Thurrock Climate Change Evidence Base

Thurrock Council

September 2008

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Prepared on behalf of the
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Executive Summary

Whilst climate change has been identified as one of the most important challenges we face as a global community, it will also have severe repercussions on a local level in Thurrock. Rises in sea level from partial melting of large ice masses, changes in rainfall and storm surge events could lead to widespread flooding. Climate change could also lead to higher local temperatures, stronger winds, significant changes in rainfall, and increases in coastal and soil erosion – all of which will have impacts on Thurrock's economy, environment and population. Without substantial reductions in greenhouse gas emissions worldwide, local and global climates may continue to change.

Consideration of the above information prompted further investigation into climate change in Thurrock. Collecting and analysing baseline information or evidence provides the basis for identifying strengths, weaknesses, opportunities and threats. Development of an evidence base is also considered an essential element of policy and strategy development, as it is likely to determine the overall direction of policy and help to prioritise strategic actions. It also helps to provide a monitoring framework and will assist in any subsequent setting of objectives and targets.

This report provides the climate change evidence base for Thurrock. Data was collected to establish a Thurrock baseline and comparative analysis against national and regional data was also undertaken, where available. This evidence base consists of an audit and analysis of existing available evidence relating to:

- Greenhouse gas emissions
- Energy
- Transport
- Land Use
- Waste
- Water Resources
- Flood Risk
- Climate

Analysis of evidence for climate change in Thurrock identified the following issues:

- Reducing greenhouse gas emissions will be essential to limiting the worst impacts of climate change. Specifically, reducing CO_2 emissions from road transport and industrial and commercial energy consumption is necessary.
- Increasing renewable energy capacity in order to help meet regional targets and reduce greenhouse gas emissions from energy consumption.
- Ensuring that new development from growth is designed to cope with a changing climate. Planning for adaptation protects investment and those who utilise development from the worst impacts of climate change.
- Retrofitting existing housing and infrastructure to adapt to climate change will be essential to minimising the impacts of climate change on society and the economy.

- Minimising and reducing greenhouse gas emissions whilst providing for 18,500 new homes and 26,000 new jobs in Thurrock by 2021

Based on these issues, the following have been identified as priorities for Thurrock to consider in relation to strategic climate change action:

- Reducing CO_2 and N_2O emissions from the industrial and commercial sector, particularly from gas and electricity consumption
- Reducing CO_2 and N_2O emissions from road transport, particularly from diesel freight vehicles and the workplace commuter
- Reducing methane emissions from the waste sector, particularly from landfill
- Increasing renewable energy generation
- Ensuring that new development incorporates energy and water efficiency into design
- Ensuring that new vulnerable development is not at risk of flooding
- Reducing flood risk at existing development

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1. Scope

1.1 Definition

Climate change refers to the variation in the Earth's global climate or in regional climates over time. Presently, climate change, particularly in reference to environmental policy, is used only in reference to changes in modern climate, including the rise in average surface temperature known as “global warming”. The United Nations Framework Convention on Climate Change (UNFCCC) definition of climate change is “a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods”. In this case, the term is used with a presumption of human causation.

Strategic action on climate change can be defined by the desired outcomes, depending on their scope. These are:

- **Climate Change Mitigation:** an anthropogenic intervention to reduce the sources or enhance the sinks of greenhouse gases.[1] Strategic mitigation activity focuses action on the reduction of greenhouse gas emissions that contribute to climate change

- **Climate Change Adaptation:** any adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.[1] Strategic adaptation activity focuses action defining a proactive approach through which to cope with and asses risk to the impacts of climate change.

- **Climate Change Mitigation and Adaptation:** A holistic approach to focus efforts both on reducing greenhouse gas emissions to mitigate climate change and also preparing the local area for adapting to the likely impacts of climate change

1.2 Impacts

The region's Sustainable Development Round Table commissioned a study, *Living with Climate Change in the East of England,* in 2002. The study concluded that summers will become hotter and drier, while winters will be milder and wetter. As well as seasonal changes, there will be more extreme climate events – very hot days and intense downpours of rain, leading to an increased risk of flooding in some areas. Sea levels will rise, increasing the risk of coastal flooding and erosion, and current extremes of high water levels will occur more frequently.[2]

[1] Intergovernmental Panel on Climate Change 2001
[2] Land Use Consultants, CAG Consultants, and SQW Limited, *Living with Climate Change in the East of England: Summary*, 2003.

In summary, the East of England will experience:

- Hotter drier summers; milder wetter winters
- Significant decrease in soil moisture content
- Extreme high temperatures more frequent
- Extreme winter precipitation more frequent
- Increase in thermal growing season
- Net sea level rise and increase in sea storm surge height

In climate change terms, the Thames Gateway and Fringes sub-region is particularly vulnerable to water resource deficiencies, sea level rise, and fluvial flooding.

All of the impacts identified above will have consequences on Thurrock's economy, environment and population. These potential consequences for the East of England are outlined **Figure 1** below.

Figure 1: Consequences of climate change impacts in the East of England

Agriculture and forestry

- Agriculture is likely to see an increased growing season; but decreasing soil moisture and availability of water supply for irrigation may constrain opportunities to capitalise on warmer temperatures;
- Access to land in winter may be constrained by increased precipitation, and possible increased storminess, causing waterlogging and flooding;
- Livestock production systems could be affected by higher temperatures, leading to increased requirements for drinking water, water wallowing sites for pigs and water to cool livestock units;
- Inshore and inland fisheries could be affected if low lying land is allowed to permanently flood. Impacts on coastal fisheries are uncertain, but external pressures on declining fish stocks are likely to exert far greater pressures on the industry;
- Favourable forestry species may change e.g. yields of Corsican Pine are predicted to increase, whilst Scots Pine is likely to decrease.

Environmental assets – natural and cultural

- Habitats and species may be affected by both direct loss through physical changes to the environment, e.g. from flooding and indirectly by temperature increases. The coast and wetland habitats will be particularly subject to change and the nature of change will depend greatly on management decisions (both in terms of flood defence and agriculture);
- Flood defence decisions may have implications for habitats e.g. potential 'coastal squeeze'
- Certain woodland species are likely to grow better whilst others will lose ground. Establishment of young trees is likely to be particularly affected;
- Water, soil and air quality may deteriorate to some extent;
- Built cultural assets may be affected by damage from contaminants, mobilised by higher temperatures, attacking foundations, subsidence and structural damage from possible extreme storm events;
- Historic sites in coastal and fluvial floodplains could be at risk of flooding.

Housing and the economy

- Housing and the economy are likely to be primarily affected by flood risk and availability of water supply and increases in occurrence of weather extremes such as storminess;
- Temperature increases may create opportunities for expanding the tourism industry in the East of England;
- Climate change may also create opportunities for other sectors e.g. civil engineering for provision of flood defences and opportunities for developing renewable energy such as solar power.

Infrastructure – water resources, flood defence, energy and transport

- Climate change is likely to cause demand for water to increase;
- Uncertainty over implications for water availability for public water supply systems, but especially under the High Emissions scenario there may be adverse impacts on availability;
- Water infrastructure may not be able to cope with long dry spells in summer, and there may be shortages of water available for direct summer abstractions;
- Combined potential supply pressures and demand increases could lead to supply deficits especially in the south-eastern part of the region;
- Increased climatic variability and increased winter rainfall could put pressure on drainage systems;
- Coastal and fluvial flooding will have impacts on many aspects of the regional economy, society and environment. Existing flood defences will face increased pressure and the costs of flood damage to built property, without increased defences, could be significant;
- Flood risk is likely to be the most important factor affecting existing energy and transport infrastructure and in future locational decisions;

Source: Land Use Consultants, CAG Consultants, and SQW Limited, Living with Climate Change in the East of England: Summary, 2003.

Due to the high level of vulnerability to the effects of climate change, it is recommended that a holistic climate change mitigation and adaptation strategy is developed for Thurrock. Adaptation needs to be built into planning and risk management now to ensure the continued and improved success of businesses, Government policies and social operations. A combined approach would provide a strategic framework through which to reduce CO_2 emissions across all sectors and limit increases from growth, whilst adequately preparing the area for adapting to climate change and reducing vulnerability to climate change impacts.

1.3 Purpose of this report

Action by local authorities will be critical to the achievement of the Government's climate change objectives. Local authorities are uniquely placed to provide vision and leadership to local communities by raising awareness and to influence behaviour change. In addition, through their powers and responsibilities (housing, planning, local transport and powers to promote well-being) and by working with their Local Strategic Partnership, local authorities can have significant influence over climate change mitigation and adaptation activities in their local areas.

Small Fish was commissioned to develop a climate change evidence base for Thurrock in June 2008, on which a subsequent climate change strategy will be based. This involved the following stages:

1. Policy Context: Audit of current relevant plans, polices and programmes at the international, national, regional and local level. This will help to account for the relationship between the resultant climate change strategy and how the strategy should contribute towards the objectives of these other plans, policies and programmes.

2. Analysis of Evidence: Collecting and analysing baseline information or evidence provides the basis for identifying strengths, weaknesses, opportunities and threats. Development of an evidence base is also considered an essential element of policy and strategy development, as it is likely to determine the overall direction of policy and help to prioritise strategic actions. It also helps to provide a monitoring framework and will assist in any subsequent setting of objectives and targets.

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2. Policy Analysis

When developing a local climate change strategy it is important to ensure that it is consistent with the international, national, regional and local policy context. There are few strategies that have been written in the UK in recent years that do not include some mention of mitigating and adapting to climate change. The policies outlined below are those that are considered most relevant and where the main focus is on tackling climate change.

2.1 International

In recognition of the global nature of the problem of climate change, the United Nations Framework Convention on Climate Change (UNFCCC) was agreed at the Earth Summit in Rio de Janeiro in 1992. As a result of this convention, the Kyoto Protocol, agreed in December 1997, sought to define the international community's response to the issue of climate change. Developed countries agreed to reduce their overall emissions of a basket of six greenhouse gases by 5.2% below 1990 levels over the period 2008-2012, with differentiated, legally binding targets.

2.2 National

The *UK Climate Change Programme* 2006 is designed to deliver the UK's Kyoto Protocol target of reducing emissions of the basket of six greenhouse gases by 12.5% below base year levels over the commitment period 2008-2012, and move the UK close to the domestic goal to reduce CO_2 emissions by 20% below 1990 levels by 2010. It also aims to put the UK on a path to cutting CO_2 emissions by some 60% by about 2050, with real progress by 2020.

In 2007, the Government put forward the Draft Climate Change Bill which will introduce a clear, credible, long-term framework for the UK to achieve its goals of reducing carbon dioxide emissions and ensure steps are taken towards adapting to the impacts of climate change. The Bill provides a framework for reducing carbon dioxide emissions through the following four elements:

- Setting targets in statute and carbon budgeting
- Establishing a Committee on Climate Change
- Creating enabling powers
- Reporting requirements

The *Stern Review on the Economics of Climate Change* (2006) assessed a wide range of evidence on the impacts of climate change and on the economic costs, and used a number of different techniques to assess costs and risks. From all of these perspectives, the evidence gathered by the Review led to a simple conclusion: the benefits of strong and early action far outweigh the economic costs of not acting. The relevant conclusions for mitigation of climate are:

1. Carbon pricing: putting an appropriate price on carbon, through taxes, trading or regulation
2. Technology policy: to bring forward the range of low-carbon and high-efficiency technologies that will be needed to make deep emissions cuts.
3. Policies on regulation, information and financing to remove the barriers to behavioural change

The relevant conclusions of the Stern Review pertaining to adapting to climate change are:

1. Government has a role in providing a clear policy framework to guide effective adaptation by individuals and firms in the medium and longer term
2. High-quality climate information will help drive efficient markets.
3. Land-use planning and performance standards should encourage both private and public investment in buildings, long-lived capital and infrastructure to take account of climate change.
4. Government can contribute through long-term polices for climate-sensitive public goods, such as natural resources protection, coastal protection, and emergency preparedness.
5. Development itself is key to adaptation. Much adaptation should be an extension of good development practice and reduce vulnerability by:
    - Promoting growth and diversification of economic activity;
    - Investing in health and education;
    - Enhancing resilience to disasters and improving disaster management;
    - Promoting risk-pooling, including social safety nets for the poorest.
    - Putting the right policy frameworks in place will encourage and facilitate effective adaptation by households, communities and firms. Poverty and development constraints will present obstacles to adaptation but focused development policies can reduce these obstacles.
    - Adaptation actions should be integrated into development policy and planning at every level.

The Energy White Paper 2007 set out the Government's international and domestic energy strategy to respond to changing circumstances, address the long term energy challenges we face and deliver four energy policy goals, one of which is to put the UK on a path to cutting CO_2 emissions by 60% by 2050, with real progress by 2020.

Planning Policy Statement 1: Delivering Sustainable Development puts climate change firmly on the planning agenda, by requiring that local planning authorities ensure that development plans address the causes and potential impacts of climate change – through policies which reduce energy use, reduce emissions, promote the development of renewable energy resources, and take climate change impacts into account in the location and design of development. Planning authorities should also enable the provision of the highest viable standards of resource and energy efficiency and reduction in carbon emissions.

Planning Policy Statement: Planning and Climate Change - Supplement to Planning Policy Statement 1 sets out how planning should contribute to reducing emissions and stabilising climate change and take into account the unavoidable consequences. It states that planning authorities should prepare and deliver spatial strategies that contribute toward delivering the *UK Climate Change Programme* and enable the provision of the highest viable standards of resource and energy efficiency and reduction in carbon emissions.

Planning Policy Statement 25: Development and Flood Risk sets out parameters for considering flood risk in development and requires the application of the sequential test for allocating development in areas of flood risk (Flood Zones 2 and 3). The sequential test dictates that only where there are no reasonably available sites in Flood Zones 1 or 2 should decision-makers consider the suitability of sites in Flood Zone 3, taking into account the flood risk vulnerability of land uses.

2.3 Regional

The *Regional Environment Strategy* contains an overarching priority to reduce greenhouse gas emissions in recognition of the threat of climate change. It also aims to keep development within environmental limits, with specific measures to take account of water shortages and flood risk:

1. Overarching: Reduce greenhouse gas emissions in recognition of the threat of climate change
2. Keep development within environmental limits, with specific measures to take account of water shortages and flood risk
3. Reduce road traffic and car dependence
4. Maintain and enhance environmental capital
5. Support environmental business by promoting the green economy and its sustainable development
6. Reduce the amount of waste regionally

The East of England Plan seeks to reduce the region's impact on, and exposure to, the effects of climate change by:

- locating development so as to reduce the need to travel;
- effecting a major shift in travel towards public transport, walking and cycling and away from car use;
- maximising the energy efficiency of development and promoting the use of renewable and low carbon energy sources; and by
- reducing the risk of damage from flooding.

Policy SS1 requires that local development documents and other statutory and non-statutory strategies relevant to spatial planning within the region should assist the achievement of obligations on carbon emissions and adopt a precautionary approach to climate change by avoiding or minimising potential contributions to adverse change, and incorporating measures which adapt as far as possible to unavoidable change. Policy TS1 aims to manage travel behaviour and the demand for transport with the aim of reducing the rate of

road traffic growth and ensuring the transport sector makes an appropriate contribution to the required reduction in greenhouse gas emissions.

In order to meet regional and national targets for reducing climate change emissions, the *East of England Plan* requires that new development should be located and designed to optimise its carbon performance. Local authorities should:

- maximise opportunities, particularly in major growth locations and Key Centres for Development and Change, for developments to set new yardsticks of performance in the use of energy from on site renewable and / or decentralised renewable or low carbon energy sources, and for reducing emissions;
- promote innovation through incentivisation, master planning and development briefs; and
- encourage the supply of energy from on site renewable and / or decentralised renewable or low carbon energy sources; and through DPDs set ambitious but viable proportions of the energy supply of substantial new development.

2.4 Local

At the local level a climate change strategy should give consideration to where good local climate change policy already exists. The Thurrock Sustainable Community Strategy is the overarching strategy which sets out the road map to achieve a long-term vision for Thurrock. The strategy aims to deliver well-planned quality housing and sustainable developments, including consideration given to impact of climate change and development that utilises renewable energy sources and is energy efficient.

The *Thurrock Transport Strategy: 2008 – 2021* also contains relevant local climate change policy and aims to reduce carbon dioxide emissions by reducing the need to travel and encouraging a modal shift. Further improvements will be achieved by reducing emissions from residual sources as well as reducing vulnerability to climate change.

Finally, the Thurrock Local Development Framework (due for submission in 2009) also aspires to tackle climate change and promote sustainable development by ensuring that all new development has maximised the potential for sustainable construction, methods using recycled construction waste, energy efficiency measures and use of renewable technologies and that new buildings have incorporated design measures to take account of the effects of changing local weather conditions arising from global climate change including flood risk.

3. Data Analysis

3.1 Background

Thurrock is a place of contrasts with a long history of change and adaptation. It has a resident population of 146,700 people and covers 165 km^2 (64m^2) and is a diverse borough, made up of people from many ethnic origins, religions and countries. To the north are scattered rural communities with a semi-urban population to the south. Over half of Thurrock is green belt, containing environmental assets valued by all.

Historically, Thurrock owes much of its prosperity to its 29 km (18m) of riverfront. With the addition of the railway during the 1850s, Thurrock became a strategic point for industry and trade on the Thames gateway to London. Despite the decline in traditional industry, Thurrock remains a national priority. During the next decade significant regeneration efforts will transform the East of England to support London's expanding population. For Thurrock this means more homes, jobs and public infrastructure.

3.2 Greenhouse Gas Emissions

Increasing atmospheric concentrations of greenhouse gases originating from anthropogenic activities are leading to enhanced warming of the atmosphere and global climate change. The major greenhouse gases are carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O), all of which have both natural and anthropogenic sources. In contrast, the three industrial gases – hydrofluorocarbons (HFC), perfluorocarbons (PFC) and sulphur hexafluoride (SF6) – are potent greenhouse gases, but only originate from anthropogenic sources.

These six greenhouse gases comprise the "basket of emissions" against which reduction targets were agreed at the Third Conference of the Parties of the United Nations Framework Convention on Climate Change (UNFCCC) in Kyoto, Japan in December 1997. The target for the UK is to achieve a reduction of the global warming potential of the six greenhouse gases of 12.5% by 2008-2012 (based on 1990 emissions estimates).

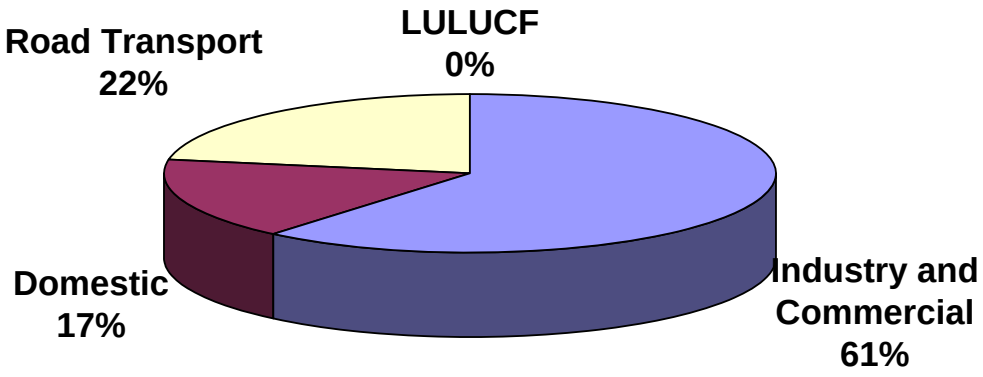
The three major greenhouse gas emissions estimates are available at the local authority levels and are discussed in detail in the following sections.

3.2.1 Carbon Dioxide

CO_2 is the major contributor to greenhouse gas emissions in the UK and arises predominately from the combustion of fossil fuels. In 2005, Thurrock was responsible for 1,956,306 tonnes of CO_2, equivalent to 13.3 tonnes per capita. **Figure 2** below outlines the 2005 CO_2 emissions profile for Thurrock, broken down by sector. Emissions in Thurrock by sector, ranked from highest to lowest are:

1. Industrial and Commercial –1,195,326 tonnes
2. Road Transport – 432,646 tonnes
3. Domestic – 327,797 tonnes
4. Land Use, Land Use Change and Forestry (LULUCF) – 537 tonnes

Figure 2: CO_2 Emissions in Thurrock by sector, 2005



One of the best ways of comparing CO_2 emissions across sectors and between local authorities is by considering per capita emissions by sector. **Figure 3** outlines the comparison between Thurrock and similar unitary authorities, as well as regional and national averages.

Figure 3: Comparison of per capita emissions by sector

Area	Industry and Commercial	Domestic	Road Transport	LULUCF	Total
Milton Keynes	3.9	2.3	2.4	0.0	8.6
Peterborough	3.4	2.3	2.6	0.0	8.3
Swindon	4.0	2.5	2.3	0.0	8.8
Telford and Wrekin	3.8	2.4	2.1	0.0	8.3
Warrington	4.3	2.6	4.0	0.1	11.0
Thurrock	***8.2***	***2.2***	***3.0***	***0.0***	***13.3***
EoE	**3.1**	**2.4**	**2.8**	**0.1**	**8.4**
UK	**4.1**	**2.5**	**2.5**	**0.0**	**9.1**

Data Source: Defra, Emissions of CO_2 for local authority areas, 2005

Defra's emissions of CO_2 for local authority areas for 2005 show Thurrock as having the highest per capita CO_2 emissions of the comparable unitary authorities and also show that CO_2 emissions in Thurrock are 46% higher than national levels and 58% higher than regional levels.

In total, Thurrock accounts for 0.36% of all emissions in the UK, but only 0.24% of the population. The main cause of this discrepancy, as well as the disproportionately high per capita emissions, is the substantial industrial and commercial emissions. Road transport emissions are also higher than proportional expectations, although domestic and land use emissions are lower.

Growth of 18,500 new homes in Thurrock between 2001 and 2021 is likely to further increase carbon dioxide emissions across all sectors, and, as of 2006, 62,600 houses remained to be built. Increases in population and housing stock from growth is likely to increase emissions from the domestic and transport sectors, whilst job growth of 26,000 is likely to increase carbon dioxide emissions from the industrial and commercial sectors. Land use, land use change and forestry emissions could increase from the sheer amount of development and the inevitable change in land uses as a result of the magnitude of the development and growth.

The Defra CO_2 emissions estimates also provide a more detailed breakdown within each sector. This detailed end user profile can be seen in **Figure 4** below. Analysis of the split within each sub-sector shows that the five sub-sectors responsible for the most emissions within Thurrock are, from highest to lowest:

1. Industrial and Commercial Gas
2. Industrial and Commercial Electricity
3. Domestic Gas
4. Domestic Electricity
5. Road Transport "A" roads diesel

Figure 4: Detailed emissions profile by end user

Sector	Detailed Sector Split	Kt CO_2	% of total
Industry and Commercial	Industrial and Commercial Electricity	419.4	21.4%
	Industrial and Commercial Gas	642.4	32.8%
	Industrial and Commercial Gas (Large Users)		0.0%
	Industrial and Commercial Oil[3]	39.2	2.0%
	Industrial and Commercial Solid fuel[3]	0.3	0.0%
	Industrial and Commercial Wastes and Biomass[3]	0.1	0.0%
	Industrial and Commercial Process Gases[3]	6.2	0.3%
	Industrial and Commercial Non fuel[3]	0.0	0.0%
	ETS Installations (all fuels)	69.3	3.5%
	Industrial off road machinery	15.9	0.8%
	Agriculture Oil	1.7	0.1%
	Agriculture Solid fuel	0.0	0.0%
	Agriculture Non Fuel	0.0	0.0%
	Diesel Railways	0.8	0.0%
Domestic	Domestic Electricity	157.5	8.0%
	Domestic Gas	159.6	8.2%
	Domestic Oil	5.7	0.3%
	Domestic Solid fuel	0.7	0.0%
	Domestic Home and Garden	0.8	0.0%
	Domestic Products	3.6	0.2%
Road Transport	Road Transport A Roads Petrol	104.0	5.3%
	Road Transport Motorways Petrol	45.8	2.3%
	Road Transport Minor Roads Petrol	45.6	2.3%
	Road Transport A Roads Diesel	123.0	6.3%
	Road Transport Motorways Diesel	81.7	4.2%
	Road Transport Minor Roads Diesel	31.2	1.6%
	Road Transport Other	1.4	0.1%
Land Use, Land Use Change & Forestry (LULUCF)	LULUCF Emissions: Agricultural Soils And Deforestation	0.6	0.0%
	LULUCF Emissions: Other	9.1	0.5%
	LULUCF Removals	-9.1	-0.5%
TOTAL Emissions – Thurrock Council		**1956.3**	**100%**

Data Source: Defra, Emissions of CO_2 for local authority areas, 2005

Emissions from each of the sectors within the Defra dataset are described in more detail throughout the report.

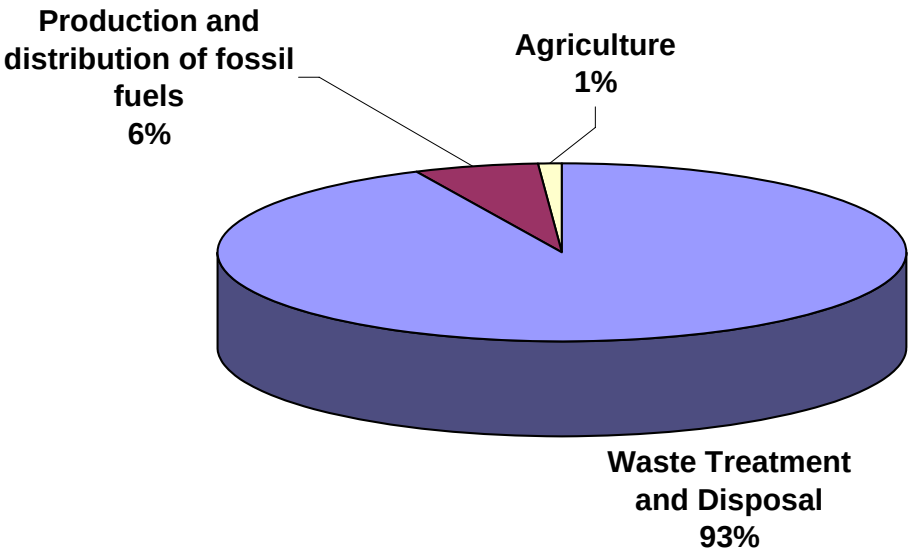
[3] Not including energy supply

3.2.2 Methane

Methane, like carbon dioxide, is naturally occurring and is part of the global carbon cycle. Methane has a warming effect on the climate 21 times greater than carbon dioxide. The major anthropogenic sources of methane are waste disposal, agriculture, coal mining and leakage from the gas distribution system.

Methane emissions in Thurrock in 2005 were equivalent to 200,340 tonnes of carbon dioxide. The majority of methane emissions in Thurrock (93%) arise from waste treatment and disposal and Thurrock should therefore focus securing methane reductions from this sector.

Figure 5: Methane emission in Thurrock by sector, 2005

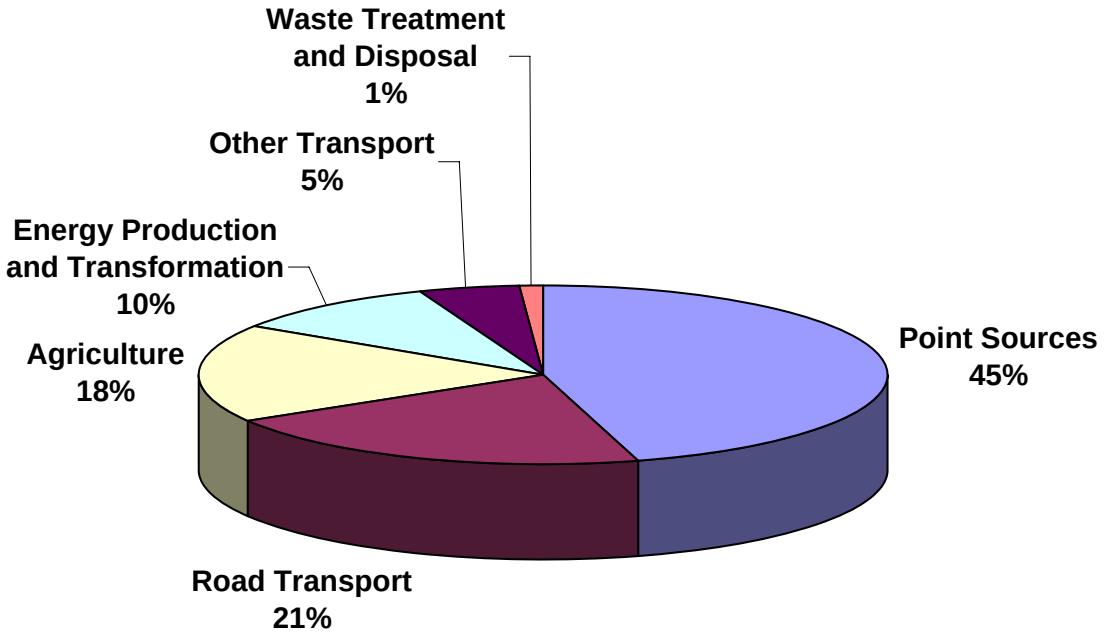


3.2.3 Nitrous Oxide

Nitrous oxide (N_2O) is emitted from natural and anthropogenic sources such as agriculture, biomass burning, coal combustion and some industrial processes. N_2O is a powerful greenhouse gas, and has a global warming potential 310 times that of carbon dioxide. However, emissions from the UK are low, so the overall contribution to global warming is relatively small.

In Thurrock, nitrous oxide emissions were equivalent to 64,790 tonnes of carbon dioxide in 2005. The majority of these emissions arise from point sources, although significant contributors also include road transport and agriculture. Thurrock should focus N_2O reduction efforts on point sources and road transport. Additionally, the potential N_2O of the proposed biomass power facility at Tilbury should be investigated, although this may offset N_2O emissions from the coal burning facility that the new station will replace.

Figure 6: N_2O Emissions in Thurrock by sector, 2005



3.3 Energy

The Defra local authority CO_2 emissions for Thurrock highlighted that the majority (70%) of CO_2 emissions arise from gas and electricity consumption from the domestic and industrial and commercial sectors.

3.3.1 Industrial and Commercial Energy Consumption

Historically, Thurrock owes much of its prosperity to its 29km of riverfront and much of the commercial and industrial activity is centred there. Since the1850's, Thurrock has been a strategic point for industry and trade on the Thames, a gateway to London. This includes many large and important industrial sites, including two large oil refineries, manufacturing industries, a container port, cruise liner terminal, distribution warehousing and one of Britain's largest refuse disposal sites at Mucking.

By far the largest emitting sub-sector within the industrial and commercial sector for CO_2 emissions is gas and electricity consumption, which account for 32.8% and 21.4% of total emissions respectively. Industrial and commercial emissions in Thurrock are extremely high, which is likely due to the industrial nature of this area. Per capita industrial and commercial emissions in Thurrock are double the national average.

Energy consumption in Thurrock is particularly high at 96,600 kWh per capita, which is three times the regional average. Industrial and commercial energy consumption is clearly the cause of disproportionately high energy consumption per capita. In terms of gas consumption, 75% arises from industrial and commercial consumers, which only account for 1% of the number of consumers. Although gas consumption in this sector fell by 8% between 2005 and 2006, the number of consumers fell by 14%. When accounting for the changes in the number of users, the end result is that gas consumption from this sector increased by 7%.

Electricity consumption reveals similar issues – industrial and commercial consumers are responsible for 72% of electricity consumption, but only 6% of the number of consumers. Electricity consumption from industrial and commercial users fell by 4% between 2005 and 2006 and the number of consumers by 2%. Overall, electricity consumption from the industrial and commercial sector fell by 2% when accounting for the change in the number of users.

High electricity and gas consumption from industrial and commercial consumers in Thurrock is likely to be directly responsible for high levels of carbon dioxide emissions. Work should be undertaken to investigate measure to improve energy efficiency or to increase low carbon/renewable energy supply to these users.

3.3.2 Domestic Energy Consumption

There are currently around than 65,000 domestic energy consumers in Thurrock, yet domestic electricity and gas consumption account for 8.0% and 8.2% of total CO_2 emissions in Thurrock. Despite these levels, domestic emissions remain slightly below proportional expectations, accounting for 0.22% of all domestic emissions in the UK, although Thurrock has 0.24% of the UK population. Per capita domestic emissions in Thurrock are 12% lower than the national average.

Domestic energy consumption appears to be disproportionately low as a result of high levels of industrial and commercial energy consumption. In terms of gas consumption, only 25% arises from domestic consumers, but accounts for 99% of the number of consumers. Although gas consumption in this sector fell by 2% between 2005 and 2006, the number of consumers increased by 2%. When accounting for the changes in the number of users, the end result is that gas consumption from this sector decreased by 4%.

Electricity consumption reveals similar issues – domestic consumers are responsible for 28% of electricity consumption, but 94% of the number of consumers. Electricity consumption from domestic users fell by 1% between 2005 and 2006, but the number of consumers remained stable.

3.3.3 Energy Efficiency

The Standard Assessment Procedure is used for measuring energy efficiency in buildings and the current Thurrock average for local authority housing stock is 78, which is significantly higher than the national average of 68. However, this indicator only qualifies energy efficiency in a small proportion of the total housing stock in Thurrock and expanding this indicator to all housing in Thurrock should be considered as a good measure on energy efficiency performance throughout the county, although this data may be difficult to obtain.

3.3.4 Renewable Energy

Thurrock is performing relatively well in terms of renewable energy with 52.6 MW of installed capacity**.** Thurrock currently contains 54% of the county's and 11% of the region's renewable energy generating capacity.

As can be seen in **Figure 7**, the majority of renewable energy in Thurrock – 76% – is provided via a landfill gas, with the remaining 24% provided by a biomass facility at Tilbury Power Station. Tilbury Green Power has also undertaken initial public consultation on a 60MW power station using a mix of imported biomass and household waste[4]. If this facility were to come forward, Thurrock's renewable energy generation would more than double and renewable energy facilities in Thurrock would account for 22% of the region's renewable energy capacity.

[4] Renewables East, *East of England Renewable Energy Statistics December 2007*.

Although there were no renewable energy installations in 2006/07, in 2004/05 there was an installation of three wind turbines at the Tilbury Enterprise Centre. The estimated amount of energy that will be generated is 42,000 kWh (42 mWh) per annum.

A test mast for wind turbines has been installed at the Port of Tilbury. There is a proposal for a series of wind turbines to be installed on this site awaiting permission.[5]

In 2005/06, the construction of the Environment and Education centre at Rainham, Wennington and Aveley Marshes RSPB Reserve was completed. The Environment and Education centre is using a ground source heat pump which is supported by photovoltaic panels yielding 10 mWh/year, which is providing 25% of the energy requirements for the building.[6]

Figure 7: Renewable Energy in Thurrock

Name	MW	Operator	Type
Tilbury Power Station	12.767	nPower	Biomass co-firing in fossil fuel power station
Aveley	3.952	Aveley Methane Ltd	Landfill Gas
Aveley - NFFO 5	2.006	Waste Recycling Group Plc.	Landfill Gas
Aveley Landfill	3.840	Waste Recycling Group (Central) Ltd	Landfill Gas
Aveley Phase 2 Generation	2.128	Waste Recycling Group Plc	Landfill Gas
Mucking 3	4.074	EDL Operations (Mucking) Ltd	Landfill Gas
Mucking Gas 2-NFFO	4.074	EDL Operations (Mucking) Ltd	Landfill Gas
Mucking Landfill	3.2	EDL Operations (Mucking) Ltd	Landfill Gas
Mucking Landfill 2	7.789	EDL Operations (Mucking) Ltd	Landfill Gas
Ockendon "A" Power Plant	4.016	Viridor Waste Management	Landfill Gas
Ockendon "B" Power Plant	4.756	Viridor Waste Management	Landfill Gas

Source: Renewables East, East of England Renewable Energy Statistics December 2007.

[5] Thurrock Council, *Thurrock Local Development Framework Annual Monitoring Report 2005*.
[6] Thurrock Council, *Thurrock Local Development Framework Annual Monitoring Report 2006*.

3.4 Transport

Per capita road transport emissions in Thurrock are 20% higher than the national average. Vehicles using "A" roads within Thurrock account for the majority of road transport emissions in Thurrock and are responsible for 11.6% of total CO_2 emissions in Thurrock, with diesel vehicles responsible for 6.3% and petrol vehicles 5.3%. This is most likely due to the high traffic volumes along the A13, which links Thurrock and eastern reaches of Essex with London. Vehicles using the motorway also contribute significantly to Thurrock's total CO_2 emissions at 6.5%.

Thurrock is traditionally an area of port-related activity, heavy industry, cement manufacture and mineral extraction, and much of its river frontage is highly industrialised, requiring high levels of freight distribution and interchange. Despite a 5 year increase of 11% in rail freight tonnage, there are high levels of Heavy Goods Vehicles (HGVs) on the road network, the majority of which are diesel.

The high diesel CO_2 contributions on both the motorway and "A" roads is most likely due to the large number of heavy good vehicles using the A13 to transport goods to and from Thurrock's many freight distribution and logistics centres. Again, the split within this is heavily weighted by the contribution from diesel vehicles, which is also likely to be due to the amount of freight activity into and out of Thurrock.

Vehicles using minor roads contribute significantly less towards total CO_2 emissions in Thurrock at 3.9%; although in this category petrol vehicles contribute a higher proportion than diesel. This is therefore more likely to be a result of local car traffic, rather than heavy goods vehicle traffic.

As a result of Thurrock's proximity to London, there are high levels of out and through commuting in the area and commuting is therefore likely to be a significant source of road transport's CO_2 emissions. Traffic has grown substantially over the past ten years in Thurrock by 20% between 1997 and 2006, compared with only 13.1% nationally and 12.6% regionally. However, traffic growth has slowed down considerably in the past five years, with five year growth at only 3.1%.

Thurrock's proximity to the M25 to the west and the Trunk Road Network has successfully attracted businesses to the area. As a result of the area's proximity to London, there are high levels of out-commuting, with nearly 40% of the Borough's working population employed outside Thurrock, the majority of these employed in London.

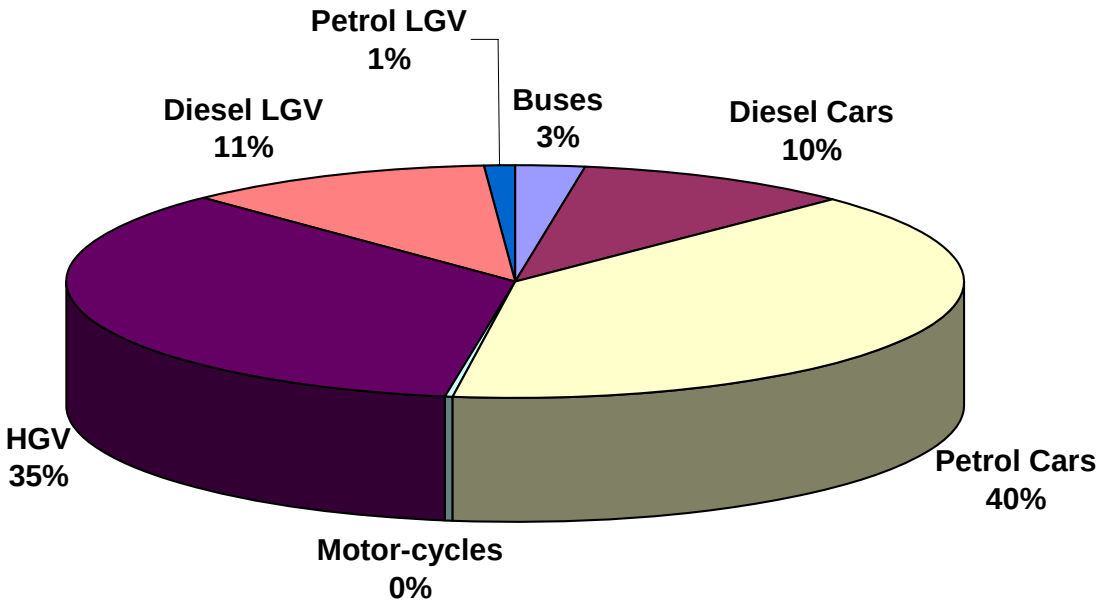
The high rate of traffic growth is a trend that is likely to continue in as a result of new development within Thurrock. Growth in traffic is likely to lead to growth in greenhouse gas emissions from the road transport sector.
In particular, traffic is likely to grow from the requirement for the delivery of 18,500 new dwellings and 26,000 new jobs in the Thurrock area by 2021, as

well as the possible development of the port of Shell Haven and associated impacts.

Figure 8 outlines the proportion of fuel consumption by vehicle category. Analysis of road transport energy consumption statistics show that petrol cars are responsible for consuming the most energy at 40%, which is lower than national and regional levels. HGVs also consume a significant amount of energy at 35%, which is substantially higher than national and regional levels of 24% and 22% respectively.

Overall, road transport energy consumption increased by 1% between 2005 and 2006, although there were some significant changes with the vehicle sector. For example, bus consumption increased by 4%, diesel cars by 7%, HGVs by 2% and diesel Light Goods Vehicles (LGVs) by 1%. Conversely, energy consumption from petrol cars, motorcycles and petrol LGVs decreased by 1%, 4% and 2%, respectively. This shows that consumption of diesel fuel is clearly on the rise, while petrol fuel consumption is decreasing.

Figure 8: Road transport energy consumption, by vehicle type, 2006



Analysis of 2001 census travel to work data provides further background into road transport emissions. As can be seen in **Figure 9**, there are relatively low levels of walking, cycling and bus use for travelling to work by Thurrock's resident population. This is balanced by high levels of train and car use.

In terms of the distance travelled to work, **Figure 10** shows that 38% of the resident population travel less that 5 km, a viable distance for using sustainable modes of transport. The statistics show that it is highly likely that many people are undertaking short distance car journeys that may be able to be accommodated by walking, cycling or public transport, thus reducing greenhouse gas emissions from road transport.

For example, 14% of workplace journeys are under 2km – a very reasonable walking or cycling distance, but walking and cycling only account for 8% of journeys to work. Additionally, those travelling a distance of between 2 and 5 km – 17% - could viably walk, cycle or use the bus, although only 12% of the daytime population use these modes. Reasons for low participation in these modes may be that buses to not travel between where people work and live, and cycling and walking infrastructure may be inadequate.

Figure 9: Resident Population Travel to Work by Mode in Thurrock

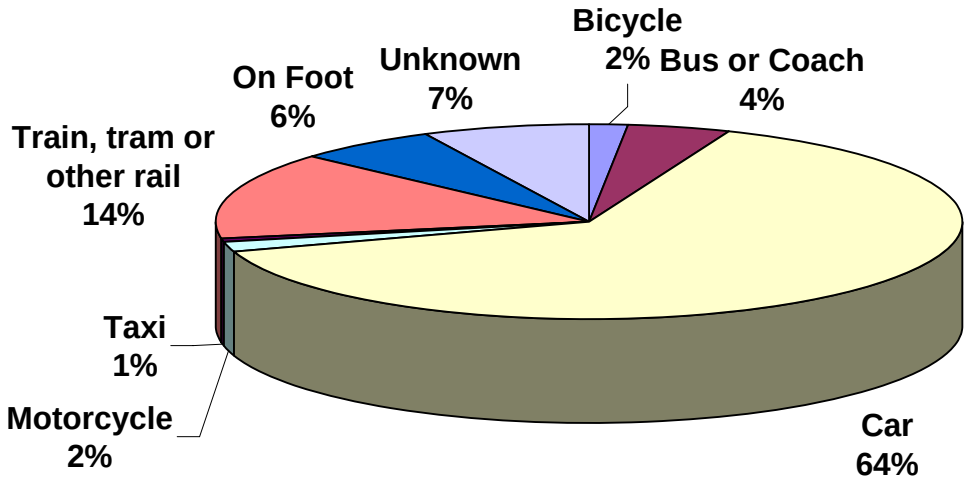
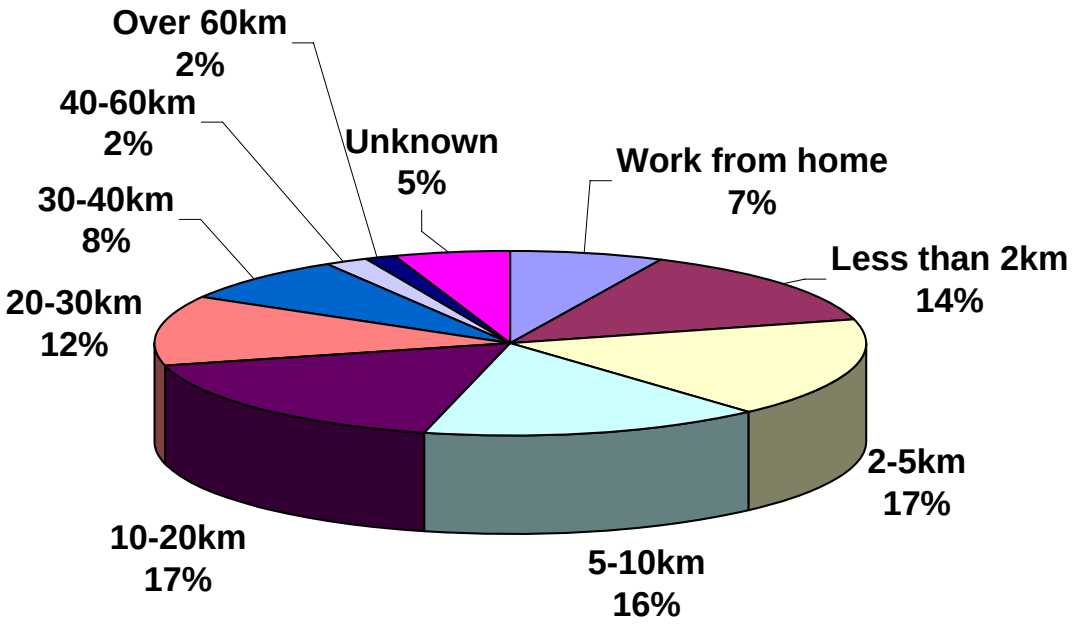


Figure 10: Resident Population Travel to Work by Distance



A significant proportion of Thurrock residents, 14.3%, travel to work by rail, which is nearly three times the national rate. This is most likely due to the high proportion of residents who work outside the borough and commute to London, making rail transport one of the more efficient modes of travel to work. Rail patronage has increased by an astounding 94% over the past five years in Thurrock. Despite relatively low travel to work figures by bus or coach, bus patronage has grown substantially over the past five years by 52% and the 2010/11 LTP target was surpassed in 2006/07.

Returns from the national PLASC journey survey identified that 31.4% of all journeys to school in Thurrock were made by car in 2006/07. This identified a decrease in car use of 25% between 2003/04 and 2006/07.

3.5 Land Use

The Land Use, Land Use Change and Forestry (LULUCF) Sector is different from other sectors in the emissions profile in that it contains both sources and sinks of greenhouse gases. The sources, or emissions to the atmosphere, are given as positive values; the sinks, or removals from the atmosphere, are given as negative values. Overall, Thurrock's LULUCF emissions balance out – with the carbon sinks nearly equalising the carbon sources.

Thurrock has done particularly well in ensuring that high proportions of new homes are built on previously developed land at over 92%, compared with 72% regionally and 75% nationally. This is likely due to the regeneration potential of Thurrock – many brownfield industrial sites have been redeveloped in recent years and Thurrock should ensure that this practice continues through the appropriate planning and policies within the Local Development Framework.

In terms of carbon stores, Thurrock has a relatively small proportion of woodland, both ancient and recent. Consideration should be given to ways that additional carbon sinks can be created throughout the Borough.

3.6 Waste

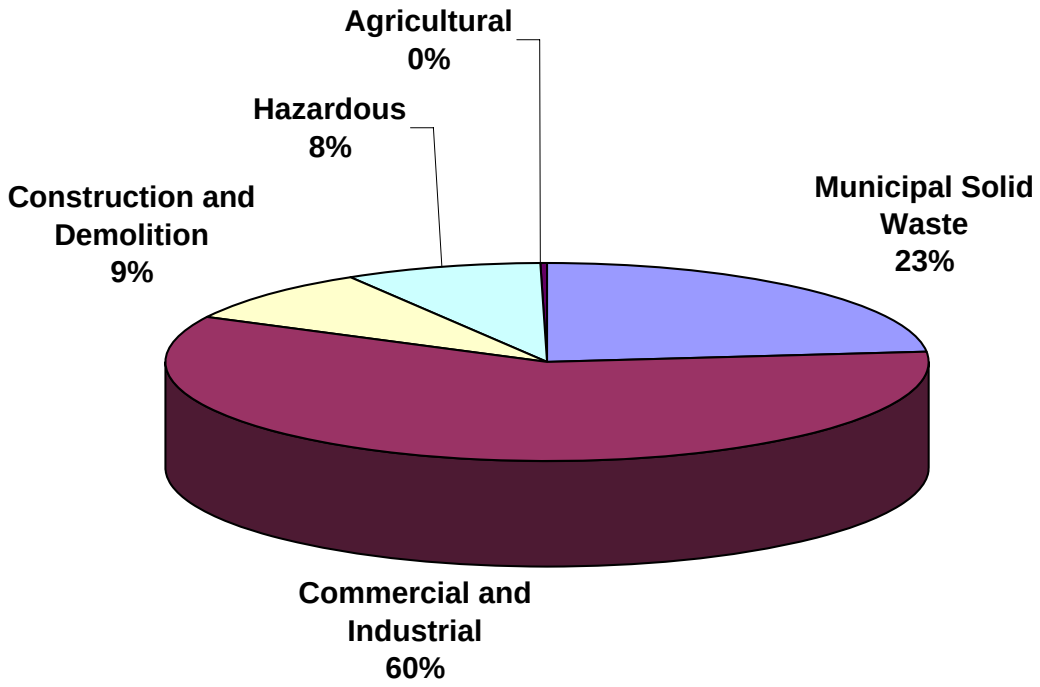
Thurrock has over 120 landfills, which is likely to be the primary cause of methane emissions in the Borough. Household waste per head is 16% higher than national levels at 510 kg. Currently, 76% of Thurrock's household waste is landfilled, compared with 58% nationally, which puts Thurrock in the bottom quartile.

A significant amount of waste is also imported from London for landfilling in Thurrock due to the Borough's proximity to the capital and availability of many worked out quarries. In 1998/99, nearly 2 million tonnes of waste was disposed in landfill – of this 1.65 million tonnes was of external origin including 1.44 million tonnes originating from London. Waste apportionments dictate that Thurrock will continue to receive 12.8% of London's waste.[7]

The Thurrock Waste Capacity and Need Study (2007) provides projections for both commercial and industrial, as well as construction and demolition waste for 2006 and beyond, which are based on three different growth scenarios. Using lower end estimate, the composition of Thurrock's total waste arisings can be seen in the **Figure 11**, below.

[7] Scott Wilson, *Strategic Environmental Assessment / Sustainability Appraisal of Thurrock Council Minerals and Waste DPD: Scoping Report,* September 2007.

Figure 11: Estimated waste arisings proportion by sector, 2006



3.7 Water Resources

Water is essential to supporting all life and most human endeavours. However, water scarcity is a threat in Great Britain as a result of growth pressures, pollution, high levels of water consumption and climate change. The East of England is the driest region in England, and one of the fastest growing. Water resource availability is limited and there are already supply-demand issues in parts of the region. In some catchments, winter abstraction is not reliable during dry winters, and under predicted scenarios for climate change, more frequent drought conditions are expected, leading to increased pressure on water resources.

Water meter penetration has increased from 25-35% in 2004/05 and 2005/06 to 36-45% in 2006/07. This may be a direct result of Essex and Suffolk Water's Thurrock Home Surveys project in July 2005.

Average household per capita water consumption in Thurrock 2004 was 166 litres a day, 8% higher than the national average of 154 litres. The Environment Agency was unable to provide water 2006/07 consumption data for Thurrock, although have published that is in the range of 151-170 litres, per head per day. A trend is therefore unable to be established as to whether water consumption in Thurrock is increasing or decreasing.

According to the Environment Agency, there are no further ground water resources available for any further development in Thurrock and no licences will be issued for further ground water extraction.

3.8 Flood Risk

There are currently nearly 11,000 properties at risk of flooding in Thurrock, which illustrates the extent of flood risk in Thurrock. Surprisingly, despite large amounts of land at risk of flooding, no planning permissions were granted in 2006/07 contrary to Environment Agency advice on flood risk grounds, compared with 13 in the region and 110 nationally.

In November 2006, the Strategic Flood Risk Assessment (SFRA) for Thurrock was published. The SFRA outlines the main flood risks posed to the council area by breaches in the tidal defences and fluvial flood sources. The spatial extent of this flood risk can be found in **Figure 12**.

Results of the SFRA concluded that much of Tilbury, Purfleet and West Thurrock are at or below mean high tide level. These areas are protected by the defence system along the Thames. Surface water in the Tilbury area is pumped to tidal outfalls. Areas of higher ground exist near North Ockendon, Chadwell St Mary and to the North of Grays. The southern areas of the district bordering the Thames are most vulnerable to breaches of flood defences as the areas of land below mean high tide level would be quickly inundated. [8]

The Mar Dyke is a fluvial river but is subject to tidal flooding in extreme events. Fluvial flooding results from large rainfall in the upper reaches of the catchment causing flows in excess of the carrying capacity of the channel. Where land is protected by fluvial flood defences, flooding can occur as a result of a breach in the defences or overtopping when a flood event is larger than what the flood defence is designed for.[4]

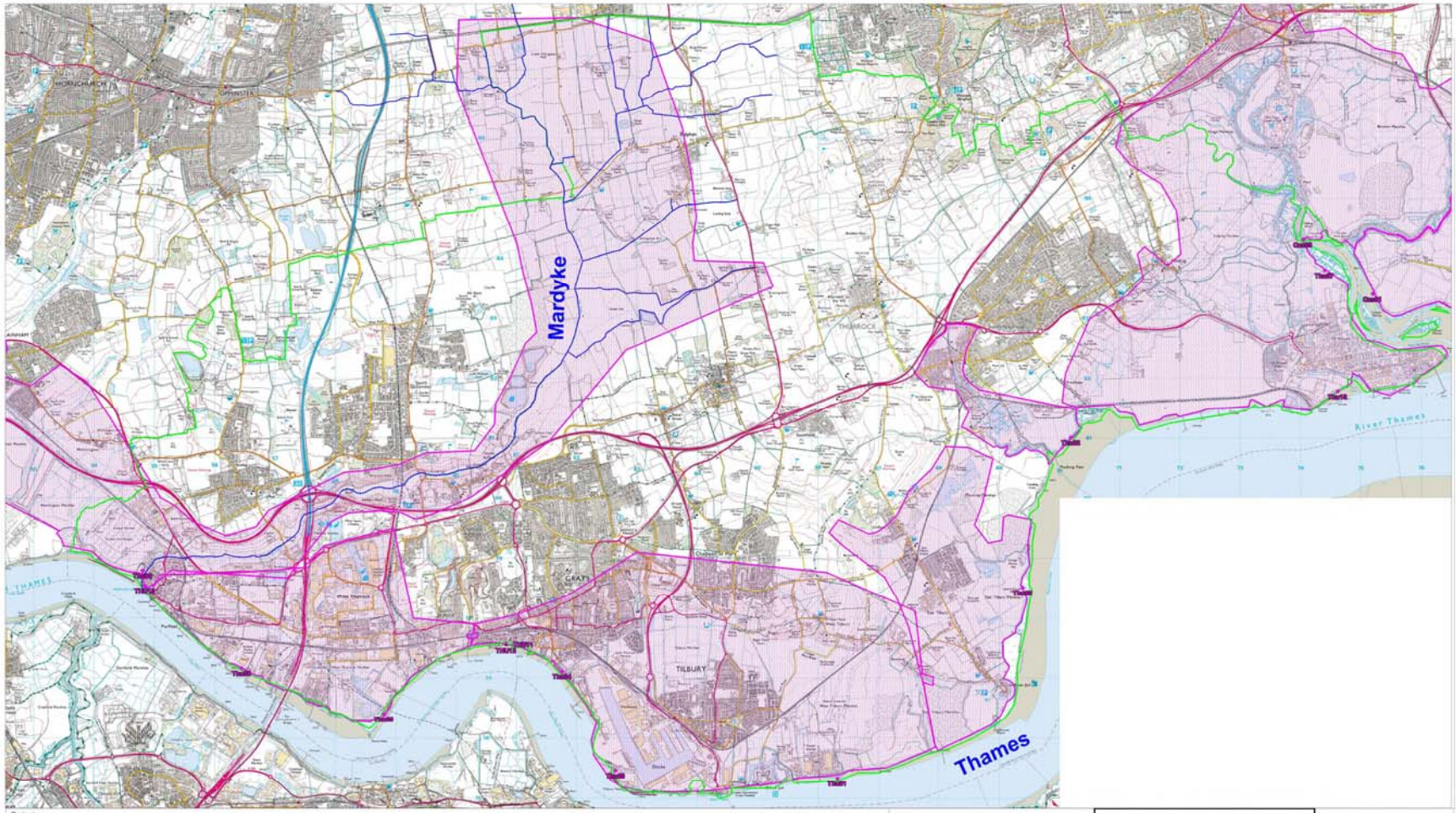
There are several drainage channels that drain surface water from low lying areas of Thurrock to the River Thames. A network of drainage channels drain the area of Tilbury and main channels also drain West Thurrock and Purfleet areas of Thurrock. Floodwater can occur for a number of reasons: rainfall exceeding the design capacity of drainage channels, blocked drainage channels, rainfall exceeding pump capacity at channel outlets to the Thames and pump failure at downstream end of drainage channels.[4]

The North Sea is the body of water that causes tidal flooding in Thurrock. Tidal flooding can result from a storm surge, high spring tides or both events combined over undefended land. In the case of land protected from flooding by sea defences, tidal flooding can occur through either a breach in the sea defences, failure of a mechanical barrier or overtopping of defences.[4]

[8] Scott Wilson, *Thames Gateway South Essex Appendix F Thurrock Borough Council Strategic Flood Risk Assessment*, November 2006.

From a flood risk perspective, further development within areas of flood risk should generally be discouraged through the Local Development Framework and Thurrock Council should investigate ways of incorporating flood resilience measures into existing development in these areas.

Figure 12: Flood Risk in Thurrock



3.9 Climate

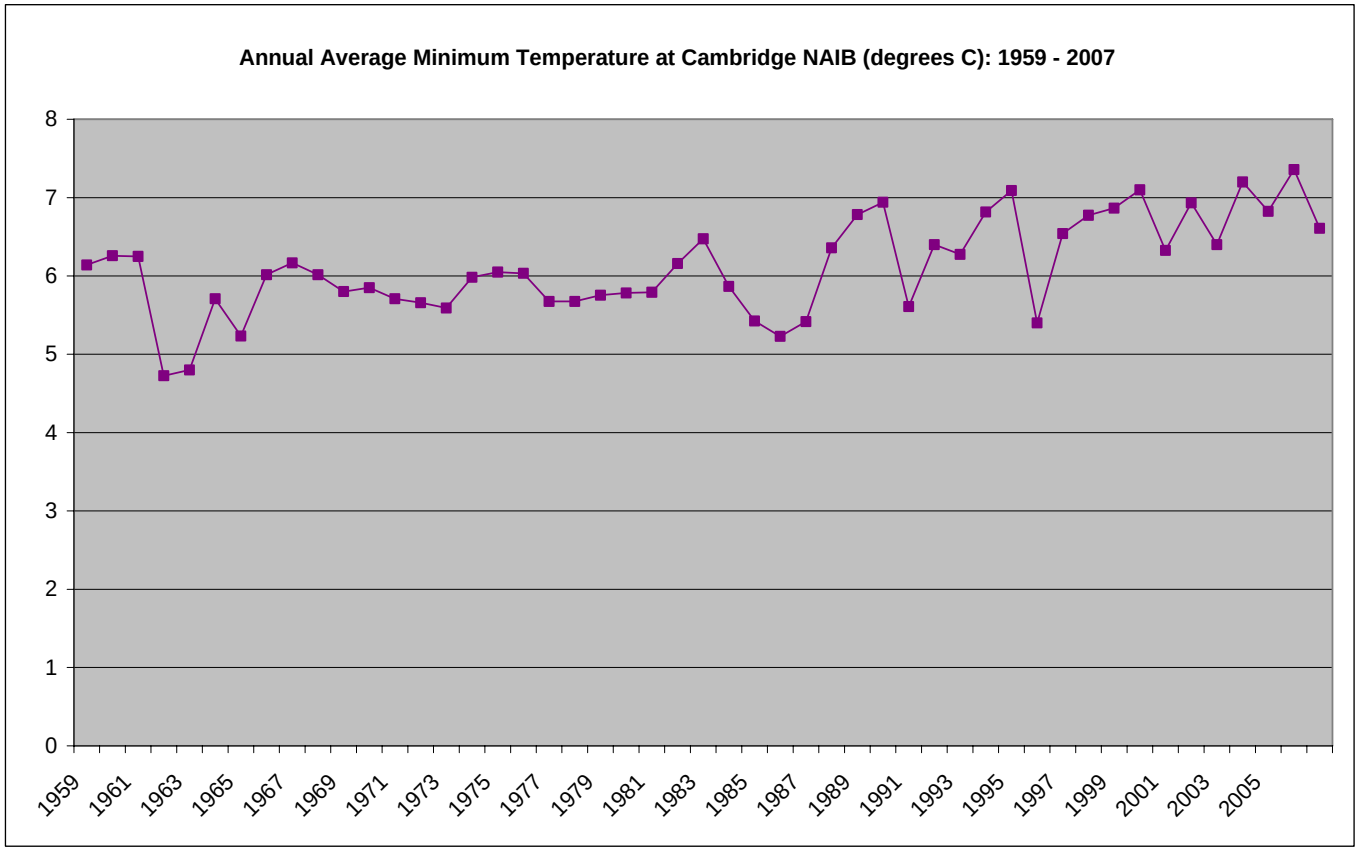
Analysis of climatic data from 1959 – 2007 show varied results. The nearest Met Office station data for Thurrock is Greenwich – however, data is only available to 2003 as a result of the closure of the Greenwich station in September 2004. Therefore Cambridge station data to 2007 has been used for analysis in this assessment, as it is the closest station that is currently operational.

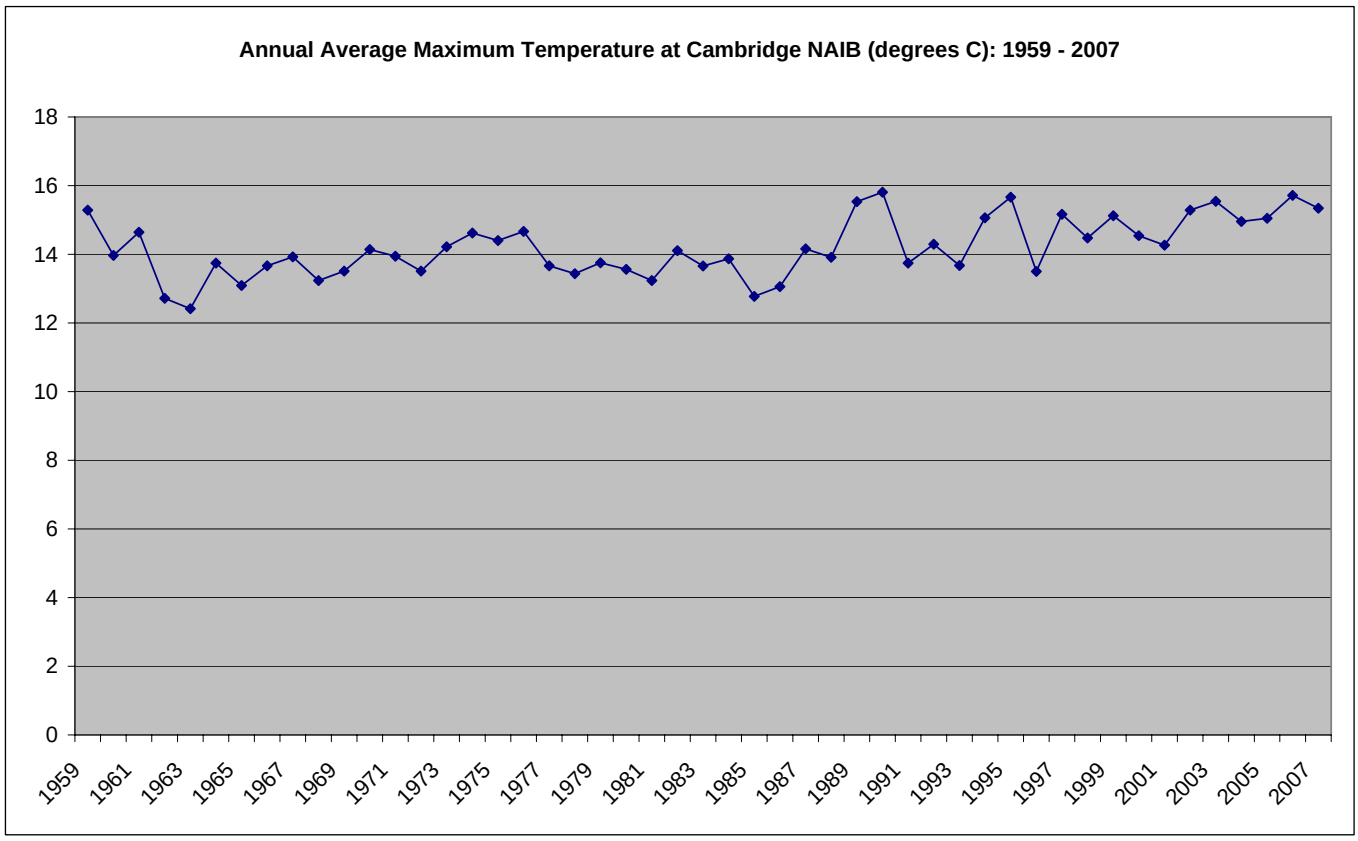
Climate data was assessed with consideration for the average annual rate of change. Overall, there have been increases in annual rainfall of 2%, 3% and 1% over five, ten and twenty-five years, respectively.

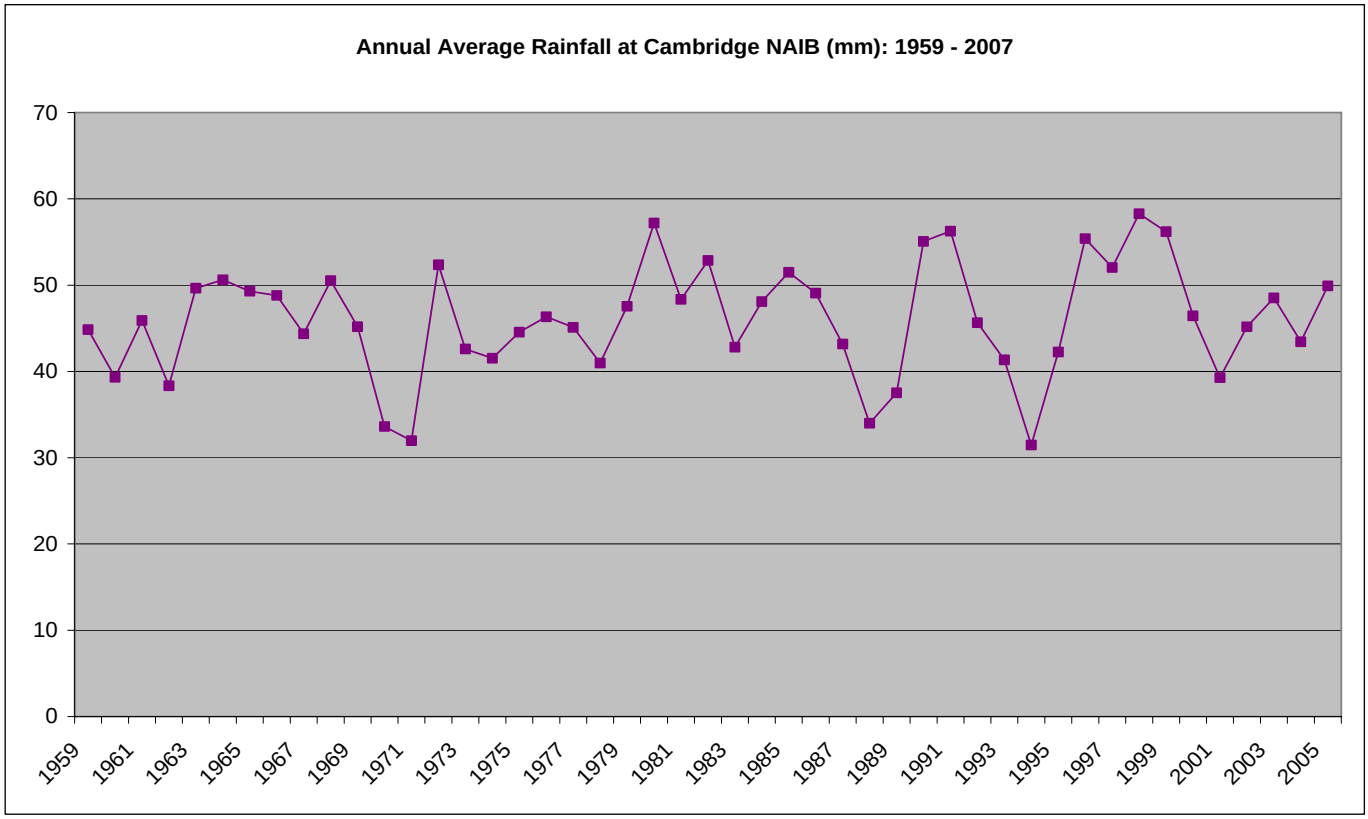
The annual average rate of change in the number of sunshine house and annual average maximum temperature have remained relatively constant over the five, ten and twenty five year period assessed. However, minimum temperature has decreased by 1% over a five year period and increased by 1% over twenty-five years. The number of days of air frost has increased most dramatically over the twenty five years by 10%, although this variation slows when looking at more recent time periods.

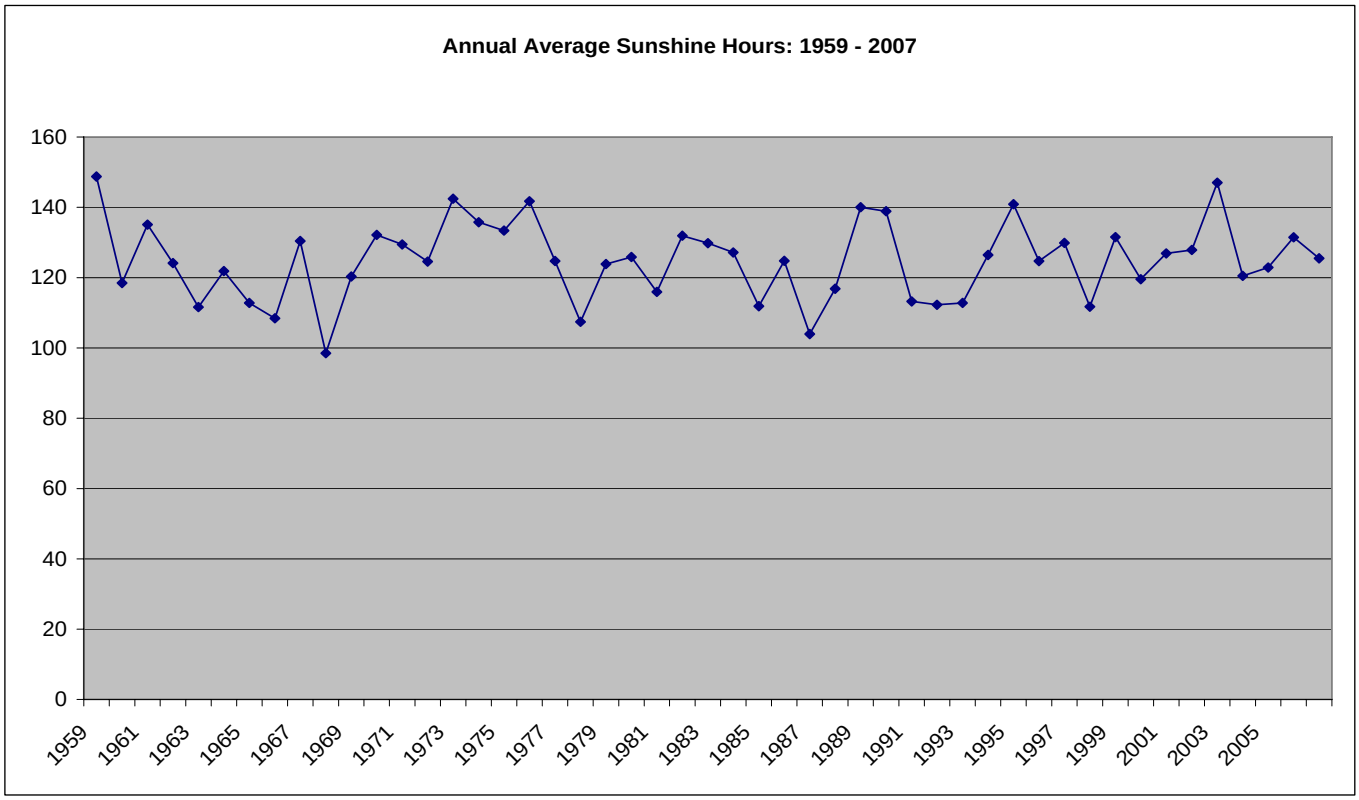
When looking at the longer term from 1959 to 2007, rainfall has seen an average annual increase of 2% and air frost days 10%. Again, the annual average rate of change in the number of sunshine house and annual average maximum temperature have remained relatively constant over the five, ten and twenty five year period assessed. However, minimum temperature has increased by 1% between 1959 and 2007.

Overall, analysis of climatic data shows trends of increased rainfall, air frost days and minimum temperatures. Small, but steady annual increases in rainfall are likely to present additional challenges in Thurrock in relation to drainage and flood risk. Increases in annual average minimum temperatures may threaten health and infrastructure and may also have economic impacts.









3.10 Climate Change Data Analysis Table

(NA = Not Available)

Indicator	Baseline	Comparator		Source and Data Year
Greenhouse Gases				
Carbon Dioxide Emissions per capita[9]: tonnes	13.3	Comparable Unitaries: 9.0 EoE: 8.4 UK: 9.1		Defra *Emissions of carbon dioxide for local authority areas* 2005
Total Carbon Dioxide Emissions: tonnes	1,956,000	EoE: 46,808,000 UK: 545,775,000		
Carbon Dioxide Emissions - proportion by sector: • Industry and Commercial • Domestic • Road Transport • Land use, land use change and forestry	 • 61% • 17% • 22% • 0%	EoE: • 37% • 29% • 33% • 1%	UK: • 46% • 27% • 27% • 0%	
Total Methane Emissions: tonnes ($t CO_2e$)	9,540 (200,340)	UK: 2,358,000 (49,525,000)		NAEI Data Warehouse 2005
Methane Emissions - proportion by sector: • Waste Treatment and Disposal • Production and distribution of fossil fuels • Agriculture	 • 92% • 6% • 1%	NA		NAEI Data Warehouse 2005
Total N_2O Emissions: tonnes ($t CO_2e$)	209 (64,790)	UK: 128,000 (39,645,000)		NAEI Data Warehouse 2005

[9] This represents all carbon dioxide emissions in Thurrock and therefore does not represent NI186 which excludes several sectors.

Indicator	Baseline	Comparator		Source and Data Year
N_2O Emissions - proportion by sector: • Point Sources • Road Transport • Agriculture • Energy Production and Transformation • Other Transport • Waste Treatment and Disposal	 • 46% • 21% • 18% • 10% • 5% • 1%	NA		NAEI Data Warehouse 2005
Energy				
Energy Consumption Per Capita - kWh	96,600	EoE: 28,600 Upper Quartile		BERR *Experimental high level energy indicators* 2005
Electricity Consumption: • Total GWh • % Domestic • % Industry and Commercial	 • 1,099 • 28% • 72%	EoE: • 28,801 • 42% • 58%	GB: • 317,832 • 37% • 63%	BERR *Regional and local authority electricity sales consumption statistics 2005, 2006* 2006
Gas Consumption • Total GWh • % Domestic • % Industry and Commercial	 • 3,543 • 25% • 75%	EoE: • 54,445 • 64% • 36%	GB: • 628,734 • 63% • 37%	BERR *Gas sales and numbers of customers by regional and local authority 2005, 2006* 2006
Renewable Energy Capacity Total MW and proportion by type: • Landfill Gas • Sewage Gas • Biomass • Onshore Wind • Offshore Wind	52.6 MW • 76% • 0% • 24% • 0% • 0%	Essex: 96.7 EoE: 457.5 MW		Renewables East *East of England Renewable Energy Statistics December 2007* 2007

Indicator	Baseline	Comparator		Source and Data Year
Renewable Energy Capacity Installed by type	0	2004/05: 42 mWh 2005/06: 10 mWh		Thurrock Council *Thurrock Local Development Framework Annual Monitoring Report December 2007* 2006/07
BV63 Energy Efficiency Average SAP rating of local authority owned dwellings	77.8	Unitaries average: 70 EoE average: National average: 68 Top Quartile. Up from 67 in 2003/04		Thurrock Council *Performance Counts – 2007/08* 2006/07
Transport				
Road transport energy consumption: • Buses • Diesel Cars • Petrol Cars • Motor-cycles • HGV • Diesel LGV • Petrol LGV	 • 3% • 10% • 40% • 0% • 35% • 11% • 1%	EoE: • 3% • 12% • 45% • 0% • 24% • 14% • 1%	UK: • 4% • 12% • 47% • 0% • 22% • 14% • 1%	BERR *Gas sales and numbers of customers by regional and local authority road transport consumption statistics 2005, 2006* 2006
Estimated traffic flows for all motor vehicles: • million vehicle kilometres • 10 year growth: 1996-2005 • 5 Year growth: 2001-2005 • Annual average growth • Growth on previous year	 • 1,599 • 20% • 3.1% • 2.0% • -0.19%	EoE: • 55, 026 • 12.6% • 4.8% • 1.3% • -0.13%	UK: • 2,865 • 13.1% • 5.0% • 1.4% • 0.24%	Department for Transport *National Road Traffic Survey* 2005

Indicator	Baseline	Comparator	Source and Data Year
% of the resident population who work who travel to work by: • car • bus or coach • train or tram or other rail • on foot • bicycle	 • 64.0% • 4.4% • 14.3% • 6.7% • 1.7%	UK: • 63.7% • 5.7% • 5.3% • 10.4% • 2.9%	Office for National Statistics Travel to Work: Census 2001
Bus Patronage: Million Passenger Journeys	3.41	NA	Thurrock Council 2006/07
Rail Patronage: Million Passengers	7.4m	NA	Thurrock Council 2006/07
Cycling Trips	534	NA	*Thurrock Local Transport Plan Delivery Report 2007* 2006
Mode share of journeys to school – % of journeys by car	31.4%	NA	*Thurrock Local Transport Plan Delivery Report 2007* 2006
Land Use			
Woodland – ha: • Ancient • Recent	 • 110 • 94	EoE: 139,114 (7.3%) UK: 352,195	Thurrock Council *A Profile of Thurrock Planning 2004*
Previously Developed Land: • Business Floor space (sq m) • New Homes (%)	 • 20,054 • 92.5%	EoE: 72% UK: 75%	Thurrock Council *Local Development Framework Annual Monitoring Report 2007* 2006/07
Waste			
% of household waste landfilled	76%	Unitaries: 59% England: 58% Bottom Quartile	Audit Commission Data profile for Thurrock 2006/07
Kg of household waste collected per head	510	Unitaries: 516 England: 441 Bottom Quartile	Audit Commission Data profile for Thurrock 2006/07

Indicator	Baseline	Comparator	Source and Data Year
Waste arisings: • Municipal • Commercial and Industrial • Construction and Demolition • Hazardous • Agricultural	 • 23% • 60% • 9% • 8% • 0%	NA	Environmental Resources and Management (ERM) *Thurrock Waste Capacity and Need Study –Final Report, May 2007* 2006
Water Resources			
Water Meter Penetration	36-45%	2004/05: 25-35% 2005/06: 25-35%	East of England Regional Assembly *East of England Plan Annual Monitoring Report: Background Paper – Water Resource Issues 2006 - 2007* 2006/07
Water Consumption: litres per person per day	166	UK: 154 Bottom quartile	Audit Commission Data Profile for Thurrock 2004
Flood Risk			
Number of Properties at Risk of Flooding: • 1:200 year tidal event • 1:100 year fluvial event	 • 10, 838 • 127	EoE: 125,000 UK: 2.3 million (10%)	Scott Wilson *SEA/SA Scoping Report on the Thurrock Local Development Framework*
Number of planning permissions granted contrary to Environment Agency advice either on flood risk grounds or water quality	0	Essex: 0 EoE: 13 UK: 110	Environment Agency *High Level Target 5 Development and Flood Risk in England 2006/07* 2006/07

Indicator	Baseline	Trend and / or comparator	Source and Data Year
Climate			
Annual Average Rainfall at Cambridge NAIB in mm	49.9	Average annual rate of change: 5 Year Change: 2% 10 Year Change: 3% 25 Year Change: 1%	Met Office *Historic Station Data for Cambridge NAIB* 2007
Annual Average Mean Minimum Temperature at Cambridge NAIB in degrees Centigrade	6.6	Average annual rate of change: 5 Year Change: -1% 10 Year Change: 0% 25 Year Change: 1%	
Annual Average Mean Maximum Temperature at Cambridge NAIB in degrees Centigrade	15.3	Average annual rate of change: 5 Year: 0% 10 Year: 0% 25 Year: 0%	
Annual Average Number of Sunshine House at Cambridge NAIB in degrees Centigrade	125.5	Average annual rate of change: 5 Year Change: 0% 10 Year Change: 0% 25 Year Change: 0%	

4. Conclusions

4.1 Strengths, Weaknesses, Opportunities and Threats

Analysis of evidence and data resulted in the identification of strengths, weaknesses, opportunities and threats (SWOT) currently related to climate change in Thurrock.

Strengths

- High levels of renewable energy
- High levels of new development on previously developed land
- High SAP rating in local authority housing stock
- Lower than average domestic CO_2 emissions
- Land use emissions are currently neutralised, i.e. the number of sources equals the number of sinks

Weaknesses

- Higher than average per capita CO_2 emissions, resulting primarily from extremely high industrial and commercial emissions and energy consumption
- Larges areas of flood risk throughout the Borough, but primarily to the south, fronting the River Thames
- Energy consumption per capita is three times the regional average, primarily as a result of extremely high industrial and commercial energy consumption
- High methane emissions as a result of many landfills and high proportion of waste going to landfill
- Higher than average levels of water consumption

Opportunities

- Good opportunities for increasing renewable energy supply, particularly though the Local Development Framework and the proposal for large scale renewable energy facility at Tilbury
- High levels of brownfield land available for redevelopment to limit land use change emissions
- To encourage energy and water efficiency, as well as low-carbon/renewable onsite renewable energy generation at new industrial, commercial and residential development
- To ensure flood risk is minimised at new development
- To reduce emissions and energy consumption from existing industrial and commercial development
- To reduce CO_2 emissions from road transport through modal shift and technological improvements

Threats

- Housing growth is likely to lead to increases in total CO_2 emissions from the domestic sector
- Housing growth coupled with high water consumption is likely to increase water scarcity
- Jobs growth is likely to lead to increases in greenhouse gas emissions from the industrial and commercial sector
- Transport growth arising from jobs and housing growth is likely to lead to increases in greenhouse gas emissions from the transport sector
- Increases in rainfall from climate change coupled with flood risk and drainage issues are likely to expound flood risk further and increase vulnerability

4.2 Issues and Priorities

Consideration of the SWOT analysis above allowed for strategic climate change issues and priorities for Thurrock to be identified.

Issues

- Reducing greenhouse gas emissions will be essential to limiting the worst impacts of climate change. Specifically, reducing CO_2 emissions from road transport and industrial and commercial energy consumption is necessary.
- Increasing renewable energy capacity in order to help meet regional targets and reduce greenhouse gas emissions from energy consumption.
- Ensuring that new development from growth is designed to cope with a changing climate. Planning for adaptation protects investment and those who utilise development from the worst impacts of climate change.
- Retrofitting existing housing and infrastructure to adapt to climate change will be essential to minimising the impacts of climate change on society and the economy.
- Minimising and reducing greenhouse gas emissions whilst providing for 18,500 new homes and 26,000 new jobs in Thurrock by 2021

Priorities

- Reducing CO_2 and N_2O emissions from the industrial and commercial sector, particularly from gas and electricity consumption
- Reducing CO_2 and N_2O emissions from road transport, particularly from diesel freight vehicles and the workplace commuter
- Reducing methane emissions from the waste sector, particularly from landfill
- Increasing renewable energy generation
- Ensuring that new development incorporates energy and water efficiency into design
- Ensuring that new vulnerable development is not at risk of flooding
- Reducing flood risk at existing development

4.3 Next Steps

Action by local authorities will be critical to the achievement of the Government's climate change objectives. Local authorities are uniquely placed to provide vision and leadership to local communities by raising awareness and to influence behaviour change. In addition, through their powers and responsibilities (housing, planning, local transport and powers to promote well-being) and by working with their Local Strategic Partnership, local authorities can have significant influence over climate change mitigation and adaptation activities in their local areas.

The most effective way for the issues and priorities identified above to be delivered in an integrated manner is through the development of a climate change strategy for Thurrock.

An integrated, community-wide response to climate change is required and therefore best achieved being addressed at the strategic level. Due to its cross-cutting nature, a climate change strategy should be delivered through as a collaborative effort across the Thurrock community in order to effectively tackle this issue.

Strategic action on climate change can be defined by the desired outcomes, depending on their scope. These are:

- **Climate Change Mitigation:** Strategic mitigation activity focuses action on the reduction of greenhouse gas emissions that contribute to climate change.

- **Climate Change Adaptation:** Strategic adaptation activity focuses action defining a proactive approach through which to cope with and asses risk to the impacts of climate change.

- **Climate Change Mitigation and Adaptation:** A holistic approach to focus efforts both on reducing greenhouse gas emissions to mitigate climate change and also preparing the local area for adapting to the likely impacts of climate change.

Due to the high level of vulnerability to the effects of climate change, it is recommended that a holistic climate change mitigation and adaptation strategy is developed for Thurrock. This would provide a strategic framework through which to contribute towards the mitigation of climate change across sectors, whilst adequately preparing the area for adapting to climate change and reducing vulnerability to climate change impacts.