3. Physical Context: Energy Demand from the Built Environment

3.1 INTRODUCTION TO THIS CHAPTER

This chapter considers the existing and future performance of buildings in Swale in terms of demand for energy (both electricity and heat). Firstly, it considers the current performance of buildings, and then considers how this energy demand from existing buildings is likely to change over time. Secondly, it considers the level of growth expected over the Core Strategy period (until 2031). The energy modelling described in this Chapter was undertaken using AECOM energy use models and building typologies developed through professional research projects.

3.2 TOTAL CO_2 EMISSIONS FOR SWALE

DECC energy use data for 2007 has been used to compare CO_2 emissions in Swale with the rest of the UK. The breakdown of emissions by sector can be seen in the table below. It shows that CO_2 emissions per capita in Swale were nearly 60% higher than the average for the UK in 2008. Industrial and commercial activity make up the most significant proportion of emissions in the Borough, and are largely responsible for an increase in total emissions of around 13% between 2005 and 2007.

Table 3: Baseline CO_2 emissions in the UK and Swale Borough for 2008 (Source: Emissions of CO_2 for local authority areas, DECC)

Tonnes CO_2 per annum (2008)	Swale	Percentage of Total	UK	Percentage of Total
Industry & Commercial	1,076,000	63%	228,137,000	45%
Domestic	288,000	17%	149,317,000	29%
Road Transport	337,000	20%	131,045,000	26%
Total Emissions	1,703,000		506,526,000	
Emissions Per Capita	**13.0**		**8.2**	

3.3 ENERGY PERFORMANCE OF EXISTING BUILDINGS

Although industrial and commercial activities have their own energy demands, the quality of the built environment will have an influence on the overall emission levels. This will be particularly pertinent for domestic properties. This chapter considers the current and future energy demand from the built environment, which forms a considerable portion of Swale Borough's CO_2 emissions. The effect of growth options on transport emissions is considered in an Addendum to this report.

3.3.1 RESIDENTIAL BUILDINGS

The table below sets out the average electricity and gas demand in Swale as compared with the regional and national averages.

Table 4: Energy consumption per residential consumer (DECC, 2008)

	Average electricity sale per consumer	Average gas sale per consumer
	Residential kWh	Residential kWh
Swale	4,324	15,469
South East Average	4,543	17,022
Britain Average	4,198	16,906

DECC also provides spatial data at Middle Level Super Output Areas for residential electricity and gas use. The figures below show the average electricity and gas use spatially to demonstrate how building types and user behaviours can change use of energy. The spatial variation of electricity and gas use gives us an insight into the areas of existing stock which are least efficient and should be a priority for improvement. The figures below show relative residential energy performance spatially.

The spatial analysis of domestic electricity and gas consumption shows that the majority of the Borough is below the South East averages. However, areas where electricity and gas consumption are above average, they substantially exceed the average. The most likely explanation for this is that they are in more rural areas where the housing stock is older, and therefore poorly insulated. These areas are also where detached houses are commonplace, which use substantially more energy than terraced housing. Higher energy use in some areas may also reflect the relative affluence of the areas. The possible reasons for spatial differences are discussed further in the sections below. Retrofit programmes, which look to improve the energy efficiency of existing homes will be an important step to improving consumption figures of the areas which have been identified as performing poorly.

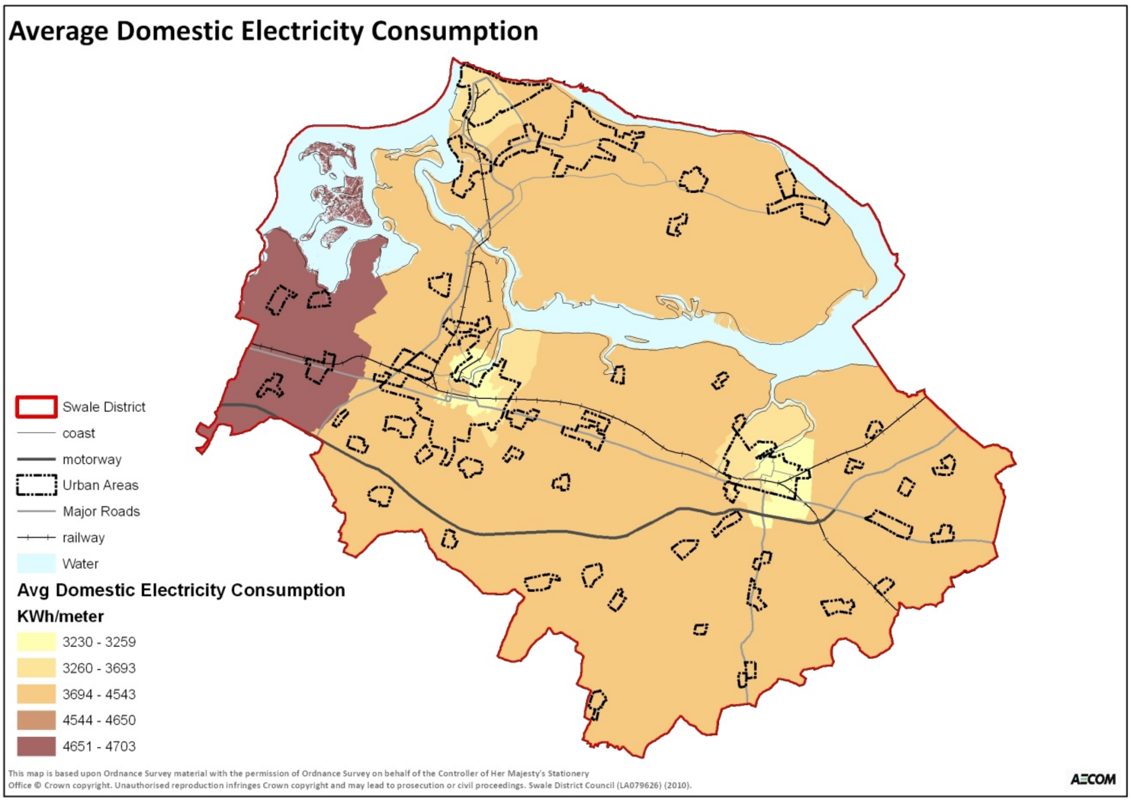


Figure 7: Average Domestic Electricity Consumption in Swale

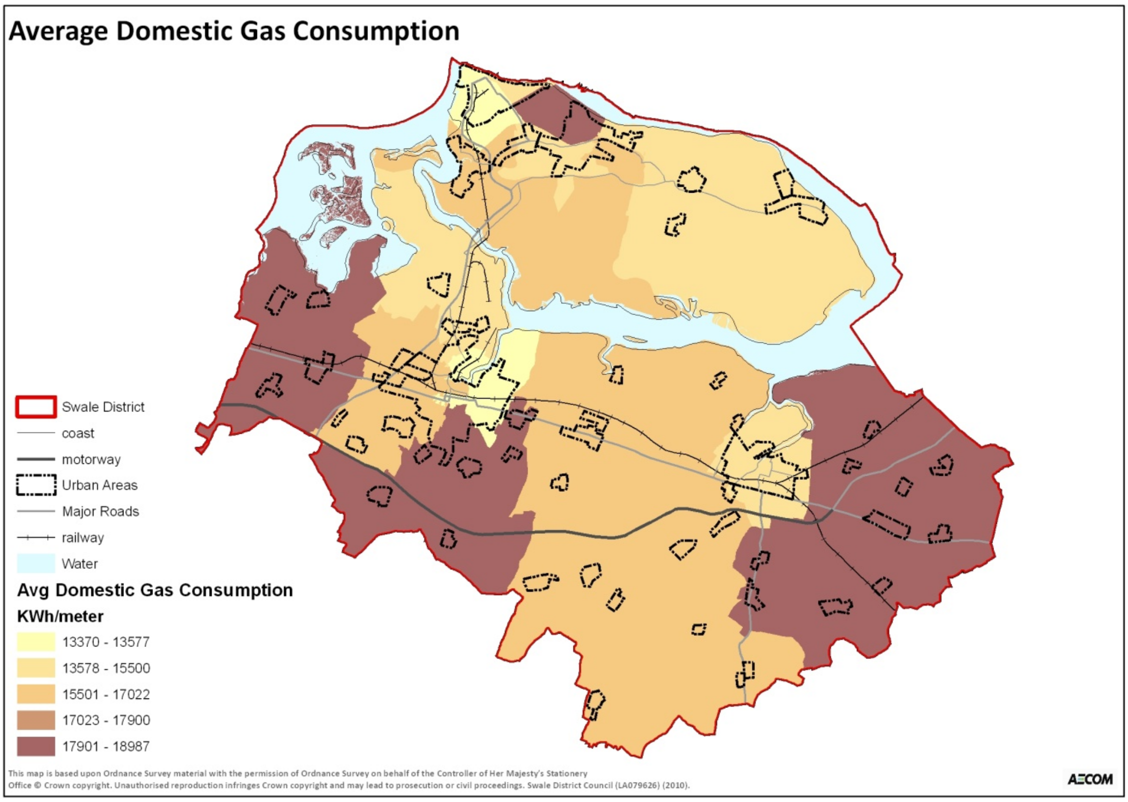


Figure 8: Average Domestic Gas Consumption in Swale

Use of other fuels

Not all properties have access to the gas grid and still rely on oil or coal, which are relatively high carbon fuels. DECC also provides information on the non-gas or electricity domestic consumption across the authority areas as detailed in the table below.

Table 5: Other fuel energy consumption (DECC, 2008)

	Total domestic consumption petroleum products (including fuel oil, LPG and petrol) GWh	Total domestic consumption coal Gwh
Swale	4.3	0.7
South East Average	5.4	0.63
Britain Average	4.6	1.01

Understanding Performance of Existing Homes

According to the English Housing Condition Survey (EHCS) 2007, the energy efficiency of homes in England has improved from an average SAP[5] rating of 42 (1996) to 50 (2007) due to energy efficiency measures. The average energy efficiency, SAP rating, of new homes in England was 78.5 (DCLG, 2009). The type and age of buildings affects their energy performance and the tenure mix can have an effect on the way in which energy is used within buildings. The 2008/09 Swale Borough Council Private Sector House Condition Survey provides details on the energy performance of energy.

Dwelling type

The form of a dwelling can dramatically affect its thermal performance. Heat energy is lost through external walls and, as heat rises, particularly through roof spaces. Detached properties are more likely to be less energy efficient as there is a higher surface area of external walls and roof space through which energy can be lost. Mid-level apartments are more energy efficient as heat rising from one level will help to keep the level above warm, before it is finally lost out of the roof and there are generally less external walls for heat to escape as show below. Similarly, mid-terrace houses are relatively thermally efficient as they have limited external walls.

[5] Standard Assessment Procedure (SAP) - The energy efficiency level of a dwelling is often measured by its SAP Rating, also known as Energy Ratings. Houses are rated from 0 – 100; 0 (Least efficient) and 100 (Most efficient). SAP ratings are the Government's standard methodology for home energy rating and uses SEDBUK figures to calculate the energy needed for space heating and hot water supply systems. The Building Regulations require a SAP assessment to be carried out on all new dwellings (DEFRA, April 2006).

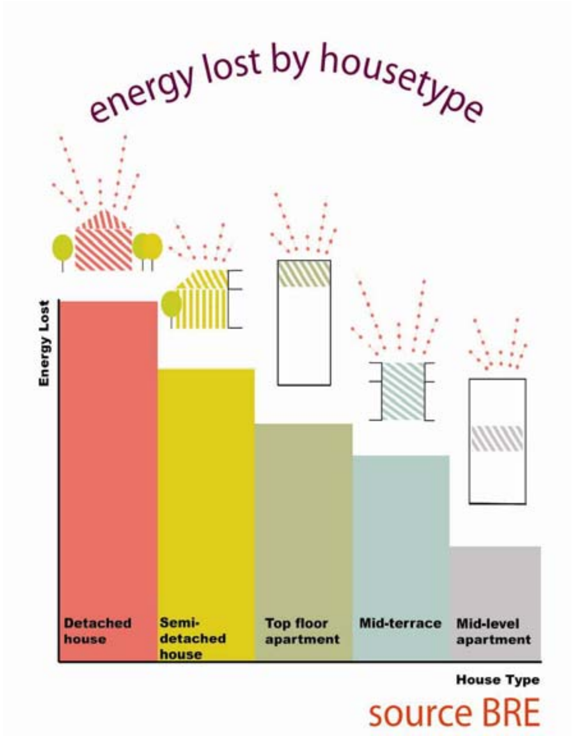


Figure 9: Comparative Heat Loss of Building Types

The table below shows that the majority of dwellings in Swale are terraced. Some of these properties are, however, either end of terrace or have a passage alongside them which will reduce their thermal performance and have therefore been separated out into a separate category. There are also a significant number of detached properties.

Table 5: Dwelling Stock Make-up in Swale (Swale Housing Stock Condition Report, 2010)

Dwelling Type	Total	% Stock
Detached	10,894	22.90%
End-terrace	5,134	10.80%
Flat	2,033	4.30%
Maisonette	64	0.10%
Mid-terrace	8,851	18.60%
Mid-terrace with passage	989	2.10%
Semi-detached	19,658	41.30%
Total	**47,623**	**100.00%**

The table below shows the average energy performance (SAP rating) by dwelling type. Unsurprisingly, maisonettes, mid-terrace housing and flats have higher SAP ratings as they are naturally more thermally efficient. End of terrace housing, and mid-terrace housing with a passage were the worst performing building types. There higher number of external walls makes them less thermally efficient. The performance of detached and semi-detached housing is relativity high. This could be for a number of reasons, such house building age or additional insulation.

Table 6: Energy Performance (SAP Rating) of Dwelling Types in Swale (Swale Housing Stock Condition Report, 2010)

Dwelling Type	SAP RATING
Detached	57.75
End-terrace	51.63
Flat	60
Maisonette	71.67
Mid-terrace	60.32
Mid-terrace with passage	52.73
Semi-detached	57.86
Total	**57.93**

Dwelling Age

The age of properties can also affect their energy use. Houses built before the end of World War I are generally built with solid walls through which over 45% of heat energy is lost, whereas from about 1920 onwards buildings started to be built with hollow cavities within the walls which provide some insulation. Following the first major energy crisis in the early 1970s the use of cavity wall insulation became standards building practice to improve performance further. It was around this time that Part L of the Building Regulations, which focuses on thermal performance, was introduced. This has progressively increased the minimum requirements for building performance, delivering better performing building design and higher specification insulation.

The table below shows the age of buildings in Swale and their average SAP rating. As expected, energy performance, largely due to improvements in thermal performance, improves over time. The majority of dwellings were built in between 1965-1980, around the time when building regulations Part L was introduced. Additionally, the vast majority of dwellings in Swale were built before this time, with a considerable proportion built before 1919, and as such have a relatively low. The proportion of older houses is however generally lower than nationally, and as a proportion, Swale has a large number of efficient, new build.

Table 7: Age and Energy Efficiency of Dwellings in Swale (Swale Housing Stock Condition Report, 2010)

Construction Age	Total	% within Swale Borough	National Average (EHS 2006)	SAP RATING
<1919	9,999	21.00%	24.90%	52.4
1919-1944	6,537	13.70%	19.20%	55.66
1945-1964	8,861	18.60%	17.10%	57.94
1965-1980	12,148	25.50%	20.30%	59.98
1981-1990	2,896	6.10%	8.40%	66.15
Post 1990	7,182	15.10%	10.00%	72.3
Total	**47,623**	**100.00%**	**100.00%**	**57.93**

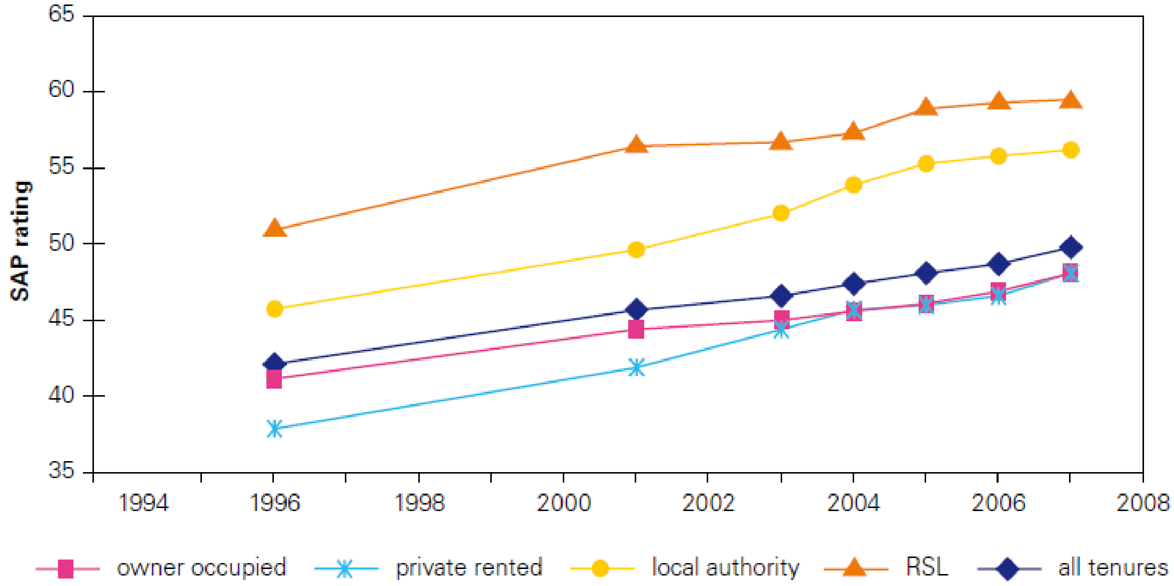
Analysis of the SAP rating against the age of dwellings as set out in table above shows that there are a high number of homes in Swale that have a good SAP rating of between 65-74. As can be expected, older housing generally has a worse energy performance and there is a marked improvement post 1980.

Table 8: Comparison of Age and Energy Efficiency of Dwellings in Swale (Swale Housing Stock Condition Report, 2010)

Construction Age	<35	35-44	45-54	55-64	65-74	75+	Total
<1919	1,217	1,624	2,576	3,276	1,248	57	9,999
1919-1944	106	775	2,422	2,150	877	208	6,537
1945-1964	91	386	2,018	2,830	2,731	805	8,861
1965-1980	239	403	2,794	3,548	4,030	1,134	12,148
1981-1990	28	10	77	719	1,635	426	2,896
Post 1990	0	14	519	881	3,580	2,187	7,182
Total	**1,680**	**3,213**	**10,407**	**13,405**	**14,101**	**4,818**	**47,623**

Tenure

Although type of tenure and the utility billing arrangement do not directly affect building energy performance they can influence the energy use of a property. The English House Condition Survey (DCLG, 2007) revealed that social sector homes on average have been the most energy efficient and have also shown the highest rate of energy efficiency improvement since 1996. Between 1996 and 2007, Registered Social Landlord (RSL) dwellings have consistently had a higher average SAP rating compared to the other three tenures. Lower levels of owner occupation and higher levels of private renting tend to be associated with lower proportions of satisfactory housing.



Base: all dwellings
Source: Communities and Local Government, English House Condition Survey

Figure 10: Energy Efficiency, Average SAP rating by Tenure (England), 1996 – 2007

In Swale, the vast majority, some 71.7%, of housing in Swale is owner occupied. There is also a significant proportion of private rented and socially rented properties.

Table 9: Dwelling Occupancy Type in Swale (Swale Housing Stock Condition Report, 2010)

Tenure Type	Total	All Housing
Owned - Mortgage	23,309	42.20%
Owned - Outright	16,325	29.50%
Rented - Private	7,921	14.30%
Shared Ownership	68	0.10%
RSL	7,644	13.80%
Total	55,267[6]	100%

Fuel Type

Using gas to for space and water heating, as well as cooking, is generally more energy efficient. The vast majority, some 43, 439 out of the 47,623 homes in Swale have gas heating. There are however 2,935 properties that use electricity for heating and a further 1,249 that use other fuels (510 on solid fuel and 739 use oil). It is generally the older properties that are not on the gas network, adversely affecting their SAP rating as can be seen in the table below.

Table 10: SAP Rating Based on Fuels Used in Housing (Swale Housing Stock Condition Report, 2010)

	Gas		Electricity		Solid Fuel		Oil		
Construction Age	No. Props	Ave SAP	No. Props	Ave SAP	No. Props	Ave SAP	No. Props	Ave SAP	Overall Ave SAP
<1919	8,519	56	929	29	126	31	425	38	52.4
1919-1944	5,884	57	338	35	125	40	191	62	55.66
1945-1964	8,244	62	267	33	242	54	109	58	57.94
1965-1980	11,530	63	587	43	17	41	14	63	59.98
1981-1990	2,628	70	268	54	0	0	0	0	66.15
Post 1990	6,634	74	547	61	0	0	0	0	72.3
Grand Total	**43,439**	**61**	**2,935**	**40**	**510**	**42**	**739**	**45**	**57.93**

Home Energy Conservation Act

The Home Energy Conservation Act has given all local authorities the status of Energy Conservation Authority (ECA) and has mandated them to carry out voluntary cost effective and practical measures that will reduce home energy consumption by 30% over 10 to 15 years, that is, by 2006 or 2011[7]. The measures as defined by HECA include a combination of any or all of the following:

6 Total number of houses iin Table 9 differ from Table 8 as House Conditions Survey did not survey Registered Social Landlords (RSL)

7 Consultation on the Review of the Home Energy Conservation Act 1995 (HECA), DEFRA (October 2007)

a. Improve levels of insulation, that is:
    - Add or increase loft insulation to a thickness of 200mm
    - Add cavity wall insulation, where applicable
    - Add or increase insulation of hot water cylinders, tanks and pipes

b. Install or upgrade heating systems to gas powered programmemable central heating

c. Upgrade all windows to double glazing

d. Install low energy lighting and energy efficient electrical appliances

e. Provide good quality advice to householders.

ECAs are also obliged to report annually on the uptake of energy conservation measures. The report must include costs, CO_2 savings and annual improvements achieved in the energy efficiency of the housing stock.

In response to the requirements of HECA, local authorities have devised several innovative schemes and initiatives which include; the establishment of community businesses, provision of loans and use of negotiated bulk discounts, as well as innovative approaches to giving advice and raising awareness. These schemes vary from one authority to another. These schemes have been developed to encourage the uptake and implementation of energy efficiency measures for the private housing sector with the goal of achieving a 30% improvement in energy efficiency of the stock.

Within Kent, there is also the Kent Action to Save Heat (KASH), which is an energy efficiency retrofit programme currently operating in the Borough. KASH has partnered with 12 local authorities across Kent in association with Creative Environment Networks to provide residents with free, expert, independent advice, and highlight any available grants or discounts in the process. Swale Borough Council is participating in this programme, which represents an opportunity to supply residents with necessary retrofit information.

In Swale, only 15.1% of properties have loft insulation above the 200mm recommended through HECA initiatives, as shown in the table below. Over 72% do, however, have at least 50mm.

Table 11: Percentage of Swale Properties with Different Levels of Loft Insulation (Swale Housing Stock Condition Report, 2010)

Current Loft Insulation	Properties	%
N/A	1,790	3.80%
0-50mm	4,336	9.10%
51-100mm	13,381	28.10%
101-150mm	14,195	29.80%
150-200mm	6,700	14.10%
201-250mm	5,072	10.60%
250mm+	2,149	4.50%
Total	47,623	100.00%

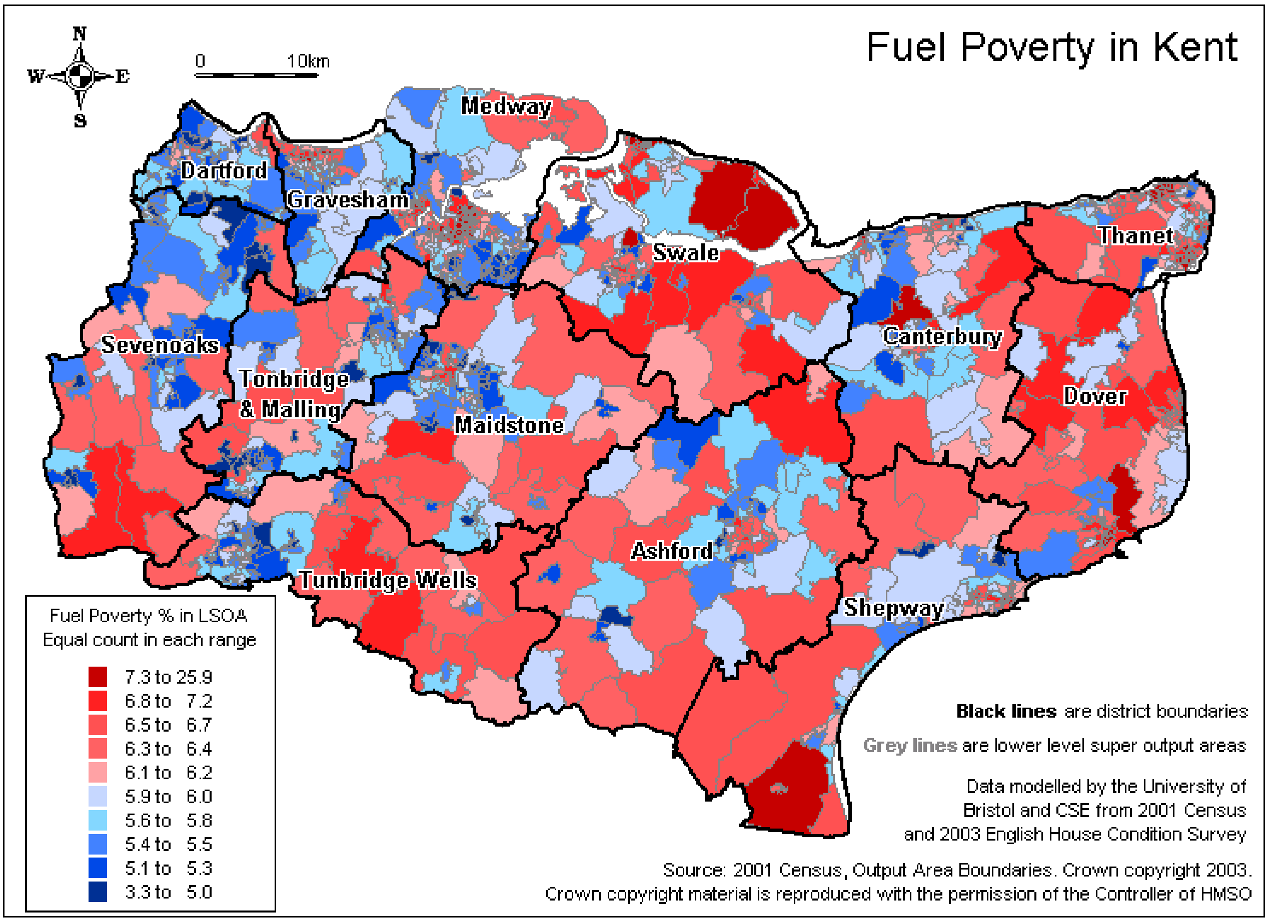


Figure 11: Fuel Poverty in Kent

Fuel Poverty

Swale's Private Sector House Condition Survey (2010) found that around 16.2%, 7,695 properties are currently in fuel poverty. This is based on the number of households that spend more than 10% of income on fuel costs. The majority of people living in fuel poverty reside in older properties. Surprisingly, a high proportion of these are mid-terraces. As these properties are naturally more thermally efficiently, the findings reflect the economic status of occupants rather than the energy performance of the building.

The figure above shows that parts of Swale are among the most fuel impoverished in Kent. The eastern portion of the Isle of Sheppey and the area to the north of Sittingbourne are the two areas showing the highest fuel poverty levels. This is likely a result of a concentration of lower income households in these areas.

3.3.2 NON-RESIDENTIAL BUILDINGS

A significant portion, some 60%, of Swale's CO_2 emissions comes from the energy used for industrial and commercial activities. The table below outlines the electricity and gas use in non-residential building. It is clear that Swale's non-domestic sector uses a substantial amount of energy. Electricity use is nearly 120% higher than the South East average and 66% higher than the national average. Similarly, gas consumption is nearly 140% higher than the region, and nearly 55% higher than the UK average., This reflects the disproportionally high levels of energy intensive industries, manufacturing and food processing/distribution activities in the Borough.

Table 12: Non-domestic energy use

	Electricity	**Gas**
	Non-domestic GWh	Non-domestic GWh
Swale	782.9	792.9*
South East LA Average	357.4	330.6
Britain Average	**470.81**	**512.2**

*Area also contains 2 large industrial consumers whose consumption is not included in the data

3.4 FUTURE PERFORMANCE OF EXISTING BUILDINGS

The carbon profile of existing buildings will change over time. As a result of changes in energy demand due to energy efficiency measures, adoption of micro-generation technologies to supply homes with renewable energy, change in behaviour, and switching to fuels which emit fewer greenhouse gases. This section considers the likely change in the energy demand profile of existing buildings until 2031.

3.4.1 RESIDENTIAL

The uptake of energy efficiency measures in existing housing stock is relatively low, with most measures taking a number of decades to reach saturation. Schemes such as the Energy Efficiency Commitment (EEC) and its successor, the Carbon Emissions Reduction Target (CERT), require utility companies to promote and facilitate energy efficiency improvements with the aim to increase adoption rates of renewables. CERT (2008 – 2011) is significantly more ambitious than previous phases of the obligation, doubling the level of activity seen under EEC 2005 - 2008. It also shifts the emphasis from terawatt hours to carbon savings targets. Under CERT, energy suppliers nationwide must, by 2011, deliver measures that will provide overall lifetime CO_2 savings of 154 $MtCO_2$ – equivalent to the emissions from 700,000 homes each year. The expectation is for this measure to lead to energy supplier investment of approximately £2.8bn.

Suppliers must focus 40% of their activity on a 'Priority Group' of vulnerable and low-income households, including those in receipt of certain income/disability benefits and pensioners over 70. By increasing the energy efficiency of UK households, CERT will not only help households from falling into fuel poverty but is also expected to help alleviate fuel poverty.

There is already a Rushenden Retrofit programme underway. RSLs, different levels of government, and a handful of industry organisations have partnered to deliver the Retrofit programme, which has a goal to develop a retrofitting guide with a focus on improving opportunities for the unemployed and disadvantaged. programmeThe programme represents a real opportunity to help retrofit existing buildings in Swale.

Estimates for energy efficiency in Swale have been based on a study of the likely penetration of measures by 2020, which are based on historic, current, and new uptake schemes[8]. These predictions have been done on a nation-wide scale and utilise expected uptake of a range of energy efficiency measures. Extrapolating these expected rates of energy efficiency increase from the 2006 energy demand baseline, as shown in the figures below, it can be seen that electricity demand is likely to increase slightly, as demand for more energy intensive appliances outweighs energy efficiency measures. Gas demand on the other hand is likely to decrease as energy efficiency measures are applied. The figures below demonstrate the expected change in electricity and gas consumption over time in line with 'business as usual' rates of improvement of existing buildings, as predicted by BRE.

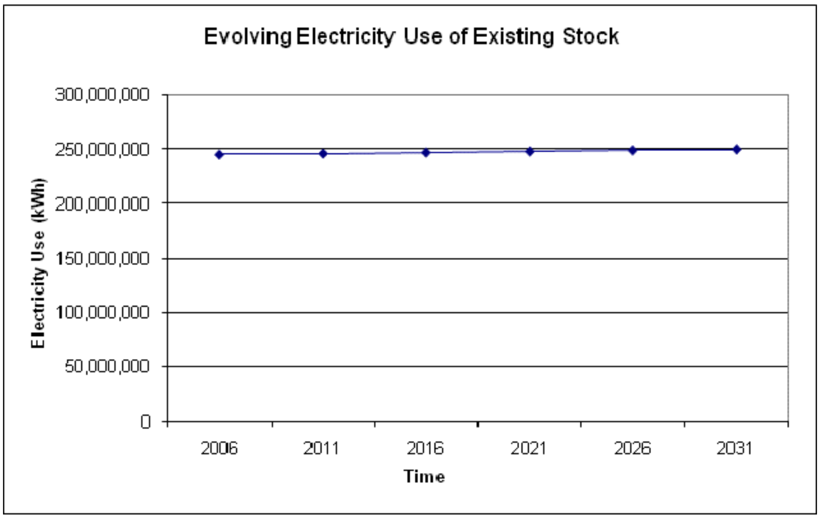


Figure 12: Expected changes in electricity demand from existing residential buildings over the core strategy period

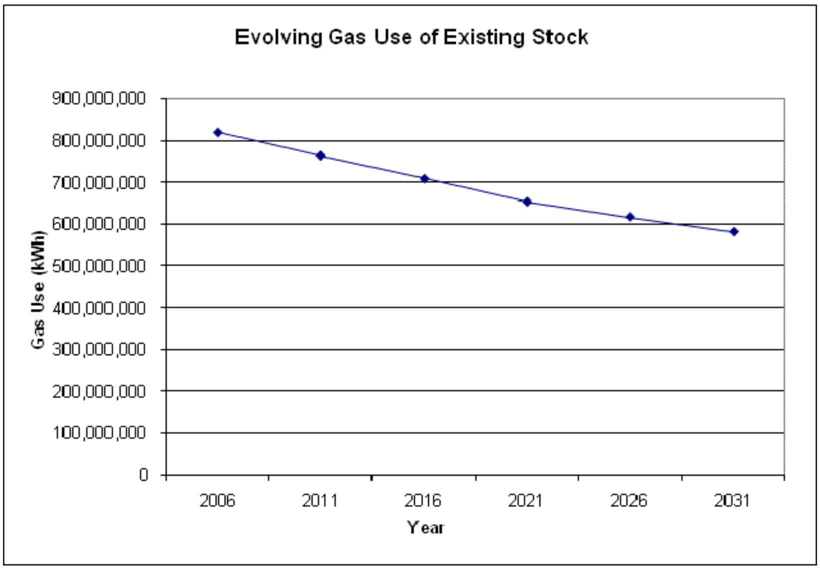


Figure 13: Expected changes in gas demand from existing residential buildings over the core strategy period

[8] Delivering Cost Effective Carbon Saving Measures to Existing Homes. BRE for DEFRA. 2007.

3.4.2 NON-RESIDENTIAL

The assessment of energy efficiency in the non-residential sector is difficult due to the range of building forms, construction, and usage types. A large amount of advice is available from bodies such as the Carbon Trust on reducing building and process energy, but it is not simple to quantify the UK potential, or uptake rates due to lack of data at a national scale. Based on Carbon Trust targets for non-residential buildings, this study has developed estimates for energy efficiency improvement expected through behavioural change, and through capital cost measures. The trend for commercial and industrial development is one of increased efficiency in both electricity and gas use as set out in the figures on the following page.

While the Carbon Trust has developed targets for energy reduction in non-residential buildings, the initiatives are less visible and less coordinated than those for residential buildings. As non-residential uses comprise the majority of Swale's energy demand, the Council will need to play a key role in encouraging energy efficiency in existing non-residential buildings to help to meet these targets.

Industries operating in Swale have already made strides to improving their sustainability. A few of the many local initiatives include:

- Floplast, a local plastic building and plumbing systems business, was recently awarded Carbon Trust Standards, which certify organisations for real carbon reductions.
- Knauf Dry Wall, a Sittingbourne producer of plaster board has many environmental commitments and produce Futurepanel, the industry's first carbon neutral plasterboard.
- Kemsley Mill (St. Regis) is powered by its own CHP plant, Grovehurst Energy, and has proposed an energy from waste plant
- Shepherd Neame Brewery was the first UK brewery to be awarded the Feed Materials Assurance Scheme (FEMAS), which guarantees the quality of its spent malt and yeast for agricultural feed. It has also previously won the Kent Environment Business of the Year Award
- Kent Science Park (KSP) is quickly becoming an international leader in renewable energy research. They are working with Aquafuel Research and Sittingbourne Analytical to research new alternative technologies, including energy from glycerine. KSP also works with numerous other environmental companies and have plans to partner with universities.
- The HMP Sheppey Cluster is researching converting its waste cooking oil into biofuel for use within the prison estate. Not only is this an efficient use of resources, but it also provides, employment, education, and training for inmates.

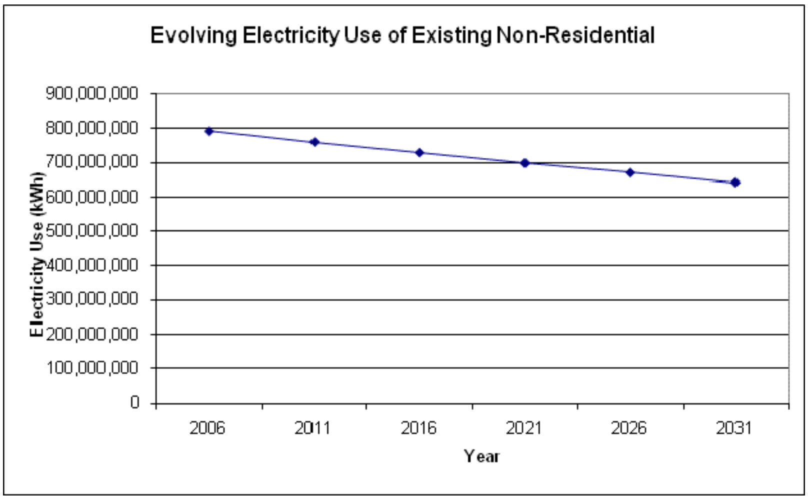


Figure 14: Predicted Change in Electricity Demand of Non-Residential Buildings

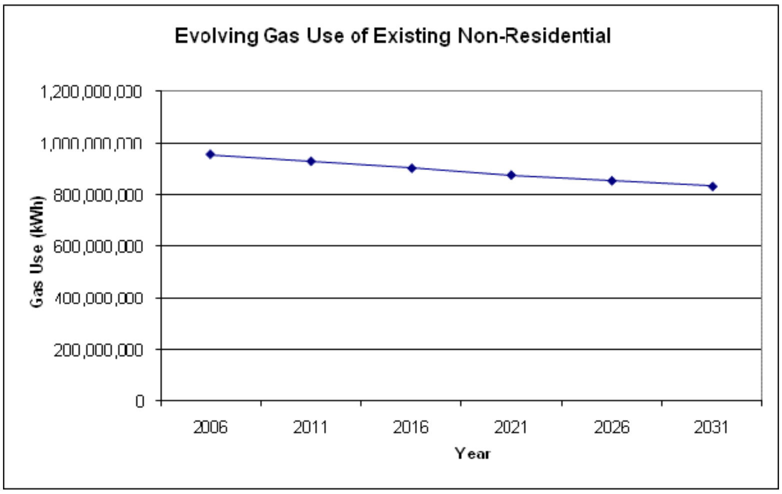


Figure 15: Predicted Change in Gas Demand of Non-Residential Buildings

3.5 ALL BUILDINGS SUMMARY

The graph below demonstrates the expected change in energy demand of existing buildings over the study period (2006-2031), due to nationally driven energy efficiency measures in both residential and non-residential buildings.

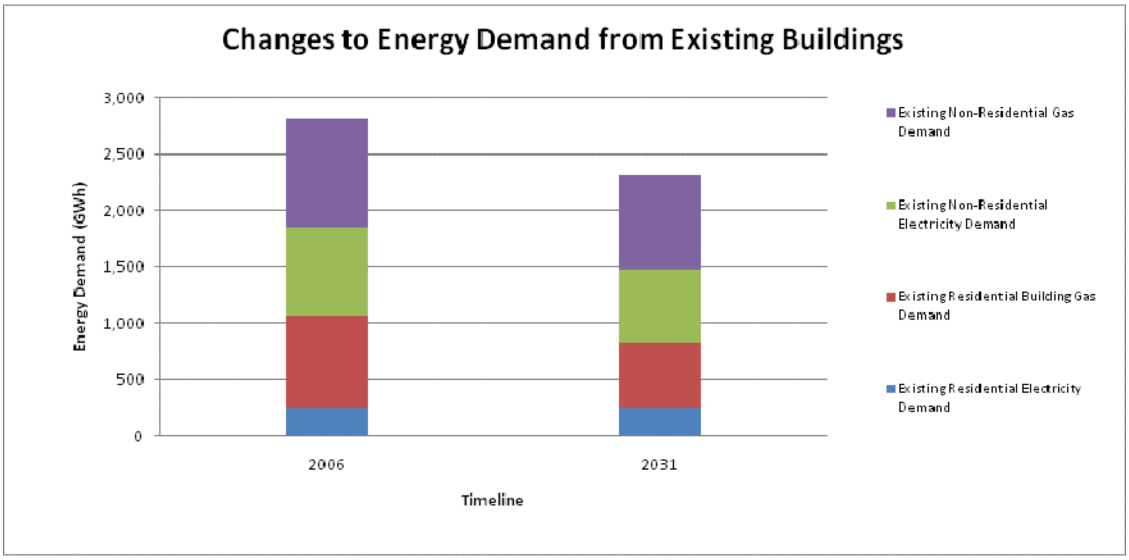


Figure 16: Expected change in electricity and gas demand over Core Strategy period under 'business as usual' energy efficiency measures

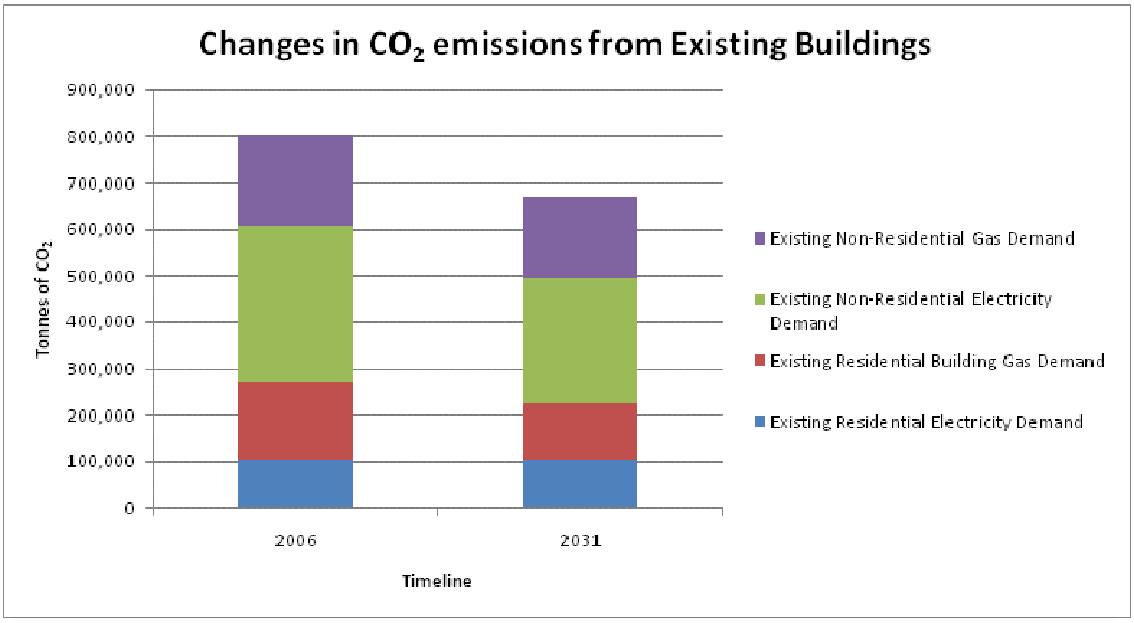


Figure 17: Expected change in CO_2 emissions over Core Strategy period under 'business as usual' energy efficiency measures

3.6 INCREASING IMPROVEMENTS OF EXISTING BUILDINGS

The estimations in the change in performance of existing buildings above show a 'business as usual' estimation, where energy efficiency measures continue to be encouraged on a national scale with existing measures and initiatives undertaken by the Council. This estimation reflects an expected uptake in energy efficiency measures based on which measures are most cost-effective and most easily retrofitted. An improved adoption rate of energy efficiency measures may be possible with targeted funding and initiatives.

The table below compares the expected CO_2 saving of a 'high rate' of energy efficiency improvement (as predicted in the study by BRE[9]), compared to the baseline situation outlined above. The CO_2 savings that can be achieved through improvement of existing buildings are substantial and should be a priority for change in Swale.

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

Demand (GWh)	2006	2011	2016	2021	2026	2031
Baseline Scenario						
Residential Electricity Demand	245	246	247	248	249	250
Residential Gas Demand	820	764	709	653	617	580
Non-Residential Electricity Demand	792	760	729	698	670	642
Non-Residential Gas Demand	955	929	903	877	856	834
High Reduction Scenario						
Residential Electricity Demand	245	243	241	239	237	236
Residential Gas Demand	820	748	675	602	556	550
Non-Residential Electricity Demand	792	721	649	583	535	488
Non-Residential Gas Demand	955	903	850	799	756	713
Potential CO_2 Saving through increased energy efficiency (tonnes)	0	26,774	53,548	78,454	94,611	102,351

[9] Delivering Cost Effective Carbon Saving Measures to Existing Homes. BRE for DEFRA. 2007.

3.7 FUTURE GROWTH IN SWALE

This section outlines expected growth in the Swale area. Understanding the scale of expected development is crucial to understanding the probable changes in the energy profile.

3.7.1 RESIDENTIAL GROWTH

While Regional policy has been recently revoked, the South East Plan still indicates the relative potential for carbon reduction in the area. The South East Regional Spatial Strategy (RSS) set a housing target for Swale Borough of 10,800 homes still to be delivered between 2006 and 2026[10]. The Council, in developing its Core Strategy, will set out options for where that growth could take place and how much growth each area could accommodate. A key document in this process is the Strategic Housing Land Availability Assessment (SHLAA), which is the main mechanism for identifying potential housing sites and assessing their deliverability. A SHLAA is currently being developed for Swale. This study is based on the sites that remained following an initial filtering exercise but does not take into account the findings of the detailed site assessments (these had not been undertaken at the time this study was prepared) identified early in the SHLAA, but was not able to utilise finalised SHLAA results. It should be noted that identified SHLAA sites do not guarantee development, but simply scopes options.

For the purpose of this study, it is assumed that the RSS targets are met, and hence the RSS housing delivery projections have been used to model housing growth in Swale. As of April 2009, the residual housing delivery target was 8,704 homes, equating to an average of 512 homes per year until 2026. This average rate has been used to predict future growth and energy demand. Sites undergoing assessment through the SHLAA have been used to spatially interrogate possible development locations in the maps in this study.

3.7.2 NON-RESIDENTIAL GROWTH

The amount of non-residential growth that will accompany housing growth is less certain, so broad assumptions have been made in this study. Swale Borough Council completed an Employment Land Review in April 2010, and the results have helped inform the Council of the future needs of the local economy and indicate growth for the future. At this stage, growth projections indicate that more than one million square metres of gross floor area (GFA) are to be delivered in Swale by 2031. This is a large expansion influenced by the recent average expansion in employment GFA of more than 27,000 m^2 per year for the last 10 years.

The Borough Council has yet to prepare its Infrastructure Position Paper and subsequent Delivery Plan. Hence, it has not been possible to establish whether or not additional schools, community or health care facilities will need to be provided in the Borough (beyond what has already got planning permission). For the purposes of this study, we have assumed the only non-residential growth will be of an employment nature.

[10] At the time of writing this report it is recognised that regional housing targets no longer exist. However, in the absence of any locally derived housing target and given that the housing target from the South East Plan is consistent with housing delivery rates in the District over recent years it seems prudent to use the 4,400 figure, between 2006 and 2026, for the purposes of this study.

3.8 EXPECTED ENERGY DEMAND FROM NEW DEVELOPMENT

New development will increase energy demands in Swale. Part L of the Building Regulations is expected to require that buildings meet increasing minimum energy efficiency standards. These standards have been applied to the quantum and assumed a housing mix set out in section 3.4 and modelled using AECOM residential profiles prepared for DCLG, and CIBSE industry benchmarks for non-residential development. In addition, increased energy performance in line with the proposed changes to Building Regulations Part L requirements which recently changed in October (2010), and will continue to progress in 2013 and 2016 have been taken into consideration, along with the expected changes to regulations affecting non-residential buildings leading up to zero carbon in 2019. The expected additional energy demand is set out in the tables below.

3.8.1 RESIDENTIAL DEVELOPMENT

The density of housing and the mix of house types expected in new development has a considerable effect on energy demand. Modelling within this study reflects two scenarios – where development follows a house type mix mirroring that of the existing house type mix (based on 2010 Swale Borough Council Housing Stock Report), or where density of new development is increased to over 50 dwellings/hectare. The table below show the existing house type mix, and the modelled higher density house type mix.

Table 14: Modelled House type Mix

Housetype	Detached	Semi-Detached	Terraced	Apartment
Existing Mix	22.90%	41.30%	31.50%	4.10%
Higher Density Mix	25.00%	21.00%	27.00%	27.00%

Table 15: Cumulative energy demand from new residential development (GWh)

	2011	2016	2021	2026	2031
Maintaining current mix of house types					
Electricity Demand	8.9	25.1	38.7	44.4	47.2
Gas Demand	15.4	39.1	52.3	57.7	60.5
Using the higher density mix of house types					
Electricity Demand	8.6	24.3	37.4	42.9	45.6
Gas Demand	14.9	38.2	51.1	56.4	59.1

The change in density across the Borough demonstrates how more efficient house types can automatically reduce energy demand and consequently reduce CO_2 emissions. Due to the energy efficient nature of Swale's current housing mix, the CO_2 savings do not look significant; however, 3 GWh saved does contribute to the Borough's energy efficiency goals. Therefore, land use planning and development density can affect CO_2 emissions, and hence even higher densities should be encouraged where suitable. Where lower density sites are being considered, the inherent increase in carbon emissions should be considered in options testing by the Council.

3.8.2 NON-RESIDENTIAL DEVELOPMENT

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

Table 16: Cumulative energy demand from new non-residential development (GWh)

	2011	2016	2021	2026	2031
Electricity Demand	12.2	20.9	39.8	53.3	60.3
Gas Demand	61.0	97.8	118.7	133.8	141.5

The scale of total energy demand from non-residential buildings is very high. This reflects the strong commercial growth focus of Swale's economy. The benefit, however, is that an energy profile with high demand presents more opportunities for 'anchor loads' – large, fixed energy users, which regulate supply through a district heating scheme. Coordinating and connecting these anchor loads to a heat network represent a real opportunity to substantially increase their collective energy efficiency.

3.9 TOTAL ENERGY DEMAND PROFILE

The following table summarises the combined energy demand profile of Swale Borough over the core strategy period.

Table 17: Expected Cumulative Energy Demand in Swale over time (GWh)

	2006	2011	2016	2021	2026	2031
Existing Residential Electricity Demand	245	246	247	248	249	250
Existing Residential Building Gas Demand	820	764	709	653	617	580
New Residential Electricity Demand	0.0	8.9	25.1	38.7	44.4	47.2
New Residential Building Gas Demand	0.0	15.4	39.1	52.3	57.7	60.5
Existing Non-Residential Electricity Demand	792	760	729	698	670	642
Existing Non-Residential Gas Demand	955	929	903	877	856	834
New Non-Residential Electricity Demand	0.0	12.2	20.9	39.8	53.3	60.3
New Non-Residential Gas Demand	0.0	61.0	97.8	118.7	133.8	141.5
Total Electricity Demand	**1,037**	**1,027**	**1,021**	**1,024**	**1,016**	**999**
Total Heat Demand	**1,775**	**1,770**	**1,748**	**1,701**	**1,664**	**1,617**

The following graph demonstrates the effect of new development on the expected energy profile. It demonstrates that while new development will make up a significant proportion of the energy demand profile, it is still far outweighed by energy demand from existing development.

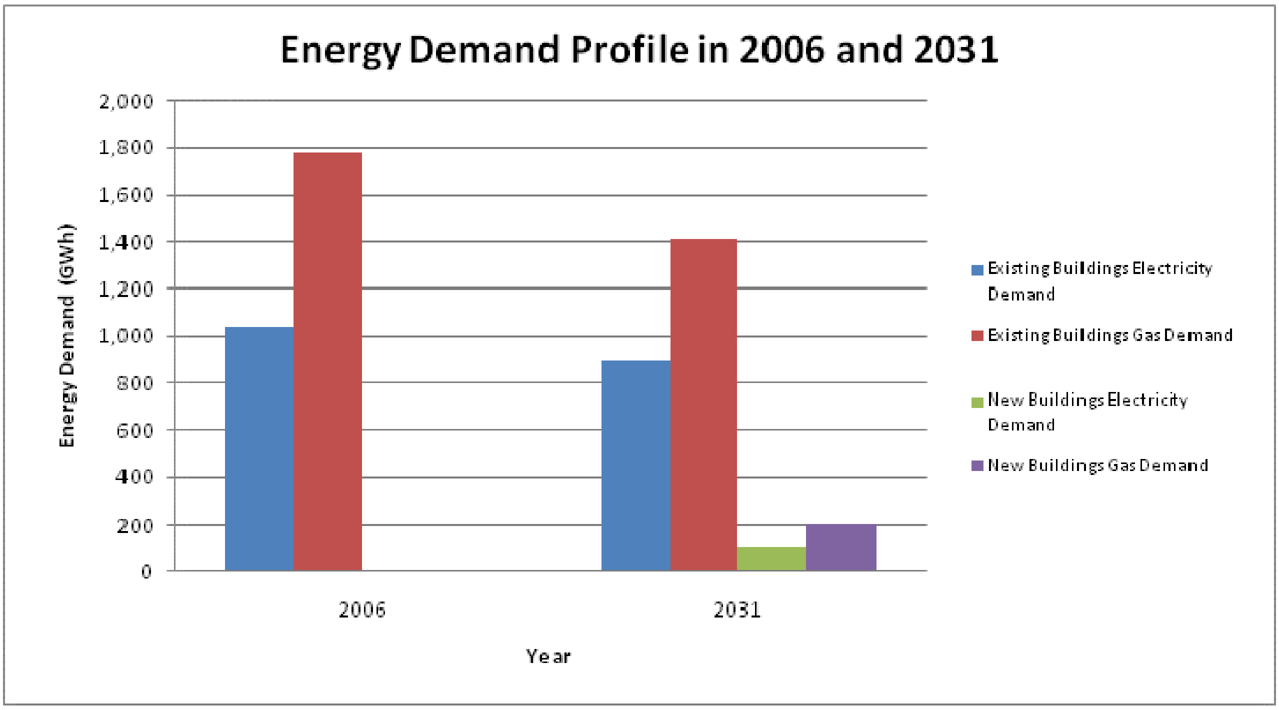


Figure 18: Comparison of energy demand from existing and new buildings

3.10 KEY CONSIDERATIONS EMERGING FROM THIS CHAPTER

The sections above have considered the energy profile of Swale Borough, both now and in the future. Key considerations emerging from this chapter are:

- It is important to realise the scale of energy demand in order to both set planning targets and measure planning targets for renewable energy delivery based on a percentage of demand. Current and future energy demands have been calculated in this chapter for use in policy and delivery;
- The spatial analysis shows areas where energy use per home is greater than average, focus should be given to these areas when applying improvements.
- The Council plays a key role in increasing energy efficiency of existing buildings. Existing buildings make up the bulk of the future energy demand, and hence efforts must be made to reduce energy demand of existing stock. A number of initiatives are also being coordinated by Kent County as a whole, and local initiatives should coordinate with those activities.
- Existing non-residential buildings often receive less focus than existing homes. In Swale's case, however, non-residential buildings are responsible for the majority of the Borough's energy demands. With this in mind, it is particularly important for the Council to support initiatives to increase energy efficiency in non-residential buildings in their area, particularly large energy users.

- Planning can affect CO_2 emissions by affecting the density of development and mix of house types. While Swale's current high density housing stock is a strength of the residential energy market, even higher densities should be encouraged where suitable.

- There is significant use of oil and coal fuels in rural areas that are not connected to the gas grid. Efforts should be made to switch these fuel users to lower carbon fuels, ideally biomass. Biomass crops, however, should not displace food crops.