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PLANNING FOR CLIMATE CHANGE

Climate Change Assessment of Development Options

Final Report

May 2008

ITP/1017

Rutland County Council

Melton Borough Council

North West Leicestershire District Council at the heart of the National Forest

Blaby District Council

District of Harborough

Hinckley & Bosworth Borough Council A Borough to be proud of

Hinckley & Bosworth Borough Council
Rutland County Council
Blaby District Council
Oadby and Wigston Borough Council
North West Leicestershire District Council
Harborough District Council
Melton Borough Council

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GLOSSARY

Selected terms used within this report are provided here:

BREEAM (BRE Environmental Assessment Method): BREEAM can be used to assess the environmental performance of buildings. Standard versions exist for common building types such as retail, offices and schools.

CHP Conventional electricity in the UK is generated in large centralised thermal generating power stations. The average efficiency of these power stations is around 37% with the rest of the energy being wasted as heat. Electricity is then transmitted across the country and is subject to around 3% transmission losses between the power station and the end user such as a household. Combined heat and power (CHP) offers an alternative and supplies both heat and power, achieving efficiencies of over 70%.

Natural gas fired CHP using either internal combustion (IC) engines or turbines, is a mature technology and is used all over the world. CHP options range from multi-mega watt plants for large scale generation to micro-CHP suitable for individual homes.

A **micro CHP** unit replaces a conventional domestic boiler and uses natural gas to power a small engine which produces electricity and heat. The overall efficiency of such a system can range between 79% and 95% representing a large increase in efficiency compared to conventional grid electricity and a conventional heat only boiler. This means savings can be made in carbon dioxide emissions and electricity costs to the householder.

PassivHaus The term 'PassivHaus' refers to a specific construction standard for residential buildings which have excellent comfort conditions in both winter and summer. For Europe (40° - 60° Northern latitudes), a dwelling is deemed to satisfy the PassivHaus criteria if the total energy demand for space heating and cooling is less than 15 kWh/m2/yr treated floor area and the total primary energy use for all appliances, domestic hot water and space heating and cooling is less than 120 kWh/m2/yr. For further information see http://www.passivhaus.org.uk

The Code for Sustainable Homes: The Code for Sustainable Homes is the new national standard for key elements of design and construction which affect the sustainability of a new home. Launched in December 2006, it is intended as a means of driving continuous improvement, greater innovation and excellent achievement in sustainable home building. Environmental performance is expressed on a scale of Level 1 to Level 6, where Level 1 is the entry level, already above the Building Regulations, and Level 6 is the highest level, corresponding to exemplar development in sustainability terms.

Zero carbon A zero carbon development is one that achieves zero net carbon emissions from energy use on site, on an annual basis. This means that emissions associated with energy use on the site are balanced by renewable energy generated on site.

1 INTRODUCTION

The Planning for Climate Change Project was initiated to provide evidence to underpin the preparation of future planning policy relating to climate change in the following local authority areas of Leicestershire and Rutland:

- Blaby District Council
- Harborough District Council
- Hinckley and Bosworth District Council
- Melton Borough Council
- North West District Council
- Oadby and Wigston Borough Council
- Rutland County Council

There are three key parts to the project:

1) Climate Change Assessment of Core Strategy Strategic Options
2) Renewable Energy Opportunities – Quantification of the potential for renewable energy in each of the seven local authority areas
3) Energy Efficiency Recommendations for New Developments - An assessment of the extent that it may be technically and economically possible to expect new buildings to reduce their carbon dioxide emissions beyond the requirements of the Building Regulations.

An executive summary summarising the project as a whole is available in a separate document.

This report contains the findings of the first part of the project – the Climate Change Assessment of Core Strategy Strategic Options.

An assessment has been made of the impacts of new developments options in the seven local authority areas in terms of:

- Energy use in buildings and associated emissions;
- Emissions associated with personal transport
- Water use;
- Effect on water run off;
- Potential for renewable energy generation and enhanced energy efficiency; and
- Waste generated and associated emissions.

This document initially describes the background behind climate change projections and the need to reduce our emissions of green houses gases. Section 4 refers to the development options for each local authority. Sections 5-9 then present the findings of the estimated impacts of the developments. Finally section 10 summarises the findings and makes recommendations to minimise the impact of the developments on climate change.

2 BACKGROUND

2.1 Climate Change

Climate refers to the average weather experienced over a long period. This includes temperature, wind and rainfall patterns. The climate of the Earth is not static, and has changed many times in response to a variety of natural causes.

The Earth has warmed by 0.74°C over the last hundred years. Around 0.4°C of this warming has occurred since the 1970s. (DEFRA)

The recent Fourth Assessment Report (AR4) of the Intergovernmental Panel on Climate Change (IPCC) leaves us in no doubt that human activity is the primary driver of the observed changes in climate. The main human influence on global climate is emissions of the key greenhouse gases - carbon dioxide (CO_2), methane and nitrous oxide. The accumulation of these gases in the atmosphere strengthens the greenhouse effect.

2.2 Climate Change in the UK

In general, the UK climate is expected to become hotter and drier in the summer and warmer and wetter in the winter. Key expected changes include:

- Average UK annual temperatures may rise by 2 to 3.5°C by the 2080s.
- Annual average precipitation across the UK may decrease slightly, by between 0 and 15% by the 2080s. However the seasonal distribution of precipitation will change significantly, with winters becoming wetter and summers drier.
- Increase in the prevalence of extreme weather events. High summer temperatures and dry conditions will become more common. Very cold winters will become increasingly rare and extreme winter precipitation will become more frequent. The summer heatwave experienced in 2003 is likely to become a normal event by the 2040s and considered cool by the 2060s.

2.3 Greenhouse gas emissions in the UK

Figure 1 below shows the total greenhouse gas emissions by end user. The figure shows how households contribute a significant part of the UK's total emissions.

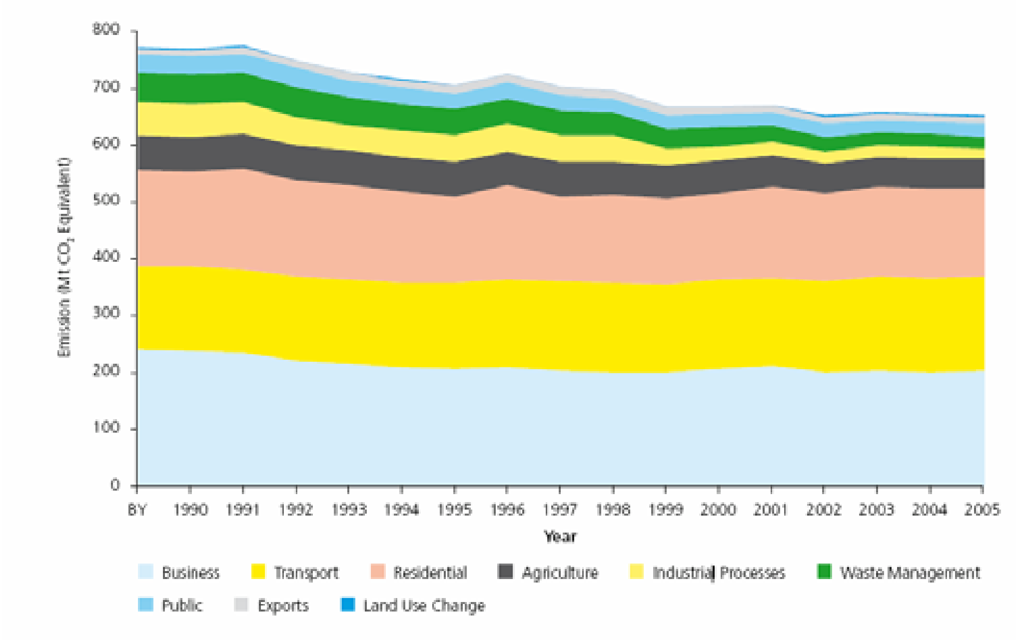

Figure 1: Greenhouse gas emissions by end user 1990-2005 (DEFRA)

Figure 2 shows a breakdown in total greenhouse emissions for UK households. Of key relevance to this study is the fact that just under half of total household emissions are influenced by the location of the home and its construction –factors which in turn can be influenced by local planning policies.

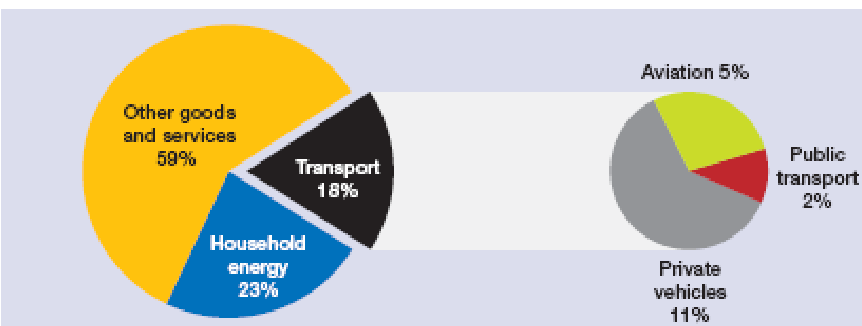

Figure 2: Total household GHG emissions (2001)[1]

Section 2.3.1 and 2.3.2 consider carbon dioxide and methane emissions in further detail.

2.3.1 Carbon dioxide

Carbon dioxide is the main man-made contributor to global warming. The UK contributes about 2 per cent to global man-made emissions, which, according to the IPCC, were estimated to be 38 billion tonnes carbon dioxide in 2004. Carbon dioxide accounted for about 85 per cent of the UK's man-made greenhouse gas emissions in 2006. In 2006, 15 per cent of carbon dioxide emissions were from residential fossil fuel use. Since 1990, emissions from road transport have increased by 10 per cent, while emissions from the energy supply industry have reduced by 9 per cent and business emissions have reduced by

[1] Data from Office National Statistics, graphic taken from Commission for Integrated Transport http://www.cfit.gov.uk/docs/2007/climatechange/02.htm

16 per cent. In 2006 the UK's total annual carbon dioxide emissions totalled 557 million tonnes. Figure 3 below shows the historical carbon dioxide emissions since 1990.

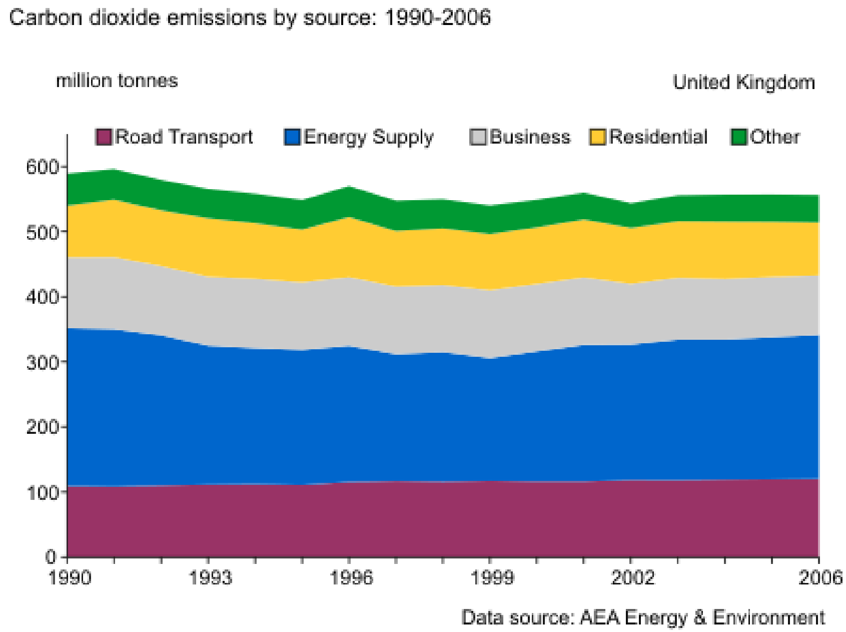

Figure 3: UK carbon dioxide emissions by end user 1990-2006[2]

2.3.2 Methane

Weighted by global warming potential, methane accounted for about 7.5 per cent of the UK's greenhouse gas emissions in 2006. In 2006, the main sources of methane were landfill sites (40 per cent of the total) and agriculture (38 per cent). Emissions from landfill have reduced by 61 per cent and emissions from agriculture by 13 per cent since 1990.

[2] DEFRA http://www.defra.gov.uk/environment/statistics/globatmos/gakf07.htm

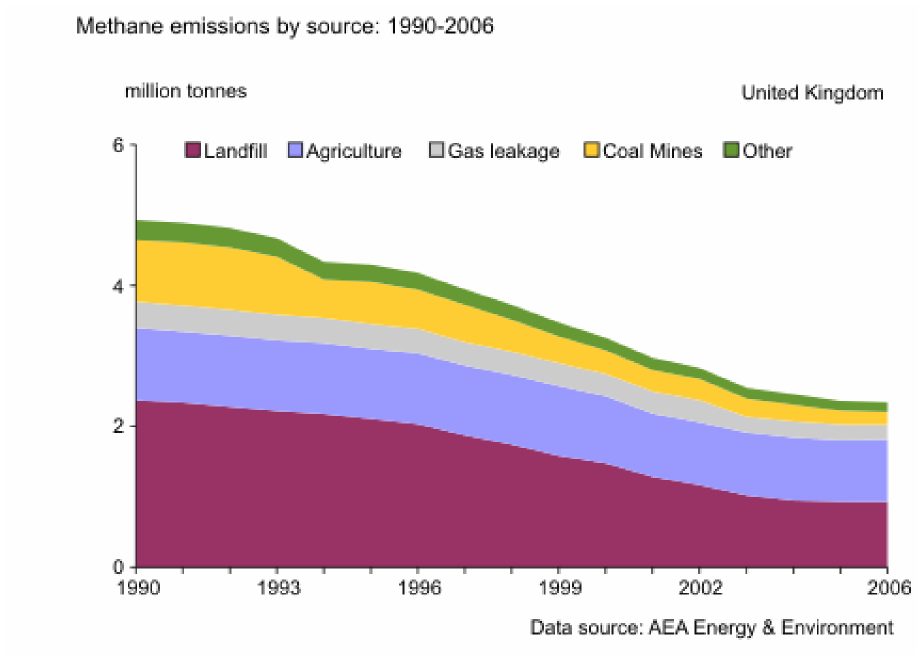

Figure 4: UK methane emissions by end user 1990-2006[3]

3 NATIONAL POLICIES

There are a number of national policies designed to implement reductions in greenhouse gases and to mitigate against the impacts of climate change. The **2006 UK Climate Change Programme** is the UK's strategy for its work on tackling climate change. It sets out the policies and measures which the UK is using to cut its emissions of greenhouse gases. The strategy also explains how the UK plans to adapt to the impacts of climate change. The elements of the programme within the three sectors of transport, domestic and local government include (amongst others) the following:

- introduce the Renewable Transport Fuel Obligation from 2008 to increase the uptake of biofuels;
- continue to use Vehicle Excise Duty and Company Car Tax to give incentives to purchase less polluting vehicles;
- work strongly to achieve further commitments from vehicle manufacturers to improve fuel efficiency; and
- update the Building Regulations in April 2006 to raise energy standards of new build and refurbished buildings;
- introduce the Code for Sustainable Homes which will have minimum standards for energy and water efficiency at every level of the Code, with the lowest levels raised above the level of mandatory Building Regulations;
- seek to achieve substantially higher carbon savings from the Energy Efficiency Commitment in 2008-11 and maintain the Energy Efficiency Commitment, Warm Front and Decent Homes schemes to deliver energy efficiency measures in low income households to help meet our fuel poverty targets; and continue to support the activities of the Energy Saving Trust

[3] DEFRA http://www.defra.gov.uk/environment/statistics/globatmos/gakf07.htm

- achieve 250,000 additional subsidised installations of home insulation over the next two years over and above existing commitments;
- launch a new initiative designed to strengthen consumer demand for energy efficiency, working closely with energy suppliers and through local authorities,
- provide more reliable consumer product information and set effective standards for energy-using products via voluntary agreements
- consider how to enable consumption feedback to households via improved billing and metering, including help to co-finance a pilot study in the use of "smart" meters;
- introduce a package of measures to drive additional action for local authorities to include an appropriate focus on action on climate change;

The proposed **Climate Change Bill** provides a long-term framework for the UK to achieve its goals of reducing carbon dioxide emissions, and will ensure that steps are taken towards adapting to the impacts of climate change. The Climate Change Bill was introduced in Parliament in late 2007 and completed its passage through the House of Lords at the end of March 2008. It will shortly go to the House of Commons for consideration. The aim is to receive Royal Assent by summer 2008. Key provisions of the bill include:

- This Bill puts into statute the UK's targets to reduce carbon dioxide emissions through domestic and international action by at least 60 per cent by 2050 and 26-32 per cent by 2020, against a 1990 baseline. (targets will be reviewed, based on a report from the new independent Committee on Climate Change on whether it should be even stronger still).
- Five-year carbon budgets, which will set binding limits on carbon dioxide emissions. Three successive carbon budgets (representing 15 years) will always be in law – providing the best balance between predictability and flexibility.

Current UK Energy Policy, as set out in the **2003 Energy White Paper** seeks to move towards more sustainable energy systems. It has four main objectives:

- To cut carbon dioxide (CO_2) emissions by 60% by 2050, with real progress by 2020;
- To maintain secure and reliable energy supplies;
- To promote competitive energy markets in and beyond the UK to assist the rate of sustainable economic growth and improve productivity;
- To ensure that every home in the UK is adequately and affordably heated.

The Energy White Paper places energy efficiency at the heart of the government's energy policy. It also sets targets to ensure that 10% of the UK's electricity supply comes from renewable sources by 2010; 15% by 2015 and an aspiration of 20% by 2020; along with a target to double Combined Heat and Power (CHP) capacity in the country by 2010.

The European Energy Performance of Building Directive (EPBD) has been implemented in the UK in the recent revisions to **Part L of the Building Regulations**. The key provisions of the directive include minimum requirements for the energy performance of all new buildings and energy certification of all buildings. From summer 2007 all new homes (and existing larger homes, when they are sold or leased) will have an Energy Performance Certificate providing key information about the energy efficiency/carbon performance of the home.

The Code for Sustainable Homes is the new national standard for key elements of design and construction which affect the sustainability of a new home. Launched in December 2006, it is intended as a means of driving continuous improvement, greater innovation and excellent achievement in sustainable home building. Environmental performance is expressed on a scale of Level 1 to Level 6, where Level 1 is the entry level, already above the Building Regulations, and Level 6 is the highest level, corresponding to exemplar development in sustainability terms.

Meeting the levels of the Code for Sustainable Homes is currently voluntary, but Level 3 may become mandatory in the near future, with increasingly tougher standards being phased in, culminating in Level 6 being compulsory by 2016. The Housing Corporation already requires a minimum of Level 3.

The **BREEAM** family of assessment methods and tools are all designed to help construction professionals understand and mitigate the environmental impacts of the developments they design and build. The scheme rates different buildings according to the environmental performance. The different schemes include retail, offices, schools and prisons.

The recently published **Planning Policy Statement on Climate Change** confirms that there will be situations where it could be appropriate for local planning authorities to expect higher levels of building sustainability than the standards set nationally through Building Regulations. Local requirements should be brought forward through development plan documents and focus on known opportunities. Local planning authorities are expected to demonstrate clearly the local circumstances that warrant and allow such local requirements.

4 DEVELOPMENT OPTIONS

The development options for each local authority are summarised within Annex 1. These are presented in terms of both numbers of homes and non-domestic developments to be built within key timeframes and in terms of location.

The timing of developments influences which Building Regulations will apply as a tiered approach towards energy and water consumption is applied with more stringent regulations coming into affect gradually.

The location of new developments affects the distances which people will travel to access different services and therefore the greenhouse gas emissions associated with travel.

The following aspects are considered in sections 5 to 9 of the report:

- Energy use in buildings;
- Potential for renewable energy generation;
- Transport and associated emissions;
- Water use;
- Surface water run off;
- Waste generated and associated emissions.

Each section introduces the issue and describes the method used for this assessment. The results are then presented for each local authority.

Results are given in terms of emissions and water usage per household per year and also over a design life of 60 years. IT Power contacted both the Home Builders Federation and the National House-Building Council to find out expected lifetimes of new homes being built. Whilst there is no information about expected actual lifetimes, the NHBC requires a design life of 60 years or more. The HBF stated that its members design and build to a minimum of 60 years. Therefore total emissions are shown for 60 years from completion.

5 ENERGY USE IN BUILDINGS

5.1 Introduction

Energy use in buildings accounts for 40% of the UK's total greenhouse gas emissions[4].

The potential for energy efficiency improvements are explored within Part 3 of the Planning for Climate Change Project and presented in the report 'Energy Efficiency Recommendations for New Developments'.

Energy use within the home accounts for 23% of total household greenhouse gas emissions (see Figure 2). The energy use by a household depends on the size of home, its construction, the efficiency of appliances installed and the behaviour of the users.

The table below shows typical energy consumption figures for different types of dwellings, built to the current Building Regulations (approved document Part LA1 2006) and also to higher standards of energy efficiency.

Table 1: Typical primary energy use in new homes (Source: CE190 Meeting the 10 per cent target for renewable energy in housing – a guide for developers and planners, Energy Savings Trust, 2006)

Type of home	**Top floor flat (61m²)**		**Mid terraced house (79m²)**		**Semi-detached house (89m²)**	
Energy efficiency standard	Heating (space and water), kWh	Other energy, kWh	Heating (space and water), kWh	Other energy, kWh	Heating (space and water), kWh	Other energy, kWh
Part LA1 2006 compliant	5083	3374	5460	3983	6835	4371
Best practice	4575	3154	4914	3711	6152	4065
Advanced Design	<3558	2714	3822	3167	4785	3454
PassivHaus	<915	2714	<1185	3167	<1335	3454

Energy use in non-dwelling is much more difficult to estimate and there is a lack of recent benchmarks available. Table 2 uses information from a recent report for the Royal Institution of Civil Engineers by Cyril Sweett[5] and shows typical energy use in three types of buildings. This information was used to estimate emissions from new employment developments.

[4] DUKES 2003

[5] Transforming Existing Buildings: The Green Challenge Final Report March 2007

Table 2: Typical energy use in non-domestic buildings

Building type	Typical energy (annual kWh/m2 floor area)		CO_2 emissions (kg per year/m2 floor)
Retail[6]	200		88.4
Office[7]	Electricity	55	38.86
	Gas	75	
Industrial	250		110.5

5.2 Methodology

In order to estimate the carbon dioxide emissions resulting from the new housing and other buildings proposed by the development options of each local authority three scenarios were used.

Scenario 1 assumes all new buildings are built to the minimum Building Regulations requirements (and social homes are built to the current requirements of the Housing Corporation i.e. Code for Sustainable Homes Level 3) and that non-domestic dwellings meet the benchmarks given in Table 2. (where a development option does not specify the type of employment development an average figure is used). The expected changes in the Building Regulations in 2010, 2013 and 2016 are discussed in the accompanying report Energy Efficiency Recommendations for New Developments' completed as part of the same project. These expected changes also form part of Scenario 1.

Scenario 2 assumes slightly improved energy efficiency levels for dwellings (10% improvement compared to baseline for private homes in 2008-2009, increased energy efficiency for social housing in 2010 and improved energy efficiency in both types of homes in 2013). For non-dwellings Scenario 2 assumes a 25% improvement over the benchmarks.

Scenario 3 represents an acceleration in energy efficiency improvements for dwellings of 25-50% better than Building Regulations until 2016. For non domestic buildings scenario 3 assumes a 50% improvement over the benchmarks.

All scenarios assume the following:

Average dwelling size 85m^2

Target Emission Rate 24kgCO_2/m^2/year

The scenarios are summarised in Table 3 and Table 4

Table 3: Energy use scenarios -overview

	Scenario 1	Scenario 2	Scenario 3
Housing	Baseline scenario based on project Building Regulations	Slightly improved energy efficiency levels over baseline.	Accelerated energy efficiency improvements of 25-50% better than Building Regulations until 2016
Non-housing	Benchmark figures (see Table 2)	25% improvement	50% improvement

Table 4: Energy use scenarios

[6] BRE (1999) Sustainable Retail Premises

[7] Carbon Trust (2000) Energy Use in Offices

Build date	Type of building	*Scenario 1*	*Scenario 2*	*Scenario 3*
2008-2009	Private housing	Baseline –Part LA1 2006)	10% improvement	25% improvement
	Social housing	25% improvement – Housing Corporation requirement	25% improvement	25% improvement
2010-2012	Private housing	25% improvement	25% improvement	44% improvement
	Social housing	25% improvement	44% improvement	44% improvement
2013-2015	Private housing	44% improvement	100% improvement	100% improvement
	Social housing	44% improvement	100% improvement	100% improvement
2016-2026	Private housing	Zero Carbon	Zero Carbon	Zero Carbon
	Social housing	Zero Carbon	Zero Carbon	Zero Carbon
2008-2026	Non-domestic	Benchmark figures (see Table 2)	25% improvement	50 % improvement

The emissions resulting on the numbers of dwellings and floor area of employment developments were estimated using the above scenarios using the trajectories of expected build rates provided. The results are presented in the following section.

5.3 Results

The results of the assessment in terms of average emissions per household and per non-domestic floor area are shown in the tables below.

Table 5: Average emissions from domestic energy use (tonnes CO2 per year per household)

	CO_2 emissions (kg per year / household)		
Construction timeframe	**Scenario 1**	**Scenario 2**	**Scenario 3**
[2008-2009]	2.89	2.79	2.64
[2010-2012]	2.64	2.44	2.25
[2013-2015]	2.25	1.11	1.11
[2016-2026]	0.00	0.00	0.00

Table 6: Average emissions from non-domestic energy use (tonnes CO2 per year per m²)

Type of development		CO_2 emissions (kg per year / m^2)		
		Scenario 1	Scenario 2	Scenario 3
Retail		88.4	66.30	44.20
Office	Electricity	24.31	18.23	12.16
	Gas	14.55	10.91	7.28
Industrial		110.5	82.88	55.25
Not specified (Average)		85	64.09	42.76

Total emissions as a result of the foreseen housing development in each local authority area are shown in Table 7. Although the same assumptions in terms of energy efficiency standards have been used for each local authority, the difference in average emissions between local authorities arises from the different build trajectories of the different local authorities (i.e. the number of homes which will be built each year). As the building regulations relating to energy efficiency will improve with time (moving to zero carbon by 2016), those authorities which plan for the majority of developments to take place after 2013 or 2016 have lower emissions. Further details about the expected evolution of the building regulations is contained within the third report produced as part of this project 'Energy Efficiency Recommendations for New Developments'.

Annex 1 contains a summary of the development options including build trajectories for each local authority.

Table 7: Total CO2 emissions from household energy use over 60 years (from completion), tonnes CO_2

	Household CO_2 emissions from energy over 60 years, tonnes CO2		
Local authority	Scenario 1	Scenario 2	Scenario 3
Hinckley & Bosworth	1 050 783	733 493	729 005
Rutland	214 722	165 439	156 323
Blaby	595 903	444 432	426 219
Oadby and Wigston	90 729	68 898	64 202
North West Leicestershire	1 229 671	860 156	715 873
Harborough	496 848	356 714	351 583
Melton	422 054	338 343	251 798

Table 8: Total CO2 emissions from non-domestic energy use over 60 years (from completion), tonnes CO_2

	Non-domestic CO_2 emissions from energy over 60 years, tonnes CO2		
Local authority	**Scenario 1**	**Scenario 2**	**Scenario 3**
Hinckley & Bosworth	414 303	310 727	207 151
Rutland	71 781	53 836	35 890
Blaby	358 904	269 178	179 452
Oadby and Wigston	*	*	*
North West Leicestershire	1 488 267	1 116 200	744 134
Harborough	*	*	*
Melton	421 116	315 837	210 558

* No non-domestic development specified in development options

5.4 Potential for renewable energy

On site renewable energy generation will be necessary in order to meet the zero carbon homes requirement in 2016 and beyond. Renewable energy is also required where a 44% or higher improvement over the 2006 Building Regulations.

The suitability of some renewable energy technologies are more site or location dependent than others. The greatest potential for renewable energy within the new development options will be in the use of building integrated technologies. Currently available options and their key characteristics are summarised in Table 9 below. In order to achieve zero carbon buildings (which for homes is expected to be required by 2016) the building must meet 100% of its demand from on-site renewables. Table 9 below includes typical capital costs per home. These will decrease over time to some degree as they become much more common.

Maximum potential for on-site renewables is achieved by considering site specific opportunities in a strategic way at an early stage.

Opportunities for renewable energy in each of the local authority areas are explored within Part 2 of the Planning for Climate Change Project. The results of the Renewable Energy Opportunities Assessment are contained within a separate report. The results of the assessment in relation to the locations of the proposed development options are summarised below in Table 10 to Table 16.

Table 9: Summary of renewable energy and low carbon technologies considered

Technology	Technical suitability and key issues:	Energy and CO_2 savings	Capital costs per home & lifetime	Operational costs /savings
Micro-CHP[8] Unit replaces conventional boiler and produces heat and power	Suitable mainly for larger homes and multi-occupancy buildings Requires more space than a conventional boiler and must be installed away from main living area due to noise Other issues: New technology, limited range of products available, Annual cost savings depend on how much electricity is directly used within the house, how much is exported and the payment received for export	Savings uncertain	£2000 Lifetime: 15 years[i]	Overall cost savings uncertain.
Small-CHP for community heating	Proven technology in widespread use in the UK and Europe. Requires space for the energy centre on site. Ideally other users such as community centre, shops etc. would also be included on the heat main. Would normally be owned and operated by an energy services company.	Savings variable depending on system selected. CO_2 maybe savings around 800 kg/yr/dwelling	Variable approx. £4000	Overall cost savings variable.
Solar water heating Collectors mounted on the roof heat water use thermal energy from the sun to provide hot water.	Requires south (or south east or south west) facing roof, 3-4m^2 of roof space, space for a large hot water tank, conventional boiler to provide remainder of heat requirement Proven technology in widespread use in the UK and Europe Users need to be given guidance on its operation and how to obtain maximum benefit	Typical system 1200 kWh /yr CO_2 savings: 230 kg/year	Typical system cost £3 000 (up to 40% grant funding available). Lifetime: 20 years	Minimal maintenance costs. Annual savings on gas bill of £50 per year.
Micro-wind (<1.5 kW) on individual houses	Not recommended for individual houses due to current lack of performance data and unproven reliability of available products.	Savings uncertain due insufficient long term field data.	£2 000 - £10 000	Savings uncertain
Small roof top wind energy Produces electricity from the wind	Requires: a windy, unsheltered location and special attention to structural design. Other issues: New technology, performance data available from manufacturers is still limited, annual cost savings will depend on how much electricity is directly used within the house, how much is exported and the payment received for export	A 2.5 kW turbine might produce around 1000-5000kWh CO_2 savings: 1420-2840 kg/year	£15 000 -18 000 depending on model chosen and structural integration. Lifetime: 20 years	Maintenance costs variable. Annual savings on electricity: £350-£700 (including revenue from ROC)[9].

[8] Combined heat and power –see Glossary

[9] Electricity generated from renewable sources can be used to obtain Renewables Obligation Certificates (ROCs) which all the supply companies need in order to prove they are meeting the government's targets for renewable

Technology	Technical suitability and key issues:	Energy and CO_2 savings	Capital costs per home & lifetime	Operational costs /savings
Solar Photovoltaics Roof mounted panels convert light energy into electricity.	Requires south (or south east or south west) facing roof South facing non shaded roof, around 8m^2 of roof space (for a 1kWp system). Proven technology in widespread use in the UK and Europe. Cost savings to household will depend on how much electricity is directly used within the house, how much is exported and the payment received for export	Typical 1 kWp[10] system produces 800 kWh/yr CO_2 savings: 454 kg/yr	Typical system cost £3 000 - 6 000. (up to 40% grant funding available). Lifetime: 20 years plus	Very minimal maintenance costs. Annual savings on electricity bill of £110 per year (including revenue from ROC)[9].
Ground Source Heat Pumps A ground source heat pump transfers heat from the ground to the home and uses it for space heating and pre heating of hot water.	Proven technology in widespread use in the Europe, less widely used in the UK A low temperature heat distribution system such as under floor heating is required. Efficiencies of typical systems are in the range of 300-400 % which means for every unit of electricity used between 3 and 4 units of useful heat are provided.	CO_2 savings, assuming grid electricity is used to power the heat pump: 200-550 kg /yr	Approx. £7 500 per home	Electricity costs around £100-160 per year. Maintenance costs virtually zero.
Biomass community heating A central energy centre contains wood chip fuelled boiler. A heat main delivers heat to individual houses.	Potential wood fuel resource is sufficient, established fuel supply. Proven technology in widespread use in the UK and Europe Requires space for the energy centre on site. Ideally other users such as community centre, shops etc. would also be included on the heat main. Would normally be owned and operated by an energy services company.	Can provide 100% of heating and hot water demand. CO_2 savings depend on heat demand: 570-1500 kg/yr	Approx. £6 000 per home	Similar overall costs to gas heating.

The tables below summarise the results of the renewable energy opportunities assessments relevant to the development locations identified by each local authority. The tables present a brief overview on wind, hydro and woodland.

energy. ROCs have a market value in the range 3p – 4p per kWh which will vary over time depending on how well these companies are doing in meeting their targets..

[10] kWp refers to the rated output of a PV system at Standard Test Conditions (STC) of 1000 Wm^2 solar radiation, 25°C, Air Mass 1.5

The potential sites for large wind (i.e. over 2MW) have been identified within the opportunities assessment (see separate report) therefore the table below considers the wind resource for smaller wind which might be associated with a housing or employment development. The table indicates the results given for each location by the Noabl wind speed database.[11] It is important to remember that the suitability of a site for wind energy relies on a suitably large open space away from obstructions since the power in the wind is proportional to the cube of the wind speed. Noise considerations and grid connection issues are also important. Areas expected to have good potential for small to medium wind are highlighted in green. The assessment is based on the results of the Noabl wind speed and how open the location is to the prevailing wind.

Hydro potential is highly site specific therefore the table indicates whether any of the 7 potential hydro sites co-incide with the development areas. Locations which co-incide with potential hydro sites are highlighted in blue.

The total biomass resource for heating in buildings includes woodland and 'woody' energy crops such as short rotation coppice. Ideally the fuel is transported only a short distance to where it is used. The locations of significant woodland areas relative to the proposed development location are therefore important and are also indicated in Table 11 and highlighted in yellow.

[11] The National Oceanic and Atmospheric Administration (NOAA) Boundary Layer) wind speed database was developed by ETSU for the DTI (Department of Trade and Industry) in 1997. This provides an estimated wind speed for a 1km square at 10 m, 25 m and 45 m above ground level. The model was applied with 1km square resolution and takes no account of topography on a small scale or local surface roughness (such as tall crops, stone walls, or trees), both of which may have a considerable effect on the wind speed. The data can only be used as a guide and should normally be followed by on-site measurements for a proper assessment. This can be difficult in the case of small and micro wind when costs of on-site measurements are significant compared to total installation costs.

Table 10: Potential for renewable energy (selected technologies) by location (Hinckley and Bosworth)

Hinckley & Bosworth	Wind resource (refer also the wind speed maps provided within section x of the Renewable Energy Opportunities assessment report)	Hydro sites	Proximity to woodland
Hinckley	Noabl wind speed database shows a good wind resource (6.1-7 m/s) for all locations considered. Urban areas will offer considerably less opportunity for small and medium sized wind turbines than sites in more rural and open locations. None of the three potential sites found for large wind in Hinckley and Bosworth coincide with locations for development.	No potential hydro sites found.	Little woodland found near to Hinckley. Hinckley is around 20 km from the National Forest.
Burbage		No potential hydro sites found.	Little woodland found near to Burbage
Barwell		No potential hydro sites found.	Little woodland found near to Barwell
Earl Shilton		No potential hydro sites found.	Little woodland found near to Earl Shilton
Desford		No potential hydro sites found.	Significant woodland area within 4 to 8km of Desford
Groby		No potential hydro sites found.	Significant woodland close to Groby (which is on the edge of the National Forest)
Ratby		No potential hydro sites found.	Significant woodland close to Ratby (which is on the edge of the National Forest)
Bagworth		No potential hydro sites found.	Significant woodland close to Bagworth
Barlestone		No potential hydro sites found.	Significant woodland area within 4 to 8km of Barlestone although delivery of fuel to Barlestone could be more of an issue than other locations.

Hinckley & Bosworth	**Wind resource** (refer also the wind speed maps provided within section x of the Renewable Energy Opportunities assessment report)	**Hydro sites**	**Proximity to woodland**
Markfield and Fieldhead		No potential hydro sites found.	Significant woodland close to Markfield (which is within the National Forest)
Thornton		No potential hydro sites found.	Significant woodland close to Thorton (which is within the National Forest) –access via minor roads only
Market Bosworth		No potential hydro sites found.	Very small wooded areas around Market Bosworth. The town in around 15km from the National Forest (via minor roads)
Newbold Verdon		No potential hydro sites found.	Significant woodland area within 4 to 8km of Newbold Verdon
Stoke Golding		No potential hydro sites found.	Little woodland found near to Stoke Golding

Table 11: Potential for renewable energy (selected technologies) by location (Rutland)

Rutland Location	**Wind resource** (refer also the wind speed maps provided within section x of the Renewable Energy Opportunities assessment report)	**Hydro sites**	**Proximity to woodland**
Oakham	The Noabl wind speed database shows a moderate wind resource (5-6 m/s) in and around Oaksham however Cottsmore RAF station may restrict the implementation of larger wind turbines.	No potential hydro sites found.	The majority of the woodland areas in Rutland lie to the north east of Oakham. There is a woodland area of approx. 100 ha within 3km of Oakham
Uppingham	The Noabl wind speed database shows a good wind resource (6-7 m/s) in and around Uppingham and very good for the area to the South West of Uppingham	No potential hydro sites found.	There are two medium sized areas of woodland to the west of Uppingham. Uppingham is further from the majority of the woodland areas than Oakham.
Villages	Cottesmore RAF station in the north of Rutland is a restricting factor for sites in the surrounding are.	Possible hydro sites were found in Duddington (20 kW – est.) and Empingham (30 kW –est.)	Majority of the woodland is in the north east of the county

Table 12: Potential for renewable energy (selected technologies) by location (Blaby)

Blaby Location	**Wind resource** (refer also the wind speed maps provided within section x of the Renewable Energy Opportunities assessment report)	**Hydro sites**	**Proximity to woodland**
Site 1 (Leicester Forest East)	The Noabl wind speed database shows a good wind resource (6-7 m/s) also since the area to the south west (likely to the direction of the prevailing wind) is not built up this site may be suitable for small to medium wind.	No potential hydro sites found.	There is little woodland in Blaby however the sites to the north of the district are close to the National Forest
Site 2 Kirby Muxloe	The Noabl wind speed database shows a good wind resource (6-7 m/s) however the surrounding area is relatively built up.		
Site 3 (Earl Shilton)	The Noabl wind speed database shows a good wind resource (6-7 m/s).		
Site 4 (Stoney Stanton)	The Noabl wind speed database shows a good wind resource (6-7 m/s).		
Site 5 (Littlethorpe)	The Noabl wind speed database shows a moderate wind resource (5-6 m/s).		
Site 6 (Blaby)	The Noabl wind speed database shows a moderate wind resource (5-6 m/s) but the area is built up to south west.		
Site 7 (Blaby)	The Noabl wind speed database shows a good wind resource (6-7 m/s).		
Site 8 (Whetstone)	The Noabl wind speed database shows a moderate wind resource (5-6 m/s).		

Blaby **Location**	**Wind resource** (refer also the wind speed maps provided within section x of the Renewable Energy Opportunities assessment report)	**Hydro sites**	**Proximity to woodland**
Site 9 (Countesthorpe)	The Noabl wind speed database shows a moderate wind resource (5-6 m/s) but the surrounding area is built up.		
Employment site near to Junction 21 of M1	The Noabl wind speed database shows a good wind resource (6-7 m/s).		The two employment sites are relatively close to the National Forest and have good access.
Employment site near Junction 21a of M1	The Noabl wind speed database shows a good wind resource (6-7 m/s).		

Table 13: Potential for renewable energy (selected technologies) by location (Oadby and Wigston)

Oadby and Wigston	**Wind resource** (refer also the wind speed maps provided within section x of the Renewable Energy Opportunities assessment report)	**Hydro sites**	**Proximity to woodland**
Adjacent to urban area south of South Wigston	Whilst the Noabl wind speed database indicates wind speeds of between 6 and 7 m/s for the majority of the borough, the potential for wind is limited by the built up nature the area. For all four areas of search considered opportunities for small to medium wind may exist on the edge of developments.	No potential hydro sites were found in Oadby and Wigston.	Insufficient woodland has been identified in Oadby and Wigston
Adjacent to urban area south of South east of Wigston			
Adjacent to urban area south of South of Oadby			
Adjacent to urban area south of South east of Oadby			

Table 14: Potential for renewable energy (selected technologies) by location (North West Leicestershire)

North West Leicestershire	**Wind resource** (refer also the wind speed maps provided within Annex 2 of the Renewable Energy Opportunities assessment report)	**Hydro sites**	**Proximity to woodland**
Ashby de la Zouch	The area surrounding Ashby de la Zouch has a good wind resource (over 6 m/s for all areas and over 7 m/s to the north and to the east of the town).	No potential hydro sites found.	Ashby de la Zouch is located in the middle of the National Forest. It is surrounded by several small areas of woodland.
Castle Donington	The Noabl wind speed database indicates wind speeds of between 5 and 7 m/s for Castle Donnington however its close proximity to East Midlands airport may make it unsuitable for anything larger than a micro turbine.	No potential hydro sites were found in Castle Donnington. Near by site Sawley Cut was found to have medium/low potential (625 kW est.)	There is little woodland immediately around Castle Donnington. The town is approximately 7.5 km from the National Forest
Coalville	The area surrounding Coalville has a good wind resource (over 6 m/s for all areas and over 7 m/s to the north and to the east of the town).	No potential hydro sites found.	Coalville is located in the middle of the National Forest. It is surrounded by several small areas of woodland.
Ibstock	The Noabl wind speed database indicates wind speeds of between 6 and 7 m/s for Ibstock.	No potential hydro sites found.	Ibstock is located within the National Forest. There are two large areas of woodland close to Ibstock, one to the North West and one to the South East.
Kegworth	The Noabl wind speed database indicates wind speeds of between 5 and 7 m/s for Kegworth however its close proximity to East Midlands airport may make it unsuitable for anything larger than a micro turbine.	Kegworth Weir (300 kW est.)– was found to have high potential for development. A second site was found in nearby Ratcliffe on Soar (150 kW est.)	There is little woodland immediately around Kegworth. Kegworth is approximately 9 km from the National Forest

North West Leicestershire	**Wind resource** (refer also the wind speed maps provided within Annex 2 of the Renewable Energy Opportunities assessment report)	**Hydro sites**	**Proximity to woodland**
Measham	The Noabl wind speed database indicates wind speeds of between 6 and 7 m/s for Measham	No potential hydro sites found.	Measham is located within the National Forest

Table 15: Potential for renewable energy (selected technologies) by location (Harborough)

Harborough	**Wind resource** (refer also the wind speed maps provided within Annex 2 of the Renewable Energy Opportunities assessment report)	**Hydro sites**	**Proximity to woodland**
Market Harborough	The Noabl wind speed database shows a moderate to good wind resource (5-7 m/s). Proposed areas to the south east of the town may be suitable.	No potential hydro sites found.	Little woodland found near to Market Harborough.
Lutterworth	The Noabl wind speed database shows a moderate to good wind resource (6-7 m/s).	No potential hydro sites found.	Little woodland found near to Lutterworth.
Lutterworth and rural centres (Broughton Astley, Kibworth, Great Glen, Fleckney)	The Noabl wind speed database shows a moderate to good wind resource (6-7 m/s) for the majority of the district. The area around Billesdon has higher wind speeds to 7-8m/s	No potential hydro sites found.	Little woodland found near to Lutterworth and rural centres.
In and around Leicestershire urban fringe	Wind energy is less suitable within urban areas although a good wind resources is shown by the Noabl wind speed database.	No potential hydro sites found.	Little woodland found.

Table 16: Potential for renewable energy (selected technologies) by location (Melton)

Melton	**Wind resource** (refer also the wind speed maps provided within Annex 2 of the Renewable Energy Opportunities assessment report)	Hydro sites	Proximity to woodland
Melton Mowbray	The Noabl wind speed database indicates wind speeds of between 5 and 7 m/s for Melton Mowbray. The area to the south of the town is likely to be most suitable for small to medium wind.	No potential hydro sites found.	The most significant woodland area in Melton is that close to Belvoir. Other areas are relatively dispersed.
Asfordby	The Noabl wind speed database indicates wind speeds of between 5 and 6 m/s for Ashfordby.		
Bottesford	The Noabl wind speed database shows a moderate to good wind resource (6-7 m/s).		Bottesford is within 9km of the large wooded area at Belvoir.
Long Clawson	The Noabl wind speed database shows a moderate to good wind resource (6-7 m/s).		

6 TRANSPORT

6.1 National and Regional Transport Statistics

Transport accounts for around a quarter of UK domestic energy use and carbon dioxide emissions. The majority of the UK's transport greenhouse gas emissions are carbon dioxide and road vehicles are responsible for 93% of this[12]. Table 17 below shows the total carbon emissions from each mode of transport. Passenger cars are the largest single source of carbon dioxide emissions from transport.

Table 17: Carbon emissions (Million tonnes carbon dioxide and percentage) by transport mode in 2003

Mode Source	Emissions, M tonnes CO_2	% of total transport carbon emissions
Passenger cars	19.8	56%
Light duty vehicles	4.4	13%
Buses	1	3%
HGVs	7.2	21%
Mopeds and motorcycles	0.1	-
Railways	0.3	1%
Civil aircraft	0.6	2%
Shipping	0.9	3%

Road transport was also shown to be an important source of carbon dioxide emissions within the local authority areas of this study. In November 2007 DEFRA published some experimental statistics of carbon dioxide emissions for Local Authority and Government Office Region areas for the year 2005. Selected summary results are shown in Figure 5. Road transport (shown in yellow) contributes significantly to total emissions and shows variation between authority areas.

[12] Energy white paper: meeting the energy challenge, May 2007 Department for Trade and Industry

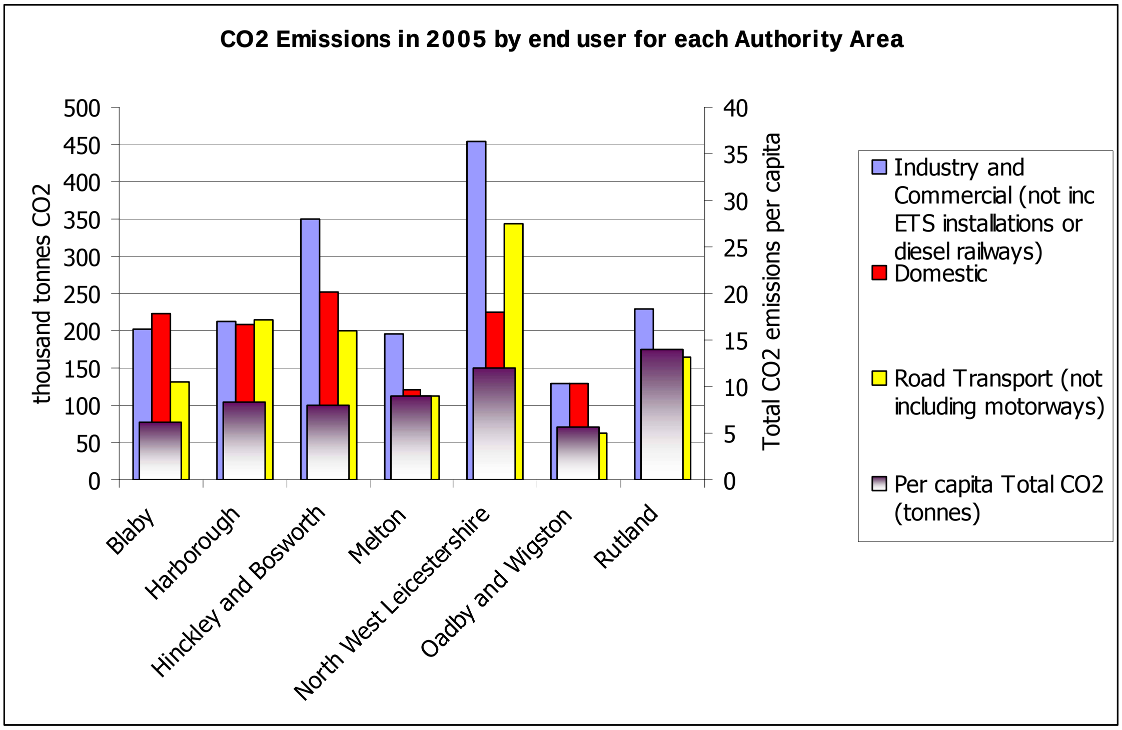

Figure 5: CO_2 emission by end user for each Authority Area

The average UK household contributes an average of 4.3 tonnes per annum of Greenhouse gases emissions resulting from transport and travel total. This includes 2.6 tonnes CO_2 from the use of privately owned vehicles and 1.7 tonnes CO_2 from public transport and civil aviation[13].

The methodology used within this study to estimate the emissions associated with transport for the various locations of development options within each local authority are based on a combination of local and national data. National data used is presented below:

The Department for Transport and the National Office of Statistics publish an annual Transport Statistics Bulletin which includes information on trip distances and frequencies per person per year by trip purpose (see Table 18).

Table 18: Personal travel: average number of trips and trip lengths distances by trip purpose[14]

Trip purpose	Trips per person	Average trip length, miles
Commuting	160	8.7
Visiting friends at private home	119	9.4
Shopping	219	4.2
Business	35	19.4
Holiday: base	11	48.5
Other escort	97	5

[13] The impact of UK households on the environment, Economic Trends 611 October 2004, Office of National Statistics

[14] Transport Statistics Bulletin; National Travel Survey 2006, Department for Transport and Office of National Statistics

Trip purpose	Trips per person	Average trip length, miles
Personal business	105	4.6
Day trip	27	14.1
Entertainment/public activity	49	7.6
Visiting friends elsewhere	49	6
Education	62	3.3
Sport: participate	16	6.6
Escort education	44	2.3
Other inc. just walk	45	1.1
All purposes	1037	6.9

Information is also available on average carbon dioxide emissions per passenger distance for different modes of transport. Specific information according to type of vehicle is available in addition to general averages, as shown in Table 19.

Table 19: Carbon dioxide emissions per passenger km[15]

Mode	gCO_2/passenger km
Average car	207.5
Bus	89.1
Train	60.2
Foot	0
Bicycle	0

Using a combination of the number of trips and average distance travelled for each purpose, together with information on the mode of transport used and then the emissions per passenger kilometre it is possible to estimate the emissions associated with travel by purpose. This is presented in Figure 6.

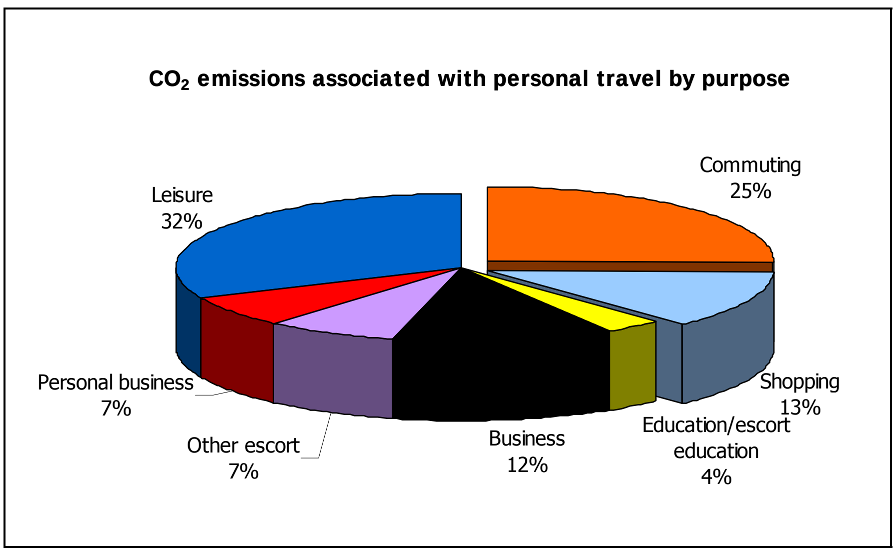

Figure 6: Carbon dioxide emissions associated with personal travel by purpose

[15] Passenger transport emissions factors Methodology paper June 2007 http://www.defra.gov.uk/environment/business/envrp/pdf/passenger-transport.pdf

6.2 Leicestershire and Rutland

Local information on transport is contained within the local transport plans for Leicestershire and Rutland. Traffic in Leicestershire (excluding City of Leicester and Rutland) grew by 7.9% between 2000 and 2004[16]. The 2001 census shows that 42% of people resident in the Leicestershire Transport Plan area travel less than 5km to their place of work and 43% travel between 5km and 20km. In Rutland traffic growth over the between 2000 and 2004 was less, approximately 1% with 14% growth over 10 years (1994-2004).[17]

The East Midlands Carbon Footprint- 'Determining Baseline Energy Consumption Data[18]' estimated the emissions due to total domestic transport for the three cities area as 1226 kgCO_2 per capita. (The Three Cities area includes Derby, Amber Valley, A Derbyshire, Leicester, Blaby, Charnwood, Harborough, Hinckley & Bosworth, Melton, NW Leicestershire, Oadby & Wigston, Erewash, Nottingham, Broxtowe, Gedling, Rushcliffe.)

The Leicestershire Local Transport Plan (2006-2011) identifies the following five-year objectives:

- Tackling congestion (increasing the use of public transport, walking and cycling with less growth in car mileage)
- Improving access to facilities (employment, education, health care, and food shopping)
- Reducing road casualties
- Improving air quality
- Reducing the impact of traffic (reducing vehicle speeds)
- Managing transport assets

6.3 Methodology

By estimating the distances residents will need to travel for selected purposes, the emissions associated with personal travel have been estimated relative to national averages.

The key challenge was in gathering data on distances people travelled for various purposes specific to the locations of the development options for each local authority was difficult. In general there was very little information available.

Local information on distances travelled was available for commuting and shopping (data for shopping for some authorities only). Shopping and commuting represent a significant part of total personal emissions (38% - see Figure 6)

Commuting: Commuting distances were estimated from the 2001 Census. For all locations the average travel to work distance in km was available by either Ward or Parish. The Ward or Parish which best represented the development location was chosen in each case.

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[16] Department for Transport National Road Traffic Survey 2004, data given in Leicester Local Transport Plan 2006-2011

[17] Rutland Local Transport Plan 2006 to 2011. Growth figures for period 2000 to 2004 are estimated from Figure 4-10.

[18] The results are based on an analysis of official energy consumption data for 2003 by the Department of Trade and Industry.

Shopping: Local retail studies were available for Melton[19], Hinckley & Bosworth[20], Harborough[21] and North West Leicestershire[22]. The retail studies divided each local authority into broad zones and indicated for each zone, the percentage of total spend at various retail sites. By measuring the distance from each development location to each retail site together with the percentage spend, the average distance for both convenience and comparison shopping was estimated.

6.3.1 Limitations in the methodology

The obvious limitation in the methodology is that local information relating to only 38% of carbon dioxide emissions was available (and only 25% where shopping information was not available). In addition the retail studies provided information on percentage spend at different sites for broad zones rather than the specific locations given by the development options. Similarly for the travel to work data in some cases presented an average for a parish much greater in area than the development option.

Despite these limitations the results generated are in line with what might be expected, with the more rural options resulting in higher emissions.

The methodology could be improved with the inclusion of data from retail studies for Rutland, Blaby and Oadby and Wigston (when available) and by including more up to date information on travel to work distances (for example when data is available from the 2011 Census).

On site surveys in the specific locations of the development options for each authority to obtain location specific information on journey distances, modes and frequencies would enable a more accurate estimation of expected emissions associated with travel.

6.4 Results

The sections below contain results by local authority. Summary information about the development options of each authority is provided in Annex 1.

6.4.1 Hinckley & Bosworth Borough Council

The preferred development option for Hinckley and Bosworth includes locations for new housing in urban and rural areas. The alternative options proposed are also divided into rural and urban locations. These are therefore considered separately in the assessment.

Table 20: Average household CO_2 emissions associated with transport for locations in Hinckley and Bosworth

Location	Emissions transport per household, tonnes per annum
Hinckley	3.05
Burbage	3.28
Barwell	3.20

[19] Melton Retail Study, September 2003

[20] Hinckley & Bosworth Retail Capacity Study, September 2007

[21] Harborough District Retail Study, October 2007
http://www.harborough.gov.uk/pp/gold/viewGold.asp?IDType=Page&ID=16788

[22] North West Leicestershire Retail Capacity Study Update 2007
http://www.nwleics.gov.uk/development_planning/DisplayArticle.asp?ID=4881

Location	Emissions transport per household, tonnes per annum
Earl Shilton	3.15
south of Earl Shilton	3.15
West of Barwell	3.25
Desford*	3.21
Groby	3.60
Ratby	3.69
Bagworth	3.41
Barlestone	3.45
Rural Villages (distributed)	3.49
Hinckley Castle (Ward)	3.04
Hinckley Clarendon	3.02
Hinckley De Montfort	3.12
Hinckley Trinity	3.01
Markfield and Fieldhead	3.49
Thornton	3.41
Market Bosworth	3.56
Newbold Verdon	3.52
Stoke Golding	3.22

Using the above estimations the average emissions associated with transport for each development option are shown in Figure 8.

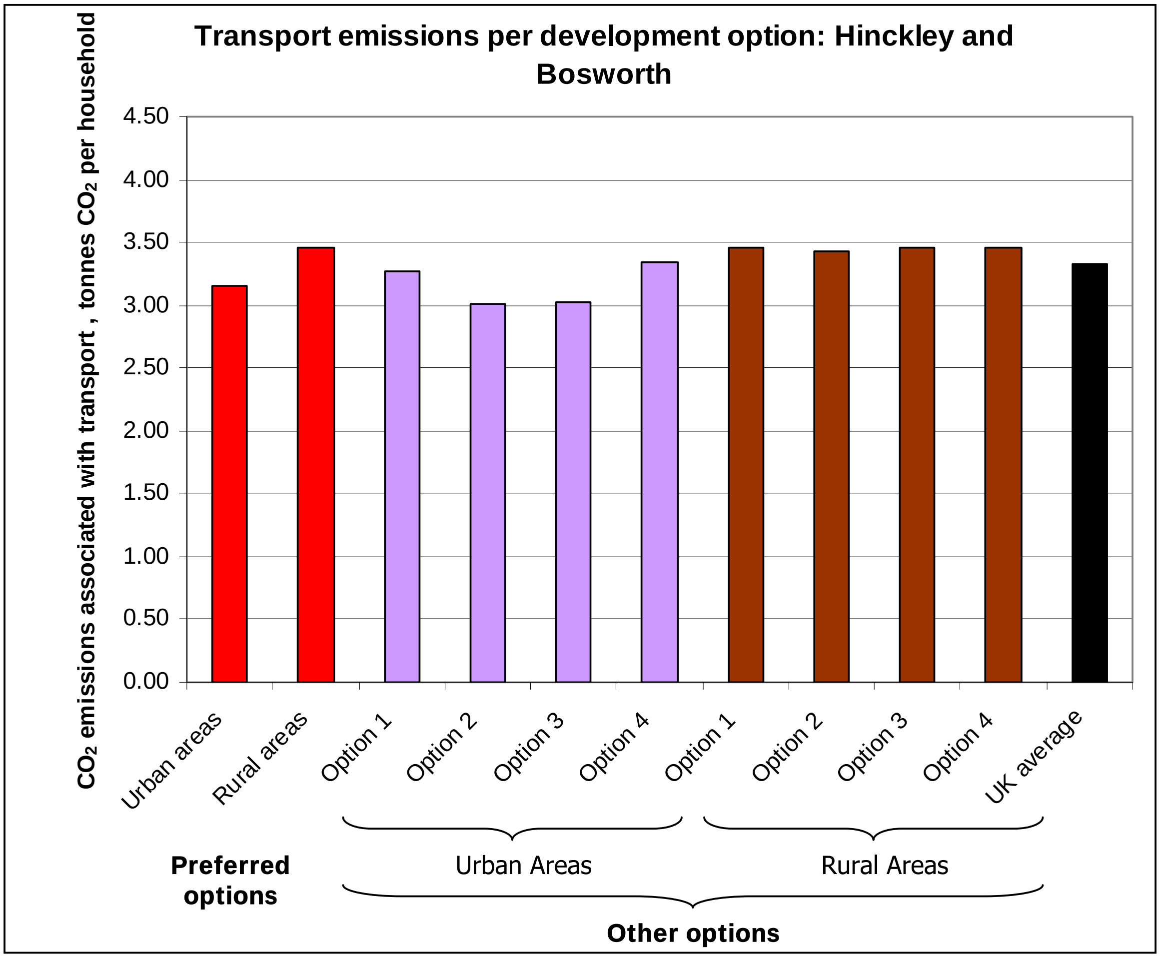

Figure 7: Household CO_2 emissions associated with transport per development option: Hinckley and Bosworth

6.4.2 Rutland County Council

There are three broad locations used within the development options for Rutland. For each location, the average emissions per household have been estimated. These are shown in Table 21.

Table 21: Average household CO_2 emissions associated with transport for locations in Rutland

Location	Emissions transport per household in this location, tonnes per annum
Oakham	3.45
Uppingham	3.41
Rutland	3.57
Rest of Rutland	3.65

Using the above estimations the average emissions associated with transport for each development option are shown in Figure 8.

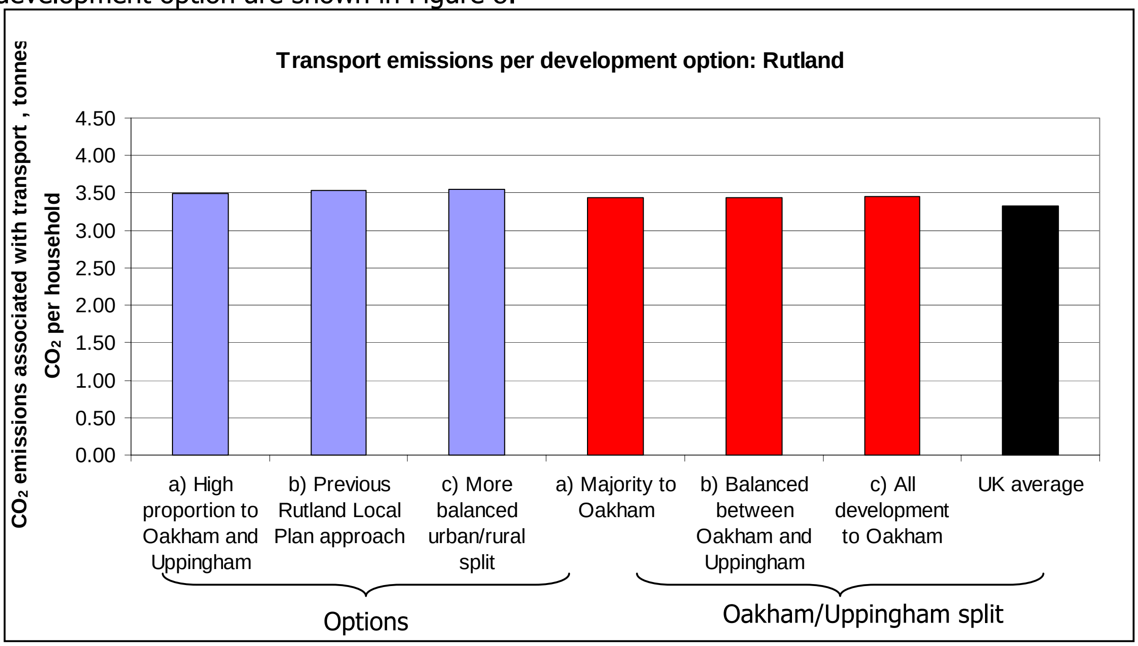

Figure 8: Household CO_2 emissions associated with transport per development option: Rutland

6.4.3 Blaby District Council

Nine sites are considered for new non-urban housing. The household CO_2 emissions associated with transport for each site are shown in Figure 9.

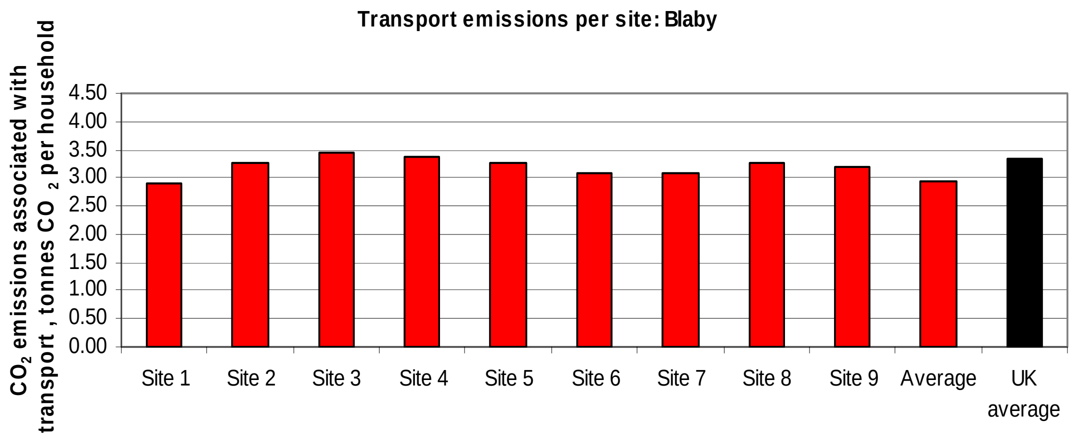

Figure 9: Household CO_2 emissions associated with each site: Blaby

Figure 9 shows significant variation in transport emissions by potential development site. Sites 3 (land South of Earl Shilton) and 4 (land east of Stoney Stanton) have the highest emissions and Site 1 (Land south of Leicester Forest East). The variation is based entirely on commuting distances since shopping trip distances was not available for Blaby.

In practice actual emissions will depend on sustainable transport measures taken (see section 6.4.8).

6.4.4 Oadby and Wigston Borough Council

Transport emissions per area of search are given below.

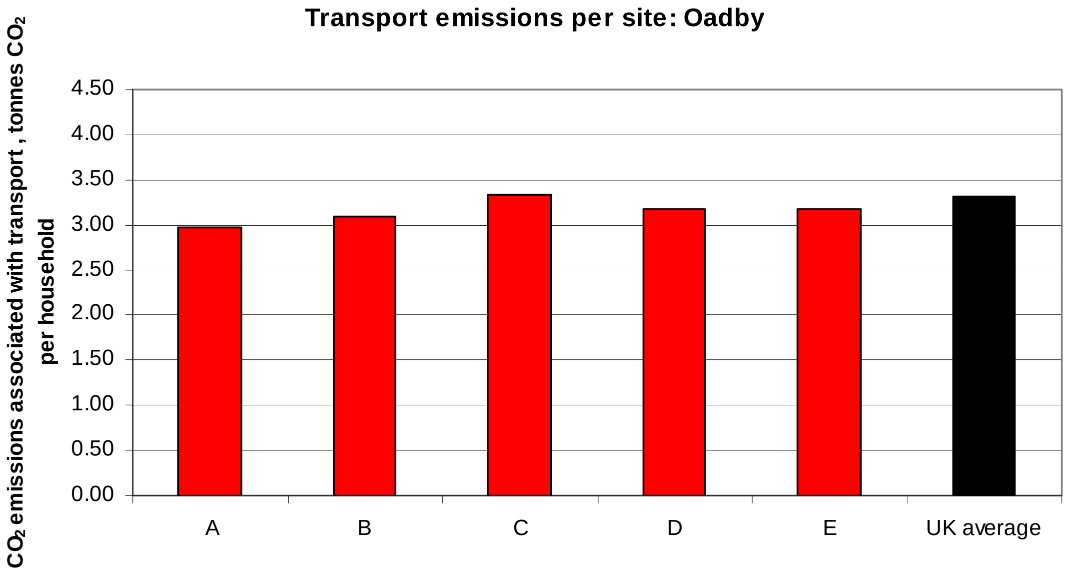

Figure 10: Household CO_2 emissions associated with transport per development option: Oadby and Wigston

Areas C, D and E (which are locations around Oadby) are slightly higher than A and B (which are around Wigston). The Oadby Town Centre Area Action Plan: Baseline Report concludes that Oadby is well placed in terms of the strategic highway network, having direct access to the A6. However the A6 also severs Oadby for pedestrians, cyclists and even bus services. The report recommends giving consideration to providing stronger links for these users. It also notes that there are limited pedestrian circuits in the town centre, partly due to the existing layout of the shopping area.

6.4.5 North West Leicestershire District Council

There are four locations used within the five development options for Harborough. For each location, the average emissions per household have been estimated. These are shown in Table 22.

Table 22: Average household CO_2 emissions associated with transport for locations in North West Leicestershire

Location	Emissions transport per household in this location, tonnes per annum
Ashby de la Zouch	3.56
Castle Donington	3.76
Coalville	3.07
Ibstock	3.49
Kegworth	3.73
Measham	3.77

Using the above estimations the average emissions associated with transport for each development option are shown in Figure 11.

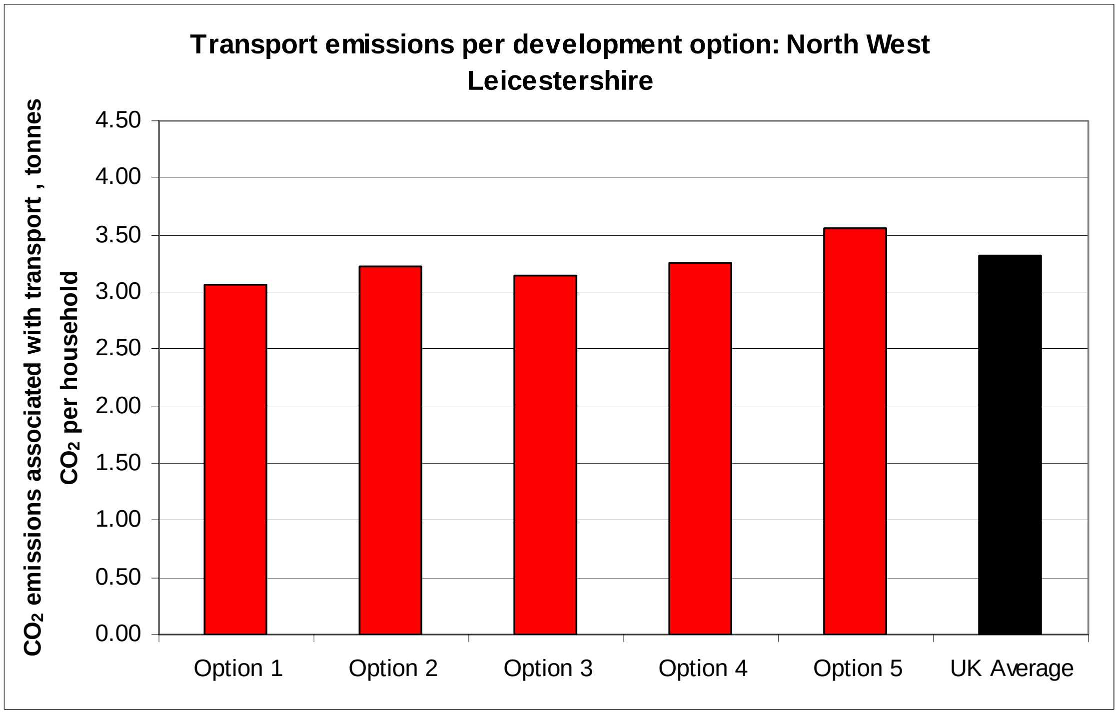

Figure 11: Household CO_2 emissions associated with transport per development option: North West Leicestershire

As shown in Figure 12 emissions for Options 1 to 4 are fairly similar but are higher for option 5. Option 5 is the dispersed option 6 500 homes split evenly between the 6 settlements (with the other options focussing on 1, 2 or 3 locations only). Not only does this mean higher baseline (i.e. based on historic situation) transport emissions but also implementing measures to reduce emissions through travel plans will be more difficult.

6.4.6 Harborough District Council

There are four locations used within the five development options for Harborough. For each location, the average emissions per household have been estimated. These are shown in Table 23.

Table 23: Average household CO2 emissions associated with transport for locations in Harborough

Location	**Emissions transport per household in this location, tonnes per annum**
In and around Leicestershire urban fringe	3.51
Market Harborough	3.40
Lutterworth	3.65
Broughton Astley	3.73
Lutterworth and rural centres (Broughton Astley, Kibworth, Great Glen, Fleckney)	4.0

Using the above estimations the average emissions associated with transport for each development option are shown in Figure 12.

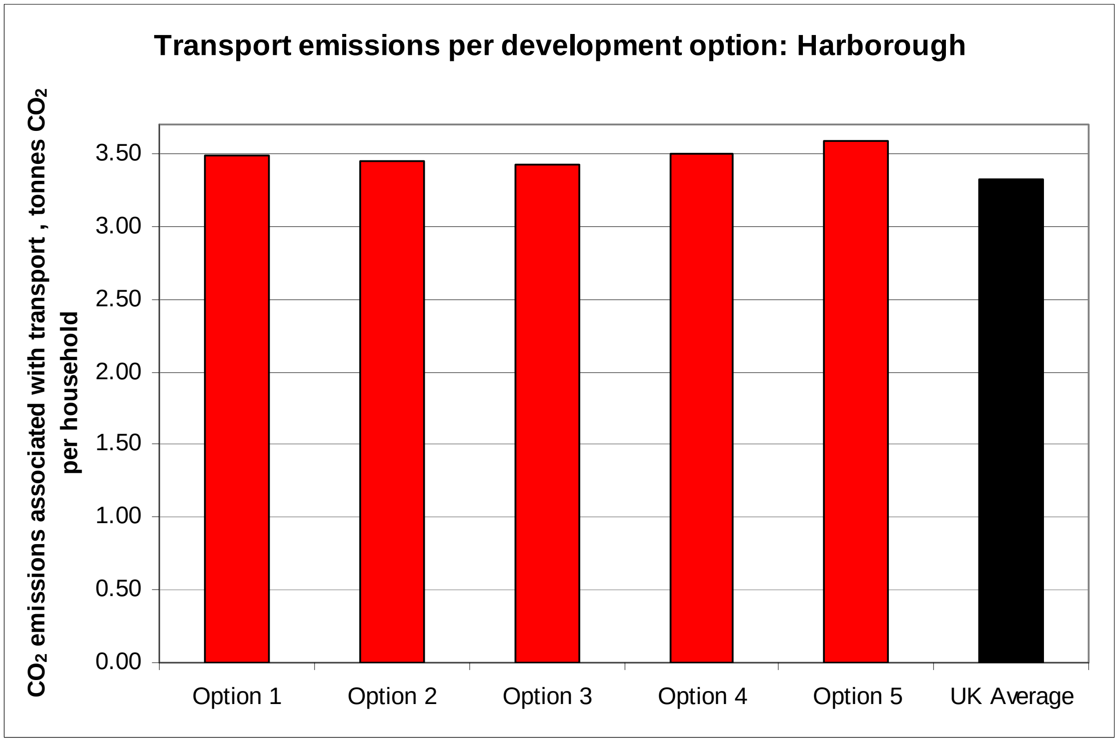

Figure 12: Transport emissions per development option: Harborough

6.4.7 Melton Borough Council

There are six main locations used within the three development options for Melton. For each location, the average emissions per household have been estimated. These are shown in Table 24.

Table 24: Average household CO_2 emissions associated with transport for locations in Melton

Location	Emissions transport per household in this location, tonnes per annum
Melton	3.37
Asfordby	3.48
Bottesford	4.69
Long Clawson	4.37
Waltham	4.36
Wymondham	3.97

Using the above estimations the average emissions associated with transport for each development option are shown in Figure 13.

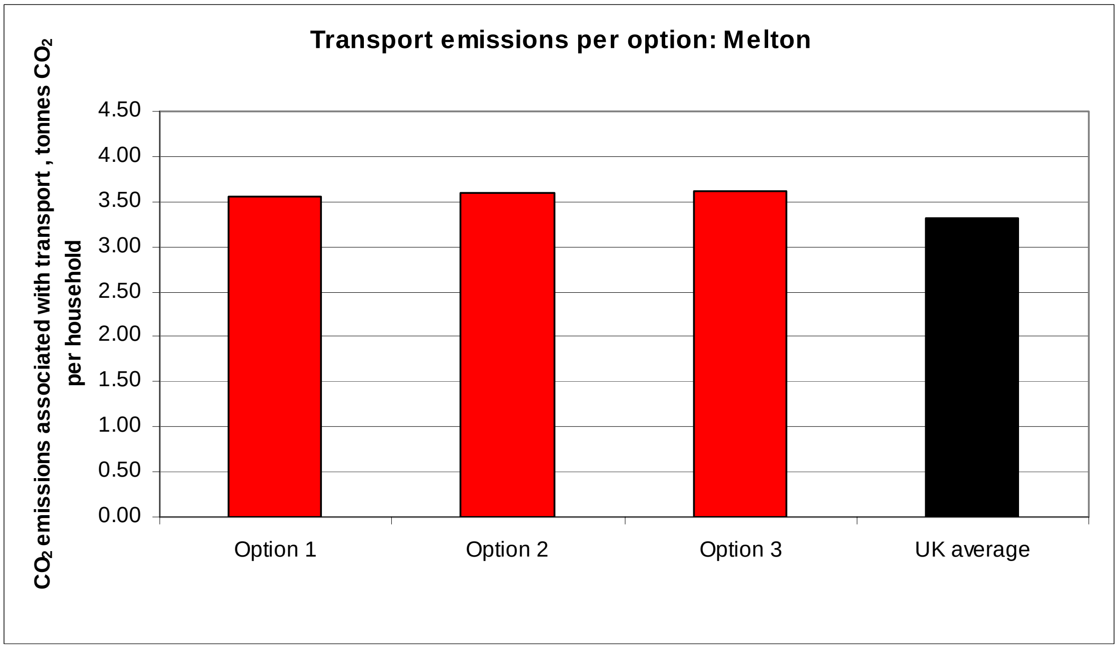

Figure 13: Transport emissions per development option: Melton

6.4.8 Summary and discussion

The estimated transport emissions for the development options are all greater than the UK average. This is partly because in general people in Leicestershire and Rutland travel greater distances to get to work than on average in the UK. The estimates for shopping trip distances generated from the retail studies were also greater than the UK average.

The variation in emissions by development option was most notable for North West Leicestershire, Blaby and Hinckley and Bosworth.

In practice the ability to implement transport emissions reduction will depend on a certain critical mass which is necessary for some aspects of travel plans (e.g. public transport provision) therefore options proposing dispersed development over a number of locations may have higher emissions.

Reducing transport emissions can be achieved by implementing a package of measures. National government initiatives in reducing emissions from transport are primarily focussed on driving change to achieve lower emission vehicles and from reducing traffic at peak times. DEFRA recommends a range of measures (including some included in the definition of 'Smarter Choices') designed to improve local air quality that in many cases would also help reduce CO_2 emissions at the local level[23]. These include:

- Measures developed under the provisions of the Road Traffic Reduction Act 1997 and other traffic regulation to reduce traffic;
- Promoting the use of cleaner fuels, as advised by the Government's 'PowerShift' and 'CleanUp' programmes;
- Transport information and guidance programmes to encourage drivers to avoid congested areas at busy times;
- Road user charging and workplace parking levies;

[23] DEFRA (2003) Part IV of the Environment Act 1995 Local Air Quality Management: Policy Guidance LAQM. PG(03) - pp.6-7 to 6-20.

- Testing cars at the roadside to ensure compliance with emission standards (although CO2 emissions are not specifically covered by EURO standards, the combustion efficiency of an engine is an indicator of emissions);
- Measures to avoid stationary vehicles with engines running, e.g. reducing congestion, or requiring taxis and buses have engines turned off at ranks or stands;
- Declaring 'Low Emission Zones', where only vehicles meeting stringent emission standards are allowed to enter;
- Traffic calming measures to reduce traffic speeds and aggressive driving;
- Reallocation of road space to favour pedestrians and cyclists, with results similar to 'Home Zones' and traffic calming;
- High occupancy vehicle lanes, which only cars carrying 2 or more people are permitted to use, to encourage car sharing;
- Requiring HGV's, Buses and Taxis to use alternative fuels;

A range of measures are required as part of a coherent and targeted strategy. Long term measures to reduce the need to travel through better integration of transport and land use planning, and a focus on access to facilities rather than mobility as an end in itself are required to help reduced greenhouse gas emissions overall.

The Department for Transport provides guidance on Residential Travel Plans. This means a package of measures designed to reduce the number and length of car trips generated by a residential development, while also supporting more sustainable forms of travel and reducing the overall need to travel.[24] These are normally the responsibility of the developer, although in the long term the success of Residential Travel Plans depends on ensuring that ownership ultimately rests with the residents who recognise the benefits and are aware that the plans are in their best interest. There needs to be an agreed mechanism for the handover of responsibility for the travel plan from the developer to residents. The DFT's travel plan pyramid (Figure 14) helps demonstrate how successful plans are built on the firm foundations of a good location and site design.

Figure 14: The Travel Plan Pyramid [24]

[24] Making residential travel plans work: guidelines for new development, Department for Transport, http://www.dft.gov.uk/pgr/sustainable/travelplans/rpt/makingresidentialtravelplans5775?page=4#a1007 accessed February 2008

Travel planning for residential development has potential to help achieve more sustainable communities by improving their accessibility. New housing development is normally characterised by high car trip generation. However, better choices about the location and density of new housing, combined with the increased use of residential travel plans, should deliver a real impact on travel patterns and aid progress towards sustainable transport and land use objectives.

It is estimated that improvements in land use planning could result in reductions in traffic of up to 2% by 2010[25]. In 1993 the Department of the Environment and the Department for Transport suggested that land use planning policies in combination with transport measures could reduce transport emissions by 16% over a 20 year period.[26]

The average emissions of all options for each local authority are summarised in Table 25 assuming three scenarios. Scenario 1 is the baseline and uses the assumptions as described in the methodology within 6.3 above. Scenario 2 assumes a modest reduction of 5% which may be achievable through good planning. Scenario 3 assumes a 16% reduction as a result of a strategic and wide ranging package of measures.

Table 25: Average emissions from travel

	Scenario 1	**Scenario 2 (5% reduction)**	**Scenario 3 (16% reduction)**
average emissions per household	**tonnes (Average per year 2008-2026)**	**tonnes (Average per year 2008-2026)**	**tonnes (Average per year 2008-2026)**
Hinckley & Bosworth	3.31	3.16	2.79
Rutland	3.52	3.34	2.96
Blaby	3.21	3.05	2.69
Oadby and Wigston	3.15	2.99	2.64
North West Leicestershire	3.25	3.09	2.73
Harborough	3.49	3.32	2.93
Melton	3.58	3.41	3.01

[25] WS Atkins and Partners (1999) Assessing the Effects of Integrated Transport White Paper Policies on National Traffic: Final Report. WS Atkins and Partners, Epsom

[26] Department of the Environment, Department of Transport (1993) Reducing Transport Emissions Through Planning. HMSO

7 WATER USE

7.1.1 Introduction

Increasing demands on essential water resources combined with changing rainfall patterns as a result of climate change mean that efficient use of available resources is essential. Water use itself also produces greenhouse gas emissions that contribute to climate change. These come from the water industry, primarily from treating and supplying water and disposing of wastewater, and from water use more widely.

The Environment Agency has the task of planning for water use in England and Wales. **The East Midlands Water Resources Strategy**[27] reflects the fact that the region is one of the driest parts of the UK (with annual average totals in places being less than 600 mms) and that climate change studies suggest summers could become drier and winters wetter. There are pressures on water environment from continued economic growth, new housing development, irrigation of crops, as well as the potential future impacts of climate change.

The largest use of water is for public supply. Over 1150 million litres of water per day (Ml/d) are abstracted for public supplies in the East Midlands. Household use accounts for about half of this.

The 25 year strategy recommends that future developments in the East Midlands should recognise the limited availability of water and incorporate efficiency measures and sustainable drainage systems at the planning stage. The timing and location of new development must respect water resources and environmental constraints. Planners should seek to ensure that development is sustainable, both in terms of water demand (water efficient devices and rainwater harvesting), water abstraction, treatment and supply, and water disposal (sewerage and sustainable urban drainage systems). Water efficiency measures are generally much cheaper to incorporate at the planning stage rather than retrofitting.

The Environment Agency has designated both Severn Trent Water and Anglian Water areas as being areas of serious water stress.

The Environment Agency's Planning Liaison Team for Leicestershire and Rutland recommends that all new developments take water saving measures such as installing water efficient fittings.

On a national level **The Water Supply (Water Fittings) Regulations 1999** were introduced to replace water company byelaws and make provision for preventing contamination, waste and undue consumption of water supplies. **Water Efficiency in New Buildings, a joint Defra and CLG policy statement** published in July 2007, responds to the key issues raised in responses to the Water Efficiency in New Buildings consultation[28] and sets out how Government proposes to bring forward regulations to implement minimum standards of water efficiency for new buildings and key fittings. These include:

- bringing forward an amendment to Building Regulations in 2008 to set a whole building performance standard for new homes at 125 litres per person per day;

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[27] A water resources strategy for the East Midlands, http://www.emra.gov.uk/publications/documents/water_resources_strategy_em.pdf

[28] Water Efficiency in New Buildings, a consultation document, December 2006, Communities and Local Government and Defra

- Also in 2008, bring forward proposals for revising the Water Supply (Water Fittings) Regulations 1999 with a view to setting new performance standards for key fittings that can be installed in buildings such as toilets, urinals, washbasin taps; and
- Communities and Local Government will, as part of the Green Commercial Buildings Task Group, conduct research and analysis to see if a whole building performance standard could be used for non domestic buildings.
- No building performance standards are to be set in the near term for non-domestic buildings because there was no robust evidence on which they could be based. In the short term robust standards for fittings used in washrooms should achieve significant reductions in water usage in the workplace.

The above actions are included within the **Government's new water strategy for England, Future Water**, which was published in February 2008. This strategy sets out the Government's long-term vision for water and the framework for water management in England.

7.2 Domestic Water use

As mentioned above the largest use of water is for public supply. Over 1150 million litres of water per day (Ml/d) are abstracted for public supplies in the East Midlands. Household use accounts for about half of this. Average domestic water use in the East Midlands is 135 litres per person per day[29]. Figure 15 shows how this is used.

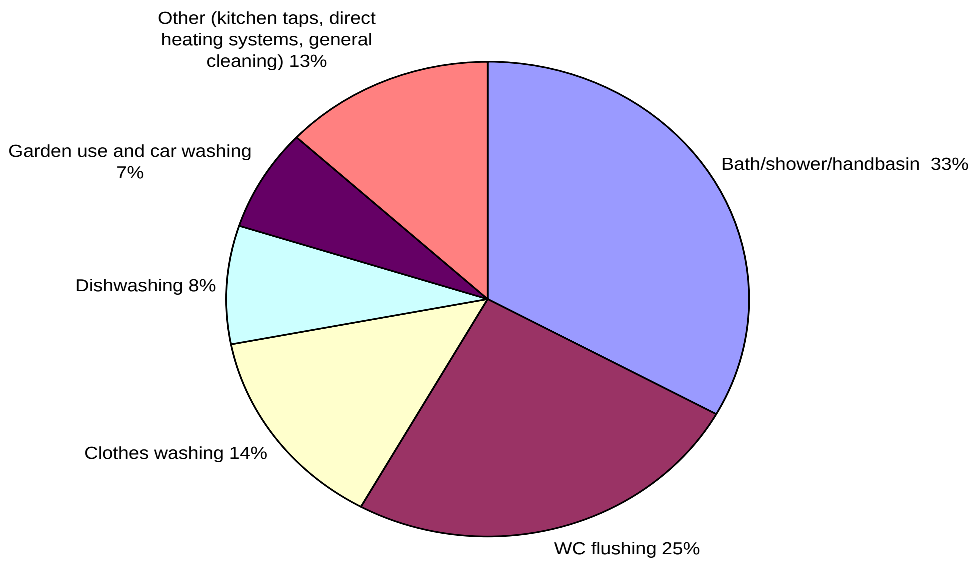

Figure 15 Typical breakdown of household water use (Source: Environment Agency[ii])

Understanding typical water usage allows estimates to be made as to the potential amount of water that is likely to be required by new developments and whether infrastructure improvements are required for the supply and sewage network. There are a number of measures which can be taken to reduce the demand for potable water. These include water efficient fittings, rainwater harvesting and grey water recycling. Rainwater harvesting is one measure which can be used as part of a comprehensive Sustainable Urban Drainage Scheme

[29] Environment Agency: Water Resources in the East Midlands http://environment-agency.wales.gov.uk/regions/midlands/835324/835524/1169184/1267859/?lang=_e

(SUDS) programme (see section 8) as it reduces peak flow run off as well as reduces demand of mains water during times of drought. The different measures are described in the section below.

7.3 Business water use

Water use by business is obviously much more variable than domestic water.

The Environment Agency estimates that commercial business can make up to 40% savings by making simple, low cost changes to toilets, showers urinals etc.

For industrial businesses potential savings are harder to estimate as they are process specific, but according to the Environment Agency can be as high as 90%.

DEFRA recommends metering and monitoring of water use

Whereas the Code for Sustainable Homes has performance specific criteria for different levels of the code, Breeam simply awards credits on the basis of:

- Water efficient fittings
- Leak detection systems
- Water meter
- Rainwater and greywater recycling (in some cases)

7.4 Water saving measures

Domestic water saving measures are considered in this section. These are also of relevance to non-domestic buildings. Water savings can be carried out over three areas:

- Fittings
- Appliances
- User behaviour

7.4.1 Fittings

Toilet flushing accounts for 25% water use in the home. Modern flush systems such as these can use 3 litres for short flush and 6 litres for long flush where as traditional toilets used to use 9 litres per flush. This is a considerable saving with little effort on the part of the user or designer and should be considered as standard. Education of users is necessary as dual flush can result in people flushing the toilet twice or even three times with short flush rather than the long flush.

Showers should be considered as a standard feature with a 5 minute shower consuming approximate 45 litres rather than 90 litres used for a bath. Power showers and multi jet showers use considerably more water than a typical shower due to the higher water pressures and increase number of jets and should be discouraged. Power showers are often perceived as a luxury item and could well be seen as a requirement of the specification depending upon the type of property being proposed.

The installation of efficient shower heads such as AAA rated shower heads which dispense water at 9litres/minute compared to 20-25litres/minute in a more traditional shower head, will minimise the amount of water needed (and in addition less energy for heating).

Tap aerators and shower head aerators should be considered. These mix air with the water so reducing the volume of water being used. Such fixings are not appropriate where high volumes of water are required such as bath taps.

Pressure reducers can also be fitted to reduce the pressure of the water arising from the taps so reducing volume consumed. Again such a fitting should not be considered where high volumes of water are required.

7.4.2 Appliances

Ten year old washing machines and dishwashers can use up to 100 litres and 25 litres respectively. If the new houses are to be fitted with new appliances then water efficient models should be considered. Some modern washing machines and dishwashers will use just 50 litres and 16 litres per wash respectively[iii]. Maximum points under the CSH are obtained when water efficient appliances are provided with the new home. Alternatively guidance can be provided to the home owner on about energy efficient appliances and their benefits.

7.4.3 User behaviour

Leaving taps on whilst cleaning teeth, taking baths instead of short showers, putting dishwashers and washing machines on with half loads all result in greater use of water. Developers can provide guidance to new householders in a handover document / home user guide.

Ensuring new home owners know that their property is on a meter ensures greater awareness of water use. In the case of multi-occupancy buildings, individual premises should have a water meter rather than the building as a whole since this ensures greater individual responsibility in water use.

7.5 Rainwater harvesting

Rainwater harvesting systems typically collect rainwater from a building roof and collect it in some form of storage to be used either for garden watering or toilet flushing. The simplest rainwater harvesting system is a water butt which can be attached to the gutters using a flow divert to a downpipe. A rainwater water butt typically holds approximately 200 litres. This is comparatively small relative to the total amount of rainfall which would fall on an average house, however the cumulative effect of a number of water butts on a housing development should not be dismissed.

More sophisticated rainwater use systems are available which have larger storage tanks typically 1500 – 3000 litres. These tanks are large (1.5 diameter x 2 meters long) and can be made of plastic, concrete or glass reinforced plastic and are typically buried. Such a system should be considered at the onset of the development as it requires significant earth works. Rainwater from the tank is pumped back into a header tank in the house to be used for toilet flushing. Other uses such as connection to washing machines can also be considered.

7.6 Greywater recycling

Greywater is the water arising from baths and showers and wash hand basins. Washing machine water can also sometimes be considered but as the amount of water arising from baths and showers corresponds to the amount of water needed for toilet flushing it is not typically considered. Water from dishwashing is typically more contaminated with food, oils and grease and is more costly to treat for reuse so is not considered as greywater.

Greywater accounts for approximately 46 litres of typical domestic water use and with treatment can be reused for toilet flushing. Greywater requires more treatment than rainwater as it is more contaminated.

Simple greywater system treatment consists of some form of filtration to remove items such as hair and grit then disinfection. More complex systems involve coarse filtration, biological treatment (using bacteria to breakdown the contaminants), fine filtration and then disinfection. The disinfection of the greywater water is important to inhibit bacterial growth during storage.

It is worth noting that whilst rainwater and greywater systems can be beneficial they consume energy in themselves and this is greater than the energy used to treat and deliver mains the water to the house. (CIRIA Best Practice report).

7.7 Results

The section presents the results of the assessment of the impact of the new developments on water use.

The estimations have been based on the BRE Water Use Calculator which calculates the water use per person based on the type of fittings installed in a home. The calculator is also used within the Code for Sustainable Homes assessment methodology.

The Code for Sustainable Homes sets out maximum water use requirements for the different levels of the code. These are shown in Table 26. Meeting 120 l per person per day or even 105 l per person per day is relatively easy however meeting the requirements of Level 5 and 6 is much more difficult and requires the installation of either grey water recycling or rain water harvesting systems in addition to water efficient appliances.

Table 26: Water use standards for the code for sustainable homes

Code for Sustainable Homes Level	Water use standard (litres per person per day)	% improvement over typical water use in East Midlands (135lpppd)
Level 1 ★	120	11%
Level 2 ★★	120	11%
Level 3 ★★★	105	22%
Level 4 ★★★★	105	22%
Level 5 ★★★★★	80	41%
Level 6 ★★★★★★	80	41%

For the non-domestic developments water used was based on benchmarks set out in a report for the Royal Institution of Civil Engineers by Cyril Sweett[30]. This report reviewed a series of existing analyses and benchmarks. The benchmarks provided for water use in both office and industrial buildings were 0.4-0.5 m^3 per year/m^2 net area. These focus on the building performance rather than industrial processes which of course vary considerably. No figures were obtainable for retail buildings but have been estimated for the purposes of this assessment to be similar to those of offices.

[30] Transforming Existing Buildings: The Green Challenge Final Report March 2007

Table 27: Water use benchmarks used

	Water (m3 per year/m2 net area)
Retail	0.4-0.5
Office	0.4-0.5
Industrial	0.4-0.5

This information was used to develop three scenarios for both housing and non-housing which were then used for the assessment. Since the water use benchmarks for non-housing are focussed on the building and personal use it is assumed that many of the water efficient fittings suitable for housing will also be applicable and that similar percentage savings can be made. The three scenarios are described in Table 28.

Table 28: Water use scenarios

	Scenario 1	**Scenario 2**	**Scenario 3**
Housing	Baseline scenario based on current average usage in 2008 and reduced to 120 lpppd (litres per person per day) from 2010	As per scenario 1 but usage reduced to 105 lpppd from 2010	As per scenario 1 but usage reduced to 105 lpppd from 2010 and to 80 lpppd from 2016
Non-housing	Baseline scenario based on benchmark of 0.4-0.5 *m3 per year/m2 net are)*	10% improvement over scenario 1	20% improvement over scenario 1

7.8 Results

Results of the assessment in terms of total average water usage are presented below.

Table 29: Summary results average per household

Average per household	**Scenario 1**	**Scenario 2**	**Scenario 3**
Average water usage (m^3 per year)	108	99	93

Table 30: Summary results average per non-domestic floor area

Average for new non-domestic households	**Scenario 1**	**Scenario 2**	**Scenario 3**
Average water usage (m^3 per year)	0.45	0.41	0.36

Results of the assessment in terms of total average additional water usage per household are presented below. As discussed within the energy section, athough the same assumptions in terms of water efficiency standards have been used for each local authority, the difference in average water use between local authorities arises from the different build trajectories of the different local authorities (i.e. the number of homes which will be built each year).

Annex 1 contains a summary of the development options including build trajectories for each local authority.

Table 31: Average water usage for all housing development foreseen to 2008-2026

	Scenario 1	Scenario 2	Scenario 3
Local authority	m3 (Average per year 2008-2026)	m3 (Average per year 2008-2026)	m3 (Average per year 2008-2026)
Hinckley & Bosworth	107	96	87
Rutland	107	95	84
Blaby	106	94	81
Oadby and Wigston	107	95	83
North West Leicestershire	106	94	80
Harborough	107	95	82
Melton	107	96	84

7.9 Recommendations

The additional costs of most water efficient fittings are small. Achieving a water use of 105l per person per day (as per Scenario 2 above) would cost an estimated additional £125 per dwelling. If a development is taking place in an area of serious water stress (as determined by the Environment Agency) it would not therefore be unreasonable to require a developer to achieve this higher water efficiency standard.

It is not necessarily recommended to require developers to meet standards higher than this (i.e. water use below 105 l per person per day).

8 EFFECT ON WATER RUN OFF

8.1 Introduction

Climate change is expected to result in more extreme weather events such as droughts and flooding. For the East Midlands the UK Climate Impacts Programme (UKCIP) model predicts that by 2059 there could be up to 13% more rainfall in winter and 18% less rainfall in summer. This part of the report deals with the effect of new developments on surface water run off. This is of much greater importance as we consider climate change and predicted increase in extreme weather.

The effect of development is generally to reduce the permeability of at least part of the site. This markedly changes the site's response to rainfall. Without specific measures, the volume of water that runs off the site and the peak run-off flow rate is likely to increase. Inadequate surface water drainage arrangements in new development can threaten the development itself and increase the risk of flooding to others.

To satisfactorily manage flood risk in new developments, appropriate surface water drainage arrangements are required, to manage surface water and the impact of the natural water cycle on people and property.

Planning Policy Statement 25 Development and Flood Risk (PPS25) sets out Government policy on development and flood risk. It aims to ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas of highest risk. Where new development is, exceptionally, necessary in such areas, policy aims to make it safe, without increasing flood risk elsewhere, and, where possible, reducing flood risk overall.

The policy requires Local Planning Authorities (LPAs) to consult the Environment Agency and other relevant bodies (including adjacent LPAs), when preparing policies in their LDDs on flood risk management and in relation to areas potentially identified as at risk of flooding. Their sustainability appraisals, land allocations and development control policies should all be informed by a Strategic Flood Risk Assessment carried out in liaison with the Environment Agency. In addition LPAs are required to consult with the Environment Agency on all applications for development in flood risk areas (except minor development), including those in areas with critical drainage problems and for any development on land exceeding 1 hectare outside flood risk areas.

Surface water arising from a developed site should, as far as is practicable, be managed in a sustainable manner to mimic the surface water flows arising from the site prior to the proposed development, while reducing the flood risk to the site itself and elsewhere, taking climate change into account. This should be demonstrated as part of the flood risk assessment.

The effective disposal of surface water from development is a material planning consideration in determining proposals for the development and use of land. It will always be much more effective to manage surface water flooding at and from new development early in the land acquisition and design process rather than to resolve problems after development. Site layout should be influenced by the topography. The location of buildings where surface water may flow naturally, or as a result of development, under extreme circumstances should be avoided if possible.

The surface water drainage arrangements for any development site should be such that the volumes and peak flow rates of surface water leaving a developed site are no greater than the rates prior to the proposed development, unless specific off-site arrangements are made and result in the same net effect.

Strategic flood risk assessments were made available for the following authorities and have been reviewed as part of this study:

- Hinckley and Bosworth
- Blaby
- Oadby and Wigston
- Melton
- North West Leicestershire

(Hinckley and Bosworth, Blaby, Oadby and Wigston: combined document)

These strategic assessments are essentially planning tools with enable the local authority to select and develop sustainable locations for development, away from flood risk areas.

The **Code for Sustainable Homes** reflects PPS25 and requires (for all levels of the code) that developments ensure that run-off rates and annual volumes of run-off post development will be no greater than the previous conditions for the site. In addition it awards points for providing rainwater holding facilities/sustainable drainage systems (SUDs) to provide attenuation of water run-off to either natural watercourses or surface water drainage systems, providing percentage time attenuation as follows:

- 50% in low flooding risk areas
- 75% in moderate flooding risk areas
- 100% in significant flooding risk areas

The **Breeam** scheme are less specific than this and award points for a development which use Sustainable Urban Drainage techniques to minimise the risk of localised flooding, resulting from a loss of flood storage on site through development.

The following sections explain the concepts of Sustainable Urban Drainage. The findings of the Strategic Flood Risk Assessment for each authority are then reviewed for each of the development options (section 8.3).

8.2 Sustainable urban drainage

A significant proportion of rainfall on a development area will evaporate and infiltrate into the ground however impermeable surfaces such as roofs, roads and paths with result in substantial volumes of runoff water which need to be discharged from the site. The traditional combined sewer system results in a risk of contamination of water courses during periods of peak runoff since the combined sewer has potential to over flow into local water courses. New developments are therefore required to install a separate surface water drainage system and must also try to reduce the potential peak flow that occurs. This in turn reduces the potential flood risk downstream. Employing sustainable urban drainage systems (SUDS) assists in alleviating this potential peak flow.

Sustainable urban drainage systems (SUDS) aim to reduce and treat surface water runoff near to its source. The advantage of SUDS is the attenuation of flow so reducing the potential for flooding downstream. In addition to reducing the potential for flooding, the SUDS approach takes into account water quality, environmental and amenity issues.

SUDS mimic natural systems in the provision of storage, flow attenuation, sedimentation, adsorption and biological treatment. They should be integrated into the environment as visually attractive features, which can also provide beneficial habitat for wildlife that would otherwise be scarce in the built environment. Typically SUDS schemes can take up 5-7% of the site area but can require significantly less if source control techniques (i.e. prevention – see below) are used[iv].

There are four general SUD techniques:

- Prevention
- Filter trenches, swales, soakaways
- Permeable surfaces and filter drains
- Basins, ponds and wetlands

A brief overview of these options is given in the sections below.

Typically SUDS schemes are required for all new developments. One issue highlighted by Tim Andrews, Technical Officer at the Environment Agency (East Midlands) is that local authorities are often reluctant to adopt SUDs schemes once built. Typically they may become the responsibility of an on-site management company but their on-going maintenance may be a problem. It is therefore recommended that authorities ensure that maintenance responsibilities for planned SUDs schemes are clearly defined at an early stage.

8.2.1 Prevention

Simply reducing the number of impermeable paved areas in a development will lower the amount of surface water runoff. This can be achieved through lower density housing and increased use of green spaces.

8.2.2 Infiltration trenches, swales & soakaways

Infiltration trenches, swales & soakaways allow water to infiltrate into the subsoil. The principle of infiltration is shown in Figure 16. Their use is dependent upon site conditions and they are unsuitable on sites with high water tables and sites with soils with a low hydraulic conductivity (permeability) such as clay.

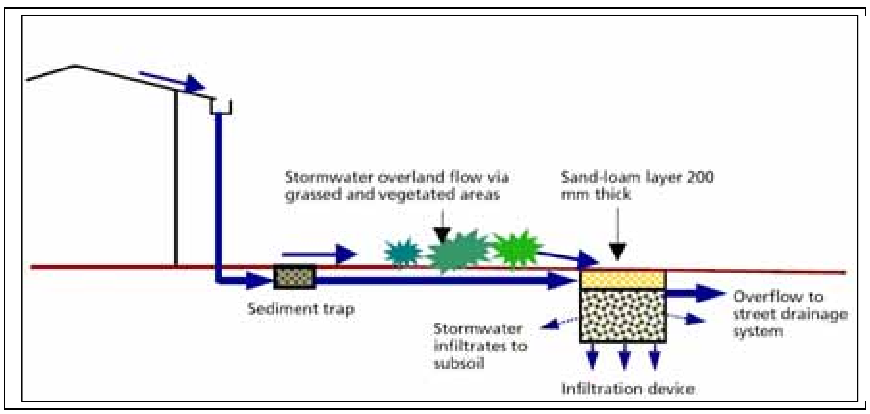

Figure 16: Principle of infiltration[31]

- A swale is a shallow vegetated channel designed to conduct and retain water, but may also permit infiltration; the vegetation filters particulate matter.
- A retention trench consists of a trench lined with geotextile fabric and filled with coarse gravel, and placed under a 300 mm layer of sand or loam. Stormwater is conveyed to the trench via an inflow pipe after passing through a sediment trap.
- A soakaway works like a 'reverse well' i.e. a 'hole-in-the-ground' that loses water rather than collecting water.

[31] http://www.wsud.org/

Figure 17: A dry swale (Source: SUDSnet[v])

Figure 18: A swale in operation (Source: SUDSnet[v])

8.2.3 Permeable surfaces and filter drains

Permeable surfaces allow water to drain either through the surface or between gaps been the pavers as shown in Figure 19. Typically they are used in areas with low traffic volumes and speeds such as car parking areas and foot paths. In areas which are not used frequently strengthened grass or gravel paving systems can be installed. Porous asphalt is another product which is available for road surfaces however it has a much shorter life than hot rolled asphalt and in winter months requires more frequent gritting so is not favoured on roads with high traffic volumes.

Depending on the substrata of the site it might be necessary to install perforated drains within the paving system to cope with excess runoff this can then be directed to retention ponds, detention basins or surface water drain. Permeable paving systems are shown in Figure 19.

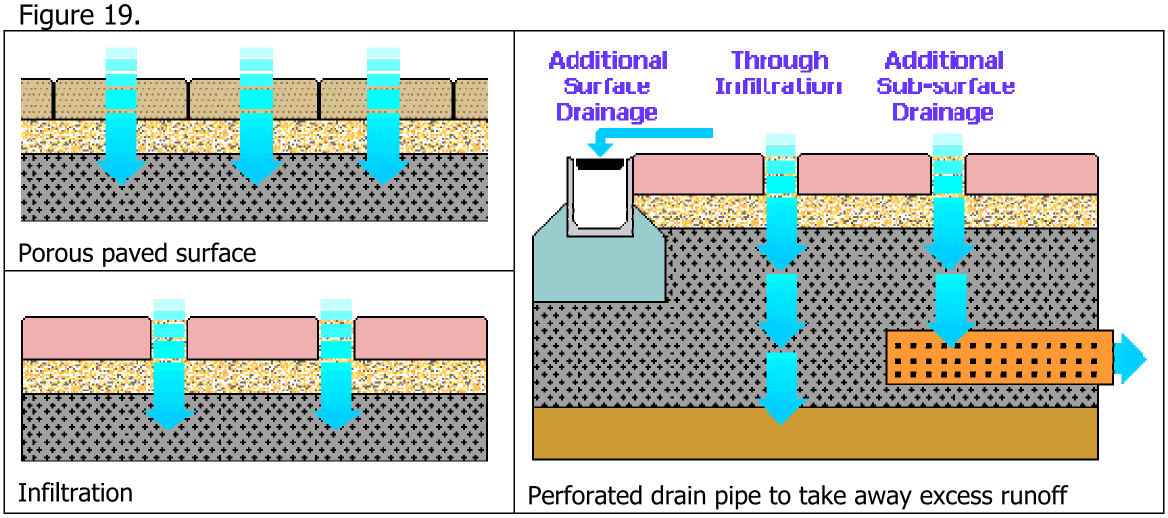

Figure 19 Examples of permeable paving systems (Source: AJ McCormack & Son)

Filter drains or French drains are linear drains consisting of trenches filled with a permeable material which often has a perforated pipe in the base. These allow a degree of filtering, storage, infiltration before discharge. Examples are shown in Figure 20.

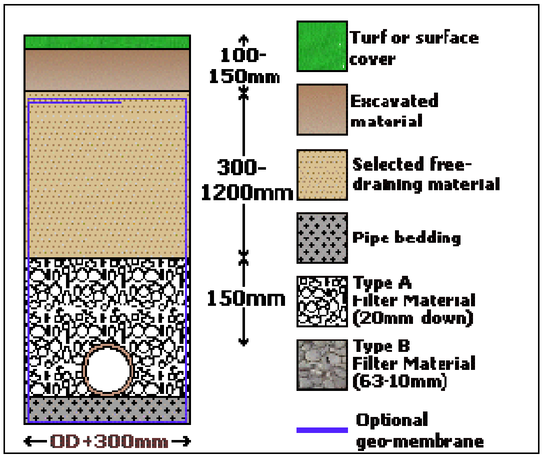

Figure 20 Filter drain (Source: AJ McCormack & Son)

8.2.4 Basins, ponds and wetlands

Detention basins are designed to hold back the storm runoff for a few hours and allow the settlement of solids. Detention basins drain via a discharge point into a watercourse or surface water drainage system. Detention basins are dry outside storm periods. An example is shown in Figure 21.

Retention ponds retain a certain volume of water at all times. This allows the settlement of solids and natural biological treatment of nutrient and organic matter. A typical retention pond will have as least 20 days retention to permit biological degradation of pollutants. An example is shown in Figure 22. Rainwater butts also act as retention ponds but on a much more limited smaller scale.

The creation of specially constructed wetlands offers enhanced filtration and nutrient removal and increase ecological benefits.

Figure 21 Detention basin (Source: SUDSnetv)

Figure 22 Retention ponds (Source: SUDSnetv)

8.3 Results: Qualitative impact assessment of development options

8.3.1 Hinckley & Bosworth Borough Council

Flood risk in the study areas is dominated by Fluvial flooding however flooding resulting from short duration, intense storms pose a significant risk to development.

The strategic flood risk assessment (SFRA) indicated that the soil types for all sites is of low permeability clay type. Both the local soil and geology types for all sites limit the effectiveness of infiltration SUDS methods. Conveyance methods such as swales, filter strips and filter drains should be considered alongside balancing of flow within the in-site drainage system. The report indicated that in Hinckley the Greenfield development sites extra drainage capacity will be required.

8.3.2 Rutland County Council

No SFRA was available for Rutland.

8.3.3 Blaby District Council

Whilst not all the possible sites for development listed for this study were assessed as part of the Strategic Flood Risk Assessment, three sites were:

- Site 1 (Leicester Forest East);
- Site 6 (Blaby);
- Site 8 (Whetstone)
- Site 9 (Countesthorpe).

The assessment showed that all sites included areas within Flood Zones 2 or 3[32] and that the soil type for all sites (low permeability, silty with clay content) and geology made them unsuitable for infiltration SUDS methods. The assessment recommended that other SUDs methods be thoroughly investigated. A number of the selected sites are greenfield sites where SUDs will be required in order to ensure that the volumes and peak flow rates of surface water leaving the developed site are no greater than the rates prior to the development.

8.3.4 Oadby and Wigston Borough Council

Four of the areas of search are located in Flood Zone 1 i.e. they have an annual probability of river flooding of less than 1 in 1000. These are all Greenfield sites. The SFRA indicates that soil type for all four sites (low permeability, silty with clay content) and geology made them unsuitable for infiltration SUDS methods. The assessment recommends conveyance methods such as swales, filter strips and filter drains should be considered alongside balancing of flow within the in-site drainage system.

B Adjacent to urban area south of South East of Wigston
C Adjacent to urban area south of South of Oadby
D Adjacent to urban area south of South East of Oadby
E Adjacent to urban area south of North East of Oadby

Area of search A contains areas designated as flood zone 3. The SFRA recommends that a flood risk assessment will be required to assess surface water run off and how it will be

[32] Flood zone 2 refers to land assessed as having a 1 in 100 to 1 in 1000 annual probability of river flooding.. Flodd Zone 3a refers to land assessed as having a probability of river flooding greater than 1 in 100.

managed to ensure flood risk to the site and existing sites further upstream and/or downstream are not increased, and where possible are decreased.

8.3.5 North West Leicestershire District Council

The next phase of the SFRA will build on the Phase 1 assessment by providing advice on flood defence and mitigation measures for the potential growth areas identified in the Council's Core Strategy and the allocated sites identified within North West Leicestershire Local Plan, the Urban Capacity Study and Leicestershire Minerals and Waste Development Frameworks.

The geology of North West Leicestershire is dominated by Triassic Mercia Mudstone which has a relatively high clay content and is relatively impermeable. Carboniferous Coal measures also underlie much of the south of the district although these are exposed only partly and for the large part of the area these lie below either Mercia Mudstone or Sherwood sandstone. The Sherwood Sandston and Coal measures are more permeable except when they form steep ridges. As a result of the underlying geology it is likely that many of the sites are unsuitable for infiltration SUDS methods. The next stage of the SFRA will indicate the suitability of the sites to SUDs techniques.

8.3.6 Harborough District Council

No SFRA was available for Harborough.

8.3.7 Melton Borough Council

Melton's SFRA did not indicate the suitability of the different locations to the use of SUDs.

8.4 Recommendations

Since the suitability of different SUDs techniques is highly site specific it is only possible to make general recommendations at this level of study. Only through detailed site investigation on the specific geology and topograph in the areas of development is it possible to establish the precise SUD techniques that can be adopted We can note however that the predominantly clay type soils in Leicestershire make application of some SUDs techniques difficult and limit the range of choices available.

9 WASTE GENERATED AND ASSOCIATED EMISSIONS

9.1 Landfill and methane emissions

The disposal of waste in landfill generates methane, a greenhouse with 21 times the global warming potential of carbon dioxide. Figure 4 shows the UK's methane emissions by source. In 2005 landfill was responsible for approximately 0.9 million tonnes methane emissions (equivalent to 19 million tonnes of carbon dioxide).

Reducing the quantity of waste sent to landfill reduces methane emissions and therefore as the local authorities work towards their recycling targets (see below) the volumes of waste landfilled and therefore the associated emission will reduce.

An independent report for DEFRA (2004) reviewed information on emissions from landfills. It reported a best estimate on landfill gas emissions per tonne of municipal waste for a typical UK landfill (77.4 kg/tonne waste). This estimate has been used for the purposes of this report to estimate the emissions from households. The report concluded that there is significant variation in emissions from site to site.

Landfill gas escapes from landfill in three ways - Fugitive gas emissions from passive venting to atmosphere through purpose built vents, cracks in the capping material, or through active and uncapped areas of the site; Release of unburnt landfill gas released after flaring or energy utilization (flaring and energy utilisation is not 100% efficient).

9.2 Local Waste Management Strategies

The County Council Waste Management Strategies set out how the waste will be dealt with in the coming years.

9.2.1 Leicestershire

In 2003/04 around 4 million tonnes of waste was produced in Leicestershire.

- Recycling rates were in the order of 18% for municipal waste, 30% for commercial and industrial waste and 50% for construction and demolition waste.
- Remainder of the waste was landfilled in Leicestershire and exported to sites in Warwickshire, Northamptonshire and Lincolnshire

LCC aims to be recycling nearly 60% of household waste by 2017.

9.2.2 Rutland

Rutland County Council's Waste Management Strategy sets out the following targets:

- To achieve a household waste recycling rate of 30% by the end of 2008/09 financial year and to achieve a 45% recycling rate by 2012.
- To meet the annual landfill allowances required in the Waste and Emissions Trading Act 2003.
- These targets satisfy the statutory targets set by the Government in its 2007 Waste Strategy for England in relation to recycling and waste diversion namely:
  - recycling 40% of all household waste by 2010, 45% by 2015 and 50% by 2020.
  - recovering 53% of municipal waste by 2010, 67% by 2015 and 75% by 2020.

9.2.3 Recycling Targets

The recycling targets and current recycling rates are presented in Figure 23 below. These trajectories are used to estimate the emissions from landfill for each local authority.

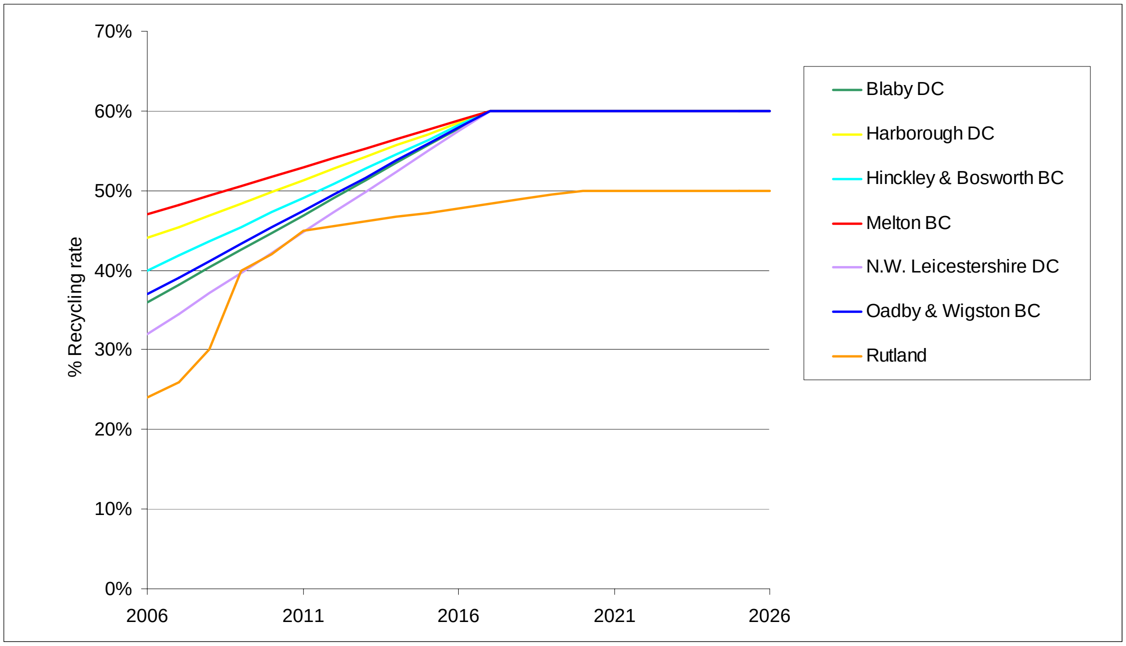

Figure 23: Recycling trajectory based on current recycling rates and future targets

9.3 Methodology

The total emissions per local authority were estimated using the recycling targets together with the following assumptions:

Quantity of waste produced per household per week	23	kg/week	*DEFRA*
tonnes methane per tonne of waste	77.4	kg per tonne of waste	

Emissions reductions can be achieved by increasing recycling rates and by decreasing the quantity of waste produced. Three scenarios have been used.

It was not possible to gain accurate benchmarks for waste production in non-housing developments so this has not been assessed.

Table 32: Emissions from waste scenarios

	Scenario 1	Scenario 2	Scenario 3
Housing	Baseline scenario based on recycling targets, current recycling rates and assumption of 23kg waste per household per week.	As per scenario 1 but additional 10% recycling by 2020	Scenario 2 plus a reduction in waste production by 10% by 2020

9.4 Results

Results of the assessment in terms of total average emissions from landfill of waste per household are presented below.

Table 33: Emissions from landfill of waste -Total CO_2 emissions equivalent (tonnes per household per year)

	Scenario 1	Scenario 2	Scenario 3
average emissions per household	**tonnes (Average per year 2008-2026)**	**tonnes (Average per year 2008-2026)**	**tonnes (Average per year 2008-2026)**
Hinckley & Bosworth	0.94	0.91	0.82
Rutland	1.13	1.09	0.99
Blaby	0.97	0.94	0.85
Oadby and Wigston	0.97	0.94	0.84
North West Leicestershire	1.01	0.98	0.88
Harborough	1.94	1.94	1.75
Melton	0.88	0.85	0.77

Table 34: Emissions from landfill of waste -Total CO_2 emissions equivalent over 60 years (tonnes per household per year)

	Scenario 1	**Scenario 2**	**Scenario 3**
average emissions per household over 60 years	**tonnes CO_2 emissions equivalent over 60 years**	**tonnes CO_2 emissions equivalent over 60 years**	**tonnes CO_2 emissions equivalent over 60 years**
Hinckley & Bosworth	797 379	674 865	607 379
Rutland	253 816	222 643	200 379
Blaby	456 929	386 738	348 065
Oadby and Wigston	96 828	81 911	73 720
North West Leicestershire	626 670	530 390	477 351
Harborough	1 126 730	1 126 730	1 014 057
Melton	327 280	276 778	249 101

10 SUMMARY OF FINDINGS

A summary of the results of the assessment are provided within this section.

The proposed developments in each local authority will result in increased emissions as a result of the additional households and additional employment areas.

The analysis for emissions from energy use and water use were neither location nor local authority specific since the parameters were based on national standards and benchmarks and future improvements.

Results for emissions from transport were dependent on location and the emissions from waste are dependent on the local authority. A summary of the non location specific results are provided in Table 35.

Table 35: Summary results average per household

Average per household	**Scenario 1**	**Scenario 2**	**Scenario 3**
Energy (CO_2) (tonnes/year)	*Baseline scenario based on project Building Regulations*	*Slightly improved energy efficiency levels over baseline.*	*Accelerated energy efficiency improvements of 25-50% better than Building Regulations until 2016*
	1.94	**1.58**	**1.50**
Transport (CO_2) (tonnes/year) - average	*Baseline -uses the assumptions as described in the methodology within 6.3*	*assumes a modest reduction of 5% which may be achievable through good planning*	*16% reduction as a result of a strategic and wide ranging package of measures*
	Location dependent	Location dependent	Location dependent
Waste (CO_2 equivalent) (tonnes/year)	*Baseline scenario based on recycling targets, current recycling rates and assumption of 23kg waste per household per week.*	*As per scenario 1 but additional 10% recycling by 2020*	*Scenario 2 plus a reduction in waste production by 10% by 2020*
	Local authority dependent	Local authority dependent	Local authority dependent
Average total greenhouse gas emissions (tonnes CO_2/year)	**5.74**	**5.28**	**4.71**
Average water usage (m^3 per year)	Baseline scenario based on current average usage in 2008 and reduced to 125 lpppd (litres per person per day) from 2010	As per scenario 1 but usage reduced to 105 lpppd from 2010	As per scenario 1 but usage reduced to 105 lpppd from 2010 and to 80 lpppd from 2016
	108	**99**	**93**

The following tables present results for each local authority in turn, presenting first the average emissions per household and the total additional emissions as a result of the developments within.

10.1 Summary of findings: Hinckley and Bosworth

Table 36: Hinckley & Bosworth Borough Council –average emissions per household

Average emissions per household per year	Scenario 1	Scenario 2	Scenario 3
Energy (tonnes CO_2)	1.53	1.12	1.10
Transport (tonnes CO_2)	3.31	3.16	2.79
Waste (tonnes CO_2 equivalent)	0.94	0.91	0.82
Total greenhouse gas (tonnes CO_2)	5.78	5.18	4.71
Total water usage (m^3)	107	96	87

Table 37: Hinckley & Bosworth Borough Council –total household emissions and water use over 60 years

Total additional emissions per local authority, 60 years from completion	Scenario 1	Scenario 2	Scenario 3
Energy	1 050 783	733 493	729 005
Transport (average)	1 653 283	1 577 079	1 394 470
Waste (CO_2 equivalent)	797 379	674 865	607 379
Total greenhouse gas (tonnes CO_2)	3 501 445	2 985 438	2 730 854
Water usage (m^3)	54 150 651	48 444 587	44 015 206

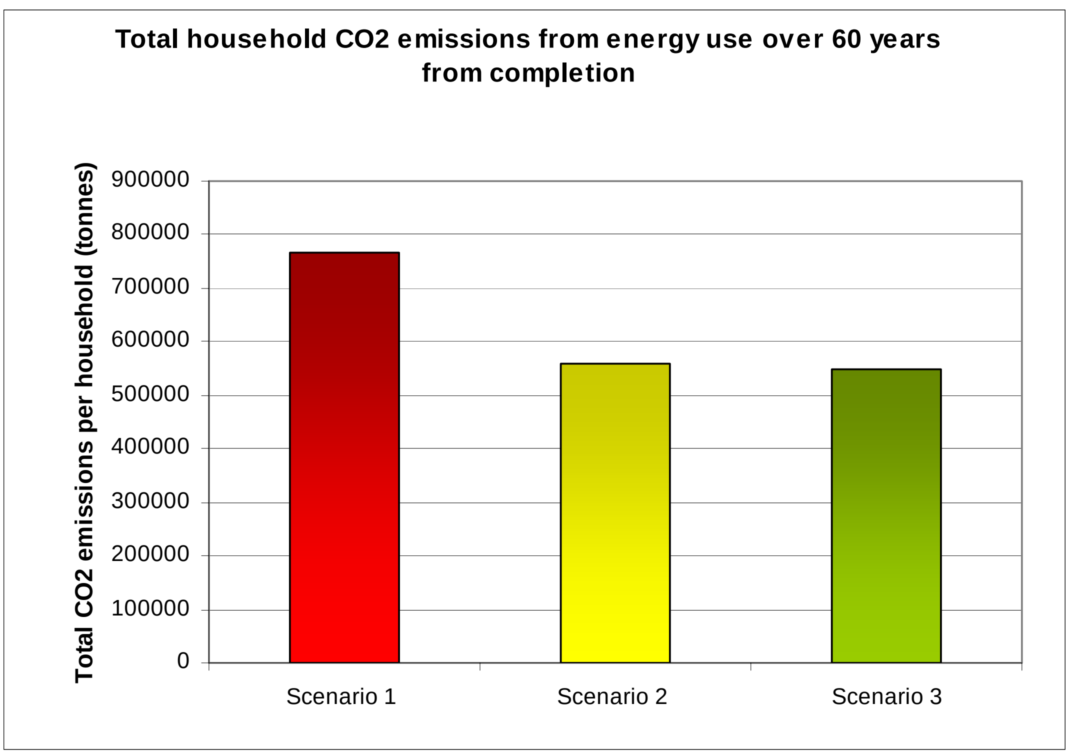

Figure 24: Hinckley & Bosworth Borough Council –total household emissions over 60 years

10.1.1 Hinckley & Bosworth Borough Council –summary of results for homes built pre-2016

Table 38: Hinckley & Bosworth Borough Council – average emissions per household (homes built pre-2016

Average per household per local authority (homes built pre-2016)	**Scenario 1**	**Scenario 2**	**Scenario 3**
Energy	2.55	1.86	1.83
Transport (average)	3.31	3.16	2.79
Waste (CO_2 equivalent)	0.94	0.91	0.84
Total greenhouse gas (tonnes CO_2/year)	6.80	5.92	5.46
Average water usage (m^3 per year)	106.98	95.70	86.97

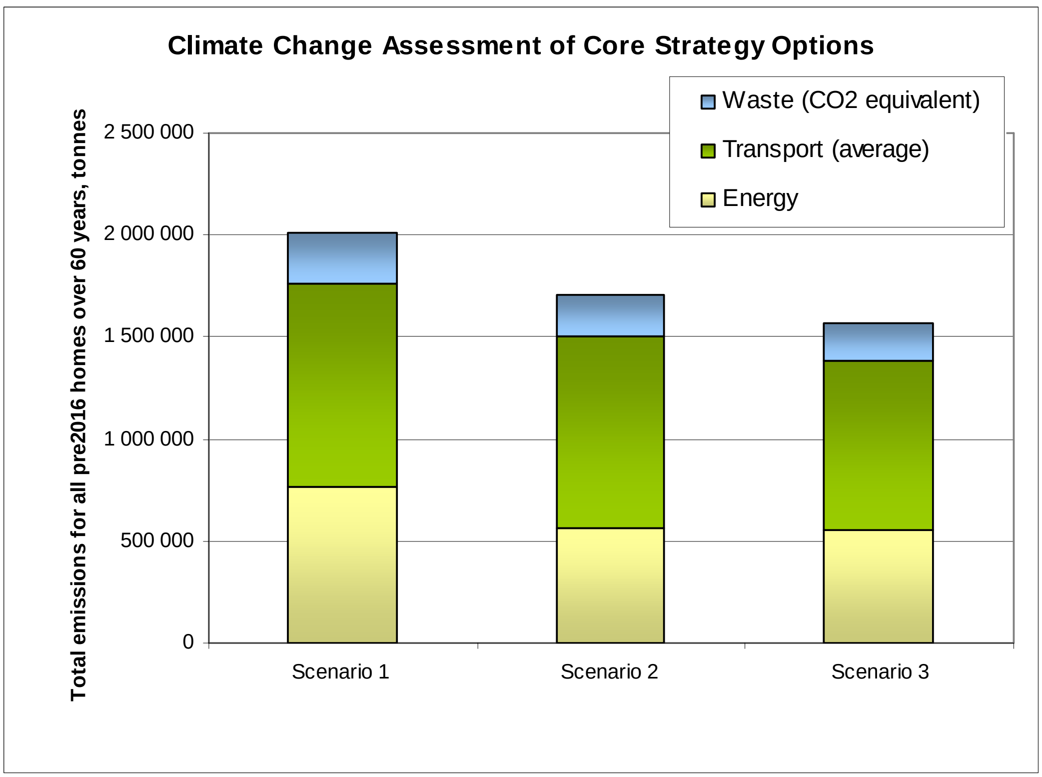

Figure 25: Hinckley & Bosworth Borough Council –total household emissions over 60 years for homes built pre 2016

Table 39: Hinckley & Bosworth Borough Council –household emissions by development option

		Total greenhouse gas emissions, tonnes CO_2 per household per year		
	Option of Core Strategy Issues and Options	Scenario 1	Scenario 2	Scenario 3
Preferred Option	Urban areas	5.6	5.0	4.5
	Rural areas	5.9	5.3	4.8
Other options: Urban areas	Option 1	5.7	5.1	4.6
	Option 2	5.4	5.1	4.7
	Option 3	5.4	4.9	4.4
	Option 4	5.8	5.2	4.7
Other options: Rural areas	Option 1	5.9	5.3	4.8
	Option 2	5.9	5.1	4.6
	Option 3	5.9	5.3	4.8
	Option 4	5.9	5.3	4.8
	Average	**5.7**	**5.1**	**4.7**

Table 40: Hinckley & Bosworth Borough Council –total household emissions by development option over 60 years (for all new homes to be built to 2026)

	Option of Core Strategy Issues and Options	Scenario 1 tonnes CO_2	Scenario 2 tonnes CO_2	Scenario 3 tonnes CO_2
Preferred Option	Urban areas	2 629 595	2 233 364	2 055 207
	Rural areas	2 782 548	2 378 670	2 183 687
Other options: Urban areas	Option 1	2 688 522	2 289 345	2 104 706
	Option 2	2 554 440	2 300 460	2 114 533
	Option 3	2 560 183	2 167 423	1 996 901
	Option 4	2 722 803	2 321 912	2 133 501
Other options: Rural areas	Option 1	2 777 678	2 374 043	2 179 596
	Option 2	2 764 665	2 287 793	2 103 333
	Option 3	2 777 678	2 374 043	2 179 596
	Option 4	2 782 548	2 378 670	2 183 687

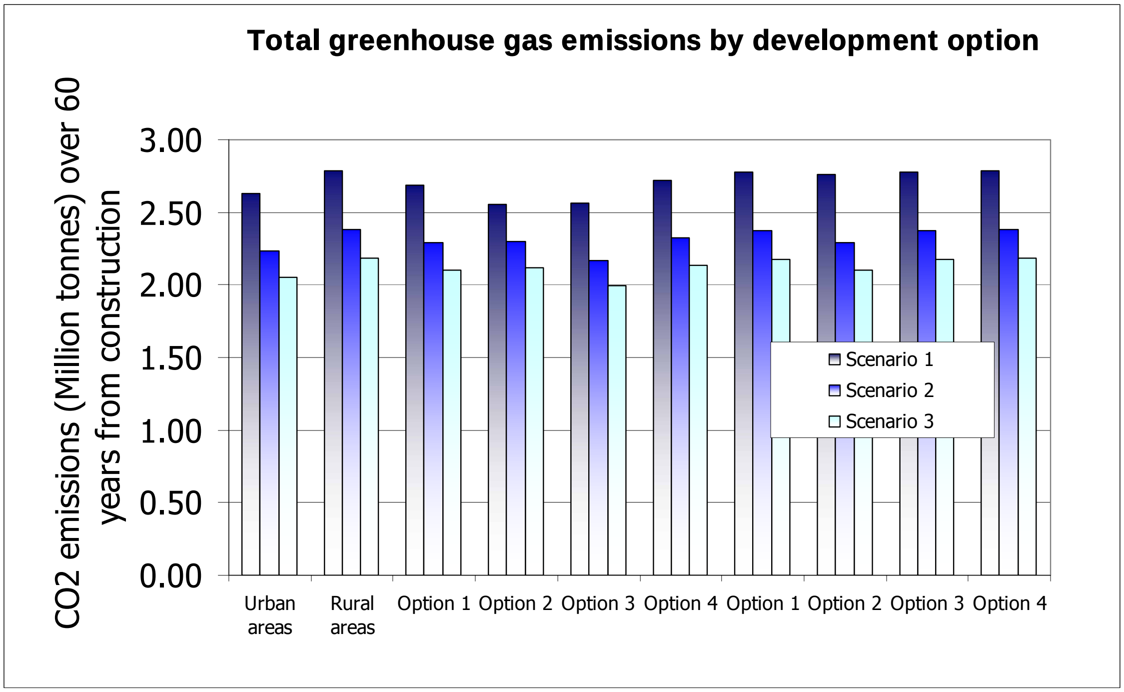

Figure 26: Hinckley & Bosworth Borough Council –total household emissions over 60 years by development option (million tonnes CO_2)

10.2 Summary of findings: Rutland County Council

Table 41: Rutland County Council –average emissions per household

Average emissions per household per year	Scenario 1	Scenario 2	Scenario 3
Energy (tonnes CO_2)	1.20	0.98	0.91
Transport (tonnes CO_2)	3.48	3.32	2.93
Waste (tonnes CO_2 equivalent)	1.13	1.09	0.99
Total greenhouse gas (tonnes CO_2)	5.82	5.39	4.83
Total water usage (m^3)	107	95	84

Table 42: Rutland County Council –total household emissions and water use over 60 years

Total additional emissions per local authority, 60 years from completion	Scenario 1	Scenario 2	Scenario 3
Energy	214 722	165 439	156 323
Transport (average)	480 896	457 669	404 676
Waste (CO_2 equivalent)	253 816	222 643	200 379
Total greenhouse gas (tonnes CO_2)	949 433	845 751	761 378
Water usage (m^3 per year)	14 861 832	13 272 115	11 637 965

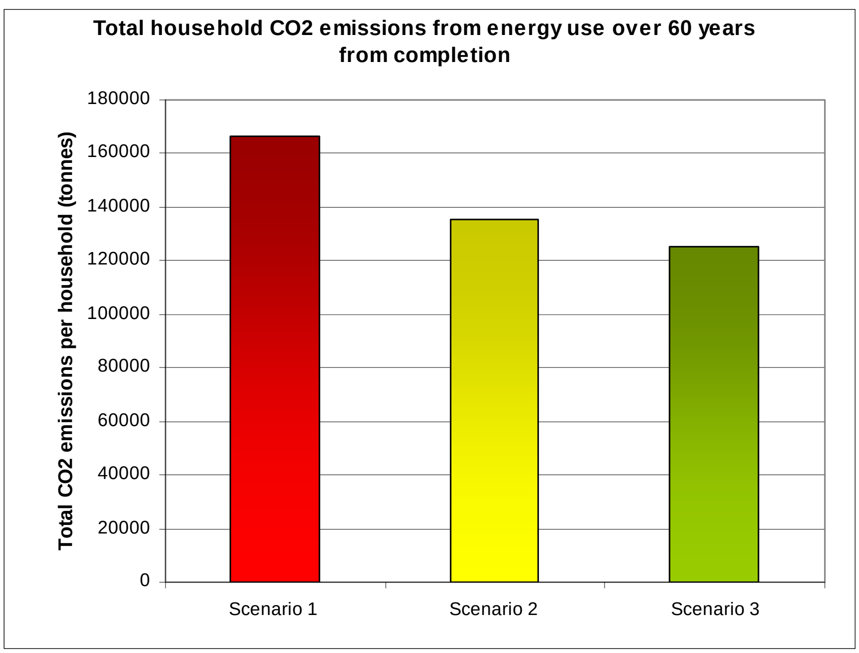

Figure 27: Rutland County Council –total household emissions over 60 years

10.2.1 Rutland County Council –summary of results for homes built pre-2016

Table 43: Rutland County Council – average emissions per household (homes built pre-2016

Average per household per local authority (homes built pre-2016)	Scenario 1	Scenario 2	Scenario 3
Energy	2.60	2.12	1.96
Transport (average)	3.48	3.32	2.93
Waste (CO_2 equivalent)	1.13	1.09	1.01
Total greenhouse gas (tonnes CO_2/year)	7.21	6.53	5.90
Average water usage (m^3 per year)	106.83	95.39	83.64

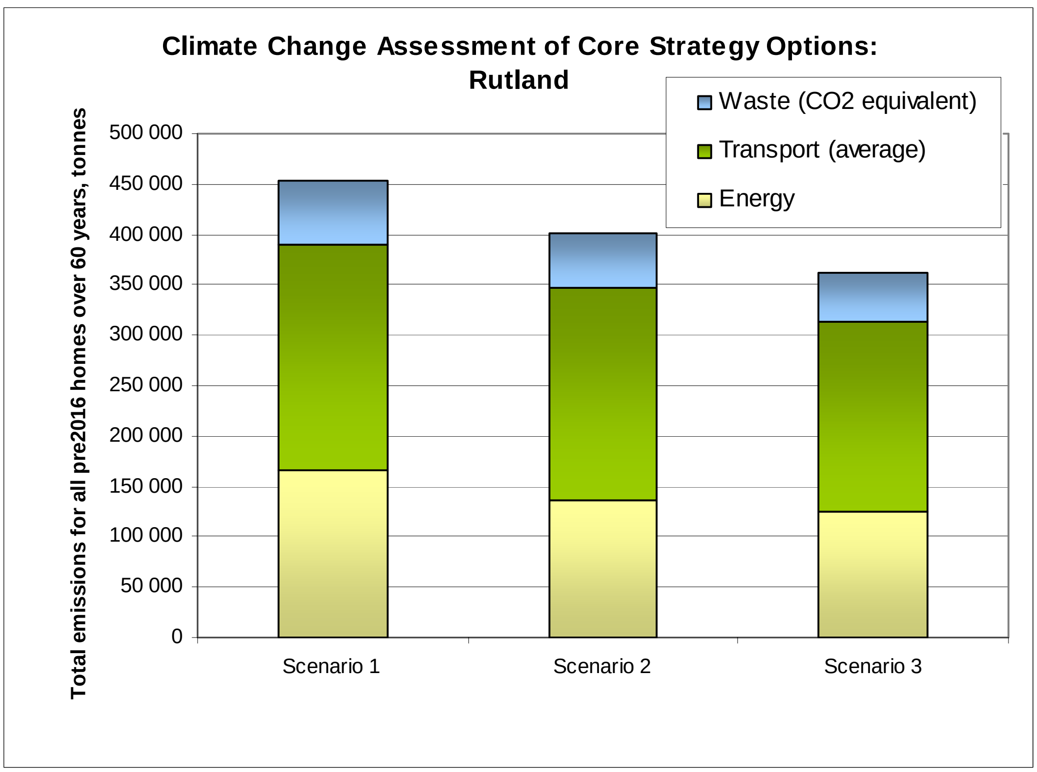

Figure 28: Rutland County Council –total household emissions over 60 years for homes built pre 2016

10.2.2 Rutland County Council –summary of results by development option

Table 44: Rutland County Council –household emissions by development option

		Total greenhouse gas emissions, tonnes CO_2 per household per year		
	Option of Core Strategy Issues and Options	**Scenario 1**	**Scenario 2**	**Scenario 3**
	Option A (High proportion to Oakham and Uppingham)	5.8	5.4	4.8
	Option B (Previous Rutland Local Plan approach)	5.9	5.4	4.9
	Option C (More balanced urban/rural split)	5.9	5.4	4.9
	Average	5.9	5.4	4.9
	a) Majority to Oakham	5.8	5.3	4.8
Oakham /Uppingham split	b) Balanced between Oakham and Uppingham	5.8	5.3	4.8
	c) All development to Oakham	5.8	5.4	4.8
	Average	**5.82**	**5.39**	**4.83**

Table 45: Rutland County Council –total household emissions by development option over 60 years (for all new homes to be built to 2026)

	Option of Core Strategy Issues and Options	**Scenario 1 tonnes CO_2**	**Scenario 2 tonnes CO_2**	**Scenario 3 tonnes CO_2**
	Option A (High proportion to Oakham and Uppingham)	695 955	622 611	560 559
	Option B (Previous Rutland Local Plan approach)	701 458	627 839	565 182
	Option C (More balanced urban/rural split)	704 210	630 453	567 493
	Average	700 541	626 968	564 411
	a) Majority to Oakham	688 586	615 611	554 370
Oakham /Uppingham split	b) Balanced between Oakham and Uppingham	688 120	615 168	553 978
	c) All development to Oakham	690 452	623 108	560 999

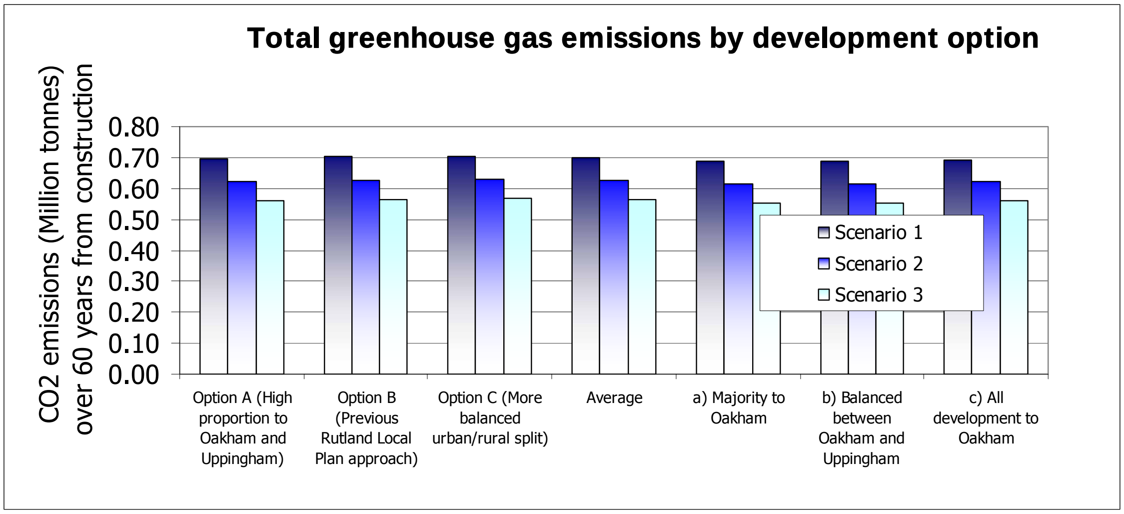

Figure 29: Rutland County Council –total household emissions over 60 years by development option (million tonnes CO_2)

10.3 Summary of findings: Blaby District Council

Table 46: Blaby District Council –average emissions per household

Average emissions per household per year	Scenario 1	Scenario 2	Scenario 3
Energy (tonnes CO_2)	0.99	0.78	0.73
Transport (tonnes CO_2)	3.64	3.46	3.06
Waste (tonnes CO_2 equivalent)	0.97	0.94	0.85
Total greenhouse gas (tonnes CO_2)	5.61	5.19	4.64
Total water usage (m^3)	106	94	81

Table 47: Blaby District Council –total household emissions and water use over 60 years

Total additional emissions per local authority, over 60 years from completion	Scenario 1	Scenario 2	Scenario 3
Energy	595 903	444 432	426 219
Transport (average)	1 531 041	1 454 489	1 286 074
Waste (CO_2 equivalent)	456 929	386 738	348 065
Total greenhouse gas (tonnes CO_2)	2 583 872	2 285 659	2 060 358
Water usage (m^3 per year)	44 386 236	39 367 350	33 788 700

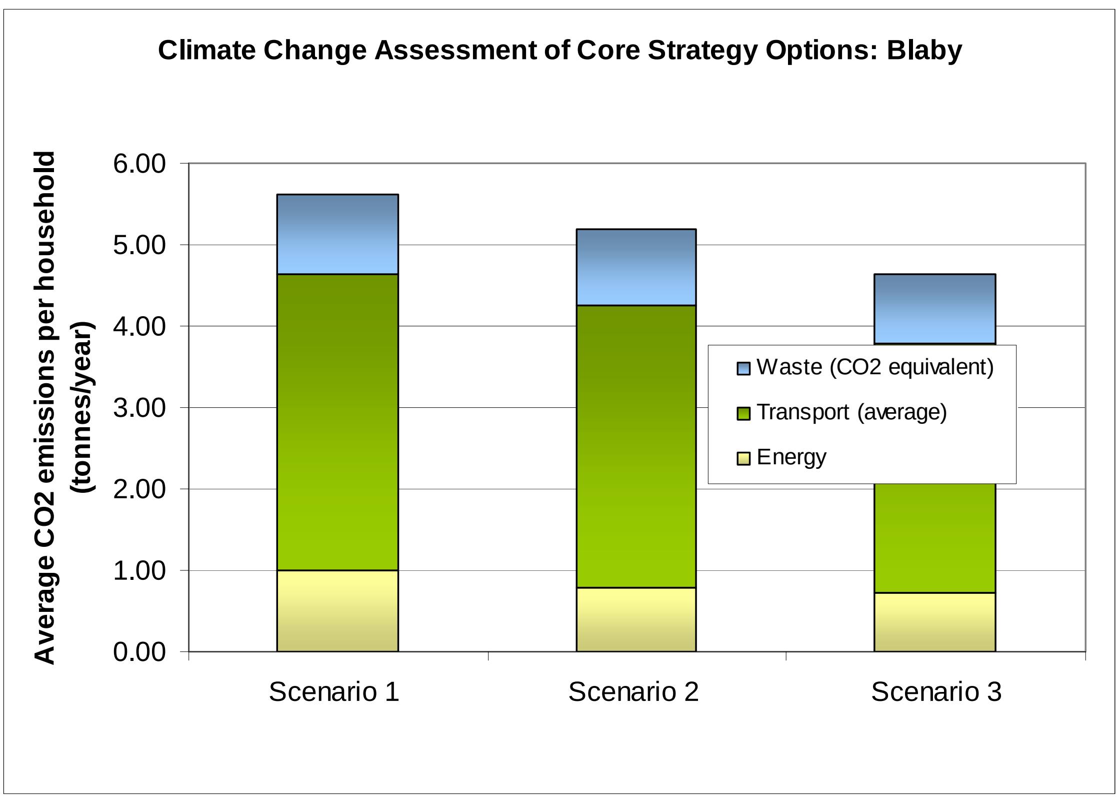

Figure 30: Blaby District Council –total household emissions over 60 years

10.3.1 Blaby District Council –summary of results for homes built pre-2016

Table 48: Blaby District Council – average emissions per household (homes built pre-2016

Average per household per local authority (homes built pre-2016)	Scenario 1	Scenario 2	Scenario 3
Energy	2.60	2.12	1.96
Transport (average)	3.48	3.32	2.93
Waste (CO_2 equivalent)	1.13	1.09	1.01
Total greenhouse gas (tonnes CO_2/year)	7.21	6.53	5.90
Average water usage (m^3 per year)	106.83	95.39	83.64

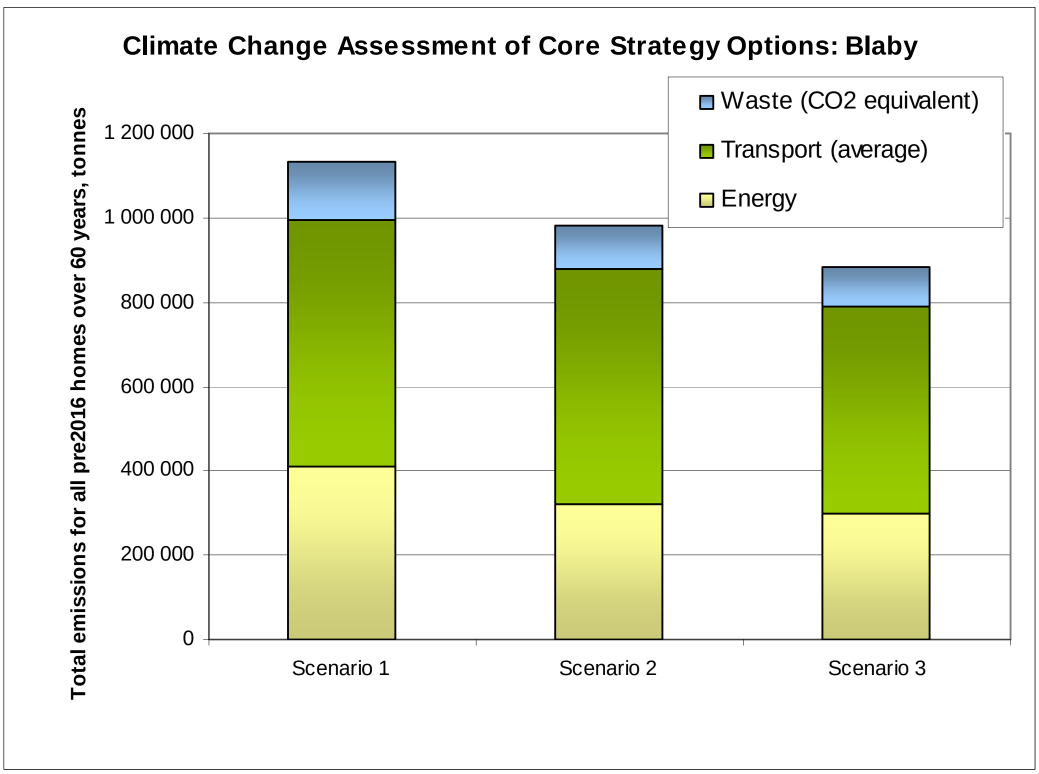

Figure 31: Blaby District Council –total household emissions over 60 years for homes built pre 2016

10.3.2 Blaby District Council –summary of results by development option

Table 49: Blaby District Council –household emissions by development option

	Total greenhouse gas emissions, tonnes CO_2 per household per year		
Option of Core Strategy Issues and Options	**Scenario 1**	**Scenario 2**	**Scenario 3**
Site 1	5.1	4.7	4.2
Site 2	5.7	5.3	4.7
Site 3	6.0	5.5	4.9
Site 4	5.9	5.5	4.9
Site 5	5.7	5.3	4.7
Site 6	5.4	5.0	4.5
Site 7	5.4	5.0	4.5
Site 8	5.7	5.3	4.7
Site 9	5.6	5.1	4.6
Average	**5.61**	**5.19**	**4.64**

Table 50: Blaby District Council –total household emissions by development option over 60 years (for all new homes to be built to 2026)

	Total greenhouse gas emissions, tonnes CO_2		
Option of Core Strategy Issues and Options	**Scenario 1 tonnes CO_2**	**Scenario 2 tonnes CO_2**	**Scenario 3 tonnes CO_2**
Site 1	1 893 990	1 677 615	1 516 612
Site 2	2 131 339	1 903 097	1 715 986
Site 3	2 250 992	2 016 767	1 816 494
Site 4	2 211 107	1 978 876	1 782 990
Site 5	2 147 290	1 918 250	1 729 384
Site 6	2 015 668	1 793 209	1 618 822
Site 7	2 015 668	1 793 209	1 618 822
Site 8	2 131 336	1 903 094	1 715 983
Site 9	2 079 485	1 853 835	1 672 428

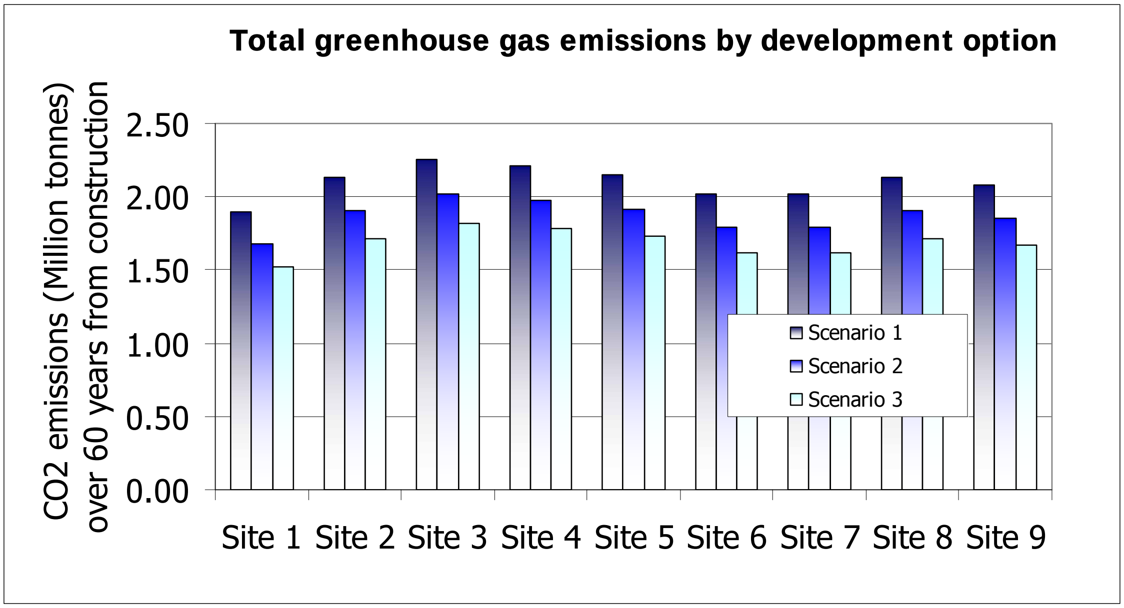

Figure 32: Blaby District Council –total household emissions over 60 years by development option (million tonnes CO_2)

10.4 Summary of findings: Oadby and Wigston Borough Council

Table 51: Oadby and Wigston Borough Council –average emissions per household

Average emissions per household per year	Scenario 1	Scenario 2	Scenario 3
Energy (tonnes CO_2)	1.15	0.92	0.85
Transport (tonnes CO_2)	3.15	2.99	2.64
Waste (tonnes CO_2 equivalent)	0.97	0.94	0.84
Total greenhouse gas (tonnes CO_2)	5.26	4.85	4.34
Total water usage (m^3)	107	95	83

Table 52: Oadby and Wigston Borough Council –total household emissions and water use over 60 years

Total additional emissions per local authority, 60 years from completion	Scenario 1	Scenario 2	Scenario 3
Energy	90 729	68 898	64 202
Transport (average)	214 131	203 424	179 870
Waste (CO_2 equivalent)	96 828	81 911	73 720
Total greenhouse gas (tonnes CO_2)	401 687	354 233	317 792
Water usage (m^3 per year)	7 251 703	6 456 996	5 629 176

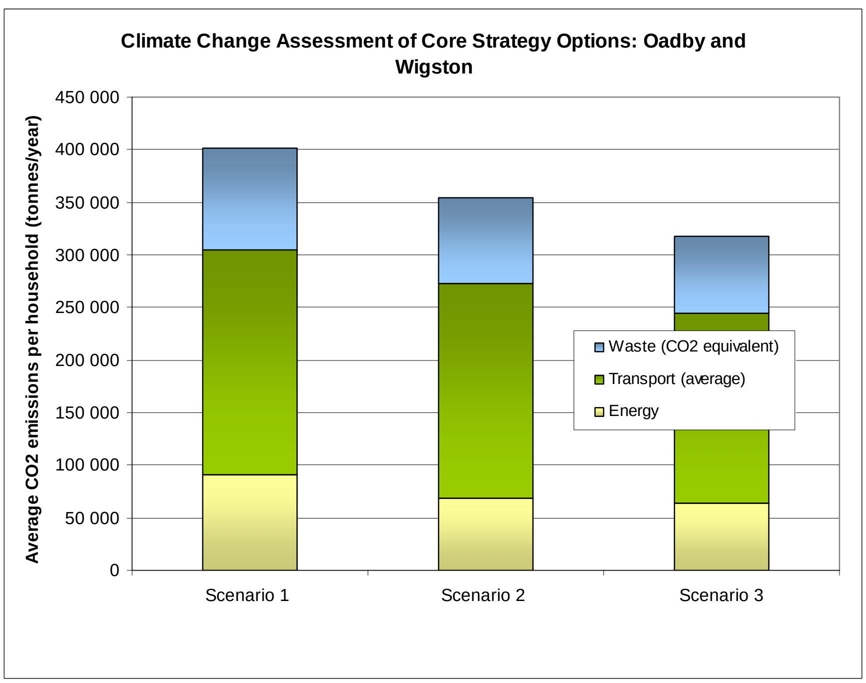

Figure 33: Oadby and Wigston Borough Council –total household emissions over 60 years

10.4.1 Oadby and Wigston Borough Council –summary of results for homes built pre-2016

Table 53: Oadby and Wigston Borough Council – average emissions per household (homes built pre-2016)

Average per household per local authority (homes built pre-2016)	**Scenario 1**	**Scenario 2**	**Scenario 3**
Energy	2.58	2.07	1.92
Transport (average)	3.15	2.99	2.64
Waste (CO_2 equivalent)	0.97	0.94	0.87
Total greenhouse gas (tonnes CO_2/year)	6.69	6.00	5.43
Average water usage (m^3 per year)	107	95	83

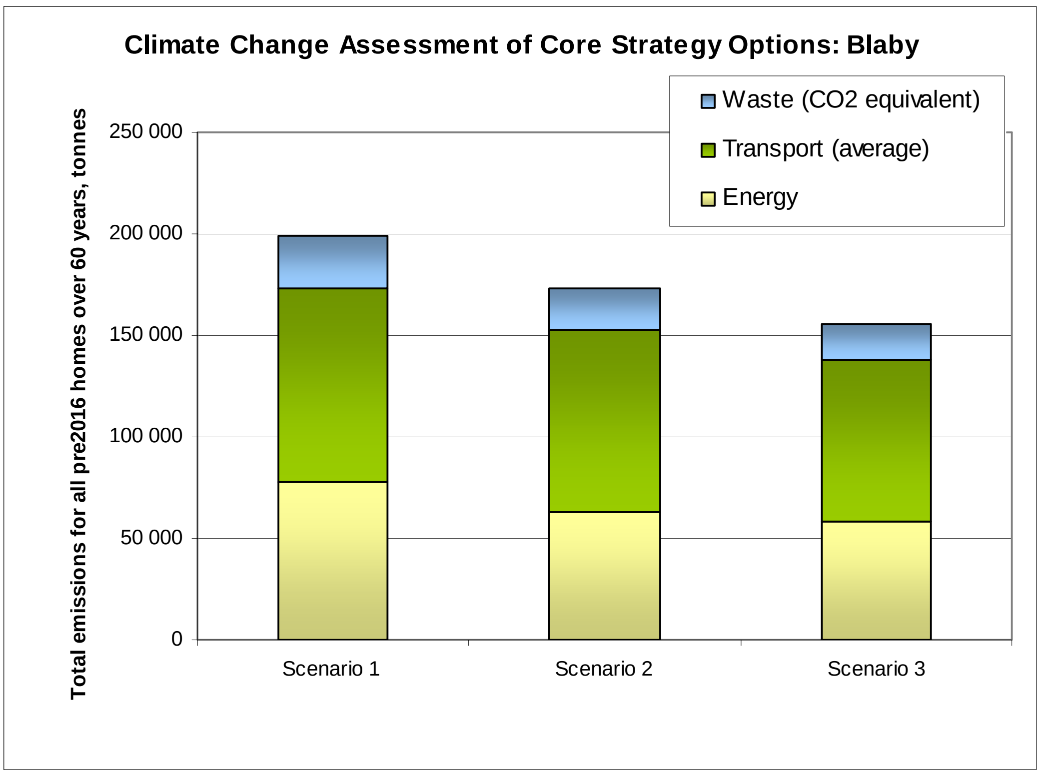

Figure 34: Oadby and Wigston Borough –total household emissions over 60 years for homes built pre 2016

10.4.2 Oadby and Wigston Borough Council –summary of results by development option

Table 54: Oadby and Wigston Borough Council–household emissions by development option

		Total greenhouse gas emissions, tonnes CO_2 per household per year		
	Option of Core Strategy Issues and Options	**Scenario 1**	**Scenario 2**	**Scenario 3**
A	Adjacent to urban area south of South Wigston	5.1	4.7	4.2
B	Adjacent to urban area south of South east of Wigston	5.2	4.8	4.3
C	Adjacent to urban area south of South of Oadby	5.4	5.0	4.5
D	Adjacent to urban area south of South east of Oadby	5.3	4.9	4.4
E	Adjacent to urban area south of North east of Oadby	5.3	4.9	4.4
	Average	**5.26**	**4.85**	**4.34**

Table 55: Oadby and Wigston Borough Council–total household emissions by development option over 60 years (for all new homes to be built to 2026)

	Option of Core Strategy Issues and Options	**Scenario 1 tonnes CO_2**	**Scenario 2 tonnes CO_2**	**Scenario 3 tonnes CO_2**
A	Adjacent to urban area south of South Wigston	292 818	260 883	233 957
B	Adjacent to urban area south of South east of Wigston	301 053	268 706	240 875
C	Adjacent to urban area south of South of Oadby	316 972	283 830	254 247
D	Adjacent to urban area south of South east of Oadby	306 726	274 096	245 640
E	Adjacent to urban area south of North east of Oadby	306 726	274 096	245 640

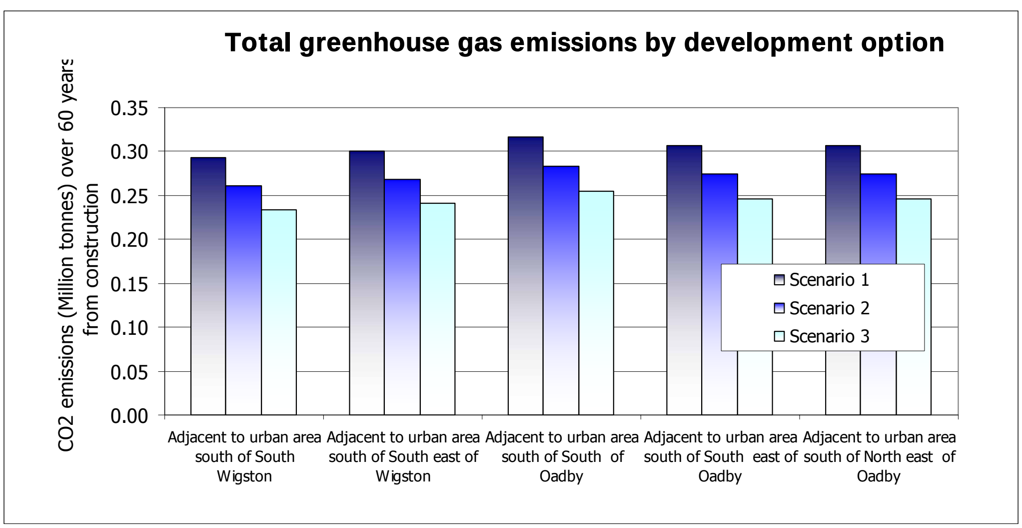

Figure 35: Oadby and Wigston Borough Council –total household emissions over 60 years by development option (million tonnes CO_2)

10.5 Summary of findings: North West Leicestershire District Council

Table 56: North West Leicestershire District Council –average emissions per household

Average emissions per household per year	Scenario 1	Scenario 2	Scenario 3
Energy (tonnes CO_2)	1.19	0.87	0.79
Transport (tonnes CO_2)	3.25	3.09	2.73
Waste (tonnes CO_2 equivalent)	1.01	0.98	0.88
Total greenhouse gas (tonnes CO_2)	5.44	4.93	4.40
Total water usage (m^3)	106.0	93.8	80.0

Table 57: North West Leicestershire District Council –total household emissions and water use over 60 years

Total additional emissions per local authority, 60 years from completion	Scenario 1	Scenario 2	Scenario 3
Energy	1 229 671	860 156	715 873
Transport (average)	1900493	1805468	1596414
Waste (CO_2 equivalent)	626 670	530 390	477 351
Total greenhouse gas (tonnes CO_2)	3 756 834	3 196 014	2 789 639
Water usage (m^3 per year)	64 067 206	56 718 032	48 398 338

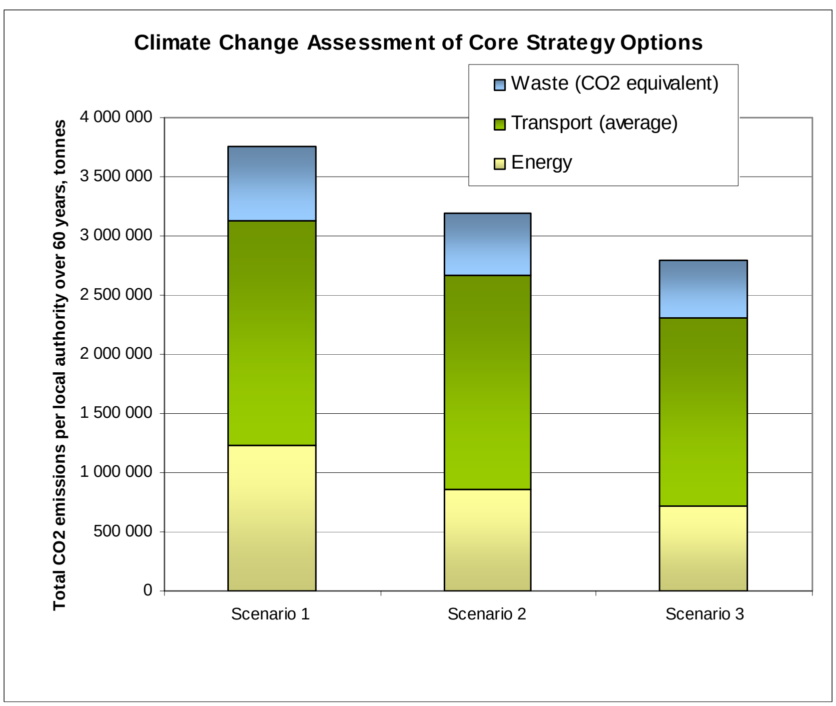

Figure 36: North West Leicestershire District Council –total household emissions over 60 years

10.5.1 North West Leicestershire District Council –summary of results for homes built pre-2016

Table 58: North West Leicestershire District Council – average emissions per household (homes built pre-2016)

Average per household per local authority (homes built pre-2016)	Scenario 1	Scenario 2	Scenario 3
Energy	3.24	2.37	2.16
Transport (average)	3.25	3.09	2.73
Waste (CO_2 equivalent)	1.01	0.98	0.91
Total greenhouse gas (tonnes CO_2/year)	7.50	6.43	5.80
Average water usage (m^3 per year)	106.04	93.83	79.95

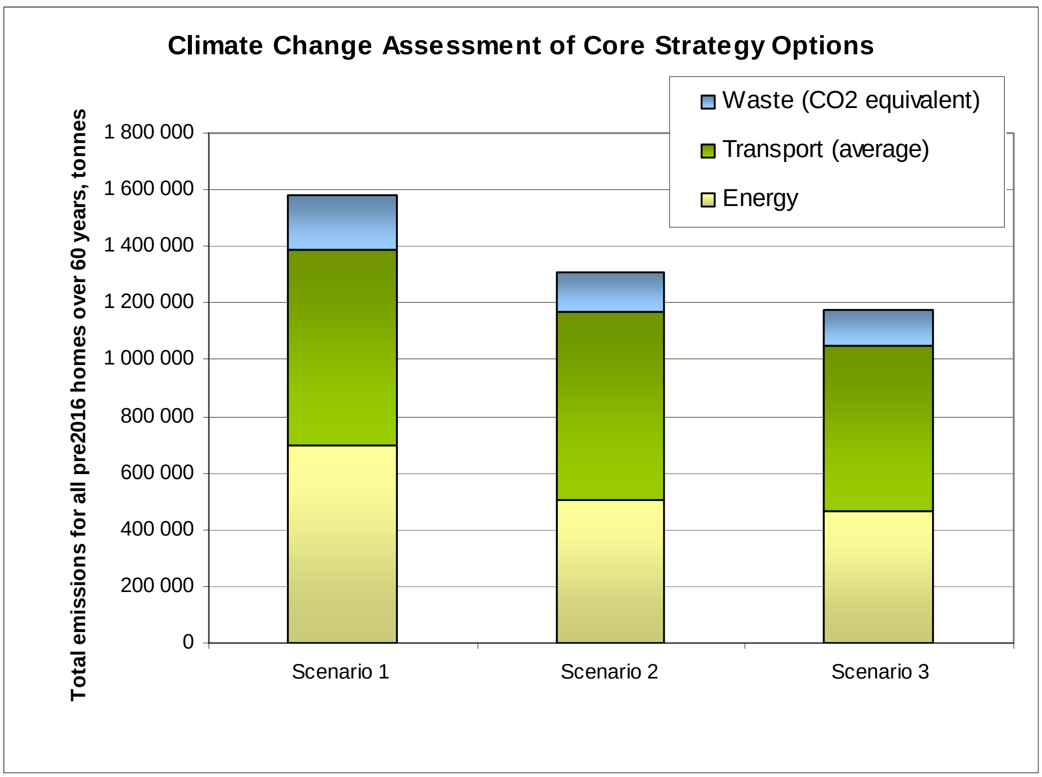

Figure 37: North West Leicestershire District Council –total household emissions over 60 years for homes built pre 2016

10.5.2 North West Leicestershire District Council –summary of results by development option

Table 59: North West Leicestershire District Council –household emissions by development option

	Total greenhouse gas emissions, tonnes CO_2 per household per year		
Option of Core Strategy Issues and Options	**Scenario 1**	**Scenario 2**	**Scenario 3**
Option 1	5.3	4.8	4.2
Option 2	5.4	4.9	4.4
Option 3	5.3	4.8	4.3
Option 4	5.4	4.9	4.4
Option 5	5.8	5.2	4.7

Table 60: North West Leicestershire District Council –total household emissions by development option over 60 years (for all new homes to be built to 2026)

Option of Core Strategy Issues and Options	Scenario 1 tonnes CO_2	Scenario 2 tonnes CO_2	Scenario 3 tonnes CO_2
Option 1	3 024 519	2 565 262	2 223 546
Option 2	3 113 147	2 649 458	2 297 994
Option 3	3 068 833	2 607 360	2 260 770
Option 4	3 130 909	2 666 332	2 312 913
Option 5	3 313 411	2 839 709	2 466 215

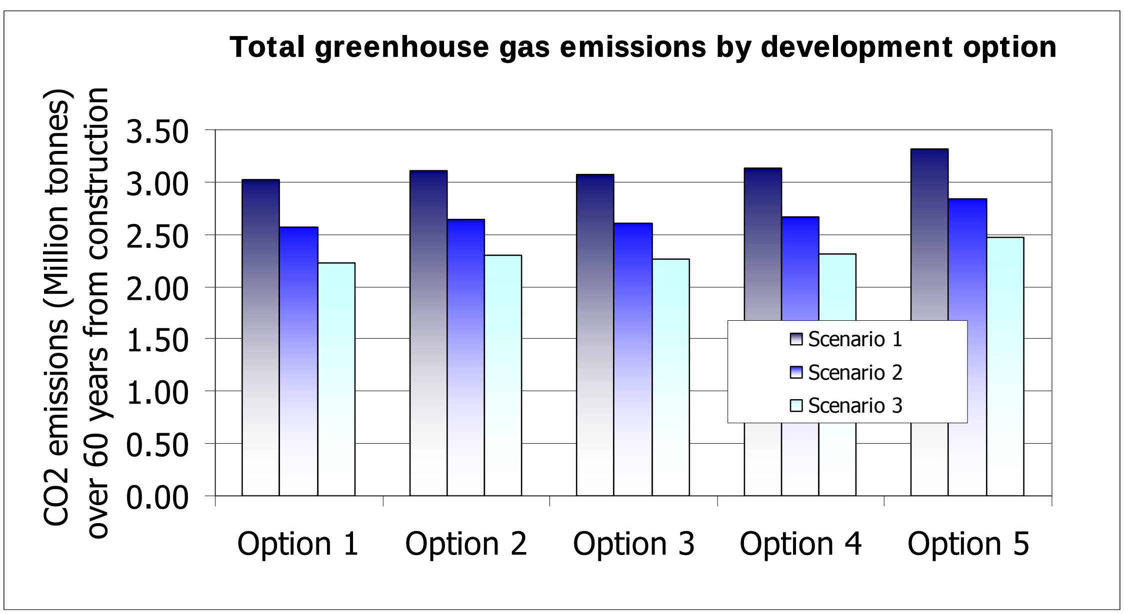

Figure 38: North West Leicestershire District Council –total household emissions over 60 years by development option (million tonnes CO_2)

10.6 Summary of findings: North West Leicestershire District Council

Table 61: North West Leicestershire District Council –average emissions per household

Average emissions per household per year	Scenario 1	Scenario 2	Scenario 3
Energy (tonnes CO_2)	1.19	0.87	0.79
Transport (tonnes CO_2)	3.25	3.09	2.73
Waste (tonnes CO_2 equivalent)	1.01	0.98	0.88
Total greenhouse gas (tonnes CO_2)	5.44	4.93	4.40
Total water usage (m^3)	106.0	93.8	80.0

Table 62: North West Leicestershire District Council –total household emissions and water use over 60 years

Total additional emissions per local authority, 60 years from completion	Scenario 1	Scenario 2	Scenario 3
Energy	1 229 671	860 156	715 873
Transport (average)	1900493	1805468	1596414
Waste (CO_2 equivalent)	626 670	530 390	477 351
Total greenhouse gas (tonnes CO_2)	3 756 834	3 196 014	2 789 639
Water usage (m^3 per year)	64 067 206	56 718 032	48 398 338

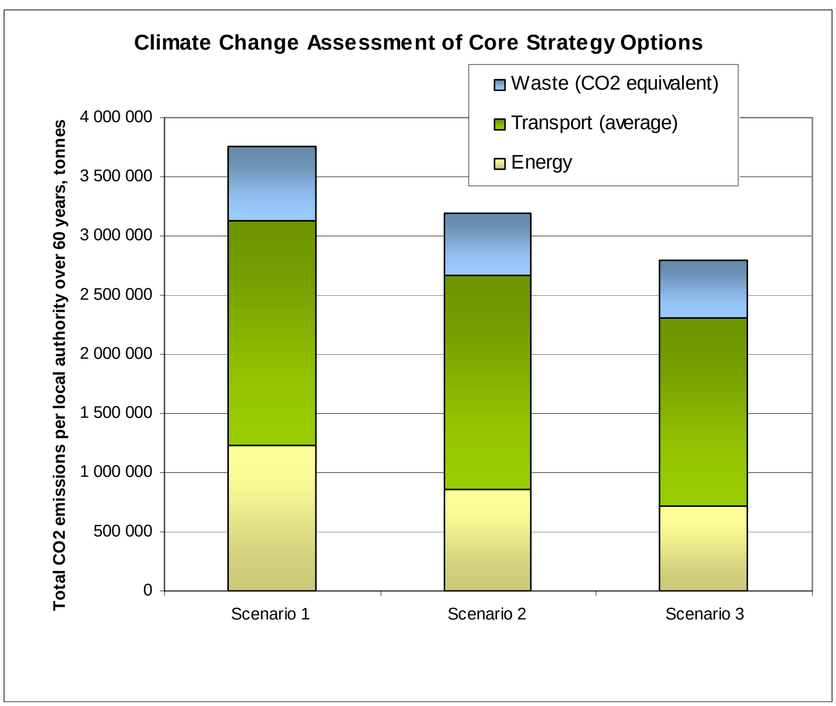

Figure 39: North West Leicestershire District Council –total household emissions over 60 years

10.6.1 North West Leicestershire District Council –summary of results for homes built pre-2016

Table 63: North West Leicestershire District Council – average emissions per household (homes built pre-2016)

Average per household per local authority (homes built pre-2016)	Scenario 1	Scenario 2	Scenario 3
Energy	3.24	2.37	2.16
Transport (average)	3.25	3.09	2.73
Waste (CO_2 equivalent)	1.01	0.98	0.91
Total greenhouse gas (tonnes CO_2/year)	7.50	6.43	5.80
Average water usage (m^3 per year)	106.04	93.83	79.95

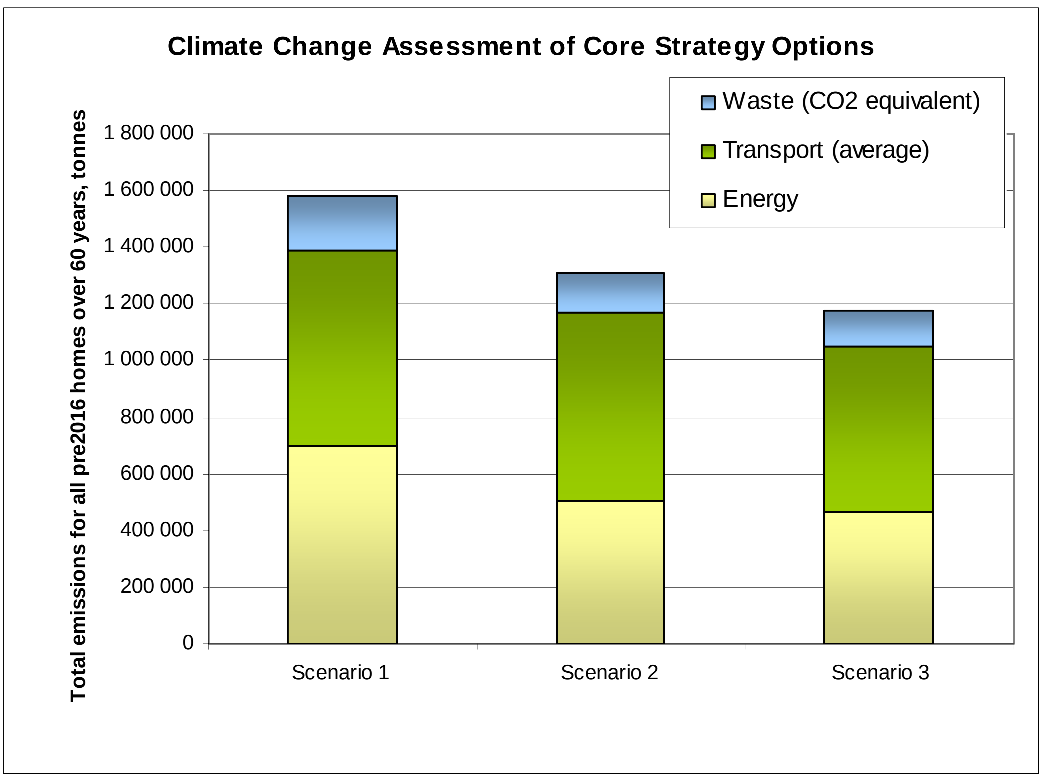

Figure 40: North West Leicestershire District Council –total household emissions over 60 years for homes built pre 2016

10.6.2 North West Leicestershire District Council –summary of results by development option

Table 64: North West Leicestershire District Council –household emissions by development option

	Total greenhouse gas emissions, tonnes CO_2 per household per year		
Option of Core Strategy Issues and Options	**Scenario 1**	**Scenario 2**	**Scenario 3**
Option 1	5.3	4.8	4.2
Option 2	5.4	4.9	4.4
Option 3	5.3	4.8	4.3
Option 4	5.4	4.9	4.4
Option 5	5.8	5.2	4.7

Table 65: North West Leicestershire District Council –total household emissions by development option over 60 years (for all new homes to be built to 2026)

Option of Core Strategy Issues and Options	Scenario 1 tonnes CO_2	Scenario 2 tonnes CO_2	Scenario 3 tonnes CO_2
Option 1	3 024 519	2 565 262	2 223 546
Option 2	3 113 147	2 649 458	2 297 994
Option 3	3 068 833	2 607 360	2 260 770
Option 4	3 130 909	2 666 332	2 312 913
Option 5	3 313 411	2 839 709	2 466 215

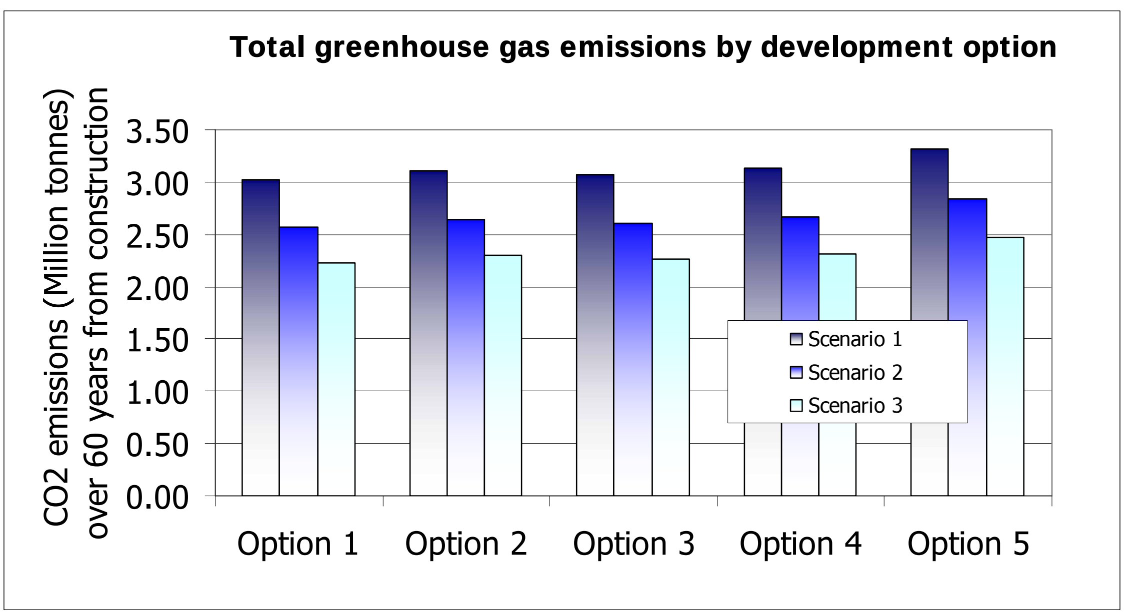

Figure 41: North West Leicestershire District Council –total household emissions over 60 years by development option (million tonnes CO_2)

10.7 Summary of findings: Harborough District Council

Table 66: Harborough District Council –average emissions per household

Average emissions per household per year	Scenario 1	Scenario 2	Scenario 3
Energy (tonnes CO_2)	1.09	0.82	0.81
Transport (tonnes CO_2)	3.50	3.33	2.94
Waste (tonnes CO_2 equivalent)	1.94	1.94	1.75
Total greenhouse gas (tonnes CO_2)	6.53	6.09	5.50
Total water usage (m^3)	107	95	82

Table 67: Harborough District Council –total household emissions and water use over 60 years

Total additional emissions per local authority, 60 years from completion	Scenario 1	Scenario 2	Scenario 3
Energy	496 848	356 714	351 583
Transport (average)	1 379 366	1 310 398	1 158 668
Waste (CO_2 equivalent)	1 126 730	1 126 730	1 014 057
Total greenhouse gas (tonnes CO_2)	3 002 944	2 793 842	2 524 308
Water usage (m^3 per year)	41 887 692	37 263 726	32 277 096

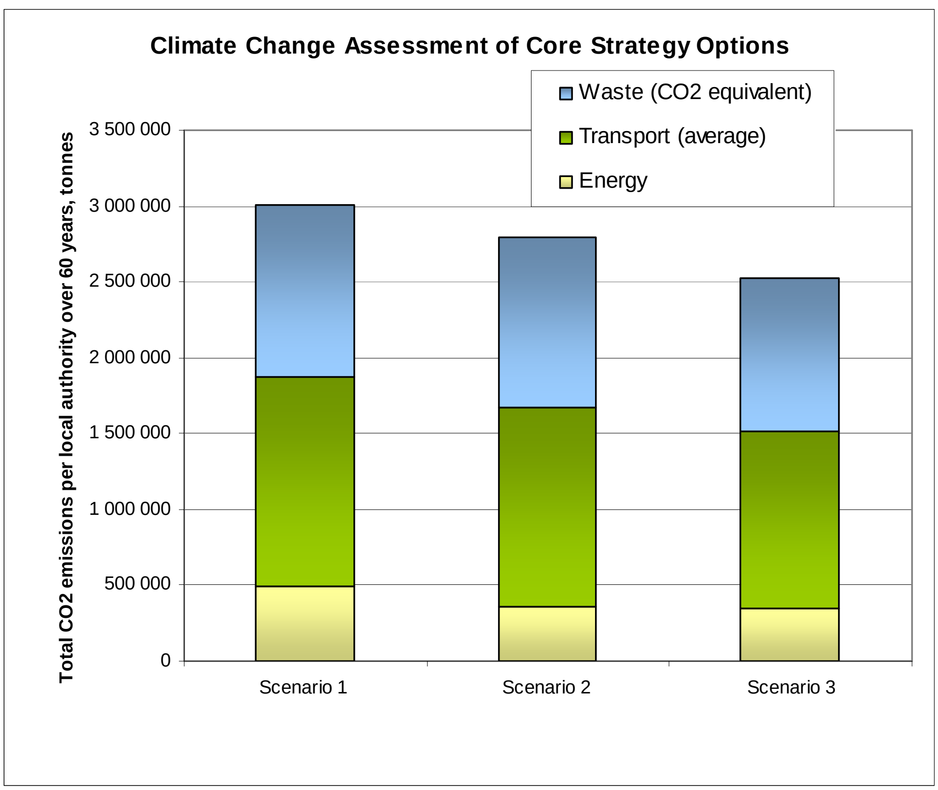

Figure 42: Harborough District Council –total household emissions over 60 years

10.7.1 Harborough District Council –summary of results for homes built pre-2016

Table 68: Harborough District Council – average emissions per household (homes built pre-2016

Average per household per local authority (homes built pre-2016)	**Scenario 1**	**Scenario 2**	**Scenario 3**
Energy	2.58	1.95	1.92
Transport (average)	3.50	3.33	2.94
Waste (CO_2 equivalent)	1.94	1.94	1.75
Total greenhouse gas (tonnes CO_2/year)	8.03	7.22	6.61
Average water usage (m^3 per year)	107	95	82

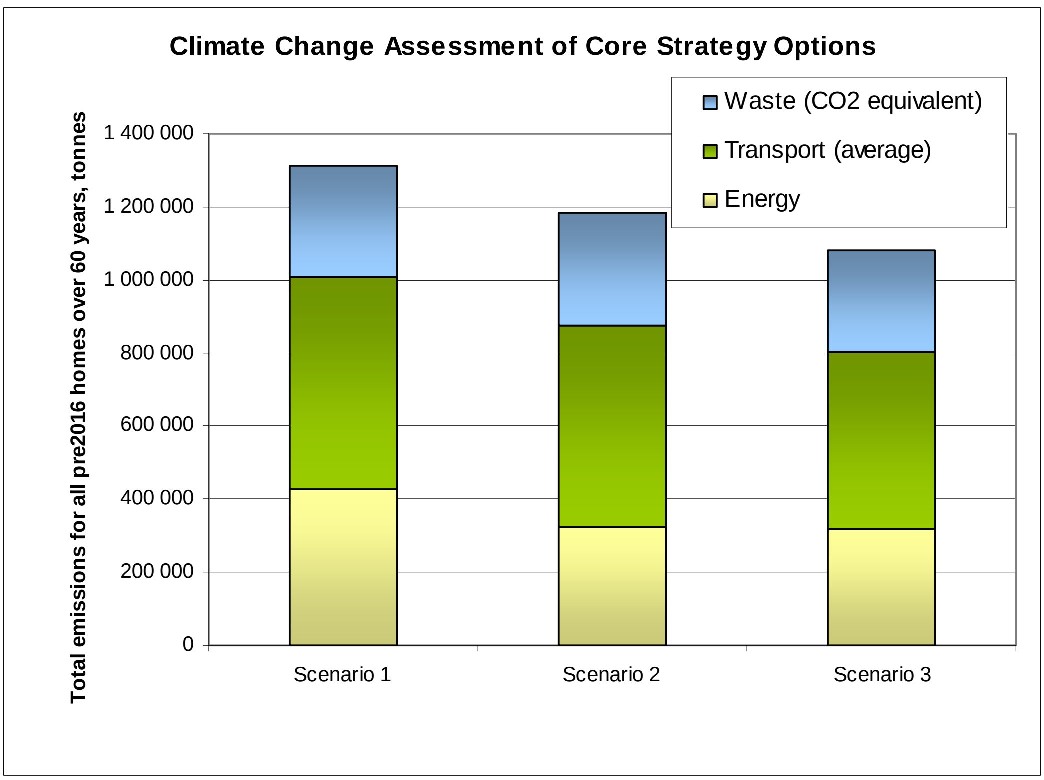

Figure 43: Harborough District Council –total household emissions over 60 years for homes built pre 2016

10.7.2 Harborough District Council –summary of results by development option

Table 69: Harborough District Council –household emissions by development option

	Total greenhouse gas emissions, tonnes CO_2 per household per year		
Option of Core Strategy Issues and Options	**Scenario 1**	**Scenario 2**	**Scenario 3**
Option 1	6.5	6.1	5.5
Option 2	6.5	6.0	5.5
Option 3	6.5	6.0	5.4
Option 4	6.5	6.1	5.5
Option 5	6.7	6.2	5.6
Option 6	6.5	6.1	5.5
Option 7	6.6	6.1	5.5
Average	**6.54**	**6.10**	**5.50**

Table 70: Harborough District Council –total household emissions by development option over 60 years (for all new homes to be built to 2026)

Option of Core Strategy Issues and Options	Scenario 1 tonnes CO_2	Scenario 2 tonnes CO_2	Scenario 3 tonnes CO_2
Option 1	1 866 499	1 657 883	1 502 090
Option 2	1 855 693	1 647 617	1 493 013
Option 3	1 844 886	1 637 351	1 483 936
Option 4	1 874 809	1 665 778	1 509 071
Option 5	1 930 275	1 718 470	1 555 662
Option 6	1 878 715	1 669 488	1 512 352
Option 7	1 882 621	1 673 199	1 515 633

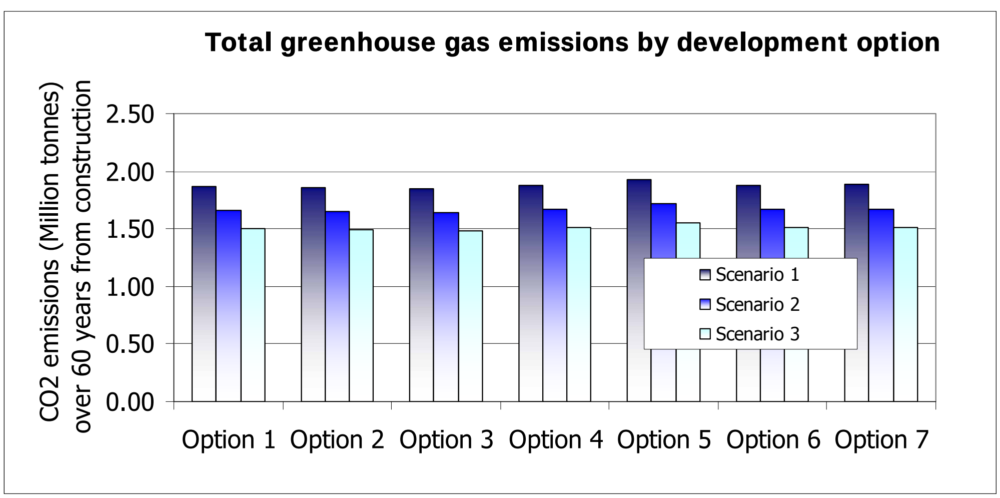

Figure 44: Harborough District Council –total household emissions over 60 years by development option (million tonnes CO_2)

10.8 Summary of findings: Melton District Council

Table 71: Melton District Council –average emissions per household

Average emissions per household per year	Scenario 1	Scenario 2	Scenario 3
Energy (tonnes CO_2)	1.29	1.10	0.84
Transport (tonnes CO_2)	3.58	3.41	3.01
Waste (tonnes CO_2 equivalent)	0.88	0.85	0.77
Total greenhouse gas (tonnes CO_2)	5.76	5.36	4.62
Total water usage (m^3)	107	96	84

Table 72: Melton District Council –total household emissions and water use over 60 years

Total additional emissions per local authority, 60 years from completion	Scenario 1	Scenario 2	Scenario 3
Energy	422 054	338 343	251 798
Transport (average)	765 214	726 953	642 779
Waste (CO_2 equivalent)	327 280	276 778	249 101
Total greenhouse gas (tonnes CO_2)	1 514 548	1 342 075	1 143 678
Water usage (m^3 per year)	23 430 564	20 956 633	18 505 303

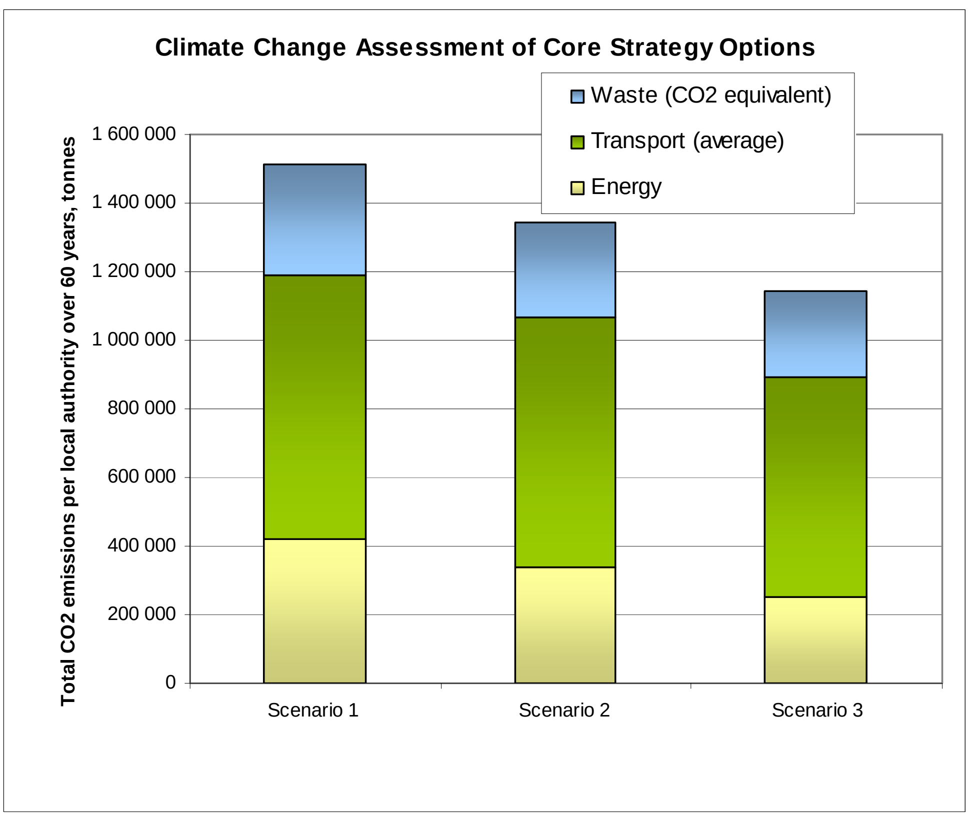

Figure 45: Melton District Council –total household emissions over 60 years

10.8.1 Melton District Council –summary of results for homes built pre-2016

Table 73: Melton District Council – average emissions per household (homes built pre-2016

Average per household per local authority (homes built pre-2016)	Scenario 1	Scenario 2	Scenario 3
Energy	2.64	2.26	1.71
Transport (average)	0.00	0.00	0.00
Waste (CO_2 equivalent)	0.88	0.85	0.80
Total greenhouse gas (tonnes CO_2/year)	3.52	3.12	2.51
Average water usage (m^3 per year)	106.95	95.64	84.44

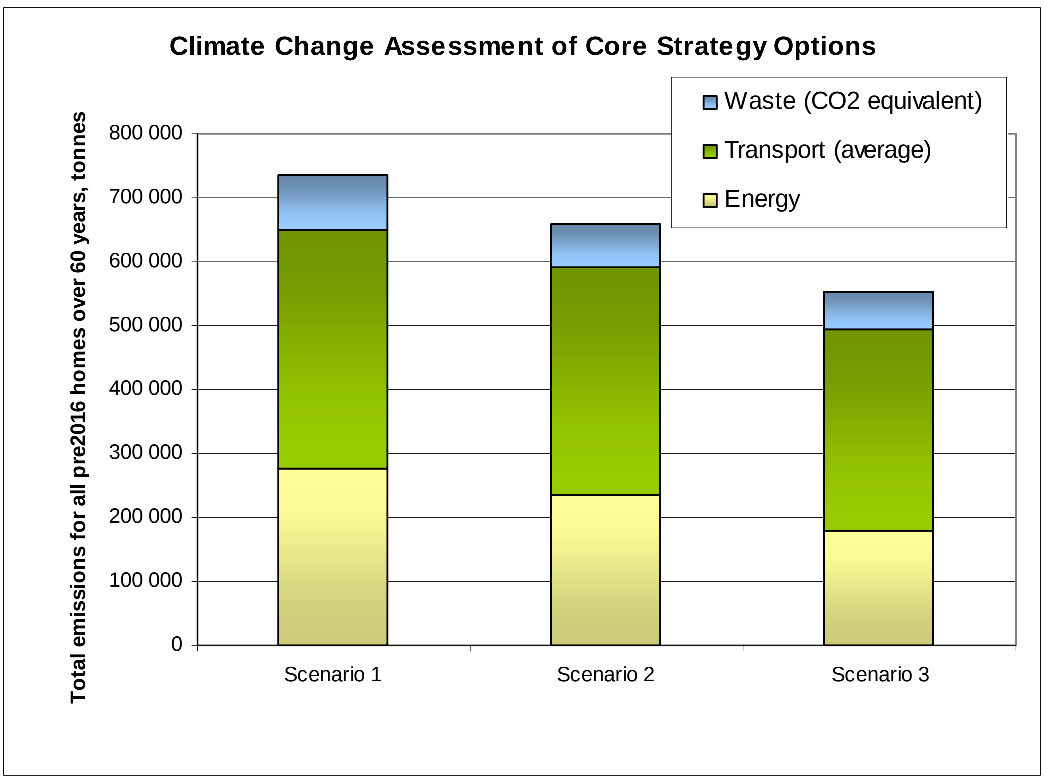

Figure 46: Melton District Council –total household emissions over 60 years for homes built pre 2016

10.8.2 Melton District Council –summary of results by development option

Table 74: Melton District Council –household emissions by development option

	Total greenhouse gas emissions, tonnes CO_2 per household per year		
Option of Core Strategy Issues and Options	**Scenario 1**	**Scenario 2**	**Scenario 3**
Option 1	5.7	5.3	4.6
Option 2	5.8	5.4	4.6
Option 3	5.8	5.4	4.6
Average	**5.76**	**5.36**	**4.62**

Table 75: Melton District Council –total household emissions by development option over 60 years (for all new homes to be built to 2026)

Option of Core Strategy Issues and Options	Scenario 1 tonnes CO_2	Scenario 2 tonnes CO_2	Scenario 3 tonnes CO_2
Option 1	1 181 853	1 060 153	890 029
Option 2	1 187 643	1 065 653	894 892
Option 3	1 192 306	1 070 083	898 810

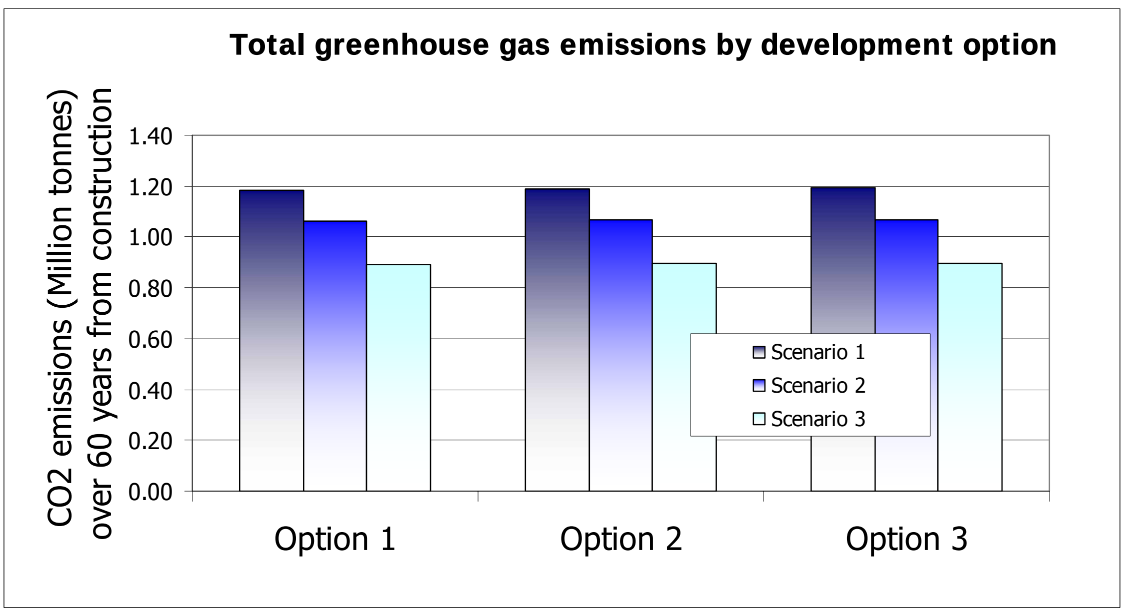

Figure 47: Melton District Council –total household emissions over 60 years by development option (million tonnes CO_2)

ANNEX 1: DEVELOPMENT OPTIONS

Hinckley & Bosworth Borough Council

Housing - Hinckley & Bosworth

Total no. houses to be provided 2001-2026	**11500**	Ref: Table 1, page 19 of LDF Core Strategy Preferred Options, Sept 2007
Existing supply		
Completions (2001-2007)	3123	
Commitments	1539	
Small site commitments	360	
Urban Housing Potential sites 2006-2016	1531	
Urban Housing Potential sites 2006-2016	1300	
Total supply	**7853**	
No. houses to find land for	**3647**	

Total no. houses included in Urban and Rural options		3600
Therefore total no. homes to be built	8330	
40% to be affordable housing, of which 75% social renting		1080

Preferred option: Urban areas Total to 2026 2800 40% to be affordable housing of which 75% social renting

No. homes to 2016 assume 181 per year

1180	Hinckley
110	Burbage
70	Barwell
85	Earl Shilton

In addition:

No. homes 2016-2026

1300 windfall sites dist amongst Hinckley, Burbage, Barwell, Earl Shilton, Desford, Ratby. Markfield, Groby, Market Bosworth, Barlestone, Newbold Verdon, Stoke Golding, Bagworth, thornton)

Sustainable Urban Extension to the south of Earl Shilton

2000 Post 2013 assume half by 1016

Sustainable Urban Extension to the West of Barwell

800 Post 2013 assume half by 1016

1700 **(post 2026)**

2500

Preferred option: Rural areas 40% to be affordable housing

800 homes in total

assume 56 per year to 2016

No. homes to 2016	total No. homes to 2026	
15	60	Desford
65	60	Groby
25	60	Ratby
125	60	Bagworth
15	60	Barlestone
	60	Markfield and Fieldhead
	60	Thornton
	60	Market Bosworth
	60	Newbold Verdon
	60	Stoke Golding
Total : 245	600	Key Rural Centres

200 Rural Villages (distributed)

Housing -Other options - Hinckley & Borsworth

Urban (4 options)

Option 1	Urban Extension to the East of Burbage	1 large SUE of 4500 dwellings to the east of burbage (Areas 1& 2) of which 1700 after 2026
Option 2	Urban Extension to the NW of Hinckley	1 large SUE of 4500 dwellings to the NW Hinckley (Area 4) of which 1700 after 2026
Option 3	Urban Extension to the east of Hinckley	1 large SUE of 4500 dwellings to the E Hinckley (Area 5) of which 1700 after 2026
Option 4	New Settlement	4500 dwellings somewhere in Borough of which 1700 after 2026

Rural (5 Options)

Option 1 Focus development on 10 Key Rural Centres

1	Desford	80
2	Groby	80
3	Ratby	80
4	Bagworth	80
5	Barlestone	80
6	Markfield and Fieldhead	80
7	Thornton	80
8	Market Bosworth	80
9	Newbold Verdon	80
10	Stoke Golding	80
		800

Option 2 Focus development on the Key Rural Centres relating to Leicester (Groby, Ratby, Markfield and Desford)

1	Desford	200
2	Groby	200
3	Ratby	200
4	Markfield and Fieldhead	200
		800

Option 3 Focus development on one of the Key Rural Centres
One centre 800 significant development in one place to allow improvement in economic, social, green and transport infrastructure

Option 4 Focus development in the Key Rural Centres followed by limited development in Rural Villages (THIS IS THE PREFERRED OPTION)

Option 5 Spread development equally amongst Key Rural Centres, Rural Villages and Rural Hamlets

Trajectory for analysis	*[2008-2009]*	*[2010-2012]*	*[2013-2015]*	*After 2016*	Totals
Supply	1068	1417	681	1564	4730
Options	111	167	1567	1755	3600
total	**1179**	**1584**	**2248**	**3319**	**8330**

Supply numbers taken from Appendix 2 of LDF Core Strategy Preferred Options, September 2007
Options numbers taken from numbers given within pages 24 and 31 of above document

Employment development Hinckley & Bosworth

	Land	Land	floorspace
	ha	m2	m2
strategic employment site	25	250000	35000
Earl Shilton	2	20000	2800
part of Barwell SUE	15	150000	21000
SMEs within Hinckley	10	100000	14000
Hinckley	2.5	25000	3500

quality managed industrial workspace

	ft2	Midrange	m2
Middleton Lane	10-20000	15000	1393.5
Druid quarter	5000-10000	7500	696.75
Office park within Hinckley Urban area (accesible to railway station	10000-20000	15000	1393.5

Rutland County Council

Housing

Proposed options 03 March 2008

		Oakham and Uppingham	Villages
a) High proportion to Oakham and Uppingham	%	80%	20%
	numbers	1840	460
b) Previous Rutland Local Plan approach	%	60%	40%
	numbers	1380	920
c) More balanced urban/rural split	%	50%	50%
	numbers	1150	1150
2) Oakham/Uppingham split			
Options		**Oakham**	**Uppingham**
a) Majority to Oakham		60%	40%
b) Balanced between Oakham and Uppingham		50%	50%
c) All development to Oakham		100%	0%

No retail studies Confirmed by Malcolm Ainsley

Accessibility indicators - Transport Plan

Trajectory

Information provided 08 Jan 2008
and amended based on above

The Draft East Midlands Regional Plan allocates 170 dwellings per year to Rutland over the period 2001-26: 4250 Total

Remaining requirement

2007-26	2885

Suggested trajectory:	Original	adjusted based on 2300 total	
2008-11	562	448	149
20011-16	774	617	123.453537
2016-21	774	617	
2021-26	774	617	
	2884	**2300**	

Trajectory for analysis:

[2008-2009]	*[2010-2012]*	*[2013-2015]*	*After 2016*	
299	396	370	1235	2300

Employment development Rutland

Expected demand for employment land is expected to be 5-16 hectares

Draft Report on the Evidence Base for Employment Policies in the Core Strategy of the Rutland LDF, January 2008

Total employment land		**Land**	**floorspace**
ha		**m2**	**m2**
	10	100000	14000

Blaby District Council

Housing

Source of housing	Number of houses	Area
Urban Capacity 2006 – 2016*	400	N/A
Urban Capacity 2016 – 2026**	200	N/A
Site 1 (Leicester Forest East)	4 500	250ha +
Site 2 Kirby Muxloe	50	5ha
Site 3 (Earl Shilton)	100	5.3ha
Site 4 (Stoney Stanton)	100	6.4ha
Site 5 (Littlethorpe)	75	5ha
Site 6 (Blaby)	150	7.3ha
Site 7 (Blaby)	150	7.5ha
Site 8 (Whetstone)	200	12ha
Site 9 (Countesthorpe)	150	7.75ha
Smaller identified infill / Greenfield sites (not urban capacity) ***	200	N/A
Total Housing 2001 - 2026	**8 875**	**306.25**

Best estimate 5 year housing supply trajectories*

2001 - 2006 (already completed)	1050		
2006 - 11	1450	290	
2011 - 2016	1800	360	
2016 - 2021	2000	400	
2021 - 2026	2200	440	
	8500		6870

*rounded to the nearest 50. This equates to the 8500 identified in the Regional Plan for the District between 2001 & 2026.

All of these sites are based on preliminary research and may be subject to change.

Trajectory for analysis:

[2008-2009]	*[2010-2012]*	*[2013-2015]*	*After 2016*	
580	1010	1080	4200	6870

Employment development

The quantity of employment land required is not specified in the east Midlands Regional Plan. However, the outstanding requirements of the Leicestershire, Leicester and Rutland Structure Plan, and the findings of the Blaby District Employment land and premises study indicate a requirement for some additional 50 hectares of employment land (25 ha of which should be on a single strategic employment site).

Land	Land	floorspace
ha	**m2**	**m2**
50	500000	70000

Oadby and Wigston Borough Council

Housing

According to draft Regional plan:	Required		Expected
Total to be built 2001-2026		1375	1471
Total to be built 1996-2016		1700	1819

Paragraph 3.1 of Core Strategy Development Plan Document -Supplemental Consultation Issues and Options: Choices and broad locations for growth

55 per year required from 2007 to meet requirement	19 years x 55 houses =	1045
Therefore no. built so far = 1375-1045 =	330	
No. to be built each year to meet expected no.	63	

Trajectory

Built 1996-31 March 2006	1 apr 06 to 31 mar 2016	Total (7% above requirement)
907	912	1819
	(Therefore 79 per year over remaining 10 years of plan to 2016)	

Regional Housing Provision of the draft Regional Plan advocates an average annual build rate of 55 dwellings for the period 2001 – 2026 (equates to **1,375**). The Borough currently achieves an annual build rate of approximately 90 dwellings. The Borough Council is currently challenging the Regional Plan in relation to this figure as such a low annual build rate will mean the Borough may have difficulty meeting its own housing needs especially for affordable housing. The draft Regional Plan does not currently include any local distribution targets for employment land. 0

Options

Freestanding settlement
Redevelopment of brownfield sites and one large sustainable urban extension
Redevelopment of brownfield sites and several sustainable urban extension
Brownfield sites only
SUE sites only

Search areas	description
A	Adajacent to urban area south of South Wigston
B	Adajacent to urban area south of South east of Wigston
C	Adajacent to urban area south of South of Oadby
D	Adajacent to urban area south of South east of Oadby
E	Adajacent to urban area south of North eats of Oadby

North West Leicestershire District Council

Housing

overall Housing 2001-2026	**12000**
Built so far	2263
Under construction/ with planning permission	624
Remainder to be built	9113

Location	**homes**
Ashby de la Zouch	873
Castle Donington	29
Coalville	623
Ibstock	53
Kegworth	500
Measham	551

This leaves 6,484 (Round up to 6500)

Options including the housing numbers above with the split of the 6,500 new homes as follows.

	Option	
Option 1	1. The Coalville Focus Option (All in/ around Coalville)	
	Coalville	6500
Option 2	2. The Coalville and a single rural town focus with Ashby being the single rural town (4,500 in/ around Coallville and 2,000 in/ around Ashby)	
	Coalville	4500
	Ashby	2000
Option 3	3. Coalville focus with a significant amount in a rural town with Ashby being the ruarl town (5,500 in /around Coalville with 1,000 in/ around Ashby)	
	Coalville	5500
	Ashby	1000
Option 4	4. Coalville focus with a significant amount in two of the rural towns, these being Ashby and Castle Donington (4,500 in/ around Coalville, 1,000 in/ around Ashby, 1,000 in/around Castle Donington)	
	Coalville	4500
	Ashby	1000
	Castle Donnington	1000
Option 5	5. The dispersed Option (6,500 split evently between the above 6 named settlements)	
	Ashby de la Zouch	1083
	Castle Donington	1083
	Coalville	1083
	Ibstock	1083
	Kegworth	1083
	Measham	1083
Option 6	6. The new settlement (all 6,500 in a new settlement)	

	[2008-2009]	*[2010-2012]*	*[2013-2015]*	*After 2016*
Trajectories	686	1282	1605	6177

Employment Land North West Leicestershire

Background information can be found on the Core Strategy Additional Consultation Document on the Councils Website (pages 16 - 19)
http://www.nwleics.gov.uk/development%5Fplanning/DisplayArticle.asp?ID=5366
The employment land requirement between 2004 and 2026 is 106.1 Ha of which 7.8 Ha would be offices and 98.3Ha would be Industry & Warehousing.

Land	**Land**	**floorspace**	
ha	**m2**	**m2**	
7.8	78000	10920	Office
98.3	983000	196600	Industry & Warehousing
106.1	**1061000**	**207520**	(location unknown)

Retail Land
Roger Tym & Partners have recently completed their update of the earlier retail Capacity Study of North West Leicestershire which takes the study up to 2026 in line with draft RSS8.
Tables 4.7 and 4.8 of this study identifies the following floorspace requirements-

	Comparison goods	Convenienece goods	total	
2004 – 08	143	21	164	m2
2008 – 11	2543	363	2906	m2
2011 -16	6319	734	7053	m2
2016 – 21	7729	897	8626	m2
2021 – 26	10539	755	11294	m2
Total	27273	2770	30043	

For these figures assume the majority will be focussed on Coalville (70%) with 30% in Ashby. Of some use in terms Coalville town centre is a Masterplan the Council commissioned in 2007 which can be found at-
http://www.nwleics.gov.uk/regeneration
/

Harborough District Council

	Housing	% housing	no. houses	Employment
Option 1	In and around Leicestershire urban fringe	75%	2700-3300	Additional land for business dev located in assoc with housing growth
	Market Harborough	25%	900-1100	
Option 2	In and around Leicestershire urban fringe	50%	1800-2200	Additional land for business dev located in assoc with housing growth
	Market Harborough	50%	1800-2200	
Option 3	In and around Leicestershire urban fringe	25%	900-1100	Major business development in Market Harborough to accompany level of housing delivered
	In and around Market Harborough	75%	2700-3300	
Option 4	In and around Leicestershire urban fringe	37%	1300-1700	
	Market Harborough	37%	1300-1700	
	Lutterworth	25%	900-1100	Appropriate scale employment dev would be delivered both within and on edge of Lutterworth to balance housing growth
Option 5	In and around Leicestershire urban fringe	37%	1300-1700	
	Market Harborough	37%	1300-1700	
	Lutterworth and rural centres (Broughton Astley, Kibworth, Great Glen, Fleckney)	25%	900-1100	
Option 6	In and around Leicestershire urban fringe	37%	1300-1700	
	Market Harborough	37%	1300-1700	
	Lutterworth and Broughton Astley	25%	900-1100	
Option 7	In and around Leicestershire urban fringe	37%	1300-1700	
	Market Harborough	37%	1300-1700	
	Broughton Astley	25%	900-1100	

Trajectory

[2008-2009]	*[2010-2012]*	*[2013-2015]*	*After 2016*
690	1035	1035	3795

Melton Borough Council

Housing

Option 1 of Core Strategy Issues and Options

		Built 06-07	Permissions	Urban Capacity	Proposed Allocations	Small site allowance to 2026*	Total dwellings	%
Melton Mowbray		120	560	394	1000	380	2454	74.4%
Other locations	Asfordby		41	60	14		115	3.5%
	Bottesford		0	0	22		22	0.7%
	Long Clawson		0	0	15		15	0.5%
	Waltham		0	12	15		27	0.8%
	Wymondham		18	0	0		18	0.5%
	Other#	79	0	0	0	570	649	19.7%
Totals		199	619	466	1066		3300	

built 06-07 at 'other' settlements includes asfordby, bottesford, long clawson, waltham and wymondham

Option 2 of Core Strategy Issues and Options

		Built 06-07	Permissions	Urban Capacity	Proposed Allocations	Small site allowance to 2026*	Total dwellings	%
Melton Mowbray		120	560	394	1000	380	2454	71.1%
Other locations	Asfordby		41	60	14		115	3.3%
	Bottesford		0	0	22		22	0.6%
	Long Clawson		0	0	15		15	0.4%
	Waltham		0	12	15		27	0.8%
	Wymondham		18	0	0		18	0.5%
	Other#	79	0	0	0	722	801	23.2%
Totals		199	619	466	1066		3452	

built 06-07 at 'other' settlements includes asfordby, bottesford, long clawson, waltham and wymondham

Option 3 of Core Strategy Issues and Options

		Built 06-07	Permissions	Urban Capacity	Proposed Allocations	Small site allowance to 2026*	Total dwellings	%
Melton Mowbray		120	560	394	1000	380	2454	68.5%
Other locations	Asfordby		41	60	14		115	3.2%
	Bottesford		0	0	22		22	0.6%
	Long Clawson		0	0	15		15	0.4%
	Waltham		0	12	15		27	0.8%
	Wymondham		18	0	0		18	0.5%
	Other#	79	0	0	0	855	934	26.1%
Totals		199	619	466	1066		3585	

built 06-07 at 'other' settlements includes asfordby, bottesford, long clawson, waltham and wymondham

***Small site allowance**

	Annual small site allowance			Total to 2026 (19 years)		
	Melton Mowbray	Other locations suitable for infill	Total	Melton Mowbray	Other locations suitable for infill	total
Option 1 - fewer locations for infill	20	30	50	380	570	950
Option 2	20	38	58	380	722	1102
Option 3 - most locations for infill	20	45	65	380	855	1235

Employment development

		Hectares			%
		Industrial	Office	Total	
Option 1	Melton Mowbray	24	4	28	80%
	Other	6	1	7	20%
	Total	30	5	35	

		Hectares			%
		Industrial	Office	Total	
Option 2	Melton Mowbray	22	3	25	71.4%
	Other	8	2	10	28.6%
	Total	30	5	35	

		Hectares			
		Industrial	Office	Total	%
Option 3	Melton Mowbray	18	3	21	60.0%
	Other	12	2	14	40.0%
	Total	30	5	35	

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[i] Whispergen website April 2007 http://www.whispergen.com/content/library/ESTbenefits.pdf

[ii] Environment Agency (1997-1998)

[iii] Environment Agency 2007

[iv] Scottish Environment Protection Agency (SEPA) Planning and Designing Guide to Sustainable Urban Drainage (SUDs)

[v] Sustainable Urban Drainage Systems Network (SUDSnet) University of Abertay Dundee