

Greenhouse gas emissions in Winchester District: Part VIII

Estimates and trends (2005-2016)

A summary

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- **Total carbon dioxide emissions in Winchester District decreased in 2016 to 668 kilotonnes CO₂ (excluding motorway emissions). At the end of 2016 the total emissions were not on track to reach a 40% reduction by 2020 relative to 2004 as part of the District's minimum share to reach the national statutory target of an 80% reduction by 2050. There was a mismatch of 6.3% and no sign of convergence with the required pathway.**
- **Winchester District lies in the worst performing 100 of the 391 local authority areas in the UK on the basis of their reduction in CO₂ emissions since 2005.**
- **In 2016 per capita total energy in Winchester District exceeded that in five adjacent local authority areas by at least 10%. Specifically residents and businesses in Winchester District used over 50% more energy than in Eastleigh Borough.**
- **The greatest emissions (309 kt) in 2016 came from road transport (excluding motorways). Electricity emissions were next (172 kt) followed by gas (148 kt).**
- **Tail pipe road vehicle emissions seem likely to continue to increase, in spite of better engine technology, until electric vehicles dominate. The number of goods vehicles continues to grow strongly; up by over 36% since 2005 and 9% since 2014.**
- **Gas emissions remain steady. Electricity emissions are expected to fall until 2025 when all UK coal-burning power stations are planned to close.**
- **Latest figures for carbon emissions and sinks related to land use, land use change and forestry (LULUCF) indicate that this sector has the net effect of absorbing 56 kt (around 8%) of the District's emissions. It deserves greater attention in future.**
- **Six principal areas in which emissions reductions can be tackled, some depending simply on encouraging behaviour change, are suggested.**
- **BEIS predicts that around the end of 2019 the carbon intensity (kg CO₂/kWh) of electricity will have become less than that of natural gas. This will herald a new era for heating in which gas will no longer be the lower carbon fuel.**
- **A growing and very buoyant local economy is not necessarily conducive to reducing emissions unless it is closely managed in a sustainable way.**

This is the eighth in a series of annual reports on Winchester District's energy consumption and greenhouse gas emissions (carbon footprint). A major reason for writing these reports has been to assess to what extent Winchester District is contributing to and meeting the national objective set in the Climate Change Act (2008) of an 80% reduction in greenhouse gas emissions by 2050 (referred to 1990). Today this ten-year old objective is coming to be seen as insufficient. The UN Paris Agreement (2015), for example, using a different criterion, agreed to hold "... the increase in the global average temperature to well below 2 °C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change".

More recently, in 2017 the UK government published its Clean Growth Strategy and this year its complementary 25-Year Environment Plan.¹ It has also requested the Climate Change Committee, following the publication of an IPCC special report on 1.5°C global warming, to review the UK's long-term target against the Paris objectives. The IPCC report, published in October 2018, noted that global warming is likely to reach 1.5°C between 2030 and 2052. In every eventuality 2°C warming is expected to have a worse impact than 1.5°C warming. Even 1.5°C warming will bring with it a high risk of extreme weather events and up to 77 cm of sea-level rise by 2100. In model pathways, with no or limited overshoot of 1.5°C, global net anthropogenic CO₂ emissions are assumed to decline by about 45% from 2010 levels by 2030, reaching net zero around 2050.² The report raises the possibility that the UK may have to implement a more stringent target to reduce emissions to "net zero" by 2050. New and more ambitious national regulations and legislation in this area are awaited. It is notable that in Scotland a draft climate change bill already proposes a 90%-by-2050 emission reduction target.³

This is not the place to comment on how future targets will be set but it is abundantly clear that greater efforts will be required in future not only to reduce the consumption of fossil-fuel energy and to use it more efficiently but also to generate more energy from renewable, and possibly other lower-carbon, sources.

Technical background

A great deal of detail about the methodology and analysis of the data on which these reports are based can be found in the earlier reports⁴ and elsewhere.⁵ Since 2014, for

¹ HM Government. "The Clean Growth Strategy; Leading the Way to a Low Carbon Future," October 11, 2017; DEFRA. "A Green Future: Our 25 Year Plan to Improve the Environment." London, UK: DEFRA, 2018.

² Allen, Myles, and ca. 61 others. "Global warming of 1.5 °C - Summary for Policy Makers." IPCC Special Report. IPCC, October 6, 2018, pp.34.

³ <https://www.theguardian.com/environment/2018/may/24/scotland-draft-climate-change-bill>

⁴ Whitmarsh, R.B. *Greenhouse Gas Emissions in Winchester District (2007-2009): Estimates and Trends*.

Winchester Action on Climate Change, March 2011; Whitmarsh, R.B. *Greenhouse Gas Emissions in Winchester District: Part II. Estimates and Trends (2005-2010)*. WinACC, September 2012; Whitmarsh, R.B. *Greenhouse Gas*

simplicity and ease of assimilation, the data provided by the Department of Energy & Climate Change (DECC), and subsequently by the Department for Business, Energy and Industrial Strategy (BEIS), have been presented mainly as graphs with extended captions.

The data are first presented in terms of energy consumed and then in terms of emissions of the greenhouse gas carbon dioxide. Gas and electricity consumption data in local authority areas are aggregated from individual meter readings. Road transport and residual fuel (other fuel) consumption statistics are modelled estimates of where the fuel was consumed and not where it was purchased.⁵ The figures for road transport and residual fuel, which were published in June 2018, may not exactly match earlier data because of changes in the models and calculations used. Therefore, “.... consumption estimates for the years 2005 to 2011 in the most recent publication will differ [from] values in earlier publications.”⁶ It is assumed here that these remarks apply equally to data for years after 2011.

Carbon dioxide emissions can be estimated directly from energy consumption data by using appropriate conversion factors. Sometimes this can introduce a measure of annual variability because such factors can vary from year to year; for example, the changes in fuel mix used by electricity-generating power stations. This can in turn obscure changes in energy consumption which more accurately reflect changes in behaviour of the domestic and commercial consumers in a local authority area such as Winchester District. Instead I have used national emissions data provided by BEIS from which they have ‘disaggregated’ national data, using digital modelling, down to local authority level. A novel aspect of this report is the addition of emissions data for land use, land use changes and forestry (LULUCF) for the major sectors (sources and sinks) involved.

Emissions in Winchester District: Part III. Estimates and Trends (2005-2011). WinACC, August 2013; Whitmarsh, R.B. *Greenhouse Gas Emissions in Winchester District: Part IV. Estimates and Trends (2005-2012)*. WinACC, September 2014; Whitmarsh, R.B. *Greenhouse Gas Emissions in Winchester District: Part V. Estimates and Trends (2005-2013)*. WinACC, September 2015; Whitmarsh, Bob. *Greenhouse Gas Emissions in Winchester District: Part VI Estimates and Trends (2005-2014). A Summary*. Winchester: WinACC, August 2016. Whitmarsh, Bob. *Greenhouse Gas Emissions in Winchester District: Part VII Estimates and Trends (2005-2015). A Summary*. Winchester: WinACC, September 2017.

⁵ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/579258/Sub-national_Methology_and_Guidance_Booklet_2016.pdf. See Table 1 and pages 12 (gas), 27 (electricity), 51 (road transport) and 56 (other fuels) for details.

⁶ Email from Georgina Eaton, DECC (3 August 2015).

Energy consumption

Electricity⁷

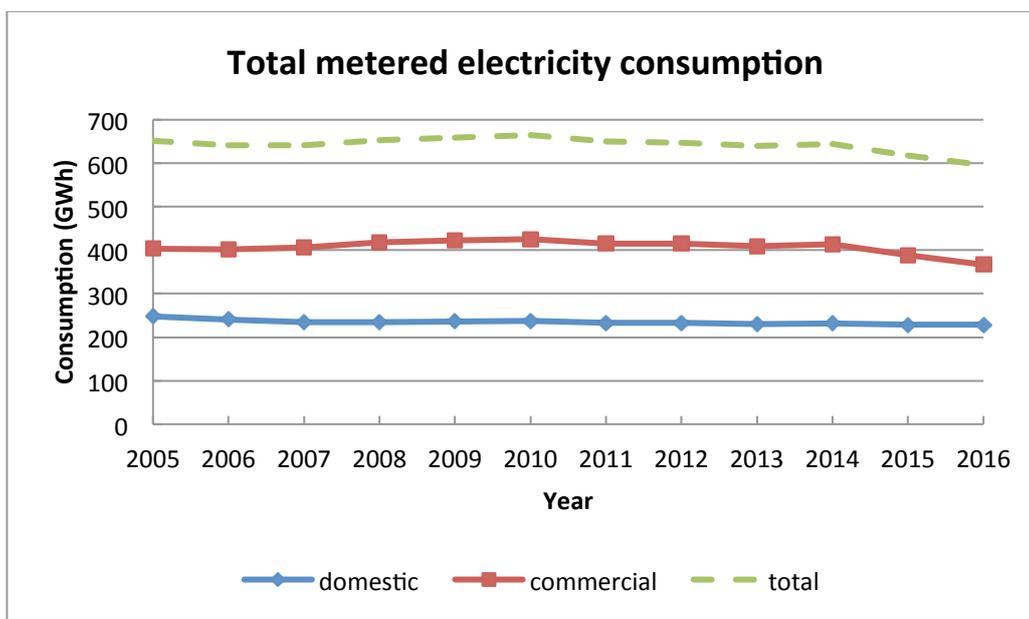


Figure 1. Total annual metered electricity consumption in Winchester District 2005-2016 from the 'domestic' and 'commercial' sectors.⁸ The 'domestic' sector includes some small businesses. Note that in 2016 the commercial sector used almost 1.6 times as much electricity as the domestic sector or almost two-thirds of the total. The average domestic consumption per meter in 2016 was 4432 kWh in Winchester District and 3812 kWh in England. The average commercial/industrial consumption per meter in 2016 was 61,387 kWh in Winchester District (but with no industry) and 66,981 kWh in England. 1 GWh = 1 million kWh.

⁷ <https://www.gov.uk/government/collections/sub-national-electricity-consumption-data>

⁸ BEIS includes households and small businesses consuming less than 50,000 kWh in their definition of 'domestic' and industrial/commercial addresses consuming more than 50,000 kWh or any bodies consuming more than 100,000 kWh in their definition of 'commercial'. BEIS says Winchester District has no industry and so industrial emissions do not feature in this report.

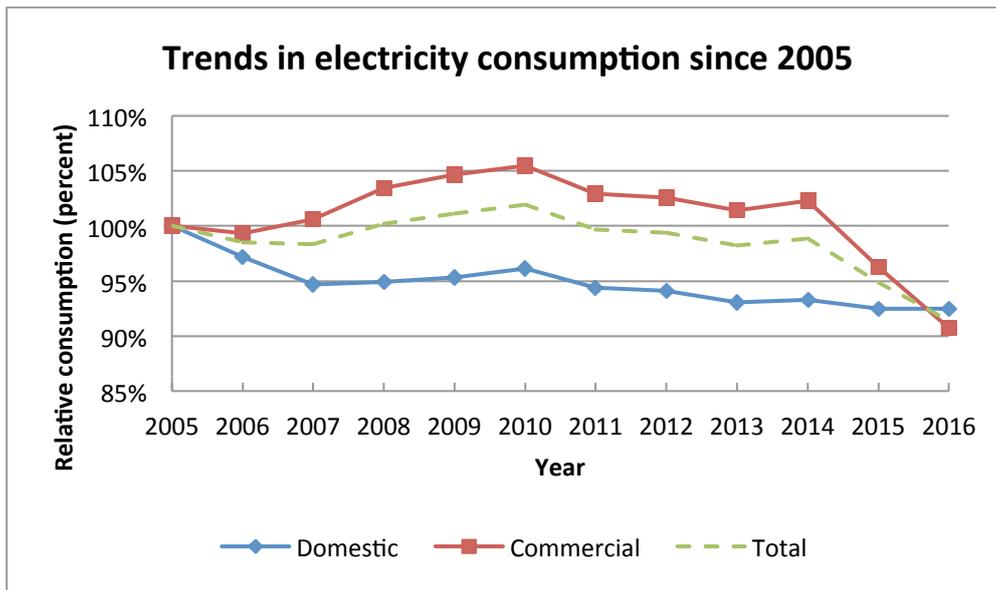


Figure 2. Relative changes in electricity consumption in Winchester District referred to 2005. Note that although the domestic sector had reduced its consumption by 7.5% by 2016, relative to 2005, progress has been relatively slow since 2011. There was a slight upturn between 2013 and 2014 but the downward trend continued in 2015 but had ceased by 2016. The commercial sector failed to reduce its consumption at all up to 2014 when it remained 2.3% up relative to 2005. However in 2015 and 2016 a steep decline set in. According to BEIS these data were revised in January 2018 (note that the 2015 figure is different from that reported here in 2017). BEIS state that “These revisions are usually due to forecasted values being replaced with actual data, where actual figures were not available at the time of publication.”⁹ The reason for the steep decline has yet to be discovered. The District’s total electricity consumption had declined by only 1.1% in 2014 relative to 2005, because of the dominant influence of the commercial sector, but since then has declined by 8.6% relative to 2005.

⁹ Section 1.4 in <https://www.gov.uk/government/publications/regional-energy-data-guidance-note>

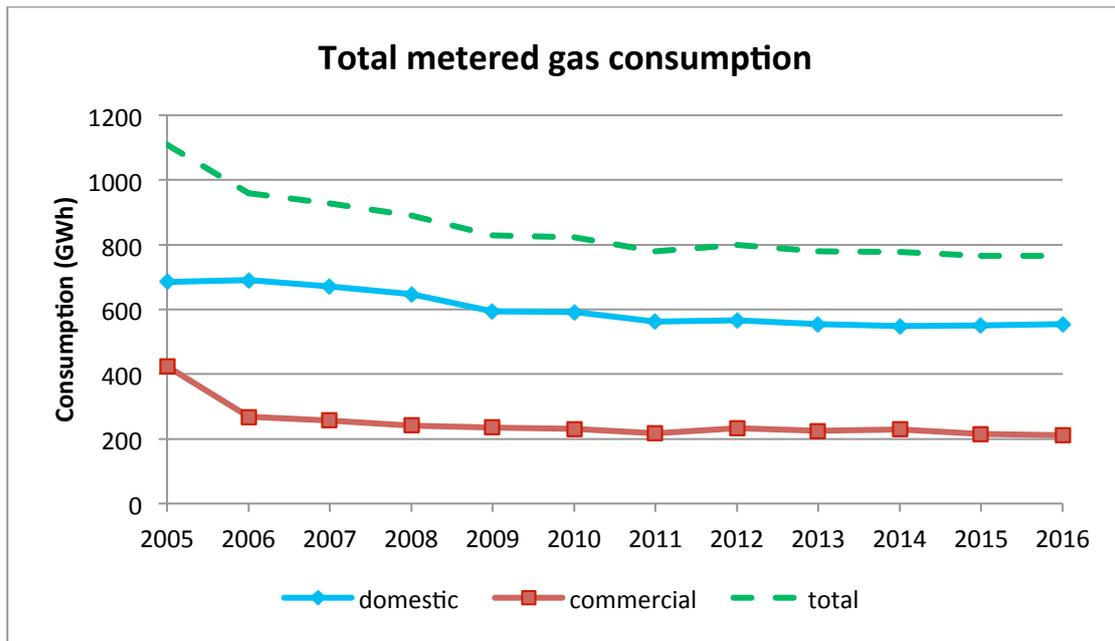


Figure 3. Total annual (1 October – 30 September) metered gas consumption in Winchester District 2005-2016 from the domestic (defined as consuming less than 73,200 kWh) and commercial sectors. Thus the ‘domestic’ sector in the UK includes around 2 million small businesses. Note that in 2016 the domestic sector used about 2.6 times as much gas as the commercial sector or about seven-tenths of the total. The average domestic consumption per consumer in 2016 was 13,892 kWh in Winchester District and 13,215 kWh in England. The average commercial/industrial gas consumption per consumer in 2016 was 362,973 kWh in Winchester District (but with no industry) and 653,024 kWh in England. Gas is used principally for heating. Allowance has been made in these figures by BEIS for seasonal variations in temperature (weather corrected). 1 GWh = 1 million kWh.

¹⁰ <https://www.gov.uk/government/collections/sub-national-gas-consumption-data>

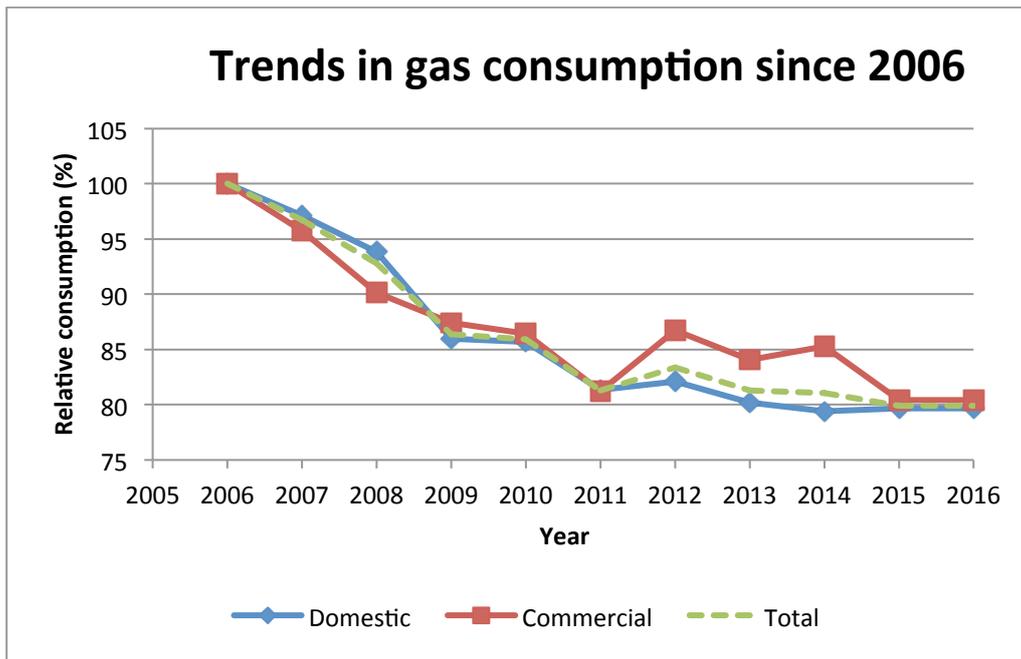


Figure 4. Relative changes in gas consumption in Winchester District referred to 2006 (the figure for commercial consumption in 2005 is suspect (Fig.3) and so 2006 has been used as the reference year). Note that although both sectors reduced their consumptions by similar proportions between 2006 and 2011 the commercial sector showed a strong increase in 2012 but then dropped to match the domestic sector again from 2015. The total gas consumption in Winchester District had declined by 20% in 2016 relative to 2006.

Road transport fuels¹¹

Data on the consumption of road transport fuels at local authority level is provided by BEIS for different classes of vehicle and for three types of road. This is particularly helpful in identifying the trends in consumption by different vehicle classes. Consumption of fuel on the three road types (motorways, A-roads and minor roads) was roughly in the ratios 4:3:3, respectively, over the period of interest.

¹¹ <https://www.gov.uk/government/statistical-data-sets/road-transport-energy-consumption-at-regional-and-local-authority-level>.

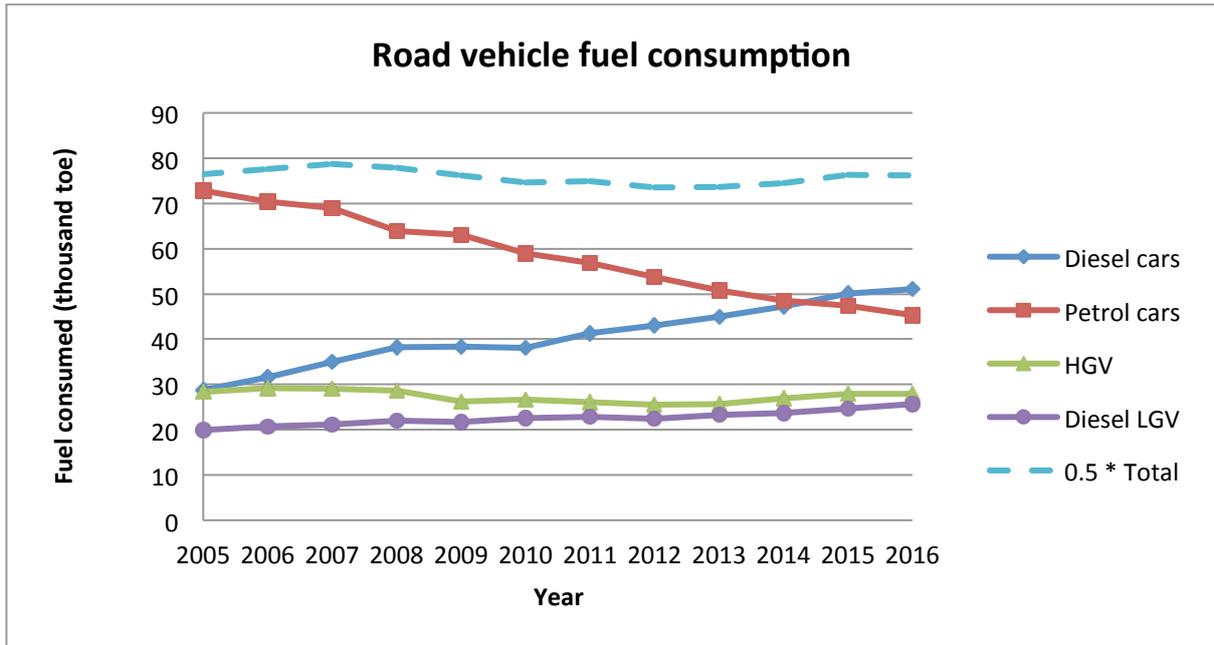


Figure 5. Fuel consumption by the main classes of road vehicle, which contribute 98-99% of the grand total, in Winchester District from 2005 to 2016. The total values have been halved for display purposes. Note that the units of consumption are tonnes of oil equivalent (toe). The strong reduction in consumption by petrol cars since 2005 is only partly offset by an increase in consumption by diesel cars which actually started to show a small reduction in growth in 2016. In 2016 fuel consumption by cars and goods vehicles was approximately in the ratio 7:4.

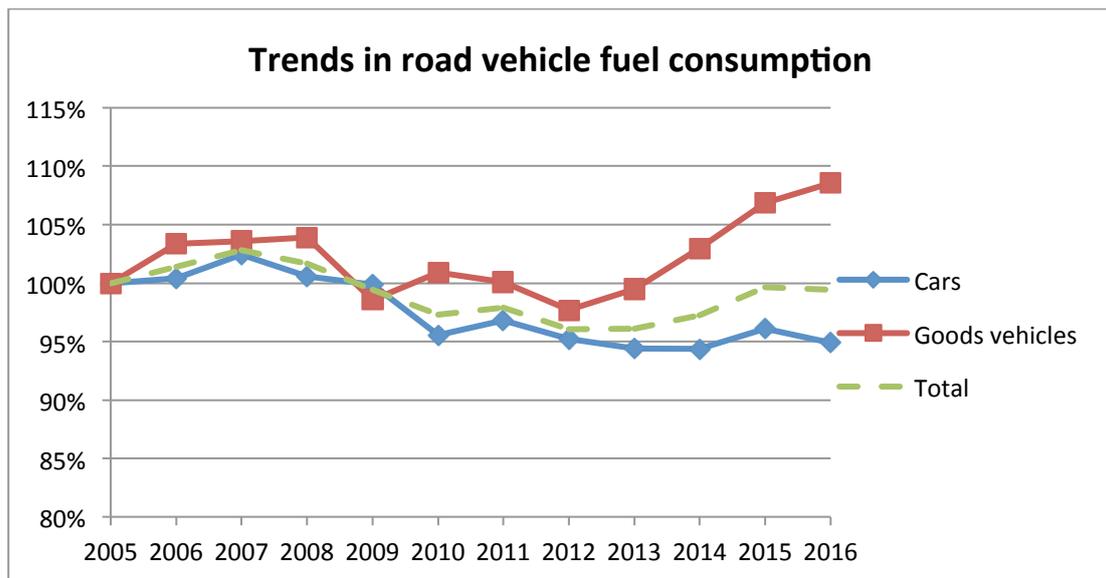


Figure 6. Trends in road vehicle fuel consumption in Winchester District between 2005 and 2016. Since 2005 the total reduction in consumption by cars plus goods vehicles (green dashed line) was only 1.3%. Total fuel consumption declined by 6.9% from 2007 to 2013 but has since increased by 3.2%. However the figure illustrates that by 2016 cars (mainly private vehicles) had more or less steadily reduced their consumption, relative to 2005, by

5.1%, even though their numbers increased by 13.3% since 2005.¹² By 2016 goods vehicles had actually *increased* their consumption by 8.6% while their numbers increased by an astonishing 36.2% since 2005. It is hard to discern any overall trend in fuel consumption by goods vehicles since 2005 but they have clearly increased substantially since 2012.

Other fuels¹³

The latest dataset, released in September 2017, contains a revision of energy estimates, most commonly because of revision to the core energy statistics presented in DUKES (Digest of UK Energy Statistics) but also covers adoption of revised methodologies. Therefore readers may note changes in the estimates reported previously particularly for domestic coal, domestic solid fuel and bioenergy & waste. Here the latest set of figures has been used for all years up to 2015.

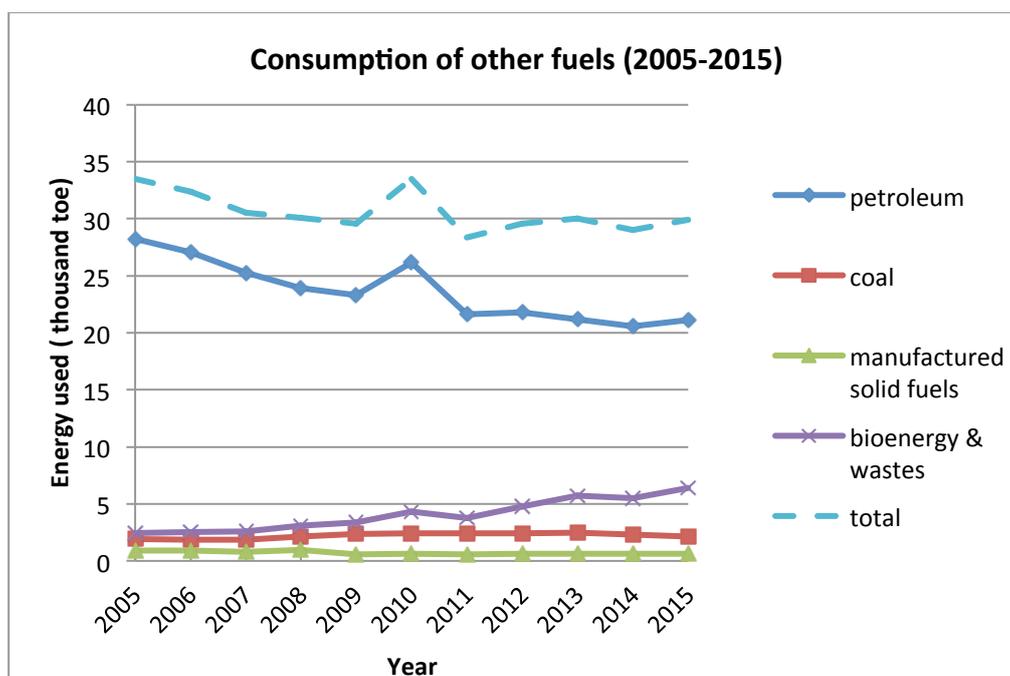


Figure 7. Other fuels, sometimes called residual fuels, are defined as non-gas, non-electricity and non-road transport fuels. They cover consumption of coal, petroleum, manufactured solid fuels and bioenergy and waste not used for electricity generation or road transport. The total annual consumption of other fuels in Winchester District declined by 10.7% from 2005 to 2015 (33.5 to 29.9 ktoe). Petroleum products accounted for 71% of other fuels in 2015. The use of coal peaked in 2013 since when it has declined by 14%. The use of bioenergy and wastes (recalculated from previous years), excluding electricity generation, had more than doubled in 2013 and remained about 21% of the overall total in 2015. Data for 2016 are due to become available in September 2018.

¹² Pers. comm. from Thomas Parry, DFT, 1 February 2018

¹³ <https://www.gov.uk/government/statistical-data-sets/estimates-of-non-gas-non-electricity-and-non-road-transport-fuels-at-regional-and-local-authority-level>. Latest data are for calendar year 2015.

Greenhouse gas emissions

Estimated national emissions from all domestic, commercial, industrial and agricultural fuel, gas and electricity use, as well as emissions associated with road transport and land use change (LULUCF), are provided by BEIS.¹⁴ National emissions, by end-user, are disaggregated, sometimes using additional data, to estimate CO₂ emissions in local authority (LA) areas.¹⁵ Emissions from international shipping and international and domestic aviation are excluded. Emissions data are given for carbon dioxide only.

However, in BEIS's figures some road transport emissions are attributed to motorway traffic. Motorways falling within Winchester District are the M3 and very short sections of the M27 and A3(M). Notwithstanding that these three motorways provide numerous access points (junctions) to and from the District it can be argued that a large but unknown proportion of these motorway emissions may be the result of vehicles in transit through the District and should not be attributable to the District.^{16, 17} On the other hand it can equally be argued that a possibly smaller number of vehicles from Winchester District will cause emissions on motorways outside the District. Eventually all such emissions have to be attributed to actual vehicles from somewhere and so the suggestion of entirely ignoring motorway emissions breaks down other than when a local authority wishes to consider what it can do to influence emissions solely within its remit. Therefore, to address the latter situation, here road transport emissions are given in addition that exclude motorway traffic. No attempt is made to estimate the actual proportion of motorway vehicles 'passing through' the District.

¹⁴ All the data in this section come from the latest version at <https://www.gov.uk/government/statistics/uk-local-authority-and-regional-carbon-dioxide-emissions-national-statistics-2005-2016> (downloaded in June 2018).

¹⁵ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/719182/Local_Authority_CO2_Emissions_Statistical_Release_2016.pdf

¹⁶ This is the principle formerly applied by DECC in calculating CO₂ emissions within the scope of influence of Local Authorities, see page 21 in 'Local authority carbon dioxide emissions estimates 2014', 30 June 2016, BEIS.

¹⁷ For example, goods vehicles and cars travelling to/from the ports of Southampton and Portsmouth from/to London and the Midlands.

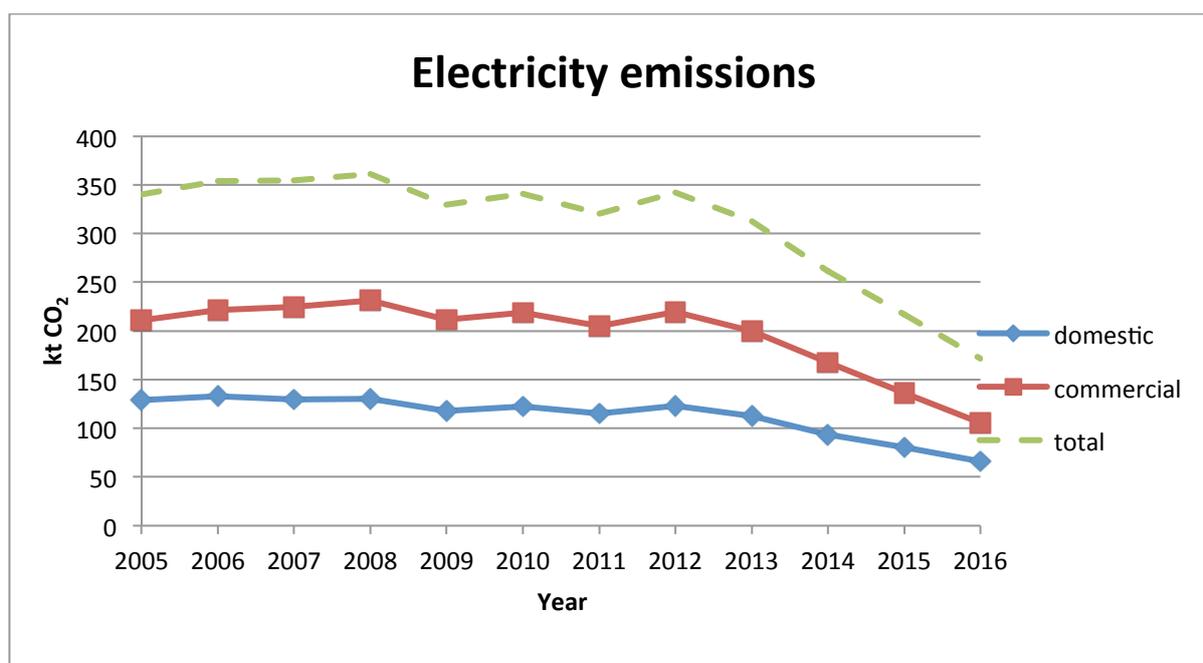


Figure 8. Total electricity emissions in Winchester District between 2005 and 2016 varied between 361 and 172 kt CO₂. Commercial emissions had decreased by almost 50% by the end of 2016. Domestic emissions behaved similarly and decreased by 49% over the same period. Emissions from both sectors followed a similar pattern partly driven by the annually varying conversion factor.¹⁸ A major contributing factor has been a 78% decrease in the amount of coal, a relatively ‘dirty’ fossil fuel, used to generate electricity since 2012.¹⁹ Total emissions from electricity consumption ended 49.5% lower in 2016 than in 2005.

¹⁸ <https://www.gov.uk/government/collections/government-conversion-factors-for-company-reporting>

¹⁹ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/643414/DUKES_2017.pdf, Table 2.4.

Gas

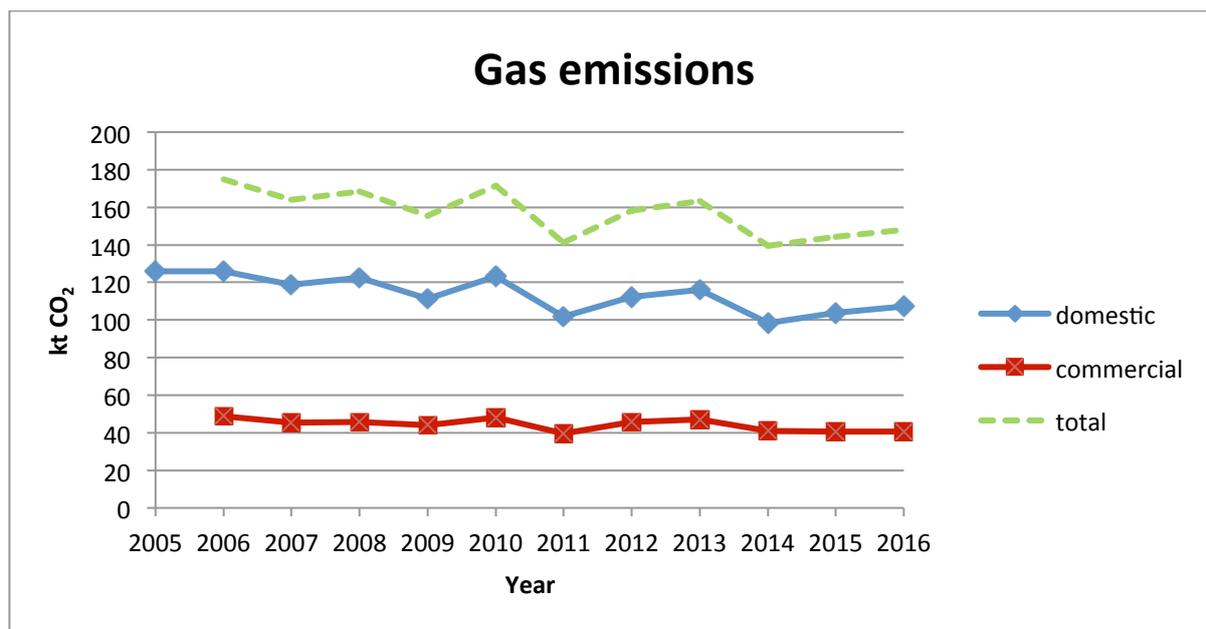


Figure 9. Total gas emissions in Winchester District from 2006 to 2016 varied between 175 and 139 kt CO₂ (the 2005 figure for the commercial sector is suspect and is ignored here). Commercial emissions decreased by 16.7% and domestic emissions by 14.8% over the period. Total emissions ended 15.4% lower in 2016 than in 2006. Gas is used principally for heating. Allowance has not been made in these figures by BEIS for seasonal variations in temperature.

Road transport

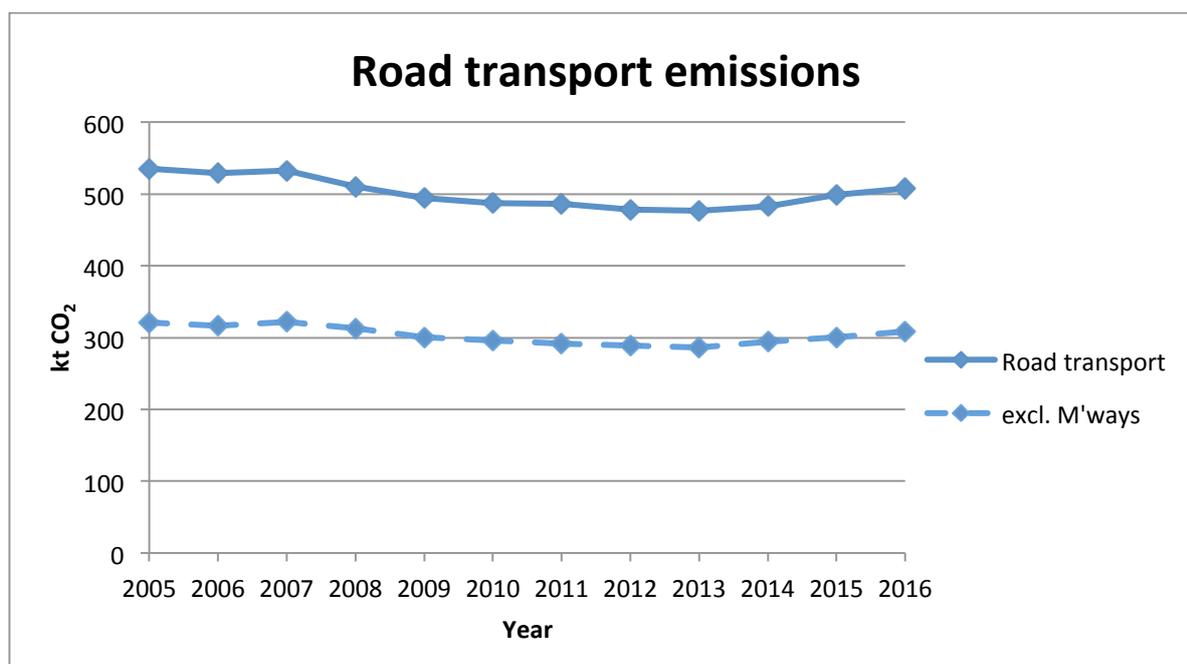


Figure 10. Total annual road transport emissions in Winchester District from 2005 to 2016 varied between 540 and 481 kt CO₂. Emissions in 2016 were 5.1% less than in 2005 even though the total number of vehicles of all sorts had increased by 15% since 2005.(ref.11)

There was a slow but steady decline in emissions after 2007 but since 2013 there has been a slight upturn in emissions. The dashed line represents emissions when vehicles on motorways in the District, which account for around 40% of the total, are excluded. Note that as presented by BEIS the emissions data are only allocated to a class of road and do not distinguish commercial vehicles from domestic vehicles.

Other fuels

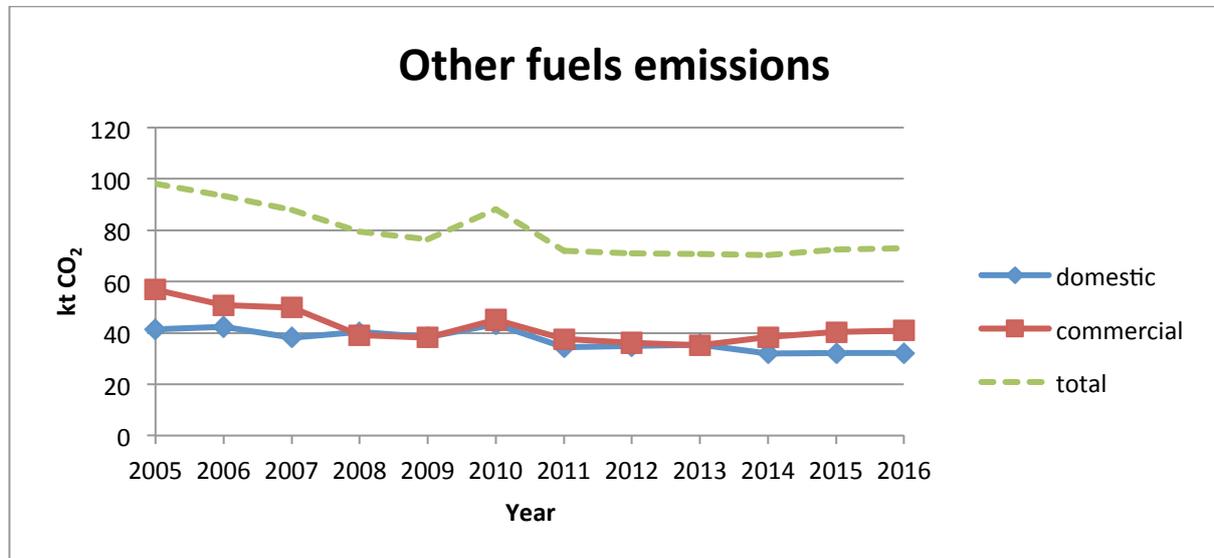


Figure 11. Total annual emissions from the consumption of other fuels in Winchester District from 2005 to 2016 varied between 98 and 70 kt CO₂. Total emissions in 2016 were 25.5% less than in 2005. Emissions from the commercial sector declined by 27.7% whereas emissions from the domestic sector declined by just 22.5%. The emissions in the commercial sector levelled off after 2011 and since 2013 have slowly increased. Emissions in the domestic sector have remained steady since 2014.

Agriculture, Land-use, land-use change and forestry (LULUCF)

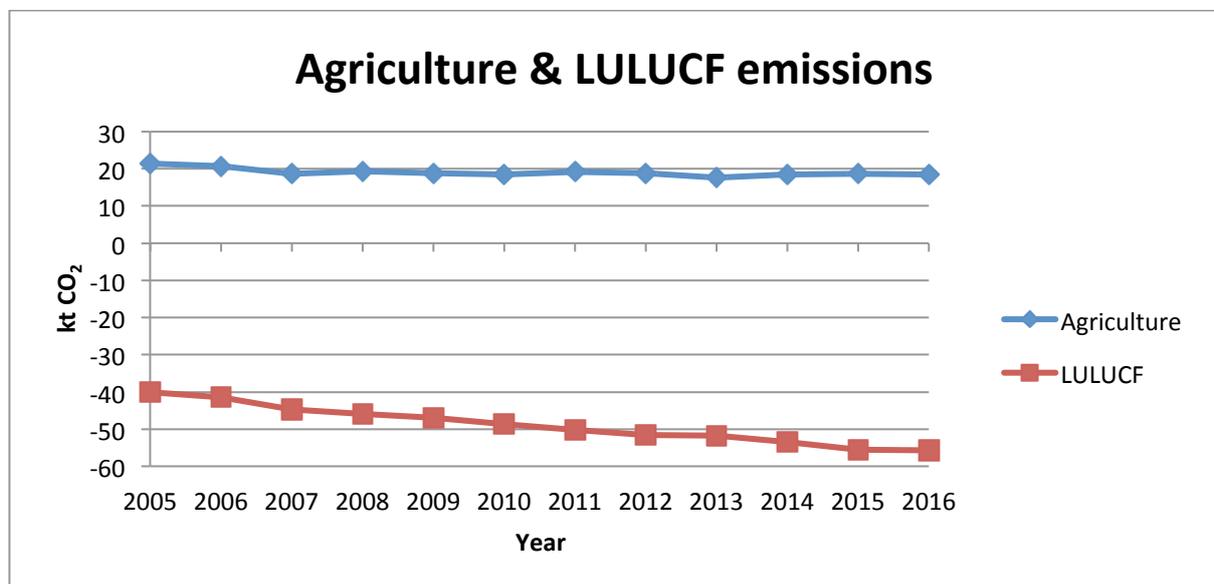


Figure 12. There has been a steady decline in LULUCF emissions since 2005 from -40 to -56 kt CO₂ i.e. the sector was a net sink for CO₂. Net emissions in 2016 were 39% more negative than in 2005. Note that 'For the 2016 inventory there were methodological changes to the way LULUCF emissions were calculated, which led to all years becoming a net sink.'²⁰ This explains why the emissions figures presented here are so different from those in the 2017 report. Agriculture fuel emissions have barely changed since 2005.

More detailed information on LULUCF carbon dioxide emissions up to 2016 have been published in the last year; emissions of non-CO₂ gases are reported elsewhere. BEIS commissioned a report on the estimated (modelled) net emissions of carbon at local authority level from land use, land use changes and forestry.²¹ These are reported as net emissions because the various categories of land which were considered can be a sink, a source, or both, of carbon. Estimated LULUCF emissions in Winchester District have decreased since 2005 and have remained a net sink for carbon (Fig.13). These figures differ from those reported in previous years as the modelling has been improved.

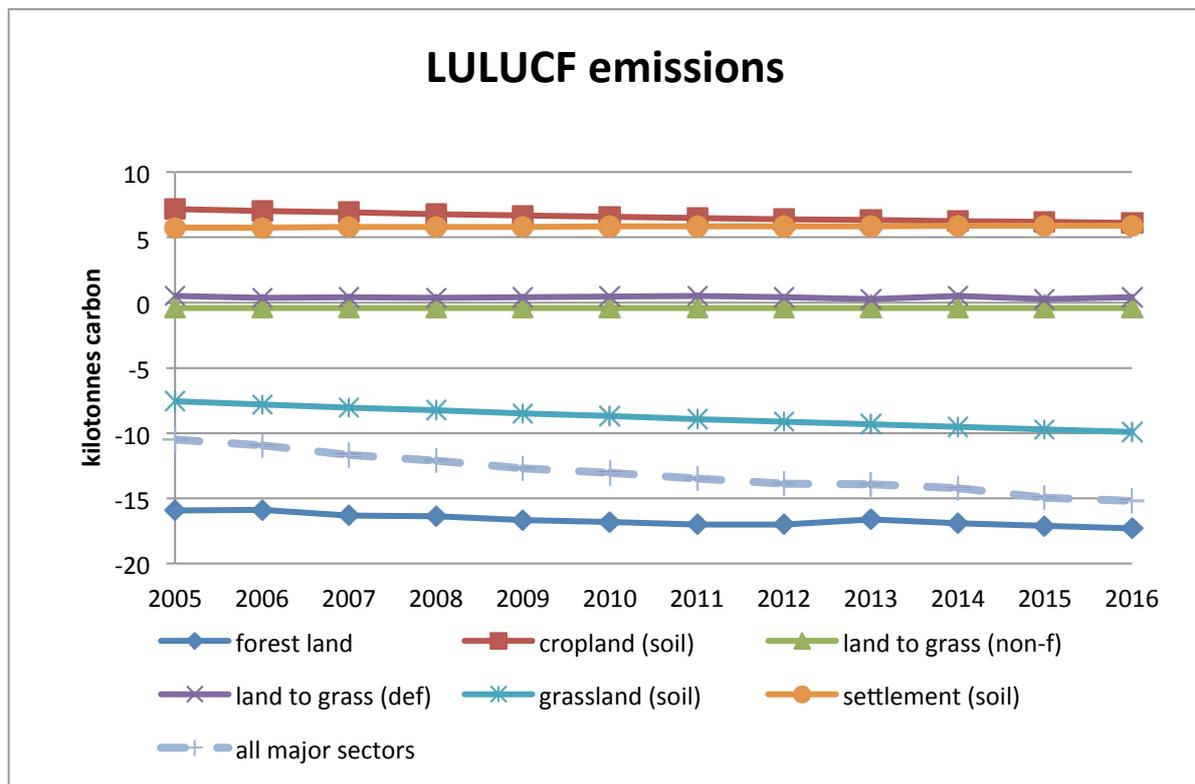


Figure 13. Estimates of the net impact of the principal LULUCF carbon emissions in Winchester District 2005-2016 from the major sources/sinks.(ref.20) non-f = non-forest biomass; def = by deforestation. The bold dashed line represents the net emissions of all major sectors combined. To convert from carbon to carbon dioxide multiply by 3.667.

²⁰ Local authority carbon dioxide emissions estimates 2016. Statistical release: National statistics. BEIS, June 2018, pp.38.

²¹ Buys, Gwen, Thomson, Amanda, Moxley, Janet, Malcolm, Heath, Henshall, Paul, and Matthews, Robert. "Mapping Carbon Emissions & Removals for the Land Use, Land Use Change & Forestry Sector; Report Based on the 1990-2016 Inventory." Penecuik: CEH/NERC, May 31, 2018 and pers. comms. from Gwen Buys.

It should be noted that the figures in Table 1 are modelled estimates with uncertainties in the range 40-50%. Additional uncertainty is associated with disaggregating the dataset to LA scale. A full uncertainty analysis of this procedure has not been carried out, however, it is estimated that the uncertainty in the disaggregation process is in the range of 20-30 %.(ref.20).

Table 1. LULUCF data for sectors in Winchester District in 2016 in order of their contribution to carbon emissions (sinks appear as negative values). Sectors with emissions of less than 0.4 kt C have been omitted. Data from CEH (ref.20).

Category	ktonnes C	ktonnes CO ₂	Map in ref.20
Forest land	-17.3	-63.5	Fig.3
Grassland soil	-9.9	-36.4	Fig.4
Cropland management, soils	-0.7	-2.6	Fig.6
Land converted to grassland (non-forest)	-0.4	-1.6	Fig,6
Cropland, organic soil drainage	0.4	1.4	Fig.5
Land converted to grassland (deforestation)	0.4	1.6	Fig,8
Settlement, soil	5.9	21.7	Fig.4
Cropland soil	6.1	22.4	Fig.4
Harvested wood products*			
NET EMISSIONS/SINK	-15.5	-57.0	

A net sink of 57 ktonnes CO₂ (Table 1) represents 8.6% of the District’s total direct emissions (excluding motorways) in 2016 with the largest contributions to this figure coming from forest land and grassland soil which act as carbon sinks. **Thus, it is clear that the protection and even development of forest land and grassland soil should be strongly encouraged whereas cropland should be reduced in area or at least the soils treated optimally. Not surprisingly, but more difficult to counter, is the fact that the soil on settlement land which has suffered change of use is a big source of CO₂ emissions.** In a global context it is worth recalling that, ‘given that agriculture and forestry together are responsible for 24% of global greenhouse gas emissions, we know that the land is going to be important for meeting either the 2°C or 1.5°C goals’ set by the Paris agreement.²²

Summary statistics for Winchester District

Table 2. Summary of principal carbon dioxide emissions (kt CO₂) in Winchester District for the years 2005 and 2016 and changes over the period.

Sector	Sub-sector	Emissions in 2005+++	Emissions in 2016	Decrease 2005-2016 (%)
Electricity	domestic	129.2	65.9	49.0%
	commercial	210.8	105.6	49.9%
Gas	domestic	126	107.3	14.8%
	commercial	48.9	40.8	16.6%
Road transport++		535.6 (321.3)	508.1 (308.8)	5.1% (3.9%)
Other fuels	domestic	41.4	32.1	22.5%
	commercial	56.7	41	27.7%
Agriculture		21.5	18.4	14.4%
LULUCF (net)		-40.1	-55.8	39.2%
Domestic subtotal+		296.6	205.3	30.8%
Commercial subtotal+		*316.4	187.4	40.8%
Grand Total++		*1130 (916)	863 (664)	23.6% (27.5)%

* gas figures for 2006 (see caption to Fig.4)

+ electricity, gas and other fuels; excluding road vehicles

++ emissions that exclude vehicles on motorways are given in brackets

²² Smith, Pete. “Guest Post: How Use of Land in Pursuit of 1.5C Could Impact Biodiversity.” *Carbon Brief* (blog), July 4, 2018. [https://www.carbonbrief.org/guest-post-how-use-of-land-in-pursuit-of-1-5c-could-impact-biodiversity?utm_source=NEW+Weekly+Briefing&utm_campaign=08a2838cc5-Carbon_Brief_Weekly_06_07_2018&utm_medium=email&utm_term=0_b6e0a2d2ef-08a2838cc5-303536269&ct=t\(Carbon_Brief_Weekly_06_07_2018\)&goal=0_b6e0a2d2ef-08a2838cc5-303536269](https://www.carbonbrief.org/guest-post-how-use-of-land-in-pursuit-of-1-5c-could-impact-biodiversity?utm_source=NEW+Weekly+Briefing&utm_campaign=08a2838cc5-Carbon_Brief_Weekly_06_07_2018&utm_medium=email&utm_term=0_b6e0a2d2ef-08a2838cc5-303536269&ct=t(Carbon_Brief_Weekly_06_07_2018)&goal=0_b6e0a2d2ef-08a2838cc5-303536269).

+++ some figures for 2005 differ from my earlier reports as a result of revisions made by BEIS since June 2015.

The overall reduction in principal emissions in Winchester District by the end of 2016 (23.6%), relative to 2005, is significantly greater than at the end of 2013. This is because electricity emissions decreased sharply from 2012 aided, at least in part, by the government’s policy of closing coal-burning power stations used to generate electricity, and possibly because nationally emissions from the domestic and commercial use of gas for space heating has also declined since 2011.¹⁹

This report has used 2005 as the base year for presenting trends in the District’s statistics. The reason is that the pre-2005 statistics are described by DECC/BEIS as ‘experimental’; they are not necessarily consistent with post-2004 statistics. However it was originally decided in Winchester District to use 2004 as the base year. To use 2004 as the base year, in this and previous reports, the District’s total emissions in 2004 were estimated by assuming that the District’s emissions changed by the same amount as the UK’s national emissions between 2004 and 2005 (see caption to Fig.18). **Thus, by 2016 total emissions are estimated to have reduced by 25.9% relative to 2004.**

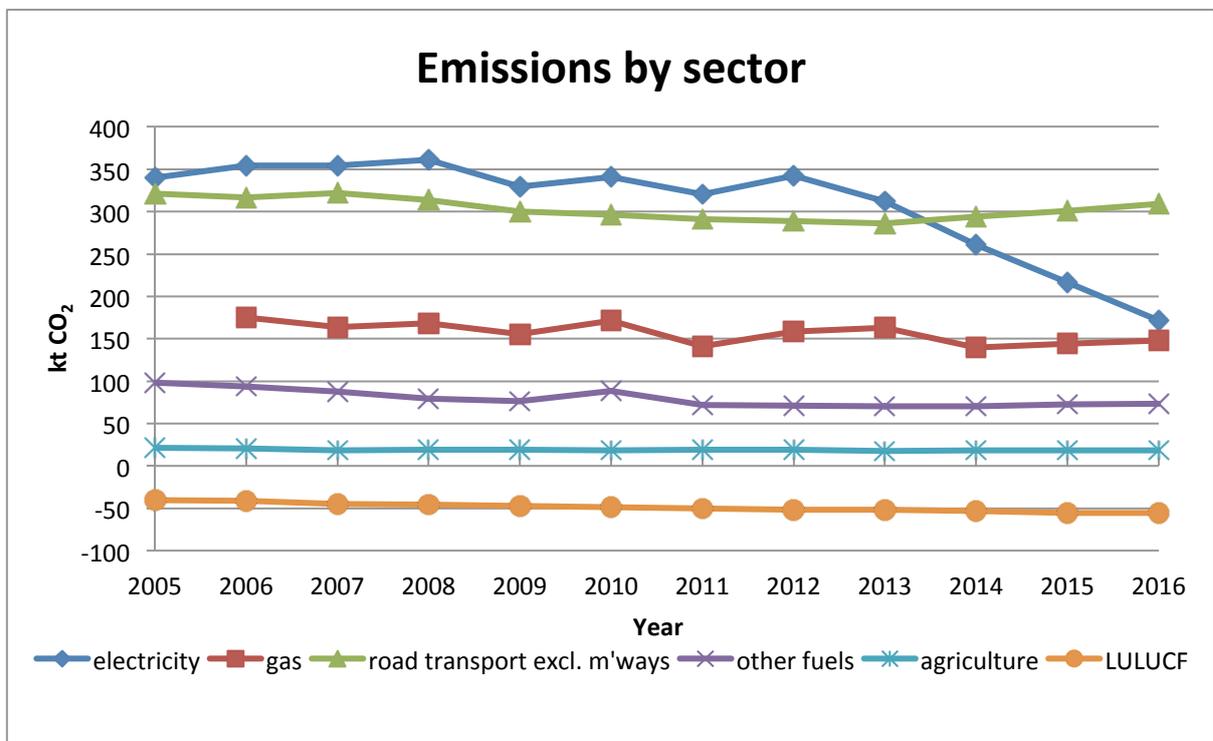


Figure 14. Carbon dioxide emissions in Winchester District from 2005 (gas from 2006) until 2016 illustrating the relative contributions of different sectors. Road transport (even excluding motorways as shown) makes by far the largest contribution. Gas has remained approximately constant whereas electricity is declining rapidly and is expected to be less than gas in the near future.

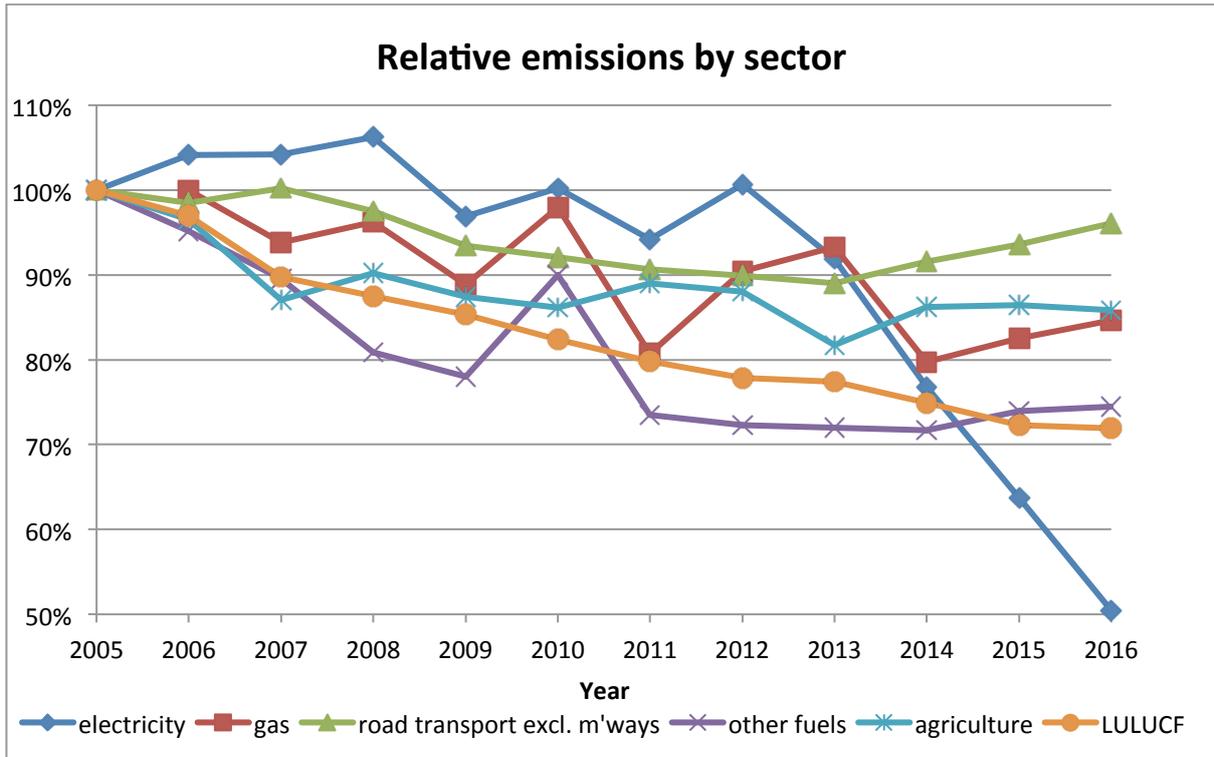


Figure 15. Relative emissions in Winchester District from 2005 (gas from 2006²³) until 2016 illustrating the performance of different sectors. Since 2004 there has been a slight downward trend in emissions from gas and electricity with the latter showing a sharp decrease since 2013. There was a steady decrease in emissions from road transport excluding motorways (from 2007) but this reversed after 2013; the decrease in relative emissions from all road transport hardly differs from the curve presented here (Fig.10). There was also a steady decrease in emissions from LULUCF, and from other fuels (excepting 2010) until 2014 since when there has been a slight increase. Agriculture fuels declined steadily from 2007. Gas emissions, unlike gas consumption figures (Fig.4), have not been corrected for seasonal temperature differences and so they fluctuate from year to year.

²³ Although gas **emissions** decreased by 6.7% from 2006 to 2013 gas **consumption** actually decreased by 18.7% (Fig.4). The reason, according to DECC, is that a) gas consumption data, unlike emissions data, are weather-corrected (smoothed) over a 17-year trend and b) the gas conversion factor (g CO₂/kWh) increased by 15%. Pers. comm. Georgina Eaton, DECC, 15 October 2015.

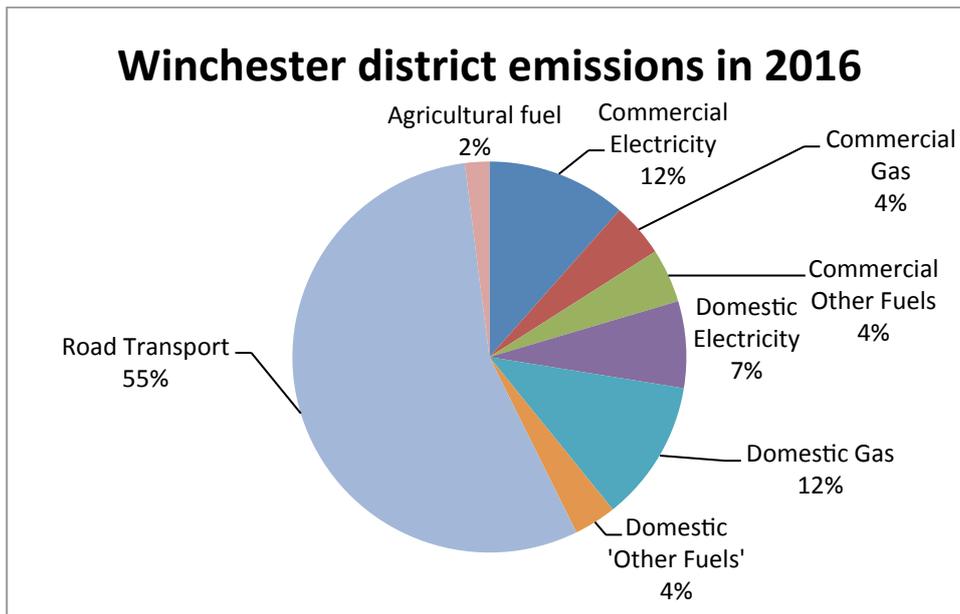


Figure 16. The split of carbon dioxide emissions in Winchester District in 2016 based on figures given in Table 2. Note the predominant influence of road transport (55%), when motorway traffic is included. Other large contributions came from commercial electricity (12%) and domestic electricity and gas (19%). Note that because LULUCF is a sink (negative emissions) it cannot be displayed on a pie chart.

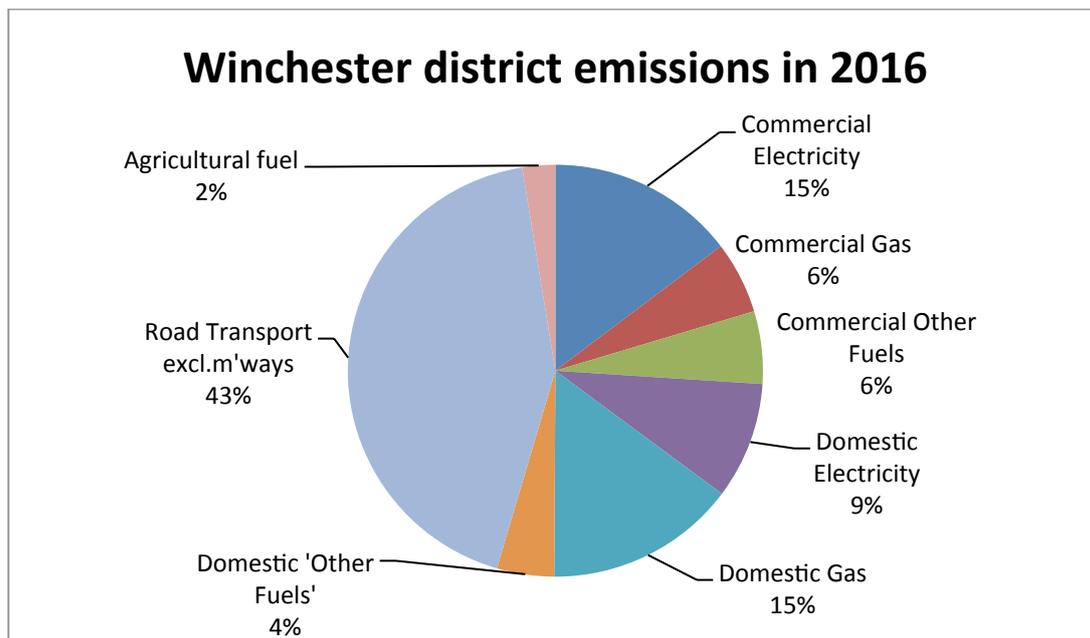


Figure 17. The split of carbon dioxide emissions in Winchester District in 2016 based on figures given in Table 2 when emissions from vehicles on motorways are excluded. Note the huge influence of road transport emissions (43%) even when motorway emissions are excluded. Other large contributions came from commercial electricity (15%) and domestic electricity and gas (24%). Note that because LULUCF is a sink (negative emissions) it cannot be displayed on a pie chart.

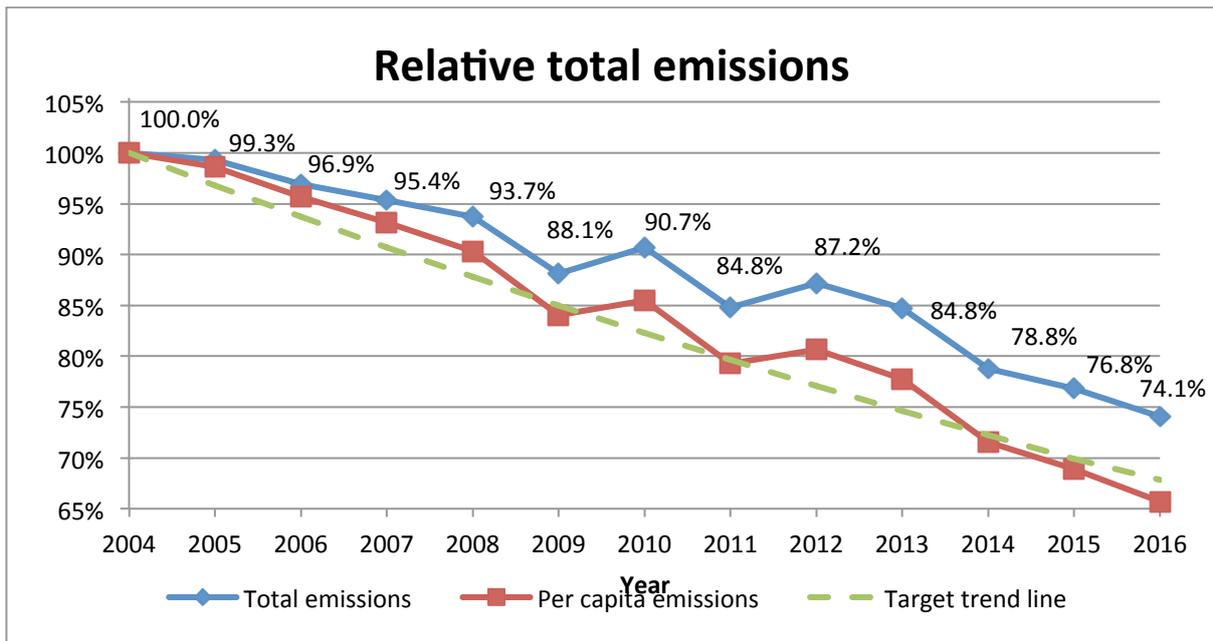


Figure 18. Relative total emissions (all sectors combined) of Winchester District from 2004 to 2016 relative to 2004. Total emissions were estimated to be 1172 kt CO₂ in 2004 by assuming that the District’s emissions reduced by 0.7%, the same amount as UK emissions, from 2004 to 2005. Per capita emissions indicate a better outcome simply because the population of the District increased by about 12% over the period. The District set a target of a 30% reduction in total emissions by 2015 and a 40% reduction by 2020 both relative to 2004. Assuming uniform annual decreases over this period, total emissions (blue diamonds) should follow the dashed green trend line. At the end of 2016 these lines were still 6.3% apart although the per capita emissions (red squares) overshot the target by 2.1%. It is evident that the District’s total emissions in 2016 remained offset from the target line and were still tending not to converge with the required trend. This result puts Winchester District in the bottom one hundred of the 391 LAs in the UK on the basis of their reduction in CO₂ emissions since 2005.²⁴

Given the District’s actual total emissions at the end of 2016 (ref.13) of 868 kt CO₂ and the target of a 40% reduction relative to 2004 (703 kt) this means that **41,250 tonnes of CO₂ emissions, or just under 5% of the current total, have to be saved each year until the end of 2020.** This is equivalent to cutting all commercial gas or commercial other fuels emissions to zero each year.

²⁴ Local Authority Carbon Dioxide Emissions Estimates 2016. Statistical Release: National Statistics, BEIS. pp.38. June 2018. Table 7.

Population growth

As is implied by Fig.18 the growth in population of Winchester District has an important bearing on the consumption of energy and consequently on emissions. This is hardly surprising as more people living in the District implies a greater demand for energy which in turn, until they are supplied with low-carbon energy for homes, travel or the workplace, will lead to an increase in emissions.

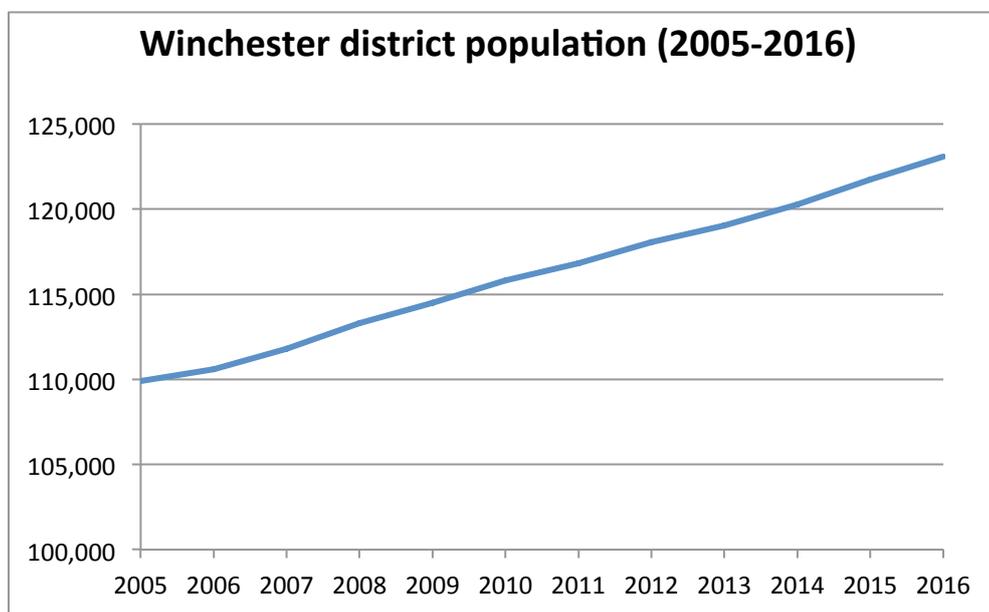


Figure 19. Mid-year population estimates for Winchester District from 2005 to 2016.²⁵ On average population grew by 1.04% p.a. over the period.

There are two likely reasons for the increase in the District's population (Fig.19); people moved into the area to live in newly built accommodation (the District has a government imposed target to build 12,500 dwellings by 2031²⁶) and/or there has been a trend towards larger families i.e. an increase in the birth rate. The first hypothesis is supported by the 8.7% increase in the number of households between the censuses in 2001 and 2011 (which almost exactly matches the 8.9% increase in population in the same period).²⁷ The second hypothesis does not stand up to examination. Although the actual number of births per year followed an upward trend from 2005 to 2013 it declined thereafter; further, the annual number of births per 1000 of the population followed a downward trend from 2005 to 2013 and fell even more steeply, by about 10%, between 2013 and 2016.

A comparison of energy consumption in five adjacent local authority (LA) areas

²⁵ <http://www3.hants.gov.uk/factsandfigures/population-statistics/pop-estimates/ons-mid-year-est.htm>.

²⁶ <http://www.winchester.gov.uk/planning-policy/local-plan-part-2-development-management-allocations/lpp2-2016-submission>. Winchester District Local Plan Part 2: Development Management and Site Allocations, Section 3.1 refers to "a total of 12,500 [dwellings] and an average rate of new housing delivery of 625 over the plan period [of 20 years]".

²⁷ <http://www.winchester.gov.uk/data/census-2011/population-figures>

Electricity and gas consumption were chosen to make comparisons with five LAs adjacent to Winchester District viz. Basingstoke & Deane, East Hampshire, Eastleigh, New Forest and Test Valley. Consumption figures were preferred over emissions figures since they are directly related to actual metered consumption and are less influenced by ‘disaggregation’ and modelling. Specifically, results are shown for commercial and domestic electricity and for domestic gas; together these sources contribute 39% of Winchester District’s total emissions if motorway emissions are excluded (Fig.17). For comparison purposes the data for each LA are presented either as per capita consumptions in 2016 or as relative annual consumptions from 2005 to 2016. Fuel consumption by road vehicles was not considered because only modelled estimates of where fuel was consumed are available and consequently the estimates are unlikely to demonstrate any objective differences between adjacent LAs.

A more extensive, one-off comparison of energy consumption in the periods 2005-2015 in adjacent LA areas and in the unitary authority areas of Portsmouth and Southampton was produced for another purpose and this document is available elsewhere.²⁸

Electricity

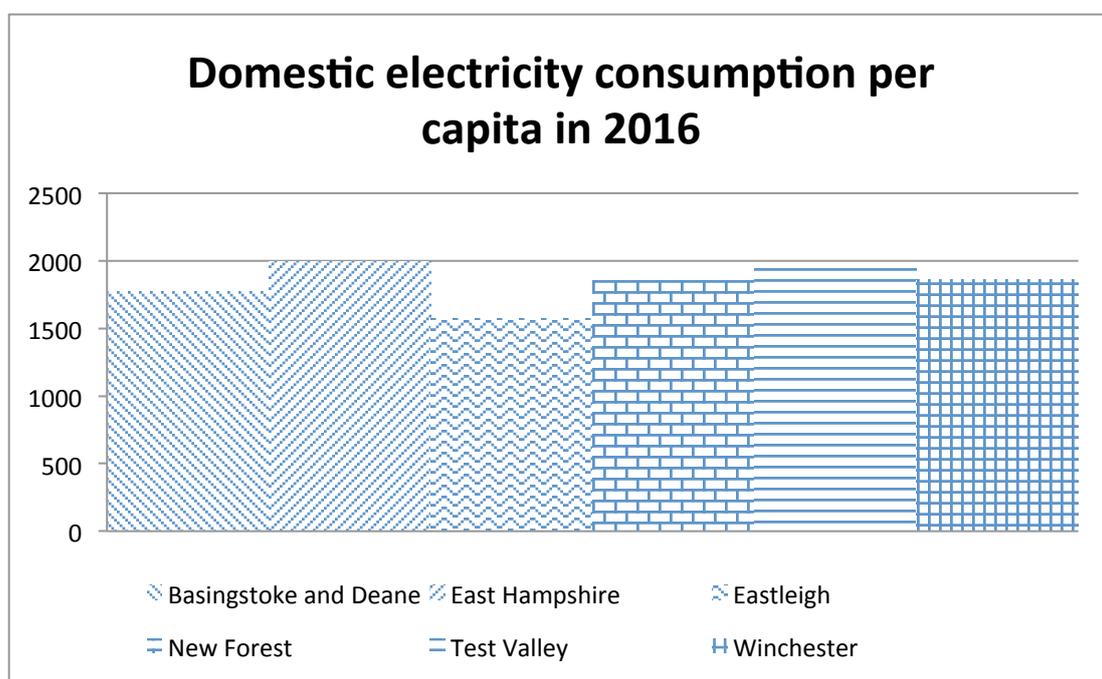


Figure 20. Per capita domestic electricity consumption in 2016 in the six adjacent LAs. The range is 1573 to 1994 kWh. The average consumption in England was 1644 kWh and in SE England was 1758 kWh.

²⁸ A comparison of energy consumed in Winchester District and adjacent Local Authority (LA) and Unitary Authority (UA) areas from 2005 until 2015, RB Whitmarsh, 9 June 2017. See <http://winacc.org.uk/publications-climate-change-members-science-and-technology-advisory-panel>

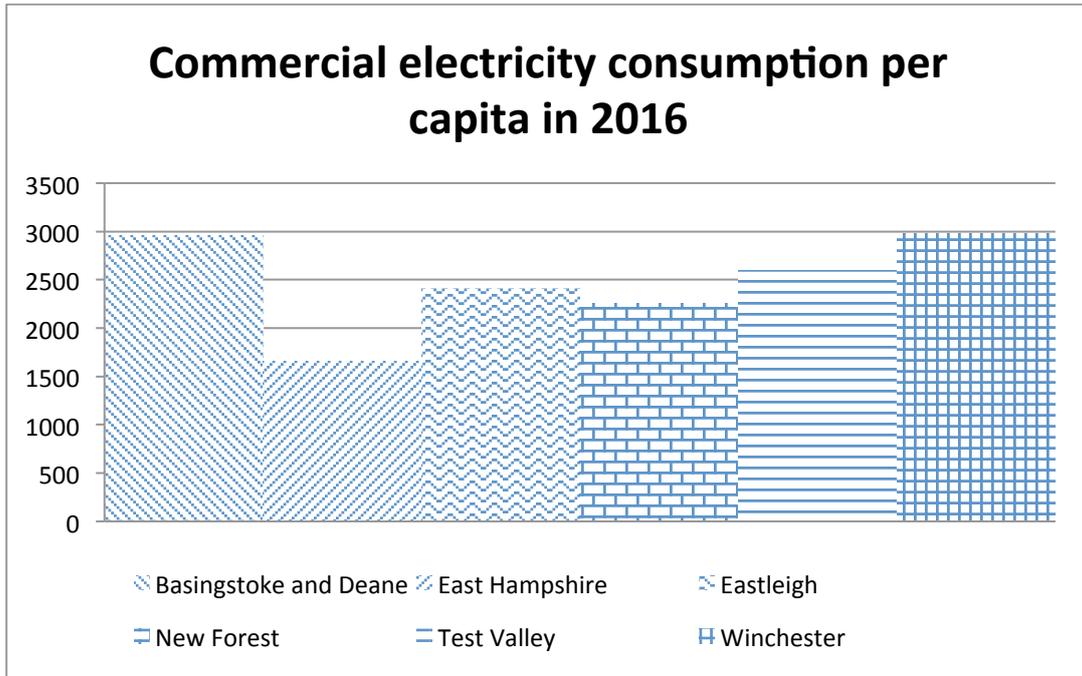


Figure 21. Per capita commercial electricity consumption in 2016 in the six adjacent LAs. The large range of 1652 to 2978 kWh reflects the different densities and degrees of commercial activity in each LA.

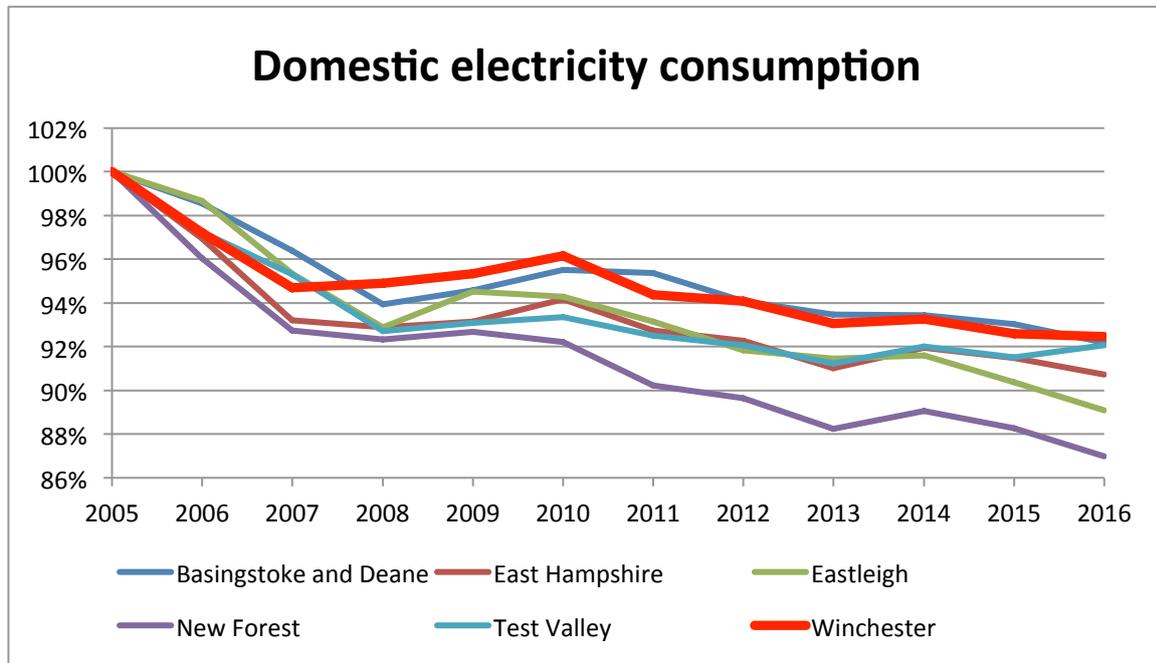


Figure 22. Relative consumptions of domestic electricity from 2005 to 2016 in the six adjacent LAs. Note that the least reductions were in Winchester (7.5%) and Basingstoke & Deane (7.8%). The greatest reduction was in New Forest (13.0%).

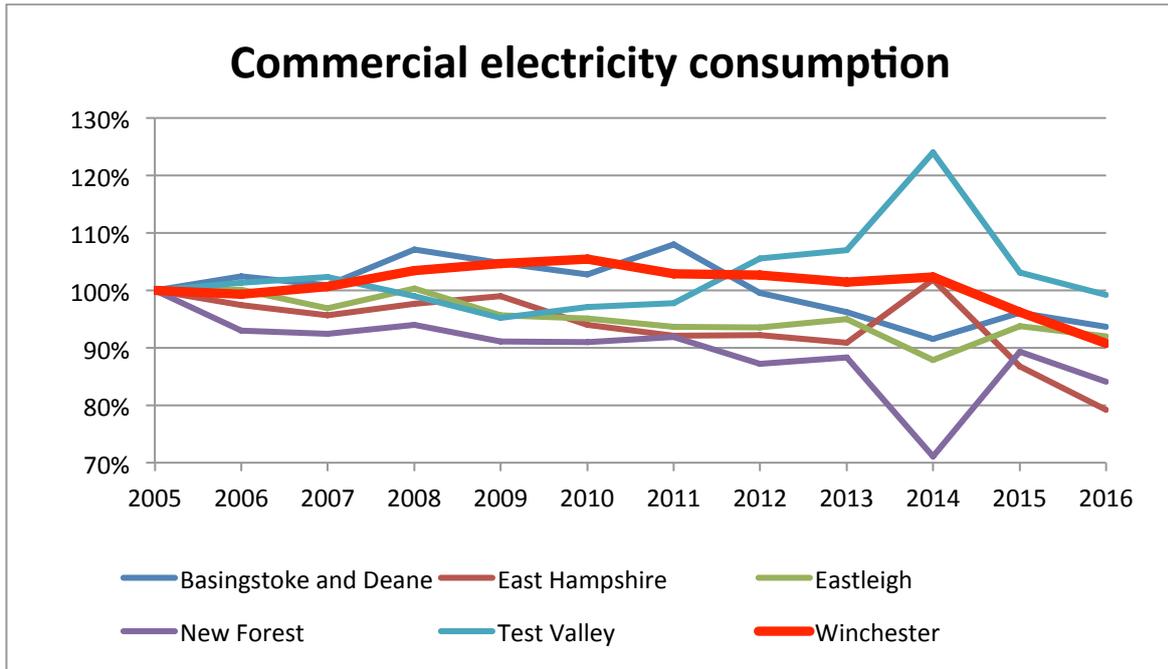


Figure 23. Relative consumptions of commercial electricity from 2005 to 2016 in the six adjacent LAs. Data for 2014 are suspect because the absolute consumptions values appear to be anomalous. Nevertheless, from 2008 to 2015 commercial electricity consumption in Winchester District was ranked first or second smallest in the size of the reduction. However consumption has decreased by 11.6% since 2014 and it ranked fourth in 2016.

Gas

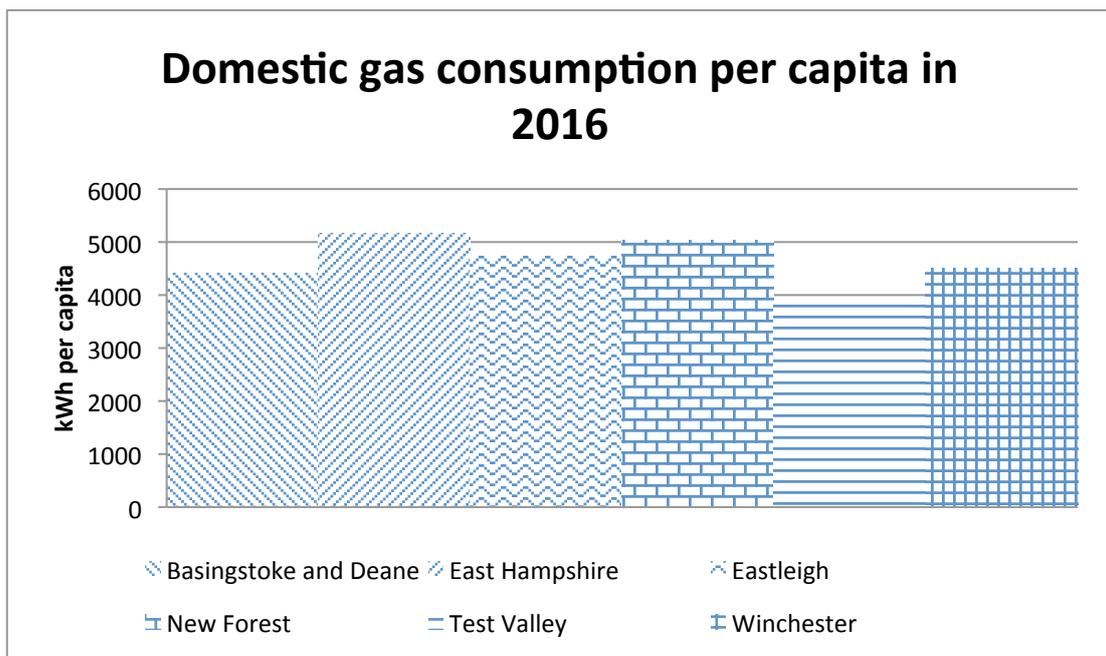


Figure 24. Per capita domestic gas consumption in 2016 in the six adjacent LAs. The range is 3883 to 5160 kWh. The average per capita consumption in England was 4829 kWh and

in SE England was 4883 kWh. These figures are influenced by the number of properties without access to the gas grid which is over 85% in some parts of Winchester District.²⁹

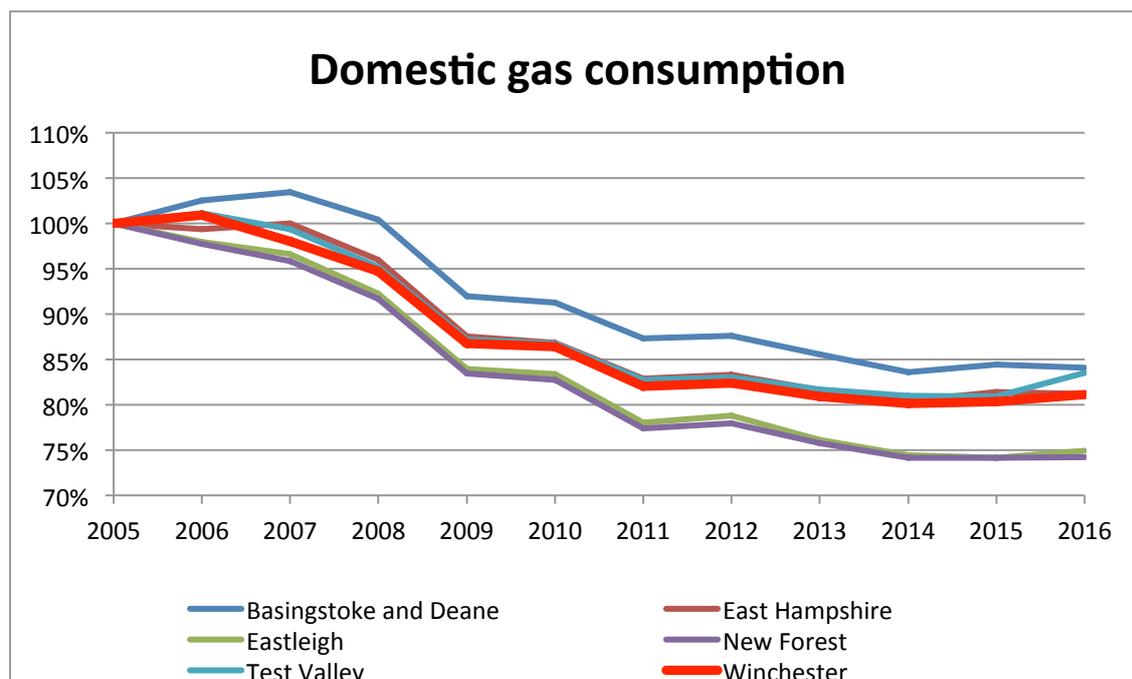


Figure 25. Relative consumptions of domestic gas from 2005 to 2016 in the six adjacent LAs. Domestic gas consumption was consistently greatest in Basingstoke & Deane and least in Eastleigh and New Forest.

Total energy consumption

A more revealing metric is total final energy which BEIS now calculates each year at local authority level. This combines the electricity, gas, road transport and residual fuels expressed in a common unit of GWh (million kWh). The latest data are for 2015 (Fig.26). The New Forest figures however are influenced by the consumption of large quantities of ‘industrial and commercial petroleum products’ and ‘industrial manufactured fuels’; these are assumed to refer to crude oil and related materials imported by Fawley refinery.

Therefore a possibly more fair and interesting comparison can be made of the final energy used by each LA in 2015 on a per capita basis, but excluding industrial manufactured fuels and industrial and commercial petroleum products (Fig. 27). This figure reveals that per capita adjusted total energy in Winchester District exceeded that in the adjacent LAs by at least 10%. **Specifically Winchester District residents and businesses used over 50% more energy than those of Eastleigh Borough.**

²⁹ <https://www.nongasmap.org.uk/>

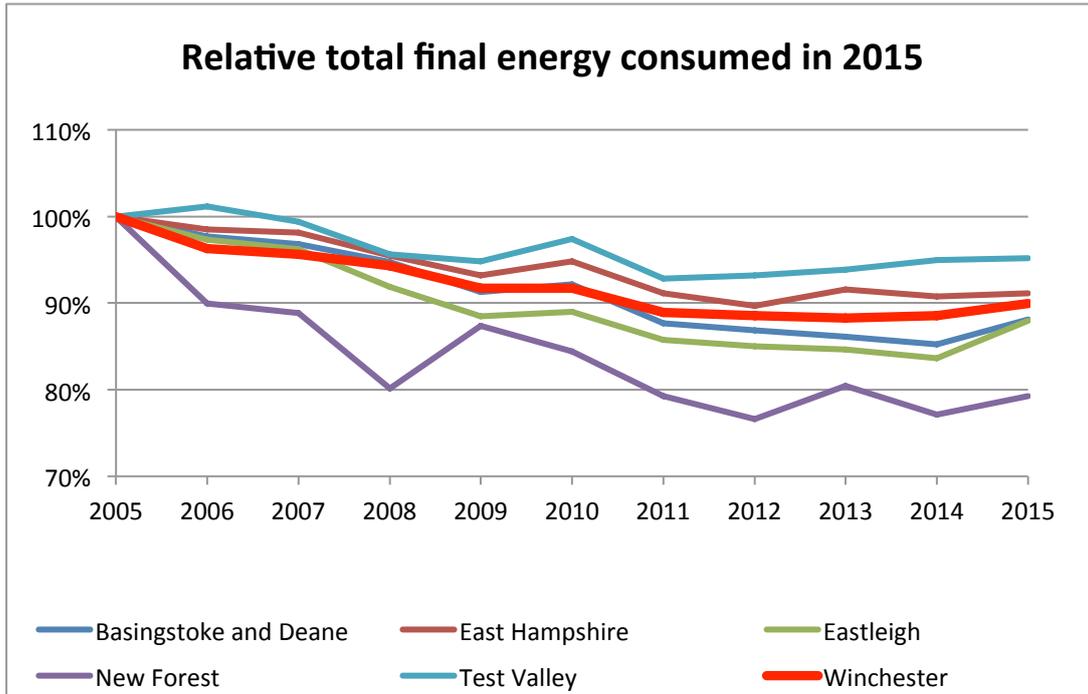


Figure 26. Relative consumptions of total energy from 2005 to 2015 in the six adjacent LAs. Note that the New Forest total final energy appears to include crude oil processed by the Fawley Refinery. The other LAs reduced their total final energy by between 4.8% (Test Valley) and 12% (Eastleigh and Basingstoke & Deane).

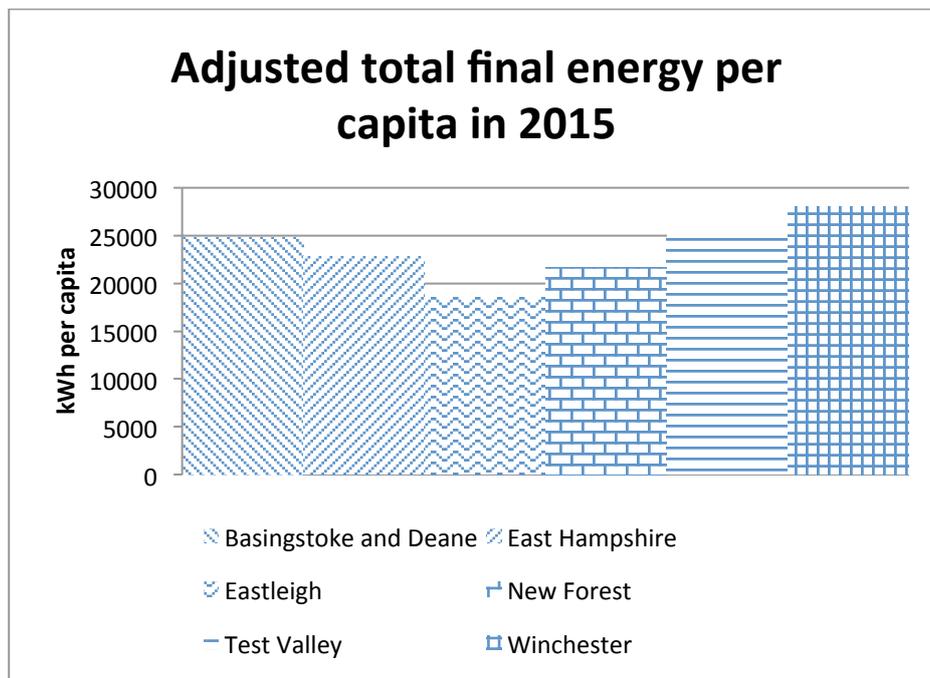


Figure 27. Final total energy consumption per capita (but omitting certain sectors as explained in the text) in the six adjacent LAs. Values range from 27,993 kWh (Winchester) to 18,561 kWh (Eastleigh), a ratio of 1.5:1. The average per capita consumption in England was 19,791 kWh and in SE England was 20,226 kWh. Note that all six adjacent LAs, except Eastleigh, far exceed the average for SE England.

A comparison with emissions in Hampshire, SE England and UK³⁰

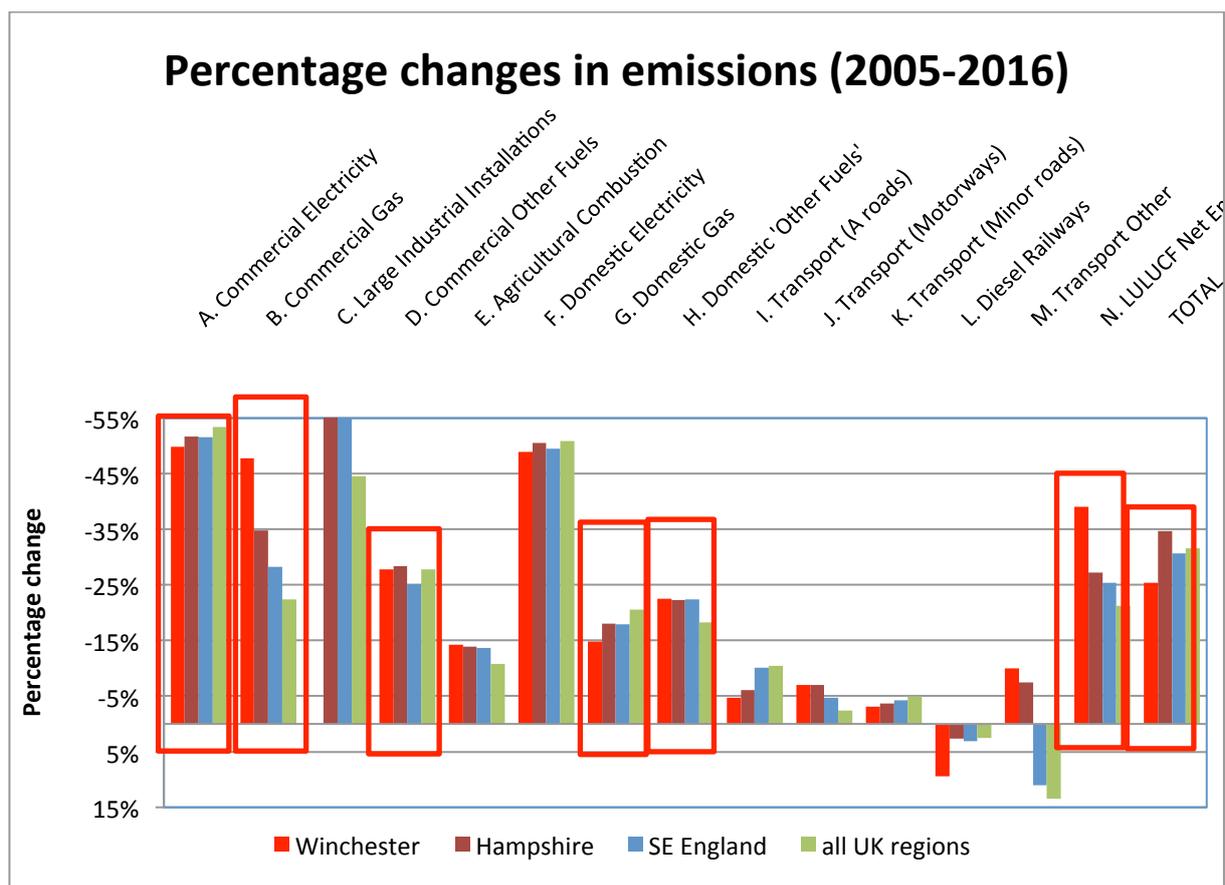


Figure 28. Comparisons of percentage changes from 2005 to 2016 in all BEIS’s emissions sectors in Winchester District, Hampshire, SE England and all UK regions combined. The red rectangles highlight the more significant differences. In Winchester District, the reduction in ‘commercial electricity’ (A) was slightly less than in the other regions whereas for ‘commercial gas’ (B) the situation was strongly reversed. The decreases in ‘commercial other fuels’ (D) and ‘domestic other fuels’ (H) was similar to the other three regions. In the domestic gas (G) sector Winchester fell short of what was achieved in Hampshire, SE England or nationally. Within the three road transport sub-sectors (I, J and K) there is no consistent overall difference between the four different geographical areas all of which showed relatively small changes which should be a problem of national concern. LULUCF net emissions savings (N) varied significantly between regions and were largest in Winchester. Overall (right-hand most rectangle) Winchester District delivered a 9% smaller decrease in its total emissions than was obtained in Hampshire, 5% less than was obtained in SE England and 6% less than was obtained nationally.

³⁰ UK local authority and regional carbon dioxide emissions national statistics: 2005-2016 from <https://www.gov.uk/government/collections/uk-local-authority-and-regional-carbon-dioxide-emissions-national-statistics>

Discussion and summary

Total carbon dioxide emissions in Winchester District continued to decrease in 2016. Although by 2015 the decline was 6.5% off the target of a 30% reduction by 2015 (relative to 2004), it did achieve the target on a per capita basis (by over 0.8%) when account is taken of the increase in the District's population since 2004. Similarly, by the end of 2016, the total emissions remained off target by 6.3% although the per capita measure had overshot the target by 2.1%.

However, as in 2015, it is clear that the decline in **emissions** since 2013, is principally down to the closure of coal-burning power stations within UK and their replacement by lower-carbon sources of electricity generation. Although emissions from the use of gas, presumably for heating, and from road transport have declined overall since 2005 worryingly both have continued to increase since 2014. In fact road transport emissions are now only 3.9% less than they were in 2005. If it had not been for increasingly stringent engine emissions standards imposed by EU directives the increase in the number of vehicle registrations, which grew 15% between 2005 and 2016, would have led to far greater road transport emissions.

Commercial electricity **consumption** in 2015 appears to have been recalculated by BEIS since it is significantly less than originally reported in 2017, and the figure for 2016 continues the steep descent of the previous year. Consequently commercial consumption appears to have decreased by 11% in two years whereas domestic consumption has continued its more gradual annual reduction. One possible generic explanation provided by BEIS³¹ is that 'Unallocated data, at a local authority level, can also include consumption for street lighting or traffic lights, where the information provided does not indicate a specific local authority.' However the computed annual decreases (23.25 GWh) in 2015 and 2016 in Winchester District is roughly the same as the total annual energy consumption (22.3 GWh) by street lighting in the whole of Hampshire.³² BEIS also note that 'the closure or downsizing of existing business for economic reasons' can lead to year on year changes but in that case coincidentally such closures led to very similar reductions in 2015 and 2016. The topic needs further research.

Emissions from the consumption of electricity will continue to fall, at least until 2025, as coal-burning power stations are closed and more sources of renewable electricity are brought online. Indeed BEIS predict that by the end of 2019 the carbon intensity (kg CO₂/kWh) of electricity will have become less than that of natural gas.³³ **This will herald a new era for heating in which gas, although still cheaper, will no longer be the preferred**

³¹ Sub-national consumption statistics. Methodology and guidance booklet. January 2018, pp.83.

³² <https://www.hants.gov.uk/transport/roadmaintenance/streetlighting/streetlightfacts>

³³ Annexes B and G in <https://www.gov.uk/government/publications/updated-energy-and-emissions-projections-2017>.

fuel from the emissions point of view and homes which are ‘off-gas’ are no longer at a disadvantage.

Although total road fuel **consumption** in 2016 was only just less (1.3%) than what it was in 2005 it had been on an upward trend since 2013. This trend was driven principally by the strong increase in consumption (9%) by, and numbers (almost 12%) of registrations of, goods vehicles (principally vans and HGVs) which in 2016 made up 36% of total registrations. Private vehicles on the other hand, which make up essentially the remainder, increased their consumption and numbers by just 0.5% and 4%, respectively. Since the emissions from road transport in 2016, excluding motorway traffic, made up 44% of all the District’s direct **emissions** the strong growth in the goods sector is of concern and needs to be reduced or reversed.

The decrease in total **emissions** was substantially less in Winchester District (by 9%) than in Hampshire, and 5-6% less than in SE England and the UK as a whole. Principally this appears to have been driven by smaller relative reductions in the District in commercial electricity and domestic gas (central heating). Nearer to home, when compared to the five adjacent LAs, the District achieved the least reduction in domestic electricity consumption since 2005. In terms of total energy consumed per capita in 2015 (the latest year for which figures from BEIS are available) by Winchester District residents and businesses is by far the highest at just under 28,000 kWh which was 50% more than in Eastleigh. All the LAs, except Eastleigh, consumed more energy per capita than the 20,200 GWh average for SE England.

The Committee on Climate Change presented its tenth annual report to parliament in June 2018 on how well the UK had been progressing to meet its statutory obligation to cut its emissions by 80% by 2050 (relative to 1990). In the Foreword Lord Deben says, referring to progress so far in reducing emissions from power stations:³⁴

“We should celebrate this progress, but it masks a worrying trend in other sectors. In this report, we refer to the ‘uneven’ balance of emissions reduction, a polite way of drawing attention to Government inaction in a host of areas.

This can’t go on. In the last five years, emissions outside of power and waste have plateaued. My Committee has chosen this moment to give a strong message to Government: Act now, climate change will not pause while we consider our options. And act in the consumer interest: pursue the low-cost, low-risk options, like onshore wind, and enforce the standards that will reduce emissions from vehicles and buildings, where consumers have been cheated by misleading industry claims.”

³⁴ Anon(CCC). “Reducing UK Emissions: 2018 Progress Report to Parliament.” Committee on Climate Change, June 2018.

The results presented here for Winchester District serve to confirm this statement. Road transport emissions, excluding motorways, have been rising and constituted 309 kt CO₂ in 2016. Gas emissions, presumably mainly for heating buildings, likewise were substantial (148 kt CO₂) and had declined by well under 20% by 2016.

Conclusions

Clearly there is a lot of room for improvement in reducing Winchester District's emissions in the coming years. For example, the District cannot continue to rely on the closure of coal-burning power stations, for cutting its emissions from electricity use, which is planned to be completed by 2025. As was stated two years ago in my 2016 report about the District's emissions '**... it is hard to identify any particular local, as opposed to national, actions that contributed to these reductions'. The time for action is now.**

In future I suggest that Winchester City Council should concentrate on all or some of the following actions many of which would be largely cost-free to WCC:

- Reduce CO₂ (and other) emissions from road traffic by improving public transport in the broadest sense, by improving cycling infrastructure, by encouraging the use of smaller, less polluting cars and goods vehicles and by discouraging the absolute number of registered vehicles
- Encourage larger commercial organisations to reduce their electricity consumption
- Mandate, or otherwise ensure, that developers build to the highest standards of energy efficiency both in the construction and subsequent operation of all new buildings
- Encourage home owners (and others) to upgrade their building insulation to the highest possible standards
- Encourage home owners (and others) to replace old central heating boilers with much more efficient condensing boilers or to change over to forms of electrical heating including air-source and ground-source heat pumps
- Encourage the protection and development of grassland soil and forest land and the reduction in area of cropland (or at least the optimal treatment of cropland soil)
- Support more applications to generate renewable energy, particularly at large scale, whether from solar PV, solar thermal or wind turbines, and to store energy.

Finally, it is worth recalling that the direct greenhouse gas emissions reported here are estimated to constitute around half of all emissions from the District. Other, indirect and harder to estimate, emissions arise from sources that include consumerism of all sorts, food production and especially long-haul flying. **A growing and very buoyant local economy is not necessarily conducive to reducing emissions unless it is closely managed in a sustainable way.**

On 15 April 2015, Winchester City Council Cabinet resolved “That the statutory national target of 80% reduction in greenhouse gas emissions (from a 1990 baseline) be recognised by Members.” and “That it be noted that the total emissions from the Winchester District need to reduce by 40% or 25,000 tonnes CO_{2e} per annum (relative to the 2004 baseline) by 2020 as the District’s minimum share towards [this] target”.³⁵ Here, the annual reduction required from 2017 to 2020 has been increased to 41,250 tonnes. This report, and earlier reports in this series, illustrate how challenging it will be to meet this target. This is especially true since the Committee on Climate Change are likely to tell the UK government later this year that even the 80% target set out in the Climate Change Act (2008) will be insufficient to meet the aim of the Paris Agreement (2015) to hold “... the increase in the global average temperature to well below 2 °C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels, ...”.

³⁵ <http://www.winchester.gov.uk/meetings/meeting/4636>