Renewable Energy Study for Brentwood Borough Council

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EXECUTIVE SUMMARY

The Centre for Energy and the Environment (CEE) was commissioned by Brentwood Borough Council to undertake a Borough wide Renewable Energy Capacity Study to form part of the evidence base for the Local Development Plan (LDP) which will run from 2015 to 2030. This report assesses a range of existing data sources and publications to understand both current demand for energy and emissions of carbon dioxide, together with the potential for the supply of low and zero carbon energy within the Borough.

Currently, around half of all energy used in the Borough is for road transport, with a third from homes and about a fifth from the commercial and industrial sector. Carbon emissions have fallen over the past seven years, following similar trends observed at a national level. Compared to the national average, emissions from the commercial and industrial sector are significantly lower, which reflects the comparatively low proportion of manufacturing within the local economy. Domestic emissions are broadly similar to national domestic emissions. This is a slightly unexpected result, but can be explained by savings from the milder climate and high proportion of gas heated homes being offset by Brentwood having on average homes that are larger than the overall UK dwelling stock. Transport emissions are higher than the national average, due to increased car ownership and access to vehicles. Over the period of the Local Plan, energy use and carbon emissions may increase by about 10% following a "business as usual" trajectory. An analysis of the impact of key Government policies indicates that by 2030 energy use might decrease by 8%, with carbon emissions falling by 28%.

The potential for renewable energy in Brentwood was assessed using existing data sources and the Government's SQW methodology where possible. The total technical potential was established, together with an indicative scenario for a potential energy mix in 2030. Following this scenario would result in about 9% of energy demand for the Borough in 2030 being met by renewable sources of energy. The technologies considered were classified into three groupings; standalone technologies, district schemes and building technologies. The most significant standalone technologies are large scale wind turbines and photovoltaic (PV) arrays. Due to their scale, a relatively small number of these installations could result in significant generation of renewable energy within the Borough. However, development would necessarily occur within the Green Belt, and may be constrained by proximity to suitable connection to the national electricity grid. The assessment did not identify individual locations, but due to site specific factors, any scheme that comes forward would need to be assessed on an individual basis. District energy schemes could also form a significant component of the Borough's energy mix. The most promising site is likely to be at the West Horndon and Brentwood Enterprise Park sites, where a large development incentivised by new building standards may result in such an approach being more cost effective for developers than considering each building in isolation. If a potential scheme here could be heated from an Energy from Waste plant, then the benefits may be even greater. There is additional potential for district schemes at Brentwood town centre and at the Council Depot site, though these would involve retrofitting schemes to existing heat users and therefore represents a greater challenge. In all cases, it is important that the local planning authority sets clear policy, and that early discussions are held with critical stakeholders. Building scale technologies often comprise permitted development, though given their small scale a large volume of installations would be required to achieve the same impact as a single large standalone scheme. The technologies with the greatest potential here include rooftop solar technologies, and biomass boilers in the commercial and industrial sector.

If Low or Zero Carbon technologies were to be implemented following the assumptions made within this report then the total generation in 2030 would be equivalent to approximately 8.7% of the total energy demand in 2030. This is somewhat short of the 15% target by 2020 proposed in the Local Plan 2015-2030 Preferred Options. In order to meet this target, uptake of the potential resource within the Borough would need to be increased. The greatest opportunity would come from large scale wind or solar as the 2030 values reported here are about 20% of the overall available resources. To meet a 15% target in 2030, a further 16 commercial scale turbines would be needed. A complementary strategy would be to further

reduce demand for energy within the Borough. The equivalent carbon savings compared to current emissions would be around 7.4%.

The National Planning Policy Framework (NPPF) was published in 2012 and acts as guidance for local planning authorities and decision-takers, both in drawing up plans and making decisions about planning applications. This, together with Part L of the Building Regulations which concerns the conservation of fuel and power, comprise the main national regulatory context. Brentwood's Local Plan Preferred Options for Consultation (July 2013) document contains a policy (CP14) titled "Sustainable Construction and Energy" that sets out the preferred approach for new development in the Borough. The analysis from the resource assessment undertaken in this report together with the draft local policy and evolving national policy were considered to propose a series of recommendations to take forward to the next stage of the development of the Local Plan.

- The first criterion set out in policy CP14 requires general sustainable construction principles to be met and evidenced qualitatively as part of a planning application. It is a positive strategy that should nonetheless not be burdensome to developers. It is recommended that wording be included to capture design measures that increase resilience of developments to the threat of climate change, for example summertime overheating. This would be consistent with Chapter 10 of the NPPF and was deemed to be positive at workshops held in Brentwood.
- Policy 14.b discusses incorporation of water conservation measures and sustainable drainage measures, whilst policy 14.c requires a Water Sustainability Assessment. The recent outcome of the Housing Standards Review (HSR) introduced a new water efficiency standard of 110 litres/person/day that may be used in areas of water stress. Whilst the exact means of assessing whether an area experiences water stress has not yet been made explicit, there is a good chance that Brentwood may fit that definition, and so this could form the local policy on water conservation. Redrafting of the final policy should continue on this basis.
- Policy 14.d currently frames standards for new housing with respect to the Code for Sustainable Homes (CSH). The outcome of the HSR has resulted in the removal of the ability of local planning authorities to set specific energy standards in excess of the building regulations, and the intent to potentially wind down the CSH. This means that the current preferred policy wording will be redundant. There is a potential interim period and so it may be possible to retain elements of the policy, for example that new homes should achieve at least CSH Level 3, with a caveat that the local policy is to remain in place until such a time as the proposed Government changes take effect. Achieving CSH Level 3 has been shown to be a low cost measure.
- There is a current legal loophole whereby through the "transitional arrangements" mechanism, developments that come forward in phases may "lock in" to early versions of Part L of the Building Regulations. It is recommended that wording is included to ensure that each phase of multi-phase developments is built under the Building Regulations of the day.
- Policy CP14.e currently sets a requirement that new non-domestic development achieves a BREEAM rating of at least "Very Good", rising in line with Part L of the Building Regulations. However, there is no such relationship between BREEAM and changes to the Building Regulations, and so this link should be removed. The detail within BREEAM is updated at regular increments to account for changes to current practice, including changes to Building Regulations. It is not clear what the additional cost of achieving BREEAM "Very Good" is, but based on an international analysis of certified buildings it is expected to be minor and so should therefore not be burdensome for developers. It should also be stated that the version of BREEAM under which a scheme should be assessed should be the version that is current at the time of the planning application.

- Policy CP14.f states that major schemes will incorporate the use of renewable and low carbon energy. It is expected that this should be achieved as a matter of course under the latest version of Part L of the building regulations, and certainly once the 2016 iteration of Part L comes into effect.
- The current policy wording for renewable energy schemes echoes the messages set out in the NPPF, namely that proposals will be supported provided they can demonstrate that they will not result in unacceptable harm to the local environment including addressing the specific planning conditions pertaining to the Green Belt. The resource assessment has shown that large scale renewable energy schemes such as commercial scale wind or PV would necessarily occur in the Green Belt. Workshops with invited stakeholders has revealed that the tension between development of large scale renewable energy schemes and the Green Belt can be addressed through careful screening and siting, for example at land adjacent to the M25. This should be reflected within the policy narrative. In practice, any application for large schemes would need to be assessed in their own right.
- There is a gap in policy about specifically capturing the potential for district energy schemes. The analysis has shown that West Horndon and the Brentwood Enterprise Park offers the greatest potential. Specific wording should be included within the policy, which could be framed around development at this location, or for the Borough at large, and should include the requirement for development to connect to existing or planned heat networks. In parallel with this, the council should being talks with potential network operators and significant end users.
- The current preferred policy includes the provision for Allowable Solutions, which is a mechanism that will be introduced together with the 2016 iteration of Part L of the Building Regulations. The detail of how the policy will be implemented at a national level is uncertain, though more will be known once the outcome of a consultation which ran during the Autumn of 2013 is published. It is recommended that unless precluded by the outcome from that consultation, the wording for the Allowable Solutions policy is revised to ensure that the funds raised are to be used within the Borough. In parallel with this, the Local Authority should begin to identify local projects that could utilise funds raised through Allowable Solutions. This could begin to address some of the wider challenges within the Borough, for example reducing energy use from older properties, or those with vulnerable residents.

Contents

1. BACKGROUND

The Centre for Energy and the Environment (CEE) was commissioned by Brentwood Borough Council to undertake a Borough wide Renewable Energy Capacity Study to form part of the evidence base for the Local Development Plan (LDP) and to inform the emerging policy on sustainable construction and energy. The Brentwood Replacement Local Plan was adopted in August 2005 and serves as the main Development Plan for the Borough. This document contains Policy IR6 Renewable Energy Schemes that permits proposals for renewable energy schemes provided there is not unacceptable detrimental impact.

The National Planning Policy Framework (NPPF)[i], published on 27 March 2012, introduced changes to national policy and guidance replacing nearly all previous Planning Policy Guidance (PPG) and Planning Policy Statements (PPS). The NPPF refers to the collection of documents that make up the statutory plan for a Local Planning Authority (LPA) as the 'Local Plan' which is broadly similar to the Local Development Framework (LDF) set out in the now superseded PPS12. In response to the Government's Localism agenda and proposed changes to the planning system, the Council decided to align its Core Strategy and Site Allocations to form a single Brentwood Local Development Plan (LDP). This was agreed by the Policy, Performance and Resources Board on 8th December 2010. On the 13th December 2012 a third Local Development Scheme was agreed by the Policy, Performance and Resources Board. This Local Development Scheme reflects the change in the Council's policy direction from a LDF to a LDP, takes account of changing legislation and sets out a timetable for the documents to be produced. The Council has published a Preferred Options for Consultation for the 2015-2030 Local Plan[ii]. The consultation ran from 24th July to 2nd October 2013. The Council is aiming for the Local Plan to be adopted by the end of 2014.

This report assesses a range of existing data sources and publications to understand both current demand for energy and emissions of carbon dioxide, together with the potential for the supply of low and zero carbon energy within the Borough.

2. CURRENT ENERGY DEMAND AND CARBON EMISSIONS IN BRENTWOOD

2.1. CURRENT ENERGY DEMAND AND CARBON EMISSIONS

Data on energy demand and emissions of carbon dioxide for the borough of Brentwood was accessed from the Department for Energy and Climate Change (DECC) for the period covering 2005 to 2011[iii]. In the most recent year where data was available (2011) approximately half of all energy used was for transport, of which a fifth (10% of the Brentwood total) was due to road transport on the M25. Motorways are classed as national infrastructure and as such are not considered to be under the influence of a local authority, for example as was defined in the now abolished National Indicator 186 (per capita carbon dioxide emissions in the local area). A third of energy used was for the domestic sector, with the remaining 18% of energy use in the commercial and industrial sector (Figure 1). Within the commercial and industrial sector the main fuel used was electricity (44%) followed by gas (36%) and petroleum products (17% - which is likely to be entirely due to the industrial sector). Within the domestic sector approximately three quarters of energy use was gas, with almost all of the remainder electricity (Figure 2). There was a very small amount of oil use in the homes (under 0.5% of total energy within the sector). Excluding energy use due to the M25, the breakdown of energy use is 20% in the commercial and industrial sector, 37% in the domestic sector, and 43% in the transport sector.

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i https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf (accessed 9/10/13)

ii http://www.brentwood.gov.uk/pdf/24072013090145u.pdf (accessed 9/10/13)

iii https://www.gov.uk/government/organisations/department-of-energy-climate-change/series/sub-national-energy-consumption (accessed 9/10/13)

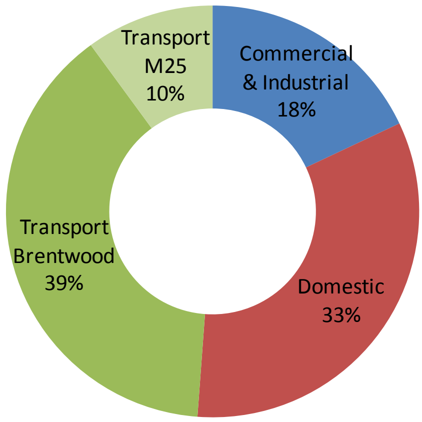


Figure 1: Breakdown of energy use by sector in Brentwood in 2011 (Source: DECC)

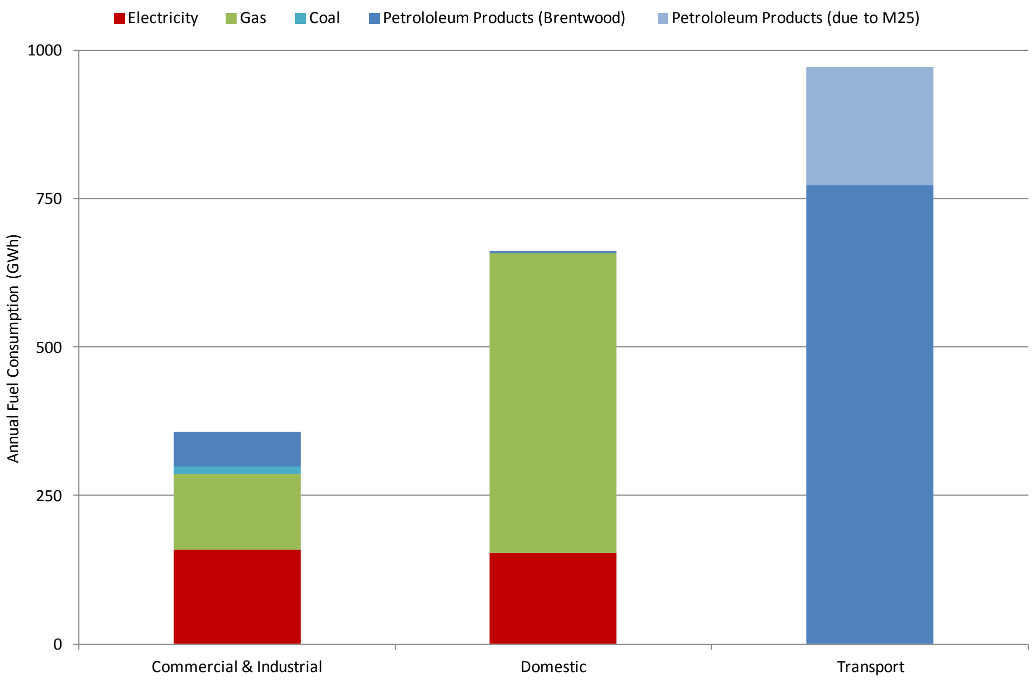


Figure 2: Breakdown of energy use by sector and fuel in Brentwood in 2011 (Source: DECC)

Carbon dioxide emitted within the borough is a combination of the total energy used together with the carbon intensity of each fuel. For example, the carbon intensity of grid electricity is a function of the mix of fuels used at power stations to generate electricity that is supplied through the national grid. Figure 3 shows the carbon emissions per person in Brentwood, Essex and England from 2005 to 2011 for the three sectors (excluding emissions arising from the M25). Broadly, carbon dioxide emissions in Brentwood have fallen over the period following similar trends at county and national levels, though per capita emissions in Brentwood are higher. However, the breakdown of those emissions in Brentwood is different. Transport emissions in Brentwood are about double the national average, which is a function of very high levels of car ownership, congestion, and likely further travel distances. Emissions in the transport sector have fallen over the period echoing national trends, which are driven by increased efficiency of new vehicles and the impact of the recession on freight transport.

Emissions in the commercial and industrial sector are significantly lower than the national average, which reflects the comparatively low proportion of manufacturing within the local economy. The reduction in emissions in this sector has not been as dramatic compared to the national picture, where the recession has had a large impact on production.

Domestic emissions are broadly similar to both county and national emissions from the sector, though it is interesting to note that emissions are slightly higher. This is surprising for an area that is located in the milder south of the country, and that has access to gas (parts of the country have high proportions of homes off the gas grid resulting in increased use of higher carbon intensity fuels). The average energy efficiency of homes in Brentwood is similar to the national average (the average SAP rating in Brentwood is 51[iv] compared to a British average of 51.6[v] (2011), though the British average in 2012 was 55[vi]) and occupancy density is similar (2.4 people per house in Brentwood, East of England and England[vii]). Based on population and land use statistic data[viii] the average area of housing for each person in Brentwood is 77 sq.m compared to 76 sq.m for the East of England and 68 sq.m for England. That homes in Brentwood are 13% larger than homes in England on average is the likely reason for higher domestic energy use. Domestic emissions are sensitive to the weather, though over time have fallen mainly due to the impact of improved energy efficiency.

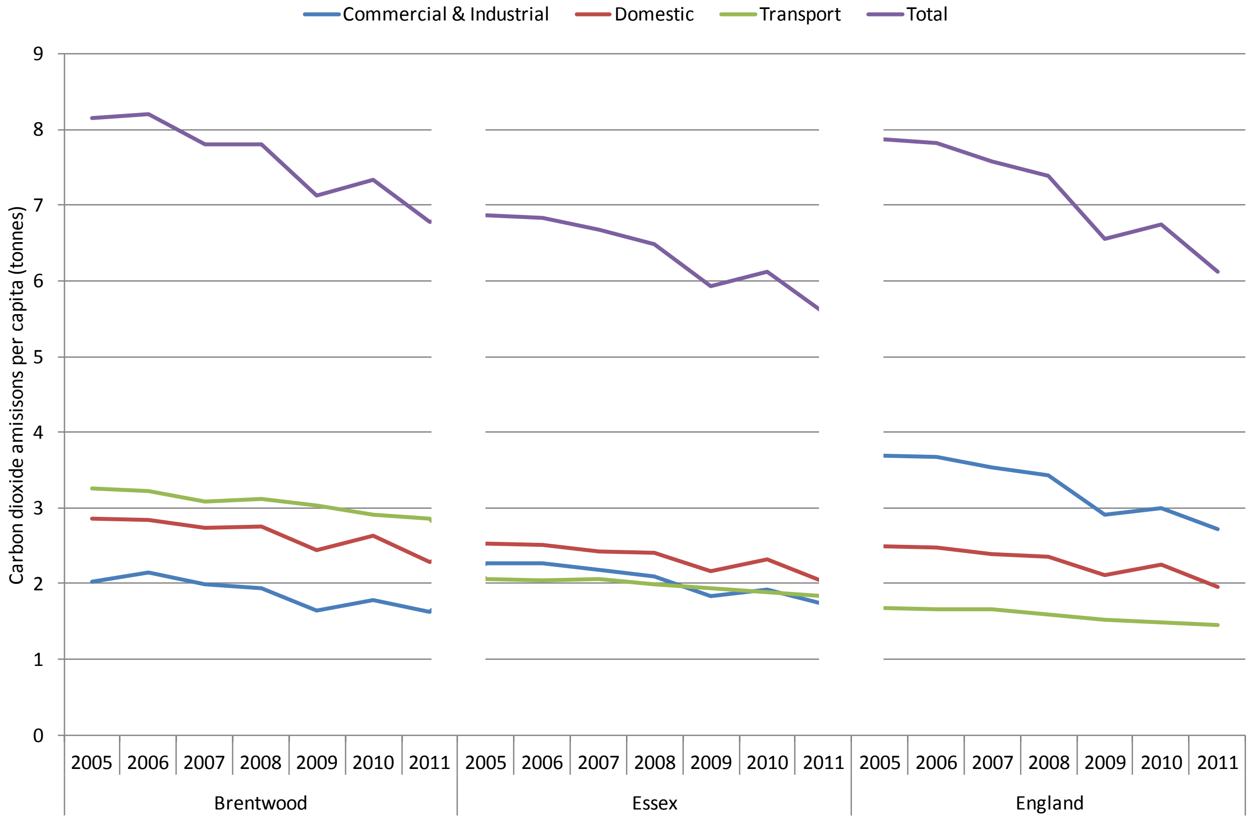


Figure 3: Carbon dioxide emissions per capita for Brentwood, Essex and England from 2005 to 2011 broken down into the commercial and industrial, domestic and transport (excluding the M25) sectors (Source: DECC)

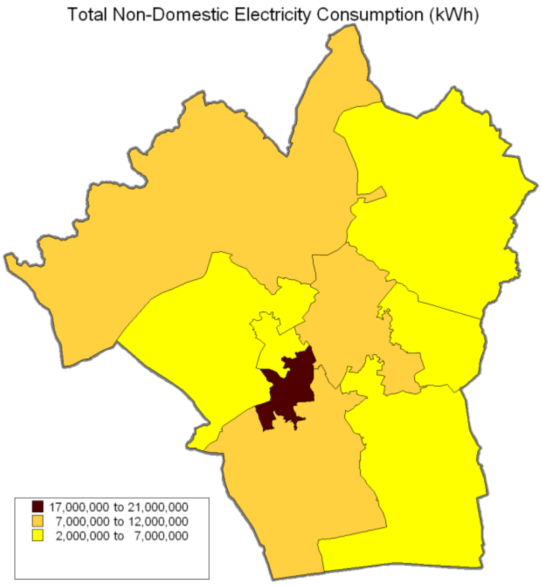
v Great Britain's housing energy fact file, DECC 2011
vi United Kingdom housing energy fact file, DECC 2012
vii Calculated from 2011 Census data http://www.neighbourhood.statistics.gov.uk/ (accessed 9/10/13)
viii
http://www.neighbourhood.statistics.gov.uk/dissemination/LeadTableView.do?a=7&b=6275033&c=brentwood&d=13&e=8&g=6423207&i=1001x1003x1004&m=0&r=1&s=1381310426815&enc=1&dsFamilyId=1201 (accessed 9/10/13)

2.2. SUB-BOROUGH ENERGY DEMAND

Intra-borough trends for energy use and related measures were investigated using data published by DECC[ix] and utilising the output of the recent 2011 Census[x]. Data from these sources was available at Middle Layer Super Output Area (MLSOA) level, and in many cases at Lower Layer Super Output Area (LLSOA) level. These are statistical geographic areas that were created in 2001 and at that time each LLSOA had an average of 1,500 residents and each MLSOA had a minimum of 5,000 residents. There are 9 MLSOAs and 45 LLSOAs in Brentwood.

2.2.1. COMMERCIAL AND INDUSTRIAL

Electricity and gas consumption data in the non-domestic sector is available at MLSOA level, and this was plotted in Figure 4. Unfortunately at this resolution, it is not possible to identify higher intensity users in order to begin to formulate policy to reduce energy use. In addition, a large proportion of electricity consumption within the data is not attributed to any specific area; rather it is attributed to consumers with "half hourly" electricity meters. A half hour meter is mandatory for all business electricity customers with a maximum demand of 100 kW or more in any single half-hour period though businesses with maximum demand of more than 70kW can opt to have a half hourly meter. In 2011 total non-domestic electricity consumption in Brentwood was 158 GWh of which 88 GWh was from sites with half hourly meters. There were 103 such meters compared to approximately 2,600 total non-domestic electricity meters. Therefore, 56% of all non-domestic electricity was consumed at only 4% of sites. The average electricity consumption at each of these large sites was 855 MWh compared to 28 MWh at the remaining smaller sites in the borough.



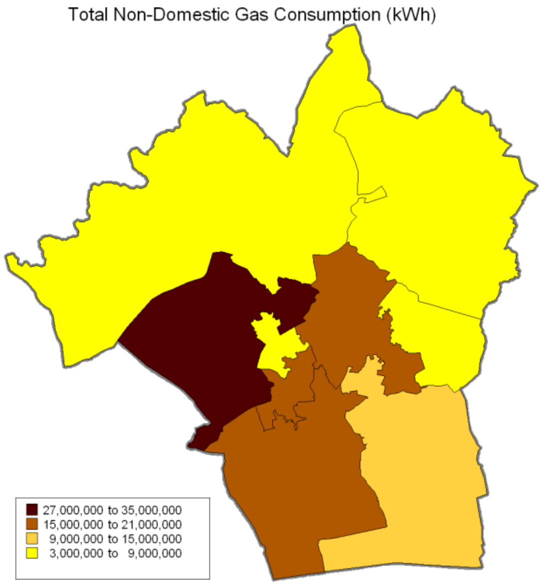
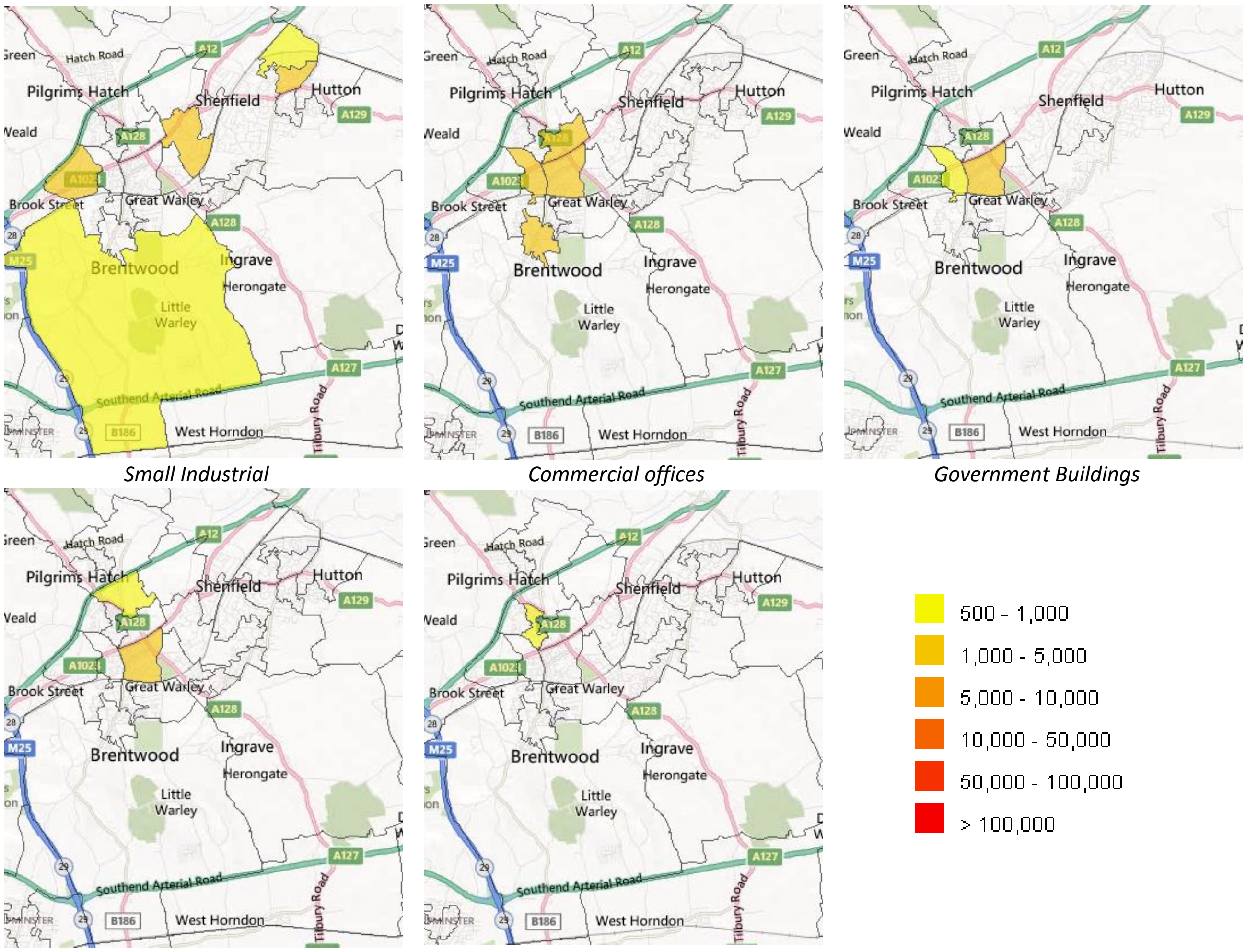


Figure 4: Non domestic electricity and gas consumption in 2011 at Middle Layer Super Output Area level (Source: DECC)

The DECC heat map[xi] provides data down to LLSOA and breaks down non-domestic consumption into sub-sector categories. The data is derived from floor areas of each sub-category together with benchmark data on energy consumption i.e. it is not based on metered energy consumption within that LLSOA. Nevertheless, it provides an indication of the heat loads within the borough. As might be expected, the commercial and public offices have the greatest heat demand (this would very likely strongly correlate with

ix https://www.gov.uk/government/organisations/department-of-energy-climate-change/series/sub-national-energy-consumption
(accessed 9/10/13)
x http://www.ons.gov.uk/ons/guide-method/census/2011/index.html (accessed 9/10/13)
xi http://chp.decc.gov.uk/developmentmap/ (accessed 9/10/13)

electricity too) in the central area of Brentwood, whilst small industrial loads are located in areas around the centre at industrial estates, for example the Hutton Industrial Estate and Warley Business Park.



Small Industrial *Commercial offices* *Government Buildings*

Education *Health*

Figure 5: Non-domestic heat loads (kW/km²) for selected lower super output areas in Brentwood (Source: DECC).

2.2.2. DOMESTIC

Energy consumption data in the domestic sector is available at the LLSOA level. Energy intensity (energy consumed per household) is lowest in the centre of Brentwood and is at its greatest on the sub-urban edges of Brentwood and Shenfield, and in the more rural fringes to the north and west of the borough (Figure 6). There is a very strong relationship between electricity and gas consumption. This can be explained by the distribution of accommodation type across the borough. High energy consumption corresponds with the location of the larger detached and semi-detached properties (Figure 7) and therefore increased number of bedrooms (Figure 8). Energy consumption is lowest where there are high proportions of terraced housing and flats. The majority of flats are located within the town of Brentwood. Brentwood has similar proportions of semi-detached houses and flats compared to the national average, though a much greater proportion of detached houses at the expense of terraced houses (Table 1). This is likely due to Brentwood being a commutable distance to the Greater London Metropolitan area and lack of manufacturing heritage which would give rise to the terraced housing. The outcome of an increased proportion of larger detached houses is that energy consumption within the borough is increased.

The majority of homes in Brentwood are heated via gas central heating (87%) compared to the national average of 78% (Table 2). There is a small proportion of oil heated homes (2%) in the rural fringes of the borough. The areas with the highest proportion of electric heating are around the town of Brentwood. Of the 30,646 households, 75% are owner-occupied. 2,703 (9%) of households rent from the council and a further 883 (3%) from other Registered Social Landlords. 3,452 (10%) rent within the private sector. The spatial distribution of non owner-occupied housing is shown in Figure 9, and can bee seen as concentrated areas about the central area of Brentwood.

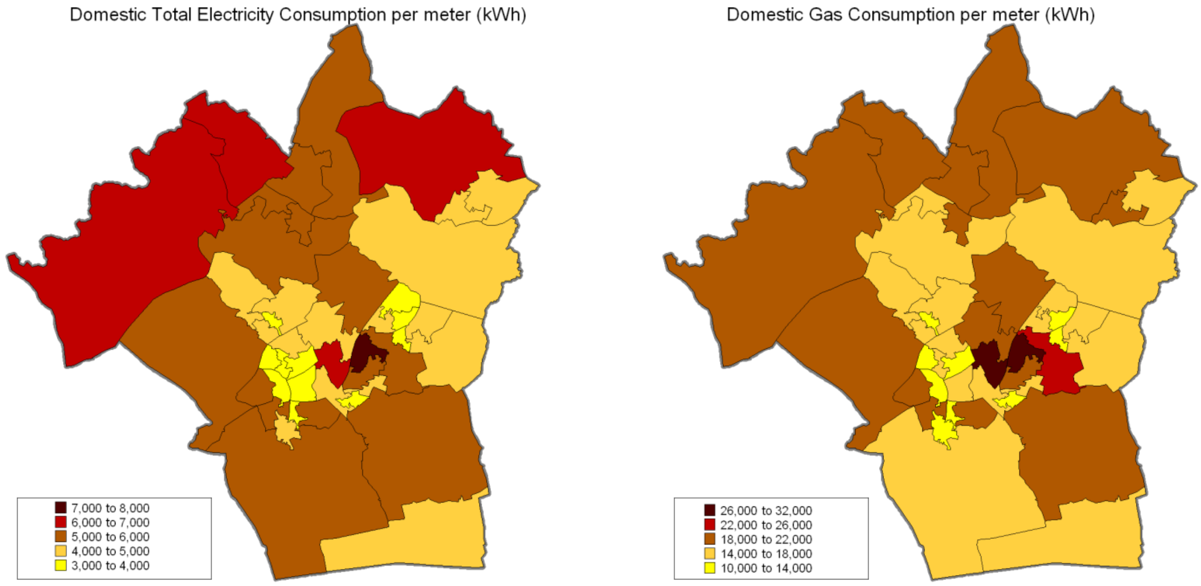


Figure 6: Domestic electricity and gas consumption in 2011 at Lower Layer Super Output Area level (Source: DECC)

Table 1: Type of housing in Brentwood, East of England and England (Source: 2011 Census)

	Brentwood	East of England	England
Detached	31.0%	29.4%	22.3%
Semi-Detached	31.9%	30.4%	30.7%
Terraced	15.7%	22.8%	24.5%
Flat/Apartment	17.9%	13.7%	16.7%

Table 2: Type of heating system in Brentwood (Source: 2011 Census)

	No central heating	Gas central heating	Electric (including storage heaters)	Oil central heating	Solid fuel (e.g. wood, coal)	Other central heating	Two or more types of central heating	Total
Number	433	25,584	1,769	441	64	232	868	29,391
Proportion	1%	87%	6%	2%	0%	1%	3%	100%

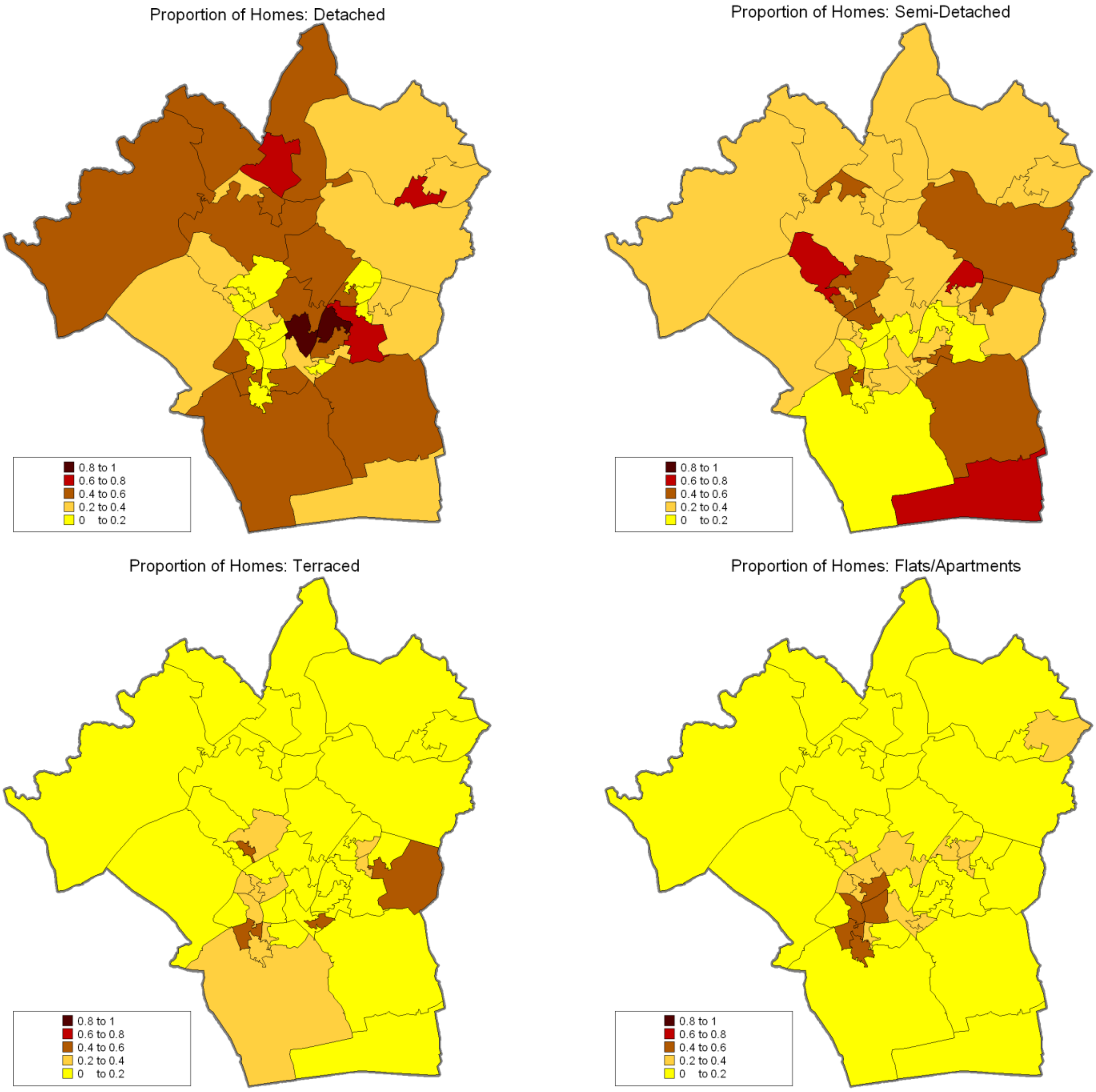


Figure 7: Proportion of detached, semi-detached, terraces and flats in 2011 at Lower Layer Super Output Area level (Source: 2011 Census)

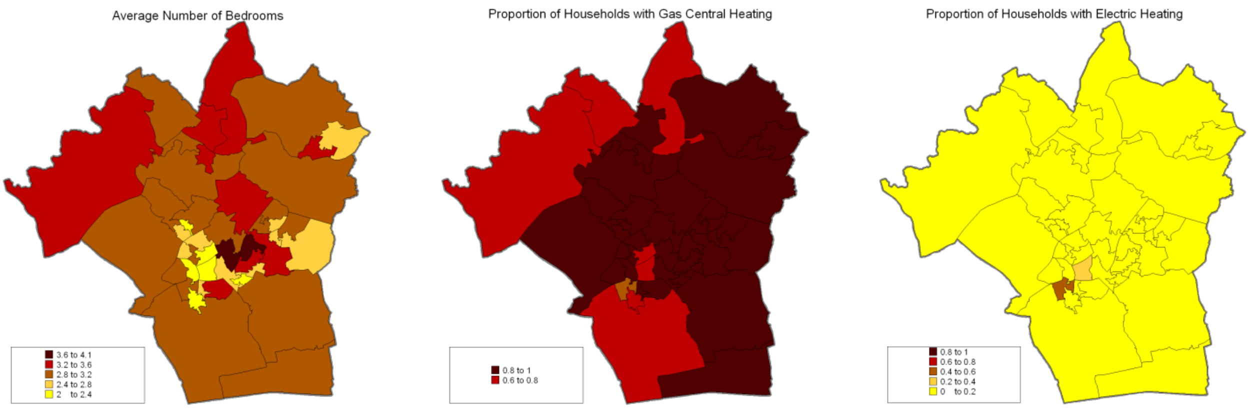


Figure 8: Average number of bedrooms (left), proportion of homes with central heating (centre) and proportion of homes with electric heating in 2011 at Lower Layer Super Output Area level (Source: 2011 Census)

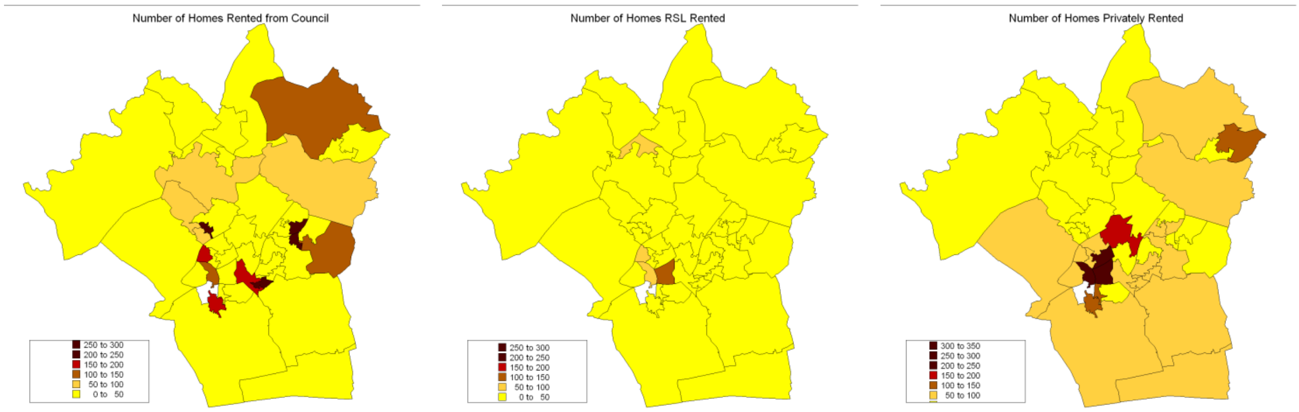


Figure 9: Number of households renting from Brentwood LA, from another RSL, or renting from the private sector (Source: 2011 Census)

2.2.3. Transport

Mode of travel to work, and levels of car or van ownership are available at LLSOA from the 2011 Census. Brentwood has fewer households with no access to a vehicle compared to the national average, and a higher number of cars per household (Table 3). Carbon emissions from transport are about twice as high per capita compared to the national average. Brentwood has fewer people not in employment, and also a larger proportion of people commuting by train, with London being the most likely destination. A similar proportion of people drive to work compared to the national average (Figure 10). As would be expected, the locations where the proportions of people commute are highest nearest to the four stations in the borough, with over 40% of commuters living in the LLSOA by Shenfield station doing so by train. Similarly, higher proportions of people commute by foot or cycle in the urban areas of the borough, though on average 7% of people commute by foot and 2% by bike. Travel by car is the most common mode of commuting, especially in the more rural parts of the borough where in some parts over 70% of those commuting do so by car (Figure 11). Just over half of all energy use in the transport sector is from cars, with 44% from lorries and vans (Figure 11). This data includes traffic from the M25 which will have an increased proportion of goods vehicle traffic. There is a net commuting flow into Brentwood from the surrounding boroughs with the exception of Harlow where there is a small net flow out, and London where there is a significant net flow of commuters from Brentwood (Figure 12). It is also very likely that there is a flow of commuters to London from boroughs beyond Brentwood e.g. Chelmsford, which would contribute to energy use and carbon emissions from transport within Brentwood.

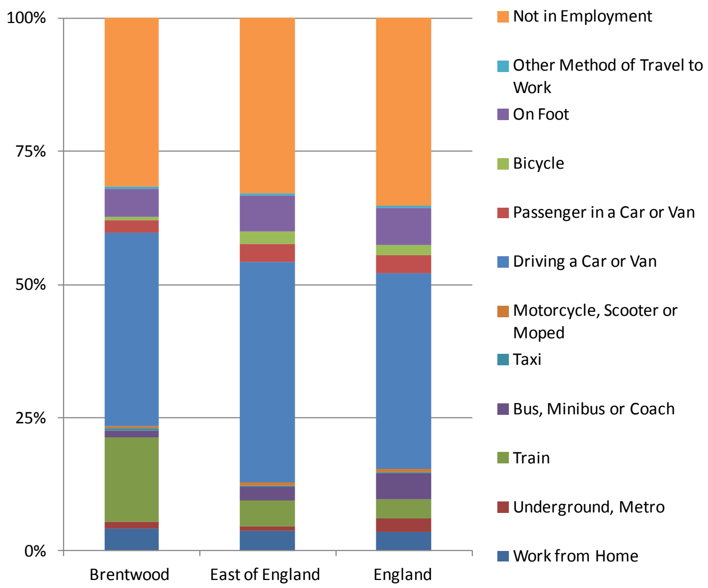


Figure 10: Method of travel to work in Brentwood, East of England and England (Source: 2011 Census)

Table 3: Car availability and ownership in Brentwood (Source: 2011 Census)

	Brentwood	East of England	England
Households with no cars or vans	15%	19%	26%
Cars per household	1.4	1.3	1.2

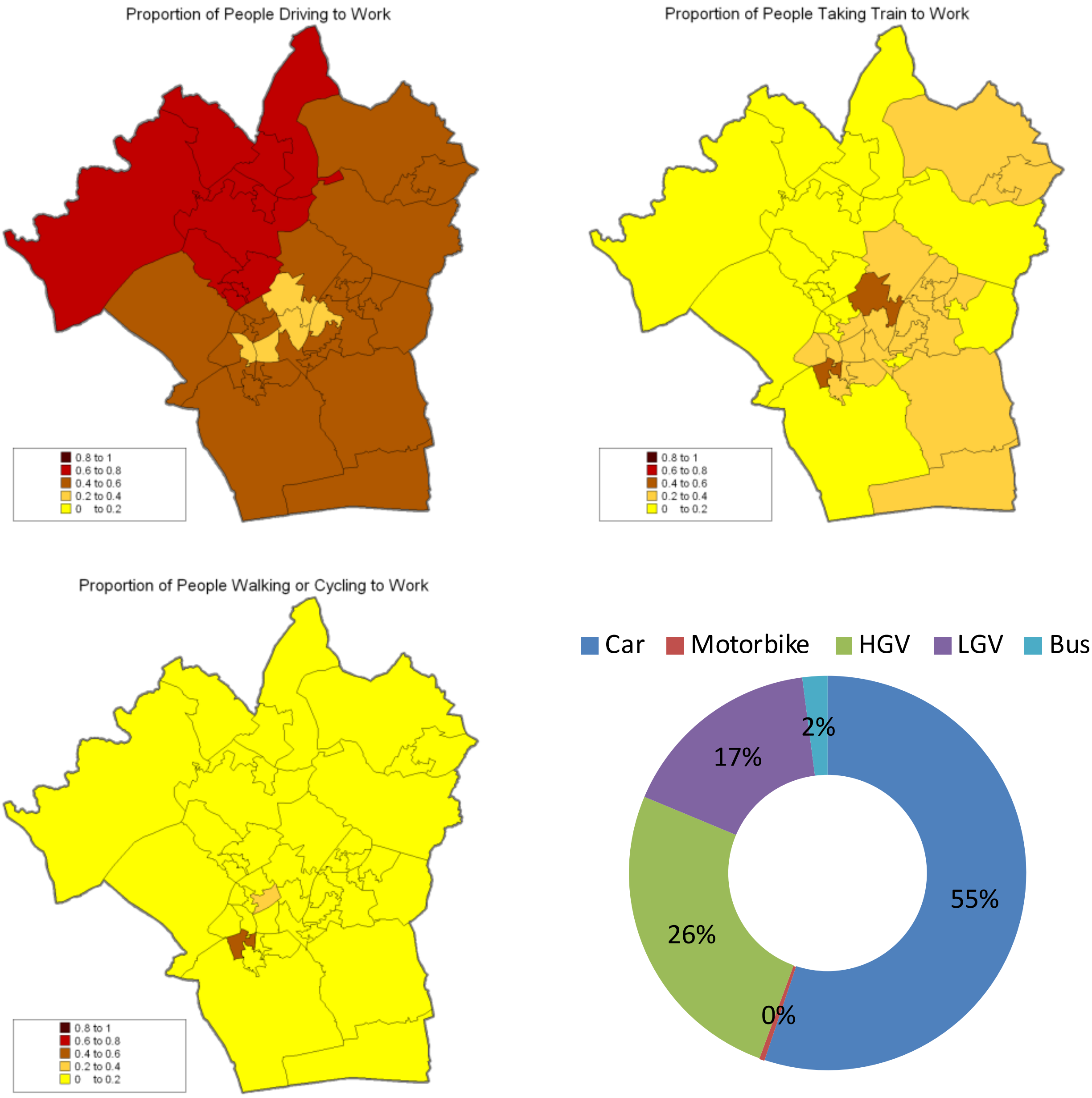


Figure 11: Proportion of people commuting by mode at LLSOA level and energy consumption by vehicle type (Source: 2011 Census and DECC).

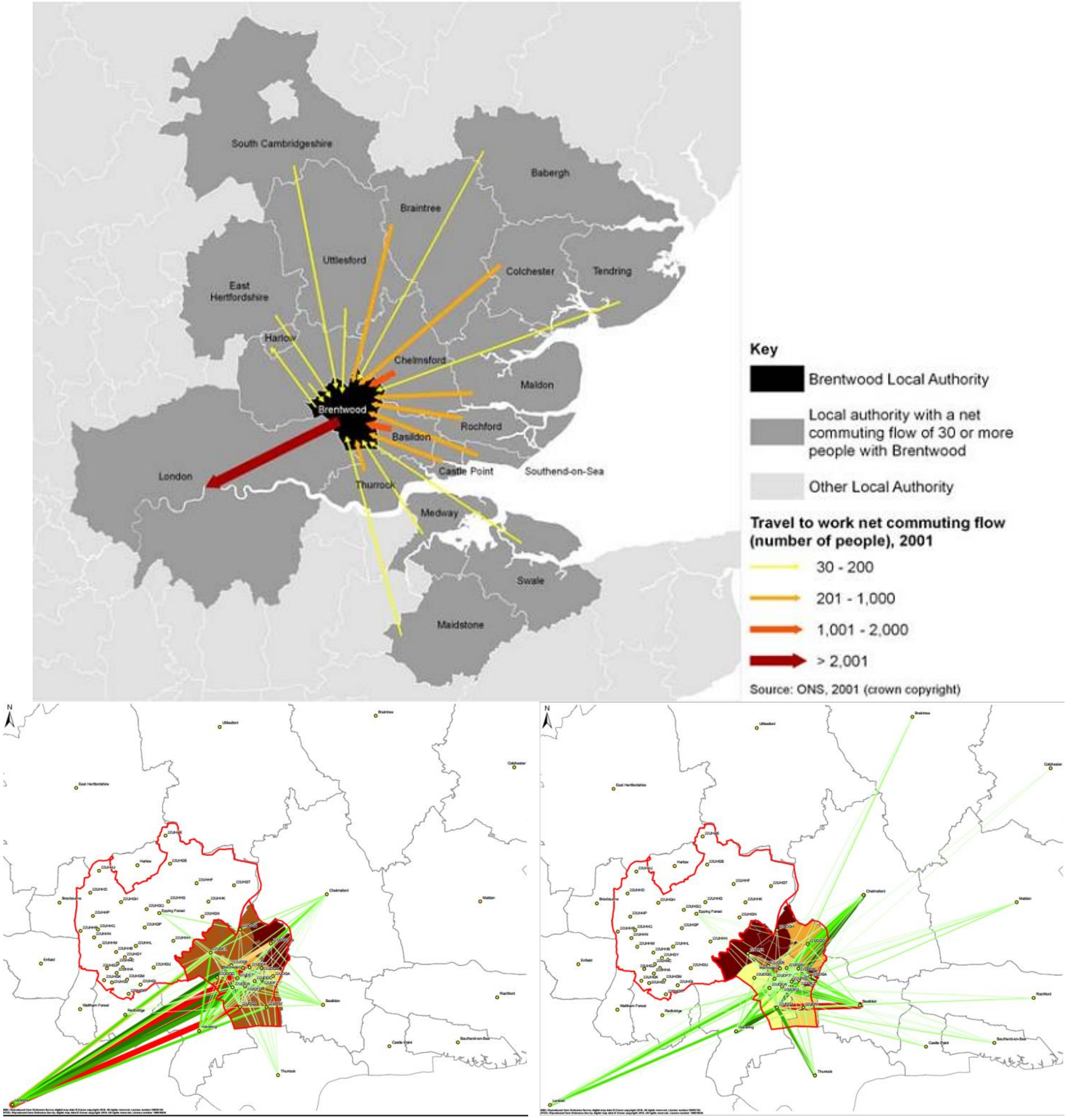


Figure 12: Net commuting flows to/from Brentwood (top) and flows out (bottom left) and in (bottom right) (Source: Nathanial Lichfield and Partners[xii], and Atkins, both after 2001 Census)

xii The Heart of Essex: Economic Futures Study, Final Report, Nathaniel Lichfield & Partners 2012

2.3. The Impact of Growth and National Policy

The potential impact of growth on energy use and carbon emissions was analysed based on a series of assumptions as stated in Appendix 1. The impact of growth due to 3,500 new homes, 31 hectares of employment space, new retail space, and the associated transport energy use is predicted to result in an increase in energy use of 10% from 2011 to 2030, and an increase in 12% in carbon dioxide emissions over the same period. The potential impact of national policy on energy use and carbon emissions was analysed based on the above trajectory for growth, together with a series of assumptions as stated in Appendix 2. The combined effect of growth and policy is projected to result in a decrease in energy use of 8% from 2011 to 2030, and a decrease in 28% in carbon dioxide emissions over the same period. The larger decrease in carbon emissions is predominantly driven by the policy to reduce the carbon intensity of grid electricity; the national trajectory is for a 64% reduction in intensity from 2007 to 2022. Other notable policies include the improvement in efficiency of new vehicles thereby gradually reducing energy use from the overall vehicle fleet, energy efficiency programmes, and the increased penetration of renewable heat. The recent analysis of national performance towards meeting carbon emissions budgets has shown that the factors with the greatest impacts are the weather and the prevailing economic climate. Figure 13 shows the impacts of both local growth and government policy on energy use and carbon dioxide emissions in Brentwood.

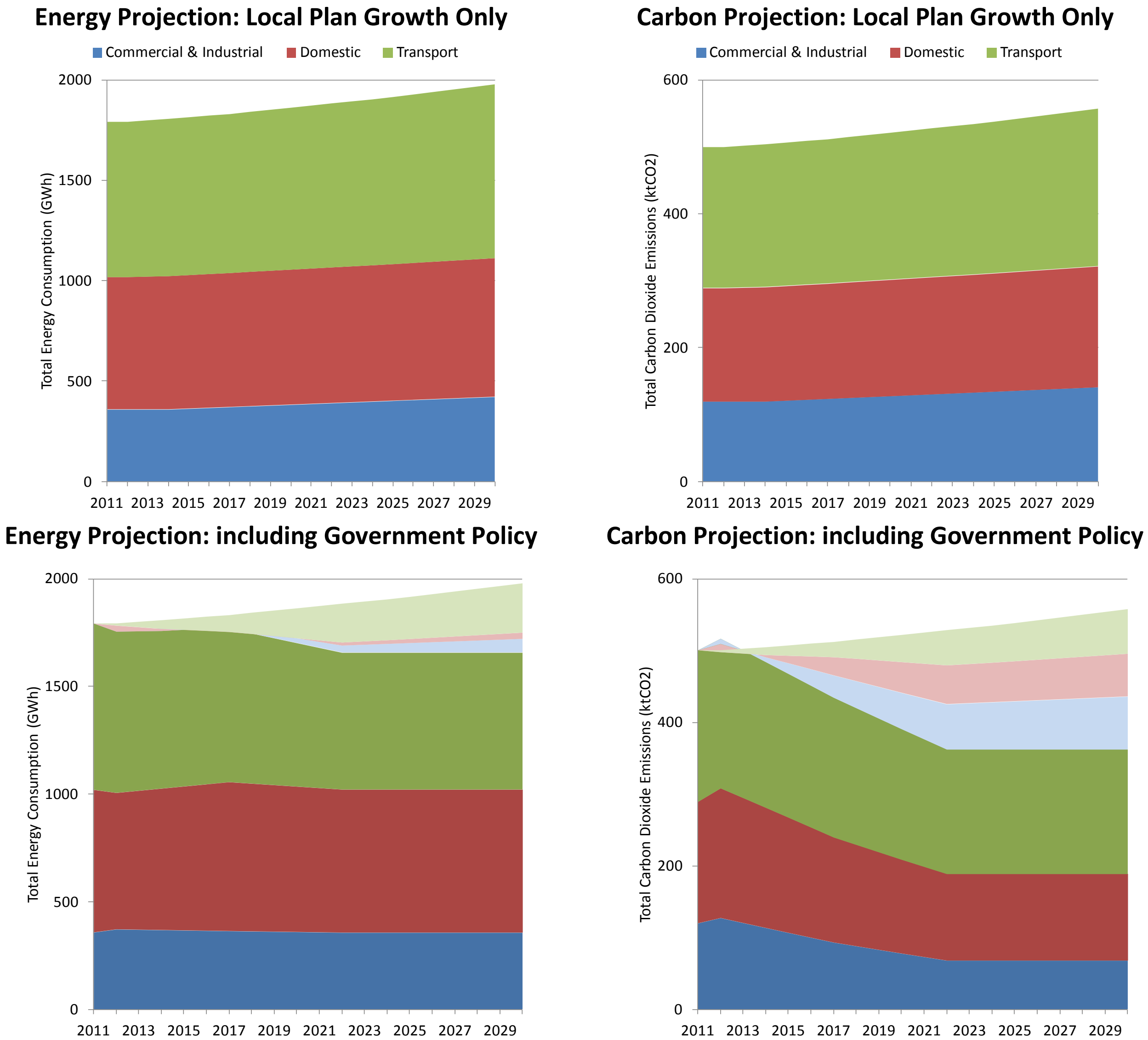


Figure 13: Changes in energy consumption (left) and carbon dioxide emissions (right) over the plan period to 2030 excluding transport energy and carbon due to traffic on the M25 as a result of growth identified in the Local Plan (top) and including the impact of national government policy (bottom). The lighter shaded regions correspond to savings.

3. THE POTENTIAL FOR RENEWABLE ENERGY IN BRENTWOOD

3.1. THE POTENTIAL RESOURCE WITHIN BRENTWOOD

The potential for renewable energy in Brentwood was assessed. This was based predominantly on a capacity study undertaken for the East of England by AECOM in 2011[xiii]. The assessment within this study was based on DECC's methodology which was developed by the consultancy firm SQW in 2010. The DECC methodology is based on a sequential constraint approach where constraints are progressively introduced to reduce the naturally available resource (level one in Figure 14) to those that are constrained by planning and regulation (level four in Figure 14). The East of England resource assessment supplemented any gaps in the DECC methodology with additional assumptions.

The East of England study concentrated on the resource potential within the region rather than the renewable energy generated within a region. For example, forestry arisings from within the East of England that are converted to a heating fuel would be classified as a renewable resource and counted within the region's capacity. Wood fuel burned in a biomass boiler within the region would be classed as renewable energy used within the region, and would not be counted in the output as the fuel may have been imported from outside of the region. The scope of the assessment covered district heating (DH) and combined heat and power (CHP), large scale onshore wind, hydro energy, biomass covering a range of fuels, energy from waste (EfW) and microgeneration technologies including small scale wind, solar, and heat pumps. The output from this assessment for Brentwood was extracted. Additional commentary on matters relating to the East of England assessment and the numbers presented here for Brentwood are given in Appendix 3, including assumptions made to establish potential targets for 2030.

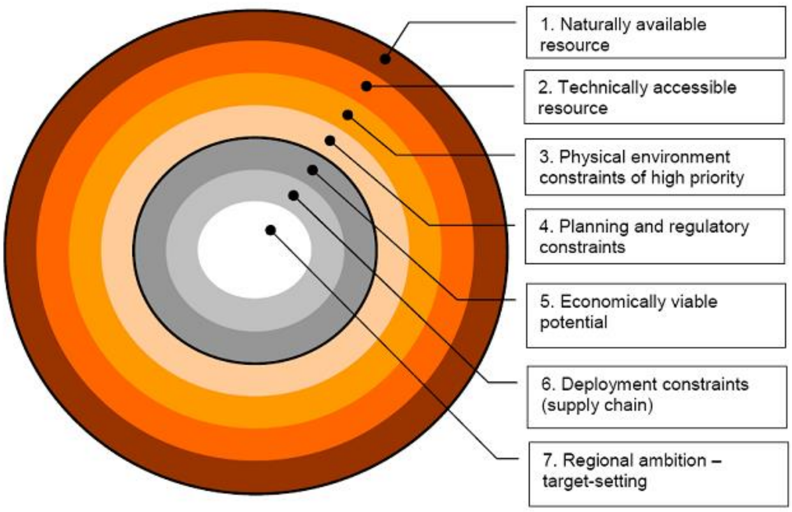


Figure 14: Stages for developing a comprehensive evidence base for renewable energy potential (Source: SQW, DECC)

The potential resource within Brentwood is spread over a range of technologies in the heat and power sectors. The most significant in terms of capacity are large scale wind turbines, building mounted thermal technologies (photovoltaic panels [PV] and solar hot water panels [SHW]), large scale standalone PV arrays, and heat pumps (Figure 15). The emphasis between these technologies changes when annual energy output rather than installed capacity is considered (Figure 16). Annual output accounts for varying output over a year, for example due to variations in wind speeds for wind turbines, or sunlight availability in the case of PV. Large scale wind energy is still shown to have the greatest total potential, whilst the importance of the energy content of biomass matter from within Brentwood is more significant. In total,

xiii http://www.sustainabilityeast.org.uk/index.php?option=com_content&view=article&id=113&Itemid=92 (accessed 18/10/13).

there is an overall potential to generate 246 GWh of electricity and 60 GWh of heat using resources from within Brentwood. By 2030, based on estimates and trajectories taken from the East of England resource assessment, 68 GWh (28% of resource) of electricity and 43 GWh (72% of resource) of heat could be generated from Brentwood's resource.

Figure 17 shows the potential for renewable energy output compared to the current and projected demand for energy from Brentwood. If the 2030 renewable energy projections were met, then in 2030 6.7% of total energy demand could be met by renewable energy, or 10.9% of buildings related energy (i.e. excluding transport).

This commentary refers to energy generation, which is the primary focus of this report. Regarding carbon emissions, the relative importance of renewable electricity compared to heat generation is increased as the carbon intensity of displaced grid electricity is higher than that of displaced heat, which in Brentwood predominantly arises from the combustion of natural gas. This is discussed further in Section 3.4.

This assessment is highly sensitive to the assumptions made for each potential resource, with some of these assumptions being more robust than others. For example, based on the East of England resource assessment, the total physical resource for large scale wind turbines were based on reasonable application of constraints for levels 1 to 3 of the SQW methodology. For level 4 however (planning and regulatory constraints), a factor of 10% was applied to the physical resource. From there, a further factor of 10% was applied in order to estimate potential uptake to 2020. From this, an estimate for a trajectory to 2030 was made for this report. The actual uptake will depend on factors such as land prices and ownership, energy costs and incentives, and local planning issues, so the results presented here must be viewed as a first order approximation.

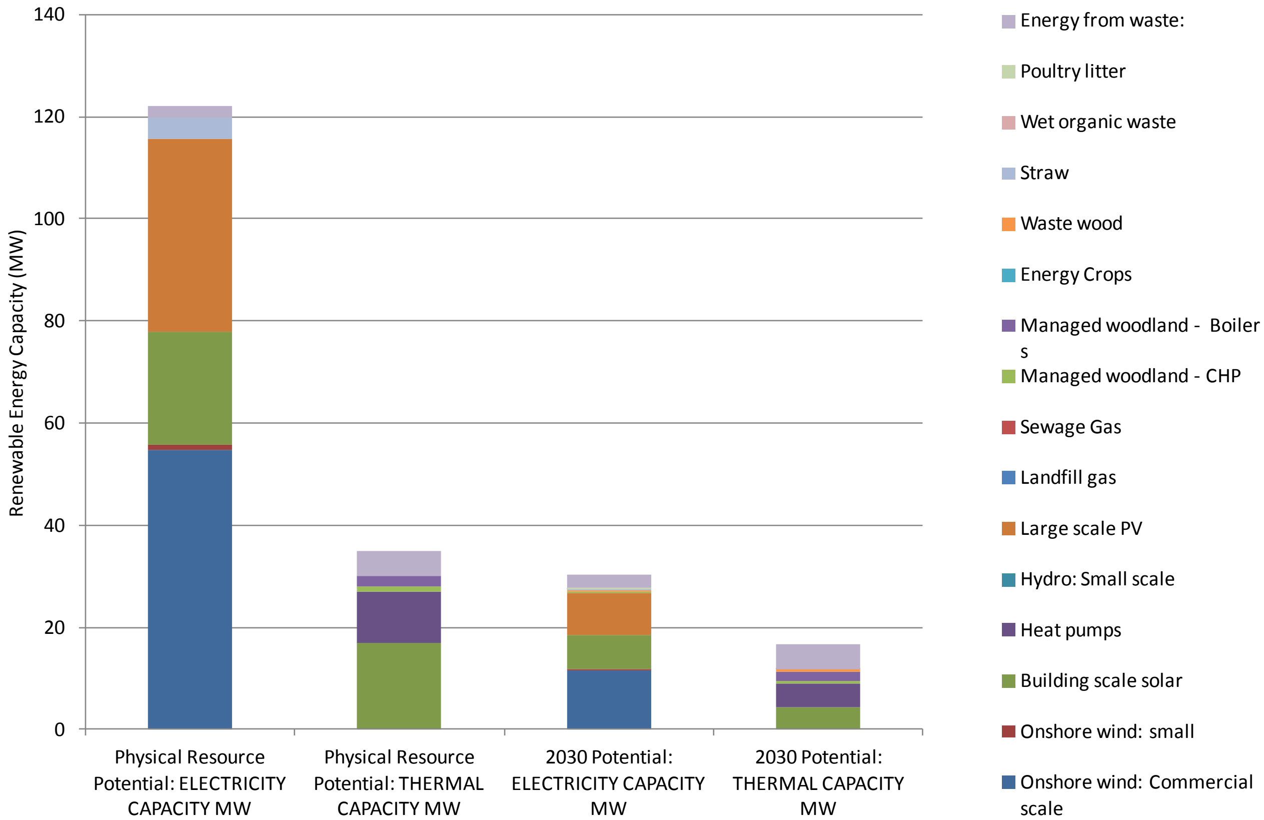


Figure 15: Total potential and potential 2030 target for capacity of thermal and electricity renewable energy in Brentwood

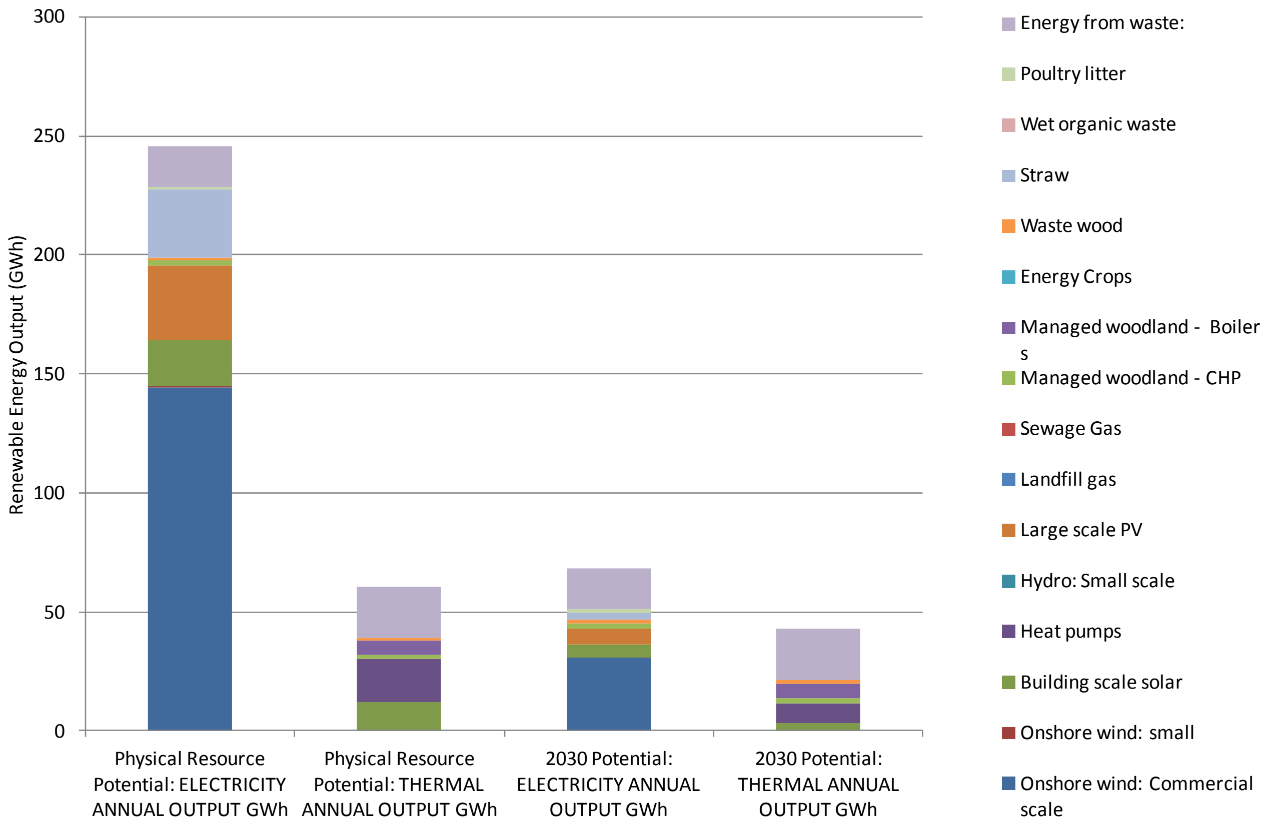


Figure 16: Total potential and potential 2030 target for output of thermal and electricity renewable energy in Brentwood

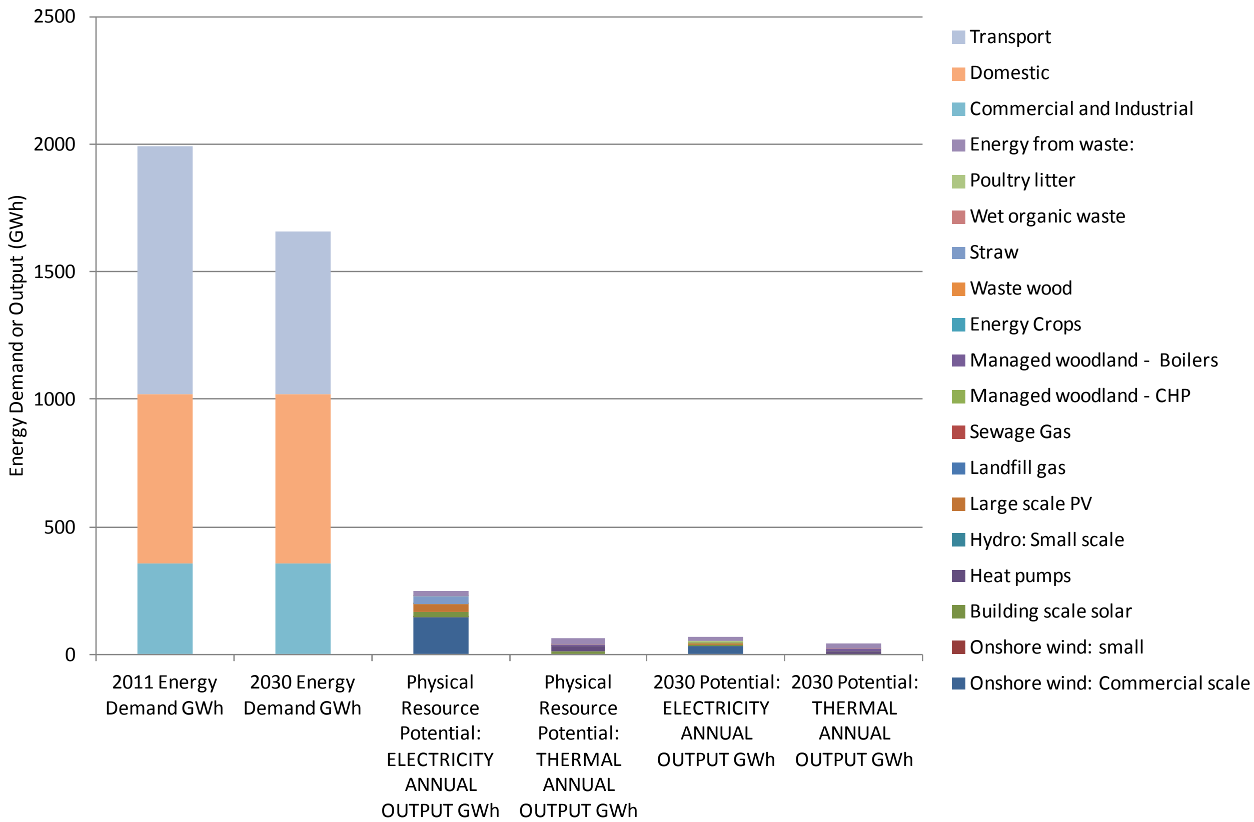


Figure 17: Total potential and potential 2030 target for output of thermal and electricity renewable energy in Brentwood, including current and projected demand for energy within the Borough

3.2. District Heating

In "the Future of Heating"[xiv] the Government highlighted the role for heat networks for delivering low carbon heat. These networks connect a central low carbon energy centre to heat consumers through a network of insulated underground pipes. The network takes hot water from the energy centre to the homes and other buildings and returns cooled water for re-heating. Small heat exchangers (Heat Interface Units or HIUs) in each building extract heat from the district heating network and control the heating and hot water in each building. Modern heat networks have low heat losses (~1°C/km) leading to low system heat losses. The energy centre typically houses a combined heat and power unit (CHP) which produces both electricity for the national grid (and/or a local customer) together with heat to be distributed through the heat network. The co-generation of electricity and heat can give overall efficiencies of up to 80%. In contrast the UK's fleet of electricity power stations had an average efficiency of 35% in 2012[xv]. A gas CHP system can therefore achieve significant overall energy and carbon savings. If a renewable fuel is used at the energy centre (e.g. biomass) zero carbon electricity and heat can be generated. Currently the UK supplies 2% of heat to buildings through heat networks. In Denmark over 61% of customers receive their heat this way.

District heating can be retrofitted for existing heat customers or installed in developments as part of a site wide low or zero carbon (LZC) energy solution.

Retrofit heat networks are most suited to areas with at least one large anchor load (e.g. a major hospital) which is located in an area with a high heat density (e.g. and number of high rise apartments). The East of England resource assessment did not identify any significant anchor loads in Brentwood. Areas with mixed use provide a more even heat load during the day and over the year, which enables the CHP plant to operate for more hours in the year, making the unit more economic. The CHP unit will typically be sized to be supplying heat for 5,000 hours per year. The remaining hours will be served by back up boilers. The East of England capacity study identified potential areas of high heat density (defined where demand exceeds 3000 kWh/km^2) that could result in the development of district schemes, notably at Brentwood town centre. Further desk study suggests that there are unlikely to be major anchor and high heat density areas in the Borough suitable for retrofit only district heating networks. New development will therefore play an important role in heat network development in the Borough.

The requirement to achieve Zero Carbon from 2016 as part of the Government's tightening of the Building Regulations is an additional driver for considering district heating and CHP especially on larger sites where a site wide approach can be taken. Experience elsewhere suggests that a site wide solution may offer the lowest cost option for developers to achieve carbon standards required through tougher building regulations. Despite this there is a tendency where land ownership is fragmented for developers to opt for traditional heating solutions. Policies which encourage developers to connect to district heating where viable can therefore be helpful in delivering heat networks, and this is encouraged in the National Planning Policy Framework (paragraph 97).

District heating is a viable low and zero carbon energy solution for new development. At the 2,900 home Cranbrook development, East of Exeter, EON is installing CHP and site wide district heating[xvi]. In autumn 2013 some 10 km of heat network had been installed and 400 homes connected. Biomass CHP will be installed making the development Zero Carbon. There is evidence that district heating can be viable on much smaller sites; according to the Carbon Trust district heating can be viable for developers on sites with as few as 200 homes[xvii]. In Woodbrook in Northern Ireland biomass district heating is cutting residents' fuel

xiv "The Future of Heating: Meeting the challenge", DECC, March 2013

xv DUKES 2013 Chapter 5 p 112, DECC, July 2013

xvi See http://www.eonenergy.com/for-your-business/Sustainable-solutions/Case-studies/Community-energy/cranbrook (accessed 28/10/13)

xvii "Biomass in the social housing sector" Carbon Trust, 2011 bills in a 358 home development[xviii]. In Banchory, Aberdeenshire a scheme is serving 40 homes with plans to extend to 206 homes[xix].

In general the viability of DH and CHP schemes are improved with increased scale, density and mix of uses. However, smaller sites close to large exiting loads may provide opportunities for collaboration which provides cost effective energy efficient low carbon heat and electricity for both.

The previous section discussed the renewable or low carbon energy *resource* potential within the region rather than the potential for renewable or low carbon *generation* within Brentwood. This involved an assessment of the amount of potential fuel that could be used for heating e.g. biomass. The energy centre in a DH or CHP scheme could be fuelled by natural gas which would necessarily be imported into the district, or using a low carbon fuel such as biomass which may arise from within the district, or which may be imported. This section discusses the potential for DH schemes and the findings sit alongside those from the previous section (district resource assessment). The Site Allocations from Brentwood's Local Plan was assessed to establish areas where there is potential for district heating and CHP, with assumptions stated in Appendix 3. Three broad sites were found, with the remaining development sites being in the main small and better suited to enhanced energy efficiency measures and building integrated renewable energy:

1. West Horndon (sites 20, 21 & 37) is a mixed use development in the south of the Borough comprising 1,500 homes and approximately 5 hectares of employment land, supporting retail, provision of pitches for Travellers, community facilities, green space etc. District heating and CHP is very likely to be viable on this site. As development at West Horndon is programmed to start in 2017/18, all homes and potentially some non-domestic buildings will need to be Zero Carbon. The scale of proposed development at West Horndon is significantly greater than elsewhere in the Borough, and as such represents the best opportunity to implement a DH scheme.
2. Brentwood town centre (Sites 3, 39, 40, 41, 100 and 102). A locality with a number of sites with a total of 399 homes and the mixed use Baytree Centre. The potential inclusion of a large nearby user (BT office at 1 London Road) could improve the potential viability. There are also approximately 300 council owned homes within 1 km north of the area which could be connected, though this has not been assumed here.
3. Council depot, The Drive, Warley (Site 81, 137 homes) and the Warley Training Centre (13b 38 homes) totalling 175 homes adjacent to the Ford headquarters building. There are also the immediately adjacent apartment blocks of council owned Gibraltar House (54 units – heating system unknown, though potentially electrically heated), Mayflower House (41 units – gas heated) and Becketts Court (35 units – electrically heated).

These sites will need the collaboration of a number of parties to deliver sufficient heat load to make district heating viable. As it is unlikely that such collaboration will occur spontaneously, leadership from the Council will be required to inspire the delivery of these networks.

Table 4 shows the estimated total heat loads for the three sites (all new build and existing buildings above connected) based on assumptions as shown in Appendix 3. The use of gas CHP at these sites is estimated to reduce energy consumption in the Borough by 9.2 GWh. The attraction for developers is the potential to achieve low and zero carbon heat at a competitive price to the alternative house by house solutions. The use of biomass CHP can achieve true net zero carbon as at Cranbrook. Alternatively, the use of residual waste (typically 50% biomass) in a gasification facility can achieve significantly greater CO_2 savings and

xviii "Woodbrook Biomass Community District Heating Scheme, Belfast", Vital Energy, 2008 see http://www.chpa.co.uk/medialibrary/2011/04/07/a0276d42/woodbrook%20biomass%20DH%20belfast%20-%20Vital.pdf (accessed 28/10/13)
xix "Hill of Banchory Case Study", Vital Energy, 2011 see http://www.vitalenergi.co.uk/CaseStudy_Hillofbancory.html (accessed 28/10/13)

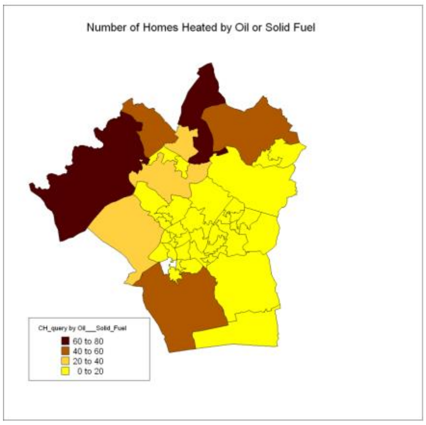
potentially play an important role in local residual waste treatment, as in Exeter[xx]. The West Horndon development in combination with the nearby Brentwood Enterprise Park (M25 works site) is perhaps the area most suited to this approach.

Table 4: District heating potential energy loads and savings

Site	Domestic heat (GWh)	Non domestic heat (GWh)	Total heat (GWh)	Saving assuming gas CHP (GWh)
West Horndon	6.7	3.4	10.1	4.0
Brentwood centre & BT office	1.7	2.8	4.6	1.8
Council depot, 130 existing homes & Ford HQ	2.3	6.3	8.6	3.4
Total potential	10.7	12.6	23.3	9.2

3.3. Biomass Boilers

The resource assessment in Section 3.1 taken from the East of England study section discussed the renewable or low carbon energy *resource* potential within the region rather than the potential for renewable or low carbon *generation* within Brentwood. As has been undertaken for district heating in the previous section, biomass boilers have been treated separately, as a potential source of generation. This estimate was based on assumptions stated within Appendix 3, and in general assumed that most homes that are currently heated using oil or solid fuel could switch to biomass, and that a certain proportion of non-domestic heat could be met using biomass boilers. For homes, the vast majority of the approximately 500 homes in the Borough that are heated using oil or solid fuel (under 2%) are located in the rural fringes, as can be seen in Figure 18. The source data does not allow a similar spatial resolution to be obtained for the commercial and industrial sector. The total potential capacity and output from biomass boilers, both technical and a potential 2030 level are shown in Figure 18.. The total capacity by 2030 could be 12.5 MW, with an output of approximately 27 GWh, with the majority of the output arising from the commercial and industrial sector. Section 3.1 identified a resource of approximately 6 GWh of biomass arising from managed woodlands for Brentwood, and so the potential demand for biomass would outstrip local supply, making the Borough a net importer of biomass and highlighting the importance of the development of regional biomass supply chains[xxi].



	Domestic	C&I	Total
Total Technical Capacity (MW)	6.5	28.8	35.3
Total Technical Output (GWh)	5.4	100.9	106.2
2030 Technical Capacity (MW)	6.5	6.1	12.5
2030 Technical Output (GWh)	5.4	21.3	26.7

Figure 18: Number of households heated by oil or solid fuel (left) (Source: 2011 Census) and Potential capacity and output from biomass boilers within the Borough (right)

[xx] "South West Exeter urban extension – an initial feasibility assessment of site wide district heating and combined heat and power", University of Exeter, June 2013

[xxi] For more information on the development of regional biomass supply chains see http://www.forestprogramme.com/

3.4. LOW AND ZERO CARBON SUMMARY FOR BRENTWOOD

The previous sections analysed the potential *resource* within Brentwood together with the potential for generation schemes such as district heating or biomass boilers. These analyses were based on assessments of the total potential within the Borough, and estimates for potential uptakes to 2030.

Table 6 presents a potential energy mix for the Borough in 2030 together with broad assumptions and issues, and is based on energy *generated* in Brentwood. This recognises that LZCs may be implemented within the Borough and that the fuel may be sourced from elsewhere. The energy and carbon savings would still accrue to the Borough. The breakdown of energy generation and carbon reduction is shown in Figure 19, and compared to overall energy demand (Figure 20) and carbon emissions (Figure 21).

If LZCs were to be implemented following the assumptions made within this report then the total generation in 2030 would be equivalent to approximately 8.7% of the total energy demand in 2030. This is somewhat short of the 15% target by 2020 proposed in the Local Plan 2015-2030 Preferred Options. In order to meet this target, uptake of the potential resource within the Borough would need to be increased. The greatest opportunity would come from large scale wind or solar as the 2030 values reported here are about 20% of the overall available resources. To meet a 15% target in 2030[xxii], in addition to the uptake as stated in Table 6, a further 16 commercial scale turbines would be needed. A complementary strategy would be to further reduce demand for energy within the Borough.

The equivalent carbon savings compared to current emissions would be around 7.4%. It is not possible to assign carbon savings from all these technologies to the Borough itself. For example, electricity generated through PV panels in Brentwood that claim incentives through schemes such as the Feed-In Tariff (FIT) would result in a reduction – albeit a very small one – in carbon intensity of all electricity supplied through the national electricity grid. As Brentwood benefits from decarbonisation of the grid from suppliers that are outside of the Borough, for example over time as more low carbon generators are added to the national supply mix (e.g. offshore wind turbines), so it cannot claim that carbon reduction from generation within the Borough, else savings at a national scale would be double counted. Therefore the carbon reduction is presented compared to current emissions, for indicative purposes.

A further scenario exploring the potential impact of delivering 6,200 homes during the plan period was undertaken. Using similar assumptions[xxiii] to a scenario of 3,500 homes then energy consumption in the Borough could rise by approximately 16% rather than the 10% value estimated for the 2,500 home scenario. The renewable energy resource assessment assumes that 50% of new homes would each be capable of installing PV panels, SWH and heat pumps, as detailed in the SQW methodology. Based on this, there may be an additional 16.3 GWh of energy generated and 2.4 ktCO_2 reduction from renewable energy in 2030. This represents an increase of 11% in renewable energy generation and 6% additional carbon reduction compared to the 2030 scenario explored in association with the original assessment with 2,500 homes. In overall terms, with the increased housing scenario the total proportion of energy demand in the Borough met from renewable energy is likely to marginally increase, though the total energy use will also increase. The difference between the two housing scenarios is relatively small, and in both cases fall significantly short of achieving a Borough-wide target of 15% of energy demand from renewable energy. Finally, if the additional 2,700 homes in the increased housing scenario were strategically sited, either to supplement the existing development at West Horndon or as a large development in its own right, then there may be further opportunities for district energy schemes. These would need to be assessed on a site by site basis.

[xxii] Note: 2030 has been assumed here on the basis of a 15% target in 2020, though actually one could expect a greater % requirement given an additional 10 years in which to deploy renewable energy.

[xxiii] The additional 2,700 homes were annualised between 2015 and 2030, transport emissions increase as per previous assumptions, no additional commercial development assumed.

Table 5: A potential energy mix in 2030 for Brentwood Borough

Technology	Comments	Energy generated or carbon saved GWh / $ktCO_2$
Standalone Technologies		
Wind Turbines	Assumes approximately 5 commercial scale turbines (2.5 MW), 135 m high to tip of blade. Potential for significant generation and carbon reduction. Most opportune areas likely to be in proximity of Shenfield or West Horndon electrical substations. Development would need to occur on Green Belt, and so planning consent is likely to be more challenging than normal for schemes of this nature. This would require balancing the protection of the Green Belt with the very special circumstances resulting from energy reduction and carbon abatement from this technology, as discussed in the NPPF. This assessment has shown it is highly unlikely Brentwood could generate 15% of its energy demand from renewable sources without developing generation at this scale.	30.5 / 15.8
Standalone PV	Assumes approximately 8 MW output which would require about 23 Ha of land. This could be delivered in a single site, or a number of smaller ones. Given land availability and designation in Brentwood, development would be on Green Belt, and agricultural land of Grade 3. The most opportune sites are in proximity of the Shenfield, West Horndon or potentially Ingastone sub-stations. Planning consent is likely to be challenging, though would need to be assessed on a case by case basis, with the underlying arguments being similar to those for large scale wind.	6.7 / 3.5
District Schemes		
District Heating/CHP	There is the potential to meet energy demand arising from some new development in the Borough from district heating schemes. The West Horndon development offers most potential due to the greater volume of housing. There is also potential in Brentwood Town Centre through linking pockets of new development with existing loads such as the BT office, and at the Council Depot site through linking new development with existing homes and loads such as the Ford office. Getting these schemes off the ground would require coordination from the local authority, and cooperation from a number of stakeholders. This is likely to be challenging for the latter two schemes as they would involve connecting to existing buildings with existing infrastructure disrupted as the heat network is installed. The West Horndon site is the most feasible, though again would require cooperation from all developers within the wider site. It has been assumed that the West Horndon scheme could be heated by a new gasification plant fuelled by residual waste that could potentially be located at the new Brentwood Enterprise Park (27 Ha total). A plant with an output of 2.5 MW_e could meet the demand for the new housing at West Horndon plus the heat (and potentially cooling) demand from the employment space. Use of the waste heat would result in considerable additional carbon savings compared to a gas CHP scheme, which has been assumed at the other two potential sites.	West Horndon; 41.6 / 7.1 Brentwood Centre; 7.6 / 0.4 Council Depot; 14.2 / 0.7 Total; 63.3 / 8.1

Building Technologies		
Heat Pumps	The assessment assumes that a quarter of off gas commercial and industrial existing buildings, and half of all new development are heated using heat pumps. The 2030 uptake includes an adjustment for a reasonable level of uptake given current and historic consumer behaviour. As a significant number of new homes (just over half) have been potentially allocated to DH schemes, about half of the remainder would be envisaged to implement heat pumps. The carbon savings are proportionately much lower than energy generation as the carbon savings are typically only marginally better than fitting an efficient gas boiler. This may improve over time as heat pump efficiencies become more reliable, and as the carbon intensity of the national electricity grid reduces. Heat pumps are relatively unobtrusive and are permitted development in the case of ground source heat pumps, and also for air source heat pumps provided certain conditions are met.	8.4 / 0.6
Biomass Boilers	It was assumed that 80% of homes currently heated by oil or solid fuels (these homes are mainly in the more northern rural fringes of the Borough) could be heated by biomass boilers by 2030. It was also assumed that the majority of non-domestic demand for gas, oil or solid fuels (aside from 25% of non-gas fuel which was allocated to heat pumps as above) could be met by switching to biomass. The values here are based on generation of heat rather than the biomass resource within the Borough, though from the resource assessment this level of uptake would make the Borough a significant importer of biomass. Practically, there would need to be sufficient access to sites for delivery of biomass fuel, and enough space to host larger boilers and increased volumes of fuel. Biomass boilers are generally permitted development provided certain conditions are met. In addition, boilers that claim the RHI will be subject to minimum standards regarding air quality. These standards are still in development. Brentwood has seven declared Air Quality Management Areas (AQMAs), with AQMA 7 (Brentwood Town Centre) being a potential constraint to bringing forward biomass heating in commercial buildings located there.	26.7 / 5.7
Solar Technologies	Building mounted solar panels both for generating electricity (PV) and to provide hot water (SWH) could provide 5% of the overall energy mix in 2030. As each system is comparatively small, a large number of installations would be required to achieve the same impact as, for example, a single large generator of renewable energy such as a commercial scale wind turbine. The assessment here has assumed PV and SWH panels are installed in a quarter of all existing homes and half of all new buildings. In addition, it was assumed that 80% of industrial properties would be fitted with PV panels. Both technologies are proven and relatively unobtrusive and are generally permitted development provided certain conditions are met. As SWH relies on storing hot water, they are generally more compatible with heating systems that include storage of hot water. SWH is also more likely to be triggered by changes to a heating system, whereas PV is relatively independent in this regard.	8.6 / 3.5

** Table notes: The following resources and technologies were not included in the energy mix for the Borough: Hydroelectricity – no resource was identified; Electricity from landfill or sewage gas – no resource was identified; Heat or electricity from energy crops – no resource was identified; Electricity from straw – although a small resource was identified, it is more likely to be utilised outside of the Borough due to issues of scale as the total potential physical resource was 4 MW_e (the straw plant in Ely is 38 MW_e); Heat or electricity from wet organic waste i.e. anaerobic digestion from slurry and/or food and drink manufacture as only a very small resource was identified; Electricity from poultry litter – although a small resource was identified, it is more likely to be utilised outside of the Borough due to issues of scale as the total potential physical resource was 0.3 MW_e (the chicken litter plant in Thetford is 38.5 MW_e).*

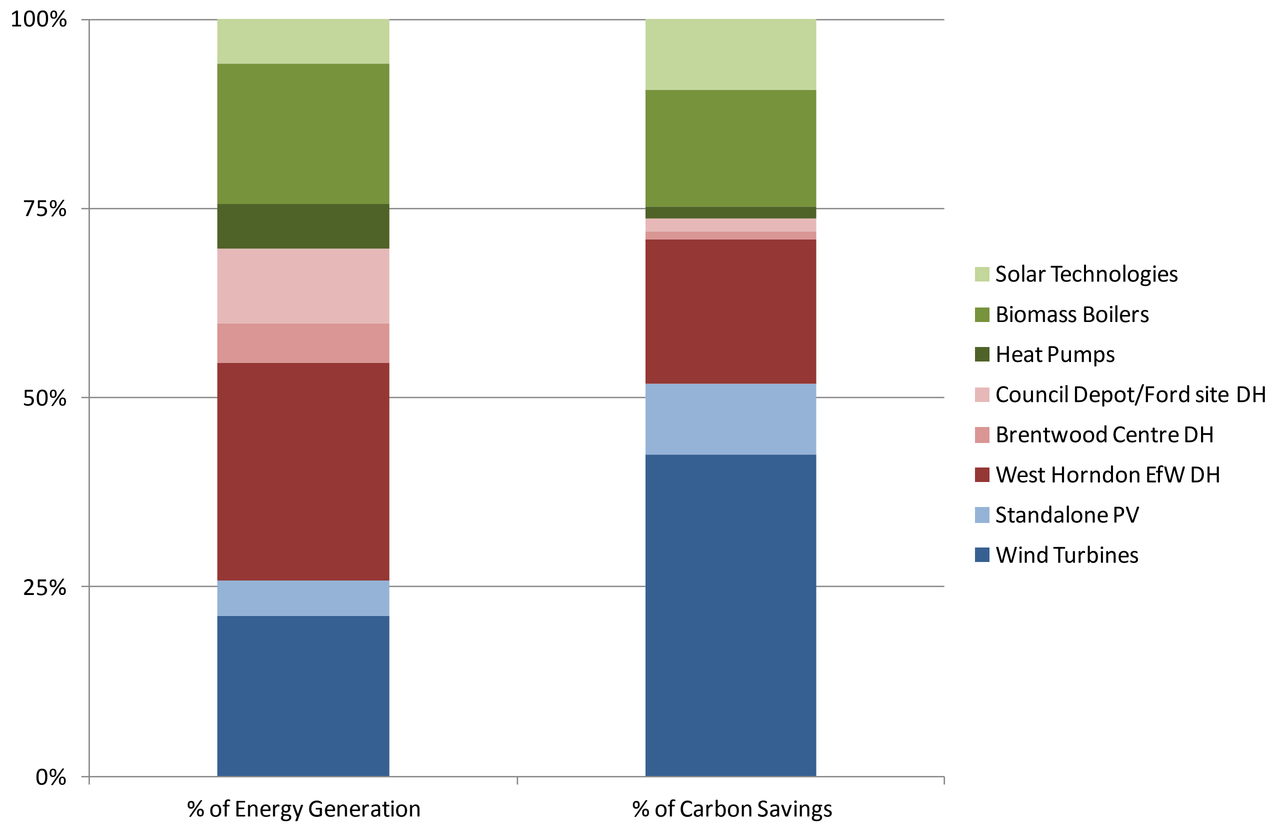


Figure 19: Proportions of energy generation and carbon savings through the use of LZCs in 2030 if all technologies taken up broken down by standalone technologies (blue), district schemes (red) and building technologies (green).

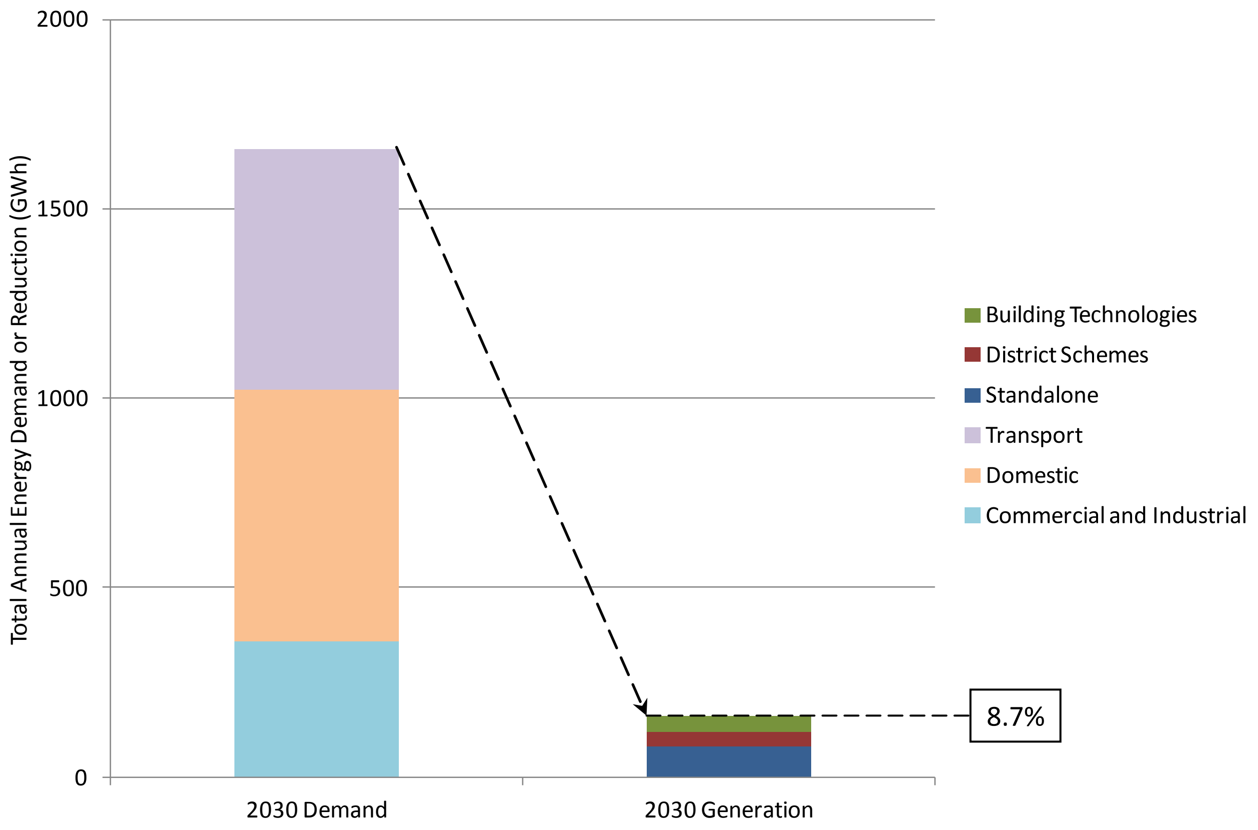


Figure 20: Energy generation through implementation of LZCs to 2030 compared to the projected energy demand in 2030

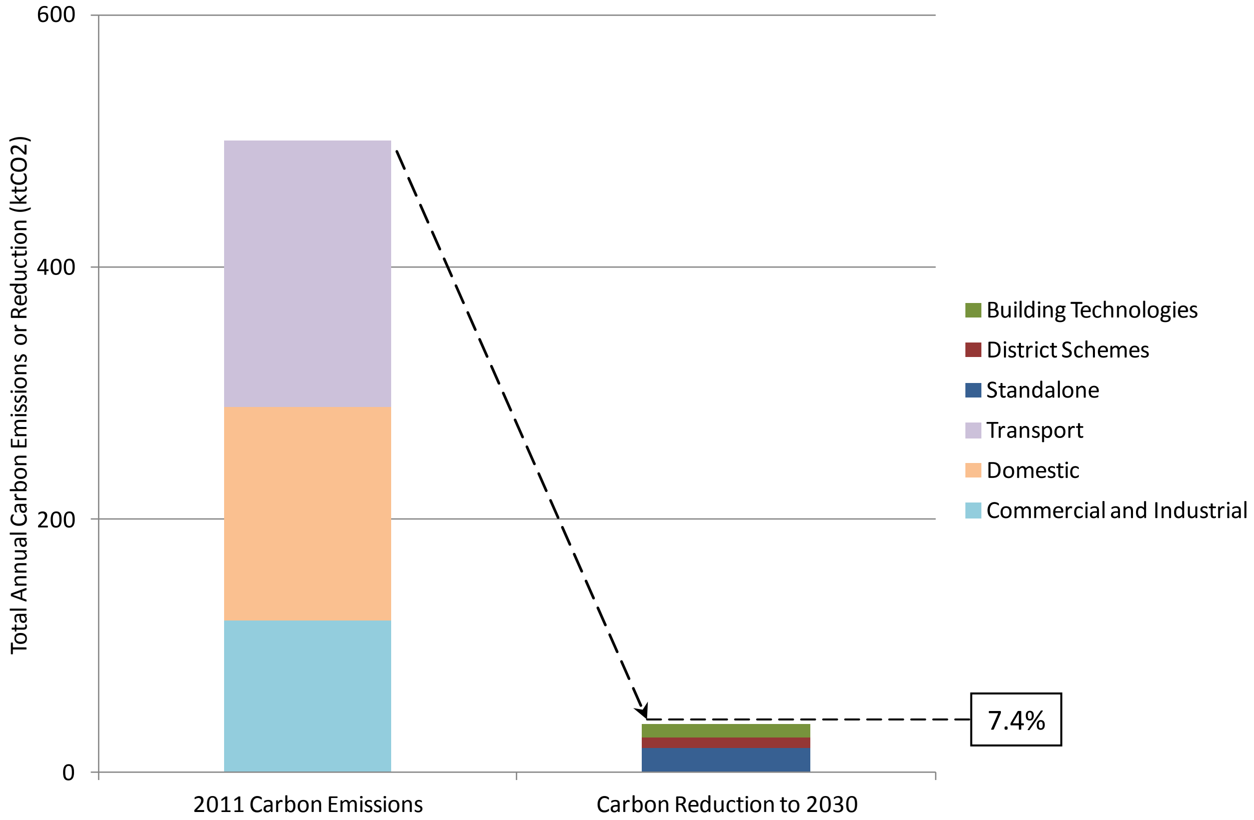


Figure 21: Carbon reduction through implementation of LZCs to 2030 compared to carbon emissions in 2011.

4. VIABILITY OF LOW CARBON AND RENEWABLE ENERGY SCHEMES IN BRENTWOOD

Currently, providing low or zero carbon energy (LZC) is more costly than traditional alternatives. For example, the levelised cost of generating electricity from renewable sources such as wind or solar is higher than generating electricity through a combined cycle gas power station. These technologies are not yet at "grid parity". However, increasing the provision of LZCs is important in order for the UK to meet its binding targets for carbon reduction and renewable energy, as well as to ensure diversity and security of energy supply. In order to overcome barriers to the delivery of LZCs, a series of regulations (for example, through a tightening of the Building Regulations, for on-site renewable energy in new developments) and incentives have been developed. The main framework for the delivery of LZCs will be through the Electricity Market Reform (EMR)[xxiv] which will be implemented through the Energy Bill (2012)[xxv]. Various financial incentives are in place for LZCs:

- Large Scale Electricity: The Renewable Obligation (RO) is currently the main support mechanism for large scale renewable electricity projects in the UK. It requires energy suppliers to source a specified proportion of the electricity they provide to customers from eligible renewable sources. Generators receive Renewable Obligation Certificates (ROCs) from Ofgem which they then sell to suppliers. The number of ROCs which a technology is eligible for depends on the technology and varies from 0.2 ROCs/MWh for landfill gas to 5 ROCs/MWh for wave energy. ROCs are tradeable commodities that have no fixed price. The current value of a ROC is capped by the government set buy out price at £46/MWh. The RO will close to new generators on 31 March 2017. Electricity generation that is accredited under the RO will continue to receive its full lifetime of support (20 years) until the scheme closes in 2037. Replacing the RO will be scheme through the EMR which will support Renewable electricity generation by setting a strike price for each technology type which guarantees a fixed price for low carbon generators using Contracts For Difference (CFD). Strike prices vary from £90/MWh to £305/MWh for wave.
- Smaller Scale electricity: The scheme that covers smaller scale electricity technologies is called the Feed-in Tariff (FIT). The FIT was introduced in April 2010. The FIT provides owners of renewable electricity installations with a "generation tariff" for each unit of electricity generated, which is guaranteed for a fixed period of time – 20 years for most technologies with the exceptions of 25 years for PV and 10 years for micro-CHP demonstration schemes. In addition to this revenue stream, if the electricity generated is used on-site, then the cost of purchasing that energy from an energy supplier is avoided. Any electricity that cannot be used instantaneously can be exported back to the grid at a rate of 3 p/kWh. An Energy Performance Certificate (EPC) rating of D or better is needed to claim the FIT for PV panels, otherwise only a lower tariff rate is available. As technology and energy costs have changed, the FIT has had to be revised in order to make the whole scheme more affordable (the payments are made by energy companies, and therefore ultimately by its customers). The tariffs are now regularly reviewed and revised depending on uptake. Therefore, specific information on costs and prices are liable to becoming outdated rather quickly. Broadly speaking however, the FIT scheme has been designed to give investors in renewable energy technology a return on their investment of 4.5-8%.
- Renewable Heat: The scheme for heating technologies is called the Renewable Heat Incentive (RHI) and was introduced in November 2011 though for non-domestic installations only. The scheme operates in a similar way to the FIT, although for biomass boilers there are two rates of tariff. The higher rate is intended to cover the heat required based on typical heat loads for a property. A second and much lower rate is needed to prevent users simply running a boiler for longer thereby using more energy to earn more income through a tariff. All qualifying heat technologies would receive the tariff for 20 years. It is expected that domestic schemes will be open to claiming RHI

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xxiv https://www.gov.uk/government/policies/maintaining-uk-energy-security--2/supporting-pages/electricity-market-reform (accessed 28/10/13)

xxv https://www.gov.uk/government/collections/energy-bill (accessed 28/10/13) from the spring of 2014. The RHI has been designed to provide a rate of return of 12% for all technologies with the exception of solar thermal which has been set at 6% as it is a more established technology and the risk therefore was that a higher return would divert investment at the expense of bringing forward emerging technologies.

Given this legislative and economic framework, the delivery of LZCs is strongly influenced by demonstrating a business case. This will be impacted by factors such as technology costs and financial incentives, together with wider economic concerns such as land values, energy prices, interest rates or competing investment opportunities. Whilst there is limited scope to influence these macro-economic factors locally, additional factors, for example spatial planning, can help to support the delivery of LZC technologies.

The National Planning Policy Framework (NPPF)[xxvi] was published in 2012 sets out the Government's planning policies for England and how these are expected to be applied. In order to meet the challenge of climate change, the NPPF stresses that it is the responsibility of all communities to contribute to energy generation from LZCs, and that in order to facilitate this local planning authorities should:

- Have a positive strategy to promote energy from renewable and low carbon sources.
- Design their policies to maximise renewable and low carbon energy development while ensuring that adverse impacts are addressed satisfactorily, including cumulative landscape and visual impacts.
- Consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure the development of such sources.
- Support community-led initiatives for renewable and low carbon energy, including developments outside such areas being taken forward through neighbourhood planning.
- Identify opportunities where development can draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers.

Therefore in order to improve the viability of renewable energy schemes the local planning authority should set clear planning guidance relating to where it is acceptable to deliver renewable energy in the Borough. Policy CP14 of the Local Plan 2015-2030 Preferred Options for Consultation states that:

"Proposals for renewable, low carbon or decentralised energy schemes will be supported provided they can demonstrate that they will not result in unacceptable harm to the local environment, including cumulative and visual impacts which cannot be satisfactorily addressed. Renewable and low carbon energy development proposals located within the Green Belt will need to demonstrate very special circumstances and that harm to the Green Belt is outweighed by the added environmental benefits of development".

This is consistent with Chapter 9 of the NPPF (Protecting Green Belt Land). The NPPF states in regard to Green Belts that:

"When located in the Green Belt, elements of many renewable energy projects will comprise inappropriate development. In such cases developers will need to demonstrate very special circumstances if projects are to proceed. Such very special circumstances may include the wider environmental benefits associated with increased production of energy from renewable sources".

This resource assessment has identified that a significant proportion of the likely potential for energy generation from renewable sources is from large scale wind and PV farms. Both of these technologies have a visual impact – in particular wind – and their deployment would necessarily fall within the Green Belt.

xxvi https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf (accessed 28/10/13)

Therefore, the tension between "inappropriate development" and the "very special circumstances" arising from the implicit "wider environmental benefits" that these technologies bring will need to be resolved. For these projects, experience has shown the support is greater where in addition there is a demonstrable local benefit, for example through community ownership or capturing of revenues by local communities.

Aside from specific renewable energy projects e.g. a wind farm or a homeowner taking a decision to install PV panels on their roof, the standards associated with the delivery of new developments require carbon targets to be met, with "zero carbon" to be met from 2016 for homes and 2019 for non-domestic buildings. In practice, this standard will be implemented via Part L of the Building Regulations through a three-tiered approach. Firstly, a defined minimum level of energy efficiency must be met. Then, a minimum level of "carbon compliance" must be achieved. Carbon compliance includes further energy efficiency or the incorporation of LZC technologies, including connecting to a low carbon DH system. The zero carbon may be met with these two tiers alone, though a third tier – "Allowable Solutions" – will be available which will enable a developer to offset emissions by contributing to carbon reduction measures off-site. The Government has recently consulted on options for Allowable Solutions[xxvii]. Many local planning authorities have set local standards based on the national timetable, and incorporating additional carbon reduction or renewable energy generation targets, for example, a requirement to generate at least 10% of their energy needs by use of LZCs. This became known as the Merton Rule. The Government has recently consulted on Housing Standards[xxviii] with the outcome of this being that local planning authorities will not be able to set energy efficiency standards in excess of the national timetable as set out through the Building Regulations, though it appears that the ability to set a "Merton Rule" has been retained.

In order to meet current and future versions of Part L, developers will therefore likely seek to meet the standard in as cost effective manner as possible. Based on the Impact Assessment from the consultation on Housing Standards, it was assumed that higher carbon standards would be achieved through efficient homes with roof mounted PV. That analysis did not capture the future revenues (e.g. from the FIT or avoided electricity charges). The proposed Local Plan and the NPPF are supportive of the likely range of LZC technologies that are likely to be specified to meet current and future versions of Part L. There may be specific circumstances where higher levels of carbon reduction can be achieved at an overall lower cost through local decentralised energy schemes (DH and CHP).

For large new developments the combination of the need to deliver low carbon new development and the need to optimally use the residual waste resource has led some local authorities to develop small thermal waste treatment plants that are able to provide heat to local users. More recently, progress in commercialising gasification of solid recovered fuels suggests that smaller gasification units, sized to local heat loads, may be able to provide heat and power at 60% efficiency. The viability of these schemes is enhanced by gate fee income over which local authorities have a degree of control. The integration of local waste treatment and low carbon development can therefore not only be viable and attractive to developers but also provide an important local dimension to the waste strategy enabling local residents to connect with local waste treatment options; an environmental-economic win-win.

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xxvii https://www.gov.uk/government/consultations/next-steps-to-zero-carbon-homes-allowable-solutions (accessed 28/10/13)

xxviii https://www.gov.uk/government/consultations/housing-standards-review-consultation (accessed 28/10/13)

5. POTENTIAL STANDARDS FOR NEW DEVELOPMENT

5.1. NATIONAL POLICY CONTEXT

In 2007 the Government set the timetable for zero carbon new buildings[xxix] which will be achieved through the sequential tightening of the Building Regulations relating to energy (Part L). Homes are required to reduce regulated energy use (space heating, hot water, fixed lighting, and pumps and fans) from the 2006 standard in three stages; 25% in 2010, 29.5% in 2014 (a 6% reduction on Part L 2010) and 100% (Zero Carbon) in 2016. Zero carbon homes are required to deliver 100% of the energy consumed by regulated uses from low carbon or renewable energy on-site (carbon compliance) or through allowable solutions[xxx]. For homes, between 44% and 57% CO_2 reduction from 2006 Part L must be met on site[xxxi]. Allowable Solutions enable those developments that cannot reduce on-site emissions beyond carbon compliance levels to achieve Zero Carbon in other ways including[xxxii] a financial contribution to a local community energy fund. New non-domestic buildings will be required to be Zero Carbon by 2019 although the detailed trajectory and standards for non-domestic buildings has yet to be established. The change to Part L 2014 (originally planned for 2013) will see an emissions reduction requirement of 9% compared to Part L 2010. The change to Part L of the Building Regulations has been delayed and is due to occur in April 2014. These regulations represent the minimum acceptable energy and carbon performance standard for new development.

The NPPF[xxxiii] recognises the important role planning plays in delivering carbon reduction at a local level. It states that local planning authorities (LPAs) should develop proactive strategies to mitigate and adapt to climate change in line with the objectives and provisions of the Climate Change Act. This sets a carbon reduction target of 80% by 2050 from 1990 levels, with an interim target of 34% by 2020. LPAs should plan for new development in locations which minimise carbon emissions, actively support efficiency improvements to existing buildings, and set targets in a consistent way with the Government's zero carbon buildings policy including adopting nationally described standards. LPAs should have positive strategies to promote energy from LZCs and should expect new development to comply with adopted Local Plan policies on local requirements for decentralised energy supply unless it can be demonstrated that this is not feasible or viable.

The Government has recently consulted on potential Housing Standards as part of a Housing Standards Review which itself was part of the Red Tape Challenge. The aim of this consultation was to prevent the proliferation of standards that have resulted from local planning authorities setting bespoke local policies. Within the consultation it was proposed to set energy and carbon targets through the Building Regulations only. The Planning and Energy Act (2008) was brought in to enable local planning authorities to set requirements for energy use and energy efficiency in local plans. The proposal in the consultation would mean that the Act may need to be amended or removed. The Government issued a response[xxxiv] to the consultation which stated that regarding energy there would be no optional additional local standards in excess of the provisions set out in Part L of the Regulations. It appears that due to proposed changes to the Deregulation Bill, policies based on the "Merton Rule" would still be permissible[xxxv].

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xxix "Building a Greener Future – Policy Statement" CLG, July 2007

xxx Allowable solutions are not finalised but may include a range of additional measures onsite e.g. smart appliances, near site e.g. the export of low carbon heat, or offsite e.g. investment on low carbon electricity generation assets.

xxxi "Carbon compliance", Zero Carbon Hub, February 2011

xxxii If the appropriate local policies are in place and subject to the result to the Government's current consultation on Allowable Solutions

xxxiii Paragraphs 93 to 99

xxxiv http://www.parliament.uk/documents/commons-vote-office/March_2014/13%20March/4.DCLG-Building-regs.pdf

xxxv http://www.businessgreen.com/bg/news/2334459/renewable-energy-industry-celebrates-as-merton-rule-retained

5.2. BRENTWOOD LOCAL PLAN 2015 TO 2030: PREFERRED OPTIONS

Brentwood Borough Council published its Local Plan 2015 to 2030 for consultation. This consultation process closed on 2nd October 2013. Policy CP14 of the plan contains six points of substance with regard to energy and carbon from new development. These will be addressed in the following sections. It is also stated that where it is not possible to meet the standards, applicants must demonstrate compelling reasons why achieving the sustainability standards would not be technically feasible or economically viable. Alternative policy options, namely setting higher levels of the Code for Sustainable Homes (CSH) or BREEAM, or requiring a "Merton Rule" type renewable energy target have been discounted. This is broadly in-line with the ethos of the consultation on Housing Standards.

5.2.1. SUSTAINABLE DESIGN AND CONSTRUCTION

The preferred option within the Local Policy states that all developments, including re-use of existing buildings, will be required *"to maximise the principles of energy conservation and efficiency in the design, massing, siting, orientation, layout and use of materials"* (CP 14.a). It is stated in the justification of the policy (paragraph 3.69) that this can be demonstrated through a Design and Access Statement (DAS). The policy is not quantified, and as such would be hard to meaningfully assess in practice. For example, given the national timetable for carbon reduction, development which meets only the minimum standards is likely to be able to be framed within a DAS as adhering to energy efficiency principles. In addition, the consultation on housing standards recently summarised the incorporation of standards for the sustainability of materials by local planning authorities, and concluded that developers and trade associations are taking a lead in agreeing materials standards, and adhering to them, and that there is also an absence of any clear understanding as to what embodied energy standards should embrace, or clear evidence of what works (nationally or internationally). The consultation proposes that materials standards are best left to the market to lead on. Nonetheless, the policy is worthy in order to place the council's broad requirements within a general context, and for contingency. The policy could be improved by including wording to support development which considers adapting to climate change, for example the increased likelihood of summertime overheating and the impact this will have on human health.

5.2.2. STANDARDS FOR NEW HOMES

The preferred option within the Local Policy states that the Council will expect *"all residential development to achieve a minimum CSH (or the equivalent standard) Level 3, rising in line with the increases to Part L of the Building Regulations*" (CP14.d). Higher standards (i.e. CSH Level 4) were rejected. The CSH is an environmental assessment method that assesses performance across a range of issues that are divided into a number of sections. The Energy and Carbon Dioxide Emissions section of the CSH contains nine issues. The first of these, Dwelling Emission Rate (Ene1), sets performance targets within the context of Part L of the Building Regulations. In order to achieve a certain overall rating within the CSH, minimum performance within Ene1 must be achieved. To achieve CSH Level 4, a 25% improvement on Part L 2010 is required. This rises to 100% of regulated emissions for CSH Level 5. There is often ambiguity when standards requires a certain "Code Level" to be met. The policy within the Local Plan is proposing an overall CSH Level 3 in the first instance i.e. a home that is at least built to the minimum carbon standards of the current version (2010) of Part L, together with attainment of additional credits such that in overall terms CSH Code 3 is achieved.

The impact assessment for the recent consultation on housing standards estimated the extra over costs of achieving both the Energy only credits of, and the overall rating within the CSH. This information was combined with the Government's zero carbon homes trajectory to estimate the potential impact of the proposal within the Brentwood Local Plan:

- Part L 2010: Achieving a CSH Level 3 is consistent with Ene1 for the 2010 version of Part L. There is therefore no additional cost within credit Ene1. To achieve the overall Level 3 rating, there will be some cost associated with process, and achievement of some additional credits. The cost is estimated as £248 per flat and £273 per house.

- Part L 2014: The original timetable for zero carbon homes envisaged a 44% reduction in emissions compared to Part L 2006 in the 2014 version of the regulations. Following the recent publication of the actual proposed changes to the regulations, the carbon reduction will be a 6% improvement on Part L 2010, which is a 29.5% reduction on Part L 2006. This does not easily relate to setting a policy which requires the minimum standard for a CSH level to rise "in line" with increases to Part L. The 6% improvement on Part L 2010 is closer to CSH Level 3 than the 25% reduction that would be required of CSH Level 4. If the requirement is held for a CSH Level 3 from April 2014, then the additional costs would be the same as stated above. If a requirement is set to achieve CSH Level 4, then the additional cost would be £1,345 for a flat, £1,560 for a 2 bed house £1,891 for a 3 bed house and £2,107 for a 4 bed house. In each of these cases, the main part of this cost is additional requirements for carbon reduction (about £500 is for non-energy parts of the Code with a further £137 for process and compliance time).
- Part L 2016: This requires "zero carbon" for regulated emissions and at present would equate to CSH Level 5. The additional cost would be £6,605 for a flat and £5,333 for a house. None of this cost is due to energy or carbon targets, as the Building Regulations minimum standard already equates to the CSH Level 5 Ene1 requirement. However, it is not clear if Allowable Solutions – which is likely to be a significant mechanism for achieving "zero carbon" – will be acceptable as part of meeting CSH requirements. The main additional cost arises from a requirement for rainwater or grey water recycling at CSH Level 5, which would add £4,643 to the cost of a flat, and £3,368 to the cost of a house. The Borough is located within an area of Serious Water Stress. Elsewhere in the Local Plan the proposal is for new developments to submit a water sustainability assessment, and there is a recommendation from the Brentwood Scoping and Outline Water Cycle Study[xxxvi] for development to achieve water consumption performance equivalent to CSH Levels 3/4. This level of performance can normally be achieved relatively cost effectively using water efficiency fittings.

With reference to the above, the recent outcome of the Housing Standards Review once implemented supersedes the current local policy wording as stated. The removal to set specific energy standards in excess of the building regulations, and the intent to potentially wind down the CSH means that setting a local standard expressed relative to the CHS and rising over time in line with the Building Regulations is redundant. There is a potential interim period and so it may be possible to retain elements of the policy with a caveat that the local policy is to remain in place until such a time as the proposed Government changes take effect. Within the outcome of the Housing Standards Review, a tighter water standard of 110 litres/person/day was introduced; this compares to the Building Regulations threshold of 125 litres/person/day. The improved standard could be applied to areas of higher water stress, which may include Brentwood. The detail of how Government will define areas of water stress is being considered, and so this should be kept under review whilst finalising local policy.

A further issue to consider is that of transitional arrangements. These were introduced with the 2010 version of Part L and are being retained for Part L 2014[xxxvii]. If a Building Regulations submission is made prior to April 2014, the 2010 regulations apply providing work on that application commences within twelve months. A valid commencement would be considered as building work such as excavation of foundations or drainage works. The transitional provisions will apply to the whole Building Regulation application which means that only one plot on a site would need to commence to validate all of the plots on the application under the current Part L requirements. It is therefore possible that developments or parts of development that are not due to be completed until later into the plan period, are pre-registered under earlier less onerous versions of Part L.

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xxxvi http://www.brentwood.gov.uk/pdf/21032011165157u.pdf (accessed 31/10/13)

xxxvii http://www.nhbc.co.uk/Builders/ProductsandServices/BuildingControl/News/Name,53135,en.html (accessed 31/10/13)

It is recommended that the following three areas are further considered with regard to standards for new homes:

- The current wording of the requirement for the CSH is at present unclear and will shortly be out-dated given the outcome of the Housing Standards Review. It may be worthwhile considering retaining a requirement for CSH 3 until such a time as the Deregulation Bill comes into effect.
- Policy addressing water stress could be phrased with reference to the new standard of 110 litres/water/day, subject to Government confirming that Brentwood is in an area of water stress.
- The nationally set transitional arrangements for Part L of the Building Regulations as they stand could result in future development being constructed to standards lower than those of the day. It may be worth considering revisions to the policy to account for larger phased developments. Based on the housing trajectories from Appendix 3 of the Local Plan, this is only likely to be a significant issue for West Horndon, where 1,500 homes (43% of all homes in the plan) are projected to be completed over the period from 2017 to 2030. There is a risk that some or all of this development could be delivered under the 2014 rather than 2016 version of Part L.

5.2.3. STANDARDS FOR NEW NON-DOMESTIC DEVELOPMENT

The preferred option within the Local Policy states that the Council will expect *"all new commercial development of more than a 1000m^2 to achieve a minimum BREEAM 'Very Good' rating (or the equivalent replacement standard), rising in line with the increases to Part L of the Building Regulations"* (CP14.e). Higher standards (i.e. BREEAM Excellent) were rejected. BREEAM is a similar scheme to the CSH (both were created by the BRE and work on the same principle), with credits available under a range of sections. There are minimum performance standards in the Energy section "Reduction of CO_2 emissions" (Ene1) to achieve higher performance levels within BREEAM. To achieve a rating of "Excellent", a 25% improvement in carbon reduction is required compared to Part L 2010. To achieve an "Outstanding" rating, this rises to 40%. However, to achieve "Very Good" it is not mandatory to achieve any credits in Ene1 i.e. a building that is just compliant with Part L could achieve a rating of "Very Good". Unlike the CSH, the national timetable for carbon reduction as implemented through the building regulations is not aligned to established BREEAM ratings. Historically, BREEAM has been revised at regular intervals such that the attainment of credits within the scheme always requires performance that is in excess of national minimum standards. For this reason, BREEAM 2011 is more onerous than BREEAM 2008. Part L 2014 will require non-domestic buildings to achieve a sector wide average reduction of 9% compared to Part L 2010.

The additional cost of achieving BREEAM ratings is not well known. A report[xxxviii] by the Department for Education and Skills (now the Department of Education) in 2006 estimated the cost uplift of BREEAM Very Good in schools to be 1.4%, with 4.7% to achieve BREEAM Excellent[xxxix]. More recently, in an open letter[xl] to Michael Gove, the UK Green Building Council and the Aldersgate Group identified that the cost uplift of achieving BREEAM Excellent was 0.7%. A report by the World Green Building Council[xli] examined the reported cost uplifts published within the last ten years of a range of projects and certification schemes globally. It was found that for the majority of certified green buildings, the cost typically ranges from less than 0% to 4%. Higher levels of certification (such as BREEAM Very Good) have been shown to range from 0% to 10%, while the highest levels (such as BREEAM Excellent) in the range of 2% to 12.5%.

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xxxviii DFES and Faithfull and Gould, Schools for the Future: Cost of BREEAM compliance in Schools, 2006

xxxix Estimated based on cost uplift £18/m2 to Very Good, £60 to Excellent and associated information that a 1.69% uplift equated to £21.5/m2 from the analysis of the cost of acoustic upgrades.

xl http://www.edgedebate.com/wp-content/uploads/2012/02/ukgreenbuildingcounciland-aldersgate_tomichaelgove_120123.pdf (accessed 1/11/13)

xli The Business Case for Green Building, A Review of the Costs and Benefits for Developers, Investors and Occupants, World Green Building Council 2013

It is recommended that the detail surrounding the proposed policy is revisited. As it stands, the policy will not result in additional energy savings or carbon reduction. The relationship between the required standard and the increases to Part L of the Building Regulations should be more clearly explained as at present the two do not obviously align. Options include setting a standard of BREEAM Very Good for major non-domestic development within the plan period, or proposing increases to the required standard over time, for example BREEAM Excellent from 2016. The version of BREEAM that a building must be assessed under should be clarified. For example, planning conditions should require performance under the latest BREEAM scheme and not be based on scheme versions that have been registered under at the pre-planning stages of a project.

5.2.4. Renewable Energy

The preferred option within the Local Policy states that the Council will expect *"major schemes to incorporate the use of renewable and low carbon technology*" (CP14.e). Higher standards, for example "Merton Rule" type requirements were rejected. The policy as it stands will not be effective at increasing the delivery of renewable energy in Brentwood. As the carbon reduction required by Part L increases, the incentive to incorporate renewable energy will increase. Experience has shown that major schemes built to Part L 2010 often have at least some renewable energy, simply to meet the minimum standard. The 2014 revision to Part L (6% reduction for homes and 9% for non-domestic buildings) will therefore likely result in the deployment of renewable energy, irrespective of the policy. The NPPF (paragraph 97) states that LPAs should have a positive strategy to promote energy from renewable and low carbon sources. It could be argued that the Local Plan as it stands would not result in the deployment of renewable energy that would not have occurred if only national minimum standards were followed, and so is at present not meeting the NPFF.

The Local Plan also states that proposals for renewable, low carbon or decentralised energy schemes will be supported provided they can demonstrate that they will not result in unacceptable harm to the local environment, including cumulative and visual impacts which cannot be satisfactorily addressed. As 80% of the Borough is within the Green Belt, it is also stated that renewable and low carbon energy development proposals located within the Green Belt will need to demonstrate very special circumstances and that harm to the Green Belt is outweighed by the added environmental benefits of development. This follows the principle of the NPPF. The resource assessment here has demonstrated that a potential target for generating 15% of the Borough's energy from renewable energy by 2020 will not be possible without deploying large commercial scale renewable technologies, for example wind turbines or PV farms. These technologies are likely to result in visual impacts on the Green Belt. The EoE capacity study considered the impact of the Green Belt in its analysis, though did not include it as a constraint. It stated that planning decisions on wind farm applications where the Green Belt has been a material consideration have varied depending on whether exceptional circumstances were demonstrated. It stated that applications would need to be assessed on a case by case basis. Similar arguments would apply to large scale PV, though there are better opportunities to mitigate visual impacts of such screen using carefully designed screening. It could be argued that as the Government has set binding targets for carbon reduction and generation of renewable energy, and that Brentwood's target of 15% by 2020 is in line with the target for renewable energy, then in order to meet those targets development would need to occur within the Green Belt as the only areas within the Borough outside of the Green Belt are built-up urban areas. Selection of the most appropriate sites would then depend on balancing technical factors such as proximity to substations, with minimising the impact of those developments through careful siting and mitigation measures such as screening in the case of PV.

There is also a potential gap regarding bringing forward district energy schemes. This resource assessment has identified that there are potential opportunities within the Borough, primarily at West Horndon, though also two further sites about Brentwood Town Centre. In the case of West Horndon, this could potentially include provision of heat and power from an EfW plant which would make use of a low carbon fuel source (waste). Developing such infrastructure is complex and requires effective co-ordination between utility providers, developers, land owners, local authorities and potentially waste handlers. The financial opportunity from district schemes exists as there are economies of scale where the costs of providing a central heat source that also generates power, together with the associated distribution infrastructure outweighs alternative means of complying with Part L. Where development occurs piecemeal, it is likely that individual developers for each site would chose traditional means of meeting Part L, which may result in a lost opportunity. Local authorities have vital roles to play in co-ordinating the many stakeholders involved, and an effective policy within the Local Plan is a critical part of that. It is recommended that additional policy is developed to capture the opportunity at West Horndon, and potentially at the other two sites. The Council should begin to work with partners to identify the viability for schemes at these sites through undertaking more detailed feasibility assessments. This should examine the economic case for a decentralised scheme compared to more traditional methods of delivery. This would form a key piece of evidence to support a policy that would require developers to connect with district heating schemes that are brought forward. This follows the principle of the NPPF (paragraph 96).

5.2.5. ALLOWABLE SOLUTIONS

The preferred option within the Local Policy states that *"where on-site provision of renewable technologies is not appropriate, new development can meet the requirements through off-site provision by making 'allowable solutions contributions'. These funds will then be used for energy efficiency and energy generation initiatives or other measure(s) required to offset the environmental impact of the development"*. Allowable solutions are a mechanism that will be introduced into the Building Regulations from 2016 to enable development to occur where it would not be otherwise be practicable to meet the requirements using on-site measures (such as energy efficiency or renewable energy) alone. It should be made explicit in Brentwood's policy that "allowable solutions contributions" would only be a valid approach once they have been introduced within the Building Regulations (i.e. not before).

The value of Allowable Solutions is dependent on both the price and the length of time over which carbon is to be abated. In the Government's recent consultation on Allowable Solutions, three potential prices were proposed (£36, £60 and £90 per tonne of CO_2), together with a period of 30 years. For a semi-detached house, these prices could add £907, £1,511 or £2,267 respectively. A report by the Zero Carbon Hub[xlii] explored potential projects that allowable solutions funds could be used on. Refurbishing social housing was estimated to cost the equivalent of £120 per tonne, with renewable energy costing £140 to £350 per tonne (depending on technology). Large scale district heating schemes were found to be more cost effective, generally being in the range of £50 to £100 per tonne (Figure 22). It concluded by stating that *"the suite of options which could be delivered at £46* [the previous suggested price of allowable solutions] *tonne CO_2 is considered too narrow"*. Even with potentially higher prices for allowable solutions as proposed in the recent consultation, it would still appear likely that they will not be sufficient to completely offset the emissions from new development to achieve "zero carbon".

The recent ZCH report also provided feedback from workshops that *"localism is important and therefore the preference is for Allowable Solutions to be delivered locally first. However, a clear desire was expressed by developers to avoid having to pay a disproportionally high price for local Allowable Solutions in instances where Local Authorities have laid claim to stewarding how Allowable Solution monies should be invested in a given area".* This contrasted with views of Local Authorities who principally viewed funds raised through Allowable Solutions as "their money", i.e. to be administered by them and spend within their local area. The recent consultation on Allowable Solutions consulted on whether there should be spatial limitations on Allowable Solutions i.e. should they be limited to the locality of the development, or should the market be allowed to compete on a national basis. The outcome of the consultation and how Allowable Solutions will be implemented in practice is not yet known. The Local Plan states that the plan *"places a high priority on the prudent use and good management of resources and effective protection for the environment"*. This

xlii Zero Carbon Hub 2012, Allowable Solutions Evaluating Opportunities and Priorities assessment has highlighted the challenge for Brentwood to meet its target for renewable energy generation. Additional support to reduce carbon emissions within Brentwood, such as from Allowable Solutions, will be important to ensure local carbon reduction is achieved. It is recommended that the wording for the Allowable Solutions policy is revised to ensure that the funds are to be used within the Borough. In parallel with this, the Local Authority should begin to identify local projects that could utilise funds raised through Allowable Solutions. The ZCH report identifies several Local Authorities that already have policies in place for Allowable Solutions, or variants thereof (Table 6).

Figure 22: Implied carbon abatement cost (£/tCO2 for various district and renewable technologies (Source: ZCH, adapted from Pöyry/AECOM & DECC 2009)

Table 6: Local Authorities with policies on Allowable Solutions (Adapted from ZCH)

Local Authority	Policy Summary
Brighton and Hove City Council	The Council set standards of CSH Level 5 for Greenfield Sites (well in excess of Building Regulations minimum standards) and so in order to achieve this, an Allowable Solutions offset was deemed essential. Through a draft Supplementary Planning Document (SPD 08) the Council has developed ideas for delivering a housing retrofit Allowable Solution. Though not enacted at this time, the principles set out appear pragmatic and realistic in terms of cost to the developer. Though not used in a housing context, SPD08 was applied in one test case, the American Express Office Development where to compensate for the carbon reductions that could not be achieved on site, the project team was able to make an appropriate Section 106 payment that was in turn used to finance a local building energy upgrade project.

Milton Keynes Council	The city has prepared for high levels of expected growth in the coming decade by establishing a Carbon Offset Fund (COF). In the current Milton Keynes model, developers pay into the COF for the carbon reductions they cannot deliver on site. A not for profit company (United Sustainable Energy Agency) administers the COF to ensure that it delivers carbon savings at least equal to the new developments in the borough. At present the COF is buoyant and, having funded significant improvements to the fabric energy efficiency of existing housing, is now moving emphasis onto upgrades of home heating systems. It is claimed that the COF is providing clear benefits for city residents and encouraging the development of the local green economy.
Ashford Borough Council	Where developers are unable to meet carbon reduction through fabric and on-site low-carbon heat and power measures, they can pay into the Ashford Carbon Fund with a carbon price based on the shadow price of carbon set by DEFRA. Ashford requires a one off carbon payment equivalent to emissions over a 10 year period. The Fund has been used to invest in solar energy technologies on public buildings, with more diverse investments in the pipeline, including social housing energy efficiency upgrades. This mechanism is based on policy CS10 which sets standards for carbon reduction and renewable energy that are more stringent than the minimum Part L standard, and varies spatially within the Borough (e.g. on Greenfield sites CSH and a 30% reduction through renewable energy is required).
Southampton City Council	Southampton's long-established District Energy Scheme provides heating, cooling, hot water and power to homes, businesses, hospitals and schools in the City's central district. CHP and industrial-scale gas boilers have been added to the original geothermal heat source to cope with increasing demand. Maintenance and investment in expansion is managed by a private company (Utilicom). To enable informed decisions, Utilicom publishes maps which indicate future network expansion areas. As well as delivering carbon savings, connection to the network is shown to have cost benefits for developers with, in one example, a 25% capital cost reduction for heating over conventional boilers. Southampton City Council's Planning documentation requires new developments to be either connected to the network or, if not, to demonstrate lower carbon emissions than a networked solution (something that can be achieved by payment into a carbon offset fund).
City of Westminster	The Pimlico District Heat Network (Pimlico District Heating Undertaking) is the oldest district heating scheme in the UK. Today the Network is managed by CityWest Homes, a company owned by the City Council, and currently provides heat and hot water to 50 commercial premises, 3 schools and over 3,200 homes. The City of Westminster Core Strategy Policy CS38 encourages new developments to connect to the network. Larger developments that cannot be connected for practical reasons must provide their own decentralised heating systems that have the potential to be extended to other nearby developments in the future, exactly the kinds of projects that might be justifiably supported by Allowable Solutions payments.

Glossary

AQMA	Air Quality Management Areas
ATT	Advanced Thermal Treatment
BREEAM	Building Research Establishment Environmental Assessment Method
C&I	Commercial and Industrial
CCC	Committee on Climate Change
CEE	Centre for Energy and the Environment
CFD	Contracts for Difference
CHP	Combined Heat and Power
CO_2	Carbon dioxide
CSCO	Carbon Saving Community Obligation (ECO)
CSH	Code for Sustainable Homes
DAS	Design and Access Statement
DECC	Department for Energy and Climate Change
DH	District Heating
ECO	Energy Company Obligation
EfW	Energy from Waste
EMR	Electricity Market Reform
EPC	Energy Performance Certificate
EST	Energy Savings Trust
FIT	Feed-In Tarrif
GW	Gigawatt
GWh	Gigawatt hour
HGV	Heavy Goods Vehicle
HHRCO	Home Heating Cost Reduction Obligation
ktoe	Thousand tonnes of oil equivalent
kW	Kilowatt
kWh	Kilowatt hour
kWp	Kilowatt peak
LGV	Light Goods Vehicle
LLSOA	Lower Layer Super Output Area
LPA	Local Planning Authority
LZC	Low or Zero Carbon technology
MLSOA	Middle Layer Super Output Area
MSW	Municipal Solid Waste
MW	Megawatt
MWh	Megawatt hour
MVHR	Mechanical Ventilation with Heat Recovery
NPPF	The National Planning Policy Framework
odt	Oven dried tonnes
PV	Photovoltaic
RHI	Renewable Heat Incentive
SHW	Solar Hot Water
SQW	The name of a consultancy who developed the Government method for establishing renewable energy resource potential.
WID	Waste Incineration Directive

Appendix 1: The Potential Impact of Growth on Energy Use and Carbon Emissions

An estimate of the impact of growth on energy use and carbon emissions in Brentwood was undertaken using the following assumptions:

- The baseline energy and carbon data was taken from the latest available data from DECC (2011), as have previously been reported in the main body of the report.
- The analysis was based on estimating changes to energy use resulting from growth as estimated from measures within the Local Plan 2015-2030.
- Energy use was converted to carbon emissions using conversion factors from SAP 2009 assuming no additional government policy such as reduced carbon intensity of electricity supply.
- Housing Assumptions:
  - Annual completion data for the plan period was taken from Policy S2.
  - It was assumed that each house was 88 m^2 (average 3-bed semi-detached property)
  - Assumed regulated emissions due to lighting and pumps/controls were taken as 2.6 $kgCO_2/m^2$.year based on investigations using SAP.
  - It was assumed that all unregulated energy consumption (electricity) was based on the current electricity consumption of homes in Brentwood (as calculated based on ordinary domestic electricity use divided by number of ordinary domestic electricity meters from DECC data), with an adjustment for lighting and pumps (as stated above).
  - It was assumed that under Part L of the building regulations, regulated emissions for the 2010 regulations would be 20 $kgCO_2/m^2$.year, 18.8 for the 2014 regulations and 11 for the 2016 regulations based on an attached property.
  - It was assumed that there was a 3 year lag between a new version of Part L coming in, and it being seen on housing completions.
  - It was assumed that all "allowable solutions" would be delivered at a national level (i.e. not in Brentwood).
- Commercial and Industrial Assumptions:
  - Growth in employment space was taken from Policy S3, and was based on an initial existing employment space area of 53 Ha, of which 18.9 Ha will be lost to housing sites, and an additional 31 Ha would be provided for new employment sites. These areas were annualised over the plan period.
  - The total proportion of the workforce in Brentwood working in the retail sector was taken from the 2011 Census (12.1%). It was assumed that 12.1% of all electricity in the C&I sector was used within Retail, and was excluded from the initial calculation (Retail was calculated separately – see below).
  - Emission data for Offices from Carbon Buzz[xliii] was taken as a proxy for energy use and carbon emissions from the C&I sector. It is assumed that all or a significant majority of the entries on Carbon Buzz are for new buildings. Based on the most current data (sample size 97), actual carbon performance was 67.2 $kgCO_2/m^2$.year compared to a benchmark of 75 i.e. a 10% reduction.
  - It was assumed that the 18.9 Ha of lost employment space resulted in a reduction in C&I energy use and emissions at a rate equal to the Borough's average, and that all new employment space was added with energy consumption at 10% below the current Borough average.
  - it is assumed Growth in retail provision was taken from policy S4 where it is stated that 7,275 m^2 of net comparison floor space and 4,277 m^2 of net convenience floor space over the plan period. These areas were annualised over the plan period.

xliii http://www.carbonbuzz.org/index.jsp (accessed 16/10/13)

    - Emission data from Carbon Buzz was taken as a proxy for energy use and carbon emissions from the Retail sector. It is assumed that all or a significant majority of the entries on Carbon Buzz are for new buildings. Based on the most current data (sample size 14), it is assumed that retail emissions are 94.6 $kgCO_2/m^2$.year, of which all are from electricity.
- Transport Assumptions:
    - Energy use arising from traffic on the M25 was excluded as being outside to scope of influence of the Local Authority (former NI186 definition).
    - A simple assumption was made whereby each additional house delivered would result in additional transport energy use based on the current energy use per household as calculated from 2011 data (energy use from DECC, and households from the Census).
    - This assumption could overstate increased transport emissions if new development is located in more sustainable locations and with increased sustainable features, or it could understate emissions if this is offset by increased congestion.
- The total increased in energy use and carbon emissions were then calculated for each of the three sectors.

Appendix 2: The Potential Impact of National Policy on Energy Use and Carbon Emissions

An estimate of the impact of central government policy on energy use and carbon emissions in Brentwood was undertaken using the following assumptions:

- The main policies connected with carbon reduction were taken from the annual reports from the Committee on Climate Change[xliv] on progress against the national carbon budgets. The most recent of these reports (the fourth and fifth, covering the periods of 2011 and 2012) were used.
- The CCC reports summarise the main policies together with targets over the first three budget periods (2008-12, 2013-17, 20188-22). It was assumed that irrespective of current progress, the UK would just meet these targets in the final year of each budget period, with linear interpolation used to assess performance within budget periods. Post-2022 performance was assumed to flat-line.
- The headline trajectories for a package of policies covering the three sectors were taken. These included changes to energy consumption in the residential, non-residential buildings, industry sectors. These were broken down into electricity and non-electricity energy use. In the transport sector, reductions in carbon emissions were taken, and assumed to correspond to changes in energy demand. This would be affected by changes in carbon intensity of fuel, and electric vehicles. The trajectories for penetration of electric vehicles over the period are comparatively small to be considered in the noise. In addition, the projections for carbon intensity of the electricity grid, and proportion of renewable heat penetration into various built environment sectors were taken to chart the trajectory for carbon emissions.
- The trajectories within the CCC report include an allowance for growth. An inherent in our approach was that growth in Brentwood occurs at a similar rate to the UK. The net effect of the policy could therefore be established by comparing the trajectories of the CCC policy+growth with the previously estimated growth trajectory for Brentwood.
- An estimate of the split of energy use within the commercial and industrial sector was required in order to apply the CCC trajectories. This necessitated the separation of "industry" within Brentwood. This was done by taking information in the economy (GVA) from ONS[xlv] broken down into 20 sectors for the East of England (2009 data). This was used in conjunction with the number of people employed in those sectors for the same areas from the 2011 Census. The two year discrepancy between these data sources was the best estimate that could be made. A productivity (£/FTE) was established for East of England and this was applied to Brentwood's employment breakdown to estimate a breakdown in GVA of Brentwood's economy. The carbon intensity (kgO_2/£) for each sector was estimated from DEFRA Scope 3 emission data. This involved taking straight averages where there was more than one sub-sector carbon intensity within the overall sector. These carbon intensities were applied to the overall economic output of the borough to estimate a breakdown of emissions from within the economy. This enabled the separation of industrial sectors from non-industrial sectors. An estimate of heat to electricity ratio in the industrial sector was made by taking the CIBSE TM46 benchmark type of workshop, which assumes 64% heat to 34% electricity (carbon emissions). From this, fuel data was allocated to these two sectors on the basis that all petroleum products were allocated to the industrial sector with additional gas added such that the ratio of heat to electricity and industrial to non-industrial emissions were solved. This then allowed the CCC trajectories to be applied fairly.
- Renewable heat was assumed to offset fossil fuel heat from within each sector at the rates projected by CCC. This required the establishment of carbon intensities for heat of each sector (residential, non-domestic, industry) based on the DECC energy and carbon data. Renewable heat was assumed to replace this with 50% of energy provided by biomass and 50% with electricity.

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xliv http://www.theccc.org.uk/ (accessed 18/10/13)

xlv http://www.ons.gov.uk/ons/rel/regional-accounts/regional-gross-value-added--income-approach-/december-2010/rft-nuts2.xls (accessed 18/10/13)

Biomass carbon intensity was taken as 0.02 $kgCO_2$/kWh which was broadly estimated from SAP 2009 for a variety of wood sources. Grid electricity intensity was taken from the projected CCC trajectory, which incorporated a decarbonisation of the grid over time. The heat pumps were assumed to have a coefficient of performance of 3, and there is an inherent assumption that the efficiency of wood fuel boilers are similar to the fossil fuel boilers that they are replacing.

- The trajectories for changes to energy demand across the sector were indexed to 2011 (the CCC trajectories start from a 2007 baseline). The trajectories include actual outturn from 2011 and 2012, with the assumption that the 2^{nd} and 3^{rd} carbon budgets are just met in their final year.
- These indexed trajectories were applied to the initial energy demand for Brentwood (2011) to establish energy use to 2030. This energy use was combined with the renewable energy trajectories to establish a carbon trajectory to 2030.
- The impact of government policy was estimated by subtracting these trajectories from the BAU growth scenario Appendix 1).

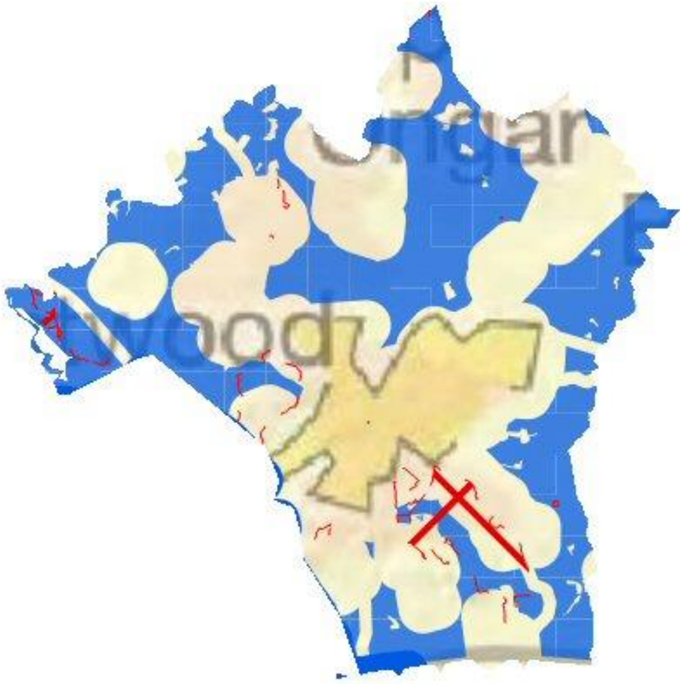
Appendix 3: Additional Assumptions Made in Applying the East of England Resource Assessment to Brentwood

The renewable energy resource potential for Brentwood presented in this report draws mainly on the output of the AECOM East of England resource assessment[xlvi]. The resource capacity both in terms of capacity and output for electricity and thermal are provided in supplementary tables at a borough level. In general, these values have been taken forward for Brentwood. There are some additional comments and supplementary calculations that have been undertaken for the various technologies.

Wind Energy:

The method undertaken established the natural resource and then applied three tiers of constrains, namely "hard", "soft" and "further considerations". The potential output once these constraints had been applied was presented in the supplementary output tables, though not including the final constraint. For Essex as a whole (no information was available for Brentwood) this has the potential to reduce capacity by a further 12%. The potential capacity and output in the tables did not include the landscape impact and cumulative impact. The report suggests that "1 in 10 of viable areas" is suitable for turbines. This factor was applied to establish the total potential. The report presents a 2020 target which is stated is based on 10% of the total technical potential. This was shown to be a reasonable approximation for the deployment of wind energy technology given the current rate of progress in the area. It appears that this 10% is based on the technical potential once a 1 in 10 adjustment for landscape impact has been applied. This assumption was taken forward and extrapolated at the same rate to result in a 2030 value. A map of the potential for large scale wind turbine locations is shown in the map below. Potentially suitable locations are shown in blue, with those areas shown in red being potential subject to "further considerations". These include National Parks, AONBs, heritage considerations, biodiversity designations and bridleways. The values from the EoE study for community scale wind were taken as presented. The 2030 value of 11.6 MW would be approximately 5 commercial scale turbines at approximately 2.5 MW each (assumed turbine size from EoE study; 100 m rotor diameter, 85 m hub height, tip height 135 m). The EoE study did not include Green Belt as a constraint in the mapping exercise, nor did it assess proximity to local electricity grid infrastructure for the purposed of connection. The section on large scale PV later in this Appendix shows substations within and immediately next to Brentwood Borough. It is likely that a significant proportion of the potential wind resource will be constrained by proximity to the grid, though this is accounted for in the broad assumption that 1 in 10 potential sites are viable. The areas with the greatest potential for large scale wind turbines are likely to be in the vicinity of either the Shenfield or the West Horndon substations (see section on large scale PV).

xlvi http://www.sustainabilityeast.org.uk/index.php?option=com_content&view=article&id=113&Itemid=92 (accessed 18/10/13)



<u>Biomass Energy (resource):</u>
The method used in the EoE study was "based on regionally available biomass feedstock, and not on the potential for biomass conversion technologies which may use imported feedstock". The assessment identified no resource for straw or energy crops in Brentwood. A very small amount potential for arisings from managed woodland for use in CHP has been identified in Brentwood. The EoE report assumed that the entirety of this resource could be realised by 2020, and therefore the 2030 value is the same as the 2020 target i.e. the total resource potential. A similarly low resource and deployment timescale had been found for industrial woody waste, and so the numbers from the EoE report were taken forward into this report, with the 2030 value being the same as the 2020 target.

<u>Energy from Waste:</u>
The EoE did not identify resource potential for Municipal Solid Waste (MSW) or Commercial and Industrial (C&I) solid waste to Borough level. The potential resource and a 2020 target are given for the East of England. This value was used to apportion MSW to Brentwood based on the ratio of population. From the 2011 Census the population of Brentwood was 73,601, and that of East of England was 5,846,965. The C&I waste was apportioned to Brentwood based on the ratio of economically active people in full time employment (Census 2011). The ratio of resource between MSW and C&I was inferred from the EoE study to be approximately 40% MSW and 60% C&I. The resource was then apportioned to Brentwood. It has been assumed that the total technical potential can be achieved by 2020, therefore the 2030 value is equal to the 2020 target.

Very small potential for wet organic waste (i.e. animal waste for use in AD) and dry organic waste (poultry waste) was identified for Brentwood. The study assumes the entire technical resource will be utilised by 2020 and so the 2030 value is the same as 2020 target.

There are no currently active landfill sites within the borough of Brentwood and so no resource is assumed. In general, the output from landfill gas is projected to decrease over time as waste streams are handled using more sustainable methods. Similarly, there are no sewage plants in Brentwood and so no resource has been assumed.

<u>Hydroelectricity:</u>
No resource was identified for Brentwood, based on the EoE study.

Large Scale PV (PV farms):

It is hard to assess the true "realistic" potential resource for large scale PV. The EoE study begins with assessing the technical resource, and concludes that there is the land availability for 28,000 MW of capacity which would be enough to meet half of the UK's electricity demand. It continues by applying a 10% factor to reduce the technical potential to 2,800 MW. The output tables from the EoE report present the total technical capacity prior to the 10% factor, and so this was adjusted for the study in Brentwood. The EoE study assumes that 10% of the adjusted technical resource could be realised by 2020. This assumption was taken forward and extrapolated at the same rate to result in a 2030 value.

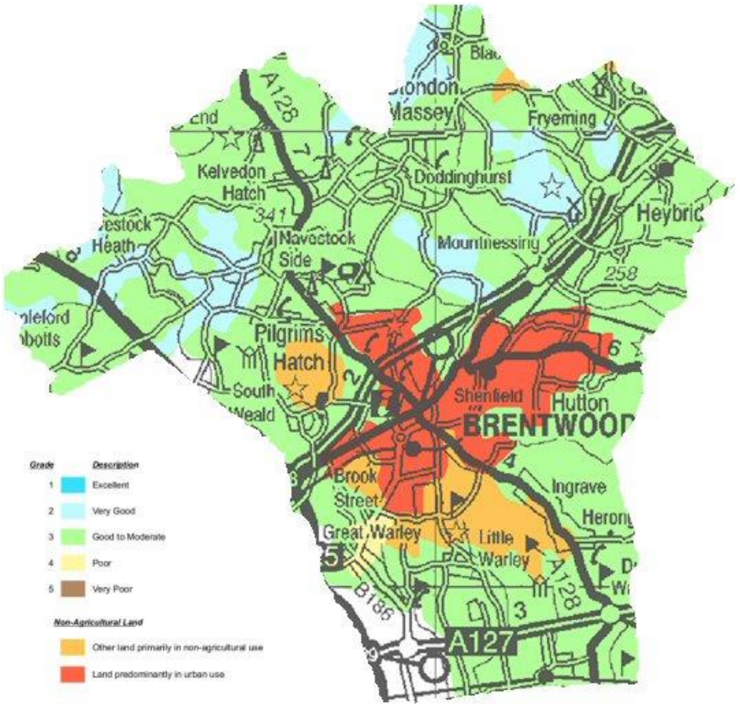
The EoE capacity study did not assign potential sites for PV farms. There is no established method for assessing this at a regional level. Additional work has been undertaken here to verify the potential for large scale PV. The majority (80%) of the Borough is designated as Green Belt (see map below). The Local Plan 2015-2030 Preferred Options highlights that protection of the Green Belt is a top priority locally. The EoE energy study stated in relation to wind farms that *"Planning decisions on wind farm applications where the Green Belt has been a material consideration have varied depending on whether exceptional circumstances were demonstrated. It is not clear where Green Belt policy will present a constraint on wind energy development, and this will need to be assessed on a case by case basis"*. Therefore the report here recognises that the Green Belt may impact on potential viability of renewable energy schemes, though this would need to be assessed on a case by case basis. CLG state in relation to cumulative landscape and visual impact that "In the case of ground-mounted solar panels it should be noted that with effective screening and appropriate land topography the area of a zone of visual influence could be zero"[xlvii].

The only previous precedent was for a small standalone scheme at Heron Hall[xlviii] which looked to be in the order of 50 kWp. The scheme was refused on the basis it would harm the setting of adjacent listed buildings, reduce the openness of the Green Belt and visually
intrude into the Special Landscape Area within which the site was located. The scheme was at the opportunity area (see below) nearby to the West Horndon substation.

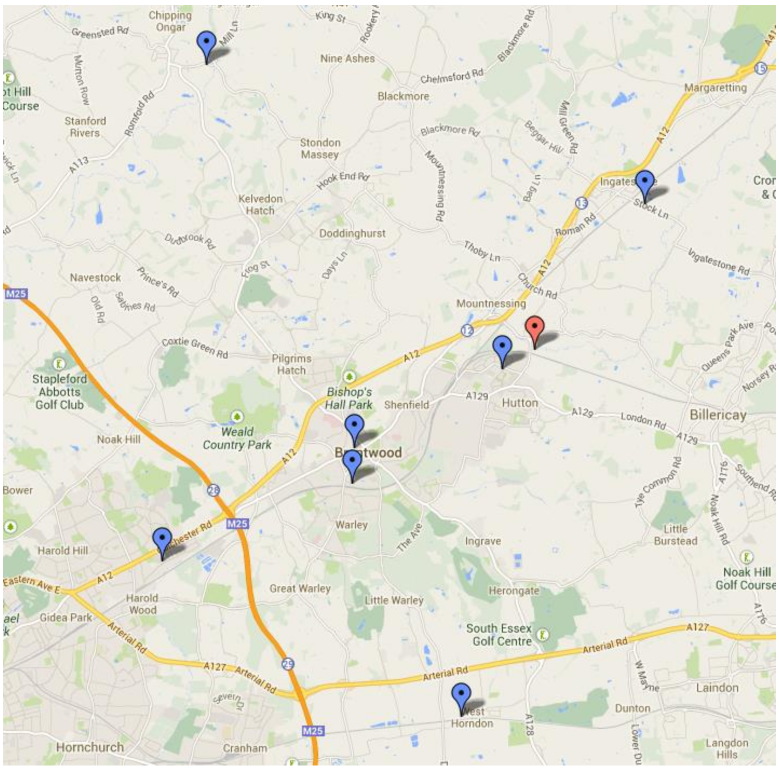
xlvii Planning practice guidance for renewable and low carbon energy, July 2013

xlviii http://publicaccess.brentwood.gov.uk/online-applications/applicationDetails.do?activeTab=summary&keyVal=LYAM9BDJ20000 (accessed 30/10/13)

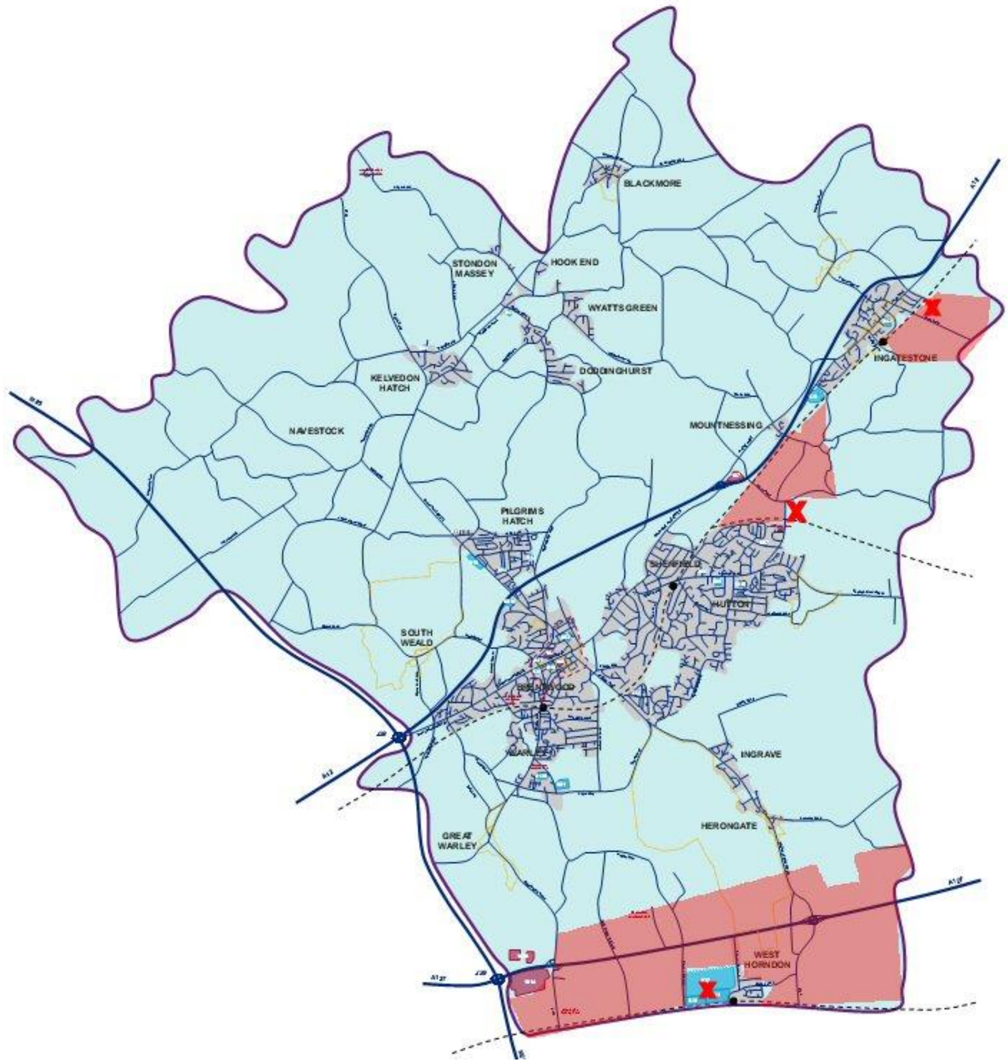
Aside from urban areas and other land that is used for non-agricultural purposes, the majority of agricultural land in Brentwood is Grade 3 or higher (see map below). There is a small area of Grade 4 identified at Great Warley, though this site is at an unfeasible distance from a grid connection.



The locations of substations in and immediately around Brentwood was taken from UK Power Networks, who are the local DNO (distribution network operator). Due to locations in built-up areas or the need to travel long distances and over obstructions such as major road and rail infrastructure, the most promising locations for large scale PV would be at Shenfield where there is a 132 kVA substation, West Horndon, and Ingastone where there are 33 kVA substations.



A quick check was undertaken to establish the potential capacity at those sites. The capacity was based on the assumptions made in the original EoE report which themselves were based on a requirement of 10 Ha for a 3.5 MW scheme. Examination of aerial photography shows potential areas where large scale PV could be a consideration. The red areas in the map below indicate potential opportunity areas, though would be subject to actual site surveys. The entire areas could not be taken up due to issues of cumulative visual impact. An estimate based on selecting sample sites reveals that the numbers within the EoE study are a reasonable first order approximation. There is probably the technical capacity for an even greater amount of large scale PV, though this could result in unacceptably adverse cumulative visual impact. The 2030 potential capacity of 8 MW could be delivered on one large site or a couple of smaller ones. For comparison, the largest current PV farm is 34 MW_p at Wymeswold Airfield[xlix] in Leicestershire (it cost £35 million, took 8 weeks to construct and is spread over 60 Ha and will provide power to the equivalent of 7,000 homes). Developing large scale PV at these areas would involve developing within the Green Belt and on agricultural land of Grade 3. Alternatively, land adjacent to the M25 may be suitable with respect to visual impact, though this location suffers from lack of nearby grid connection, and so potentially larger schemes may be required to justify the additional infrastructure overhead.



xlix http://www.larkenergy.co.uk/news/uk-s-largest-solar-farm-completed-and-grid-connected/ (accessed 28/10/13)

Microgeneration:
The method for microgeneration technologies in the EoE report used the DECC methodology with some additional assumptions. These numbers have been taken forward for this study. The potential trajectories to 2020 were extrapolated to 2030.

District Heating:
A high level estimate was made for the potential for District Heating (DH) with CHP for three broad sites, namely:

1. West Horndon: 1,500 homes plus 5 Ha employment space and a community centre.
2. Brentwood Centre: 399 homes plus shopping centre plus existing BT offices.
3. Council Depot: 175 homes plus 130 existing homes and the existing Ford HQ plus data centre.

The heat demand for a new home was assumed to be 4.4 MWh/year. The heat demand from existing homes at the Council Depot site was taken as the average gas consumption per domestic meter for that LSOA. For non-domestic development land areas were converted to floor areas based on experiences of previous schemes. The energy demand from non-domestic buildings was taken from CIBSE “good practice” benchmarks for new and recent buildings, and “typical” practice for older buildings. The heat demand for a community building at the West Horndon site was estimated from experience on previous schemes. Electricity demand from the Warley data centre at the Ford HQ building was based on the electrical supply for the facility to which a 50% capacity factor was applied.

For the Brentwood Centre and Council Depot sites, heat savings were based on the comparison of a baseline scheme consisting of generating heat by burning gas in a boiler with an efficiency of 92% and provision of electricity though the national grid, against a DH CHP system with an energy output of 30.8 electricity and 47.5 heat for 100 input. The comparison converted these into carbon equivalents and resulted in a 68% carbon saving on any heat delivered (the electricity was assumed to be at grid parity and no savings were attributed to the electricity). This saving in heat was attributed to each scheme based on implementation at 5,000 hours per year.

For the West Horndon site, the demand for heat and electricity was estimated as per the other two sites. This demand was compared to the resource of MSW, C&I waste and waste wood from within Brentwood. This resource could supply a plant with a capacity of 2.5 MW_e (with a 2:1 heat to power ratio), and the total output would be enough to meet the demand of the West Horndon site and the Brentwood Enterprise Park, with the employment land being a suggested location for the plant. Carbon savings were estimated on the assumption that half of the waste stream was biomass and so zero carbon, with the remainder being hydrocarbon based and of similar carbon intensity to any fossil fuel that would be displaced by such a scheme.

The scenarios investigated are indicative only and in practice would require the consent and co-operation of a number of stakeholders.

Biomass Boilers (generation):
The capacity and output from biomass boilers was estimated separately from the EoE study (which looked at *resource* within the Borough rather than the potential for *generation* within the Borough). The estimate was based on a series of assumptions, and calculated separately for the domestic and C&I sectors. For homes, the total number of households heated using oil or solid fuels was taken from the 2011 Census (505 homes in total, which is 1.7% of all households in Brentwood). It was assumed that 20% of these homes would not be suited to biomass heating for technical reasons (e.g. access or fuel storage issues). It was assumed that the remainder could potentially be heated by a 16 kW boiler with load factors of 9.5%

(average values from AEA report to DECC[l]). It was assumed that these would be delivered with the support of mechanisms such as the RHI and that the entire potential could realistically be delivered by 2030. Within the non-domestic sector the total current demand for energy from solid fuels, petroleum products and gas was taken from DECC's 2011 data. It was assumed that 25% of demand for heat in off gas was already potentially met in the future from heat pumps (i.e. to account for the EoE study assumptions) and "off gas" was taken to be all fuel use from petroleum products and solid fuels. It was assumed that the existing efficiency of boilers was 70%, and that these boilers could be potentially replaced with biomass boilers with an efficiency of 81% and a load factor of 0.4 (from the AEA report, taking averages where necessary). It was assumed that 20% of these sites would not be suited to biomass heating for technical reasons (e.g. access or fuel storage issues), and that a further 20% of the remaining heat demand would not be offset by biomass as the proposed implementation of biomass boilers would include multi-boiler installations where the biomass boiler would be the "lead" boiler, and fossil fuel boilers would provide "peak lopping". This is a more cost effective means of carbon abatement using biomass, and provides an element of backup. It was assumed that this formed the basis of the technical potential. It was assumed that 10% of this could be implemented from 2011 to 2020 which is based on the generic approach taken from the EoE study. This uptake rate was extrapolated to 2030. The total technical and 2030 capacities and outputs are shown in the table below:

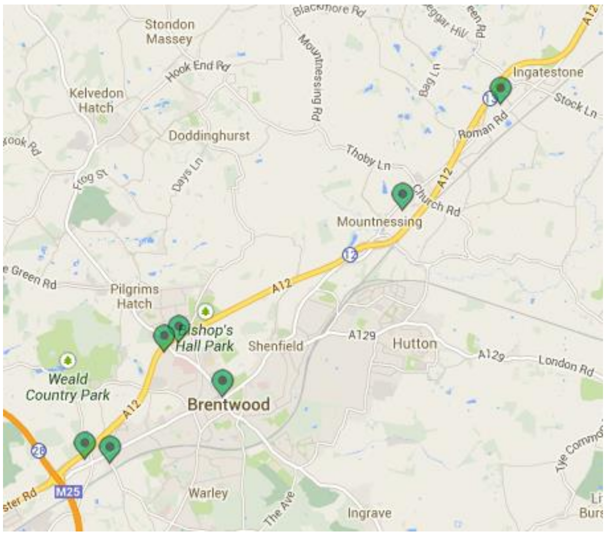
	Domestic	**C&I**	**Total**
Total Technical Capacity (MW)	6.5	28.8	35.3
Total Technical Output (GWh)	5.4	100.9	106.2
2030 Technical Capacity (MW)	6.5	6.1	12.5
2030 Technical Output (GWh)	5.4	21.3	26.7

Brentwood has seven declared AQMAs[li] (see map[lii] below). These are mainly along the A12, and also in the Brentwood Town Centre. The first six of these AQMAs contain mainly a small number of homes, none of which have been assumed to take up biomass boilers. AQMA 7 at the Town Centre (see map below) may impact on the ability to install biomass heating systems, though these sites may be unsuitable anyway as they would likely have constraints regarding fuel delivery and storage.

l AEA 2011, Review of technical information on renewable heat technologies URN: 11D/0020, Report for the Department of Energy and Climate Change.

li http://aqma.defra.gov.uk/aqma/local_authorities.php?la_id=33 (accessed 31/10/13)

lii http://aqma.defra.gov.uk/aqma/maps.php (accessed 31/10/13)


Stondon
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Hook End Rd
Kelvedon
Hatch
Doddinghurst
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Roman Rd
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Church Rd
Mountnessing
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Frog St
Days Ln
Pilgrims
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London Rd
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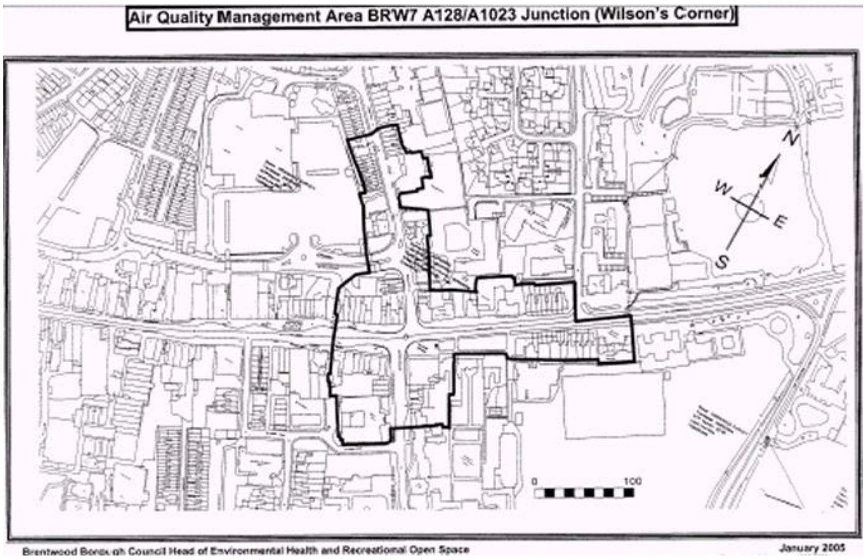
Warley
The Ave
Ingrave


Air Quality Management Area BRW7 A128/A1023 Junction (Wilson's Corner)
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Brentwood Borough Council Head of Environmental Health and Recreational Open Space
January 2005

APPENDIX 4: STAKEHOLDER WORKSHOPS

The findings of this study were presented to at a workshop held at Brentwood Borough Council on 24th March 2014. A diverse range of stakeholders were invited to the workshop including officers from the Borough and County councils, the LEP, interest groups, Renewables East, key private organisations (e.g. Ford and BT) and developers, though not all of those invited attended. The purpose of the workshop was to present the findings of the study and to give stakeholders the opportunity to provide input into the study. The workshop was split into four sections, discussing each of national policy, local energy use and emissions, renewable energy potential and local standards for Brentwood.

LDP STAKEHOLDERS RENEWABLES WORKSHOP

Monday 24 March 2014 **Committee Rooms 1 & 2, 1.30pm – 3.30pm**

Attendance:	
Cllr. Linda Golding	Herongate, Ingrave & West Horndon Ward
Cllr. Roger Hirst	Hutton South Ward
Cllr. Ann Coe	South Weald Ward
Anna Davies	Persimmon Homes
David Kavanagh	EA Strategic L
Pete Jeavons	Iceni Projects
Phil Dash	Essex County Council
Anthony Norton	Centre for Energy and the Environment, University of Exeter
Dr. Daniel Lash	Centre for Energy and the Environment, University of Exeter
Tony Pierce	Interim Head of Panning
Alex Bird	Planning Policy Team
Phil Drane	Planning Policy Team
Conor McCarthy	Planning Policy Team
Camilla James	Planning Policy Team
Mo Aleshionye	Planning Policy Team
Yee Cheung	Development Management Team
Sukhi Dhadwar	Development Management Team
Richard Seaward	Development Management Team
Anne Knight	Economic Development Officer

Key Discussion Points

- Concern was expressed that the housing standards review potentially left the council's position to affect development locally in a far weaker state.
- A point was made about the wording of the deregulation Bill that is going through Parliament, namely the distinction between setting standards in excess of the Part L Building Regulations trajectory, and the ability to set a specific % of energy met from renewables.
- It was stated that the housing standards review applies only to homes and not to non-domestic development.
- The point was made by Councillor Hirst that the inability to set local standards in excess of a national baseline standard was potentially perverse, in that the relative incremental cost of achieving these standards is much higher in places with low land value. This means that development would be disproportionately expensive in those places, or the baseline would be so low as to have little effect.
- Cllr. Hirst expressed concern that the Government definition of zero carbon was disingenuous and constituted a misbranding. A "zero carbon" home for example could still emit about a tonne of carbon dioxide from regulated emissions alone.

- A question was raised as to how important local authority input was in bringing forward district heating schemes. It was stated that it is not essential as there are example where private sector to private sector schemes have come forward. Nonetheless supporting policy is an extremely helpful lever in this regard.
- The examples of Denmark and Sweden were given where culturally district energy is well integrated.
- Allowable solutions were discussed, namely the ability of local authorities to own and administer allowable solutions monies.
- A discussion took place on the siting of large renewable schemes immediately adjacent to road and rail infrastructure, as they do on the continent. In principal there would be no reason to not specifically do this, subject to the usual impact being mitigated. The resource assessment allows a 150 m buffer zone around roads and railways as per the Government's methodology.
- Cllr. Golding mentioned an approved standalone PV scheme that was unanimously approved feeding Cheale abattoir. It had been originally recommended for rejection, though it was a well screened site. This provides a useful case study going forward.
- Cllr. Golding stated that wind turbines are a much more contentious issue for residents. On a visit to a BRE site Cllr. Golding undertook a site visit to a wind turbine and was surprised by the lack of noise.
- Cllr. Hirst questioned the application of schemes and the viability with regard to grid connection. It was stated that with these standalone schemes the required proximity to a grid connection is highly sensitive to the resource and the scale of the scheme i.e. a high output scheme would enable a developer to be located further from a grid connection.
- Cllr. Golding questioned whether Government policy was moving away from large land based renewable energy schemes. It was stated that the examples of the South West of England is showing that due to well organised "anti" campaigns, developers are choosing not to bring forward many schemes.
- A discussion took place on the Green Belt and that there are examples of individual small turbines, though not large wind farms. It was stated that the role of the Green Belt is to prevent urban sprawl, and that the inherent amenity/beauty of the Green Belt was not uniform.
- It was stated that in the case of large standalone electricity schemes e.g. wind and PV, they are temporary structures and planning clauses can be put in place to require the technology to be removed and the site restored, say after 25 years.
- It was questioned whether existing employers were consulted regarding district heating schemes. It was stated that the approach taken was to consider where new development was located near to existing development and where there might be opportunities to bring forward retrofit schemes. The two scenarios presented in the analysis included BT and Ford respectively. They were invited to this workshop though were not in attendance. Going forward, it would be worthwhile for the Council to open up lines of communication to discuss what, if any, the opportunity is for district schemes in Brentwood. It was acknowledged that retrofitting district energy schemes is inherently more challenging.
- Cllr. Golding questioned whether dealing with the existing building stock was the "elephant in the room". It was agreed that the existing stock was very much a challenge. The average energy rating of homes in Brentwood is actually the same as the national average, as measured using the SAP methodology. Clearly within the overall stock, there will be older harder to treat properties. Past and present retrofit schemes were discussed, with the current effectiveness of the Government's flagship Green Deal scheme being extremely limited. Future changes to incentivise uptake at the point of sale and rent may help to drive retrofitting, though the removal of the requirement to undertake efficiency improvements for homes where other work is being done represented a further blow to the scheme.
- A point was made that the two undeveloped motorway junctions should be considered as a potential opportunity, as it is likely development will come forward over the next 25 years.
- The next issue of the Local Development Plan is due in the summer of 2014, and the work undertaken here will inform that plan. This plan will involve developing more site specific schemes and suggestions.