfields - Beccles Airport (licensed for public use).

Further constraints that have been discounted and therefore not mapped include:

- Flood zones
- Airport radar safeguard zones

Constraints are mapped onto the Waveney District in Figure 23 and are discussed further below.

Figure 23: Wind opportunity areas in Waveney



The areas which have potential for further investigation are highlighted in Figure 23. Further detailed feasibility studies would have to consider a number of additional siting constraints in addition to these before any site could be confirmed, including:

- **Local Wind Resource Survey** - Wind speeds of 5.5m/s or above at turbine hub level are needed to operate a large scale wind turbine efficiently. The national dataset for wind speeds at a height of 45m above ground level was used to examine w ind speeds across Waveney District. The energy output of wind turbines is extremely sensitive to the wind speed and therefore a measurement campaign should take place to ascertain exact wind speeds in the area.
- **Noise implications** - Concerns over noise are usually related to perception rather than actual experience. The noise impact of large scale wind turbines in Waveney District will depend on local sources of noise such as from major roads, rail lines, industrial areas etc. Impacts of noise from turbines in the Lowestoft area are not expected to be significant. There are no required distances between wind turbines and residences, but 400m is a rough guideline that is often used and has been adopted within this assessment. Distances between turbines and industrial buildings such as at Ness point are not subject to the same restriction. More detailed studies will be require to map noise and identify areas of least impact for turbine development.
- **Aeronautical and Defence Impacts** – Wind turbines may interfere directly with the operation of aeronautical and defence equipment, for example, when located near aerodrome protected surfaces, runway takeoff points or within military low-flying zones. Radar systems associated with airports and military sites are also a significant issue; for example, radar technology that is unable to differentiate between rotating turbine blades and an approaching aircraft have contributed to the rejection of a number of wind applications in the UK. Consultation will have to be undertaken with MOD and nearby airport authorities to determine particular constraints in the area and possible mitigation strategies, such as software upgrades to the radar technology. It is emphasised that the presence of local airports or military sites is not necessarily a critical constraint when considering the exploitable wind resource, but consultation is advised on a case by case basis.
- **Grid connection and Sub Station Requirements** – Currently grid capacity is seen by local turbine manufacturers as a major barrier to the development of wind in the East of England. A number of

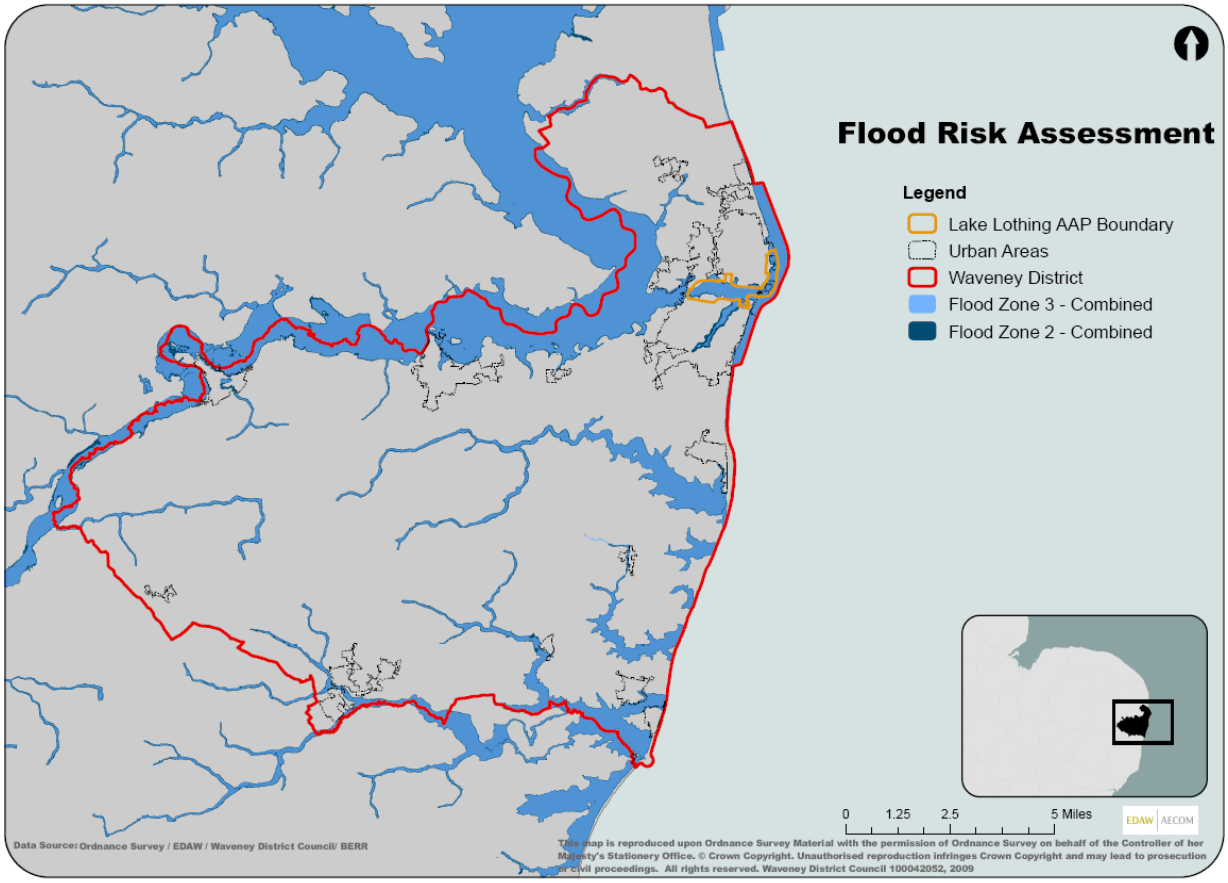
reports from the BWEA, ICE[2] and National Grid identify the need for additional grid reinforcement required for the East of England along with Scotland and Wales. It is possible that delays to the reinforcement of the grid infrastructure to the East of England could lead to delays in the development of the onshore wind resource. It is considered that this may be a constraint up to 2020 but that infrastructure will need to be installed by this date. It will be necessary to carry out a detailed assessment of the opportunities and constraints presented by this existing infrastructure in relation to each turbine site. And this information should feed into any development programme for turbines. Planning applications for sites close to a suitable grid connection should be prioritised.

- **Flood risk -** Development of wind turbines on areas of high flood risk is currently restricted by PPS25. This could potentially impact upon the construction of turbines in the Lowestoft area (although the preference to locate turbines on high points of topography avoids this to some degree). Proposed revisions to PPS25 suggest wind turbines be reclassified as essential infrastructure3. This would largely permit turbine development in flood zones and as such flood zones have not been considered a constraint in the above analysis. Figure 24 highlights the areas of flood risk in Waveney.

[2] http://www.ice.org.uk/downloads/windenergy.pdf

[3] Planning Policy Consultation – Consultation on proposed amendments to Planning Policy Statement 25: Development and flood risk, paragraphs 3.31-3.38
- http://www.communities.gov.uk/documents/planningandbuilding/pdf/consultationfloodrisk.pdf

Figure 24: Waveney Flood Risk



- **Shadow Flicker Modelling** - This can be an issue at certain times of day when the wind is blowing, but effects can usually be mitigated against and has not been specifically considered at this stage. This would need to include driver distraction issues, in partnership with the Highways Agency and Suffolk Highways Services.
- **Telecommunication Impacts** - Wind turbines can interfere with radio signals, television reception and telecommunications systems. This has not been specifically assessed at this stage, but with consultation measures can be put in place to mitigate these effects.
- **Landscape and Visual Impact** - A detailed visual and landscape impact assessment has not been conducted at this stage. The specific sites of the turbines would have to be carefully considered to ensure that they do not detrimentally impact key view corridors and that they are well integrated into the surrounding landscape.
- **Bird Migration** - An important element that will need consideration is the annual migration of birds, particularly due to the presence of important environmental sites in the area. A detailed migration survey should be conducted over a year period where risk is considered significant.
- **Transport Access Assessment per turbine** - Blade section is the longest/largest full section to be delivered on-site. Could be delivered by road, rail or after development delivered by sea to Lowestoft quay. Low access sites would require crane to assist.
- **Additional losses to turbine energy output** - A more detailed analysis would be required into the effect of local topography, clustering effects, hysteresis and local climatic conditions on the energy yield of the turbines.
- **Impact upon land use and land management** - The amount of land consumed by wind turbines is relatively small. Nevertheless, further study should be carried out to ensure that the turbines do not have a negative footprint upon the land.
- **Ground Condition Survey** – The feasibility of the construction of a large turbine would have to be supported by geotechnical investigations.
- **Gas pipelines and other sub terrain analysis** - The current assessment has not assessed the presence of utility pipelines beneath the sites which would have considerable impact on the ability to site turbines.

- **Archaeological Constraints** - Any impacts on archaeology in the area will have to be assessed in more detailed studies.
- **Listed Building and Conservation Area impact** – A detailed impact assessment has not been conducted at this stage and would be required for any further study.

The most favourable sites for further investigations in terms of wind speed are along the coast surrounding Lowestoft. To the south, development is constrained by the Area of Outstanding Natural Beauty. There is also considerable resource availability inland in agricultural areas across the remainder of Waveney. Community involvement in the decision making process and in the financial gain from electricity generation, such as through community investment models, will be important if the resource is to be utilised for the benefit of the District and with community support. Site-specific studies, Environmental Impact Assessments and stakeholder consultation would have to be undertaken to identify which areas are the most favoured based on wind availability and other constraints.

Estimated Scale of Potential in Waveney

Comparatively, Waveney District has a good potential for wind power as identified by the large coverage of 'unconstrained' areas in Figure 22 above. In reality, the suitability of wind power in these locations will depend on context and key issues including land ownership and ability to connect to the grid at low cost. The wind resource potential map, Figure 23, has been analysed assuming that 3MW turbines are distributed across Waveney District to give an indication of the maximum wind energy capacity of the District. Large wind turbines require a buffer distance between them to avoid significant turbulence effects (a distance of 400m is assumed here). In theory, the sites with potential in the District for wind development could accommodate hundreds of 3MW turbines. Obviously, delivery on this scale is not realistic, however, when comparing the number of turbines required to contribute to meet Waveney's proportion of the national targets of approximately 30% of electricity consumption, wind is considered an unconstrained resource – that is the targets will be met significantly in advance of Waveney meeting the maximum theoretical capacity. Table 22 sets demonstrates the wind energy requirements to meet the National targets.

Table 22: Wind energy resource to meet Waveney's proportion of the National target

Onshore wind – year of delivery	MW installed	GWh p.a.	% of District consumption	Suggested target	~ number of 3 MW turbines
2010	9.00	20.50	3%	10%	3
2015	43.00	97.94	16%	17%	15
2020	70	159.43	24%	30%	24
2025	97	220.93	31%	40%	33

The above analysis assumes the delivery of large 3MW turbines, where the height of the hub of the turbine is approximately 85m above ground level. If large turbines were undesirable on some sites, a larger number of smaller turbines could be utilised instead. The efficiency and power output of turbines decreases dramatically with reduction in size and hub height. It is expected that choosing smaller turbines might constrain the achievement of Waveney's proportion of the East of England target. Costs also increase as the number of turbines increases.

Delivery of numerous turbines in Waveney is likely to lead to cumulative visual impacts on the landscape as seen in Denmark or Germany where lines or clusters of turbines are a familiar site in the rural landscape. The sight of large turbines in the landscape is expected to become as familiar in the UK as it has become in the continent. Potential routes to community participation in the fiscal benefits from local turbines should be explored to ensure acceptance. Options might be community owned not for profit companies to deliver turbines and provide a healthy return on investment.

Delivery Considerations for Wind Power in Waveney District

The conversion of potential to delivery requires consideration of a number of factors including:

- **Thorough engagement and investigations** – While there is a great impetus to deliver renewable energy, and wind power has strong potential, engagement with stakeholders and thorough investigation of all effects of wind power development needs to be undertaken to locate feasible sites.

- **Delivery mechanisms** – The most efficient way of providing electricity through large-scale wind is most likely connection to the grid rather than individual developments. 'Private wire' systems can be installed to connect wind turbines directly to developments, generally connecting to the grid holds greater technical and economic viability. The Lowestoft Area Action Plan may offer one exception. A clear funding scheme would have to be put in place to establish which developments can claim allowable solutions from such an investment in electricity generation and how they contribute to that investment.
- **Partnerships with electricity providers** – To finance the capital investment and collect revenue, wind projects would have to partner with an electricity provider.

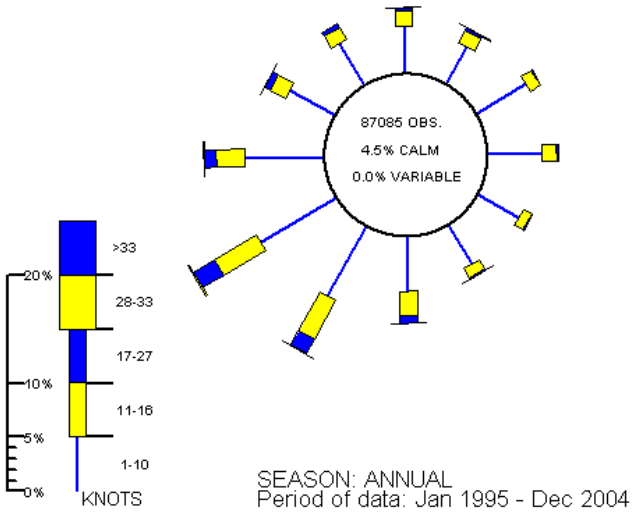
4.5 MEDIUM-SCALE WIND ENERGY POTENTIAL

Smaller wind turbines have a significantly reduced visual impact and, whilst their output is significantly less, medium-scale wind can contribute to Waveney's renewable energy generation capacity.

Recent reports have shown that medium-scale wind is not suitable for urban or suburban locations due to the effects of turbulence at low levels on power output. Agricultural land is characterised by large fields with a relatively uninterrupted wind flow which will minimise the impact of turbulence on power output.

The yearly average wind rose for Coltishall, Norfolk, the closest annual wind rose available from the Met Office to Waveney, indicates that as with the rest of the UK the predominant direction of wind is from the southwest, see Figure 25. Medium-scale turbines that cannot afford to carry out a year-long monitoring exercise examining wind speed and direction should therefore be sited to take maximum advantage of winds originating from this direction.

Figure 25: Met office wind rose for the Coltishall, Norfolk, East of England [4]



Scale of Potential

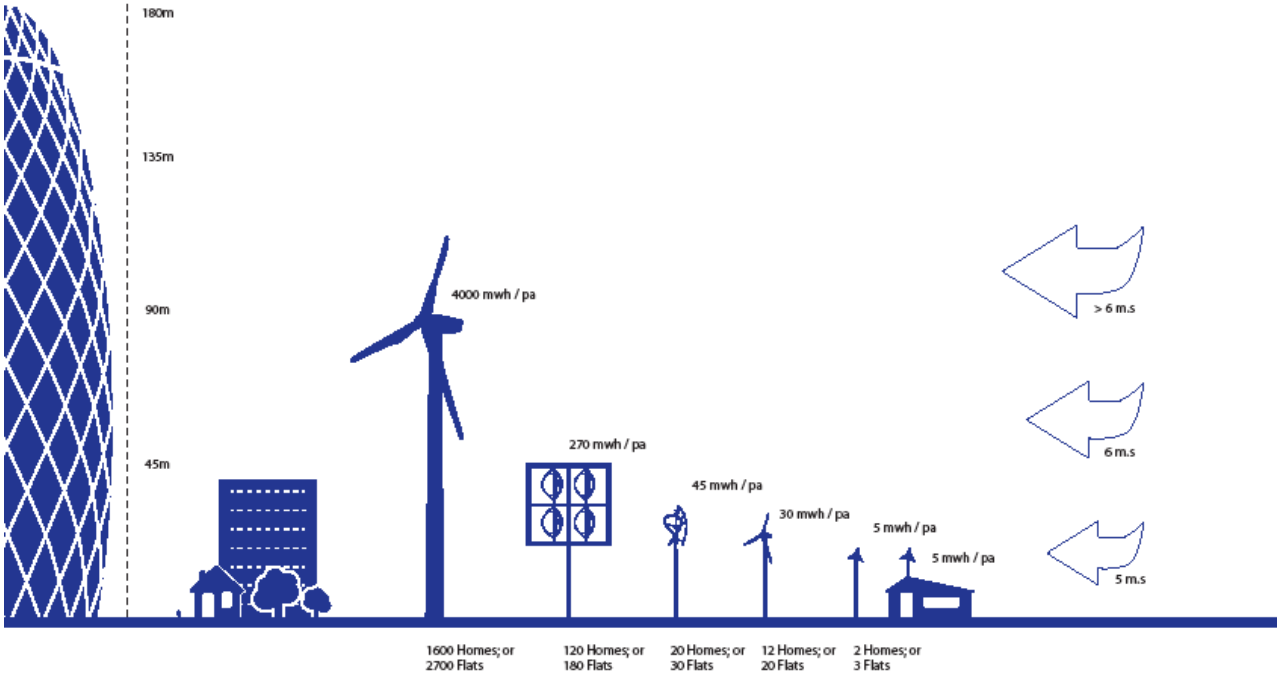
There are 579 farms in Waveney District. In assessing the maximum capacity for Waveney District it is assumed that a maximum resource would equal one turbine per farm (in practise larger farms might feature more than one and some smaller or less optimally located farms none). Assuming one turbine per farm for illustration, 580 6kW turbines would add 3.5MW capacity to Waveney's contribution to the East of England target and generate approximately 8MWh per annum. This contribution is only slightly greater than the electricity generated by 1 large turbine. This demonstrates the efficiencies of scale achieved by large scale wind, as demonstrated in Figure 26. Table 23 shows a more reasonable expectation of the contribution that medium and small wind turbines could deliver.

[4] http://www.metoffice.gov.uk/climate/uk/location/southwestengland/wind.html

Table 23: Contribution from medium wind turbines

Medium wind– year of delivery	MW installed	GWh	% of District consumption	Suggested target	~ number of 6 kW turbines
2010	0	0.00	0.00%	10%	0
2015	0.348	0.79	0.11%	17%	58
2020	0.5211	1.19	0.17%	30%	87
2025	0.6948	1.58	0.23%	40%	116

Figure 26: Difference in output relating to scale of wind turbine



Delivery Considerations for Medium-Scale Wind Power in Waveney District

The conversion of potential to delivery requires consideration of a number of factors including:

- Finance - Farming is generally in decline in the UK due to increasingly limited margins and a potential income source from renewable electricity would be welcome. However, it is expected that a significant barrier to investment in small scale renewables will be the upfront investment. As such, some form of fiscal support such as an 'energy loan' is likely to be required to provide funding. Such a loan could be set up through the use of a revolving door energy fund such as SALIX[5] if it was applicable to renewables. In addition to funding such a service would need to provide information and advice and expect a return in investment from energy saving and ROCs (Renewable Obligation Certificates) receipts.
- Partnerships with turbine providers and installers to leverage efficiencies of scale.

[5] http://www.salixfinance.co.uk/home.html

4.6 BIOMASS ENERGY POTENTIAL

Introduction to Biomass Energy

Biomass is an organically based fuel which can be utilised to produce low carbon energy. As organic material can be grown, it is regarded as a rapidly renewable resource. Utilisation of biomass for energy production does produce carbon emissions, but during the growth and production of organic matter, carbon is also absorbed from the atmosphere, so over its whole lifecycle it is regarded as a low carbon fuel source.

Biomass can contribute to generation of heat through either individual biomass boilers in homes or district heating systems, and it can contribute to the generation of both heat and power through the use of a combined heat and power system (CHP). The use of CHP requires a higher tonnage of biomass fuel to produce the same amount of heat, though it also produces electricity. Some types of biomass can also be used to produce biogas through an anaerobic digestion process.

Some biomass products are waste products from other activities including agriculture and forestry, while biomass can also be specifically produced through growth of bio-crops. There is concern in the industry that excessive specification of biomass technologies on a site-by-site basis will lead to either long-distance import of biomass material or the sacrifice of food-producing arable land to grow dedicated biomass crops. There is a need to take a district-wide approach to biomass sourcing and supply to ensure that biomass is both available for energy use, but that its use is managed and sustainable and that waste biomass sources are utilised first.

The following sections consider various types of biomass available in Waveney District:

- Biomass suitable for combustion in biomass boilers or biomass CHP
    - Waste wood from industrial uses
    - Forestry residues
    - Fuel crops including miscanthus and short rotation coppice such as willow
    - Straw
- Organic waste suitable for utilisation in anaerobic digestion processes
    - Pig and poultry farming sectors
    - Meat and Poultry Processors
    - Brewing
    - Water industry

To avoid stimulating long distance transport of biomass the modelling within this project has tested the local availability of biomass.

4.6.1 BIOMASS SUITABLE FOR DIRECT COMBUSTION

Potential and Constraints for Combustible Biomass

Three sources of biomass have been explored:

1. Waste wood recovery
2. Predicted arisings of low grade wood from improved management of forestry in the Waveney District area. Currently much of forestry in the District is unmanaged and could be brought back into productive use as a biomass fuel resource
3. Potential contribution of dedicated biomass crops such as miscanthus or willow, grown in short rotation on agricultural land in the area. It is unknown how much biomass is currently grown for fuel in the District, though it is assumed to be negligible. The use of Grade 3 agricultural land for cultivation of biomass crops is considered optimal as it does not impact on the most productive areas yet is of sufficient quality for crops to grow. See figure 27 below.

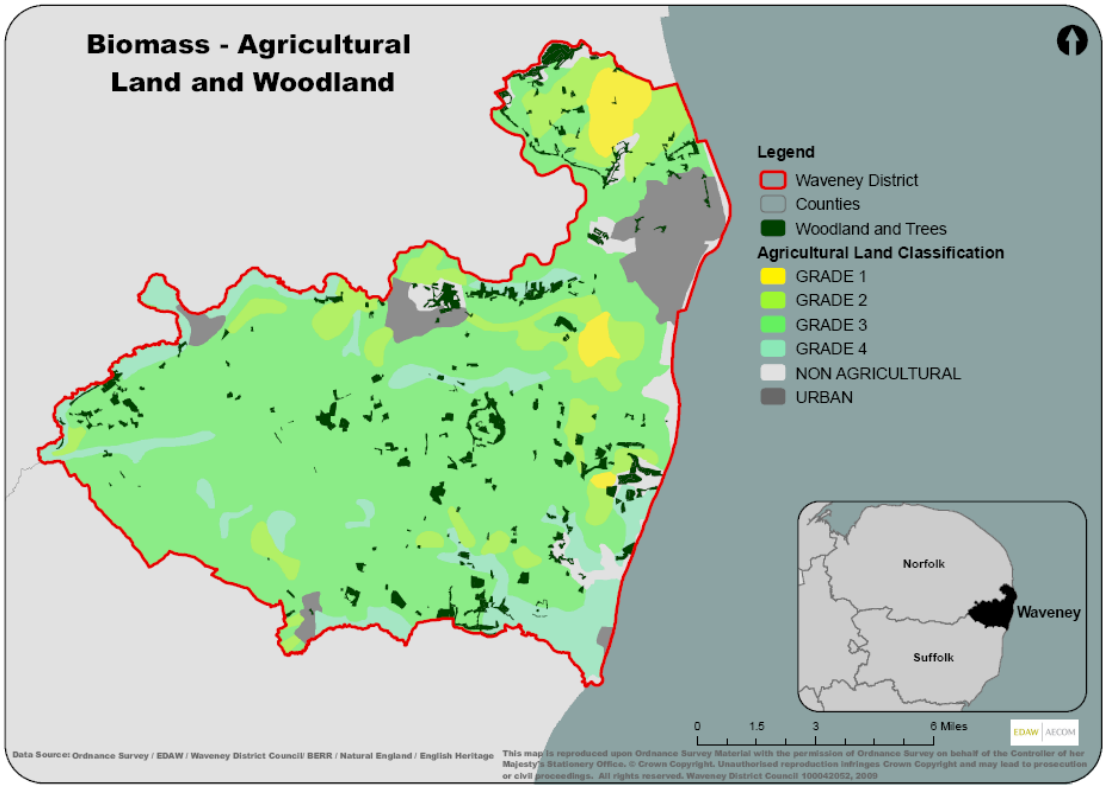
Biomass Available from Waste Wood Streams

Municipal waste streams offer potential for source separated fuels (wood fuels) that can be burnt, in fact currently the most frequent fuel for biomass heat projects in the East of England is waste wood. This is a reflection of the commercially viability of avoiding disposal costs by using waste wood as a heat source. Enviros calculated, in their study for Renewables East (2006), that the waste wood resource in the East of England region is in excess of 1 million t/yr, of which ‘as much as 637,000 t/yr could be secured and supplied from waste streams within the region into bio-energy schemes’.

Translating this to Waveney District's waste stream is difficult with limited district scale information but based on population, approximately 13,000 t/yr might be secured and supplied from waste streams within the District into bio-energy schemes. The most cost effective use for such waste material is through co-location of energy plant and customers. This is expected to be most likely in the Lowestoft area and a detailed review of waste wood arisings is suggested for the main town. The majority of waste wood arisings tend to be contaminated and as such the key to utilisation will be compliance of the plant with the Waste Incineration Directive (WID).

Assuming that by 2020 all of the available resource is secured and supplied to a biomass plant, 13,000 tonnes of waste wood would be expected to generate around 40GWh/yr of heat that could be used to heat homes or to provide pre-heating for high grade industrial uses. It is conservatively assumed that one third of the predicted resource might be secured by 2015 and two thirds by 2020.

Figure 27: Wood-based Biomass potential in Waveney



Biomass Available from Woodland Management

A report prepared for the East of England Development Agency, the Forestry Commission East of England Conservancy and the Countryside Agency East of England Region entitled 'Wood Fuel in the East of England – Prospects and Potential' (2003), provides a picture of wood fuel availability in the East of England region. This report states that the East of England has a huge woodland resource that is currently substantially underutilised.

Renewables East found that the East of England has an annual availability of forestry derived fuel of around 290,000 t/yr (dry basis) of which around 22,000 t/yr (7.7%) is sawdust. Much forestry derived fuel is already secured in medium- to long-term contracts. Opportunities to source further fuel for new bio-energy uses were identified from private managed forestry and sawmills. Sawdust lends itself to the production of higher value (c. £100 –150/t) wood pellet or briquette fuels to supply smaller scale boiler plant where space for plant and storage is constrained.

GIS modelling has identified that there is limited woodland in Waveney amounting to just under 1900 hectares. When asked the forestry commission stated that there was some difficulty is providing estimates of available wood resource at a district level. To provide an estimate for Waveney this report scales data at a county and regional level. Of the 1900 hectares it is estimated that around half, 950 hectares, are currently unmanaged. In assessing the maximum resource potential it is assumed that 100% of the woodland could be brought back into

management or, if already being managed the useful low grade wood from these woodlands could be diverted for use in Waveney District minimising transport costs and maximising revenue to woodlands owners.

If all the biomass from forestry management was used in a Biomass CHP unit in Lowestoft AAP supplying commercial and domestic demands, then the total forestry resource could provide approximately 16 GWh of heat and 11.7 GWh of electricity, enough to supply around 4000 homes with heat and 3100 homes with electricity each year.

Alternatively all biomass could be used to fuel communal urban biomass boilers and smaller individual rural boilers replacing carbon intensive oil and electric heating in the District. Use of the biomass for boilers would generate around 33.5 GWh of heat per year enough heat to supply 8350 homes annual heat demands from renewable sources.

A more likely outcome is that a proportion of fuel will be used in a biomass CHP unit to supply the AAP area and the remainder fuel small scale rural biomass boilers. A wood processing station could be introduced within the AAP area to process and store biomass locally for use.

There is already a drive in Suffolk to bring under-managed woodlands back into active management in a project called the Anglian Woodland Project. Lessons can be learnt from this scheme in increasing the utilisation of neglected woodlands and finding new markets for low-grade woodland material.

Biomass Available from Cereal Straws

Defra list 11,348 hectares of agricultural land under cultivation for cereal crops in Waveney District, three quarters of which (8460 hectares) is wheat. Using a methodology consistent with that used in the East of England Biomass Foundation Study (Enviros, 2006) this area of cultivated crops is predicted to result in 54,745 tonnes of straw per year being traded and potentially available for combustion.

55,000 tonnes of straw is estimated to potentially generate around 235GWh of heat per annum approximately 25% of Waveney Districts total predicted 2025 demand.

If all of this straw was bought for combustion in local Biomass CHP around 70GWh electricity and 172GWh heat might be supplied, this is equivalent to 9% of the predicted entire electrical demand and 17% of the entire heat demand of Waveney in 2025, existing and planned).

Livestock rearing is a significant consumer of locally generated straw and it is not expected that 100% of straw would be available for combustion. A small CHP plant might require around 100,000 tonnes of straw.

The use of straw for combustion for the generation of electricity with or without the use of heat will be dependent on the cost and availability of straw. The price of straw has been steadily rising over recent years and currently ranges from £38 to £50 per tonne depending on time of year (range was £27-£38 per tonne in 2005). A high price of straw will limit the viability as a combustion fuel. The scale of straw combustion to be economic is greater than the production capacity of Waveney District as such if a straw burning power station were to be built straw would need to be imported from surrounding eastern districts outside the existing catchment of Ely Power station. To be able to utilise heat from such a power station would require its location near to significant heat consumers located in Waveney's market towns or at Lowestoft.

Biomass Potential from Biofuel Crops – Short Rotation Coppice and Miscanthus

The majority of agricultural land in Waveney is Grade 2 to Grade 3. The ideal land for cultivation of bio-crops is grade 3 and 4 (though lower yields are expected on grade 4). This is due to the need to preserve grade 1 and grade 2 land for sole use for agricultural crops. Due to the large amounts of Grade 3 land in Waveney, the development of a biofuel market and supply chain is considered a significant opportunity. Opportunities will have to be balanced with market demands and overall management of competition with food crops. What Grade 4 land there is in the District is predominantly located in AONB. It is not expected that industrial biomass cultivation would be suitable in the Area of Outstanding Natural Beauty.

A DEFRA study[6] into the potential for growing miscanthus in the East of England considered that the entirety of Waveney District could potentially grow the crop. This reflects the good agricultural quality of the land. As such the resource could be considered unconstrained (if, as suggested in the EERA report, 25% of all land was diverted to bio-crops, 149GWh electricity and 203GWh heat might be supplied from Biomass CHP, this is equivalent to 21% of the predicted entire demand of Waveney in 2025, existing and planned). It is not suggested that Waveney convert such a significant portion of its agricultural land to Biomass but this estimation offers an indication of the availability of the resource and the energy demand of the District.

Diverting significant areas of good quality arable land from food cultivation to industrial growth for fuels could prove counter-productive to wider aims of sustainability and local self sufficiency. Nonetheless, as part of a wider strategy for regional and District energy self sufficiency, sourcing a proportion of fuel from woody bio-fuels offers the potential to reduce the carbon emissions in Waveney District. Key opportunities are offered by Lowestoft and other areas of high density heat demand that offer sufficient demand to make a Biomass CHP system viable.

It is expected that energy crops would be developed later than the utilisation of woodland trimmings and waste wood. This will be driven by the market price of energy crops. Currently the market price of miscanthus is comparable to that of straw so it is not yet considered economically viable in the East of England. It is expected that increased competition for limited fossil fuel resources and a rising cost of carbon will drive an increase in the demand for biofuels. It is none the less expected the predominant use of land in Waveney will be agricultural. In order to achieve a target of 12% renewable heat in the District, Waveney District should firstly seek to harness waste wood and forestry arisings, along with straw before supplementing supply with local bio-crops. Where local supply-chains are not in place, fuel can be imported from elsewhere, but this is not desirable from a carbon perspective.

Considering there is currently no market for biomass crops in Waveney, the challenge of achieving this target should not be underestimated. It is assumed that 10% of grade 3 land could be utilised for biomass by 2015, 20% by 2020. Biofuels such as miscanthus are more suited to larger scale combustion and electricity generation than for small scale combustion in domestic individual and communal boilers.

Table 24: Potential energy from bio-crops

Projection	Total % of Grade 3 land utilised	GWh heat CHP	GWh elec CHP	% District consumption	~No homes heat	~No homes elec
2010	0%	0.00	0.00	0	0	-
2015	5%	29.34	21.52	2.86%	7295	5,761
2020	10%	58.68	43.04	5.71%	14589	11,523

Delivery Considerations for Wood-Based Biomass Energy in Waveney

It is suggested that any Biomass CHP plant in Waveney be specified to be able to operate on a range of fuels stocks including straw, waste wood, wood chip and fuel crops to enable flexibility in the sourcing and market for fuel uses. It is likely that higher value fuels such as chip from forestry residues or short rotation coppice and wood pellets from sawdust will tend to supply domestic and smaller industrial consumers who have lower heat demands, less flexibility in boiler choice and feedstock, and with less space for fuel storage.

The conversion of potential to delivery requires consideration of a number of factors including:

- **Establishment of a supply chain** – While there is already biomass resource available in Waveney, there is no supply chain set up to collect, process and distribute that fuel. The Council should work with partners to enable the set up of a local supply chain.
- **Management of local forests** – Ownership and status of local forest varies. A management plan and coordinated programme will need to be in place in partnership with the Forestry Commission and key stakeholders to ensure forests are appropriately managed and the biomass yield is captured for local use. This initially might be best undertaken on a regional scale.

[6] http://www.DEFRA.gov.uk/farm/crops/industrial/energy/opportunities/pdf/yield/miscanthus/eastern_miscanthus_yield_250.pdf

- **Using the AAP opportunity** – A wood station could be established within the AAP area as part of the redevelopment plans for the area. The station could collect local wood and bio-crops for processing, and act as a local centre for the distribution of biomass fuel.

4.6.2 BIOMASS SUITABLE FOR ANAEROBIC DIGESTION

Potential and Constraints for Anaerobic Digestion

There are a variety of waste streams available in Waveney which could be utilised for energy production using Anaerobic Digestion (AD). Anaerobic Digestion refers to the decomposition of putriscible waste such as food waste, animal slurries and potentially a proportion of garden waste in anaerobic (no oxygen) conditions. AD produces a biogas made up of around 60 per cent methane and 40 per cent carbon dioxide (CO_2). This can be burnt to generate heat or electricity. The biogas produced by the AD process can be used to generate electricity in a gas engine. Note that the AD process itself has an electricity requirement of between 10 - 20% of the power generated. There is currently one AD plant in the East of England in Bedfordshire and none in Waveney.

Although AD can be used to process other garden wastes, too much garden waste in the mix reduces the yield of biogas, as a substance called lignin which is found in woody materials does not break down without oxygen. In such cases where the feedstock contains too much wood fibre and AD cannot break it down enough for it to be used as a soil conditioner, it can also be composted.

Potential for Utilisation of Household Food Waste

In association with WRAP[7], Waveney has been trialling separate food collection waste in 4800 properties in Lowestoft and 800 properties in Halesworth. Separated food waste was transported to an in-vessel composting plant in Parham, Suffolk where it is composted for agricultural use. The results of this trial were to achieve approximately 1.3 kg per household served per week equivalent to approximately 7300kg food waste per week or 380 tonnes p.a.

An AD plant in south Shropshire processes 5,000 tonnes per year of source-separated household bio waste. The initial feedstock of combined kitchen and garden waste, but this was found to have too low a putriscible content and too much contamination. The plant is now supplied with food waste from a similar kitchen waste collection service to that run by Waveney. Some of the electricity generated in the plant is used to run an electric collection vehicle reducing the emissions associated with the collection of the waste.

There are around 40,000 households in Waveney District which theoretically could result in the collection of over 40 tonnes of waste a week or 2000 tonnes per year. In practice, it is expected that only Lowestoft and the Waveney's market towns will have sufficient population to justify separate collection of kitchen waste.

If all 2000 tonnes per annum of kitchen waste were collected for AD treatment potentially 0.58GWh of electricity and 0.63GWh of heat might be generated. For a commercially viable plant more than double this weight of kitchen waste would need to be collected. The distances over which this waste may need to travel could make the location of an AD facility in Waveney District uneconomic. It is not predicted that AD will be viable for the treatment of kitchen waste in a standalone plant in Waveney over the period of projection unless food waste is collected across District boundaries or if food waste is mixed with industrial food arisings. Potentially kitchen waste might be sourced from Great Yarmouth but it is unlikely to be sufficient to make an AD plant viable on food waste alone.

Potential for Utilisation of Agricultural Waste – Slurry and Litter

Waveney is a predominantly rural district, with 27,000 hectares[8] of farmed land, supporting a wide range of agricultural sectors. Each sector produces some form of primary production waste; organic material which can be used as a fuel for anaerobic digestion or conventional combustion/CHP depending on its characteristics. Arable farming is the largest land use sector producing primarily cereals. The District also supports a significant population of livestock, particularly pigs, chickens and some cattle. Horticulture and other smaller agricultural

[7] The Waste and Resources Action Programme http://www.wrap.org.uk/
[8] Defra - June 2007 Agricultural and Horticultural Survey - England

sectors also operate in Waveney and produce useful organic wastes such as slurries. The generally free range nature of these farms, the small size of most holdings, and their dispersed nature will make the establishment of supply chains more difficult. For these reasons the collection of agricultural slurries are not considered further in this quantitative analysis. The East of England Biomass Foundation Study (2005) identified large holdings and farmer co-operatives as quick wins in sourcing suitable slurry wastes. It is recommended further work is carried out to identify and contact suitable useful potential agricultural waste suppliers.

Poultry litter is already exploited as a fuel, with the major facilities already supplying their waste to existing power plants at Thetford (41.5MW) and Eye (14.3MW). The size of the poultry industry across the East of England region is declining; further exploitation of this resource is not expected.

Potential for Utilisation of Food and Drink Processing Waste

Waveney and the East of England as a whole are dominant in the UK food processing sector. While the scale has declined, it remains one of the key sectors of local employment. Approximately one fifth of the birds slaughtered in the UK every year are killed in the East of England. Waveney hosts large processing plants including Bernard Matthews at Holton (160,000 turkeys) and Busted Chicken in Bungay. These substantial waste streams which could in theory be diverted to AD.

The Regional Biowastes Management Study (2008), written by Eunomia, for EERA lists three key constraints which affect the availability of biowastes from poultry slaughtering. These are summarised as:

- 'Animal By-Products Regulation (ABPR) requirements for specific treatments to manage Category 2 animal-by products;
- The current duopoly enjoyed by rendering companies, which effectively control the treatment market; and
- A lack of on-site source separation of Category 2 ABPR materials from Category 3 by-products.'

High bone content of arisings from some sub-sectors, especially 'cutting' leads to only 50% of total arisings considered to be suitable for at AD facilities.

There is also the Adnams Brewery in Southwold, which may create a waste stream usable in AD. The Regional Biowastes Management Study identifies several key points relating to the potential to use biowaste from the brewing process:

- 'The main biowaste from the malt production process commands a market value and is usually sold to animal feed agents;
- The biggest quantity of biowaste from brewing comes in the form of spent grain. Again, this material is generally purchased by feed merchants;
- Hops and other brewery wastes are also sold as animal feed or can be directly applied to land without prior treatment.'

This study agrees with the biowastes management study in that very little of the tonnage of biowastes generated from brewing operations is likely to be available for processing at biological treatment facilities.

The geographically distribution of sources of biowastes may limit the development of the resource. Biowastes should be treated as close to their source as possible. Likely development opportunities might be on the outskirts of Lowestoft where industrial wastes, such as from poultry slaughtering, are generated in higher concentrations. Hence, particularly around the northwest of the District the development of a significant AD facility could be viable and should be investigated. A detailed assessment of the environmental benefit of such a plant will be necessary balancing transport impacts with energy and environmental benefits.

Potential for Utilisation of Water Industry Sludge

The water industry produces both wet and dry sludge in large quantities which can be diverted for energy recovery. The majority of biomass electricity projects in the UK are sewage gas projects that are less than 2.2 MW in electrical capacity[9]. Anaerobic digestion produces a sewage gas which contains methane and can be

[9] East of England Biomass Foundation Study report, Renewables East, November 2005

used to fuel gas CHP. Anglian Water has the generating capacity to exploit part of this waste stream with plans to increase the level of sewage gas use.

Delivery Considerations for Anaerobic Digestion

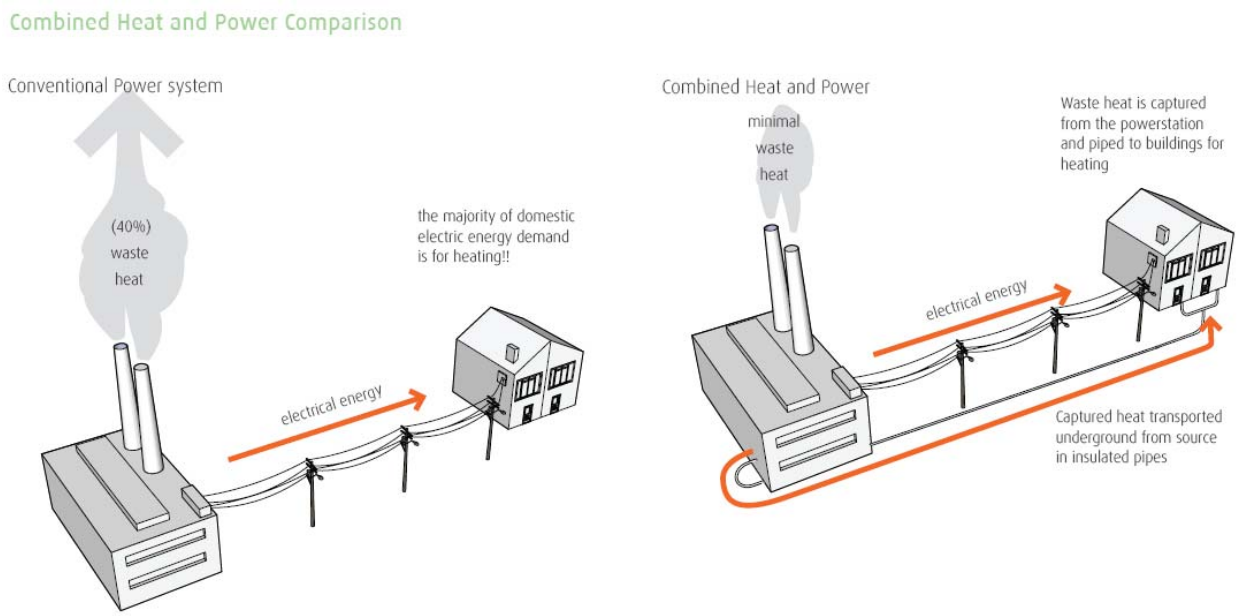
Across the District, there are a range of potential sources of putriscible waste available which could be utilised by Anaerobic Digestion processes. The quantity of material available means that AD is viable in the District, and that further resource supply chains may be able to be developed in partnership with surrounding districts. The establishment of a supply chain is key to delivery. This supply chain would need to both gather suitable wastes, and achieve a mix of wastes which is suitable for combination in AD. The scale of potential of household food waste alone in Waveney District is not enough to justify an AD plant, but the potential from food processing wastes and agricultural wastes is potentially significant if supply chains are put in place. Waveney District Council should look for opportunities to support the development of such supply chains and proposals for AD in the region, and work with local industries and agriculture stakeholders to pool biomass resources for use in central AD plants.

4.7 COMBINED HEAT AND POWER

Potential and Constraints of CHP

Combined Heat and Power provides a much more efficient way of generating and distributing energy as it makes use of the heat usually wasted in energy production and because it is located close to the development the losses in transmission are reduced. Typically, a standard CHP achieves a 35% reduction in primary energy usage compared with conventional power stations and heat only boilers. However, CHP can also be run using biomass/biogas to provide a low carbon solution, with reductions in emission nearing 100%. Figure 28 shows CHP compared with traditional energy generation.

Figure 28: CHP comparison



Scale of Potential

Figure 29 and Figure 30 highlight areas which have a heat demand intensity of greater than 3MW/km^2 (or 26kwh/m^2). These areas are expected to be commercially viable for the installation of a district heating or combined heat and power system based on professional experience. There is already significant heat demand clusters in Lowestoft where a heat network could be introduced (a system of insulated piping carrying hot water to feed the heating demands of those on the network).

Figure 29: Current distribution of heat density in Waveney

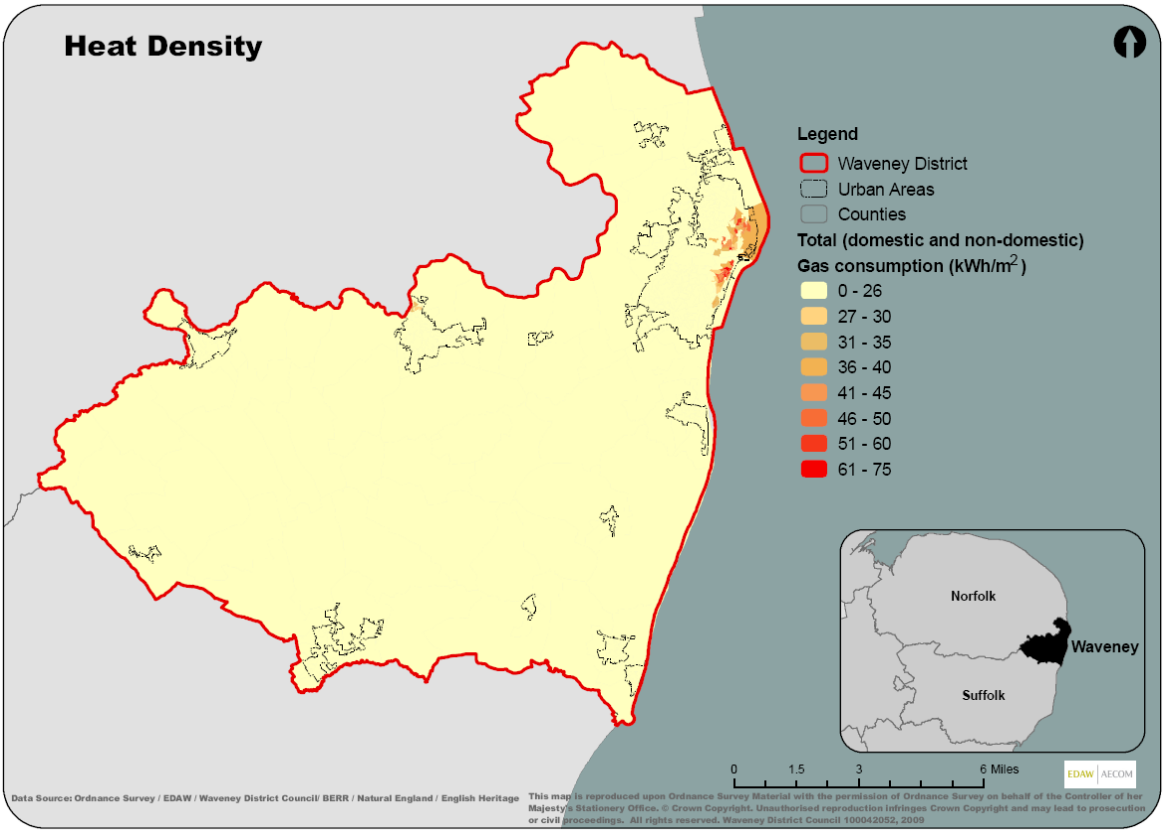
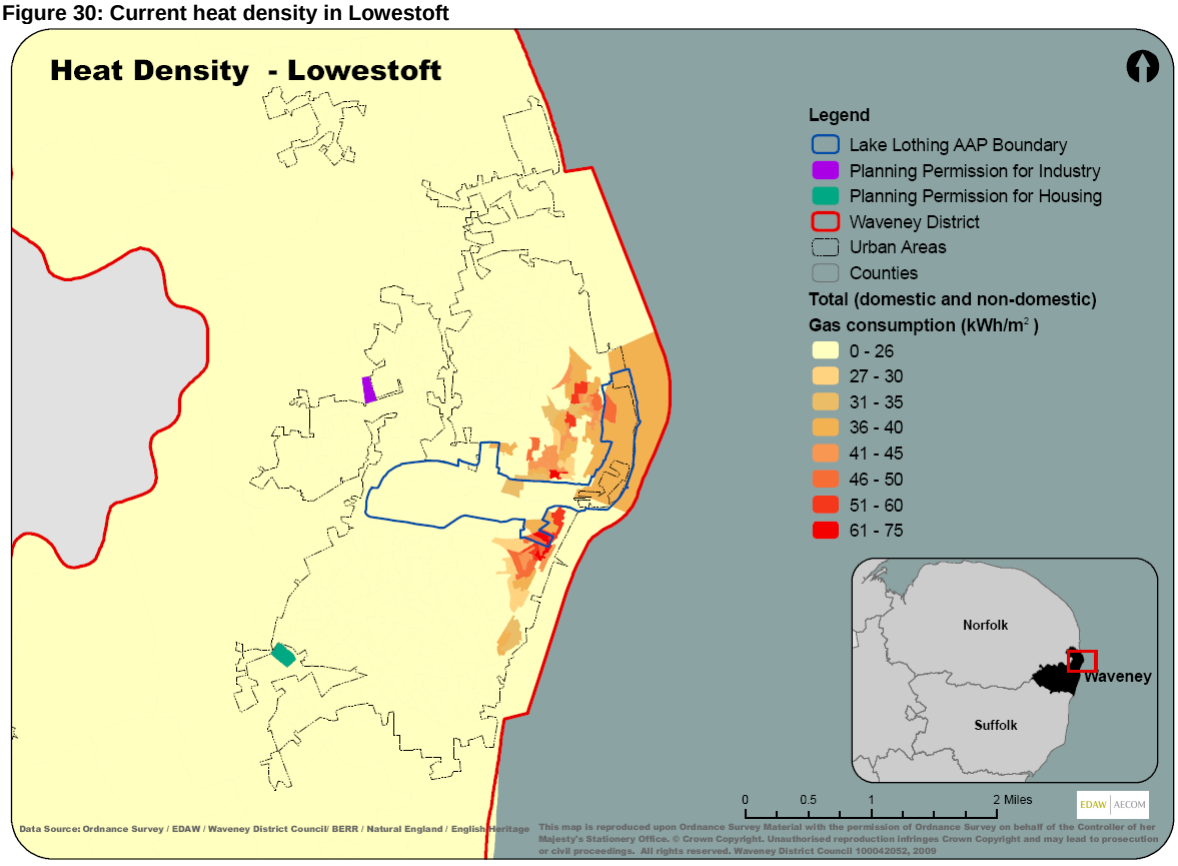


Figure 30: Current heat density in Lowestoft



The heat network could either be connected to a district heating system or a combined heat and power system (which distribute waste heat from the electricity generation process). These systems could utilise gas or biomass as a supply fuel, and the distribution of heat in such a fashion brings great efficiencies as heat demands are balanced across an area. It should be noted that while the introduction of CHP is strongly encouraged at a

European and National level, and local authorities play a key role in delivery, CHP will only count towards renewable energy targets where it is fuelled by a renewable or low carbon source such as biomass or biogas. Technology surrounding biomass powered CHP is still developing in the UK but is expected to be perfected over the coming years. Hence, depending on delivery conditions it may be more suitable to implement gas-fired CHP in the interim and convert the fuel source to biomass or biogas as the technology and supply chain develops.

Table 25 shows the expected energy generation and carbon dioxide savings associated with installation of gas-fired CHP in Waveney District to 15% of the viable areas (5% uptake each phase, beginning phase 2). Carbon reductions could be further increased through a larger take up of heat networks, or through the use of biomass fuel in the place of gas.

Table 25: Effect of introduction of gas CHP in existing areas

	2007-2011	2011-2016	2016-2021	2021-2025
Electricity from CHP introduction in existing areas (kWh)	0	10,731,467	21,462,933	32,194,400
Heat from CHP introduction in existing areas (kWh)	0	35,771,556	71,543,111	107,314,667
Total carbon saving over conventional supply (tonnes CO_2)	0	1,720	3,440	5,161

Delivery Considerations

CHP linked to a neighbourhood via a district heating arrangement could meet the home's annual heating, hot water and most, if not all, of their electrical requirements. Higher density housing, typically at least 50 dwellings per hectare, is more commercially viable to reduce district heating infrastructure costs as cost is related to the length of the pipe, although CHP is technically viable at most densities. CHP also works best in mixed use developments as they operate most efficiently at near maximum capacity. As different users have different energy use patterns (residential more in the morning and evening whilst offices through the middle of the day) mixed use development allows energy requirements to be balanced.

The size of the facility will be somewhat dependent on the number of homes it is to serve. For a facility to serve 1500 homes, you would probably require a facility of 500m^2. For biomass powered you would need a fuel storage area as well. The majority of the building could be 4m high, but a section rising to 7-9m would also be needed to house the heat store and there would also be a flue which will need to be a few metres higher than surrounding development.

As CHP works best in higher density areas, siting facilities can become a challenge. With sensitive and creative urban design, there is however, limited reason as to why they could not be able to be integrated into a townscape. Figure 31 below highlights some potential options for urban design of CHP.

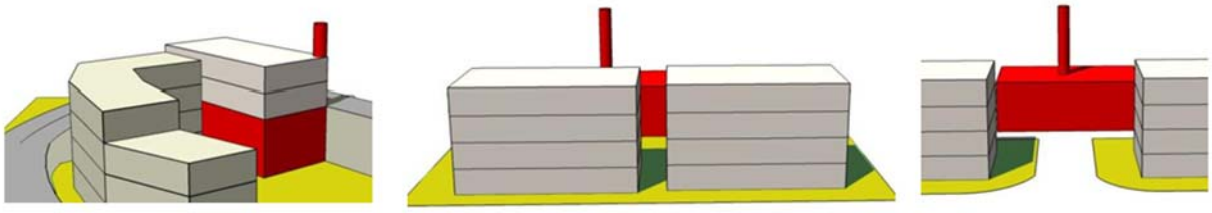


Figure 31: Design options for siting CHP

4.8 MICRO-GENERATION POTENTIAL

The term micro-generation is used to describe small scale technologies (typically less than 50 kW electric and 100 kW thermal). These technologies are usually based in a building or on a small site, providing energy to one or more buildings. Micro-generation technologies include:

- Heat pumps
- Micro CHP
- Photovoltaics (PV)
- Solar thermal
- Small and micro-wind

The authors of the East of England resource assessment for EERA took the view that the contribution from micro-renewables should be included in the projections for reductions in regional (or District for Waveney) energy consumption.

Scale of Potential

A study for BERR[10] modelled the UK market for micro-generation technologies out to 2050, by simulating the UK consumer base and technologies for both the domestic and non domestic sectors. A number of assumptions are made based on regional surveys of consumer's attitudes to technologies and costs, and their likelihood of purchasing a technology depending on their current house / building type, the current energy price environment, and their "willingness to pay". Using this work and assumptions for a 'medium level' uptake of micro-generation in Waveney, the following installation of micro-generation is expected.

Table 26 sets out the total potential from a mix of micro-generation sources, although solar energy presents the greatest micro-generation energy resource in Waveney and is discussed in more detail below.

Table 26: Effect of introduction of substantial micro-generation in existing buildings

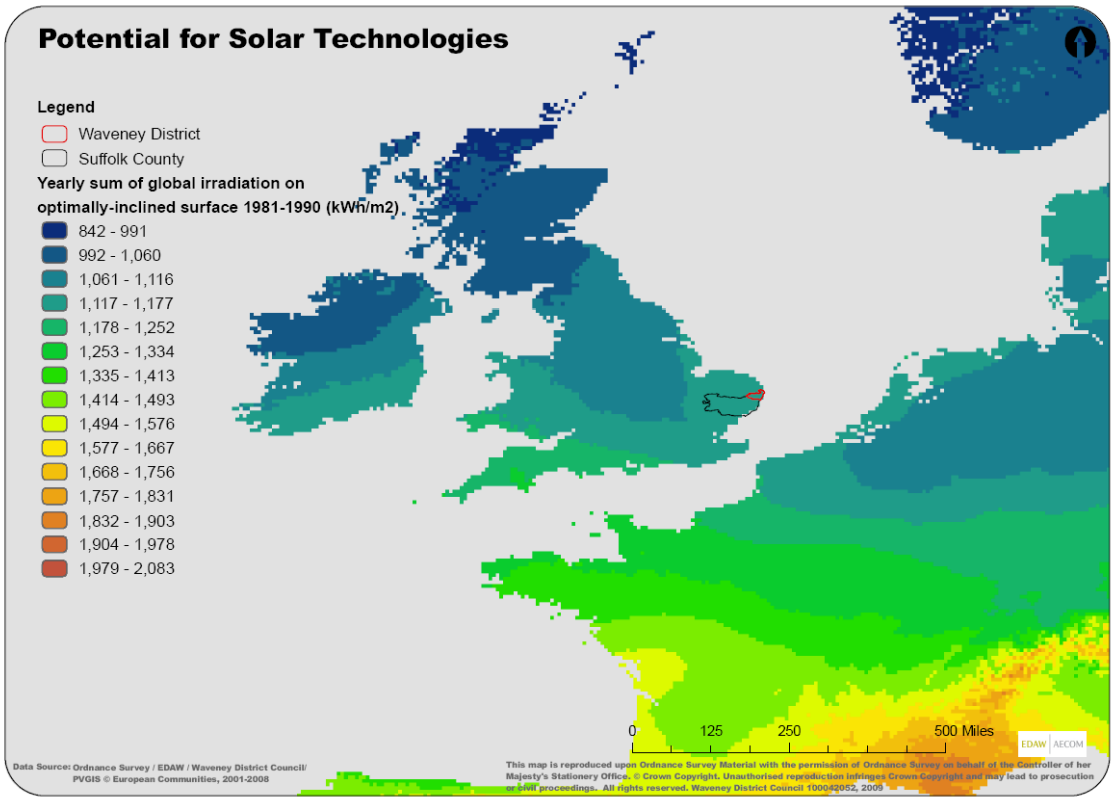
	2007-2011	2011-2016	2016-2021	2021-2025
Micro-generation Electricity Production (kWh)	180,158	468,423	1,617,902	4,482,511
Micro-generation Heat Production (kWh)	368,022	908,559	3,048,081	8,823,311
Carbon Reduction due to Micro-generation in Existing Buildings (tonnes)	45	112	431	1,407

Potential and Constraints for Solar Energy

Compared with the rest of the UK, the solar potential in Waveney is good. The East of England receives the some of the most sunshine of any part of the UK. However, on a global scale, solar technologies do not perform at high efficiencies in the UK as compared to say Colorado, nonetheless, parts of the East of England receive as much or more solar irradiation as Germany which has a large installed capacity of solar panels. Figure 32 shows the solar irradiation in the UK.

[10] The Growth Potential of Micro-generation in England, Wales, and Scotland. Element Energy 2007. BERR

Figure 32: Potential for solar energy



There are two main types of solar technology that are generally delivered alongside built development. Photovoltaic panels can be mounted on structures or used in stand-alone installations. Solar thermal panels are commonly used to directly heat hot water in homes, but can also be used to assist heating.

Photovoltaics are currently expensive in comparison to other renewable energy options, but they are one of the few options available for renewable electricity production and are often one of the only on-site options to assist in carbon reduction associated with electricity use. Solar thermal panels are more space and cost effective and are well utilised technology for heating hot water.

Scale of Potential of Solar Energy

Waveney is home to over 40,000 households[11], with nearly 5000 additional home being delivered to 2025. Assuming 2kWp or 12-16m² of panels per home was installed on half of all homes – the remainder being over shaded or sub-optimally orientated 35GWh of renewable electricity could be generated each year (equivalent to 5 3MW turbines), or around 7% of the electricity consumption of Waveney District.

Table 27: Energy potential from PV

Projection	No Homes 2 kWp installation	No industrial 0.5 MW installations	KWp	GWh elec	% District consumption	~No homes elec
2010	0	0.00	0	0	0.00%	0
2015	1500	4.00	5500	4.4	0.63%	1180
2020	2000	6.00	8000	6.4	0.91%	1930

Delivery Considerations for Micro-Generation in Waveney

Solar technologies are widely available and will have a role to play in energy generation, especially on low density development with a substantial amount of exposed roof space. It is expected that the installation of solar thermal panels on the roof of homes and businesses will largely be driven by Building Regulations To ensure that

[11] Waveney Household composition 2001 census

solar technologies are effective, south facing roof space should be favoured in building design and masterplanning (through street orientation).

There is the potential for Waveney to incentivise swifter uptake of renewable electricity in the District through a business information awareness campaign and through working with Renewables East to identify commercial/industrial businesses with larger areas of south facing roof who might either be interested in investing in PV or who would be interested in linking up with an investment body.

Historically, as with the rest of the UK, the take up of solar technologies has been limited by cost. Whereas before the role of solar technologies was largely predicted to be restricted to small-scale on-site development, the introduction of feed-in tariffs could potentially make roof mounted PV of interest to investors. Renewables East are looking to develop take-up of PV, linking investors with commercial and industrial businesses such as warehouses, hospitals etc that have large areas of roof-space where PV could be installed.

Since the publication of the EERA resource assessment the Government has published planned feed-in tariffs for the generation and export of renewable electricity for a range of micro-generation renewables including, PV, as well as Anaerobic Digestion, biomass, small hydro and wind. Table 28 shows the potential feed-in tariff for PV and Figure 33 provides more details as to how feed-in tariffs operate.

Table 28: Feed-in tariff for PV

PV Scale	Potential initial tariff (pence/kWh)	Annual degression %
<4kW new build	31.0	7
<4kW retrofit	36.5	7
4-10kW	31.0	7
10-100kW	28.0	7
100kW-5MW	26.0	7
Stand alone system	26.0	7

Figure 33: Feed-in Tariffs

Feed in Tariffs

Feed in Tariffs are to be introduced in April 2010 to replace the support provided by the Low Carbon Buildings Programme and stimulate increased vigour in the take up of installation of small-medium scale renewable electricity generation. The Government intends the FIT system will be simple and user-friendly in order to maximise take up.

The scheme will include:

- Fixed payment from the electricity supplier for every kWh generated (the "generation tariff").
- A guaranteed minimum payment additional to the generation tariff for every kWh exported to the wider electricity market (the "export tariff").
- Generators receiving FITs will also benefit from on-site use: where they use the electricity they generate on-site, they will be able to offset this against electricity they would otherwise have had to buy.
- Technologies included: wind, solar PV, hydro, anaerobic digestion, biomass and biomass CHP, no-renewable micro CHP.
- Tariffs will be paid for 20 years for new projects.
- The tariff levels proposed have been calculated to ensure that the total benefits an investor can be expected to achieve (from the generation tariff, the export tariff and/or the offsetting benefit) should compensate the investor for the costs of the installation as well as provide such a rate of return.
- The government intends to set tariffs at a level to encourage investment in small scale low carbon generation. The rate of return will be established between 5% and 8%.
- The proposed tariff levels for new projects will decrease by predetermined rates each year ("degression"). [The tariff rate agreed at the project outset will be maintained for the 20 year period – this therefore incentivises early take-up for maximum revenue return]

4.9 EXPECTED DELIVERY OF RENEWABLE AND LOW CARBON ENERGY THROUGH NEW DEVELOPMENT

Carbon efficient new development will be delivered through a combination of energy efficiency measures and development driven renewable and low carbon energy infrastructure in-line with the Government's commitment to zero carbon development in 2016. This would require around a 70% reduction above the TER with the remaining 30% potentially picked up through a range of 'allowable solutions' to offset the remaining energy requirements. Consequently, new development will deliver a proportion of renewable and low carbon energy which can contribute to the District's renewable energy targets.

Range and Potential of Technologies Expected for Inclusion with New Development

The selection of technologies included in new development will depend on the level of carbon reduction which can be achieved through energy efficiency, and the most cost effective energy generating technologies available for inclusion on-site to reach the required carbon reduction. The general range of technologies available for use in new development and their constraints is shown in the Figure 34.

Figure 34: Range of renewable and low carbon technologies available for use in new development

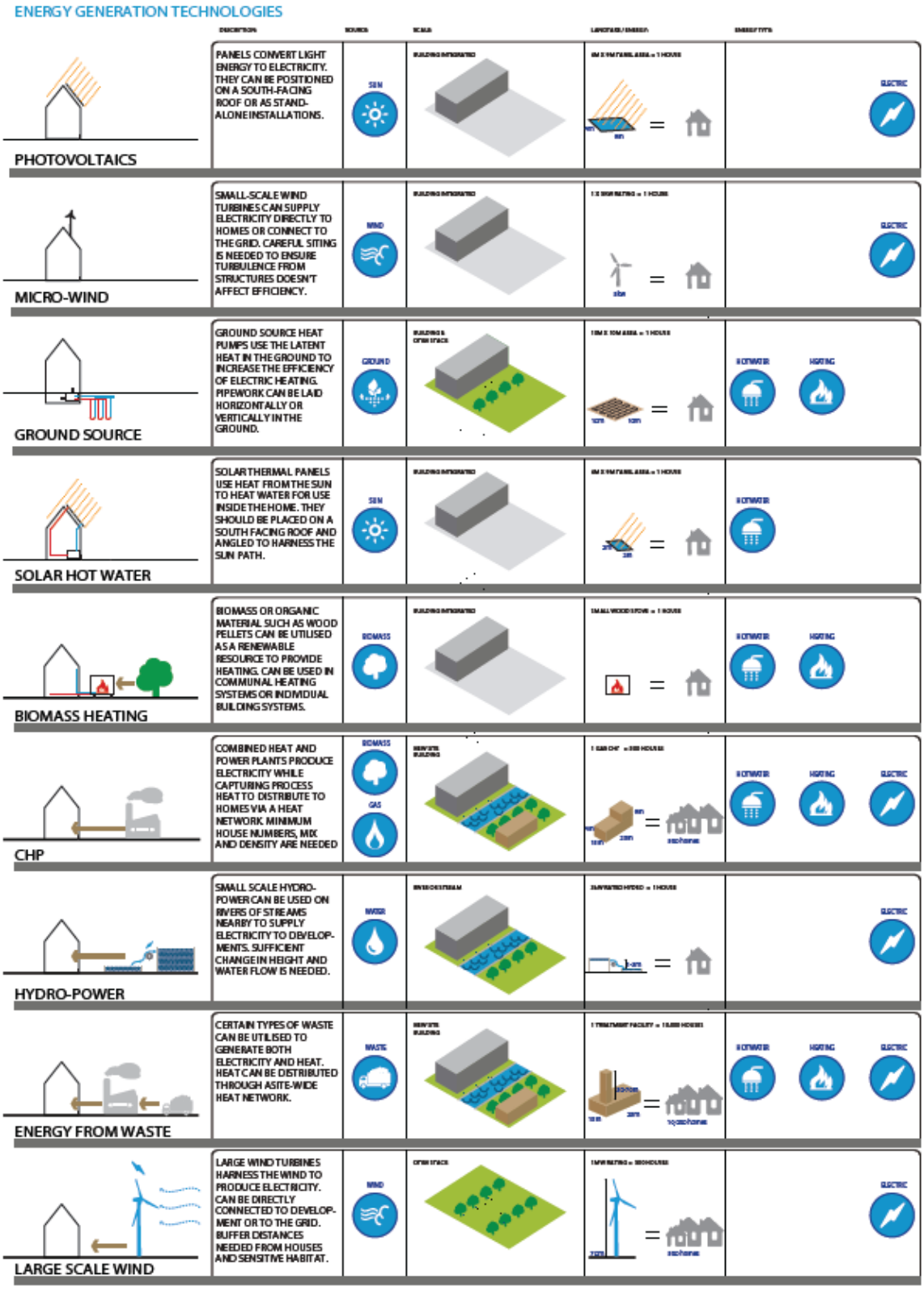
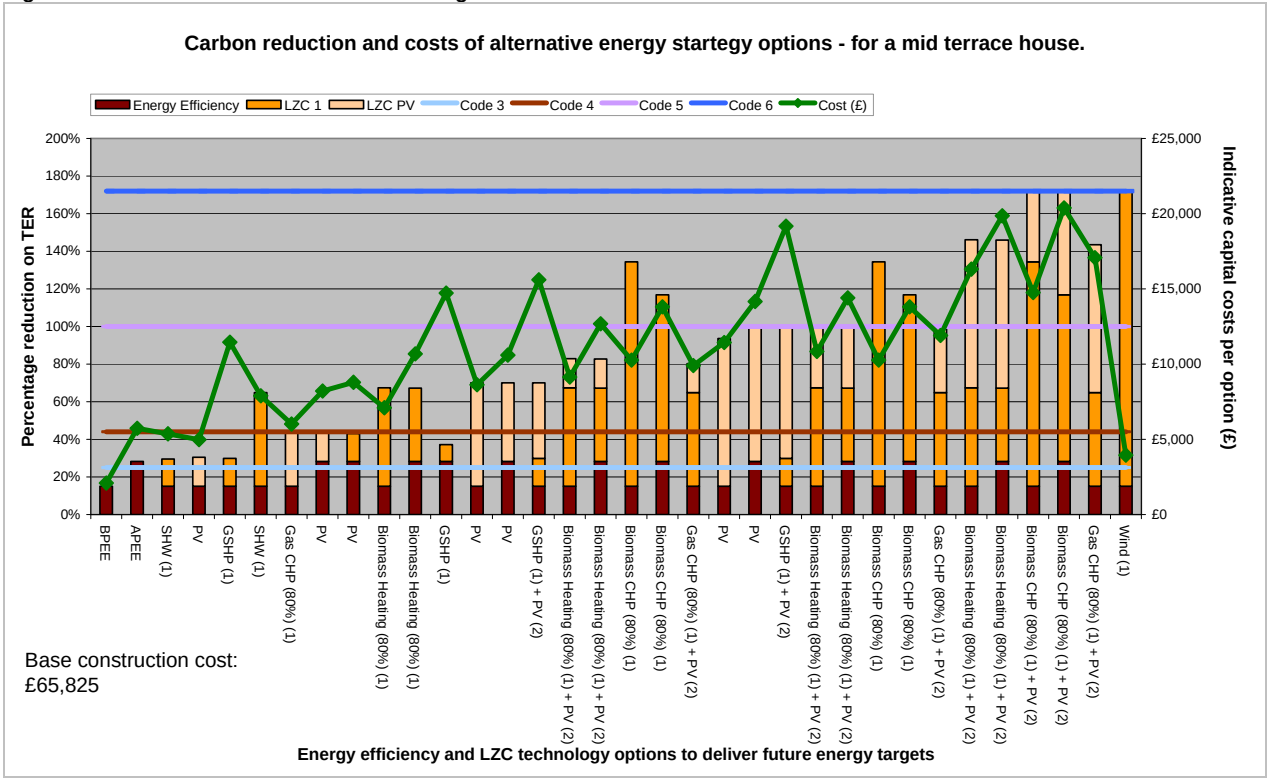


Figure 35 below demonstrates the various costs of combinations of technologies to deliver the energy requirements of level 3, 4 and 6 of the Code for Sustainable Homes. These correspond to expected requirements under Building Regulations, with the exception that 'zero carbon' under code level 6 requires all carbon reductions to be achieved on-site (thus increasing cost significantly), while Building Regulations allow off-site carbon reduction through 'allowable solutions'.

Figure 35: Relative cost of different technologies for a terraced house to meet various code levels



Key

BPEE = Best Practice Energy Efficiency

APEE = Advance Practice Energy Efficiency

SHW = Solar Hot Water

PV = Photovoltaics

GSHP = Ground Source Heat Pumps

CHP = Combined Heat and Power

Scale of Potential

Figure 36 sets out an expected mix of renewable and low carbon energy generation infrastructure to come forward within new development sites based on the cost profile of different technologies used in new development in order to achieve zero carbon requirements as developed through research undertaken by AECOM and Cyril Sweett. This has been used to predict the developer's choice of technology to use on-site. The predictions also take into account urban or rural character and the expected selection of technologies in the AAP area. Figure 37 relates the contribution on different technologies in terms of carbon reduction.

Figure 36: Expected use of renewable and low carbon technologies on new development sites in Waveney

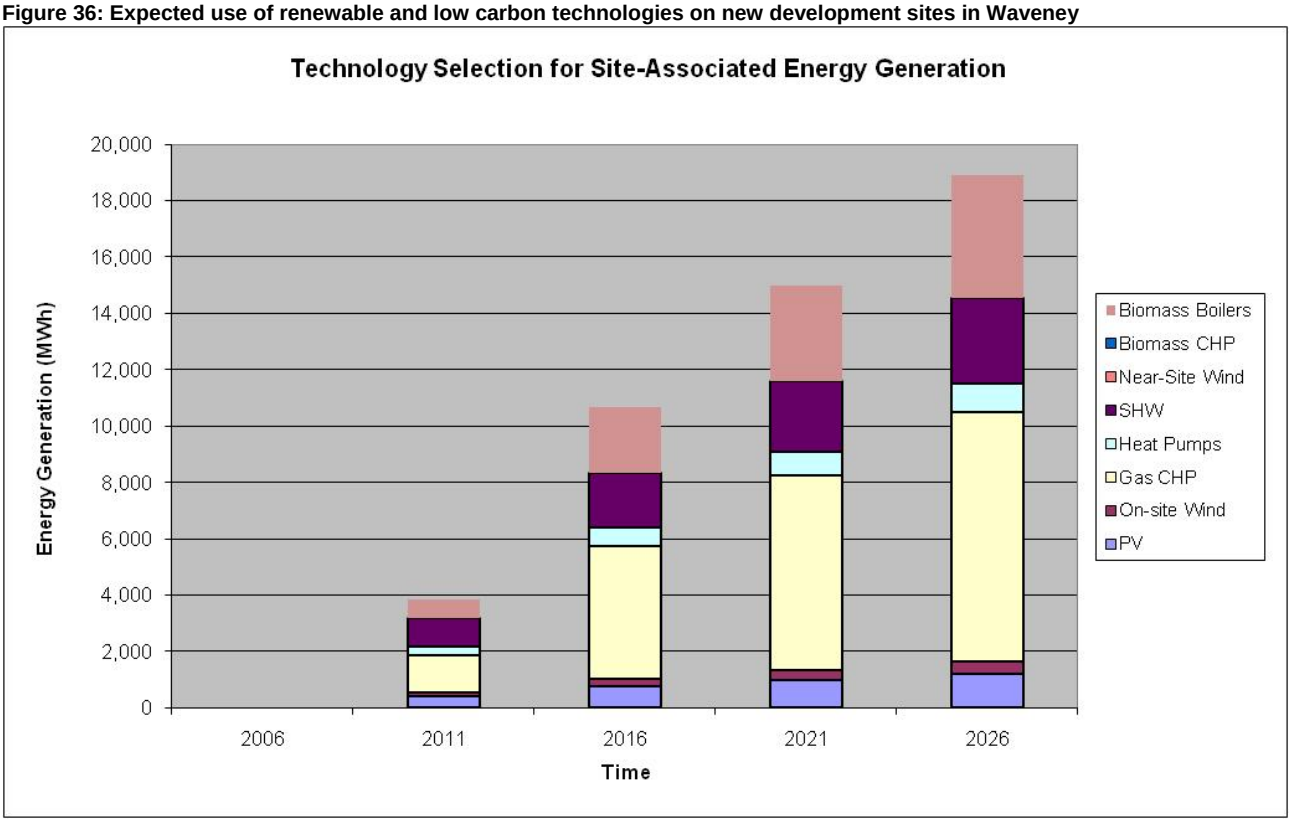
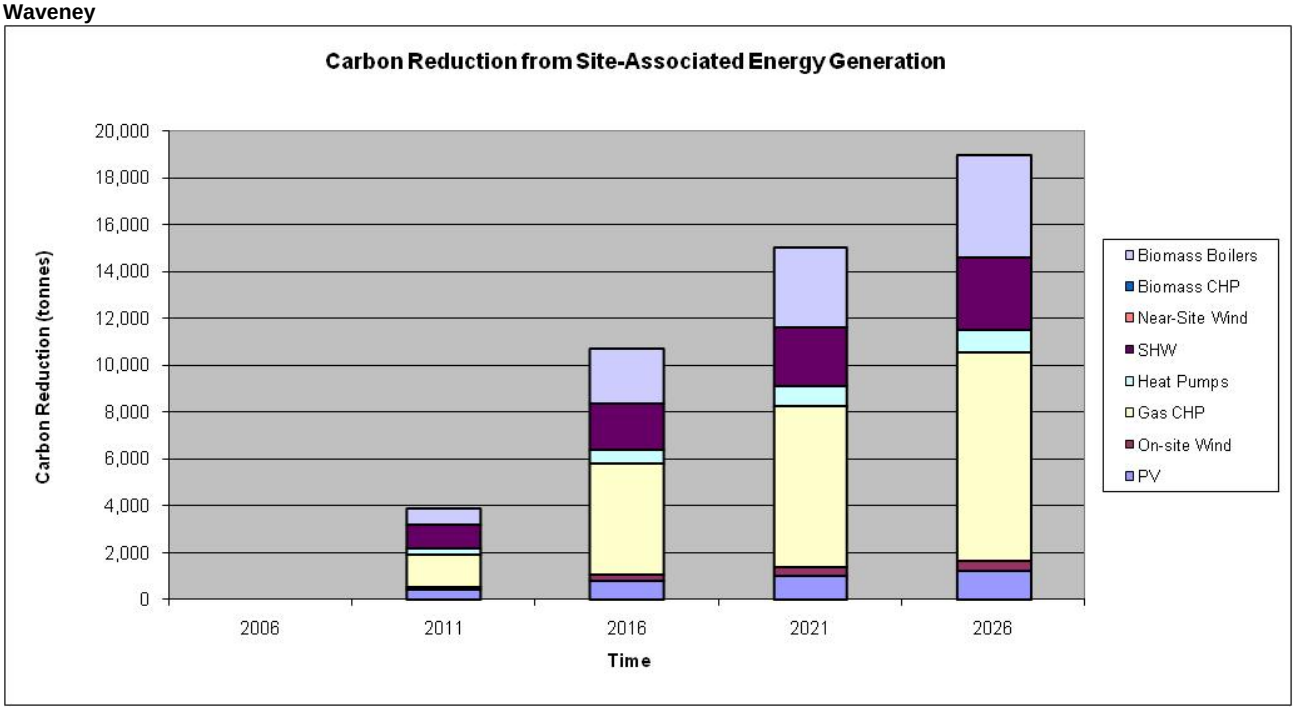


Figure 37: Carbon reduction through use of renewable and low carbon technologies on new development sites in Waveney



Delivery Considerations in Waveney

- **Good planning and design**: Large cost savings can often be made by planning in low carbon and renewable infrastructure at the start of the design process.
- **Different technologies for different types of development**: A range of technologies assures there are different types which are more suitable for different types of developments. The character areas outlined in Chapter 7 describe the best opportunities for different types of development expected in Waveney.

4.10 POSSIBILE SCENARIOS TO MEET RENEWABLES TARGETS

Through the analysis above, it is clear that there is substantial renewable and low carbon resource in Waveney which can be utilised to meet a portion of the National Targets for Renewable Energy equivalent to their portion of national energy use. There are various scenarios and combinations of renewables that could be used to deliver against the targets. The best scenario will be determined through delivery opportunities and partnerships over time.

Some of the possible combinations of opportunities are outlined below to demonstrate the scale of the challenge and possible synergies that may exist in delivery options. Three scenarios have been tested to illustrate indicative options to reach Waveney's contribution to national targets. Delivery options and constraints are discussed in detail in Chapter 5.

Scenario A: Wind power led delivery – In this scenario there is a concentration on delivery of large scale wind turbines (1.5MW+) in Waveney by either private or public led development. This option provides a potentially low cost solution, but may conflict with other planning objectives, see Table 29.

Scenario B: Biomass CHP led delivery – This scenario examines the potential contribution from installing Biomass CHP within the AAP area and the area where heat loads are currently viable in Lowestoft. A biomass CHP network could be introduced through a Council or community led scheme or an ESCo, see Table 30.

Scenario C: Community renewables led – This option takes the emphasis away from large wind power market solutions and considers the opportunity for wide spread micro-generation, high up-take of medium-scale wind, focus on anaerobic digestion of wastes and community scale biomass utilisation, see Table 31.

Table 29: Scenario A Potential Contributions of Renewables

Renewable Resource	GWh Electricity	Gwh Heat	Corresponding Delivery Intervention Needed
Landfill gas	7.93	0	Continue existing landfill gas arrangements
Large wind power	201.18	0	Delivery of all planned and existing turbines, plus the equivalent of 25 additional 2.75MW turbines (like Gulliver)
Medium wind power	1.19	0	Delivery of the equivalent of 86 6kW turbines on individual properties
Biomass Heating	0	144	Utilising wood-based biomass to heat homes and support industry. Utilising 100% of theoretical arisings from local forestry management, 100% of waste wood, and 30% of straw of District (no contribution from bio-crops assumed).
Biomass CHP	0	0	None delivered under this scenario
Anaerobic Digestion	3	3.6	Assuming a mix of waste is available to create three small scale AD plants
Micro-generation on Existing Buildings	1.61	3.05	Medium up-take case for addition of micro-generation technologies for existing homes
Renewable energy included with New Development (on-site)	1.35	6.75	Expected renewable energy to be included with new development (on-site) following changes to Building Regulations.
Total (kWh)	216.26	157.4	
% of Waveney Consumption	30.3%	12.3%	*This scenario delivers a large amount of wind power, and utilises all local biomass streams.*
Target	30%	12%	

Table 30: Scenario B Potential Contributions of Renewables

Renewable Resource	GWh Electricity	Gwh Heat	Corresponding Delivery Intervention Needed
Landfill gas	7.93	0	Continue existing landfill gas arrangements
Large wind power	44.68	0	Delivery of all planned and existing turbines only
Medium wind power	1.19	0	Delivery of the equivalent of 86 6kW turbines on individual properties
Biomass Heating	0	0	All biomass resource utilised for CHP
Biomass CHP	161.25	535.5	Biomass CHP used to supply 75% of the 'viable' area of Lowestoft identified in the heat map
Anaerobic Digestion	0	0	No AD contribution
Micro-generation on Existing Buildings	1.61	3.05	Medium up-take case for addition of micro-generation technologies for existing homes
Renewable energy included with New Development (on-site)	1.35	6.75	Expected renewable energy to be included with new development (on-site) following changes to Building Regulations.
Total (kWh)	218.01	545.3	
% of Waveney Consumption	30.6%	42.7%	*This scenario delivers a biomass CHP to a large proportion of Lowestoft, contributing to both electricity and heat targets. The heat target is significantly exceeded under this scenario.*
Target	30%	12%	

Table 31: Scenario C Potential Contributions of Renewables

Renewable Resource	GWh Electricity	Gwh Heat	Corresponding Delivery Intervention Needed
Landfill gas	7.93	0	Continue existing landfill gas arrangements
Large wind power	138.58	0	Delivery of all planned and existing turbines, plus the equivalent of 15 additional 2.75MW turbines (like Gulliver)
Medium wind power	1.58	0	High up-take of medium scale wind. Delivery of the equivalent of 112 6kW turbines on individual properties
Biomass Heating	0	33.5	Utilising 100% of theoretical arisings from local forestry management, heating 8,350 homes.
Biomass CHP	45	61.4	Assuming Biomass CHP is introduced to the AAP area plus expanding to serve an equivalently sized proportion of existing Lowestoft's energy demand
Anaerobic Digestion	17.8	21.4	Assuming equivalent to half the pig waste in Waveney is utilised for AD
Micro-generation on Existing Buildings	7.42	33.36	High up-take case for addition of micro-generation technologies for existing homes where a rapid increase in up-take is seen following successful implementation of a feed-in tariff.
Renewable energy included with New Development (on-site)	1.35	6.75	Expected renewable energy to included with new development (on-site) following changes to Building Regulations.
Total (kWh)	219.66	156.41	
% of Waveney Consumption	30.8%	12.3%	*This scenario delivers a large amount of wind power, and utilises all local biomass streams.*
Target	30%	12%	

Chapter 4: Key Policy Considerations

The analysis of resource potential in Waveney District has shown that there is significant potential to be exploited, which will allow Waveney District to meet or exceed its proportion of the national renewable energy targets. The scenarios demonstrate that delivery of the targets need concentrated effort in delivering large scale wind power and biomass fuel for CHP or heating. Policy should support the optimization of these opportunities. Policy recommendations should also identify mechanisms to deliver renewable and low carbon energy potential through new development, both on-site and off-site (through allowable solutions or otherwise).

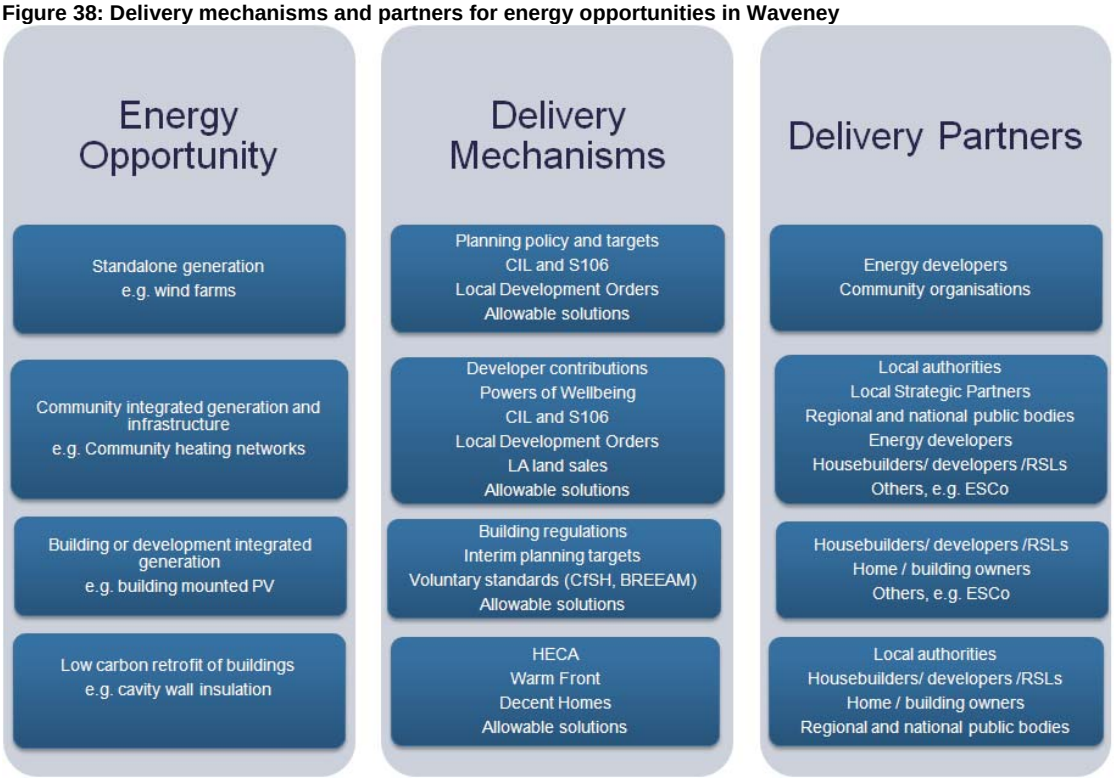
5. Delivering Change in Waveney

This section describes the opportunities and mechanisms available to Waveney District to deliver, and potentially go beyond the national and regional carbon reduction targets. The proposed approach is designed to balance delivery of decentralised low carbon and renewable energy from proposed new development with the wider opportunities available to the Council, drawing on:

- Improving the energy performance of existing buildings:
  - through energy efficiency; and
  - through micro-generation.
- Delivering carbon efficient new development:
  - through energy efficient new stock;
  - through on-site renewables; and
  - through development driven off-site renewables and low carbon infrastructure.
- Delivering stand alone renewable and low carbon infrastructure:
  - through private investment;
  - through community delivery;
  - through local government delivery; or
  - through a combination of the above through partnership.

The nature of planning for energy at the local level is such that the planning process cannot deliver the opportunities alone; it will require a collaborative approach between the Council, the Waveney Local Strategic Partnership (WLSP), private developers and the community. Figure 38 summarises some of the mechanisms and partners required to deliver the change in Waveney.

Figure 38: Delivery mechanisms and partners for energy opportunities in Waveney



5.1 IMPROVING THE ENERGY PERFORMANCE OF EXISTING BUILDINGS

The Role of Planning

Planning is limited in its remit to address deficiencies in the performance of the existing buildings stock. However, through generating evidence based reports such as this, it can play a role in informing other local authority departments and partners to promote the need energy efficiency improvements in the District.

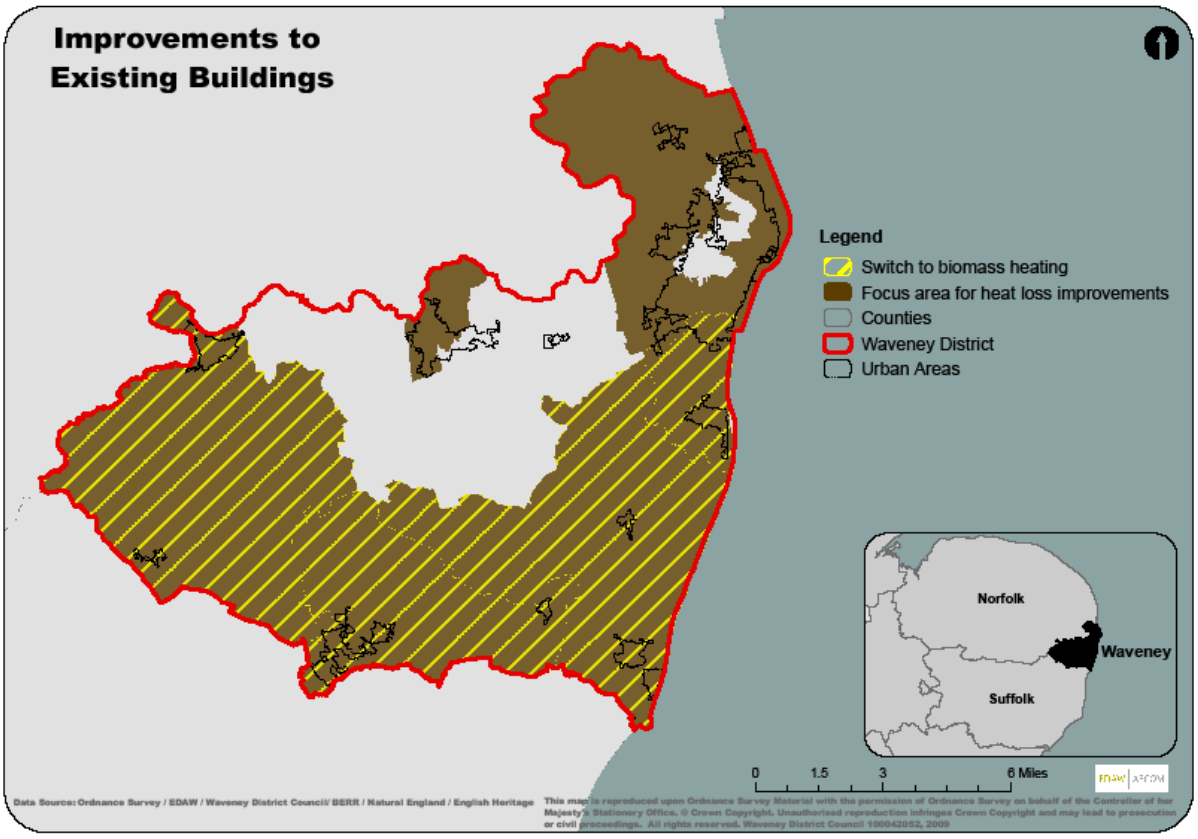
Improving Energy Efficiency of Existing Buildings

Our estimations in the change in performance of existing buildings in chapter 3 show the differences between a 'business as usual' estimation, where energy efficiency measures continue to be encouraged on a national scale with existing measures and initiatives undertaken by the Local Authority, and a 'higher reduction' situation where further steps are taken to maximise energy efficiency. To increase the uptake of energy efficiency measures, concentrated funding and a programme of improvement would have to be introduced to trigger the completion of higher cost elements of retrofit. The carbon savings that can be achieved through improvement of existing buildings are very substantial and this should be a priority for change in the District. The Council can encourage higher energy efficiency in existing buildings by working with partner organisations to distribute and focus funding.

Figure 39 shows key areas for improvements to existing buildings. The brown area is where home improvement measures such as loft and cavity insulation, double glazing and boiler replacement should be heavily promoted, as these are the least efficient areas on a per home basis. Of course, energy efficiency measures should be promoted in homes across the District. In addition, those areas hatched in yellow, are areas where oil, coal or electric heating systems are thought to be most prevalent in the absence of access to a gas network. Significant carbon savings could be made through conversion of these fuel users to biomass fuel. In these areas efforts should be made to convert these systems to wood burning stoves and biomass boilers utilising wood as a lower carbon fuel. It is expected that conversion of homes that currently utilise oil or coal to use biomass would be straightforward in most cases.

Waveney is a high user of high carbon fuels like oil and coal in industrial and commercial processes. The Council should work with local businesses and industry to reduce use of these fuels and encourage energy efficiency.

Figure 39: Key areas for focus of improvement of existing buildings[12]



Aiding Introduction of Micro-Generation

In addition to the energy efficiency measures, there is potential to install micro-generation technologies to some existing properties. Delivery of low carbon and renewable technologies within existing buildings and communities cannot be required by planning, but can be encouraged by the Council. The Council should seek to engage communities and highlight the cost-saving benefits of the inclusion of micro-generation, especially with the introduction of the feed-in tariff (see funding section below). There are also other funding sources available to homeowners and businesses to assist with the capital cost of installation.

5.2 CARBON EFFICIENT NEW DEVELOPMENT

Role of Planning

Although Building Regulation include minimum building performance standards in relation to carbon arising from energy use, and these are proposed to be strengthen in 2010, 2013 and 2016 (2019 for non-residential buildings), planning can set more stringent targets for development depending on the opportunity in the District. PPS1 actively encourages opportunities to be sought to set higher standards on strategic sites. The different opportunities for different characters areas are described in more detail in Chapter 7.

Carbon Efficient New Development

Carbon efficient new development will be delivered through a combination of energy efficiency measures and development driven renewable and low carbon energy infrastructure in-line with the Government's commitment to zero carbon development in 2016. This would require around a 70% reduction above the TER with the remaining 30% potentially picked up through a range of 'allowable solutions' to offset the remaining energy requirements.

As part of the allowable solutions, developers can look for opportunities to reduce carbon further either on-site or off-site. Generally, CHP and wind energy provide excellent opportunities for developers to reduce carbon

[12] Improvements to existing buildings should be sought in all areas. The areas highlighted in brown have relative high energy use, and thus could be a first focus for improvement.

associated with new development in a cost effective manner. Often the integration of these technologies cannot be delivered solely within the boundary of the site:

- there may be restricted space for integration of a wind turbine on-site, while there is space on adjacent property without turbulence issues created by development; and
- heat networks may be more viable when connecting into heat loads off-site, or a developer may see opportunity to invest in adjoining networks as part of their allowable solutions.

Therefore it is important to realise the context for the expected development of large sites (100 homes+) to seek opportunities to deliver wind power or heat networks directly associated with new development. Figure 40 shows the main opportunity areas for stand-alone development driven infrastructure, with a more detailed plan of Lowestoft in Figure 41. The main opportunity is for medium-large scale wind turbines near new development sites and to drive district heating or CHP integration in the centre of Lowestoft and connect in existing areas.

The Council should highlight key possibilities to developers and require investigation of key opportunities as strategic sites come forward. The Council should take a leading role in highlighting and enabling the delivery of key 'allowable solutions' and look for opportunities to drive delivery of these solutions in conjunction with new development.

Figure 40: Key large-scale opportunities that could be driven by new development

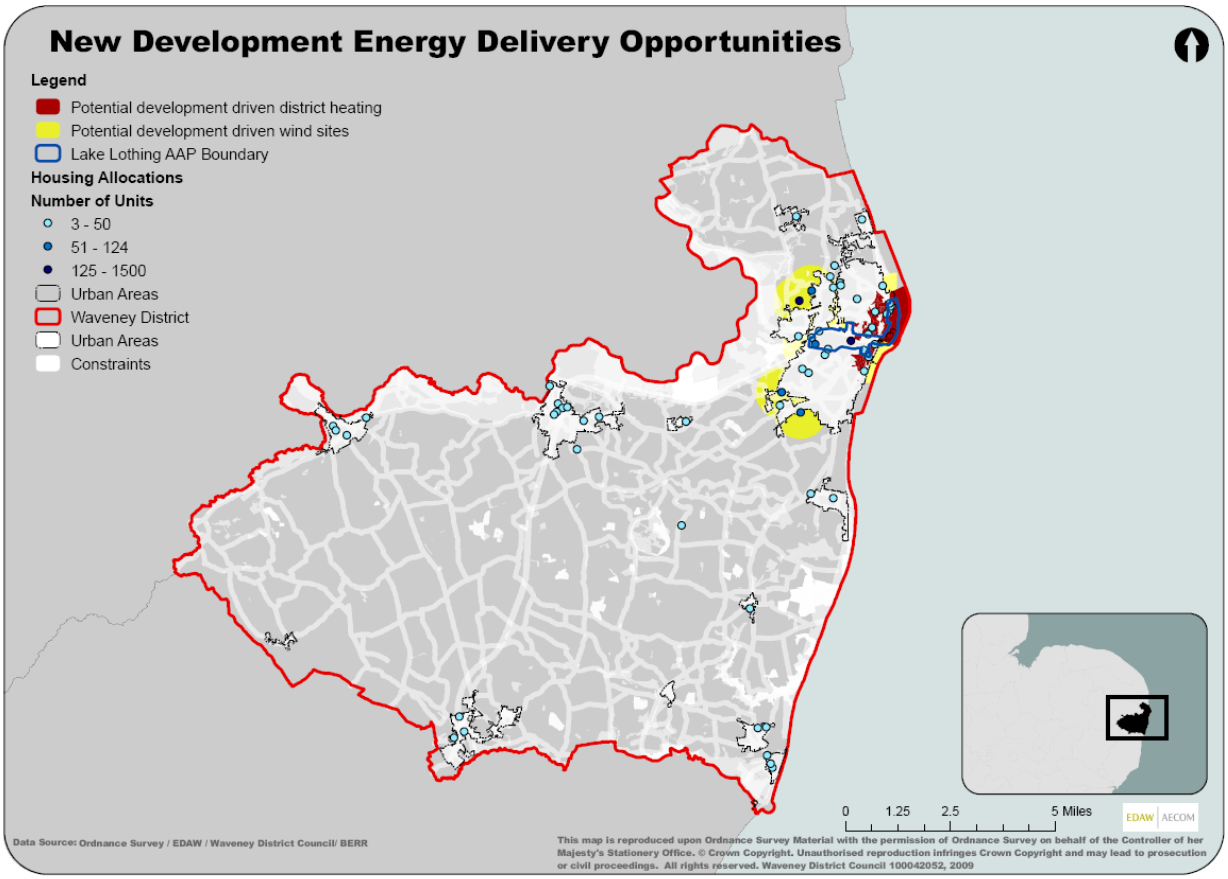
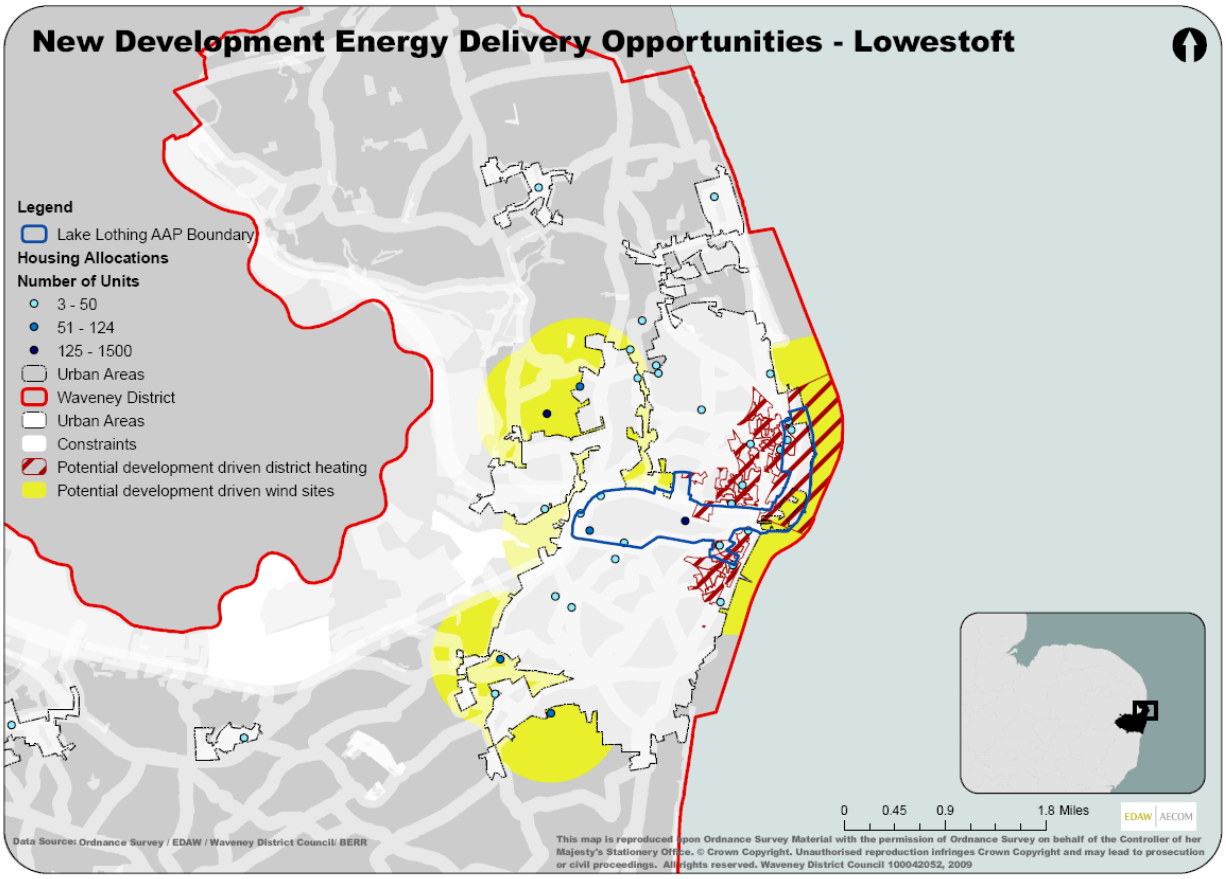


Figure 41: Development-driven opportunities around Lowestoft



5.3 STAND-ALONE RENEWABLE AND LOW CARBON INFRASTRUCTURE

Role of Planning

Planning can play a key role in both supporting and delivering renewable and low carbon infrastructure. Planning and policy should support the market development of renewable energy, where it doesn't conflict with other planning criteria. Planning can also play a leading role in delivering renewable energy, either alone, in partnership with private energy developers or in partnership with the community. Under its powers of well-being, a local authority can set up its own energy company. The Council will also need to play a role in supporting the delivery of energy infrastructure funded by 'allowable solutions' or through policy requirements under the Community Infrastructure Levy. The various roles of the Council are outlined in more detail in the following sections.

Expected Demand for Off-site Carbon Reduction from New Development in Waveney

Chapter 4 outlines the expected delivery of a range of on-site technologies in conjunction with new development. After 2016 new development will be required to reach a 70% reduction in carbon on-site, and the remainder can be delivered off-site through allowable solutions. From our modelling of expected selection of energy strategies by developers, we predict the carbon reductions that will need to be met off-site through allowable solutions to be equivalent to that in the table below.

Table 32: Predicted cumulative demand for off-site carbon reduction through allowable solutions

	2006	2011	2016	2021	2025
Demand of carbon reduction off-site from new development (tonnes CO_2)	0	0	692	2,815	4,815

The scale of demand for carbon reduction is substantial. The carbon reduction expected to be demanded through allowable solutions driven by new development by 2025 is equivalent to:

- Introduction of gas CHP to 13% of the estimated 'viable' area of existing community where strong heat demand intensities exist; or
- The delivery of 2 large scale wind turbines (2MW rating).

It should be noted that the delivery of the above contribution will only act to offset energy demand from new development to meet the overall zero carbon requirements (expected to come into play after 2016). The Council should seek further opportunities in addition to reduce its carbon profile further and meet renewable energy targets.

Recommendation: Waveney District Council should develop a plan to deliver allowable solutions in the District, to ensure funding available from new development is directed towards the best solutions in a coordinated manner.

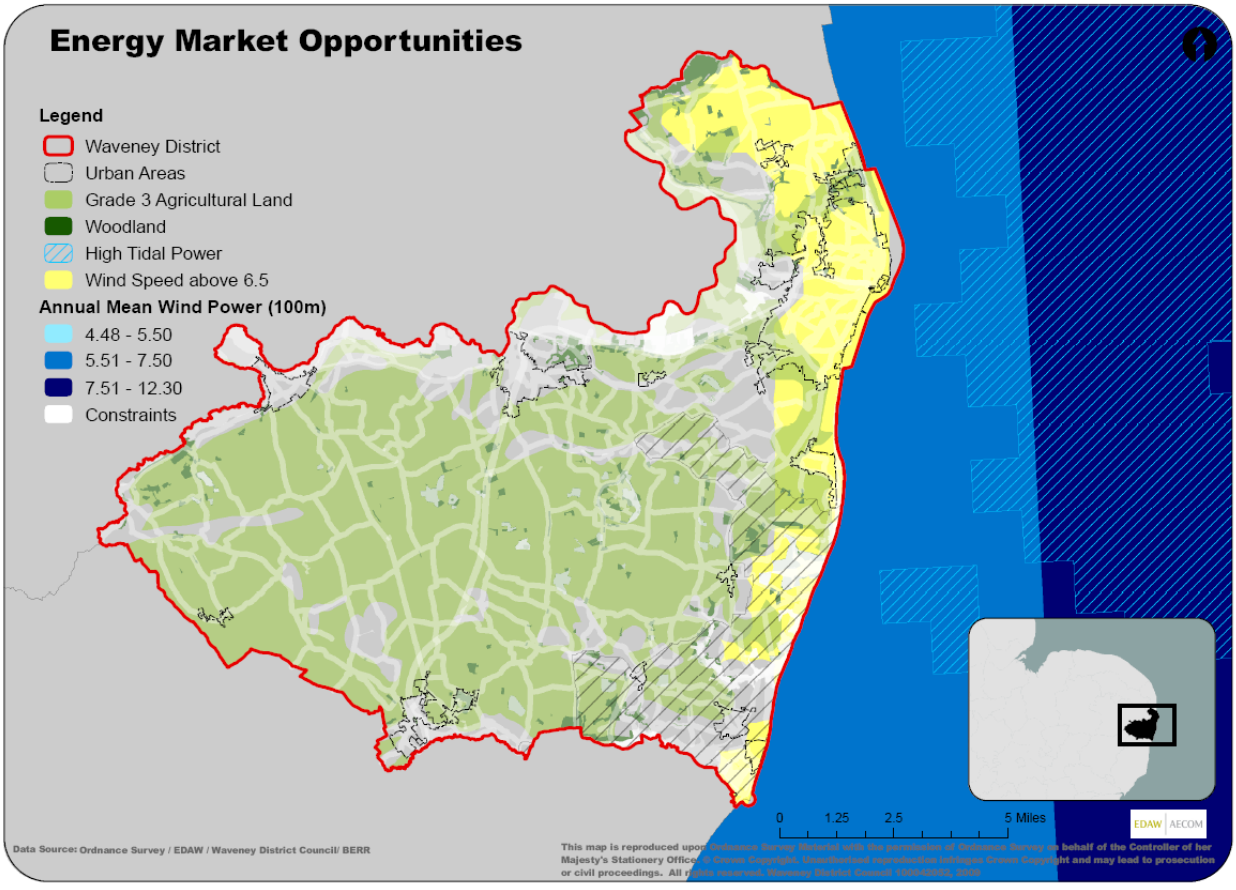
Supporting Market Delivery in Waveney

As energy is a key economic market for Waveney, planning can support the set up of local energy businesses through landuse planning and delivery of employment and industrial sites to meet their needs. It is expected there is a key opportunity to do this within the AAP area, led by the development of the Power Park.

Wind development is a major market opportunity in Waveney, as can be seen through the delivery and planned delivery of turbines across the District. Waveney District Council should seek to positively market development of wind energy, subject to a criteria based assessment against key constraints and environmental impacts.

There is also a key market opportunity to set up a biomass delivery chain, coordinating both forestry waste and growth of bio-crops locally. The Council should seek opportunities to support the set up of a supply chain to ensure new and existing development can be supplied with biomass fuel. The key market opportunities for private developers are shown in the Figure 42. This map includes offshore opportunities which Waveney can support through the provision of on-land supporting infrastructure.

Figure 42: Market delivery opportunities in Waveney



Enabling Local Delivery Opportunities

The principle stand alone renewable and low carbon infrastructure opportunities in Waveney District come from large and medium scale wind turbines and district heating networks to provide community heat from biomass (preferably with CHP to provide electricity). These types of technologies are likely to come forward in one of two ways; through private commercial interest or through local authority/community investment. Where market delivery isn't coming forward, Waveney District Council can lead delivery of energy infrastructure with support from private investors or communities. Communities may also want to join together to deliver energy infrastructure, investing and in capital cost and receiving income from selling energy. Generally the largest opportunities regard the implementation of wind power and heat networks.

- Large Scale Wind – A significant number of the wind opportunity areas identified in EOP are likely to be attractive to commercial developers. Supportive planning policies and targets should be sufficient to deliver significant generation installations. However, there will also be sites that, once detailed constraints have been assessed, will be too small to attract the interest of commercial developers. Additionally, securing planning permission for the potential wind turbine locations in more constrained sites could prove difficult for commercial developers and projects may be constrained by local archaeological and hydro geological factors.

  The local authority could take forward less commercial opportunities in partnership with the community. Project finances could be raised by the issuing of bonds to residents and businesses by an ESCo (see below) and giving returns based on energy sales, Renewables Obligation Certificates and feed-in tariffs. Further community incentives could include discounts on council tax. A co-operative venture, possibly with the involvement of the local authority is another option that should be explored.

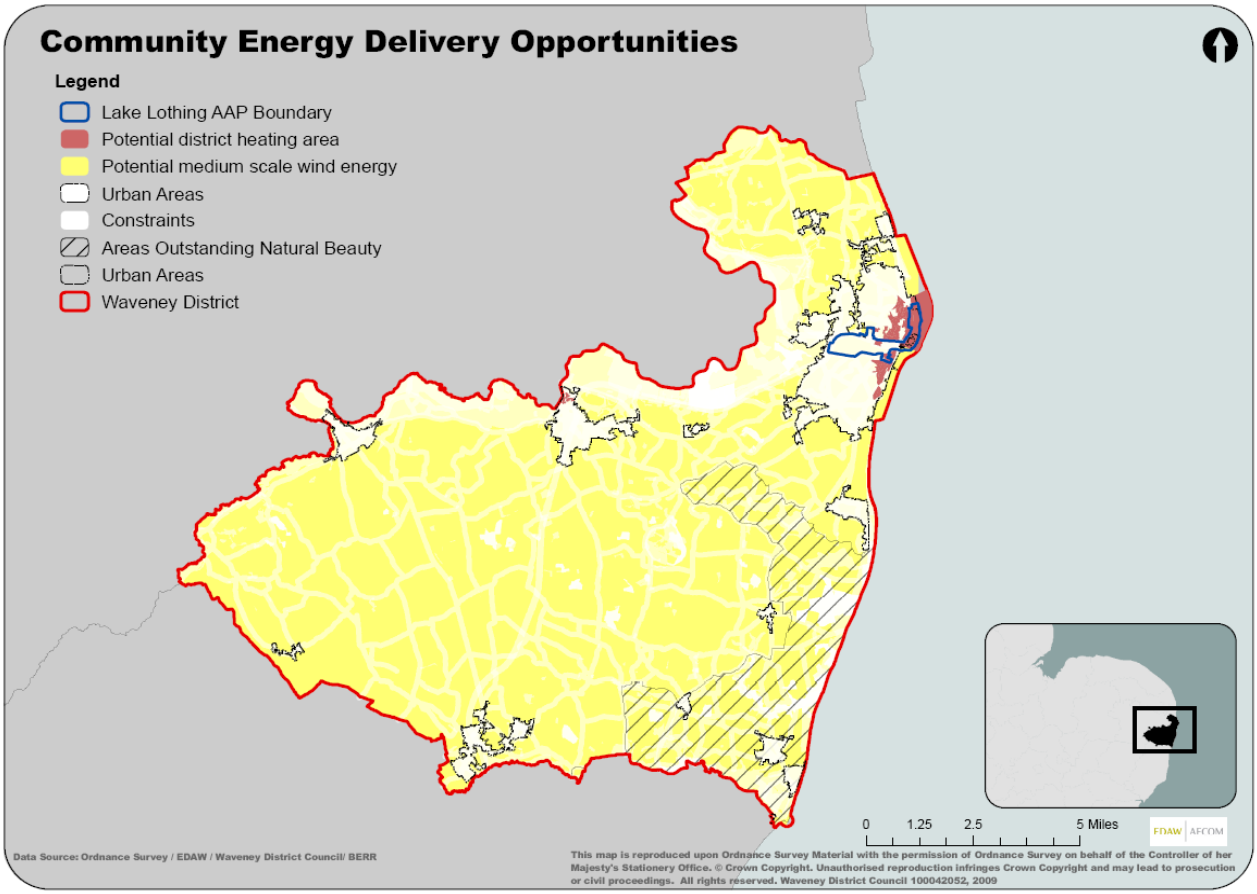
- District heating with CHP – The primary district heating opportunity area in Waveney is the Lake Lothing AAP and this should be reflected in the AAP masterplan. An eventual aim could be to connect areas with sufficient heat density (primarily Lowestoft) but which lie outside the AAP to one overall network.

  Different elements of the network can be treated differently. The operating costs of the insulated pipes that move heat between the energy centre and customers are relatively low. The main cost is installing the pipeline at the start. This can be competitively tendered by a local authority ESCo and, since Waveney Council may have access to low interest rates and repayments over a long time period using Prudential Borrowing, capital costs can be kept to a minimum. Repayments could be serviced by energy sales and income from the renewable heat incentive and for a CHP system generating both heat and electricity, from ROCs and/or the proposed feed-in tariff.

  Energy centres tend to have lower upfront costs. The expense comes with ongoing operation and maintenance, a shorter life span (around 15 years) and exposure to fluctuations in energy prices. While ownership of the sites and buildings may be retained by the local authority, the plant itself could be operated by a private sector ESCo.

An energy company would be the preferable vehicle for delivery of community scale facilities such as district heating networks. Figure 43 shows areas most suitable to local authority / community investment.

Figure 43: Energy opportunities for focus from community/local authority groups



Setting up an Energy Company in Waveney

The Wellbeing Power, introduced through the Local Government Act 2000, enables local authorities to do anything that they consider likely to promote the economic, social and environmental wellbeing of their area unless explicitly prohibited elsewhere in legislation. The Power promotes innovation in the way authorities provide services. This includes setting up or participating in local energy services companies (ESCo) and other joint ventures, supplying heat and/or power.

The Energy Opportunities Plan identifies a range of opportunities that are not by their nature deliverable through individual developments or planning applications. A local authority ESCo would be ideally placed to plan, deliver and operate part or all of a district heating network, for example. The implications of this for the local authority are significant. We are no longer simply talking about a set of planning policies; rather success depends on co-ordination between planners, other local authority departments, including the corporate level and local strategic partners. This is a challenging proposition, however, the gains in terms of CO_2 emission reductions and potential delivery against other local authority objectives means that this option needs to be given serious consideration.
Dialogue between AECOM and the Council has demonstrated that there is enthusiasm for setting up a local authority ESCo although the workshop identified important concerns that will need to be fully addressed. The skills needed to set up a local authority ESCo will need to be developed. This does not need to be an insurmountable barrier and there are a growing number of authorities engaging in similar activities both in energy and other areas. They key to success is likely to be leadership: leadership from senior local authority management or, at least initially, from committed individuals in planning or other departments.

Consideration will need to be given to the extent of private sector or community involvement. Broadly speaking, the greater the involvement of third parties the lower the risk to the authority but, importantly also, the less control the authority will have over the company. ESCo models range from fully public, through partnerships between public, private and community sectors to fully private. The spectrum is illustrated in Figure 44 and discussed in detail in Making ESCos Work[13].

[13] Making ESCos Work – Guidance and Advice on Setting Up & Delivering an ESCo (London Energy Partnership, 2007)

It is important to remember that while this type of initiative may be new territory for Waveney Council, and indeed for most local authorities, it is fully supported by Government, including in the context of CO_2 reductions and energy. It is not intended to provide a comprehensive list of considerations and details here, rather it seeks to offer a flavour of what setting up an energy company entails and the further work to be undertaken.

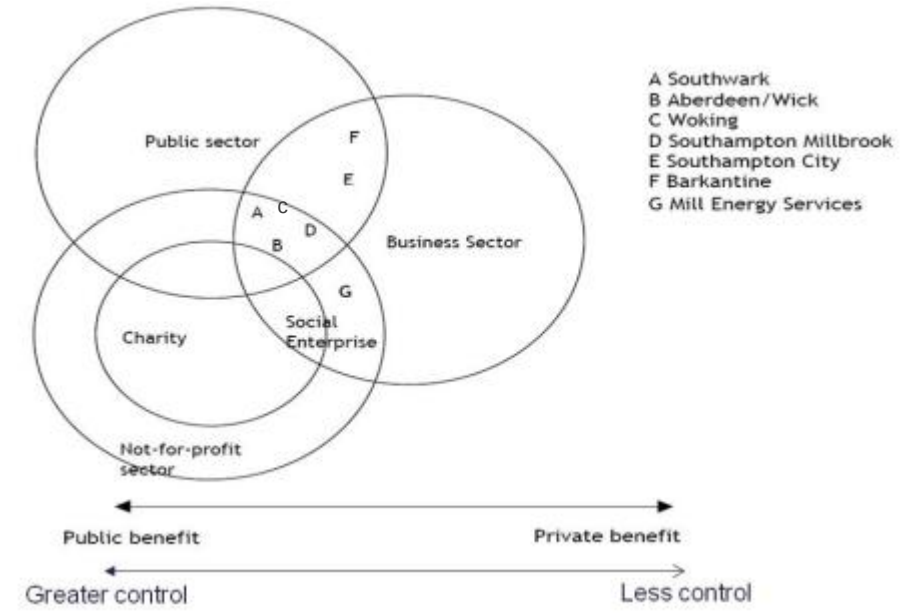
Recommendation: the planning department should lead the Council and its strategic partners in considering the role that the local authority should play in delivering non-development related energy opportunities.

Recommendation: further work should be undertaken to establish the most appropriate type of ESCo and its remit

Table 33: Advantages and disadvantages of ESCo models

	Private Sector Led ESCo	Public Sector Led ESCo
Advantages	▪ Private sector capital ▪ Transfer of risk ▪ Commercial and technical expertise	▪ Lower interest rates on available capital can be secured through Prudential Borrowing ▪ Transfer of risk on a district heating network through construction contracts ▪ More control over strategic direction ▪ No profit needed ▪ Incremental expansion more likely ▪ Low set-up costs (internal accounting only)
Disadvantages	▪ Loss of control ▪ Most profit retained by private sector ▪ Incremental expansion more difficult ▪ High set-up costs	▪ Greater risk ▪ Less access to private capital and expertise, though expertise can be obtained through outsourcing and specific recruitment

Figure 44: Spectrum of ESCo (Source: Making ESCos Work)



5.4 DELIVERY AND FUNDING

Alongside the Wellbeing Power the Government also introduced, in the Local Government Act 2003, the concept of Prudential Borrowing that will enable Waveney Council to borrow money to establish and deliver services that they would otherwise be unable to. The loans, obtained at public sector borrowing rates (currently around 3.5%) can be serviced by energy sales and other related income sources. Other potential income sources include: money raised through a Community Infrastructure Levy or similar charge; revenue from ROCs, the feed-in tariff (from April 2010) or renewable heat incentive (from April 2011); and bonds issued to local communities.

Community Infrastructure Levy (CIL)

Linked to delivery of the energy opportunities plan is the potential to raise money through the CIL. This is a charge which local authorities in England and Wales are empowered, but not required, to levy on most types of new development in their areas. The size of the charge is based on the size and character of the development and will be spent on local and sub-regional infrastructure to support the development of the area. The definition of infrastructure is intentionally kept broad to enable local authorities to have the choice of what infrastructure they need to deliver their development plan, including funding for district heating networks14. It could be a useful tool for pooling developer contributions to fund community energy infrastructure. This flexibility will enable Waveney District Council, as a 'charging authority', to fund energy infrastructure identified in the Energy Opportunities Plan.

The Council will need to:

- Develop a charging schedule that is subject to the same level of scrutiny as a development plan document.
- Set out the proposed amount to be levied, expressed as a cost per meter squared.
- Consider the impact of a levy on scheme viability.

The draft Regulations are currently out for consultation and a number of uncertainties remain that will need further clarification:

- Can wind turbines be defined as 'infrastructure'? If this is the case then a CIL could offer a flexible way of delivering energy generation plant that is not directly related to a particular development.
- Current plans indicate that the amount to be levied should be expressed as a cost per square metre - a levy expressed as cost per tonne of CO_2 would be more suitable for an energy CIL.
- Can money raised by the Council be coordinated and spent by a local authority led ESCo? Co-ordination of the CIL by an ESCo would be an ideal scenario since it would assist in consolidating planning, delivery and management activities.

Recommendation: once clarity is gained over the detailed CIL Regulations and the remaining issues specific to this project, appropriate planning policy should be prepared.

Local Development Orders (LDO):

The PPS presents further opportunities at the local level in the form of Local Development Orders (LDO), which can be applied by local authorities to extend permitted development rights across whole local authority areas or to grant permission for certain types of development. Although there is little experience of local planning authorities having used LDOs the PPS suggests that the government is keen on them being used stating that: "*planning authorities should give positive consideration to the use of Local Developments Orders to secure renewable and low carbon energy supply systems*" (paragraph 21).

Delivery of Micro-Generation Technologies

The evidence base identifies a number of micro-generation technologies, in particular, solar energy, as a key resource for Waveney in both existing and new buildings. The following describes mechanisms through which increased uptake of micro-generation technologies could be stimulated by Waveney District Council.

[14] Section 2.21 The Community Infrastructure Levy (Department of Communities and Local Government, August 2008)

Householder or business purchase

The introduction of the feed-in tariff nationally in April 2010 gives householders and businesses the opportunity to benefit from more affordable energy generation technologies. The feed-in tariff offers a guaranteed income for energy generated from a range of micro electricity generating technologies, including PV.

Householder or business hire purchase

Despite the feed-in tariff, the upfront capital costs of installing solar remain high. It is likely that the pay-back period will still be longer than the average home turnover (often assumed to be around 7 years). Therefore, a hire purchase arrangement may be suitable. A local authority ESCo benefiting from possible opportunities to bulk-buy, could lease solar PV panels to householders and businesses. Rental costs would be charged as a proportion of the feed-in tariff received by the beneficiary. After a period of time ownership of the panels would transfer to the householder or business.

Householder or business rental

A third model could be for the ESCo to retain ownership of the panels and to rent roof or other suitable space from homeowners, businesses and other organisations. Again, rental costs would be set as a proportion of income from the feed-in tariff. As with the hire purchase option this approach would give benefits of low carbon and renewable energy to communities without the up-front expense. The particular advantage of this option would be the retention of control over phasing and technology choice, and greater flexibility to respond to changes in technology and demand.

Recommendation: further work will need to be undertaken to confirm the best approach or mix of approaches to delivering micro-generation technologies for Waveney and to agree the details.

Sources of Funding for Public Bodies

There are a number of central Government and charitable funds for low carbon energy projects that can be tapped into by local authorities.

UK Green Stimulus Package Pre-Budget Report 2008

The Government has pledged £100 million of new funding for Warm Front and £60 million to provide 16,000 social houses with energy efficiency and heating measures as part of an accelerated Decent Homes programme.

Salix Finance

This is a publicly funded company designed to accelerate public sector investment in energy efficiency technologies through invest to save schemes. Funded by the Carbon Trust, Salix Finance works across the public sector including Central and Local Government, NHS Trusts and Higher and Further Education institutions. It will provide £51.5 million in interest free loans, to be repaid over 4 years, to help public sector organisations take advantage of energy efficiency technology[15].

Salix launched its Local Authority Energy Financing (LAEF) pilot scheme in 2004. The success of this programme has allowed the pilot to be rolled out into a fully fledged Local Authorities programme. The next closing date for applications is 1st October 2009.

Low Carbon Buildings Programme – Phase 2

This is a capital grant scheme from the Department of Energy and Climate Change (DECC) totalling £50m for the installation of micro-generation technologies by organisations including local housing authorities, housing associations, schools and other public sector buildings and charitable bodies[16]. The programme is open to all products and installer companies registered on the Micro-generation Certification Scheme (MCS).
The current deadline for grants to be made and installations to be completed has been extended from 1st July 2009 to April 2011 to run up to the introduction of feed-in tariffs and the Renewable Heat Incentive. Applications

[15] http://www.salixfinance.co.uk/loans.html
[16] http://www.lowcarbonbuildings.org.uk/about/useful/

can be made for up to 50% (up to a maximum of £200,000) of the cost of installing approved technologies, although the maximum grant levels can depend on the nature of the organisation.

Carbon Emission Reduction Target (CERT)

The Carbon Emissions Reduction Target (CERT) is a legal obligation on the six largest energy suppliers to achieve carbon dioxide emissions reductions from domestic buildings in Great Britain. Local authorities and Registered Social Landlord's (RSL) can utilise the funding that will be available from the energy suppliers to fund carbon reduction measures in their own housing stock and also to set up schemes to improve private sector housing in their area.
The main different types of measures that can receive funded under CERT are:

- Improvements in energy efficiency.
- Increasing the amount of electricity generated or heat produced by micro-generation.
- Promoting community heating schemes powered wholly or mainly by biomass (up to a size of three megawatts thermal).
- Reducing the consumption of supplied energy, such as behavioural measures.

The Community Energy Saving Programme

This is a £350million programme for delivering "whole house" refurbishments to existing dwellings through community based projects in defined geographical areas. This will be delivered through the major energy companies and aims to deliver substantial carbon reductions in dwellings by delivering a holistic set of measures including solid wall insulation, micro-generation, fuel switching and connection to a district heating scheme. Local authorities are likely to be key delivery partners for the energy companies in delivering these schemes.17
The Community Sustainable Energy Programme has two grant initiatives. Both are only available to not-for-profit community based organisations in England.

Renewable Obligation Certificates (ROCs)

The Renewables Obligation requires licensed electricity suppliers to source a specific and annually increasing percentage of the electricity they supply from renewable sources. The current level is 9.1% for 2008/09 rising to 15.4% by 2015/16[18]. The types of technology and the number of ROCs achieved per MWh are outlined in Table 34.

Table 34: The types of technology and the number of ROCs achieved per MWh

Technology	ROCs/MWh	Technology	ROCs/MWh
Hydro	1	Energy from Waste with CHP	1
Onshore wind	1	Gasification/Pyrolysis	2
Offshore wind	1.5	Anaerobic Digestion	2
Wave	2	Co-firing of Biomass	0.5
Tidal Stream	2	Co-firing of Energy crops	1
Tidal Barrage	2	Co-firing of Biomass with CHP	1
Tidal Lagoon	2	Co-firing of Energy crop with CHP	1.5
Solar PV	2	Dedicated Biomass	1.5
Geothermal	2	Dedicated energy crops	2
Geopressure	1	Dedicated Biomass with CHP	2
Landfill Gas	0.25	Dedicated Energy Crops with CHP	2 [19]
Sewage Gas	0.5		

[17] http://www.energysavingtrust.org.uk/business/Business/Local-Authorities/Funding
[18] http://www.berr.gov.uk/energy/sources/renewables/policy/renewables-obligation/what-is-renewables-obligation/page15633.html
[19] http://chp.DEFRA.gov.uk/cms/roc-banding/

The value of a ROC fluctuates as it is traded on the open market. However, on the most recent auction day (7 April 2009) the average value of a ROC was £52.65.

Feed-in tariffs

These are due to come into action in April 2010[20] for installations not exceeding 5 MW[21]. The following low carbon technologies are eligible:

- Biomass & Biofuels
- Fuel cells
- PV & Solar Power
- Water (including. Waves and tides)
- Wind
- Geothermal sources
- CHP with an electrical capacity of 50 kW or less

The electricity produced by these technologies will be bought by the utilities at above market prices. These prices will decrease over time to reflect the impact of increasing installation rates on end prices charged to consumers, the goal being to enable industries to "stand alone" at the end of the tariff period[22].

EDF Renewable Energy Fund

EDF customers on the Green Tariff pay a small premium on their electricity bills which is matched by EDF and used to help support renewable energy projects across the UK.
This money is placed in the Green Fund and used to award grants to community, non-profit, charitable and educational organisations across the UK.
The Green Fund awards grants to organisations who apply for funds to help cover the cost of renewable energy technology that can be used to produce green energy from the sun, wind, water, wood and other renewable sources. Funding will be provided to cover the costs associated with the installation of small-scale renewable energy technology and a proportion of the funding requested may be used for educational purposes (up to 20%). Funding may also be requested for feasibility studies into the installation of small-scale renewable energy technology. There is no minimum value for grants, with a maximum of £5,000 for feasibility studies, and £30,000 for installations. All kinds of small-scale renewable technologies are considered. The closing dates for the applications usually fall on the 28th February and the 31st August.

The objective of the Intelligent Energy - Europe Programme aims to contribute to secure, sustainable and competitively priced energy for Europe. It covers action in the following fields:

- Energy efficiency and rational use of resources (SAVE)
- New and renewable energy resources (ALTENER)
- Energy in transport (STEER) to promote energy efficiency and the use of new and renewable energies sources in transport

The amount granted will be: up to 75% of the total eligible costs for projects and the project duration must not exceed 3 years.

[20] http://www.guardian.co.uk/environment/2009/may/14/feed-in-tariff-solar-power
[21] Energy Act 2008 Section 41.4.b
[22] http://www.actionrenewables.org/uploads_documents/SolarcenturyFeedTariffguide.pdf

Merchant Wind Power

This scheme is operated by Ecotricity who build and operate wind turbines on partner sites. Ecotricity take on all the capital costs of the project, including the turbine itself, and also conducts the feasibility, planning, installation, operation and maintenance of the wind turbines. MWP partners agree to purchase the electricity from the turbine and in return receive a dedicated supply of green energy at significantly reduced rates.

Taking Delivery Forwards and Monitoring

Key to delivering an effective area-based low carbon and renewable energy strategy is successfully drawing on all of the available opportunities. This includes the Comprehensive Area Assessment (CAA) process, which recognises the fact that no single organisation can be responsible for meeting local needs. Alongside the opportunities for a local delivery ESCo are shorter-term Local Area Agreements (LAA) and National Indicators. The Renewable Energy Strategy proposes introducing a renewable energy indicator, but until this time several can be used to deliver energy projects:

- NI 185 – Percentage CO_2 reduction from local authority operations.
- NI 186 – Per capita CO_2 emissions in the local authority area.
- NI 187 – Tackling fuel poverty – percentage of people receiving income based benefits living in homes with a low and high energy efficiency rating.

There are a wide range of delivery mechanisms that can be employed to support planning for energy. Not all will be suitable for Waveney and mix is likely to be needed to encompass all of the energy opportunities. This report provides the context for making those decisions. Further work, discussions and advice will be needed to make them happen.

There will be a key role for a range of local actors, led in the first instance by planning. However, to be effective, leadership will be needed at the corporate level with buy-in from the WLSP. The Partnership will need to provide strategic direction for energy policy and delivery of the energy opportunities plan.

6. District-Wide Policy Recommendations

The previous chapters have developed an evidence base for policy development, considering the policy context, the energy use context, the environmental context, the resource potential and delivery considerations. The evaluation of the evidence base has led to the recommendation of four District-wide policies, as set out in the sections below.

The recommended policies relate to the emerging policy considerations from each of the chapters above, as summarised in Table 35 below.

Table 35: Development of policy from key considerations emerging from the evidence base

Policy Consideration	Relevant Chapter	Resulting Policy Recommendation
Significant growth is expected in Waveney District, which needs to be sustainable. Comprises key changes in Lowestoft AAP area, along with small scale residential and light industrial growth.	Chapter 1	Policy 4: Sustainable Construction AAP area policy Recommendations – Chapter 7
Development in Waveney District needs to protect and enhance the local environment and promote Waveney's sustainable development objectives. Water supply and flood prevention are key focus areas for Waveney District.	Chapter 2	Policy 4: Sustainable Construction AAP area policy Recommendations – Chapter 7
Code for sustainable homes and BREEAM standards can be required without significant financial implications up to Code Level 4 and BREEAM 'very good' respectively. Large-scale opportunities for water recycling should be investigated in the AAP area.	Chapter 2	Policy 4: Sustainable Construction AAP area policy Recommendations – Chapter 7
PPS1 requires authorities to provide a framework to encourage low carbon and renewable energy generation, and seek opportunities to require higher standards than Building Regulations.	Chapter 3	Policy 1: Renewable Energy Policy 2: Energy Opportunities Plan Policy 3: Community Infrastructure Levy
The UK Renewable Energy Strategy includes a target of 15% renewable energy by 2020 (30% of electricity and 12% of heat). Built environment and stand-alone generation have a key role to play in meeting this target. It is important to relate targets to the evolving energy demand baseline and growth over the Core Strategy period.	Chapter 3	Policy 1: Renewable Energy
The renewable energy resource in Waveney District is considerable, and sufficient to meet Waveney District's share of national renewable energy targets under various scenarios.	Chapter 4	Policy 1: Renewable Energy

Key opportunities should be encouraged, prioritised and coordinated through planning.	Chapter 5	Policy 2: Energy Opportunities Plan
Delivery mechanisms need to be set up to trigger installation of large-scale renewables and community-scale renewables, particularly wind power and CHP/district heating. The AAP area provides a key opportunity to drive change.	Chapter 5	Policy 2: Energy Opportunities Plan Policy 3: Community Infrastructure Levy AAP area policy Recommendations – Chapter 7
The Council can play a key role in supporting delivery of community-scale opportunities. Action should begin before 2016 and the expected introduction of allowable solutions.	Chapter 5	Policy 2: Energy Opportunities Plan Policy 3: Community Infrastructure Levy

6.1 POLICY RECOMMENDATION: RENEWABLE ENERGY

Recommendation for new Policy 1: Renewable Energy

Applications for standalone energy generation and other CO_2 reductions will generally be supported in the District. The District is seeking new renewable energy generation capacity to deliver an appropriate contribution towards the UK Government's binding renewable energy target. Therefore:

- **At least 214GWh of renewable electricity by 2020 (approximately 30% of total electricity demand in Waveney).**
- **At least 153GWh of renewable heat by 2020 (approximately 12% of total heat demand in Waveney).**

Policy Justification

The binding renewable energy target of 15% of total energy to be generated from renewable sources by 2020 can be delivered through a combination of renewable electricity, heat and transport fuel. The Government's July 2009 Renewable Energy Strategy indicates that this is likely to comprise: 30% of total electricity from renewables; 12% of total heat; and 10% of total transport fuel. Planning has a key role to play across all three but the focus of this study is on electricity and heat, therefore, the targets relate to these elements only.

The targets included in the recommended Policy 1: Renewable Energy are calculated from the expected energy demand baseline derived in Chapter 3.

The energy and heat modelling indicate that the proposed targets are challenging but deliverable. The nature of the renewable energy resource in Waveney means that much of this is likely to be delivered through larger wind turbines, however, small and medium scale wind, solar photovoltaics and other technologies will also play an important role. The role of the local authority and communities as delivery agents will be important and is explored in more detail in the section above.

The Council may wish to support the policy and targets above by setting criteria by which decisions will be taken. In the context of national policy in PPS22 and the PPS1 Supplement and the Regional Spatial Strategy, these would need to cover all or some of the following: local amenity; ecology; landscape and visual impact; cultural heritage; the technologies; weighing up impacts and benefits; and community involvement and ownership.

6.2 POLICY RECOMMENDATION: ENERGY OPPORTUNITIES PLAN

Recommendation for new Policy 2: Delivering the Energy Opportunities Plan

Decentralised, low carbon and renewable energy is a priority for Waveney Council. Planning applications for new development in Waveney will need to demonstrate how they contribute to delivery of the current 'Energy Opportunities Plan'. Delivery can take a number of forms:

- **"Carbon compliance" – this will require at least a minimum level of carbon reduction (compared to current Building Regulations) through a combination of energy efficiency measures, incorporation of on-site low carbon and renewable energy technologies and directly connected heat (heat source not necessarily on-site).**
- **Payments into a 'carbon buyout fund', ideally through a Community Infrastructure Levy (CIL) (refer to Policy 3).**

Compiling the various key energy opportunities across the District for renewable and low carbon energy, these have been used to create an 'Energy Opportunities Plan' (EOP). This can be used as a resource in policy and planning to guide key opportunities for consideration. The Energy Opportunities Plan is shown in Figure 45 below, with a zoomed in version of Lowestoft, Figure 46.

Figure 45: Energy Opportunities Plan

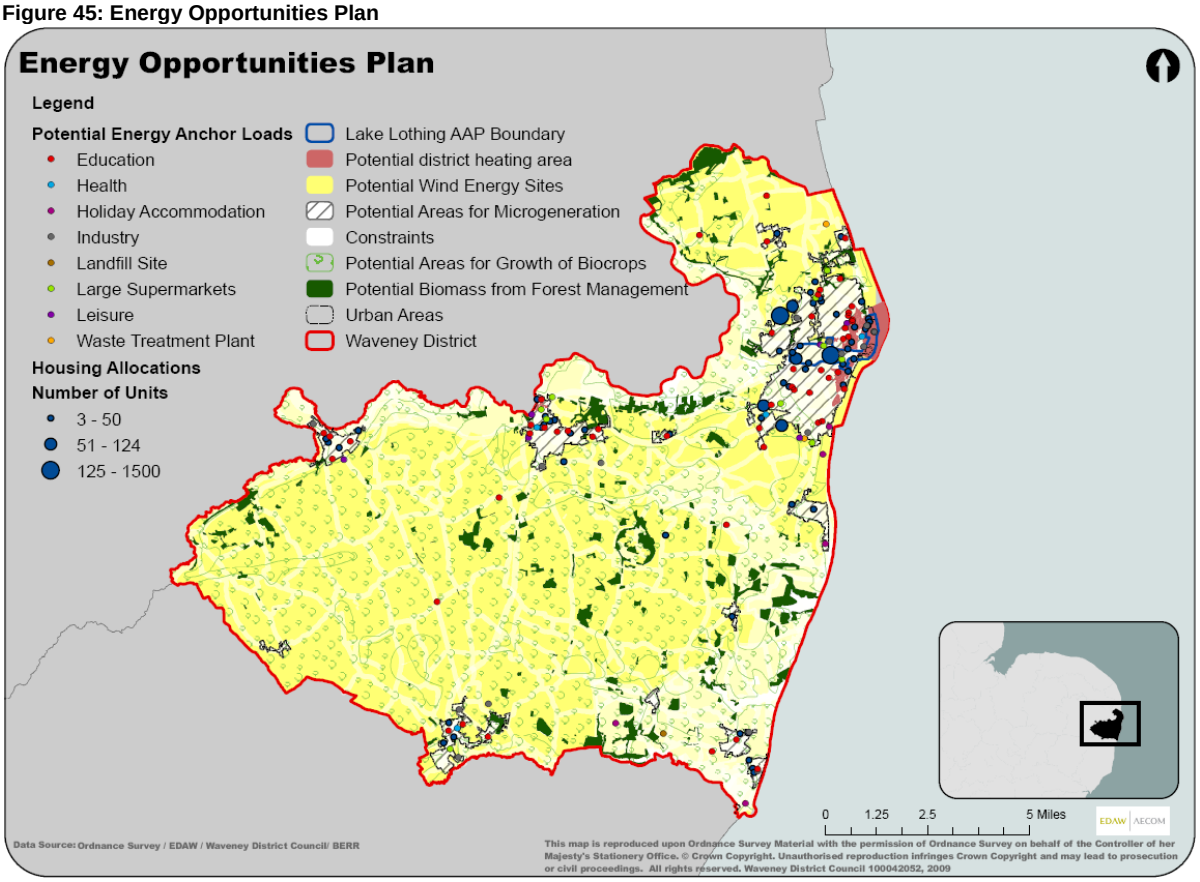
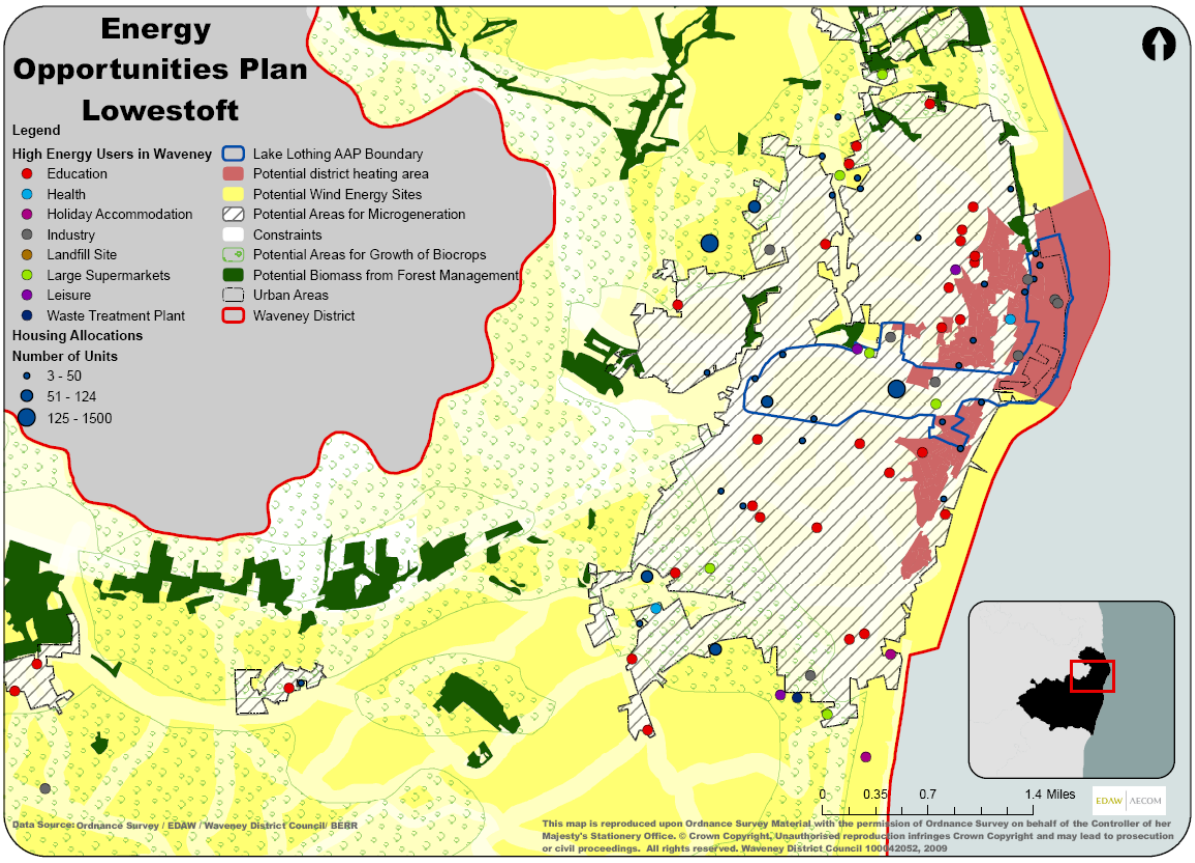


Figure 46: Energy Opportunities Plan - Lowestoft



Policy Justification

The Energy Opportunities Plan (EOP) acts as the key spatial plan for energy projects in Waveney. It underpins the policies and targets described here and sets out where money raised through the CIL will be spent. The plan should also be used to inform policy making in the Sustainable Community Strategy and other corporate strategies, and investment decisions taken by the local authority and Waveney Local Strategic Partnership (see section above for further detail on delivery mechanisms). The EOP should be incorporated into supplementary planning guidance and corporate strategies so that it can be readily updated to reflect new opportunities and changes in feasibility and viability.

The policies proposed here will need to be reviewed if and when the approach to local authority delivery is agreed by the Council and its partners. The review will need to consider:

- The nature of the local authority delivery mechanism and the role of planning policy in supporting this;
- The extent to which existence of this mechanism influences the viability and feasibility of the targets set, and whether more explicit criteria need to be set;
- Whether or not policy can be extended to planning applications for refurbishment.

6.3 POLICY RECOMMENDATION: FUNDING DELIVERY THROUGH COMMUNITY INFRASTRUCTURE LEVY

Recommendation for new Policy 3: Community Infrastructure Levy – Energy and CO_2

In order to contribute to the delivery of the Energy Opportunities Plan, all new buildings in Waveney will be required to either:

- **Be subject to a Community Infrastructure Levy, charged at £100 per tonne of CO_2 per building emitted over a 30 year period (or a one-off payment of £3,000 per tonne of CO_2 per building); or**
- **Achieve a 15% reduction in residual CO_2 emissions in all buildings after Building Regulations Part L compliance has been demonstrated. This can be achieved through "carbon compliance", i.e. a combination of energy efficiency measures, incorporation of on-site low carbon and renewable technologies and directly connected heat (not necessarily on-site).**

Planning approval will be dependent on the provision of design stage and as-built Building Control Compliance documentation clearly showing the Target Emission Rate (TER) and Dwelling Emission Rate (DER) / Building Emission Rate (BER).

More information and supporting guidance will be provided within the Sustainable Design and Construction SPD.

Policy Justification

There is a clear framework throughout national and regional policy for inclusion of CO_2 emissions targets and higher energy and carbon performance standards than Building Regulations. Changes to the Building Regulations for residential buildings, in 2010 and expected in 2013 and 2016, will bring in tough standards for CO_2 emissions. After 2016 it will be necessary for all new residential buildings to be built to zero carbon standards, with the equivalent standard for non-residential buildings due to be introduced in 2019.

The new Policy 3 simply accelerates the move towards zero carbon, as shown in the table below for residential buildings. All new buildings, both residential and non-residential, will be expected to achieve an additional 15% reduction on the residual CO_2 emissions after Building Regulations compliance. This should be met thorough "carbon compliance;" a combination of energy efficiency measures, incorporation of on-site low carbon and renewable technologies and directly connected heat (not necessarily on-site). The function of the policy is to drive delivery of carbon reductions in Waveney. There are key opportunities for wind power and biomass CHP which need to be delivered at a District-wide scale. It is considered essential that immediate action is taken to begin to deliver renewable energy in Waveney to meet 2020 targets. Allowable solutions may provide funding post 2016, but key opportunities will be missed in the interim. The redevelopment of the AAP area will be a key opportunity to delivery infrastructure which is likely to start coming forward, at least in part, before 2016.

The additional 15% of residual emissions is not expected to add significant cost to development (see cost modelling in Appendix A). The additional requirement does not exceed the 70% overall reduction in regulated emissions expected to be met on-site by 2016 under current government proposals, and is therefore considered feasible. In the case where additional carbon reductions are not feasible on-site or are considered to add significant cost, the 'carbon buyout fund' can be utilised by developers. The 2007 Housing Market Assessment for Waveney shows that there is a need for high quality housing in Waveney, with housing delivery progressing at a faster rate than surrounding areas (prior to the recession). Therefore, we expect that the limited cost uplift, combined with the certainty of cost given by the 'carbon buyout fund' and the flexibility of possible approaches, will not adversely affect delivery in the area. The Housing Market Assessment highlights the need for greater affordable housing delivery in urban areas, and therefore cost uplift issues may need to be assessed accordingly in light of other Section 106 demands in certain cases.

The total CO_2 emission savings targets are shown in the right hand column of Table 36. They are calculated by adding the building regulations targets to the additional local target for an additional 15% reduction on the residual regulated emissions. Taking the top row of table 36 as an example - where the building regulations target is for a 25% reduction on regulated emissions the residual regulated emissions are 75%. A 15% reduction of 75% is 11.25%. By adding 25% with 11.25% you get the 36.25% target.

Table 36: Comparing Waveney District Council new policy 3 with Building Regulations standards

Carbon Compliance Required for Residential Buildings			
Period	**Building Regulations Part L (residential)**	**Waveney District Council Additional Reduction in Regulated Emissions**	**Total**
2010-2013	25%	11.25%	36.25%
2013-2016	44%	8.4%	52.4%
Post 2016	70%	Allowable Solutions	Zero Carbon

In setting the minimum level of carbon compliance that all new homes are required to meet, we need to be confident that we are not setting technical standards or costs that are unacceptably high for development. Government has decided[23] that, based on the assumptions in its consultation document on the definition of zero carbon[24], a carbon compliance standard of 70% of regulated energy use is as ambitious as possible for on-site CO_2 mitigation, while being technically achievable on most sites. The additional reductions required by Waveney District Council should therefore be technically feasible on the majority of developments.

Nonetheless, there may be circumstances when it is not possible or desirable to achieve the standards proposed for Policy 3. An example might be where there is no district heating network available or planned to connect to and other technologies. Developers who feel that they are unable to meet the standards required by the new Policy 3 do have an alternative way of contributing towards a lower carbon district. The new policy introduces a 'carbon buyout fund'. The preferred fund mechanism will be the Community Infrastructure Levy that applies to every building constructed within Waveney at a rate to be determined by Government. Since the CIL cannot apply until April 2010 and the Regulations are still in draft form, this policy recommendation may need to be reviewed post April 2010.

The aim is to provide a mechanism that helps deliver the EOP, but is also compatible with delivery of 'allowable solutions' post 2016. The proposed levy has therefore been capped at £100 per tonne of carbon up to a maximum of £3,000 and has been selected to balance incentives for innovation whilst maintaining confidence in the house building market. In its definition of zero carbon consultation, Government selected 30 years as being broadly representative of:

- The lifetime of on-site low carbon and renewable carbon technologies; and
- The period beyond which the electricity grid will be substantially decarbonised.

The costs of meeting new Policy 3 are therefore transparent and provide certainty to the developers as to the extent of their planning obligations. Diverting these payments into a carbon buyout fund via the CIL could provide the District with an income for investment in low carbon and renewable energy projects, as identified by the EOP. The fund should allow Waveney District Council to strategically coordinate and phase the infrastructure required to deliver community scale energy generation installations such as district heating networks.

The new Policy 3 does allow flexibility in the ways that applicants mitigate CO_2 emissions and it is expected that at the lower standards, the most cost effective way to meet the target will be through increased energy efficiency. However, it is probable that as Building Regulations Target Emissions Rates increase over time, many will choose to install on-site renewable technologies, which will assist the District in meeting regional renewables targets.

It is important to emphasise that no real energy or CO_2 reductions are achieved from new development, but simply the mitigation of additional energy demand. For the Government's binding target of an 80% reduction in CO_2 equivalent by 2050 from 1990 levels, development presents something of a problem since it increases CO_2 emissions. Attempts to mitigate climate change cannot only come from planning policy. The delivery section sets out options that local authorities have access to. Delivery can also come in the form of assurances by regional and national politicians and inspectors that, in determining planning applications, CO_2 reduction issues are paramount. To justify these policies, Districts can refer to this evidence base and also to relevant government policy which is continually evolving and strengthening.

Implementation of the Policy and Expected Revenue

This places a requirement for all new buildings, both residential and non-residential, to achieve a 15% reduction in residual CO_2 emissions beyond that required by the Building Regulations, with the alternative option available of a payment into a Carbon Buyout Fund. The amount to be paid to the Carbon Buyout Fund is charged at a rate of £100 per tonne of CO_2 over the building lifetime of 30 years; this equates to a lump sum of £3,000 per tonne of CO_2. The levy has been capped in accordance with the central option costs for allowable solutions in the Zero Carbon consultation, reflecting the cost of off-site renewable electricity. The sections below explain the

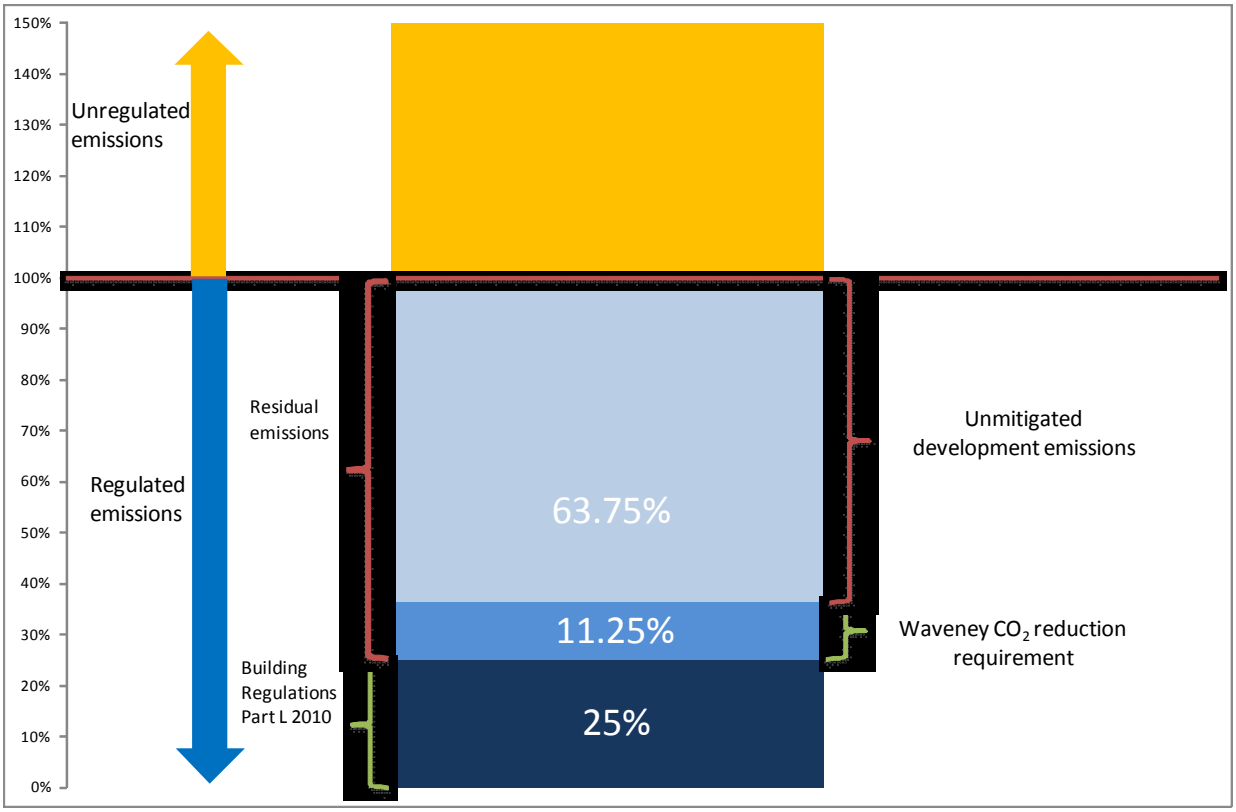
[23] Eco-towns and zero carbon homes statement (Minister for Housing & Planning, July 2009)
[24] Impact Assessment of the Zero Carbon Homes Consultation, CLG, December 2008

implementation and measurement of the policy over time and the expected contribution that might be paid to the Carbon Buyout Fund.

Period from 2010 to 2013

From 2010, it is likely that the Building Regulations will require an improvement of 25% in the regulated CO_2 emissions of residential buildings on 2006 levels. The Building Regulations and proposed Waveney policy requirements from 2010 are illustrated below in Figure 47.

Figure 47: Building Regulations 2010 requirements plus Waveney 2010 CO_2 reduction requirements



The table below gives an indication of the maximum levies that are likely to be incurred by standard dwelling types between 2010 and 2013, if built to minimum Building Regulations standards.

Table 37: Building Regulations 2006 Baseline TER, Building Regulations 2010 updated TER and Waveney required TER, and the maximum levy chargeable for some standard dwelling types

Building Type	Building Regulations 2006 TER (annual tonnesCO2)	Building Regulations 2010 TER (annual tonnesCO2)	Waveney required TER (annual tonnesCO2)	Emissions Subject to Levy (annual tonnesCO2)	Levy cost (£)
Detached	2.20	1.65	1.40	0.25	**£740.84**
Semi	1.61	1.21	1.03	0.18	**£544.01**
End	1.48	1.11	0.94	0.17	**£499.09**
1 bed flat	1.06	0.79	0.67	0.12	**£356.29**
2 bed flat	1.30	0.97	0.83	0.15	**£438.03**
General office	26.48	19.86	16.88	2.98	**£8,937.08**
General retail	6.27	4.70	4.00	0.71	**£2,115.01**

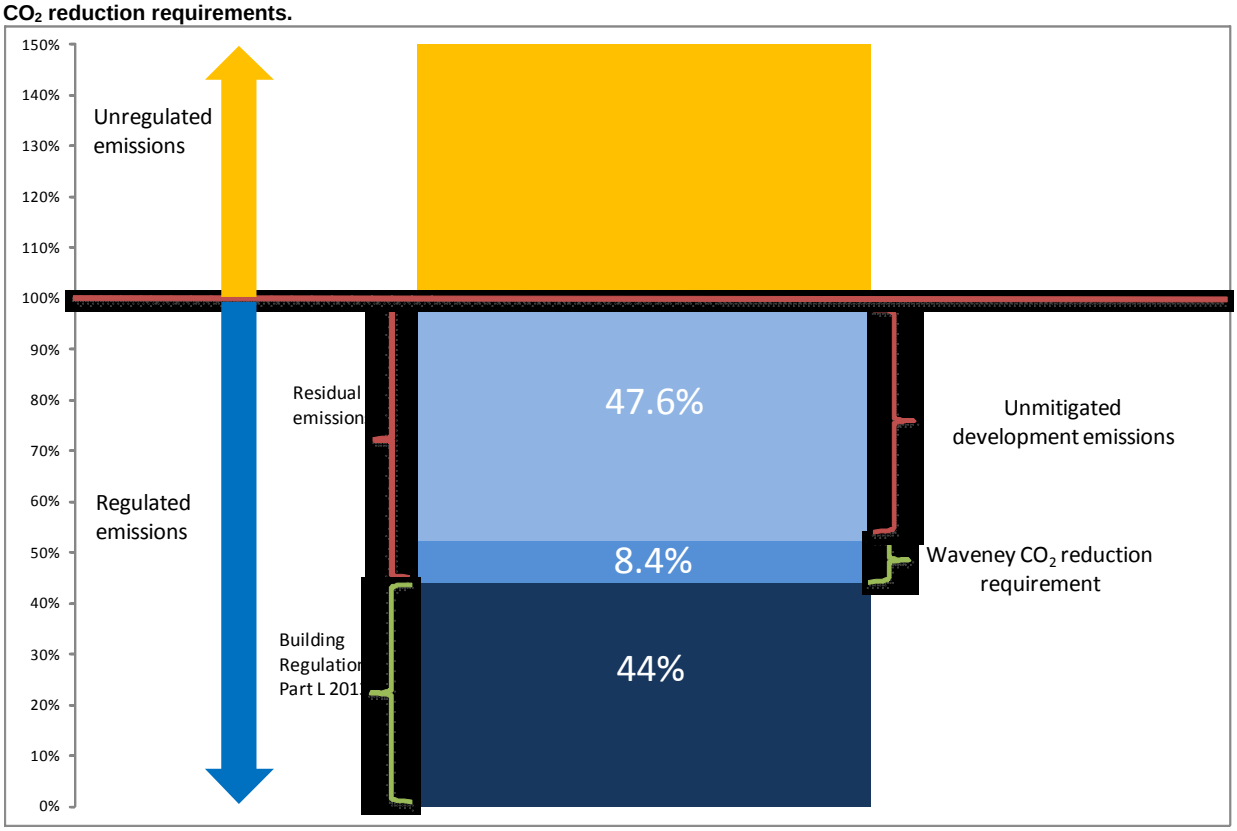
It should be noted that on certain sites, there may be other factors, beyond capital cost, affecting the decision of whether to invest in additional carbon compliance or make a payment into a Carbon Buyout Fund. For example, the developer may also be the building occupant, or, in the case of a housing association, will have an interest in reducing the running costs for tenants as well as their own management costs for energy services, and energy for communal areas, etc. They may also be able to take advantage of feed-in tariffs from installing micro-generation technologies. Where the developer is planning to provide commercial rents, they may also have an interest in reducing energy costs for communal areas. Building occupiers will also benefit from reduced risk and security of supply.

Developers may also be able to market zero or low carbon developments at a premium. An example of this is seen in the mindset of developers committed to respond to Merton-Plus style planning policies, requiring a proportion of energy demand to be met through on-site renewable energy. Many have viewed this as an opportunity to lead the field in the designing, constructing and marketing of low carbon buildings – with the opportunity to sell them at above market rate. This "marketability" aspect may increase in the future, homeowners become more aware of the energy performance of new buildings through the energy labelling measures that came into force in the UK in 2008 from the EU Energy Performance in Buildings Directive.

Period from 2013 to 2016

From 2013, it is expected that the Building Regulations will require an improvement of 44% in the regulated CO_2 emissions of residential buildings on 2006 levels. There are currently no proposals for changes to the standards for non-residential buildings in this period. Building Regulations and proposed Waveney policy requirements from 2013 are illustrated in Figure 48.

Figure 48: Building Regulations 2013 requirements (applicable to new residential buildings only) plus Waveney 2013 CO_2 reduction requirements.



Examples of the levies that are likely to be incurred by standard dwelling types from 2013 are presented in Table 38.

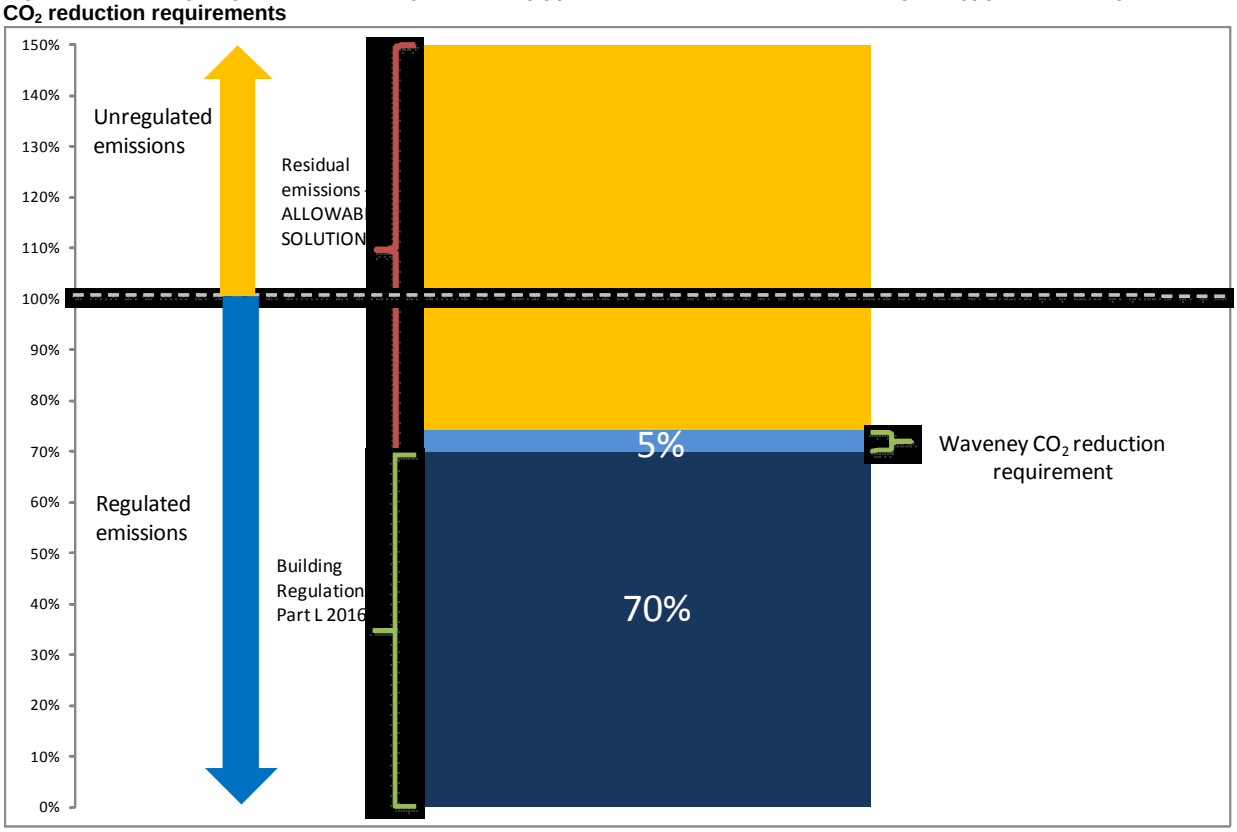
Table 38: Building Regulations 2006 Baseline TER, Building Regulations 2013 updated TER and Waveney required TER, and the maximum levy chargeable for some standard dwelling types

Building Type	Part L 2006 TER (annual tonnesCO_2)	Part L 2010 TER (annual tonnesCO_2)	Waveney required EER (annual tonnesCO_2)	Emissions subject to levy (annual tonnesCO_2)	Levy cost (£)
Detached	2.20	1.23	1.04	0.18	**£553.16**
Semi	1.61	0.90	0.77	0.14	**£406.19**
End	1.48	0.83	0.70	0.12	**£372.65**
1 bed flat	1.06	0.59	0.50	0.09	**£266.03**
2 bed flat	1.30	0.73	0.62	0.11	**£327.06**
General Office	26.48	19.86	16.88	2.98	**£8,937.08**
General Retail	6.27	4.70	4.00	0.71	**£2,115.01**

Post 2016

Current government policy suggests that all new residential buildings will be required to be zero carbon. Developers will have to reduce both regulated and unregulated CO_2 emissions by up to 70% "carbon compliance" i.e. improved energy efficiency measure or on-site low carbon and renewable energy generation. The remaining 30% will have to be offset through allowable solutions. In 2016, the additional reduction in the TER required by the proposed new Waveney policy will be 5% of total building CO_2 emissions. The Building Regulations and proposed Waveney policy requirements from 2013 are illustrated below in Figure 49.

Figure 49: Building Regulations 2016 requirements (applicable to new residential buildings only) plus Waveney 2016 CO_2 reduction requirements



Government has announced that all new schools will be expected to be zero carbon by 2016. Guidance is likely to be introduced as to how new school buildings will meet this standard.

Other non-residential buildings will incur the same costs as in the period 2010-2016, unless changes to the Building Regulations are introduced to ease the trajectory to zero carbon.

Post 2019

All new buildings are expected to be required to be zero carbon. Guidance is likely to be introduced as to how non-residential buildings will meet this standard.

6.4 POLICY RECOMMENDATION: SUSTAINABLE CONSTRUCTION TARGETS FOR NEW DEVELOPMENT

Recommendation for new Policy 4: Sustainable Design and Construction

All new residential developments in Waveney are required to meet full Code for Sustainable Homes standards or equivalent. These requirements will not come into effect until successive updates to Part L of the Building Regulations become mandatory:

- **At least Code level 3 will be required for all new homes once updates to Part L come into effect (currently scheduled for April 2010).**
- **At least Code level 4 will be required for all new homes once updates to Part L come into effect (currently scheduled for 2013).**

All new non-residential developments in Waveney over 1000 square metres gross are required to achieve the BREEAM the "Very Good" standard or equivalent, with immediate effect (relevant versions of BREEAM are available covering offices, retail, industrial, education and healthcare).

Planning applications will require submission of interim Code for Sustainable Homes certificates or design stage BREEAM certificates as appropriate, in order to demonstrate compliance. Planning conditions will require submission of final Code certificates and post-construction BREEAM certificates, as appropriate. Conditions will not be discharged until compliance has been demonstrated in this way.

Table 39: Comparing Waveney District Council new policy 4 with Building Regulations standards

Period	Building Regulations Part L	Waveney District Council
2010-2013	25% reduction of regulated carbon emissions compared to 2006 Building Regulations (equivalent to Code for Sustainable Homes Level 3 Energy Requirements)	Full Code Level 3 required
44	44% reduction of regulated carbon emissions compared to 2006 Building Regulations (equivalent to Code for Sustainable Homes Level 4 Energy Requirements)	Full Code Level 4 required
Post 2016	Zero carbon (including all regulated and unregulated emissions in line with the Government definition)	Full Code Level 4 required

Policy Justification

The PPS1 Supplement allows local authorities to require levels of building sustainability in advance of those set nationally where local circumstances warrant them. Issues around water, waste and recycling, ecology and land use, pollution and Lifetime Homes sections should be prioritised by the Council as being of particular relevance to Waveney. The District will be disproportionately affected by climate change, rises in sea and river levels, frequent summer droughts and winter flooding, changes in the landscape as well as changes in habitats and species composition, habitat fragmentation and changes in soils, agricultural land use, recreation and tourism and cultural heritage.

This means that actions must not only be taken to reduce the impacts of climate change by reducing CO_2 emissions, but also to adapt proposed development to the effects of climate change and other environmental

damage. The Code for Sustainable Homes (CfSH) is the voluntary Government-backed building assessment tool that covers a full range of sustainability issues including, but not restricted to, energy and CO_2 emissions.
The proposed policy does not require residential building to standards beyond Code Level 4. At Code Level 4, based on cost analysis available (see section 1), the cost uplift associated with Level 4 is expected to be achievable on most sites. Therefore, this is a suitable requirement to drive good design and a needed response to climate change over across the District, and it is up to developers to demonstrate compliance is not achievable where special site conditions exist. At higher levels of the Code, the mandatory criteria for low water use ($80m^3$ per person per day) effectively means that all new homes will have to have a greywater recycling or rainwater capture system in order to meet the requirements. Including water requirements beyond Code 4 would currently add significant financial burden to a development and would increase its energy consumption. A number of research reports also challenge the idea that such systems are more sustainable or environmentally benign than the use of main water. We expect the approach to water efficiency to progress rapidly in the coming years to address these issues. This study has therefore concluded that the installation of water reuse systems on all new homes would place an unnecessary burden on development, but we would encourage early review of the Code water criteria to account for future changes in requirements for Code Levels 5/6 and greater clarity over what constitutes an appropriate approach.

Similarly, BREEAM ‘very good’ is a widely adopted measure for non-residential buildings, and is considered viable for the majority of buildings. Cost up-lift surrounding BREEAM ‘excellent’ is much more substantial, and hence this standard is not recommended for Waveney.

7. Strategic Sites and Character Areas

7.1 INTRODUCTION

PPS 1 Climate Change Supplement sets out a requirement that:

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

This chapter focuses on opportunities particular to the Lake Lothing AAP area in central Lowestoft and the potential to exceed the District wide targets for low carbon energy. In addition, the three development characters which are considered most prevalent are profiled to provide evidence for Waveney District Council in support of the proposed District wide targets and to highlight the opportunities and constraints related to each development character to allow the Council to identify potential to surpass those targets as suitable sites come forward.

7.2 STRATEGIC SITE - LAKE LOTHING AAP AREA

The Lake Lothing AAP is a statutory development plan document that sets out the vision, objectives and structural masterplan for an area of around 135ha of land in the centre and along the waterfront of Lowestoft as shown in Figure 50. This area is central to regeneration objectives and is expected to accommodate 1500 new dwellings. The preferred option, setting out the proposed masterplan, was published in 2007. This is currently being reviewed, although it is considered that the broad land use mix will remain including around:

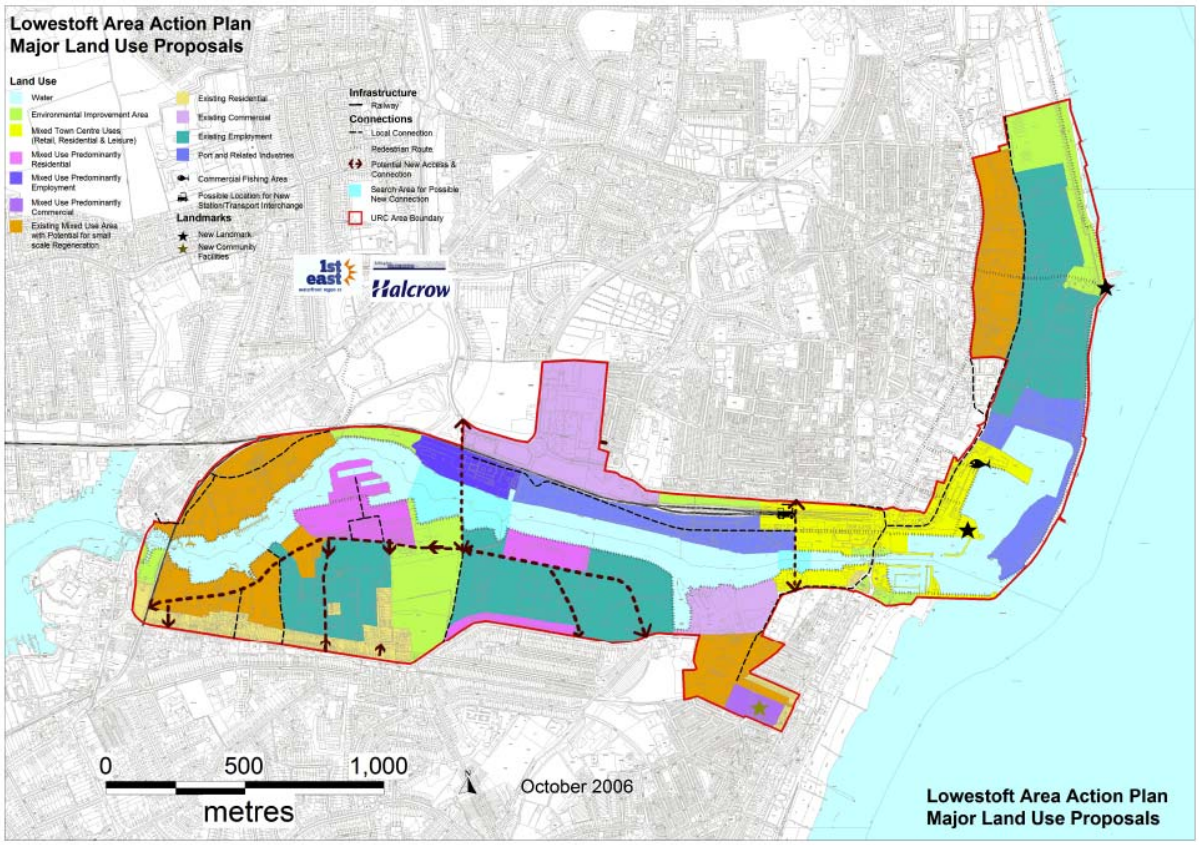
- ~100,000sqm office
- ~20,000sqm retail
- ~125,000sqm mixed use (inc leisure, tourism, research, community)
- ~13ha port/light industrial

The AAP proposed masterplan shows a number of land uses or zones - as shown in Figure 51 below. This masterplan is currently subject to review and may change as the AAP process progresses. Accordingly, this study is based on the current masterplan, but highlights changes to the energy strategy which may occur in relation to changes in land uses. It is recommended that an energy study of the site is completed once land use breakdowns and locations are finalised. This will allow the AAP to allocate sites for energy infrastructure and to arrange delivery mechanisms accordingly.

The detail in terms of building areas within each of these zones and the proposed development phasing is not known at this stage. Energy demands at this stage have been estimated based on a number of assumptions, and low and zero carbon technology opportunities have been considered for the AAP as a whole, irrespective at this stage, of development phasing.

Figure 50: Lake Lothing AAP area

Figure 51: Lake Lothing AAP – Major Land Use Proposals



Future AAP energy demands

Assumptions relating to the proposed building numbers and areas are shown below in Table 40 and Table 41 sets out the assumed development phasing. Note that at this stage the development housing mix and phasing timetable is purely indicative for purposes of modelling since a confirmed mix was not available at the time of this report. The assumptions reflect an urban context, to give an idea of the scale of potential. As such, once the development mix has been finalised, it would be advisable to revisit these findings.

Table 40: Assumed development quantum, building type

New Commercial	
CIBSE: TM46 Energy Benchmarks	**m3**
General office	100,000
General retail	20,000
Large non-food shop	65,000
Large food store	20,000
Restaurant	30,000
Cultural activities	30,000
Entertainment halls	20,000
Fitness and health centre	10,000
Public buildings with light use	15,000
Workshop	65,000
New Residential	
Housetype (new/post 2001)	**Units**
Detached (new/post 2001)	0
Semi-detached (new/post 2001)	40
Terraced (new/post 2001)	160
3 bed flat (new/post 2001)	550
2 bed flat (new/post 2001)	400
1 bed flat (new/post 2001)	350

Table 41: Assumed phasing

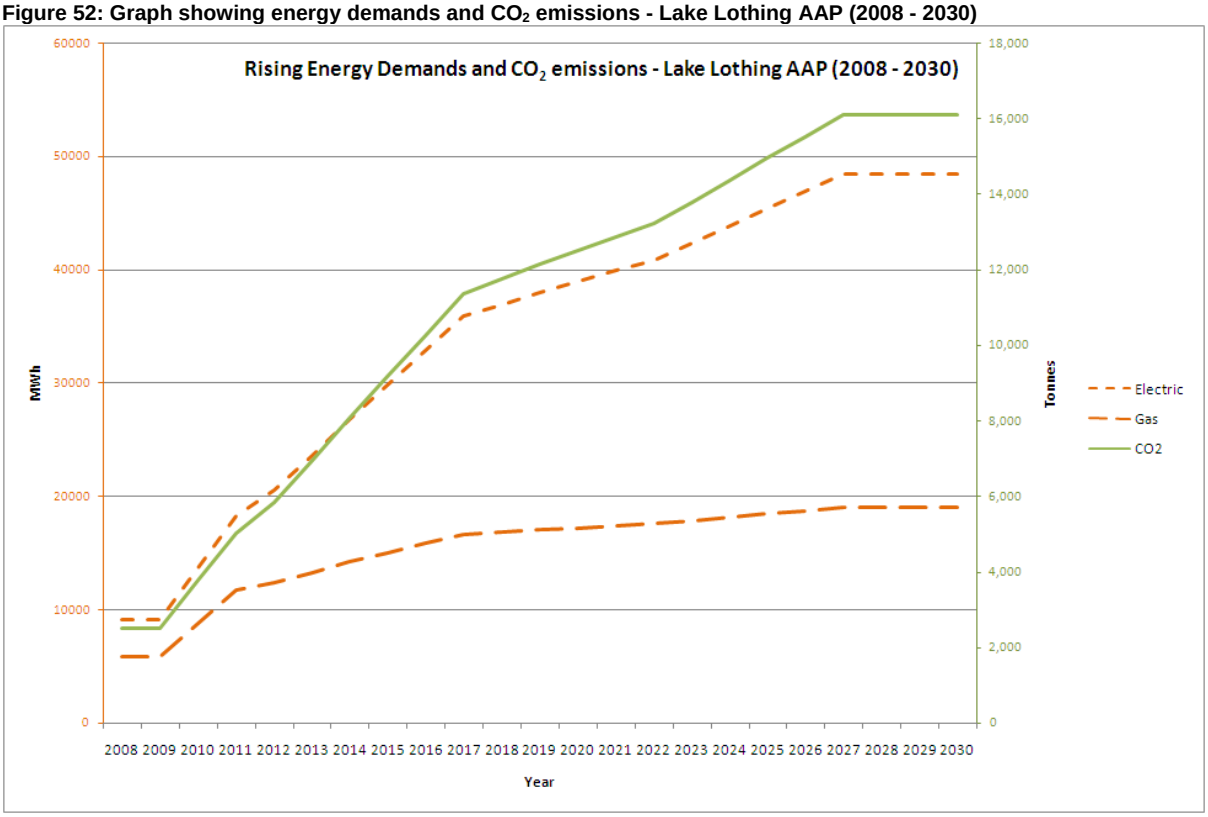
Year	Development Progress	Year	Development Progress
Pre 2009	10%	2018	66%
2009	15%	2019	69%
2010	20%	2020	72%
2011	25%	2021	75%
2012	32%	2022	80%
2013	39%	2023	85%
2014	46%	2024	90%
2015	53%	2025	95%
2016	60%	2026	100%
2017	63%		

Indicative energy demands and consequential CO_2 emissions for the AAP area are shown in Table 42 and Figure 52 below. These estimates have been made using industry standard energy benchmarks (kWh/m^2) for different building types and are based on the assumptions set out above for development quantum, building types and development phasing. At this stage no allowance has been made to take account of reduced demands from buildings which may result from the introduction of minimum standards for energy efficiency through future versions of Part L of the Building Regulations.

Table 42: Energy demands and CO_2 emissions - Lake Lothing AAP (2008 - 2030)

Phasing	Heat				Electric				CO_2
	Commercial	*Residential*	**TOTAL**	**CO_2**	*Commercial*	*Residential*	**TOTAL**	**CO_2**	
	kWh	kWh	MWh	tonnes	kWh	kWh	MWh	tonnes	tonnes
Pre-2008	5,124,375	773,203	5,898	1,144	2,799,375	470,503	3,270	1,380	2,524
2009	5,124,375	773,203	5,898	1,144	2,799,375	470,503	3,270	1,380	2,524
2010	7,686,563	1,159,805	8,846	1,716	4,199,063	705,754	4,905	2,070	3,786
2011	10,248,750	1,546,406	11,795	2,288	5,598,750	941,005	6,540	2,760	5,048
2012	12,810,938	1,933,008	14,744	2,860	6,998,438	1,176,256	8,175	3,450	6,310
2013	16,398,000	2,474,250	18,872	3,661	8,958,000	1,505,608	10,464	4,416	8,077
2014	19,985,063	3,015,492	23,001	4,462	10,917,563	1,834,960	12,753	5,382	9,844
2015	23,572,125	3,556,735	27,129	5,263	12,877,125	2,164,312	15,041	6,347	11,610
2016	27,159,188	4,097,977	31,257	6,064	14,836,688	2,493,663	17,330	7,313	13,377
2017	30,746,250	4,639,219	35,385	6,865	16,796,250	2,823,015	19,619	8,279	15,144
2018	32,283,563	4,871,180	37,155	7,208	17,636,063	2,964,166	20,600	8,693	15,901
2019	33,820,875	5,103,141	38,924	7,551	18,475,875	3,105,317	21,581	9,107	16,659
2020	35,358,188	5,335,102	40,693	7,894	19,315,688	3,246,468	22,562	9,521	17,416
2021	36,895,500	5,567,063	42,463	8,238	20,155,500	3,387,618	23,543	9,935	18,173
2022	38,432,813	5,799,024	44,232	8,581	20,995,313	3,528,769	24,524	10,349	18,930
2023	40,995,000	6,185,625	47,181	9,153	22,395,000	3,764,020	26,159	11,039	20,192
2024	43,557,188	6,572,227	50,129	9,725	23,794,688	3,999,272	27,794	11,729	21,454
2025	46,119,375	6,958,829	53,078	10,297	25,194,375	4,234,523	29,429	12,419	22,716
2026	48,681,563	7,345,430	56,027	10,869	26,594,063	4,469,774	31,064	13,109	23,978
2027	51,243,750	7,732,032	58,976	11,441	27,993,750	4,705,025	32,699	13,799	25,240
2028	51,243,750	7,732,032	58,976	11,441	27,993,750	4,705,025	32,699	13,799	25,240
2029	51,243,750	7,732,032	58,976	11,441	27,993,750	4,705,025	32,699	13,799	25,240
2030	51,243,750	7,732,032	58,976	11,441	27,993,750	4,705,025	32,699	13,799	25,240

Figure 52: Graph showing energy demands and CO_2 emissions - Lake Lothing AAP (2008 - 2030)



Major variations to the proposed land uses

It is important to note that the energy demands shown above are guided by the land uses set out in the proposed masterplan for the AAP (2007). This masterplan is still developing and changes to the proposed building uses could have significant impacts on the expected energy demands. Alternative phasing strategies will also significantly impact the timing of energy demands, as well as the technical viability of some of the low and zero carbon solutions which may be considered to help meet these demands.

A shift towards a more residential focused scheme would have the effect of reducing the overall electricity demand and CO_2 emissions compared against a scheme of predominantly office and retail. If changes to the masterplan reduce the amount of commercial development, and replace with light industrial development, depending on the types of industries, demand for gas or heat sources may increase. Table 43 below shows gas, electricity and CO_2 benchmarks (per m^2) for 5 standard commercial and residential types. Industrial types are difficult to compare as energy use changes depending on type of industry. The traffic light shading shows where demands or emissions are high (red) or low (green). Table 43 is intended only to illustrate how a changing masterplan (i.e. different assumptions relating to building uses) can impact on overall energy demands for the AAP area. It will therefore be important to iteratively review the energy demand estimates as the masterplan is developed.

Table 43: Relative energy benchmarks (Gas and Electric) for different building types

Varying energy benchmarks for different building types						
		Commercial				Residential
		General office	High street agency	General retail	Large non-food shop	Average residential
Gas	kWh/m^2	120	0	0	170	60 - 90
Electric	kWh/m^2	95	140	165	70	30 - 48
CO_2	kg/m^2	69	27	32	85	25 - 37

Other impacts of masterplan changes to consider:

- Dense development is less energy intensive - Large detached homes have a much greater heat requirement and greater heat loss than terraced homes or flats in apartment buildings due to their increased surface to floor area ratio. Typically a development where a greater proportion of the overall housing mix is apartments and terrace homes will have a lower energy demand than a development which is more predominantly detached homes. A reduction in the expected density of development is likely to increase energy demand.
- Compact master plans also facilitate a greater number of options for delivering heat and power to homes in a low carbon way. The higher density helps to make District heat and power options more economically viable, it also means that more space is available for the siting of wind turbines on-site.
- If the quantum and density of the AAP area decreases under changed proposals, the energy intensity will also decrease. In terms of energy options, this will decrease efficiency of CHP or district heating, but conversely may increase unconstrained space for large scale wind power on-site.

Opportunities and Constraints for Low and Zero Carbon Technologies

Low or zero carbon (LZC) technologies or building improvement which could be considered for the Lothing AAP include:

Enhanced energy efficiency - improved fabric and services specifications

There are no site specific opportunities or constraints for enhanced energy efficiency within the AAP area. Meeting higher standards of energy efficiency will reduce what needs to be done on-site with renewables and low carbon technologies to deliver the carbon compliance level (i.e. either 44% (of regulated emissions) for Code for Sustainable Homes level 4 or 70% (of regulated emissions) for 'zero carbon').

Current building energy modelling for housing shows that energy efficiency alone can deliver up to a 25% reduction on the building TER, although this varies depending on the house type and may increase change going forward due to potential changes to the notional building proposed in published SAP (i.e. Standard Assessment Procedure) consultation documents. The notional building is used as the modelling base case.

Solar Water Heating (SWH)

SWH has been successfully used in various building types but contributes little CO_2 reduction (in percentage terms) in commercial building uses (e.g. offices, retail, leisure etc) where demand for hot water is low relative to the overall building energy demand. SWH is more attractive for use in homes, where it is well proven and can contribute up to ~13% CO_2 saving. New homes (after 2013) will be required to deliver a greater level of CO_2 saving than can be delivered using just SWH and the technology may be less favoured in future as it competes for demand with other technologies such as biomass heating and Combined Heat and Power (natural gas or renewable fired) both of which can contribute much higher levels of CO_2 saving. These technologies also meet energy demands for space heating and - in the case of CHP - generate electricity. Good design should mean that there are no constraints to the use of SWH. Roofs should be able to be designed to accommodate the panels and flats and houses can be designed allowing for hot water storage. Benefits from SWH can be less in tall buildings where potentially not all of the flats can be served.

Photovoltaics (PV)

Other than wind turbines, PV is the only renewable energy technology which delivers electricity. PV is a proven technology which has become more cost effective in the last few years as prices have dropped relative to other LZC technologies. PV is likely to play a major role in delivering future targets for on-site CO_2 reduction. The energy output from PV is only limited by the amount of suitable area for accommodating panels, and by cost. Good design should be able to maximise the area which can be used for mounting PV panels, which need to face South at a 30^o pitch. Valley roofs or flat roofs can be used where conventional pitched roofs cannot be orientated to face South.

The economics of PV is likely to be further improved in the future with the introduction of feed-in tariffs from April 2010. This presents a major opportunity to introduce commercially viable PV arrays. Large areas of roof space, like the

industrial roofs likely to be present within the AAP area present an ideal opportunity for PV arrays, and could also be an iconic feature for the AAP area.

Ground Source Heating (GSHP)

The potential for the use of open loop ground source heating and cooling on or close to the AAP opportunity has not been investigated. It is assumed that closed loop systems either in to the ground or water bodies (lake/ estuary) could be employed to meet energy demands from some of the buildings within the AAP masterplan. Given the proposed land raising, it would need to be ensured that ground conditions are suitable for the use of GSHP.

Ground Source Heating/Cooling is unlikely to deliver the 44% reduction on regulated CO_2 emissions that is required to meet Code for Sustainable Homes Level 4 energy requirements. GSHP can deliver Code for Sustainable Homes Level 3 energy requirements (or Level 4 when combined with other technologies). However much of the benefit from GSHP is due to the technology taking advantage of the 'fuel factor' for electricity; this means that the calculated TER is higher than if the base case were gas heating, therefore making it easier to meet the target improvements set by the Code. The use of this fuel factor for heat pumps is being reviewed for future versions of Building Regulations[25], meaning that in future GSHP's may not achieve the calculation benefits they do under current Regulations.

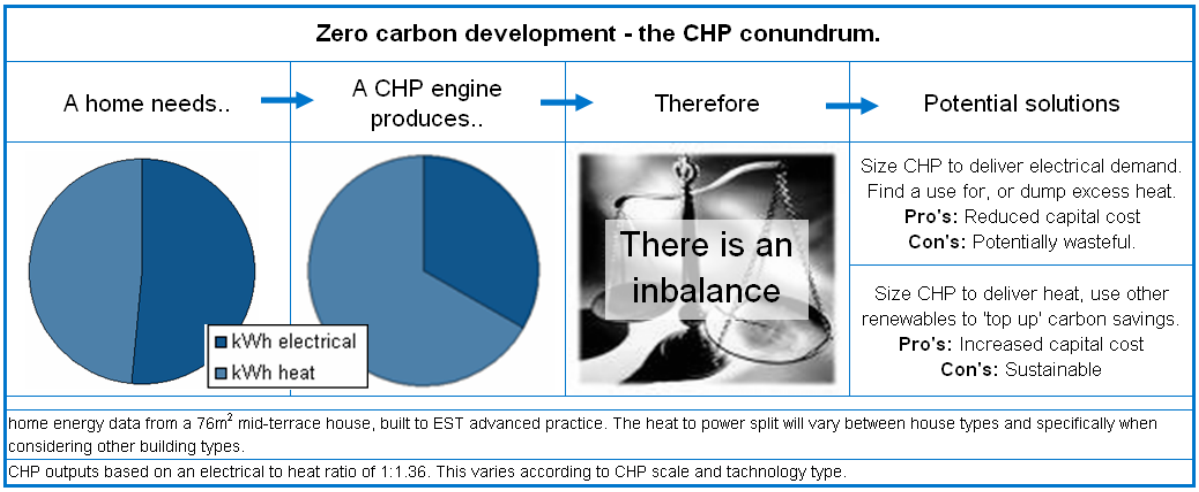
Biomass Boilers/Biomass Combined Heat and Power (BCHP)

Section 4.5 sets out that there is around 950 hectares of unmanaged woodland in Waveney which could be used as fuel either for biomass boilers or in combined heat and power (CHP). In addition there is potential to grow energy crops in the East of England which could increase biomass supply. The Lake Lothing AAP development could be a site for a tree station which could act as a catalyst for further uptake of biomass technology in the area. Fuel supply in the short term (until 2020) should not limit biomass technology uptake.

Biomass boilers may be preferred for the residential development. Mixed use and commercial development which has a higher electricity demand may be better suited to CHP. Biomass could also be used as a CHP fuel. Biomass boilers typically deliver ~44% CO_2 saving in homes by meeting the demand for space heating and Domestic Hot Water (DHW). This can be topped up by also using PV as part of the same energy strategy. Biomass CHP can meet the energy requirements of Code for Sustainable Homes Level 5 (100% reduction on regulated emissions) and can deliver greater savings if sized to meet the development electric demand – although this does mean that some of the heat generated is lost. Figure 53 is intended to illustrate the issues around the sizing of combined heat and power engines.

[25] Energy efficiency requirements for new dwellings, A forward look at what standards may be in 2010 and 2013 http://www.communities.gov.uk/documents/planningandbuilding/pdf/Energyefficiencyrequirements.pdf

Figure 53: Illustration of the issues around sizing CHP engines. (i.e. should designers target system efficiency or CO_2 savings?)



The successful use of biomass CHP on-site would be a reason to consider setting higher planning targets for the AAP. The fuel resource per-se does not seem a limiting factor however further study would be required to ascertain whether the development scale, type and density is sufficient to make the development of an on-site biomass CHP plant commercially viable.

Gas fired Combined Heat and Power (CHP)

Gas fired CHP (for homes) typically delivers CO_2 savings of around 44% (Code Level 4). Although the technology is likely to be viable as a heat and power source for the homes linked into other major heat anchors this does not warrant the consideration of CO_2 reduction targets greater than are being proposed for Waveney as a whole. Gas fired CHP provides a useful interim district heating solution until sufficient development scale is achieved to make biomass CHP financially viable. It requires the installation of the same basic district heating infrastructure.

Biomass heating and biomass CHP are also likely to benefit in the future from the proposed Renewable Heat Incentive (RHI) from April 2011. The government are consulting on the detail of the Renewable Heat Incentive later in 2009 which will provide more information on the possible impact on homeowners, communities and businesses.

Wind Turbines

Micro (building mounted) wind turbines have not been considered – early feedback from field trials (by BRE, Carbon Trust and Energy Savings Trust) has shown limited energy outputs from small turbines installed in urban locations where wind conditions are turbulent. Section 4.3 and section 4.4 of this report set out the energy resource potential from Large Scale and Medium Scale wind turbines respectively.

Figures 22 and 23 show wind speed distribution and the wind opportunity areas in Waveney. Average wind speed for the whole east coast of the District is 7m/s at 45m (or approaching) and it appears from Figure 22 that there is potential to site further turbines in these areas of relatively high wind speed. Analysis of the constraints diagram (Figure 23) suggests that even with allowances for buffer zones from residential properties there is land available to site numerous 3MW turbines within and nearby the AAP area, following the example of the existing 2.75MW turbine in the port area.

A single turbine 3MW turbine produces ~6.83GWh p.a (6,833MWh p.a). Five turbines of this size would be sufficient to deliver the estimated annual demands of the Lake Lothing AAP masterplan if these were met entirely through wind power. Installing this number of 3MW turbines may be achievable and should be investigated further. Whilst medium scale turbines suffer some loss of efficiency due to increased turbulence and smaller rotors, they are also less visually intrusive and so could offer an alternative way of meeting renewable energy and CO_2 reduction targets in Waveney.

Summary - Opportunities and constraints for low and zero carbon technologies

There are only two LZC technologies with the potential to deliver on-site CO_2 savings exceeding the targets being proposed for Waveney as a whole (see Chapter 6). These are Biomass Combined Heat and Power and Large/Medium scale Wind power. Both of these technologies should be investigated further as the AAP masterplan is developed.

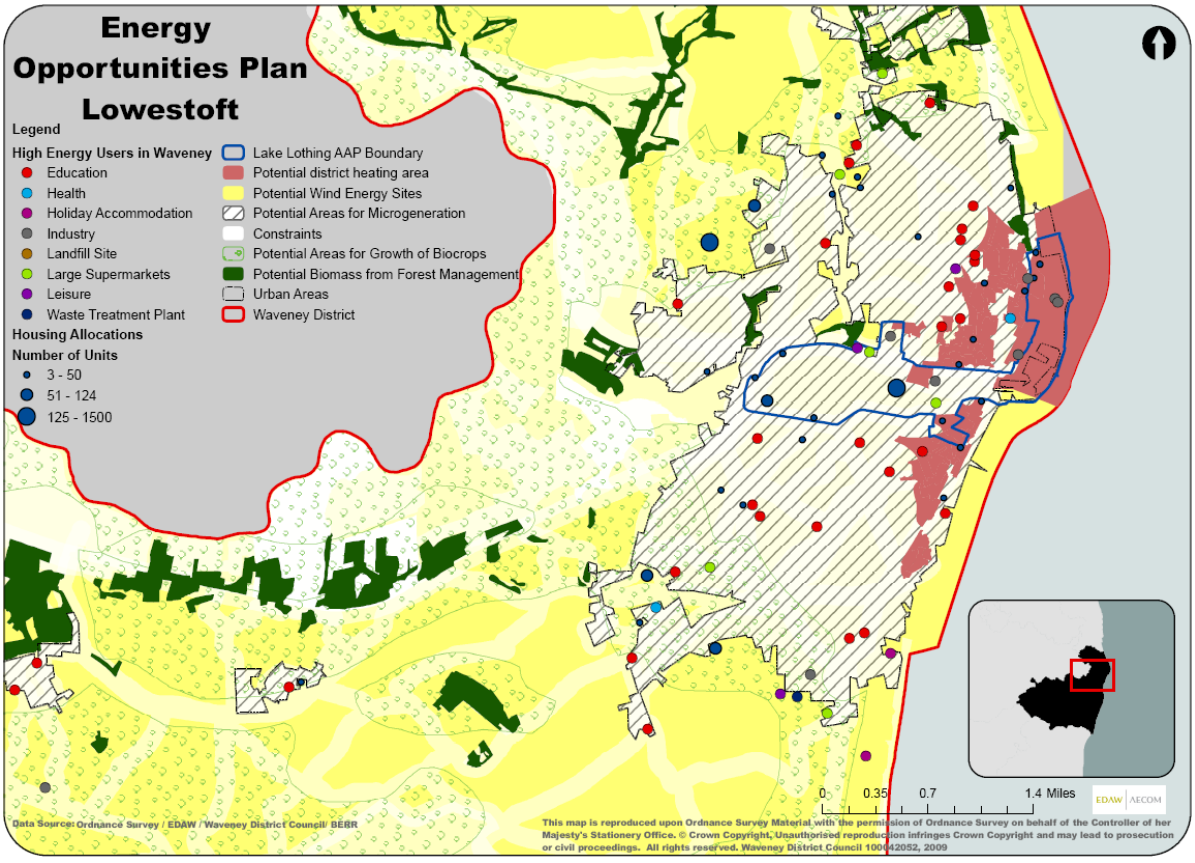
Once there is a greater certainty on proposed building uses and phasing for the AAP masterplan the energy demand figures should be checked and the biomass resource demand (assuming the use of biomass CHP) should be estimated. Opportunities for the appropriate siting of large 3MW wind turbines should also be investigated thoroughly.

With the development of the power park on-site, there are key opportunities to make the AAP area an iconic area for Waveney (and nationally) in terms of energy. This links with wider regeneration and economic opportunities for Waveney. Opportunities for research and bespoke projects should also be encouraged within the AAP area.

Delivering Future Climate Change Targets for the AAP

As shown in the Energy Opportunities Plan, Figure 54, for Lowestoft below, the Lake Lothing AAP masterplan appears to have strong potential to make use of 'on' or 'near' site large scale wind turbines and depending on the final quantum, mix and type of development may also be able to support a biomass CHP unit. Where either or both of these technologies can be employed it would be desirable to set targets within the AAP to encourage this.

Figure 54: Energy Opportunities Plan - Lowestoft



Importantly, the quantum of change in a concentrated central area such as the Lake Lothing AAP area also provides a clear delivery opportunity to install new infrastructure and attract either a public or private delivery body to install and operate energy infrastructure. Opportunities like this are rare, and it should be a key priority of Waveney District Council to seek to obtain high standards of carbon reduction on the site.

It is expected that a substantial proportion of development will be delivered after 2016, and is therefore expected to have to meet the Building Regulations zero carbon requirements. Through the delivery of either on-site biomass CHP or large scale wind energy, developers will be provided with easily accessible and potentially cost effective means to reach their carbon targets.

The role of Waveney District Council and 1st East

1st East is an Urban Regeneration Company which has been set up to direct development in the Lake Lothing AAP area. Both 1st East and Waveney Council play a key role in delivering opportunities on the site. While individual developers only have direct influence and opportunity within the bounds of their site, Waveney District Council can direct ambition and allocate key infrastructure sites through the AAP process, and 1st East can direct and manage development to achieve site-wide energy and sustainable construction opportunities. One or both of these bodies could play a role in installing and operating energy infrastructure across the site, or partnering with an ESCo to do so.

Recommendation: Waveney District Council and 1st East should coordinate to explore delivery and management mechanisms to plan and install site-wide energy infrastructure within the AAP area.

Recommendation: Once the vision and land use breakdown for the AAP area is finalised, an energy study should be undertaken to determine sites for site-wide sustainable infrastructure which can then be delivered through AAP policy.

The Economics of Going Beyond the Area Wide Planning Targets for the Lake Lothing AAP

Figure 35 shows the CO_2 reduction potential and absolute costs (£) for 34 different energy strategy approaches (using either different technologies or technologies applied at varying scales). This graph highlights that it is only large scale wind and biomass CHP that have the potential to deliver close to zero carbon development and that the costs (or cost effectiveness) of these two technologies vary enormously. Currently, large scale wind is considered to be reasonably cost effective with costs (for a residential scheme) of between £3k and £5K per home. Biomass CHP is thought to cost between £20K and £30K per home, although costs for this technology are much less robust since there are fewer examples of this technology in operation. Costs associated with biomass CHP should be reviewed during AAP design to reflect expected changes in uptake of the technology nationwide.

Excluding wind turbines - which are a bit of an anomaly - costs for delivering CfSH level 4 energy targets are typically around £10K - £15K per home rising to between £18K and £30K to deliver zero carbon on-site. (Based on CLG studies AECOM have undertaken with Cyril Sweet). Note that in other parts of this report these costs have been considered integral to the base build cost as the targets will be required by Part L of the Building Regulations. Costs uplifts reported elsewhere relate to costs associated with delivering other credits under the Code for Sustainable Homes, which will not be required by future Regulations.

The Role for Allowable Solutions

Under the most recent government definition of 'zero carbon' it is proposed that for building regulation compliance a minimum standard for on-site carbon compliance is set (proposed 70% reduction on regulated emissions) with the remaining regulated emissions and the unregulated energy uses (from small power, appliances etc) being offset by 'allowable solutions'. Allowable solutions are outlined in section 3.2.

Although it is unclear at this stage how allowable solutions will be funded and managed and the final list of eligible measures is not fully defined, it may be possible for Waveney to encourage investment in low carbon heat infrastructure for the AAP site which developers on smaller sites in the District could help fund through the allowable solutions mechanism. The most recent ministerial statements exclude off-site large scale wind as an allowable solution although it does state that other measures remain under consideration.[26] Allowable solutions could used to fund the development of wind energy on-site.

[26] http://www.publications.parliament.uk/pa/cm200809/cmhansrd/cm090716/wmstext/90716m0002.htm

Delivering Other Sustainability Targets

Although it may be viable to set a stretch target for CO_2 reduction for the AAP masterplan (depending on the results of further feasibility study) it is important to consider whether this should be set just in terms of energy and CO_2 or whether it could be more wide reaching covering other elements of sustainable construction.

Scope for Higher Code for Sustainable Homes Targets
Aside from energy, moving from a Code Level 4 target to Code Level 5 or Code Level 6 target would mean achieving further credits in other areas discussed in Table 44.

Table 44: Opportunities and Constraints Relating to Other Aspects of the Code

Other Code for Sustainable Homes Categories	Opportunities and Constraints to Meeting Code Credits in the AAP area
Water	• While on a building by building basis, reaching the mandatory water targets for Code Level 5/6 can be costly, there are significant opportunities to reduce this cost through site-wide strategies. An overall water strategy for the site could identify opportunities to balance rainwater, greywater, stormwater and blackwater sources with demand to significantly reduce mains water consumption. A dual supply of water (potable and non-potable) could be installed throughout the site to distribute recycled water. As Waveney has a severely restricted water supply, the AAP area presents a key opportunity to significantly reduce water consumption in the District. • The mix and location of uses in the AAP area is still uncertain. It is recommended that a water strategy is completed to inform the water infrastructure vision for the site once there is more certainty around land uses.
Materials	• There may be opportunities to reuse and recycle demolition waste on-site. • Materials should be considered alongside the energy efficiency strategy, as thick concrete walls and insulation materials may clash with materials credits. Otherwise materials credits are unconstrained.
Surface Water Drainage	• As land raising is required to raise the AAP area out of the flood zone, the site is likely to lose a credit under the code. • Mandatory requirement to include Sustainable Drainage Systems (SuDS). Sufficient space should be allocated in the AAP area for storage and treatment of water.
Waste	• Waste infrastructure and provision for the site is currently unknown. • A tree station could be located on-site for collection and processing of local biomass resource to feed fuel to biomass CHP on-site and in the Waveney area.
Pollution	• No particular constraints in the AAP area
Health & Wellbeing	• No particular constraints in the AAP area

Management	• No particular constraints in the AAP area
Ecology	• Ecological status of the site is currently unknown, but it is a Brownfield site, meaning it will automatically gain credits under the Code. • Other ecological measures can be taken through design.

Importantly more onerous mandatory targets would need to be met for water - moving from internal water consumption of 105 l/p/d to 80 l/p/d. This would involve the use of rain and grey water recycling systems. The overall cost uplift associated with delivering CfSH levels 5 and 6 can be seen in Figures 2 and 3 in section 2.2 of this report. However, there may be opportunities to significantly reduce cost per unit associated with installation of water recycling infrastructure when planned on a site-wide basis. A water strategy should be completed for the AAP area once land use mix is finalised further to identify opportunities for site-wide water recycling and distribution infrastructure. Targets should then be set according to the opportunities to reduce water consumption beyond 105/person/day.

BREEAM Targets

The District-wide target for non-residential buildings has been set at BREEAM 'very good'. There is insufficient evidence at this stage to show the total capital cost uplift associated with delivering BREEAM 'Excellent' 2008 targets to justify an increase of BREEAM target on the AAP site. For this reason the introduction of a policy target requiring non domestic buildings in the Lake Lothing AAP to achieve BREEAM Excellent has not been recommended at this stage. Market conditions are constrained and endangering delivery, and therefore it is felt that additional cost burden through increased sustainability targets on-site needs to be considered in detail. Flood constraints on the AAP site will also make some BREEAM targets challenging.

BREEAM 2008 (for all BREEAM schemes) introduces a mandatory number of credits that are required under ENE1 to achieve an Excellent BREEAM rating. Requiring all of the mandatory energy credits for an Excellent rating to be delivered is something which could be further explored as a Lake Lothing AAP policy to drive the inclusion of CHP and wind opportunities.

Masterplan and Design Implications

Integration of biomass CHP and large scale wind turbines both have major implications in terms of master planning. Biomass CHP systems require a suitably located and accessible energy centre and storage on-site for wood fuel. The energy centre and fuel storage buildings both need to be accessed by delivery truck and maintenance vehicle, so appropriate turning circles should be allowed. The buildings themselves can be of significant size and will need to be carefully integrated into the masterplan to limit visual intrusion. Also the energy centre will require a flue which will need to be of sufficient height to properly disperse air pollutants.

The size of the energy centre cannot really be properly estimated until the development mix is fixed. At this stage when the rating of the CHP engine (kW/MW) has been estimated the size of the energy centre and storage buildings can be gauged. Air quality, transport and landscape specialists should be consulted to work with the energy consultants and masterplanners to ensure the energy centre and district heating pipework is properly integrated with the masterplan. In addition to the major energy centre there may also need to be smaller energy hubs to take account of development phasing.

Large scale wind turbines need to be located with a buffer zone between the turbines and the nearest buildings for reasons of safety, noise, flicker etc. Constraints for locating large scale wind turbines are set out in greater detail in section 4.3. These issues will need to be considered in detail as part of the masterplan development if wind turbines are to be installed in the AAP area.

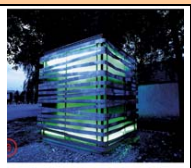
Other masterplanning opportunities that should be considered in the development of the AAP are outlined in Table 45.

Figure 55: Urban design considerations for integration of CHP or wind power

District wide energy centres: Implications for masterplanning

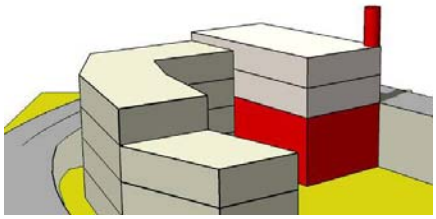
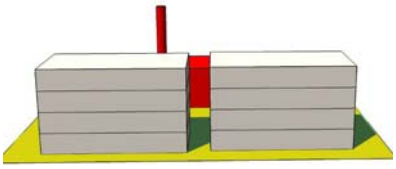
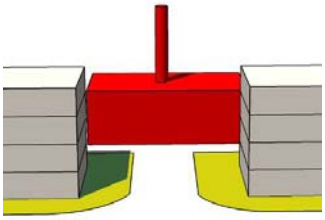
Location *(Example: The Carbon Challenge Brief, PeterDistrict)*

Visual






Design considerations

‘Bury it’	‘Screen it’	‘Celebrate it’

Wind Turbines: Implications for masterplanning

- Location
- Size
- Hub height
- Prevailing wind
- Wind speed
- Distance to nearest building (‘buffer zone’)
- Shadow
- Flicker
- Noise
- Visual appearance
- EIA
- Proximity to airports and radar interference

Image: The Carbon Challenge Brief, PeterDistrict.

Table 45: Masterplanning and Urban Design Implications of Code and BREEAM requirements

Sustainable Design Consideration	Impact on masterplan
Efficient Use of Land	Design to ensure density is high enough to achieve a high enough floor area to footprint ratio to achieve credits and protection of open spaces for ecological purposes.
Energy Efficiency	Energy efficiency will be improved through the use of higher density house types with greater adjoining wall areas. Apartments and terraced housing is more energy efficient than detached or semi-detached housing. Masterplanning should consider passive design and orientation to manage natural heat and light and to minimise heat losses from wind exposure. Where possible the long-side of blocks, individual houses or streets should be orientated along an east-west axis to give maximum exposure to the southern side of buildings. Orientation initiatives need to be considered alongside other urban design criteria to ensure they do not impact adversely on place making. Landscaping can be used to provide seasonal shade and shelter from wind.
Incorporation of on-site wind energy	The possible incorporation of medium-large scale wind energy should be considered at the beginning of site planning, as wind energy is usually a cost-effective way of supplying on-site renewable electricity as part of code requirements. Wind installations need to be specifically sited to avoid turbulence from surrounding vegetation and structures, and placed a distance away from residential development to avoid significant noise and shadow flicker effects.
Incorporation of on-site solar technologies	Photovoltaics and solar thermal panels require an un-shaded, well-orientated surface to work efficiently. To ensure residential units with sloped roofs are well positioned for the use of solar technologies, orientate buildings so that a significant portion of roof area can be orientated within 20 degrees of south.
Density and Energy Load Mix	To increase the efficiency and financial feasibility of combined heat and power systems or district heating systems, significant heat loads should be clustered. A mixed use development with various day and night heat demands is desirable. Higher density development will lead to cost savings. The location of a site-wide energy centre should be accessible to large trucks for fuel deliveries. Location should also consider local noise, vibration, height of flue, view and pollution effects.
Mandatory internal water use of 80 litres/person/day or less for Code Levels 5 and 6 means that rainwater and/or greywater recycling will be required.	Allow for space in the masterplan for water collection tanks (can be underground) and additional plant space. Communal water recycling systems for blocks or the whole site should be considered. These could utilise rainwater, greywater, storm water or wastewater.
Mandatory requirements for the reduction of surface water run-off - credits available for the use of Sustainable Drainage Systems (SuDS)	Drainage solution should be properly considered at the beginning of masterplanning. Measures should be taken to reduced impermeable surface area and provide source control including green roofs, storage areas and rainwater harvesting. Within the masterplan, areas should be provided to provide water treatment and attenuation. These areas should be integrated into the design of public realm and open space, providing ecological benefit where possible. Baseline analysis has identified that contamination and groundwater depth may constrain SuDS options that involve infiltration.

Cycle storage	Space provision for weatherproof and secure cycle storage. This may impact on building footprint and block layout.
Simple rainwater collection	Space for rainwater collection for external use (water butts or central water tanks)
Waste collection	Space for recycling and composting facilities either within individual units or in communal space.
Ecology	Ensure protection of any existing ecological features and space to allow the improvement of the ecological value of the site (e.g. green/brown roofs, wildflower meadows).
Daylight	Unit design in order to achieve good daylighting levels and view of the sky (to achieve relevant Code credit where possible). Consider overshadowing effects and effects of street widths.
Private Space	A number of Code credits can be achieved through the careful design of building typologies and private space: - Provision of private or semi-private amenity space for all units. - Provision of home offices. - Compliance with Lifetime Homes
Secured by Design	Ensure the design incorporates good natural surveillance and lighting.
Noise and mix of land uses	Ensure compliancy with noise protection levels.
Local food production	Masterplanning should consider the provision of space for allotments and private areas for food production.

Policy Recommendations for the Lothing Lake AAP

The opportunities and constraints analysis for the Lothing Lake AAP suggests that policy to encourage increased levels of carbon reduction through renewable energy infrastructure is appropriate, given the potential for both biomass CHP and Large Scale Wind. It is assumed that the 2016 zero carbon target required by regulation will translate as a 70% reduction on emissions regulated under Part L of the Building Regulations with the remaining 30% regulated and unregulated CO_2 emissions being delivered through allowable solutions. Biomass CHP and large scale wind will also allow the delivery of those allowable solutions.

The Lake Lothing AAP has the potential to deliver a 100% reduction on regulated CO_2 emissions on-site (equivalent to Code Level 5 energy requirements) subject to the viability of delivery of biomass CHP or large scale wind turbines on-site. There is insufficient evidence at this stage to require a full Code for Sustainable Homes Level 5 target for the entire site, but this target should be aspired to and viability should be investigated.
It is recommended that further feasibility work (alongside the masterplan development) is undertaken before any percentage targets are set within policy.

The site also presents a key opportunity to exceed district-wide water efficiency targets, through potential site-wide water recycling measures. Opportunities need to be investigated and costed through a water strategy for the site before specific targets are set.

Preliminary work should be initiated and led by Waveney District Council and 1st East to further establish delivery mechanisms for site-wide energy and water infrastructure to ensure the AAP responds to opportunities and that more stringent targets are set when the evidence is at hand.

Strategic Sites - Policy Recommendations

The Lake Lothing AAP is still in development. Once land uses and distribution of development is developed in further detail, it is recommended that an energy strategy and a water strategy for the whole AAP area is undertaken to identify infrastructure delivery needs and phasing to allow delivery of higher targets for energy and water. These strategies will give a site-wide overview and allow straight-forward delivery of opportunities by developers. Linked with these overall strategies, the following policies are suggested for inclusion in the AAP.

ENERGY

4. *Developers must explore the potential to bring on line large scale wind turbines and/or biomass combined heat and power (CHP) plant as part of development within the AAP. Unless these technologies can be proven technically unsuitable or commercially unviable developers must deliver the equivalent of the energy requirements of Code for Sustainable Homes Level 5 (in residential buildings) and BREEAM excellent (in other buildings). Investigations should be based on opportunities identified in the area-wide energy strategy for the AAP.*

5. *Opportunities should be sought to link together development within the AAP with district heating networks, taking advantage of the diversity of energy loads from the different proposed building uses. This process will be supported by 1st East and Waveney District Council. Where a CHP system is delivered on-site, all buildings are required to connect.*

6. *An energy strategy and delivery plan must be submitted alongside any planning application for development within the AAP area outlining expected carbon reductions and the viability of exceeding District-wide energy targets on-site.*

WATER

4. *Developers must explore the potential to implement water recycling measures on a building or site-wide scale to significantly reduce mains water demand as part of development within the AAP. Unless these strategies can be proven technically unsuitable or commercially unviable developers must deliver infrastructure to reduce mains water consumption to the equivalent requirement of Code for Sustainable Homes Level 5 (in residential buildings) and BREEAM excellent (in other buildings). Investigations should be based on opportunities identified in the area-wide water strategy for the AAP.*

5. *Opportunities should be sought to link together development within the AAP with site-wide recycled water networks, taking advantage of the diversity of water sources and uses on-site. This process will be supported by 1st East and Waveney District Council. Where a recycled water network is delivered on-site, all buildings are required to connect.*

6. *A water strategy and delivery plan should be submitted alongside any planning application for development within the AAP area outlining expected mains water demand reductions and the viability of exceeding District-wide water targets on-site.*

In the policy above, the energy and water requirements for Code for Sustainable Homes Level 5 are suggested as a target mechanism. Under expected changes to the building regulations, after 2016, buildings in the AAP area will need to be built to zero carbon standards. Under the current zero carbon definition, a 70% reduction in regulated emissions will need to be delivered on-site, with the remainder deliverable through allowable solutions. Under Code 5, a 100% reduction in regulated emissions must be delivered on-site. This target ensures opportunities on-site are utilised.

It is important that the AAP policy recommendations are reviewed iteratively alongside the developing masterplan to ensure that all opportunities for central energy generation and water conservation are reviewed properly on a site-wide basis. As the masterplan is evolving further evidence should be sought on the costs of delivering more stringent sustainable construction targets, which could be set in future policy if shown to be viable.

7.3 CHARACTER AREAS IN WAVENEY

Based on the projected development in Waveney District set out in Chapter 1, three generic development character areas have been created to profile the most suitable mix of energy efficiency and renewable and low carbon technologies that are likely to be most suitable. These are:

- **Residential development in Lowestoft of 10 dwellings or more** – It is proposed that there will be approximately 700 additional dwellings in Lowestoft over the growth period. Generally, there are a wider range of viable options for improving energy performance at a scale of 10 dwellings and above through introduction of site-wide infrastructure.
- **Light Industrial** – A significant proportion of new employment development, particularly in the Market Towns is likely to be light industrial. The light industrial profile does not examine commercial office buildings in particular, but conclusions for that type of development are likely to be similar.
- **Dispersed residential development** – Outside of Lowestoft residential development is most likely to come forward through small scale windfall development.

Table 46 below sets out the key opportunities and constraints for each of the three character areas and highlights what this means in terms of policy recommendations.

Table 46: Character Area Profiles

Development Type	***Precedent image***	
Residential development in Lowestoft of 10 dwellings or more		**Opportunities and Constraints:** • It is likely that some developments of this character would not have access to a district heating network or wind energy and would not be able to support a district heating scheme in their own right. This would mean delivering energy targets greater than a 44% reduction in CO_2 emissions would be technically challenging and would rely predominantly on the use of PV and solar water heating. • The increased cost of meeting mandatory credits for water conservation will mean that delivering Code for Sustainable Homes ratings greater than level 4 could not be justified at this stage.
		Recommendations: • A review of this character area supports the proposed district-wide energy policies. • Higher CO_2 reduction targets should be considered for development that can link to community energy generation schemes. • Waveney DC should consider setting higher sustainability targets for developments of this type through Development Briefs etc where development can take advantage of local large scale energy generation.
Light Industrial		**Opportunities and Constrains:** • These developments would typically have large electricity demands and minimal demands for space heating. They also often have large availability of roof space for mounting photovoltaic panels. Many industrial developments may be able to link to district heating schemes or wind power energy generation - although this unlikely to be the case for all development of this character. • Much of the electrical use would be for small power (unregulated) and wouldn't impact on delivering CO_2 reduction targets which are framed against the regulated emissions. • Technology options would be limited in some cases (i.e. all electrical buildings) to the use of wind and PV (or just PV).
		Recommendations: • No change to proposed district-wide energy policies. • Higher CO_2 reduction targets should be considered for development that can link to community energy generation schemes or accommodate wind energy on-site. • Higher BREEAM targets should be considered – mandatory credits for Energy may be able to be set in policy depending on further review of the likely cost impact. • Waveney DC should consider setting higher sustainability targets for developments of this type through Development Briefs etc where development can take advantage of local large scale energy generation.

Dispersed Residential		**Summary:** • It is likely that some developments of this character would not have access to a district heating network or wind energy and would not be able to support a district heating scheme in their own right. This would mean delivering energy targets greater than a 44% reduction in CO_2 emissions would be technically challenging and would rely predominantly on the use of PV and solar water heating. The development scale will limit the technology choices. **Recommendations:** • No change to proposed district-wide energy policies. • Higher CO_2 reduction targets should be considered for development that can link to community energy generation schemes or is near a high energy user 'anchor load' such as a hospital, school or industrial user. • Waveney DC should consider setting higher sustainability targets for developments of this type through Development Briefs etc where development can take advantage of local large scale energy generation.

The examination of the character areas above support the recommendation of the District-wide targets in Chapter 6 as suitable for the expected key types of development in Waveney. There is also basis for increasing targets for sites coming forward where certain conditions exist:

- Due to the scale of the site (>500 homes), or proximity to existing areas of high energy demand, or the proximity of the site to an existing district heating network, there may be cause to require installation of district heating infrastructure and/or CHP.
- Where new development is planned near sites with potential for wind development, the investigation of the use of wind energy on-site or near-site should be required.
- Where large industrial development is proposed, and costs of increasing requirements to BREEAM 'excellent' will not threaten viability of development, this should be required.

Chapter 7: Key Policy Considerations

There is a key opportunity for higher policy requirements in the AAP area in Lowestoft, as supported by further investigations as development mix and spatial layout are investigated. The key development characters expected in Waveney can viably meet the district-wide targets, but opportunities to exceed these targets should be exploited, particularly where development conditions exist that enable larger scale energy solutions to be implemented. It is recommended that an energy strategy and water strategy is undertaken for the AAP area to identify and coordinate delivery of site-wide opportunities.

Appendix A: Testing of Recommended Policy on Carbon Compliance for New Development in Waveney

Development viability is a function of both technical feasibility and financial viability. A key issue for testing policy is whether or not a policy requirement for CO2 emissions places an "undue burden" on developers, primarily in terms of additional build cost – the financial implications of the recommended targets and policies are presented in this section.

What constitutes an undue burden will vary from site to site, and development to development. In the short term, in situations where the developer has bought the land before the policy existed and so was unable to take account of any additional build cost, there are aspects of a development which may affect the overall viability of a development.

TESTING COST VIABILITY OF THE ACCELERATED CARBON COMPLIANCE POLICY

The following scenarios were modelled using our AECOM Stock Energy Model to compare the financial implications of a range of policy options. The highlighted policy below represents our proposed policy for the LPA area. 'Business as usual' refers to the scenario when construction progresses according to minimum Building Regulations Compliance.

1. 15% reduction in total CO_2 emissions beyond Building Regulations (any method allowed);
2. **15% reduction in residual CO_2 emissions beyond Building Regulations (any method allowed);**
3. 15% reduction in total CO_2 emissions, must be met through renewables;
4. 20% reduction in total CO_2 emissions beyond Building Regulations (any method allowed);
5. 20% reduction in residual CO_2 emissions beyond Building Regulations (any method allowed);
6. 20% reduction in total CO_2 emissions, must be met through renewables;
7. 25% reduction in total CO_2 emissions beyond Building Regulations (any method allowed);
8. 25% reduction in residual CO_2 emissions beyond Building Regulations (any method allowed);
9. 25% reduction in total CO_2 emissions, must be met through renewables;

The capital costs and associated CO_2 savings with each policy type over time are presented the figures below. It should be noted that capital cost is not the only factor affecting the viability of a low carbon solution. On certain sites for example, the developer may also be the building occupant, or, in the case of a housing association, will have an interest in reducing the running costs for tenants as well as their own management costs for energy services, and energy for communal areas, etc. They may also be able to take advantage of feed-in tariffs from microgeneration technologies. For rented commercial property, developers may also have an interest in reducing energy costs for communal areas.
Developments with lower energy demands and shared infrastructure such as community heating can potentially offer savings in running costs in relation to alternatives such as individual boilers, and may

offer attractive whole life costs. Building occupiers will also benefit from reduced risk and security of supply.

Period from 2010 to 2013

From 2010, the Building Regulations will require an improvement of 25% in the regulated CO_2 emissions of residential buildings on 2006 levels. Figures A1-A4 shows the capital costs and associated CO2 savings of meeting each type of policy, based on a representative selection of building types.

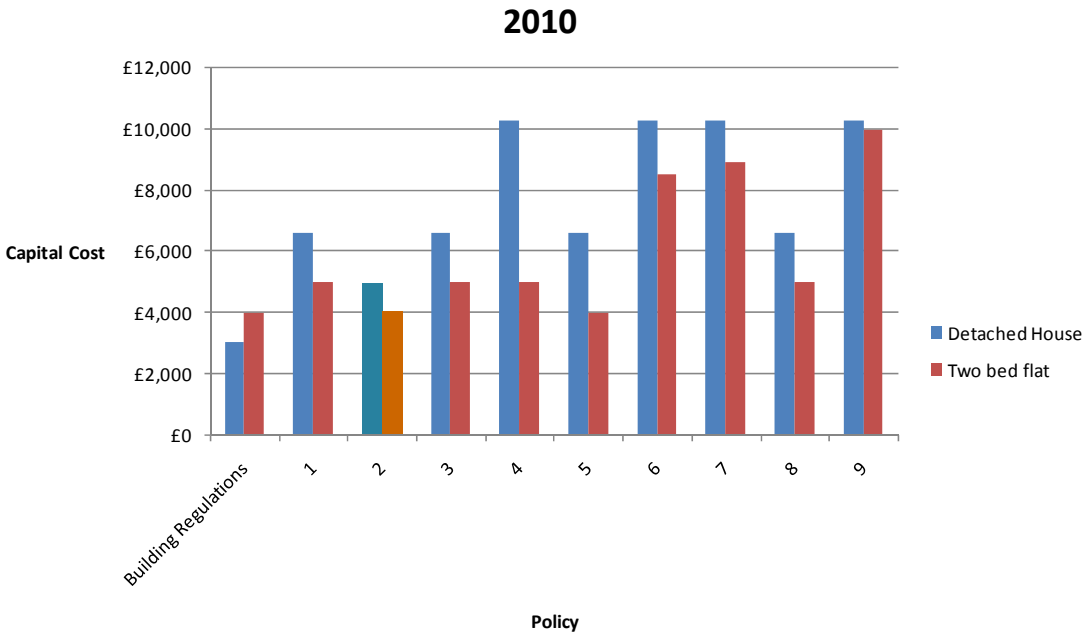


Figure A1: Cost per building type of meeting 2010 targets for a detached house and a two bed flat under different policy scenarios (Source: AECOM Stock Energy Model)

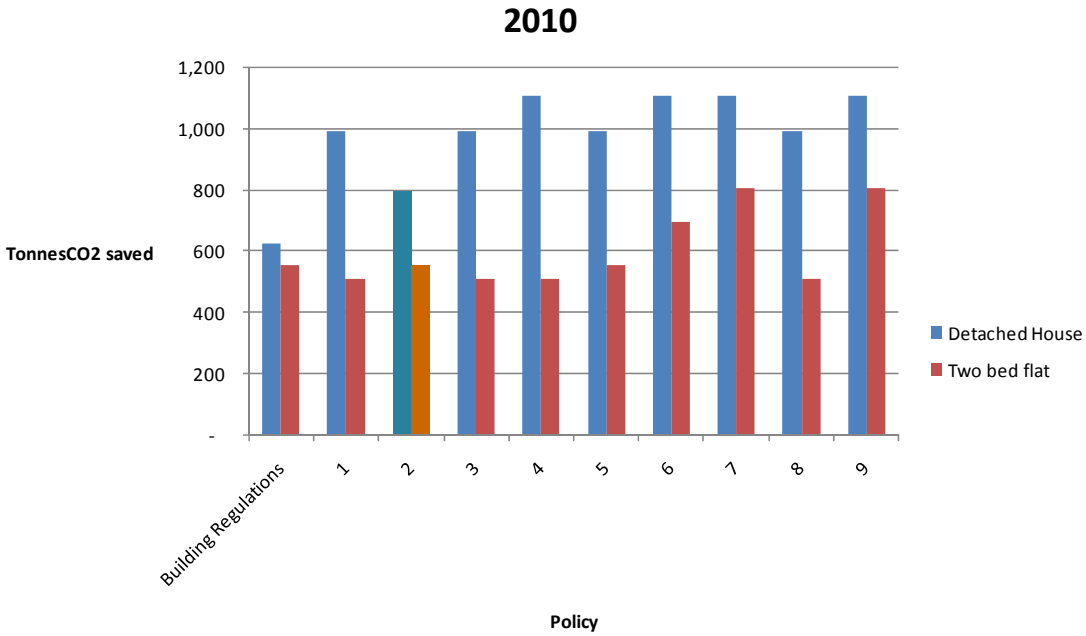


Figure A2: CO_2 savings of meeting 2010 targets for a detached house and a two bed flat under different policy scenarios. (Source: AECOM Stock Energy Model)

Policy option 2 (the proposed policy) results in comparable CO_2 savings to the other policies, but it is relatively cheap for a new retail unit or office to comply, compared with the other policies.

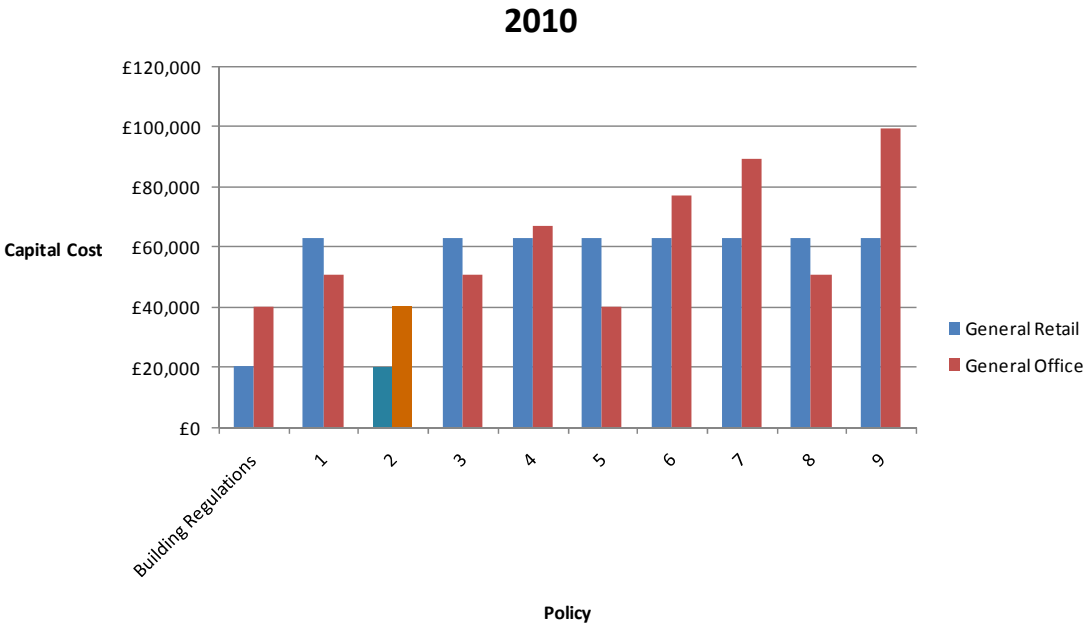


Figure A3: Cost per building type of meeting 2010 targets for an office and a retail unit under different policy scenarios (Source: AECOM Stock Energy Model)

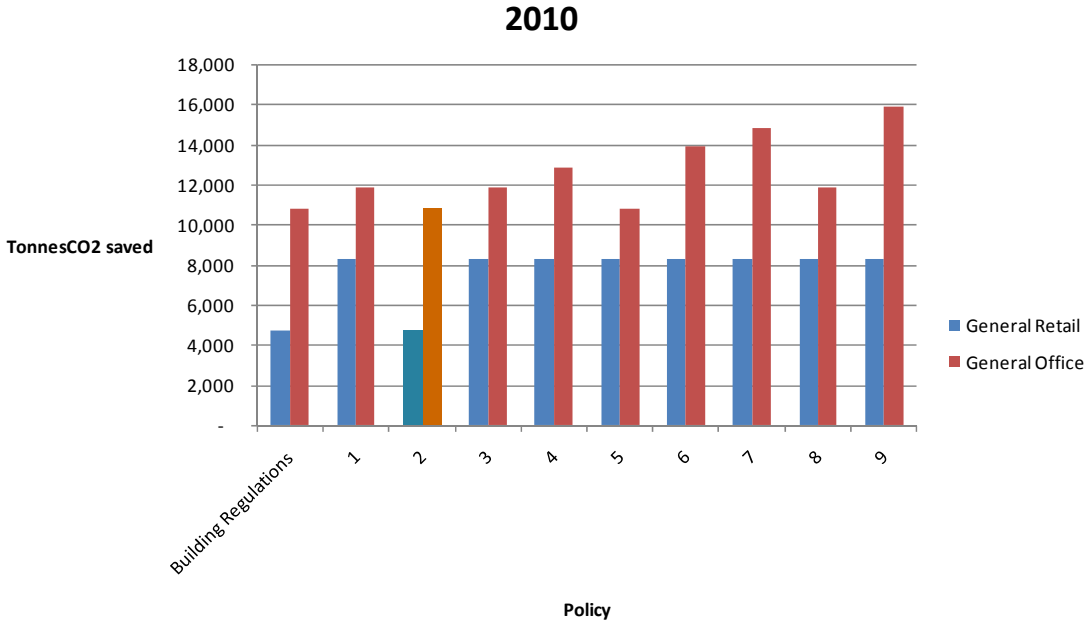


Figure A4: CO_2 savings from meeting 2010 targets for an office and a retail unit under different policy scenarios (Source: AECOM Stock Energy Model)

Period from 2013 to 2016

From 2013, the Building Regulations are expected to require an improvement of 44% in the regulated CO2 emissions of residential buildings compared to 2006 levels. There are currently no proposals for changes to the standards for non-residential buildings in the period 2013 to 2016. The costs and CO_2 savings associated with a range of policy types are shown below in Figures A5-6. Whilst there is not much difference in capital cost between the policy options for a detached house, the policy option 2 is

significantly cheaper to achieve for a two bed flat. This is because energy efficiency measures supplemented with PV would be sufficient to achieve policy option 2 for a two bed flat in 2013.

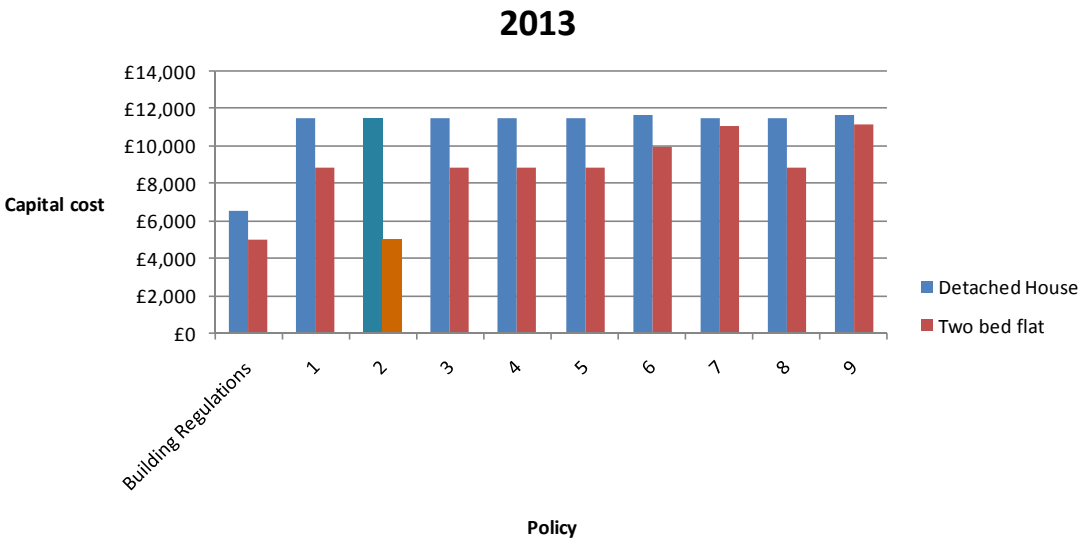


Figure A5: Cost per building of meeting 2013 targets for a detached house and a two bed flat under different policy scenarios. (Source: AECOM Stock Energy Model)

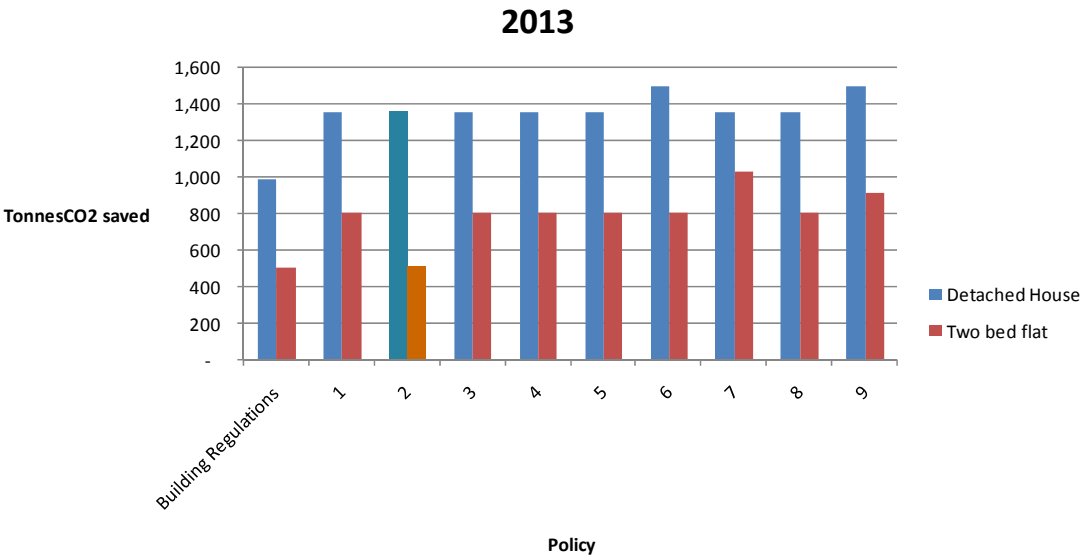


Figure A6: CO_2 savings of meeting 2013 targets for a detached house and a two bed flat under different policy scenarios. (Source: AECOM Stock Energy Model)

Post 2016

All new residential buildings will be zero carbon. Developers will have to reduce both regulated and unregulated CO_2 emissions by up to 70% “carbon compliance” i.e. improved energy efficiency measures or onsite low carbon and renewable energy generation. The remaining 30% will have to be offset through allowable solutions. This is proposed as national legislation and therefore the costs of meeting this policy have not been assessed.

EFFECT OF CARBON BUYOUT FUND

We have tested the effect of setting the amount to be paid to the Carbon Buyout Fund at a rate of £100 per tonne of CO2 per square metre over the building lifetime of 30 years; this equates to a lump sum of £3,000 per tonne of CO2 per square metre and is in accordance with the central option costs for allowable solutions in the Zero Carbon consultation, reflecting the cost of off-site renewable electricity. Table A1 gives an indication of the maximum payments that are likely to be incurred in 2010 by a selection of building types if built to minimum Building Regulations standards. Examples of the payments that are likely to be incurred by standard dwelling types from 2013 are presented in Table A2.

Building Type	Building Regulations 2006 TER (annual tonnesCO_2)	Building Regulations 2010 TER (annual tonnesCO_2)	Policy Required 2010 TER (annual tonnesCO_2)	Emissions covered by Levy (annual tonnesCO_2)	Payment Required per square metre
Detached	2.20	1.65	1.40	0.25	£740.84
Semi	1.61	1.21	1.03	0.18	£544.01
End terrace	1.48	1.11	0.94	0.17	£499.09
1 bed flat	1.06	0.79	0.67	0.12	£356.29
2 bed flat	1.30	0.97	0.83	0.15	£438.03
General office	26.48	19.86	16.88	2.98	£8,937.08
General retail	6.27	4.70	4.00	0.71	£2,115.01

Table A1: Building Regulations 2006 Baseline TER, Building Regulations 2010 updated TER and required TER, and the maximum payment chargeable for a selection standard dwelling types.

Building Type	Building Regulations 2006 TER (annual tonnesCO_2)	Building Regulations 2013 TER (annual tonnesCO_2)	Policy Required 2013 TER (annual tonnesCO_2)	Emissions covered by Levy (annual tonnesCO_2)	Payment Required (£)
Detached	2.20	1.23	1.04	0.18	£553.16
Semi	1.61	0.90	0.77	0.14	£406.19
End	1.48	0.83	0.70	0.12	£372.65
1 bed flat	1.06	0.59	0.50	0.09	£266.03
2 bed flat	1.30	0.73	0.62	0.11	£327.06
General Office	26.48	19.86	16.88	2.98	£8,937.08
General Retail	6.27	4.70	4.00	0.71	£2,115.01

Table A2: Building Regulations 2006 Baseline TER, Building Regulations 2013 updated TER and required TER, and the maximum levy chargeable for some standard dwelling types.