Warwickshire Energy Statistics 2007

Climate Change Strategy Update

Second Report for Warwickshire County Council

Warwickshire County Council

Working for Warwickshire

Warwickshire Energy Statistics 2007

Report for Warwickshire County Council

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1.0 Introduction and Key Points

1.1 Introduction

In 2005 Warwickshire County Council decided to lead the formulation of a Climate Change Strategy for the county. This report provides an update of work done in 2005 to profile the nature, scale and importance of the energy sector in the county and includes estimates of the energy consumption and related emissions. Unless otherwise stated the report uses 2004 or 2005 data, whichever is the most recent year available. Importantly, there has been a significant increase in the quality and availability of sub-regional data in respect of energy use since the original report. Hence, when presenting trends, there are comments on any changes in the data which may have distorted the trend. The intention is to provide recently released data for previous years as well as the most recent year.

1.2 Key Points

The following key points have emerged:

Coal Industry

- Warwickshire contains Daw Mill, the only active coal mine in the West Midlands.
- Daw Mill is a significant employer – typically employs some 600 people annually.
- The energy content of the approximately 3 million tonnes of coal extracted annually is approximately 20,000 GWh. This is approximately 98% of the total energy consumption in Warwickshire.
- Output appears to have been consistent over the last few years.

Renewables

- Renewable electricity capacity as of 2007 in the county is 20,693 kWe (20.7 MWe), almost exclusively from landfill and sewage gas.
- Compared with the 2005 report, renewable capacity has increased by 19% or 3,280 kWe.
- The output from this capacity in 2006/07 was 75,844 MWh (76 GWh). This is equivalent to 2.5% of the county's total electricity demand in 2005. This compares with 81,382 MWh in 2005 (though it is suspected that there were errors in the 2005 data which inflated the output).
- The annual consumption of renewable electricity in Warwickshire needs to increase to 154 GWh per year by 2010 to meet the county's share of the 5% West Midlands regional target.
- In the long term it is likely that the amount of landfill gas available and hence the electricity which can be generated from it will decline.
- A number of planning permission's have been submitted for new renewable energy schemes in the county and to date three schemes are awaiting construction. A planning permission application for a wind energy scheme near Stratford on Avon was withdrawn in 2005.

Combined Heat and Power (CHP)

- No data is available from Ofgem to enable an update of the combined heat and power capacity in Warwickshire. We are assuming that the 2005 report total of 2MWe remains true (though many of the schemes are old and may well have ceased to operate). This data should be available by the end of the year (according to Ofgem's contractors).

- For Warwickshire to meet its share of the national UK CHP target, the county's CHP capacity should reach 80 MW by 2010.

Energy consumption

- Total gas sales fell by approximately 16% since 2003 to 5,320 GWh/year, however, it is likely that this reduction is a result of data quality improvements rather than real changes in consumption.
- Whilst gas sales per domestic consumer have remained on par with the national average, gas sales per commercial and industrial consumer continue to be significantly below the national average (76% in 2005). There are significant variations within the county, which are thought to relate to the size and number of industrial consumers.
- Total electricity consumption has increased by over 17% since 2003 to 3,203 GWh/year. However, as with gas consumption, it is likely that this increase is a result of data quality improvements rather than real changes in consumption.
- Average electricity consumption (domestic; and industrial and commercial) remains above the national average. Domestic electricity consumption per consumer is particularly high in Stratford-on-Avon, whilst industrial and commercial electricity consumption per consumer is particularly high in North Warwickshire and Rugby.
- Notably, almost half (46%) of all industrial and commercial coal consumption in the West Midlands region is consumed in Warwickshire. This is thought to be a result of extensive use of coal at the cement works in Rugby.

Final Energy Consumption by Sector

Transport

- As at the end of 2006, Warwickshire had 283,541 cars licensed, representing a 2% increase compared to the end of March 2005.
- In 2006 75% of registered cars in Warwickshire were petrol whilst 24% were diesel. The corresponding proportions for petrol and diesel in 2005 were 79% and 20% respectively, indicating a continuing shift from petrol to diesel.
- In 2005, the consumption of road transport fuel was 686.3 ktonnes, representing a decrease of 2% or 13 ktonnes compared with 2004. In terms of carbon emissions, the level of road transport fuel consumed in 2004 was equivalent to 2,569 ktonnes of carbon dioxide (CO_2) emissions.
- It has been estimated that aircraft refuelling at Coventry Airport emit a further 56 ktonnes of CO_2 emissions annually.

Domestic

- Domestic energy consumption has fallen from 5,535 GWh in 2003 to 5,059 GWh in 2004, representing a reduction of some 9%. However, as mentioned above, this reduction is most likely to be a result of data quality improvements rather than a real change in consumption.
- The resultant CO_2 emissions by the domestic sector is estimated at 2.7 tonnes of CO_2 per capita, which is 7% higher than the regional average and 3% higher than the national average. CO_2 emissions per capita are particularly high in Stratford-on-Avon and Warwick. This is thought to reflect a combination of higher than average incomes and greater use of oil and coal (due to a larger number of rural customers with no mains gas connection).

Industrial & Commercial

- Industrial and commercial energy consumption increased significantly between 2003 and 2004, from 5,229 GWh to 6,256 GWh. However, as with domestic consumption, this increase is likely to be a result of data quality improvements rather than a real change in consumption.
- Natural gas remains the main source of energy, but as with the domestic sector there is a higher use of coal among Warwickshire businesses than is typical.
- In respect of carbon emissions, the industrial and commercial sector emits 8.9 tonnes of CO_2 per employee, which is 6% higher than the regional average.
- Since the 2005 report, data on large point sources of emissions has become more available. Notably, the cement manufacturer in Rugby emitted some 1.1 million tonnes of CO_2 in 2005. This represents an increase of 120% compared with their reported 2000 emissions.

Overall Energy Balances

- Domestic energy consumption accounted for just under a quarter (24.7%) of final energy consumption in Warwickshire in 2004 (total 20,484 GWh).
- Transport accounted for the largest share, approximately 45%, whilst industry and commerce account for approximately 31%.
- The main type of fuel consumed is petroleum products (51%), followed by natural gas (26%), electricity (15%), then coal (8%). Renewables and waste only account for 0.4% of the total energy consumption in Warwickshire.
- Total CO_2 emissions from the energy consumption in 2004 in Warwickshire have been estimated at 5,312 ktonnes. This is an increase of 713 ktonnes or 16% from 2003. However, again this is most likely to be a result of data quality improvements rather than real changes in carbon emissions. Non-energy emissions (e.g. from the cement works) and emissions from aviation are not included in this estimate.
- The transport sector is the largest emitter, accounting for over 41% of all CO_2 emissions. In terms of fuel types, petroleum products are the largest emitters, accounting for almost half (47%) of all emissions.
- Electricity accounts for 25% of CO_2 emissions but only 15% of total consumption.
- By contrast, natural gas accounts for 26% of energy consumption but only accounts for 19% of CO_2 emissions in Warwickshire.
- Warwickshire consumes 31% more energy per million £ of gross value added (GVA)[1] compared with the national average. To a considerable extent this is thought to be a result of a higher than average proportion of employment in energy intensive sectors (i.e. industries which use a lot of energy in relation to their GVA) in Warwickshire.

[1] GVA represents a measure of the total economic activity in a region or sub-region. It is equal to output excluding the intermediate inputs, and hence represents value added.

2.0 Energy Resources

This section describes the amount of unrefined (primary) energy that is first made available for use in Warwickshire as well as the outputs of the facilities where energy is transformed from one form to another. This is combined heat and power (CHP) and generation of electricity from renewable sources.

2.1 Coal Extraction

Warwickshire contains the Daw Mill coal mine situated 13km to the northwest of Coventry, 2km southeast of the village of Furnace End. A DTI review of the reserves at UK deep coal mines[1] reported that in 2002 the reserves at the mine were 26 million tonnes with a resource of 6.3 million tonnes and a mineral potential total of 43 million tonnes.

Currently, Daw Mill's typical annual output is approximately 3 million tonnes and the mine typically employs some 600 people[2] . The energy content of this amount of coal is approximately 20,000 GWh[3] which is approximately 98% of the total energy consumption in Warwickshire (see section 5.1). Output appears to have been consistent over the last few years.

Coal mine methane is composed of approximately 70% methane, 15% nitrogen and 15% carbon dioxide. It escapes to atmosphere from operating and abandoned mines. As with onshore oil and gas, the DTI lets Petroleum Exploration and Development Licences (PEDLs) to developers who may wish to extract and utilise CMM. A number of PEDLs were let in Warwickshire in previous rounds but none of these licences appear to have been turned into active sites.

2.2 Renewables

Ofgem produces a register of all accredited generating stations and it also publishes the number of Renewables Obligation Certificates (ROCs) issued each month (since April 2001) to each station (on the ROC register). One ROC is issued per MWh of eligible electricity generated. The following table lists all the generators of electricity from renewable sources that could be identified in Warwickshire.

[1] http://www.dti.gov.uk/energy/coal/mine_reviews/c4dawmill.pdf
[2] UK Coal, 2007
[3] Typically, 24 Gigajoules per tonne of coal (UK Coal). 1 Gigajoule (Gj) = 277.8 kWh.

Table 1 Renewable Electricity Schemes in Warwickshire, June 2007

Name	Capacity (kWe)	Output (MWh)	Note
Judkins Landfill Site	2,880	8,103	Landfill gas
Ling Hall Landfill (Generation Phase 1)	1,003	7,091	Landfill gas
Ling Hall Landfill (Generation Phase 2)	1,048	5,545	Landfill gas
Packington Gas Control Plant	8,250	27,954	Landfill gas
Ryton Landfill Site	900	1,764	Landfill gas
Ufton	1,003	4,693	Landfill gas
Waverley Wood Farm	988	4,136	Landfill gas
Waverley Wood II (NFFO)	1,413	4,494	Landfill gas
Finham2 STW	2,096	7,985	Sewage gas
Hartshill STW	190	592	Sewage gas
Rugby STW	190	639	Sewage gas
Spernal STW	625	2,767	Sewage gas
Hillcrest Solar	2	2	Photovoltaics (solar electricity)
EPIC Nuneaton[1]	105	79	Photovoltaics (solar electricity)
Total	**20,693**	**75,844**	

Source: Ofgem ROC Register, 2007

The following points can be derived from the information.

- The renewable capacity in Warwickshire is principally fuelled by landfill gas. Though this is a source which will remain in the short term, it is likely to decline over the longer term, as the fraction of biodegradable waste which is sent to landfill reduces in line with the requirements of the Landfill Directive. Though alternative waste treatment technologies may replace some of the capacity.
- Output is approximately 2.5% of Warwickshire total electricity demand (see section 3.2).
- Importantly, since the report in 2005 a number of schemes have started to operate, most notably Finham2 STW and Waverly Wood II (NFFO), adding 3,280 kWe of capacity. However, despite this increase in capacity, output has fallen sharply since the 2005 report – from 81,382 MWh to 75,844 MWh. However, it is suspected that there were errors in the 2005 data which inflated the output.

[1] Eliot Park Innovation Centre was not identified on the RO Accreditation list but has been included.

The target for the UK is for 10% of all electricity generated to come from renewable sources by 2010. However, the West Midlands Energy Strategy contains a lower and differently phrased target - for 5% of the electricity consumed in the region to come from renewable sources by 2010. The target was reduced due to the relative lack of a wind resource (no uplands or coastline) in the region (in comparison to others) as wind is widely accepted to be the most likely source of growth in renewables capacity in the short term. The phrasing was switched from % of generation to % of use to reflect the relative lack of large scale power stations in the region.

The annual consumption of renewable electricity in Warwickshire needs to increase to 154 GWh per year by 2010 to meet this 5% consumption target.

Annex 1 contains information on the number of planning applications for renewable energy schemes in the county.

2.3 Combined Heat and Power

A combined heat and power (CHP) unit is an installation where heat energy present as a by-product of engine-driven electricity generation is used for space heating or process requirements. This results in a much higher overall efficiency of useful delivered electricity and heat than is the case where electricity and heat are generated separately.

Ofgem's contractors have reported that the CHP register is currently being updated and were unwilling to release any information for this report. However, we are assuming that the 2005 report total of 2MWe remains true (though many of the schemes are old and may well have ceased to operate). Data on CHP units should become available by the end of the year (according to Ofgem's contractors).

Table 2 CHP Schemes in Warwickshire

Scheme Location	Site Address	Commissioning Date	CHP Capacity kWe	Max Heat Output kWt
Stratford Upon Avon Foods (believed to have ceased trading)	Stratford Upon Avon	1997	980	948
Hospital of St Cross	Rugby NHS Trust	1991	410	695
Moat House International Hotel	Stratford-Upon-Avon	1993	300	452
Newbold Community Leisure Centre	Royal Leamington Spa	1999	216	0
Ken Marriott Leisure Centre	Rugby	1996	56	103
St Michaels Hospital	Warwick	1995	54	0
Royal Mail Leamington Spa	Leamington Spa	1995	40	0
Abbey Fields Leisure Centre	Kenilworth	1994	38	67
Biddle Air Systems Ltd	Nuneaton	1991	18	55
WJ Findon & Sons	Stratford on Avon	2000	30	Exhaust gas used to promote plant growth in a greenhouse
		TOTAL	**2,142**	**2,320**
Future Prospect				
Scottish & Southern	Malpas Quarry Rugby	This application was listed in the 2005 National Grid 7 year statement. It does not appear in the 2007 statement.[1]	115,000	

Source: Warwickshire Energy Statistics (2005) ECOTEC Research & Consulting

The UK target is to have 10,000 MW of CHP capacity by 2010. If Warwickshire's share of this target is calculated from its proportion of national electricity demand (0.8% of the UK total), the county's CHP capacity should reach 80 MW by 2010.

[1] See: http//www.nationalgrid.com/uk/Electricity/SYS

3.0 Energy Consumption

This section covers energy consumed within the county.

3.1 Natural Gas

This section presents data on gas consumption in Warwickshire by local authority.

The table overleaf presents this data. The data shows:

- In 2005, gas sales in Warwickshire totalled 5,320 GWh.
- Consumers in Warwickshire represent 0.9% of total consumers in Great Britain, and they account for 0.8% of total gas sales nationally. Within the West Midlands, Warwickshire represents 9.4% of all consumers but only 8.8% of gas sales.
- The latter under-representation comes from industrial and commercial (I&C) consumers. Warwickshire hosts 9.8% of the region's industrial and commercial consumers. Yet these demand less than 7.6% of the total industrial and commercial gas sales in the region.
- Average consumption per domestic consumer in Warwickshire is largely on par with the national and regional averages.
- Average consumption per commercial and industrial consumer is much lower in Warwickshire at 492,142 kWh, representing 78 percent of the regional average and 76 percent of the national average.
- Early analysis of national figures by the DTI has indicated a potential trend of lower than expected domestic gas consumption in areas with an active coal mining sector. This may explain the relatively low gas use in Nuneaton and Bedworth which contains the Daw Mill mine.
- Gas consumption in North Warwickshire is substantially higher than both the Warwickshire and national average.
- The sharp decline in gas sales per consumers since 2003, particularly for industrial and commercial, can largely be explained by data quality improvements rather than real changes in consumption[1].

[1] The 2004 and 2005 data has been collected from a restructured gas distribution network, which is different to the earlier National Grid data sets. The most significant difference is the improvement in the geographical allocation process for the consumption data. In addition, consumption for the National Grid data set will have a more significant level of adjustment than the revised data set, given that it is weather corrected to a longer 35 year trend. New data is based on the current 17 year trend weather correction, which will reflect the milder temperatures of more recent years.

Table 3 Gas sales and numbers of customers by area, 2005

	Domestic consumers (1)		Commercial and industrial consumers		All consumers		Sales per consumer	
Area	**Sales - GWh**	**Number of consumers ('000)**	**Sales 2005 - GWh**	**Number of consumers ('000)**	**Sales - GWh**	**Number of consumers ('000)**	**Domestic- kWh**	**Commercial and Industrial - kWh**
North Warwickshire	428	21.1	439	0.4	867	21.5	20,280	1,017,500
Nuneaton and Bedworth	874	47.2	281	0.7	1,155	47.9	18,500	432,365
Rugby	677	34.8	394	0.6	1,071	35.4	19,455	648,291
Stratford-on-Avon	648	33.6	254	0.8	902	34.4	19,290	327,578
Warwick	942	49.2	382	1.1	1,324	50.3	19,164	350,297
Total Warwickshire	**3,569**	**186.9**	**1,751**	**4.6**	**5,320**	**189.5**	**19,199**	**492,142**
Warwickshire as % of WM	9.5%	9.4%	7.6%	9.8%	8.8%	9.4%	101	78
Total West Midlands	**37,726**	**1,985**	**22,963**	**36**	**60,689**	**2,021**	**19,006**	**630,898**
Warwickshire as % of GB	0.9%	0.9%	0.7%	0.9%	0.8%	0.9%	101	76
Total Great Britain	**410,737**	**21,595**	**256,850**	**398**	**667,587**	**21,993**	**19,020**	**645,050**

Source: DTI, 2007

(1) Customers with an annual consumption of 73,200 kWh or lower which will include some small industrial and commercial consumers

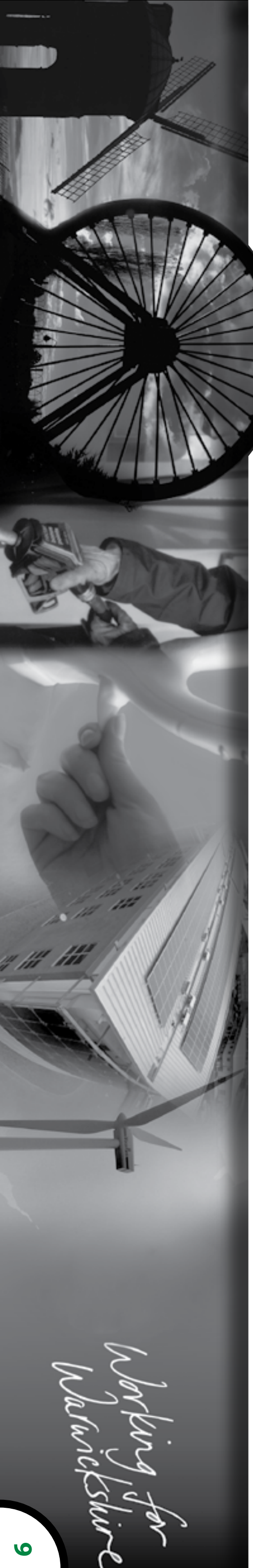


Table 4 Gas sales and numbers of customers by area, 2004

	Domestic consumers (1)		Commercial and industrial consumers		All consumers		Sales per consumer	
Area	Sales - GWh	Number of consumers ('000)	Sales - GWh	Number of consumers ('000)	Sales - GWh	Number of consumers ('000)	Domestic- kWh	Commercial and Industrial - kWh
North Warwickshire	432	20.9	444	0.5	875	21.4	20,658	939,911
Nuneaton and Bedworth	883	47.2	309	0.7	1,192	47.9	18,721	447,009
Rugby	670	34.2	376	0.6	1,046	34.9	19,583	584,501
Stratford-on-Avon	637	32.7	268	0.8	905	33.5	19,469	325,747
Warwick	937	48.5	369	1.1	1,306	49.6	19,308	331,815
Total Warwickshire	**3,559**	**183.5**	**1,766**	**3.7**	**5,325**	**187.3**	**19,391**	**471,905**
Warwickshire as % of WM	9.4%	9.3%	7.3%	9.3%	8.6%	9.3%	101	79
Total West Midlands	**37,974**	**1,971**	**24,238**	**40**	**62,212**	**2,011**	**19,268**	**599,698**
Warwickshire as % of GB	0.9%	0.9%	0.6%	0.9%	0.8%	0.9%	100	74
Total Great Britain	**414,363**	**21,442**	**276,343**	**434**	**690,707**	**21,875**	**19,325**	**637,366**

Source: DTI, 2007

(1) Customers with an annual consumption of 73,200 kWh or lower which will include some small industrial and commercial consumers

3.2 Electricity

As with gas sales there have been recent efforts to improve the availability of local and regional data. The results of this have recently been released by the DTI (on an experimental basis) and are shown in the table overleaf:

A number of interesting points can be noted from this table.

- In 2005, electricity sales in Warwickshire totalled 3,203 GWh.
- In Warwickshire the average domestic consumption and the average industrial and commercial consumption is higher than the national and regional averages (10% / 4% and 20% / 10% respectively).
- Consumers in Warwickshire account for 10.7% of all consumers (MPANs)[1] in the West Midlands and account for 11.7% of total sales in the region. This over-representation occurs for both domestic and industrial and commercial consumers, but is more pronounced for the industrial and commercial sector, which accounts for 11% of consumers and 12.1% of sales.
- There have been a number of methodological changes in the data sets released by DTI since the 2005 report, hence differences in consumption between 2003 and 2005 are more likely to be a result of data quality improvements rather than real changes in consumption. This appears to be particularly true for industrial and commercial consumption, where large increases are apparent.

[1]Meter Point Administration Numbers

Table 5 Electricity sales and numbers of customers by area, 2005

	Domestic consumers		Commercial and industrial consumers		All consumers		Sales per consumer	
Area	**Sales - GWh**	**Number of MPANs ('000)**	**Sales - GWh**	**Number of MPANs ('000)**	**Sales - GWh**	**Number of MPANs ('000)**	**Domestic - kWh**	**Commercial and Industrial - kWh**
North Warwickshire	135	25.9	382	2.5	517	28.4	5,213	150,616
Nuneaton and Bedworth	237	53.5	272	3.7	509	57.2	4,424	73,744
Rugby	202	41.0	498	3.6	700	44.6	4,934	137,241
Stratford-on-Avon	295	48.6	340	5.8	635	54.4	6,073	58,203
Warwick	285	59.0	556	6.1	841	65.1	4,830	91,849
Total Warwickshire	**1,154**	**228.0**	**2,049**	**21.8**	**3,203**	**249.8**	**5,062**	**94,168**
Warwickshire as % of WM	11.2%	10.7%	12.1%	11.0%	11.7%	10.7%	104	110
Total West Midlands	**10,318**	**2,130**	**16,950**	**197**	**27,267**	**2,327**	**4,845**	**85,883**
Warwickshire as % of GB	1.0%	0.9%	1.0%	0.8%	1.0%	0.9%	110	120
Total Great Britain	**119,429**	**25,930**	**200,895**	**2,568**	**320,324**	**28,498**	**4,606**	**78,223**

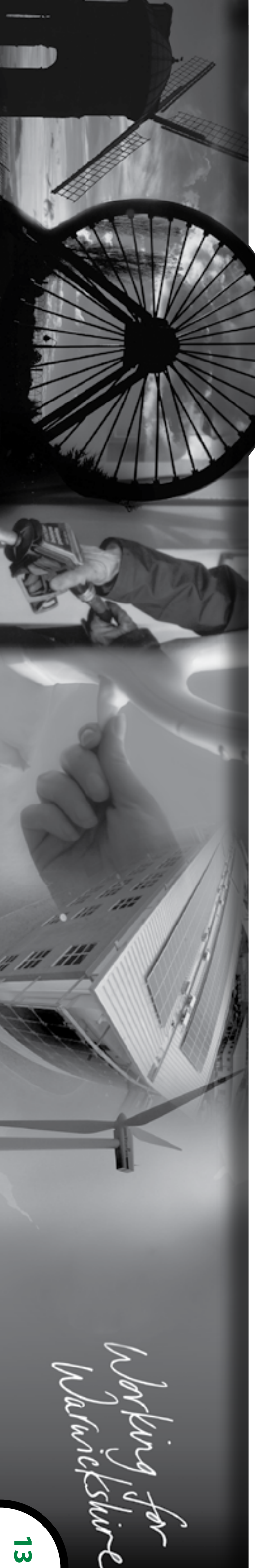
Source: DTI, 2007

Working for Warwickshire

Table 6 Electricity sales and numbers of customers by area, 2004

	Domestic consumers		Commercial and industrial consumers		All consumers		Sales per consumer	
Area	**Sales - GWh**	**Number of MPANs ('000)**	**Sales - GWh**	**Number of MPANs ('000)**	**Sales - GWh**	**Number of MPANs ('000)**	**Domestic - kWh**	**Commercial and Industrial - kWh**
North Warwickshire	140	26.7	352	2.6	492	29.2	5,249	136,669
Nuneaton and Bedworth	239	52.7	253	3.4	491	56.1	4,531	74,324
Rugby	204	40.3	448	3.4	652	43.8	5,048	129,984
Stratford-on-Avon	308	52.3	315	6.0	623	58.3	5,889	52,435
Warwick	287	58.0	540	5.7	827	63.7	4,956	94,689
Total Warwickshire	**1,178**	**229.9**	**1,908**	**21.1**	**3,085**	**251.1**	**5,121**	**90,277**
Warwickshire as % of WM	10.9%	10.0%	11.5%	10.3%	11.3%	10.0%	109	111
Total West Midlands	**10,761**	**2,297.8**	**16,632**	**205.0**	**273,93**	**25,02.8**	**4,683**	**81,136**
Warwickshire as % of GB	1.0%	0.9%	1.0%	0.9%	1.0%	0.9%	111	116
Total Great Britain	**119,864**	**25,902.0**	**192,284**	**2,477.3**	**312,148**	**28,379.2**	**4,628**	**77,620**

Source: DTI, 2007



3.3 Other fuels

The data for this section comes from the DTI but is modelled rather than being based on actual sales (which the gas and electricity data is).

Notably, almost half (46%) of all industrial and commercial coal consumption in the West Midlands region is consumed in Warwickshire. To a considerable extent this is thought to be a result of extensive use of coal at the cement works in Rugby. Rugby accounts for 92% of coal consumption in Warwickshire.

Table 7 Other fuels consumption by area (thousand tonnes oil equivalent), 2004

	Petroleum						Coal		Manufactured Solid Fuels		Renewables & Waste (4)	Total
Area	Industrial (1)	Domestic	Rail	Public Admin.	Commercial	Agriculture (2)	Industrial & Commercial (3)	Domestic	Industrial	Domestic	All Sources	Domestic
North Warwickshire	12.7	2.5	4.2	0.0	0.5	1.4	0.6	1.6	0.0	0.1	0.5	24.2
Nuneaton and Bedworth	7.3	0.6	1.4	0.1	0.1	0.3	0.0	0.3	0.1	0.0	0.5	10.7
Rugby	12.9	1.8	2.0	0.1	0.8	2.1	119.0	0.8	0.0	0.4	4.1	144.1
Stratford-on-Avon	18.8	9.3	3.4	0.2	1.1	6.2	4.0	5.0	0.1	0.0	1.8	49.9
Warwick	17.7	3.3	4.1	0.1	0.7	1.5	5.6	1.3	0.2	0.7	0.8	36.1
Total Warwickshire	**69.6**	**17.5**	**15.2**	**0.5**	**3.3**	**11.6**	**129.3**	**9.0**	**0.3**	**1.2**	**7.6**	**265.0**
Total Warwickshire as % of WM	9.8%	10.2%	18.1%	7.7%	22.8%	11.5%	46.2%	12.5%	8.9%	4.9%	11.6%	17.3%
Total West Midlands	**708**	**172**	**84**	**7**	**14**	**101**	**280**	**72**	**3**	**26**	**66**	**1,533**
Total Warwickshire as % of GB	0.5%	0.7%	1.8%	0.5%	1.5%	0.9%	5.8%	1.0%	0.1%	0.5%	0.6%	1.0%
Total Great Britain	**15,453**	**2,578**	**864**	**97**	**214**	**1,236**	**2,222**	**935**	**532**	**247**	**1,280**	**25,658**

Source: DTI, 2007

(1) Includes consumption within industry and the energy sectors including oil refineries, of which 8557 ktoe is consumed by industry and 7226 ktoe by the energy sector. (2) Excludes the consumption of propane. (3) Includes some coal consumption by auto-generators. Here 2134 ktoe is consumed by the industrial and commercial sectors and 244 ktoe by auto-generators. (4) Includes some consumption within the energy sector. Here 59 ktoe is consumed by the energy sector and 1251 ktoe by the industrial, commercial and domestic sectors.

4.0 Final Energy Consumption by Sector

This section breaks down energy consumption by the three main energy using sectors Transport; Domestic; and Industrial and Commercial.

4.1 Transport

As at the end of 2006, Warwickshire had 283,541 licensed cars. This is a 2% increase compared to the end of March 2005. The following table shows the number of licensed cars in Warwickshire by propulsion type. In total 75% of registered cars in Warwickshire are petrol, and a further 24% are diesel. The corresponding proportions for petrol and diesel in 2005 were 79% and 20% respectively, indicating a continuing shift from petrol to diesel.

Table 8 Number of licensed cars by propulsion type, 2005-2006

Propulsion type	March 2005	December 2006	% change
Petrol	221,164	214,033	-3.2%
Diesel	56,669	68,831	21.5%
Electricity	5	2	-60.0%
Steam	1	1	0.0%
Gas	11	8	-27.3%
Petrol/Gas	321	375	16.8%
Gas/Bi-Fuel	236	148	-37.3%
Hybrid Electric	25	143	472.0%
Total	278,432	283,541	1.8%

Source: Department for Transport, 2007

In Warwickshire, motor vehicles travelled a total of 8,674 million kilometres in 2005, representing a 4% increase since 2002[1] . This rate of growth in motor vehicle distance travelled is slightly higher than the regional and national growth rates (3% and 2.7% respectively). Warwickshire accounts for approximately 18% of vehicle kilometres travelled in the West Midlands and 1.7% of all vehicle kilometres travelled nationally.

[1] DfT, 2007

Local and regional road transport fuel consumption data sets were not available at the time of the 2005 report, and hence ECOTEC derived road transport fuel consumption from national data (the Digest of UK Energy Statistics - DUKES). It is important to note though that the DUKES data, used in the original report, differs from the aggregated levels of consumption from the local and regional data sets provided by DTI[1] . Hence, there is little value in comparing the level of consumption in the original report with that presented in this report. However, to allow for some trend analysis, the tables below present road transport fuel consumption for 2004 and 2005[2] . It should be noted that the quality of the consumption statistics for road transport fuel is considerably lower than for gas and electricity, as they are based on modelled rather than real consumption estimates based on the use of a number of different information sources. These include CO_2 emissions data from the National Atmospheric Emissions Inventory (NAEI); and road traffic flows (from traffic surveys) and typical vehicle fuel consumption data from the Department for Transport.

- In 2005, the consumption of road transport fuel was 686.3 ktonnes, representing a decrease of 2% or 12.5 ktonnes compared with 2004.
- It is estimated that the road transport fuel consumed in 2005 in Warwickshire is equivalent to 9,005 GWh of energy use[3] .
- Personal travel accounted for almost 60% of all road transport fuels used, with the remaining 40% of road transport fuels being used for freight.
- Warwickshire accounts for 18% of road transport fuels used in the West Midlands which is on par with the sub-region's percentage of vehicle kilometres travelled. Nevertheless, it should be noted that this is higher than Warwickshire's share of the population in the West Midlands and is likely to reflect the relative density of the road network in the county.
- Warwickshire accounts for almost a quarter of all road transport fuels used by HGVs in the West Midlands. This can be partly explained by the presence of three motorways in the county and a relatively high number of freight distribution centres, particularly in North Warwickshire.

[1]The local and regional data set includes all road fuel purchased abroad and consumed in the UK, though excludes road transport fuel purchased in the UK and consumed abroad. The DUKES data was based on sales volume data recorded by UK energy suppliers. In the 2005 report the Warwickshire proportion of the national figure was calculated by the county's proportion of employees in haulage and the percentage of personal vehicles registered in the county.

[2]Data from 2003 is also available, however, as a result of some methodological changes the data is less comparable with the 2004 and 2005 data.

[3]Includes rail transport.

Table 9 Road Transport Fuel Consumption (ktonnes of fuel), 2005

Area	Buses	Diesel Cars	Petrol Cars	Motor-cycles	HGV	Diesel LGV	Petrol LGV	Personal (1)	Freight (2)	Total	Total - GWh[1]
North Warwickshire	2.2	19.3	76.4	0.3	60.1	25.2	2.1	98.2	87.4	185.6	2,435
Nuneaton and Bedworth	2.8	6.0	25.4	0.2	10.6	7.1	0.7	34.3	18.4	52.7	695
Rugby	2.6	14.5	58.5	0.2	43.3	18.6	1.6	75.9	63.5	139.4	1,816
Stratford-on-Avon	2.7	19.3	78.4	0.4	38.1	23.6	2.0	100.9	63.7	164.6	2,159
Warwick	3.6	17.6	71.2	0.3	31.2	18.6	1.6	92.7	51.4	144.1	1,902
Total Warwickshire	**13.9**	**76.8**	**309.9**	**1.4**	**183.3**	**93.1**	**8.0**	**401.9**	**284.4**	**686.3**	**9,005**
Total Warwickshire as % of WM	9.4%	17.6%	17.1%	13.2%	22.1%	17.5%	16.2%	16.7%	20.2%	18.0%	18.0%
Total West Midlands	**148**	**436**	**1,815**	**11**	**829**	**533**	**49**	**2,410**	**1,410**	**3,820**	**50,156**
Total Warwickshire as % of GB	0.9%	1.6%	1.6%	0.9%	2.3%	1.7%	1.5%	1.5%	2.0%	1.7%	1.1%
Total Great Britain	**1,503**	**4,727**	**19,797**	**152**	**7,961**	**5,578**	**521**	**26,179**	**14,060**	**40,239**	**786,841**

Source: ECOTEC Analysis, based on DTI data

(1) Personal travel includes buses, diesel cars, petrol cars and motor cycles.

(2) Freight includes HGV, diesel LGV and petrol LGV

[1] Care should be taken when interpreting these etimates as they have been derived using the same conversion factors as for 2004. Include fuels used by both rail and road

Table 10 Road Transport Fuel Consumption (ktonnes of fuel), 2004

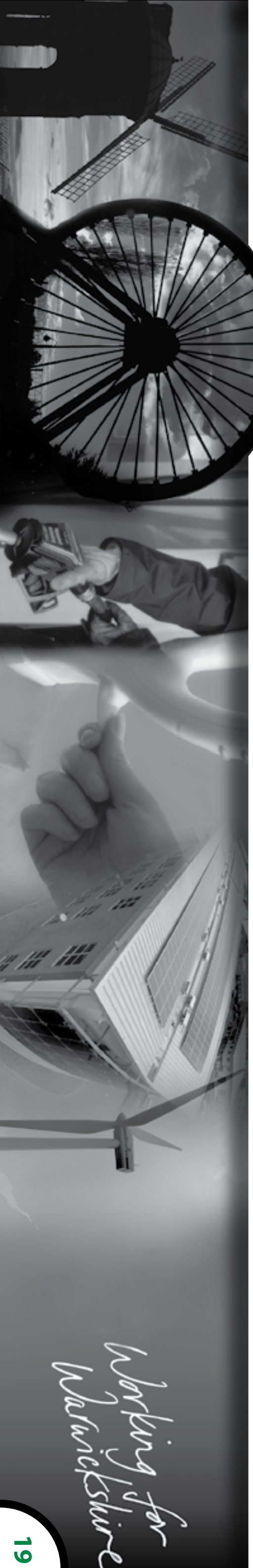
Area	Buses	Diesel Cars	Petrol Cars	Motor-cycles	HGV	Diesel LGV	Petrol LGV	Personal (1)	Freight (2)	Total	Total - GWh[1]
North Warwickshire	2.2	16.9	74.7	0.3	61.4	23.2	2.3	94.1	86.8	180.8	2,372
Nuneaton and Bedworth	2.6	5.6	26.2	0.2	11.4	6.7	0.7	34.6	18.8	53.4	704
Rugby	2.4	13.4	60.3	0.3	46.0	18.1	1.8	76.4	65.9	142.2	1,852
Stratford-on-Avon	2.7	18.0	81.7	0.4	42.0	22.3	2.3	102.9	66.6	169.5	2,223
Warwick	3.3	16.8	76.0	0.3	35.6	19.0	1.9	96.3	56.6	152.9	2,018
Total Warwickshire	**13.2**	**70.7**	**318.9**	**1.5**	**196.4**	**89.3**	**9**	**404.3**	**294.7**	**698.8**	**9,169**
Total Warwickshire as % of WM	9.2%	17.6%	17.1%	13.6%	22.1%	17.6%	16.7%	16.7%	20.3%	18.1%	18.0%
Total West Midlands	**143**	**402**	**1,864**	**11**	**888**	**508**	**54**	**2,420**	**1,450**	**3,870**	**50,812**
Total Warwickshire as % of GB	0.9%	1.7%	1.6%	0.9%	2.4%	1.7%	1.6%	1.6%	2.1%	1.8%	1.2%
Total Great Britain	**1,451**	**4,235**	**19,740**	**158**	**8,030**	**5,265**	**569**	**25,584**	**13,865**	**39,449**	**769,672**

Source: ECOTEC Analysis, based on DTI data

(1) Personal travel includes buses, diesel cars, petrol cars and motor cycles.

(2) Freight includes HGV, diesel LGV and petrol LGV

[1]Include fuels used by both rail and road.



The resultant CO_2 emissions from the road transport fuels consumed in Warwickshire are set out in the table below. This data has been sourced from Defra and may not be directly comparable to the consumption data presented above. To date, no data has been released for 2005.

Table 11 Road Transport Fuels Carbon Emissions (ktonnes CO_2), 2004

Area	Road Transport
North Warwickshire	663
Nuneaton and Bedworth	197
Rugby	522
Stratford-on-Avon	624
Warwick	563
TOTAL WARWICKSHIRE	**2,569**
Warwickshire as % of WM	18%
TOTAL WEST MIDLANDS	**14,250**
Warwickshire as % of UK	1.7%
UK TOTAL	**150,471**

Source: Defra, 2007

In summary:

- In total, 2,569 ktonnes of CO_2 was emitted in 2004 in Warwickshire as a result of the consumption of road transport fuels.
- CO_2 emissions in Warwickshire as a proportion of regional and national emissions, reflect the county's share of road transport fuel consumption[1].
- The largest emitter of carbon dioxide in Warwickshire is North Warwickshire, followed by Stratford-on-Avon and Warwick, reflecting the road network and traffic density.
- Considering that road transport fuel consumption was reduced between 2004 and 2005, it can be expected that carbon dioxide emissions have also fallen.

Although not strictly used within the boundaries of the county, it is also interesting to consider the amount of energy used by aircrafts refuelling at Coventry Airport.

[1]Carbon dioxide emissions measured as proportion of UK, whilst the consumption of road transport fuels is measured as a proportion of GB.

According to Coventry Airport, 24 million litres of Jet A1 and 800,000 litres of Avgas are being used annually, which represents approximately 17.5 ktonnes of fuel[1]. It is estimated that this corresponds to over 56 ktonnes of CO_2 emissions[2].

4.2 Domestic

The tables below set out the final energy consumption by domestic users in 2003 and 2004. As with road transport fuels, detailed data on domestic consumption (other than gas and electricity) was not available for Warwickshire at the time of the 2005 Warwickshire Energy Statistics report. ECOTEC's estimate for 2003 was derived from national data in DUKES based on the county's proportion of the national population. This method appears to have underestimated the total domestic energy consumption in Warwickshire (4,973 GWh in 2003).

A number of interesting points can be noted from the tables below.

- According to data from the DTI, domestic energy consumption totalled 5,535 GWh in 2003, falling to 5,059 GWh in 2004. However, as mentioned above this is likely to be result of data quality improvements rather than real changes in consumption.
- Whilst natural gas is the main source of energy, there appears to be higher than average use of coal and electricity among Warwickshire residents.
- Notably, in Stratford-on-Avon almost a tenth of domestic energy consumption comes from petroleum products, which is likely to be a result of some individuals and communities in the rural areas not being served by the gas network.
- In 2004, the domestic energy consumption per capita in Warwickshire was slightly lower than both the regional and national average. Domestic energy consumption per capita was particularly low in Nuneaton and Bedworth; Stratford-on-Avon and Warwick.

[1] Using a conversion factor of 1,412 litres per tonne.
[2] According to the Economist (2007), 1 tonne of fuel burnt by a jet areoplane produces 3.2 tonnes of carbon dioxide.

Table 12 Domestic Final Energy Consumption (GWh), 2004

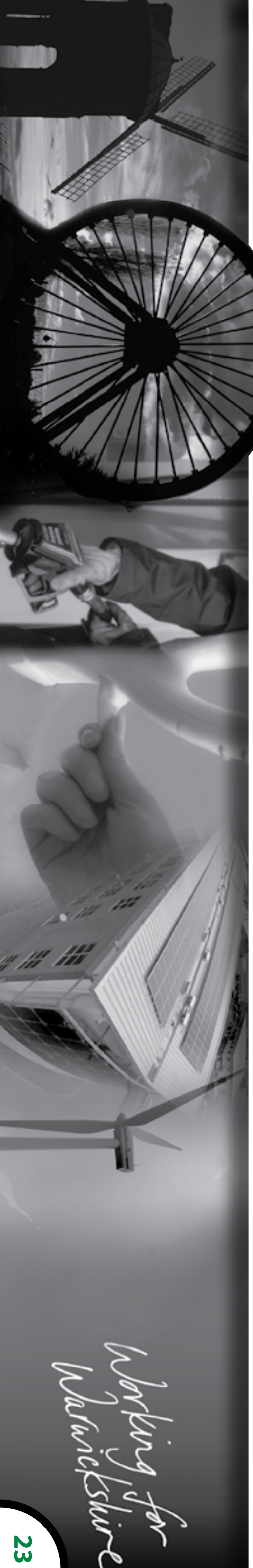
Area	Coal	Manufactured fuels	Petroleum products	Natural gas	Electricity	Total Domestic	Domestic per capita (MWh)
North Warwickshire	18.1	1.6	29.1	431.8	140.0	620.6	10.0
Nuneaton and Bedworth	3.6	-	7.1	882.9	238.8	1,132.4	9.4
Rugby	9.7	4.4	20.8	670.4	203.6	908.9	10.1
Stratford-on-Avon	58.0	-	108.2	636.6	307.9	1,110.7	9.5
Warwick	15.7	8.5	38.0	937.1	287.2	1,286.5	9.4
Total Warwickshire	**105**	**15**	**203**	**3,559**	**1,178**	**5,059**	9.6
Warwickshire as % of WM	12.5%	4.9%	10.2%	9.4%	10.9%	9.8%	99
Total West Midlands	**843**	**299**	**2,000**	**37,974**	**10,761**	**51,876**	9.7
Warwickshire as % of GB	1.0%	0.5%	0.7%	0.9%	1.0%	0.9%	97
Total Great Britain	**10,876**	**2,870**	**29,983**	**411,988**	**119,745**	**575,462**	9.9

Source: DTI, 2007 and ONS, 2007

Table 13 Domestic Final Energy Consumption (GWh), 2003

Area	Coal	Manufactured fuels	Petroleum products	Natural gas	Electricity	Total Domestic	Domestic per capita (MWh)
North Warwickshire	19.7	18.0	36.0	728.5	136.7	938.8	15.2
Nuneaton and Bedworth	8.3	20.2	24.9	650.4	233.3	937.1	7.8
Rugby	6.4	3.8	63.7	567.1	199.2	840.1	9.4
Stratford-on-Avon	27.2	2.0	233.5	743.4	302.5	1,308.4	11.4
Warwick	4.6	3.3	66.2	1,160.3	276.4	1,510.9	11.4
Total Warwickshire	**66.2**	**47.3**	**424.3**	**3,849.7**	**1,148.0**	**5,535.3**	**10.7**
Warwickshire as % of WM	14.4%	14.4%	13.8%	10.0%	10.8%	10.4%	107
Total West Midlands	**459**	**329**	**3,075**	**38,527**	**10,609**	**52,998**	**10.0**
Warwickshire as % of GB	1.0%	1.4%	1.2%	0.9%	1.0%	1.0%	107
Total Great Britain	**6,774**	**3,317**	**34,760**	**415,948**	**118,251**	**579,049**	**10.0**

Source: DTI, 2007 and ONS, 2007



4.3 Industrial and Commercial

The tables below set out the final energy consumption by industrial and commercial users in 2003 and 2004. As with the other two sectors, detailed data on industrial and commercial consumption (other than gas and electricity) was not available for Warwickshire at the time of the 2005 Warwickshire Energy Statistics report. Nevertheless, the estimate that ECOTEC derived from national data (DUKES) for 2003 was relatively close to a more recent estimate provided by the DTI (5,149 GWh compared to 5,229 GWh).

A number of interesting points can be noted from the tables.

- According to data from the DTI, industrial and commercial energy consumption increased significantly between 2003 and 2004, from 5,229 GWh to 6,256 GWh. However, as mentioned above this is likely to be a result of data quality improvements rather than real changes in consumption.
- Whilst natural gas is the main source of energy, there is higher than average use of coal among Warwickshire businesses. To a considerable extent this is a result of extensive use of coal at the cement factory in Rugby.
- Final energy consumption per employee in 2004 in Warwickshire was higher than the regional average, but on par with the national average.
- The Warwickshire average masks some significant differences within the county. For example, energy consumption per employee in North Warwickshire and, particularly, Rugby is substantially higher than the other constituent local authorities.

Table 14 Industrial and Commercial Final Energy Consumption (GWh), 2004

Area	Coal	Manufactured fuels	Petroleum products	Natural gas	Electricity	Renewables & Waste	Total Industrial and Commercial	I&C per employee (MWh)
North Warwickshire	6.9	0.0	170.9	443.6	352.1	5.8	979.3	33.8
Nuneaton and Bedworth	0.4	0.8	91.0	309.3	252.6	5.3	659.4	17.3
Rugby	1,384.4	0.0	185.3	375.8	447.9	47.3	2,440.8	61.1
Stratford-on-Avon	46.4	0.9	305.9	268.1	314.9	21.0	957.4	18.9
Warwick	65.4	1.8	233.9	369.0	540.1	9.5	1,219.5	16.7
Total Warwickshire	**1,503.5**	**3.5**	**987.0**	**1,765.9**	**1,907.5**	**88.9**	**6,256.4**	**27.1**
Warwickshire as % of WM	46.2%	8.9%	10.2%	7.3%	11.5%	11.6%	11.5%	116
Total West Midlands	**3,254**	**40**	**9,644**	**24,238**	**16,632**	**768**	**54,576**	**23.4**
Warwickshire as % of GB	5.8%	0.1%	0.5%	0.7%	1.0%	0.6%	0.9%	100
Total Great Britain	**25,847**	**6,189**	**197,706**	**271,181**	**187,801**	**14,884**	**703,609**	**27.2**

Source: DTI, 2007 and ONS, 2007

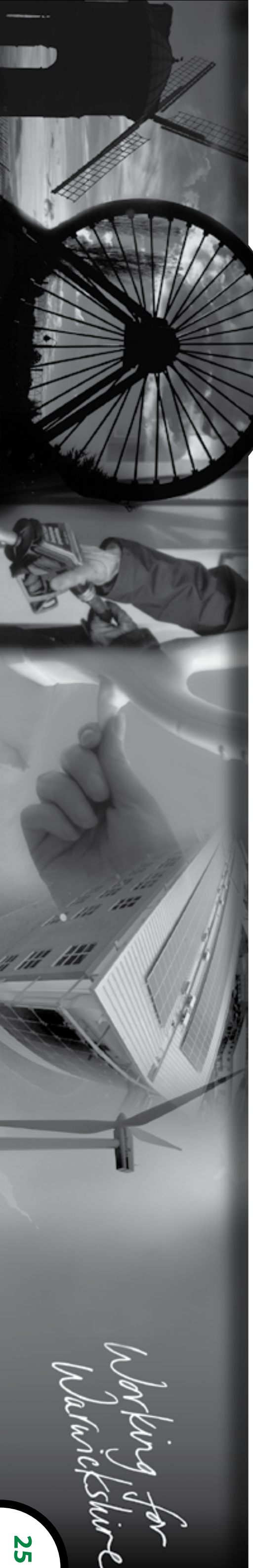


Table 15 Industrial and Commercial Final Energy Consumption, (GWh), 2003

Area	Coal	Manufactured fuels	Petroleum products	Natural gas	Electricity	Renewables & Waste	Total Industrial and Commercial	I&C per employee (MWh)
North Warwickshire	6.3	0.0	208.5	514.7	318.2	25.3	1,073.1	38.7
Nuneaton and Bedworth	0.4	0.9	55.9	295.5	213.8	1.6	568.1	15.4
Rugby	2.0	0.1	205.2	447.1	313.9	2.6	970.9	23.9
Stratford-on-Avon	10.9	1.9	304.0	389.3	277.0	13.2	996.3	20.8
Warwick	5.4	2.0	346.5	807.6	456.8	2.3	1,620.6	23.1
Total Warwickshire	**25.1**	**4.8**	**1,120.1**	**2,454.3**	**1,579.8**	**44.9**	**5,229.0**	**23.4**
Warwickshire as % of WM	6.6%	9.5%	12.6%	8.3%	14.3%	8.0%	10.3%	107
Total West Midlands	**380**	**50**	**8,882**	**29,641**	**11,062**	**559**	**50,573**	**21.9**
Warwickshire as % of GB	0.3%	0.1%	0.6%	0.8%	0.9%	0.7%	0.8%	88
Total Great Britain	**8,559**	**8,026**	**177,600**	**307,795**	**169,983**	**6,808**	**678,771**	**26.6**

Source: DTI, 2007 and ONS, 2007

The resultant carbon dioxide emissions from the industrial and commercial sector in Warwickshire are set out in the table below. The data has been sourced from Defra and refers to 2004.

Table 16 Industry and Commerce Carbon Emissions (CO_2 ktonnes), 2004

Area	Industry and Commercial	Employees	Industry and Commercial per employee
North Warwickshire	330	29.1	11.3
Nuneaton and Bedworth	250	38.1	6.6
Rugby	849	40.2	21.1
Stratford-on-Avon	365	52.7	6.9
Warwick	570	73.6	7.7
Total Warwickshire	**2,365**	**266.1**	**8.9**
Warwickshire as % of WM	12.0%	11.3%	106
Total West Midlands	**19,758**	**2,346.8**	**8.4**
Warwickshire as % of UK	1.0%	n/a	n/a
Total United Kingdom	**245,107**	**n/a**	**n/a**

Source: Defra, 2007

- Perhaps unsurprisingly, given the extensive use of coal at the cement factory, Rugby is by far the highest emitter in the county with 849 ktonnes of CO_2 emitted in 2004 (36% of total CO_2 emissions in Warwickshire).
- Carbon dioxide emissions per employee in Nuneaton and Bedworth; Stratford-on-Avon; and Warwick are significantly lower than the regional average.

5.0 Overall Energy Balances

5.1 Final Energy Consumption and Emissions

The following table sets out final energy consumption for Warwickshire on a sectoral and fuel-type basis.

Table 17 Final Energy Consumption in Warwickshire (GWh), 2004

Sector	Coal	Manufactured fuels	Petroleum products	Natural gas	Electricity	Renewables & Waste	Total
Domestic	105	15	203	3,559	1,178	-	5,059
Industrial & Commercial	1,504	4	987	1,766	1,908	89	6,256
Transport[1]	-	-	9,169	-	-	-	9,169
Total	1,609	18	10,359	5,325	3,085	89	20,484

Source: ECOTEC Analysis, based on DTI data

The transport sector accounts for approximately 45% of total final energy consumption in Warwickshire. Industry and commerce accounts for approximately 31%, whilst the domestic sector accounts for the remaining 24%.

The main type of energy consumed is petroleum products (51%), followed by natural gas (26%). Renewables and waste only account for 0.4% of the total energy consumption in Warwickshire.

The tables below provide an indication of the trend in final energy consumption in Warwickshire. However, due to data limitations and data quality improvements care should be taken when interpreting the results, particularly between 2003 and the other two years.

Table 18 Final Energy Consumption in Warwickshire (GWh), 2003-2005

Sector	Coal	Manufactured fuels	Petroleum products	Natural gas	Electricity	Renewables & Waste	Total
2005[2]	1,609	18	10,195	5,320	3,203	89	20,434
2004	1,609	18	10,359	5,325	3,085	89	20,484
2003	288	-	8,568	6,304	2,728	139	18,027

Source: ECOTEC Analysis, based on DTI data

[1]Road and rail transport. Does not include air and water transport.
[2]Based on 2005 consumption of gas, electricity and petroleum products (transport sector). DTI statistics not yet available for coal, manufactured fuels, renewables and waste.

Table 19 Final Energy Consumption in Warwickshire (GWh), 2003-2005

Sector	Total 2003		Total 2004		Total 2005[1]	
Domestic	5,077	28.2%	5,059	24.7%	5,046	24.8%
Industrial & Commercial	5,493	30.5%	6,256	30.5%	6,294	30.9%
Transport	7,457	41.4%	9,169	44.8%	9,005	44.3%
Total	18,027	100%	20,484	100%	20,345	100%

Source: ECOTEC Analysis, based on DTI data

5.2 Carbon dioxide emissions by sector and fuel-type

In order to convert the total energy consumption we have made use of the following fuel conversion factors.

Table 20 Fuel Conversion Factors

Fuel Type	kg CO_2/kWh
Coal	0.32
Manufactured Solid Fuels (1)	0.30
Petroleum Products (2)	0.24
Natural Gas	0.19
Electricity (3)	0.43
Renewables and Waste	0.00

Source: Defra, 2007

(1) Coking Coal

(2) Petrol (0.24) and Diesel (0.25)

(3) For electricity, the real emissions vary year on year due to the different mix of fuels used in the power stations. However, the figure quoted for electricity is 0.43kg CO_2/kWh which has been held constant since 2000. This value is used by DEFRA to ensure a consistent base on which to measure savings and was calculated on the projected fuel mix for the grid 1998-2000.

[1]Based on 2005 consumption of gas, electricity and petroleum products (transport sector). DTI statistics not yet available for coal, manufactured fuels, renewables and waste.

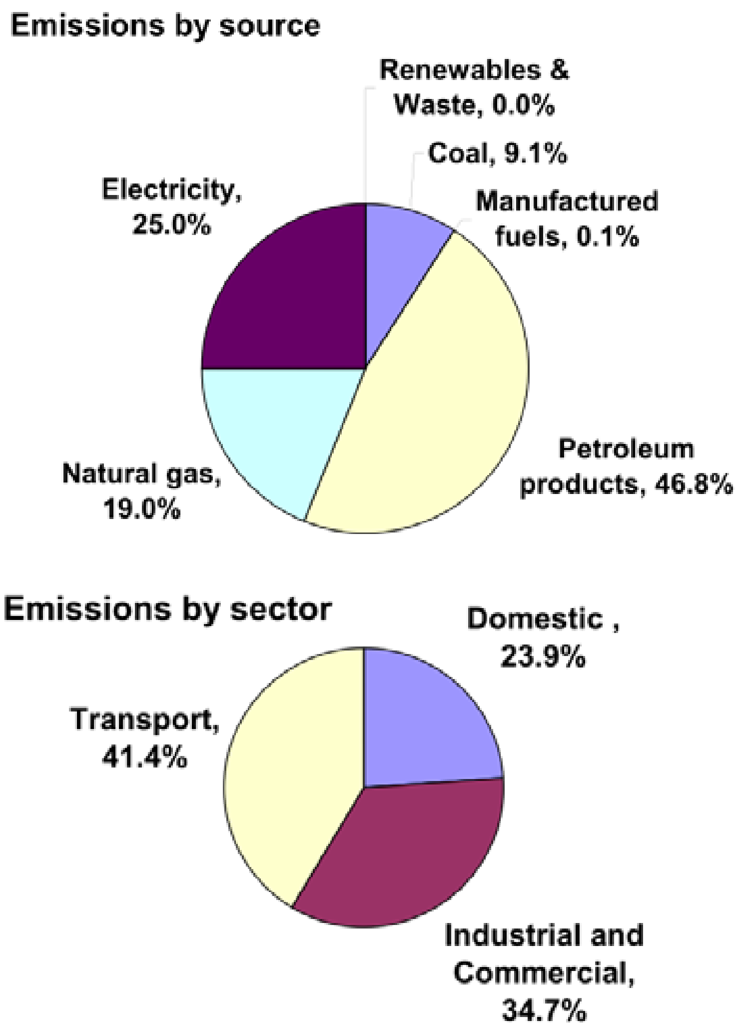
The table below sets out CO_2 emissions on a sectoral and fuel-type basis.

Table 21 Carbon dioxide emissions by sector and fuel type (ktonnes CO_2), 2004

Sector	Coal	Manufactured fuels	Petroleum products	Natural gas	Electricity	Renewables & Waste	Total
Domestic	32	4	49	676	506	-	1,267
Industrial & Commercial	451	1	237	336	820	-	1,845
Transport	-	-	2,201	-	-	-	2,201
Total	483	5	2,486	10,12	1,327	-	5,312

Source: ECOTEC Analysis, based on DTI and Defra data

Figure 1 Emissions by Source and Sector



Source: ECOTEC Analysis, based on DTI data, 2007

- In total, Warwickshire emits more than 5.3 million tonnes of CO_2 per annum.
- The transport sector is the largest emitter of CO_2 in Warwickshire and accounts for just over 41% of all CO_2 emissions in the county.
- The industry and commerce sector accounts for 35% of CO_2 emissions, whilst the domestic sector accounts for the remaining 24%.
- In terms of fuel types, petroleum products are the largest emitters – accounting for nearly half (47%) of all CO_2 emissions in Warwickshire.
- Notably, electricity accounts for 25% of CO_2 emissions but only 15% of total consumption.
- By contrast, natural gas accounts for 26% of energy consumption but only accounts for 19% of CO_2 emissions in Warwickshire.

The tables below provide an indication of the trend in carbon dioxide emissions in Warwickshire. However, due to data limitations and data quality improvements care should be taken when interpreting the results, particularly between 2003 and the other two years.

Table 22 Carbon dioxide emissions by fuel type (ktonnes CO_2), 2003-2005

Sector	Coal	Manufactured fuels	Petroleum products	Natural gas	Electricity	Renewables & Waste	Total
2005[1]	483	5	2,447	1,011	1,377	-	5,323
2004	483	5	2,486	1,012	1,327	-	5,312
2003	86	-	2,142	1,198	1,173	-	4,599

Source: ECOTEC Analysis, based on DTI data

Table 23 Carbon dioxide emissions by sector (ktonnes CO_2), 2003-2005

Sector	Total 2005[2]	Total 2004	Total 2003
Domestic	1,259	1,267	1,387
Industrial & Commercial	1,903	1,845	1,348
Transport[3]	2,161	2,201	1,864
Total	5,323	5,312	4,599

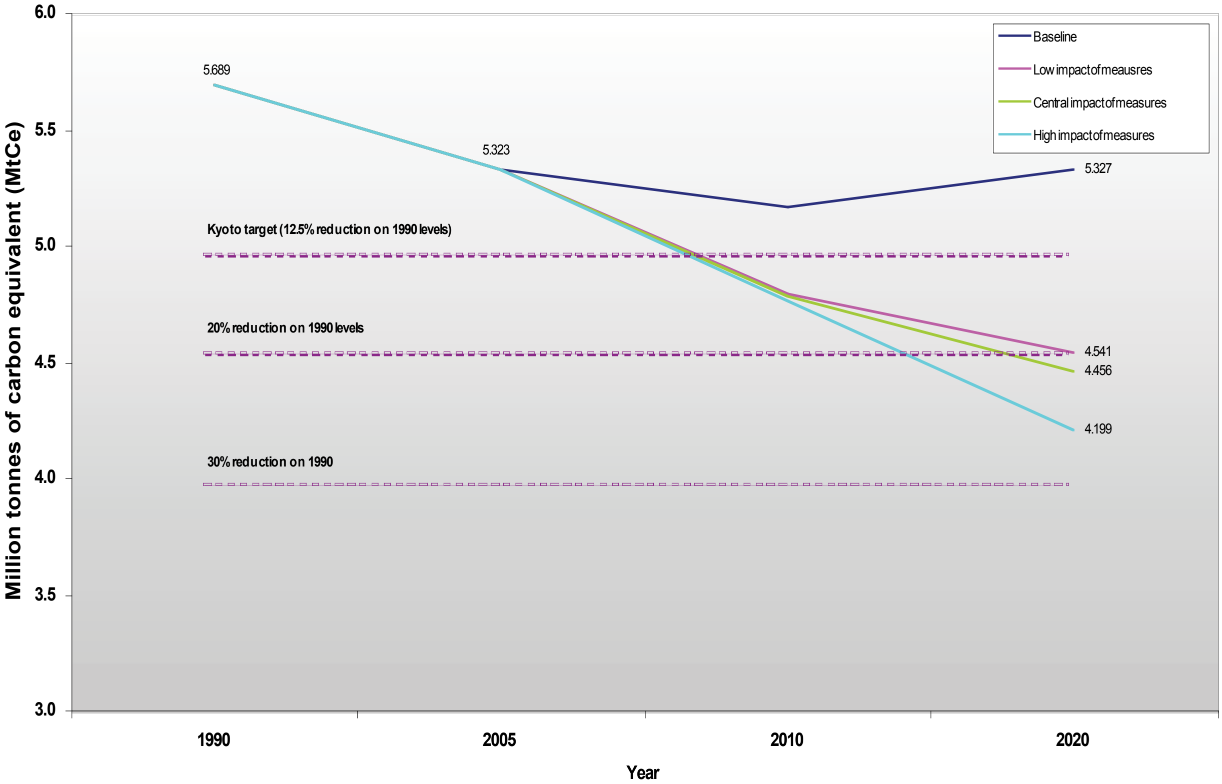
Source: ECOTEC Analysis, based on DTI data

[1]Based on 2005 consumption of gas, electricity and petroleum products (transport sector). DTI statistics not yet available for coal, manufactured fuels, renewables and waste.
[2]Road and rail transport. Does not include air and water transport.

5.3 Predictions of Future Energy Consumption

The following graph is based on the latest predictions of future energy use (applied to the baseline data for Warwickshire) as updated in the recent White Paper on Energy[1] . It illustrates the gap between projected emissions and the path emissions need to take to reach various targets. It is important to note that the predictions of future energy use will continue to be updated over time as policies change.

Figure 2 Future predictions of Warwickshire Carbon Dioxide Emissions and Target Reductions



Source: ECOTEC Analysis based on data from recent White Paper on Energy, 2007

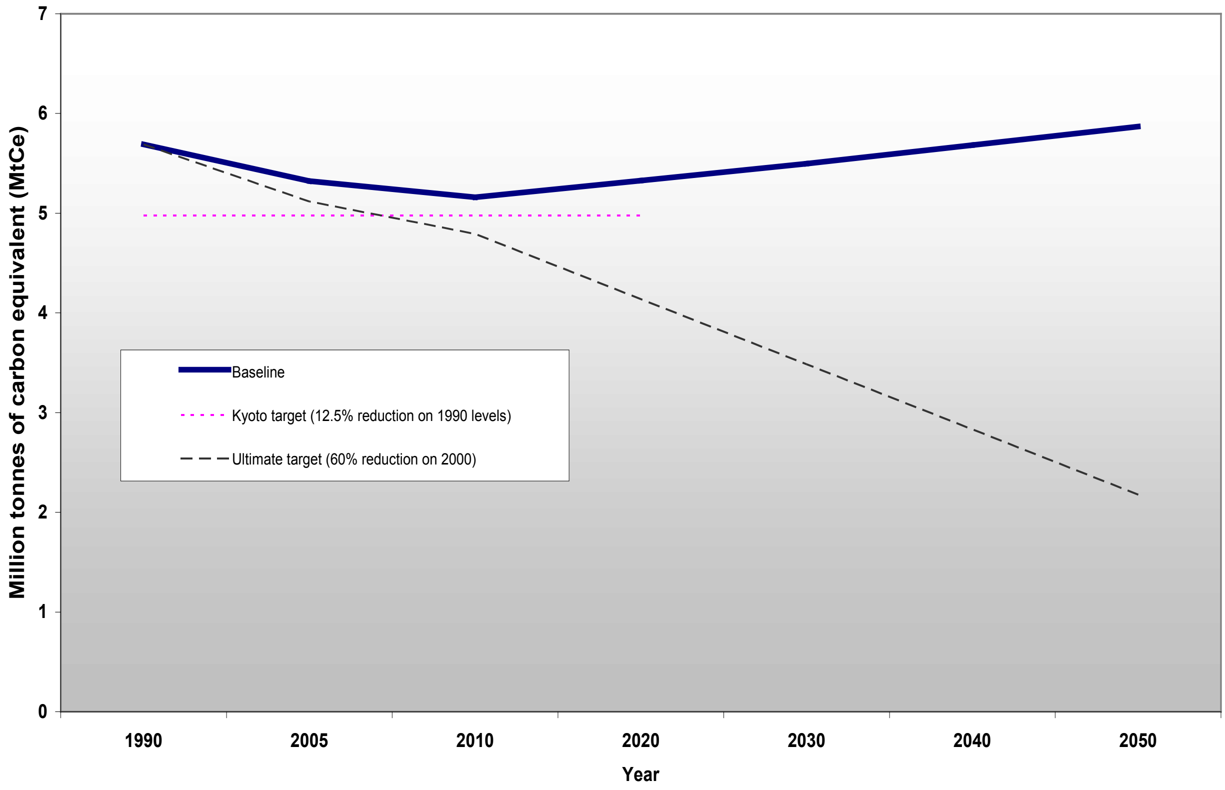
The measures referred to in the figure above include the following:

- introduction of the Carbon Reduction Commitment;
- requirement of Energy Performance Certificates for all buildings, to be sold or rented, providing an energy efficiency rating for the property;
- improve information to the consumer on energy use in homes and businesses through improvements to energy metering and billing and the launch of an online CO_2 calculator;
- requirement of energy suppliers to provide a free real-time electricity display to all home owners who ask for one;
- work with manufacturers, retailers and service providers to obtain supply chain commitments to meet the targets;

[1]Meeting the Energy Challenge – A White Paper on Energy (2007), DTI

In order to retain consistency with the previous report the following figure projects the baseline emissions (without measures) to 2050 along with a straight line illustration of the pathway to achieving a 60% reduction on 2000 emissions by 2050 (the target implied in the original 2004 energy paper). The recent energy paper does not update the projections beyond 2020 so the original data has been used.

Figure 3 CO_2 Projections to 2050



Source ECOTEC based on DTI data

In order to reach the target of a 60% reduction on 2000 levels by 2050, carbon emissions need to be reduced to 2,168 million tonnes of carbon emissions.

Annex One: New Data and Analysis

1 Energy Resources

1.1 Renewable Energy Planning Applications

In addition to the renewable energy schemes outlined above, there is also a number of schemes that have had their planning application approved but are still awaiting construction (see table below). The planning permission applications submitted for Hollow Meadow Farm was withdrawn in 2005.

Table 1 Renewable Energy Planning Permissions in Warwickshire

Name	Technology	Capacity (MW)	Status	Location*	Notes
Nuneaton Animal Waste Incinerator	Biomass - Dedicated	5.00 (Installed[1]) 5.00 (DNC[2])	Application approved 03/06/2003 Awaiting construction	North Warwickshire	
Rugby Cement Works	Municipal and Industrial Waste	35.00 (Installed) 35.00 (DNC)	Application approved (no date) Awaiting construction	Rugby	The cement plant was given consent to test the use of scrap tyres as a fuel for 6 months in 2005. It appears this trial has not carried on.
Ryton Pools Country Park	Landfill Gas	0.33 (Installed) 0.33 (DNC)	Application approved 24/05/2005 Awaiting construction	Warwick	Assumed that this is an additional site/ capacity to the Ryton Landfill Site presented in the table above.
Hollow Meadow Farm	Wind Onshore	0.00 (Installed) 0.00 (DNC)	Application withdrawn 01/06/2005	Stratford-on-Avon	Adjacent to a special Landscape Area

*Source: RESTATS, 2007; *Determining Authority*

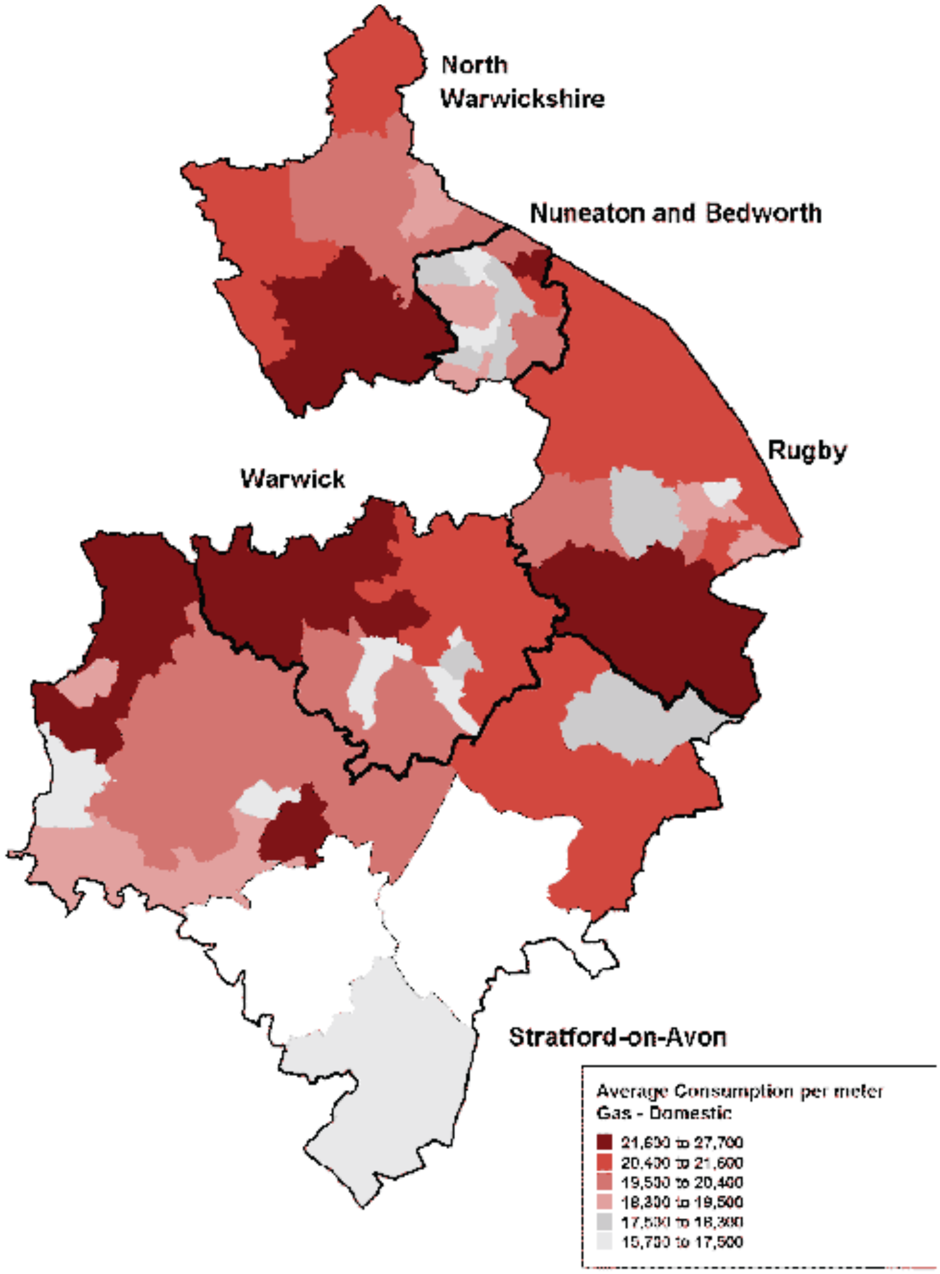
[1] Installed capacity is what the equipment is capable of producing.
[2] Declared Net Capacity (DNC) is defined as the maximum continuous rating of the generating sets in the stations less the power consumed by the plant itself reduced by a specified factor *(B) to* take into account the intermittent nature of some of the renewable energy sources.

2 Energy Consumption

2.1 Natural Gas

Since the original report in 2005, gas consumption data has also become available for Middle Layer Super Output Areas (MLSOAs[1]). The maps below show the average gas consumption per meter for the domestic, as well as the industrial and commercial sector.

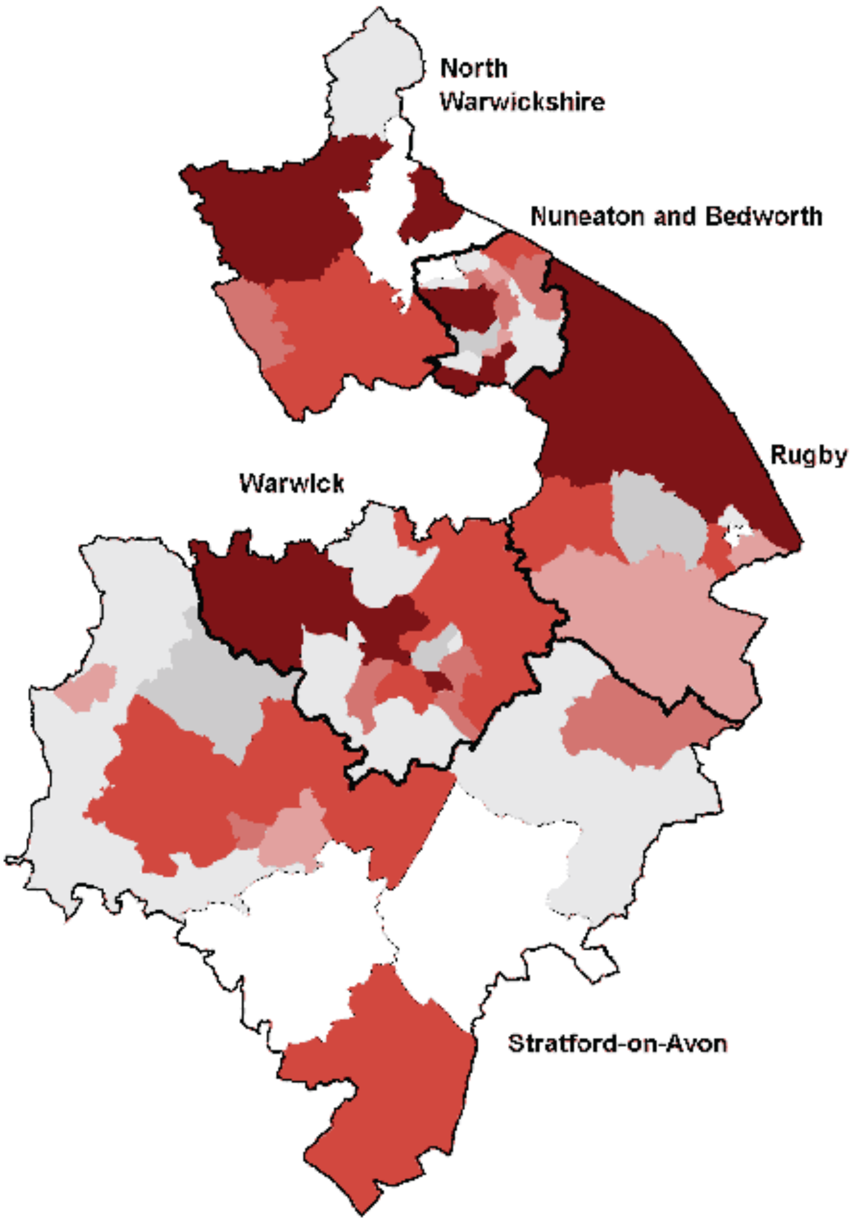
Figure 1 Average gas consumption per meter (kWh), 2005



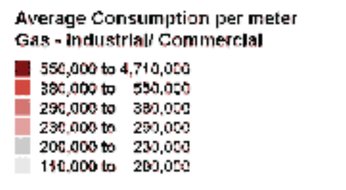
Source: DTI, 2007

[1]MLSOAs are a spatial division designed to produce areas with more stable and more equal populations than electoral wards.

Figure 1 Average gas consumption per meter (kWh), 2005



Source: DTI, 2007

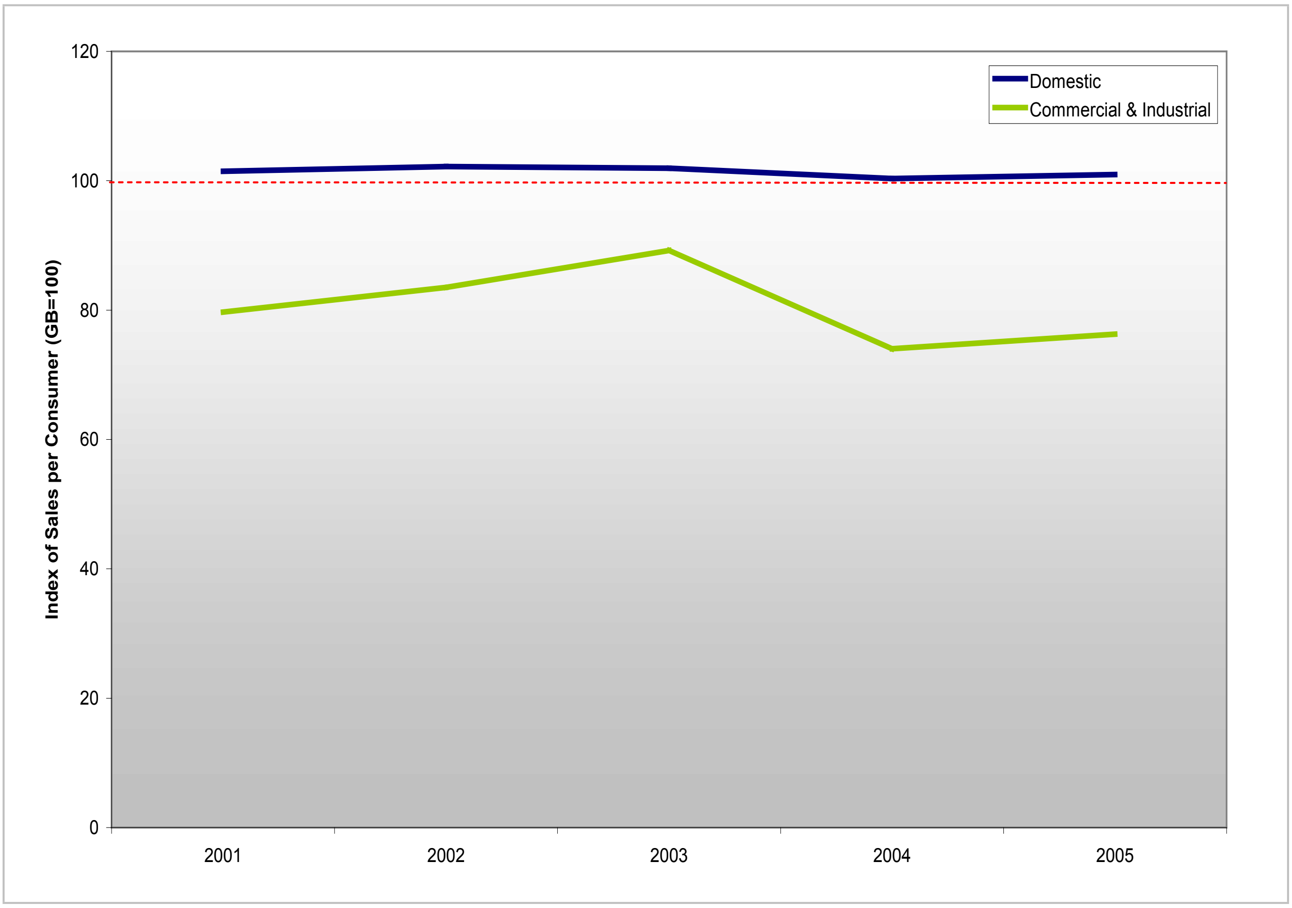


A number of interesting points can be noted from these maps:

- Gas consumption is relatively low in large parts of Stratford-on-Avon (possibly due to its relatively rural nature and hence partial lack of mains gas availability).
- Areas within Warwick, Rugby and North Warwickshire exhibit particularly high gas consumption levels. This could be due to a small number of very large consumers in these areas.

The figure below sets out gas sales per consumer as an index of the national average for the period 2001-2005.

Figure 2 Index of Gas Sales per Consumer (GB=100), 2001-2005



Source: ECOTEC Analysis, based on DTI data, 2007

Whilst gas sales to domestic consumers have remained on par with the national average, sales to commercial and industrial consumers continue to be significantly below the national average and declined from 89% of the national average in 2003 to 76% in 2005. The significant decline between 2003 and 2004 is likely to be a result of differences in data collection, as mentioned above.

The table below sets out annual degree days[1] and annual gas consumption, in order to illustrate the effect of weather on gas consumption. Whilst the consumption data is not directly comparable across all years due to differences in DTI methodology, the increase in domestic gas consumption between 2004 and 2005 could be partly attributable to the increase in the number of degree days. Commercial and industrial consumers are less affected by the number of degree days.

Table 2 Degree days and gas consumption, 2001-2005

Year	Degree days	20 year average	Domestic per consumer - kWh	Commercial and Industrial per consumer- kWh
2001	2,235	2,192	20,233	619,339
2002	2,001	2,192	20,560	652,708
2003	2,086	2,192	20,498	650,836
2004	2,028	2,192	19,391	471,905
2005	2,047	2,192	19,199	492,142

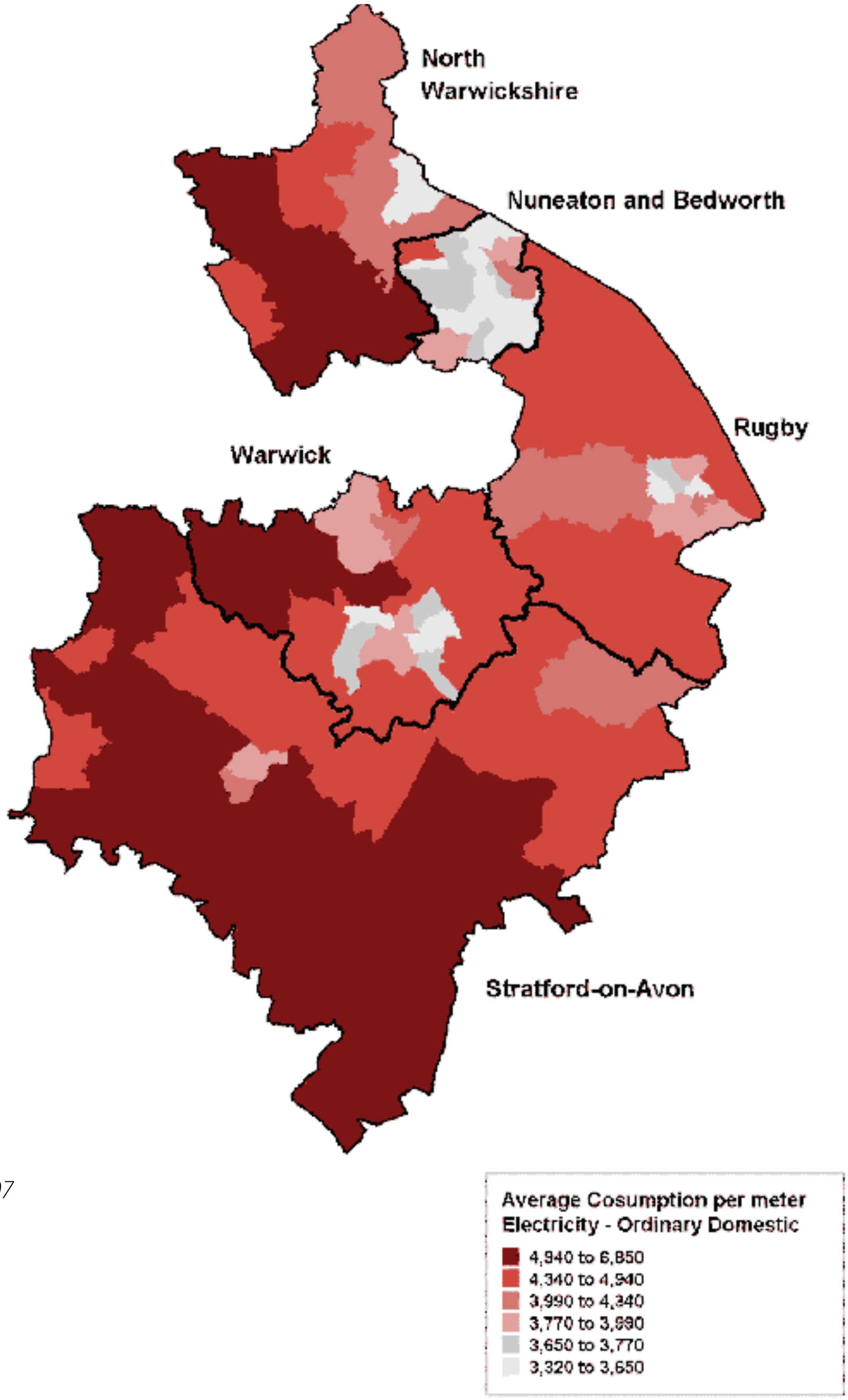
Source: Degree day figures from vesma.com; gas consumption data from DTI, 2007

2.2 Electricity

As with gas, electricity consumption estimates have also recently been released for MLSOAs. The maps show the average electricity consumption per meter for the domestic (ordinary and Economy 7 meters), as well as the industrial and commercial sector.

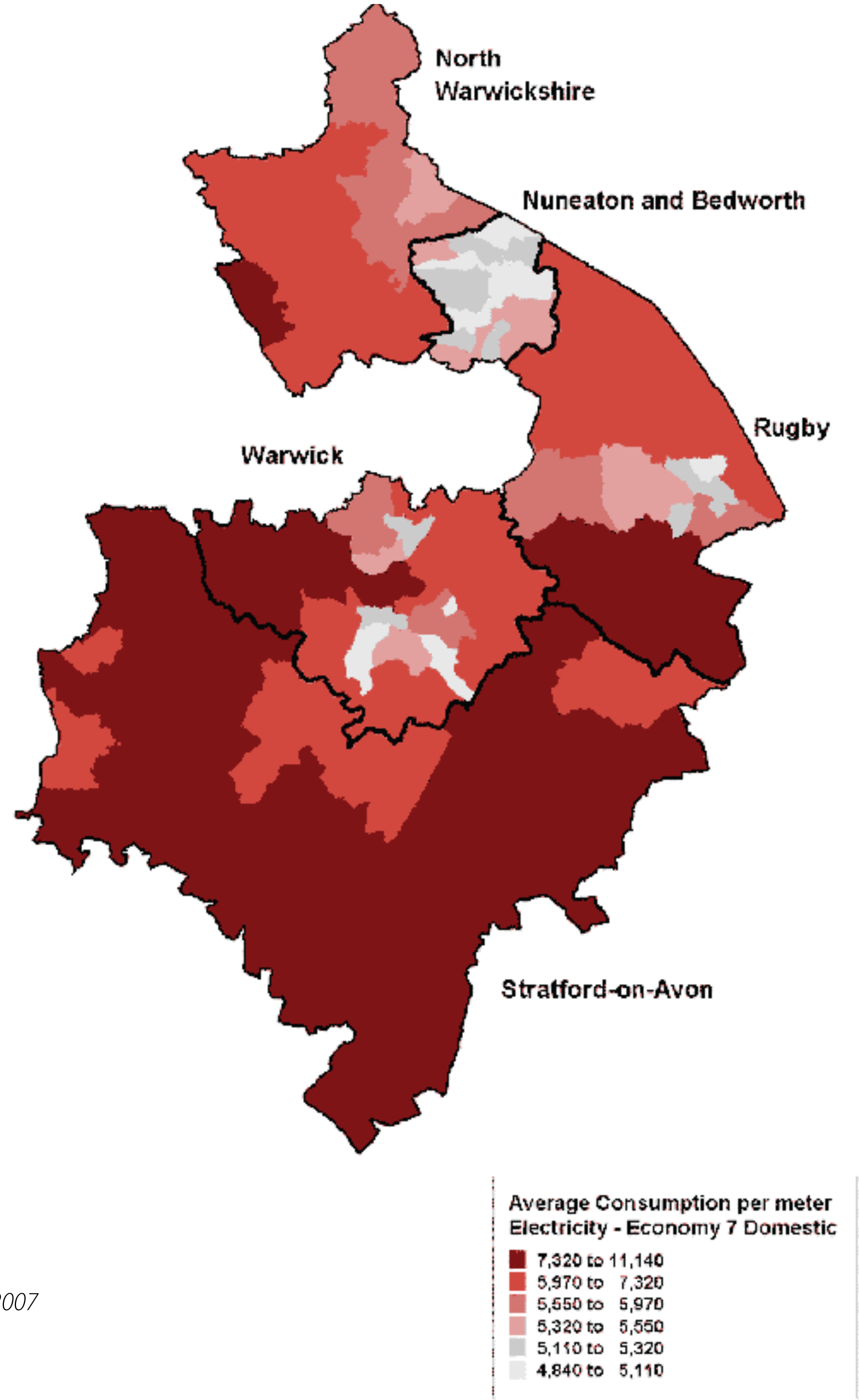
[1] Degree days are a measure of the difference between the daily average temperature (15.5 degrees) and the actual outdoor temperature multiplied by the number of days. The higher the number the colder the year in question.

Figure 3 Average electricity consumption per meter (kWh), 2005



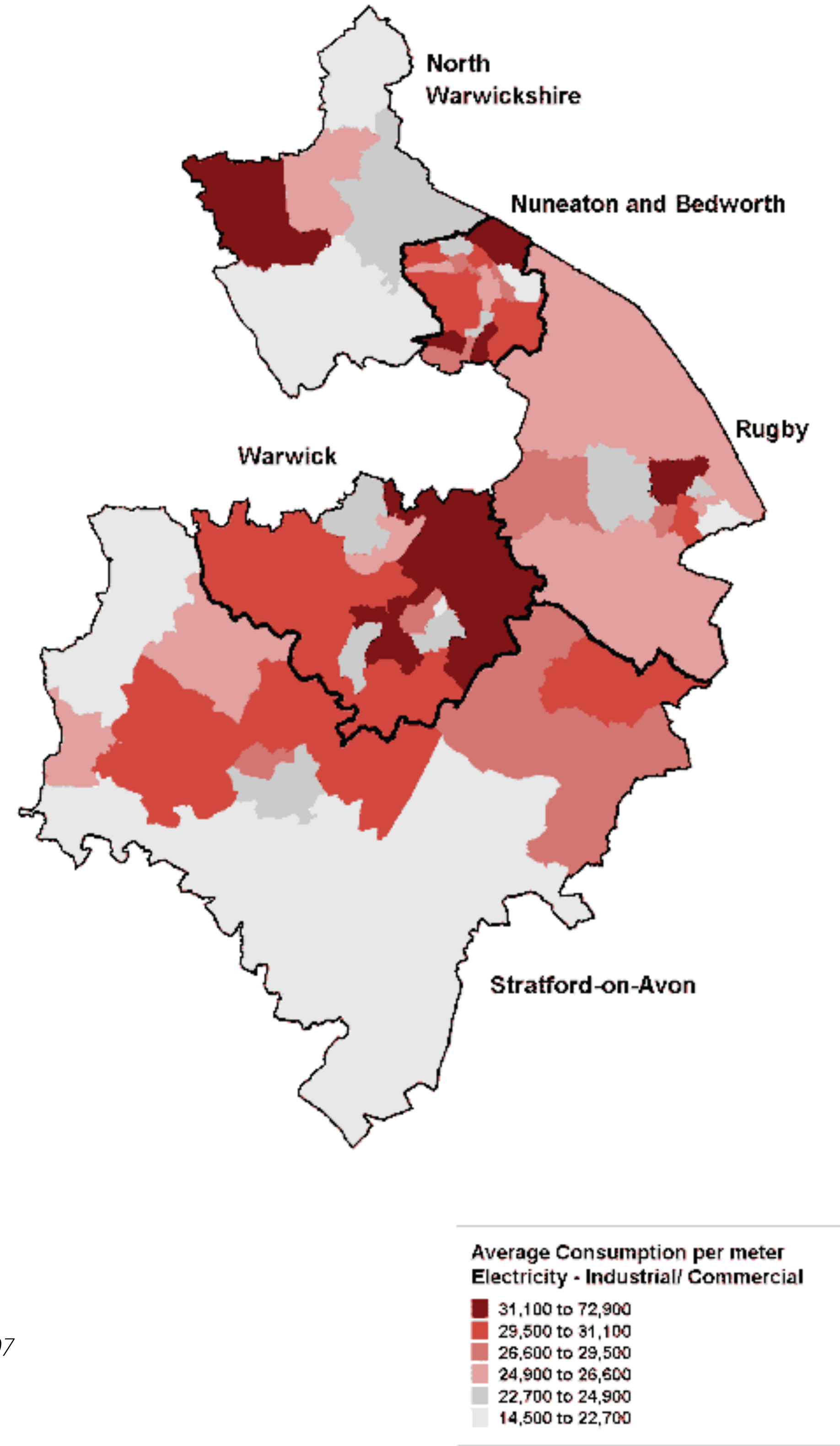
Source: DTI, 2007

Figure 3 Average electricity consumption per meter (kWh), 2005



Source: DTI, 2007

Figure 3 Average electricity consumption per meter (kWh), 2005



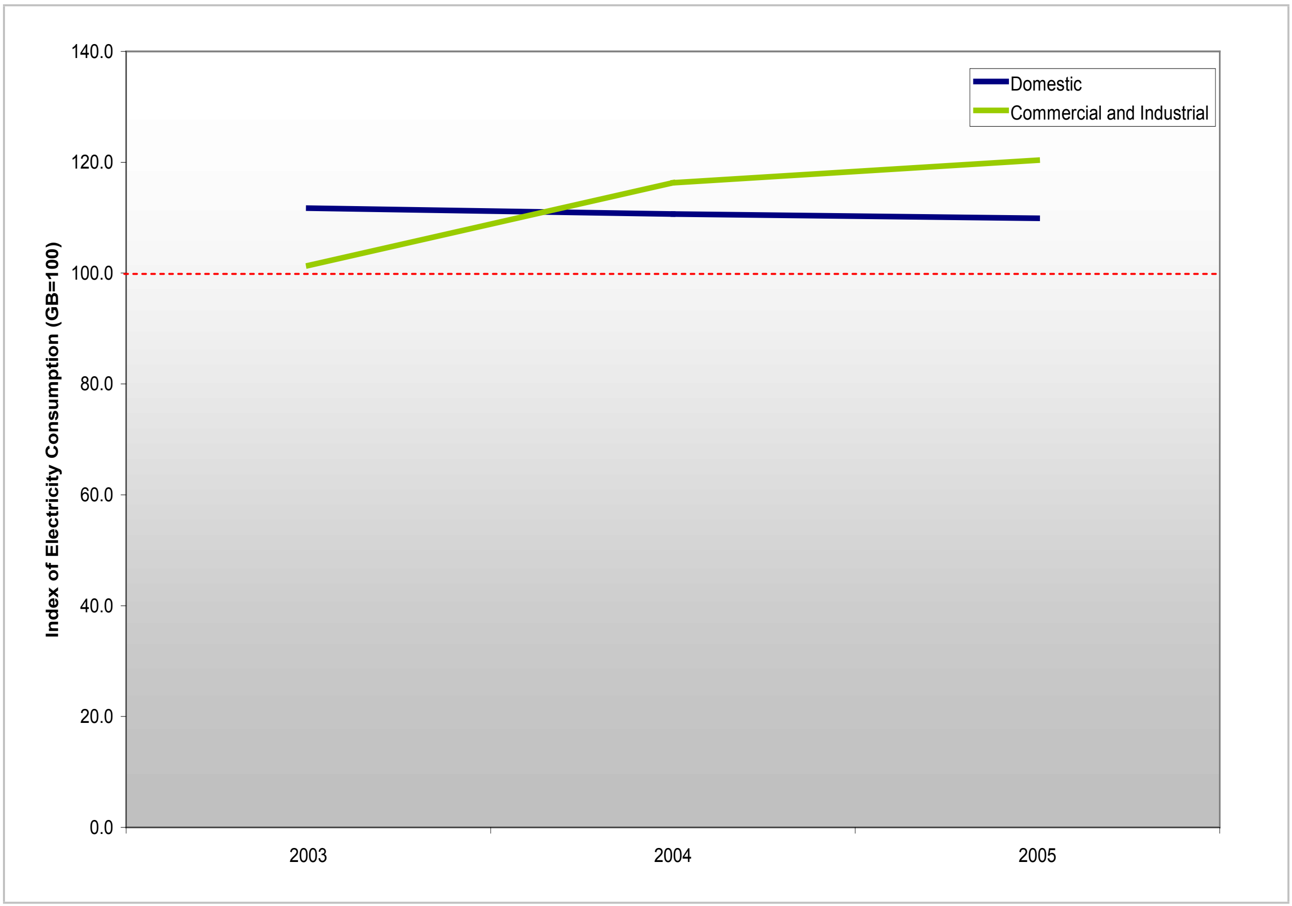
Source: DTI, 2007

A number of interesting points can be noted from the maps:

- The gas network does not seem to serve some of the more rural areas of Stratford-on-Avon, which may explain the relatively high average electricity consumption levels within the local authority - on the assumption that electrical heating will be more common in these areas.
- Within the domestic sector, average electricity consumption is relatively low in areas within the
- Nuneaton and Bedworth local authority.
- Within the industrial and commercial sector, average electricity consumption is relatively low in large parts of the North Warwickshire local authority.

The figure overleaf sets out the average electricity consumption in Warwickshire as an index of the national average for the period 2003-2005.

Figure 4 Index of Electricity Sales per Consumer (GB=100), 2003-2005



Source: ECOTEC Analysis, based on DTI data, 2007

Average electricity consumption has remained above the national average throughout the 2003-2005 time period. However, whilst the gap with the national average has been narrowed for domestic consumers, the gap has widened considerably in respect of commercial and industrial consumers. Indeed, since 2003 the average electricity consumption for commercial and industrial consumers has increased from approximately 79,000 kWh (1% above the national average) to more than 94,000 kWh (more than 20% above the national average). However, as mentioned above, these changes in consumption are thought most likely to be a result of data quality improvements.

3 Final Energy Consumption by Sector

3.1 Domestic

The resultant CO_2 emissions from the domestic sector in Warwickshire are set out in the table overleaf. As with the road transport sector the data has been sourced from Defra and relates to 2004.

Table 3 Domestic Carbon Emissions (CO_2 ktonnes), 2004

Area	Domestic	Population '000	Domestic per capita CO_2 (tonnes)	Average earnings – full-time workers (median)
North Warwickshire	176	62	2.8	£20,700
Nuneaton and Bedworth	261	119	2.2	n/a[1]
Rugby	216	87	2.5	£22,794
Stratford-on-Avon	349	111	3.1	£26,265
Warwick	378	126	3.0	£25,605
Total Warwickshire	**1,380**	**506**	**2.7**	**£23,037**
Warwickshire as % of WM	10.2%	9.6%	107	111
Total West Midlands	**13,484**	**5,267**	**2.6**	**£20,795**
Warwickshire as % of UK	0.9%	0.9%	103	104
Total United Kingdom	**155,139.8**	**58,785**	**2.6**	**£22,056**

Source: Defra, 2007

Whilst domestic energy consumption per capita in Warwickshire is lower than both the regional and national average, the resultant carbon dioxide emissions are higher. This is likely to be a result of a slightly higher than average use of energy sources such as coal, petroleum products and electricity.

There appears to be a weak relationship between average income and energy use / CO_2 emissions - with higher average income areas having higher energy use, though North Warwickshire does not follow the trend.

[1] Statistically unreliable

3.2 Industrial and Commercial

The DTI also provides energy statistics for specific sectors; however, this is only provided for the UK as a whole. Estimates for Warwickshire have been derived using Warwickshire's proportion of total UK employment in each sector. It should be noted though that the total does not add up to the total presented in the table above and hence the data should only be used to provide an indication of variations in energy use across specific sectors.

- From the table overleaf, it is clear that the commercial sector has the highest energy consumption in Warwickshire, followed by the public administration sector and the vehicles sector.
- Coal and manufactured fuels are used extensively in the manufacture of iron and steel and mineral products.
- A relatively high proportion of energy consumption in the public sector and agriculture comes from renewables / waste / heat – 11% and 8% respectively.

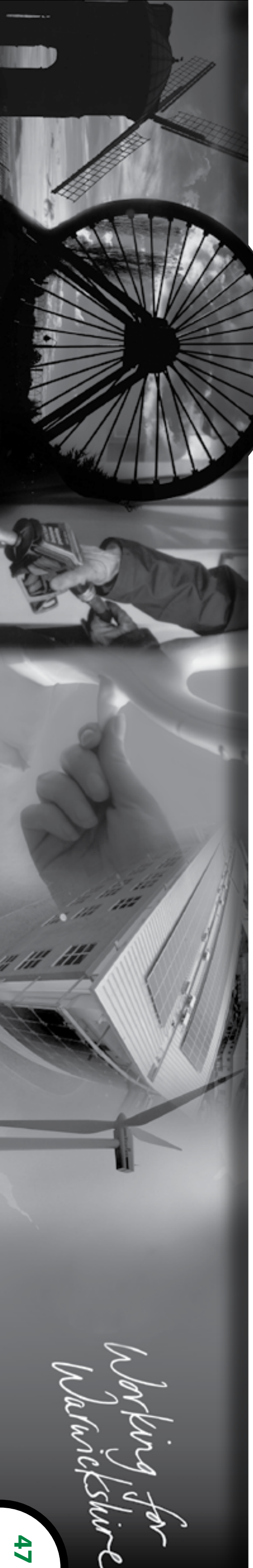


Table 4 Warwickshire Energy Consumption by Sector and Fuel-type, 2005

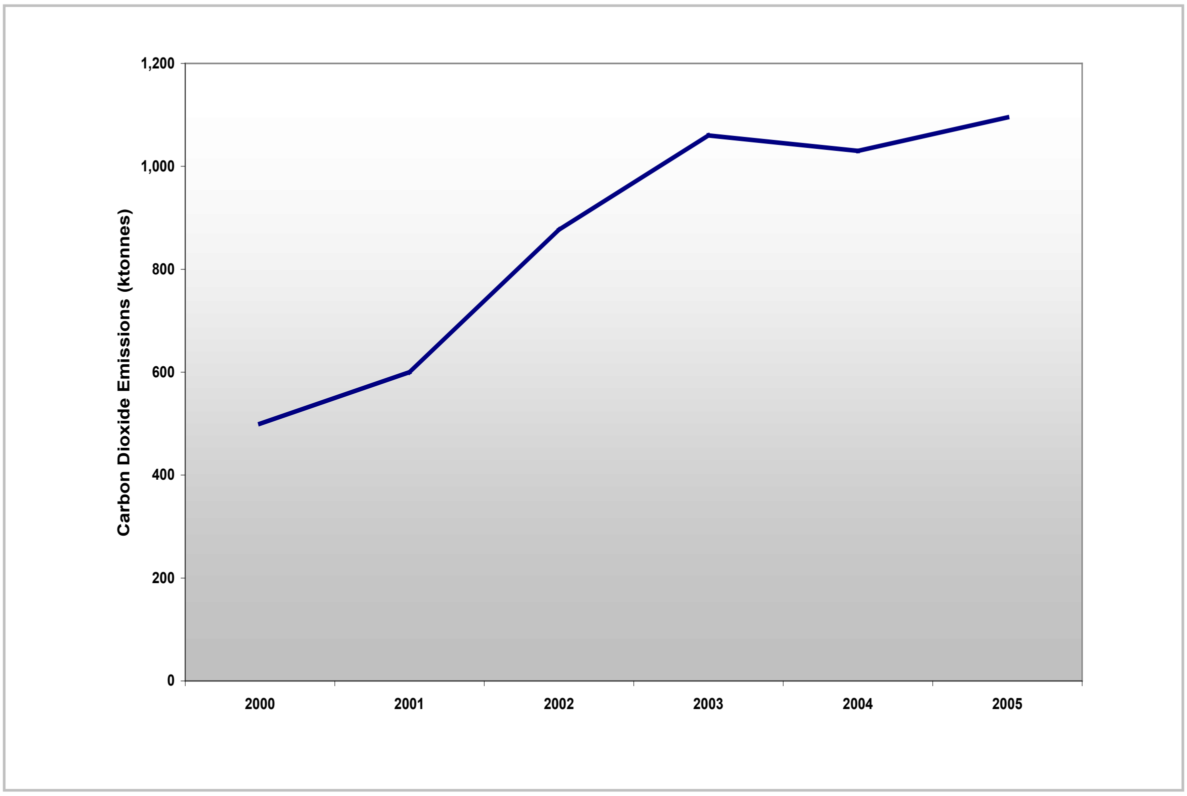
Sector	Warwickshire Energy (GWh)	Warks employment as % of UK total	Coal and manufactured fuel	Petroleum products	Natural Gas	Renewables & Waste & Heat Sold	Electricity
Unclassified	314	0.9%	24	273	1	15	-
Iron and Steel	276	1.3%	93	2	113	-	68
Non Ferrous metals	154	1.3%	4	8	41	-	101
Mineral Products	391	1.2%	106	31	157	-	97
Chemicals	164	0.2%	2	5	94	10	53
Mechanical Engineering and metal products	291	1.6%	2	21	132	0	136
Electrical and instrument engineering	102	0.8%	0	3	36	-	62
Vehicles	505	2.8%	12	46	280	-	166
Food, beverages and tobacco	179	0.4%	1	15	112	0	51
Textiles, clothing , leather and footwear	38	0.3%	2	4	21	-	11
Paper, printing and publishing	123	0.4%	5	4	55	3	55
Other industries	406	0.6%	7	191	56	27	124
Construction	62	0.9%	-	20	24	-	18
Public administration	619	0.8%	1	47	341	66	164
Commercial	1,029	0.9%	-	38	326	-	665
Agriculture	39	0.4%	0	15	6	3	15
Miscellaneous	192	0.9%	0	9	178	4	-
Total	**4,884**	**n/a**	**260**	**734**	**1,976**	**129**	**1,785**
Percentage of UK	0.8%	0.9%	1.1%	0.8%	0.8%	0.6%	0.8%

Source: ECOTEC Analysis, based on DTI data, 2007

3.3 Large point sources of emission

Since the original report in 2005, data on large point sources of emissions has become more available. The figure below presents carbon dioxide emissions from the cement works in Rugby, which emitted some 1.1 million tonnes of CO_2 in 2005. This represents an increase of 120% compared with their 2000 emissions.

Figure 5 Rugby Cement Works CO_2 Emissions, 2000-2005



Source: Environment Agency, 2007

In addition to the emissions associated with the energy consumption at the cement works, CO_2 is also emitted as a result of the cement manufacturing process. During cement manufacture, CO_2 is emitted from a process known as calcination or decarbonation of calcium carbonate (or limestone; $CaCO_3$). Cement kiln feed is a mix containing around 78% calcium carbonate with a balance of silica bearing material. During the calcination process, the cement kiln feed is exposed to high temperatures which causes the calcium carbonate component to form lime (CaO) and CO_2. The latter is released to the atmosphere as a by-product[1].

ECOTEC estimate that the cement works emits in the order of 625 ktonnes of CO_2 through the calcination process. This estimate is based on the notion that 500kg of CO_2 is emitted per tonne of PCE (Portland Cement Equivalent)[2] and that the capacity at the Rugby plant is 1,250 ktonnes per annum[3].

4 Energy Intensity

Energy intensity is a measure of the energy efficiency of an economy and is calculated as units of energy per unit of GVA. As the table below outlines, the energy intensity of Warwickshire's economy was higher than both the regional and national averages in 2004. With 2.3 GWh of energy consumption per million £ of GVA, Warwickshire consumes 31 percent more energy compared with the national average. To a considerable extent this is thought to be a result of a higher than average proportion of employment in energy intensive sectors in Warwickshire. The change in energy efficiency since 2003 is most likely to be a result of data quality improvements rather than real changes in efficiency.

Table 5 Energy Efficiency (GWh/million £ GVA)

	2003	2004
Warwickshire	2.5	2.3
West Midlands	2.0	1.9
United Kingdom	2.2	1.8

Source: ONS, 2007 and DTI, 2007

[1] Guidelines for the Measurement and Reporting of Emissions by Direct Participants in the UK Emissions Trading Scheme (2007) Defra.

[2] Performance Review UK Cement Industry (2006) British Cement Association.

[3] British Cement Association, 2007

Annex Two: Glossary Terms

C

Climate Change Programme (UK)

Published in 2000, sets out the Government and Devolved Administration strategic approach to tackling Climate Change and meeting the UK's Kyoto target. This is set at a 12.5% reduction in greenhouse gas emissions from 1990 levels by 2008-2012 and the domestic goal of reducing CO_2 emissions by 20% by 2010.

Combined Heat and Power (CHP)

A combined heat and power (also referred to as a cogeneration or a CHP) unit is an installation in which heat energy released from fuel is transmitted to electrical generator sets, which are designed and operated in such a way that energy is partly used for generating electrical energy and partly for supplying heat for various purposes. The thermal efficiency of a combined heat and power unit is significantly higher than that of an electricity-only unit.

Coal mine methane (CMM)

CMM is a waste product of the deep coal mining industry which leaks into the atmosphere from abandoned mines adding to greenhouse gas emissions. This powerful greenhouse gas can be captured and used to generate electricity .

CMM plant

Coal Mine Methane plants generate electricity and heat from methane that is emitted from disused coal mines.

D

Department for Environment, Food and Rural Affairs (Defra)

Defra is a UK Government Department. The overarching challenge for Defra is to enable everyone to live within our environmental means. This is most clearly exemplified by the need to: tackle climate change internationally and through domestic action to reduce greenhouse gas emissions, and secure a healthy, resilient, productive and diverse natural environment.

Digest of United Kingdom Energy Statistics (DUKES)

The Digest provides essential information for everyone, from economists to environmentalists and from energy suppliers to energy users. It contains extensive tables, charts and commentary covering all the major aspects of energy, including separate sections on petroleum, gas, coal and electricity. It provides a detailed and comprehensive picture of energy production and use, with key series taken back to 1970.

DTI / BERR

The Department of Trade and Industry became The Department for Business, Enterprise and Regulatory Reform on 28th June 2007. The Department's central purpose is to help ensure UK business success in an increasingly competitive world.

E

Energy Intensity
Energy intensity gives an indication of the effectiveness with which energy is being used to produce added value.

F

Final Energy Consumption
Final energy consumption is the energy consumed in the transport, industrial, commercial/public authority and domestic sectors. It excludes deliveries to the energy transformation sector and to the energy producing industries themselves.

G

Greenhouse Gases
The main greenhouse gas emission considered in this report is carbon dioxide (CO_2). Emissions of this gas are associated with the "Greenhouse Effect" which gives rise to an increase in the Earth's temperature. Some publications use tonnes of carbon as opposed to tonnes of carbon dioxide. In order to convert between them the difference between the atomic weights of carbon dioxide and carbon molecules are used, i.e. 1 t of C = 44/12 t of CO_2.

Gross Value Added (GVA)
Gross Value Added measures the contribution to the economy of each individual producer, industry or sector in the United Kingdom. GVA is used in the estimation of Gross Domestic Product, which is a key indicator of the state of the whole economy.

M

MW
Mega Watt - a measure of power, one million watts.

MWh
Mega Watt hour, one thousand kWh. A 1 MW power-generating unit running for 1 hour produces 1 MWh of electrical energy.

MWe
Megawatt electrical. CHP output is defined in terms of both electrical and heat output.

O

Office of National Statistics (ONS)
The Office for National Statistics (ONS) is the government department responsible for collecting and publishing official statistics about the UK's society and economy.

OFGEM
Office of Gas & Electricity Markets (UK government). Ofgem is the Authority that determines strategy, sets policy priorities and takes decisions on a range of matters, including price controls and enforcement. The Authority's powers are provided for under the Gas Act 1986, the Electricity Act 1989, the Utilities Act 2000, the Competition Act 1998 and the Enterprise Act 2002.

R

Renewable Energy
Renewable energy includes: biomass, hydroelectricity, solar power, wind, wave and geothermal energies.

Solid renewable energy sources consist of energy crops, other biomass, wood, straw and waste, whereas gaseous renewables consist of landfill gas and sewage waste.

Renewables Obligation
The obligation is placed on licensed electricity suppliers to deliver a specified amount of their electricity from eligible renewable sources.

Renewables Obligation Certificate (ROC)
Eligible renewable generators receive Renewable Obligation Certificates (ROCs) for each MWh of electricity generated. These certificates can then be sold to suppliers. In order to fulfil their obligation, suppliers can either present enough certificates to cover the required percentage of their output, or they can pay a 'buyout' price of £30 per MWh for any shortfall. All proceeds from buyout payments are recycled to suppliers in proportion to the number of ROCs they present.

ROC Register
The Renewables Obligation (RO) Order gives Ofgem specific functions in relation to the implementation of the RO including monitoring suppliers' compliance with the RO. One such function requires Ofgem to establish and maintain a Register for the purpose of keeping a record of eligible Renewables Obligation Certificates (ROCs), and of Registered Holders and Prospective Registered Holders of ROCs. The Register is available for public access and reflects a Registered Holder's position with regard to their holding of ROCs at any one time.

T

Tonne of Oil Equivalent (toe)

The tonne of oil equivalent (toe) is a unit of energy: the amount of energy released by burning one tonne of crude oil, approximately 42 Giga Joules (GJ).

V

Value Added

The value added (to a product, or added value of a product) is the increase in the value of that product as the result of a particular stage of a production process.

W

Watts

The standard unit of energy is the joule. It is equal to the energy dissipated by an electrical current of 1 ampere driven by 1 volt for 1 second. One watt amounts to 1 joule per second. Electrical appliances are rated in watts and this describes their instantaneous load, or in the case of electricity generators their output, e.g. a 100 watt light bulb, or a 2 kW kettle. In common with all units large amounts of watts are described as follows:

1 kW (kilo Watt) = 1,000 W
1MW (Mega Watt)= 1,000,000 W
1 GW (Giga Watt) = 1,000,000,000 W

In order to describe energy consumption, or generation the watthour unit is used. 1 watthour is the continuous load/output of 1 watt for 1 hour. As with watts multiples of the units are described as follows:

1 kWh = 1,000 watts for 1 hour, also MWh and GWh
Gas and electricity bills describe the number of kWh consumed and the prices are given in pence per kWh. To put this in context 200 people consume about 1 GWh of electricity a year.

For any further information regarding this document please telephone:
01926 736324
or email climatechange@warwickshire.gov.uk

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