

Domestic energy consumption by energy efficiency and environmental impact, 2015

Introduction

This article aims to compare domestic energy consumption by using data from both the National Energy Efficiency Data-framework and Energy Performance Certificates.

The analysis confirms the natural expectation that, generally, households that are less energy efficient and less environmentally friendly tend to use more gas and electricity. However, this is not always the case with 'Band G' properties (the least efficient and least environmentally friendly) tending to use less energy than the band D-F properties. These less intuitive results can partly be explained by the fact that very few of these properties use gas as the main heating fuel, but there may be other factors in play.

About Energy Performance Certificates

Energy Performance Certificates were first introduced in England and Wales in 2007. Certificates are needed whenever a property is built, sold or rented. EPCs are now also required prior to a property having a measure through the Green Deal¹, Renewable Heat Incentive (RHI) or Feed in Tariffs (FiTs)².

An EPC contains:

- information about a property's energy use and typical energy costs; and
- recommendations about how to reduce energy use and save money.

The Reduced Data Standard Assessment Procedure (RDSAP)³ is used to assess and compare the energy and environmental performance of dwellings with results included in the EPC. RDSAP assigns a score to a property based on how much energy a dwelling will consume based on standard assumptions about occupancy and behaviour. It quantifies a dwelling's performance in terms of: energy use per unit floor area, a fuel-cost-based energy efficiency rating (the Energy Efficiency Rating) and emissions of CO₂ (the Environmental Impact Rating).

The energy efficiency ratings are grouped into bands from A (most efficient with lower running costs) to G (least efficient and higher running costs). Similarly, the environmental impact rating is also grouped into bands A (very environmentally friendly, lower CO₂ emissions) to G (not environmentally friendly, higher CO₂ emissions).

Number of EPC's

A total of 14.4 million EPC's covering domestic properties have been lodged on the Domestic Register between 2008 and the period ending 31 December 2015⁴. At the end of March 2015, there were around 25 million dwellings in England and Wales⁵. Figure 1 shows the number of EPCs lodged in each year from 2008 to the end of 2015.

¹ www.gov.uk/government/publications/green-deal-deciding-on-the-best-energy-saving-home-improvements-for-you

² www.gov.uk/government/publications/feed-in-tariffs-and-grants

³ www.gov.uk/standard-assessment-procedure.

⁴ www.gov.uk/government/statistics/energy-performance-of-buildings-certificates-in-england-and-wales-2008-to-december-2015 . Some properties may have had more than one EPC during the period; therefore there will be fewer than 14.4 million individual properties with an EPC.

⁵ Live tables on dwelling stock published by the Department for Communities and Local Government: www.gov.uk/government/statistical-data-sets/live-tables-on-dwelling-stock-including-vacants.

Figure 1: Number of EPCs by year, for all dwellings in England and Wales, DCLG

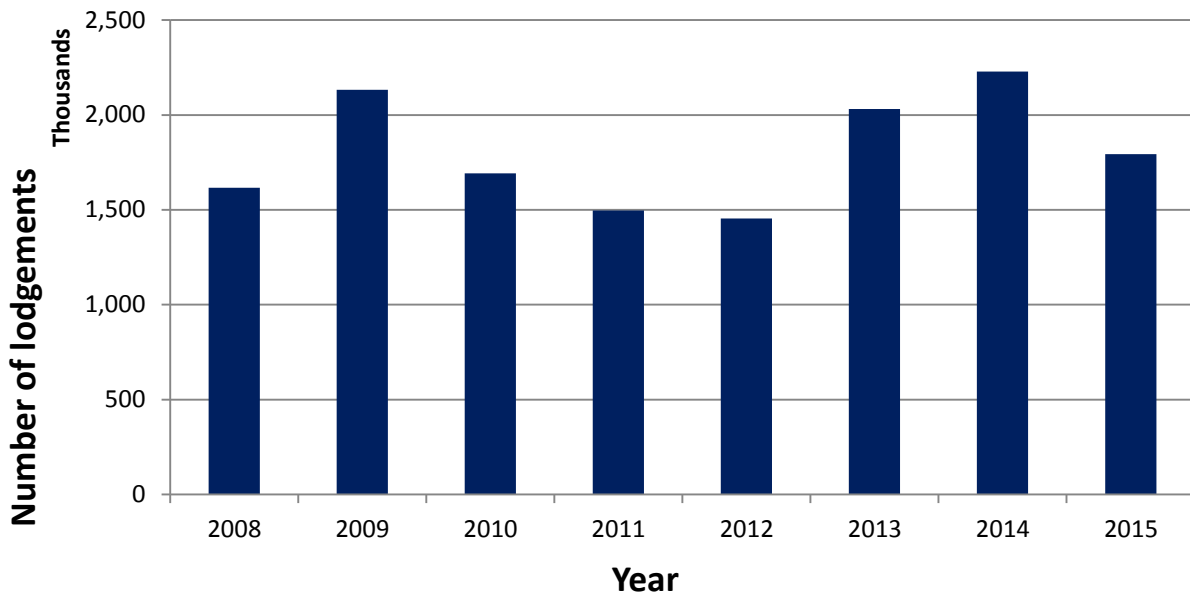
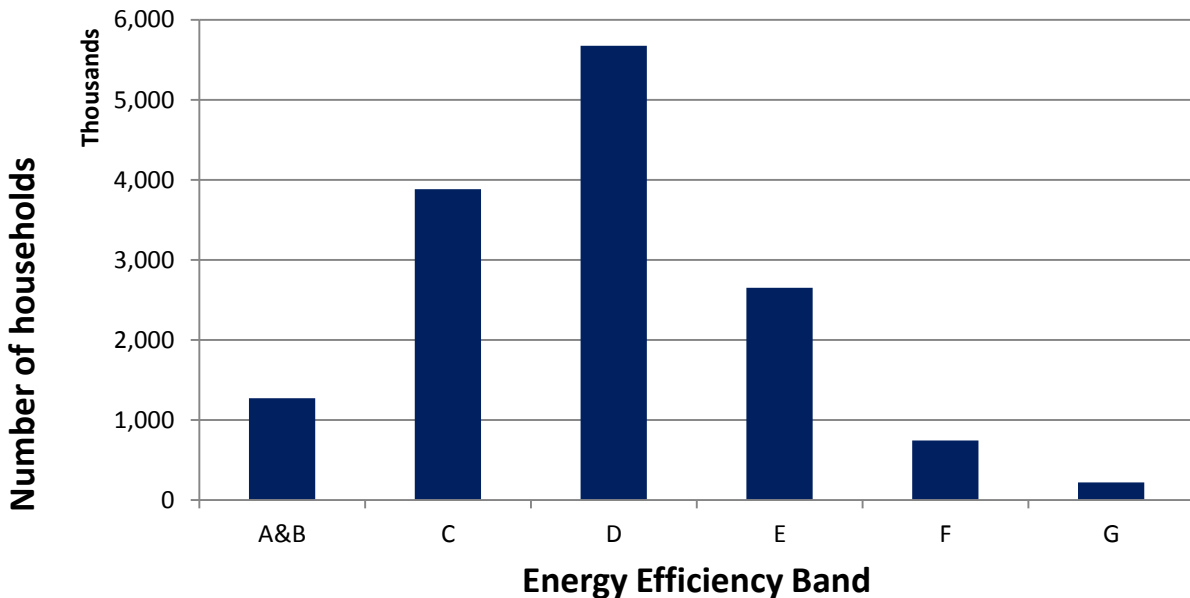


Figure 2 shows the energy efficiency band of properties in England and Wales, based on data from Energy Performance of Buildings Certificates⁴. Further information on this data is available on the Department for Communities and Local Government (DCLG) Website⁶.

The figure shows that the most common energy efficiency band for data up until the end of 2015 is D, with 5.7 million households or 39 per cent of all households in England and Wales in this band. Few properties are in bands A and G; therefore results presented for these groups will be subject to greater uncertainty and should be treated with caution.

Figure 2: Properties in England and Wales by energy efficiency band, DCLG



⁶ General information, including how to find EPCs for individual properties is available here: www.gov.uk/buy-sell-your-home/energy-performance-certificates. A sample EPC including explanation of content is here: www.gov.uk/government/uploads/system/uploads/attachment_data/file/49997/1790388.pdf.

Special feature - Energy consumption and EPC's

This report provides provisional estimates of typical gas and electricity consumption and fuel prices by energy efficiency band and environmental impact band (consumption figures are estimates only).

The results are produced based on the same methodology as that used for the headline NEED results⁷, using the full dataset on properties and energy consumption. Approximately 14 million properties included in the EPC open dataset⁸ have been used, which have all had an EPC in England and Wales between the introduction of EPCs in 2007 and 31 December 2015. The EPC data for each property has been matched to other sources of data used in NEED analysis, including meter point gas and electricity consumption data and property attribute data. Unlike with the headline NEED results, Experian data has been used in place of Valuation Office Agency data for the property attribute information.

The accompanying data tables to this report can be found at:

www.gov.uk/government/publications/energy-trends-december-2017-special-feature-article-domestic-energy-consumption-by-energy-efficiency-and-environmental-impact-2015

The data tables now include fuel price estimates based on average variable unit price (£/kWh) and average fixed cost (£/year)⁹. The average variable unit price represents the energy costs directly associated with varying energy consumption. The average fixed cost represents the energy costs which do not vary with consumption, such as standing charges. When there are two unit prices, this includes the difference between the two prices, multiplied by the split level.

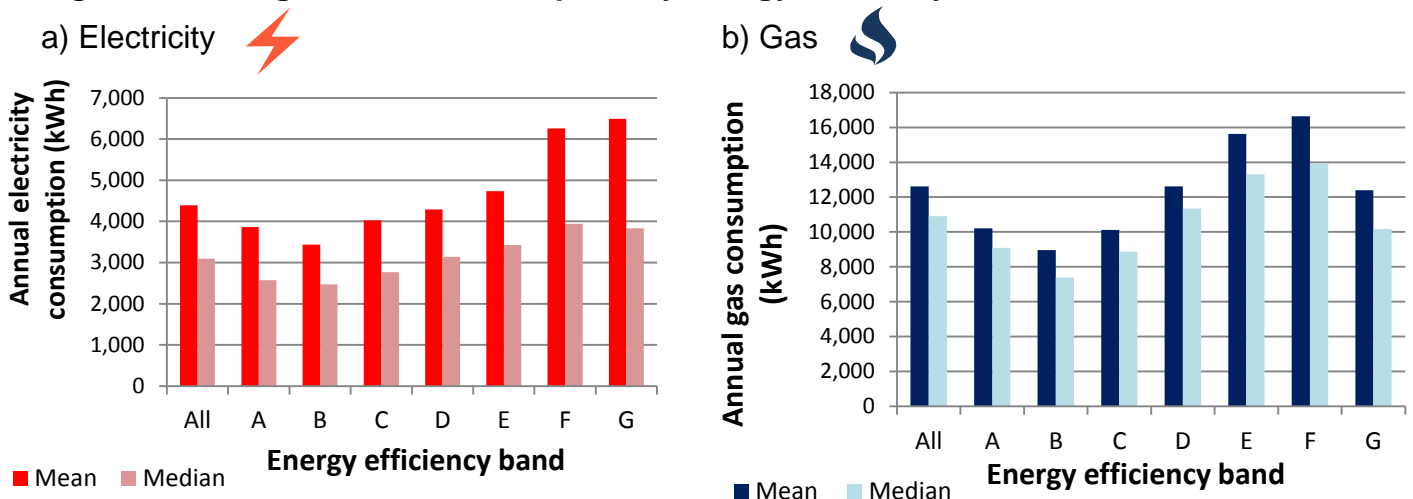
As EPCs are required in a very specific group of properties, the dataset used for analysis is not representative of the population of dwellings in England and Wales. For example, properties built since 2008 are more likely to be included in the dataset, and there are likely to be a higher proportion of more energy efficiency properties in the EPC data. Results for consumption have not been weighted to reflect the housing stock in England and Wales. Therefore, estimates presented here reflect the properties in the EPC sample.

Results

Consumption by energy efficiency band

Figure 3 shows the average annual consumption by energy efficiency band for gas and electricity.

Figure 3: Average annual consumption by energy efficiency band, 2015



⁷ www.gov.uk/government/publications/domestic-national-energy-efficiency-data-framework-need-methodology

⁸ <https://epc.opendatacommunities.org/#register>

⁹ This is published in the Quarterly Energy Prices publication: www.gov.uk/government/collections/quarterly-energy-prices

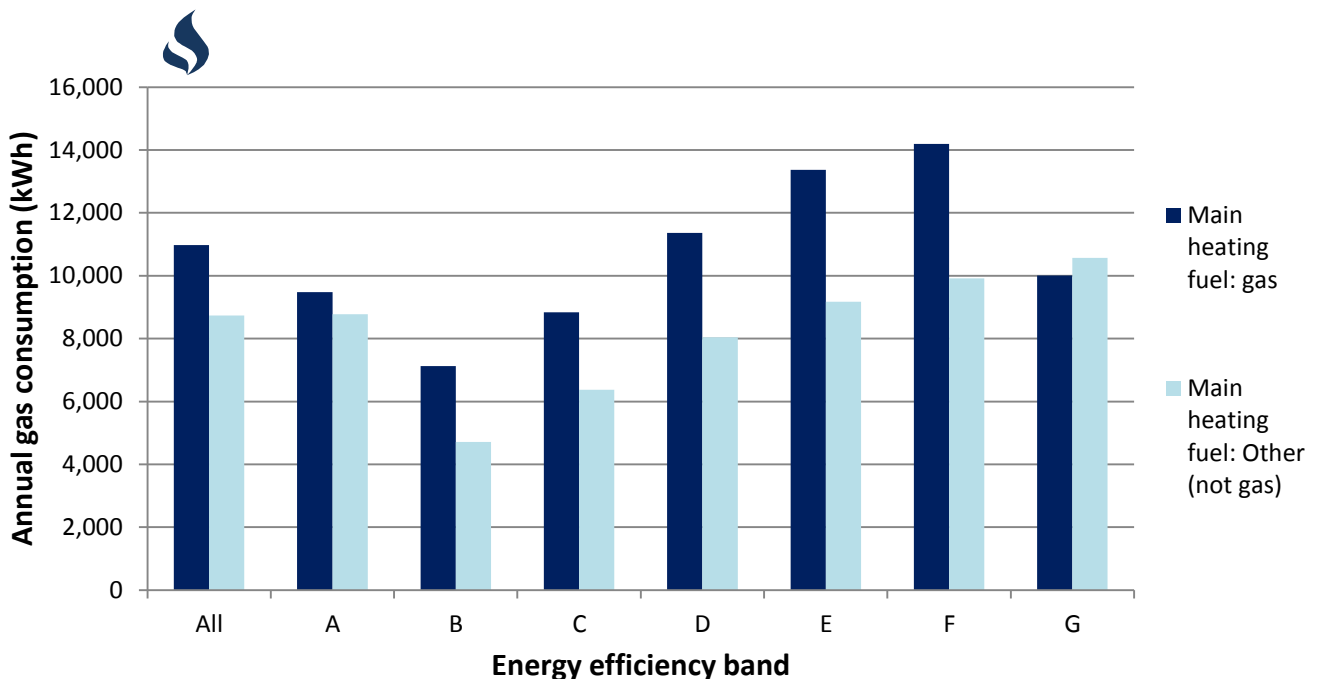
Both charts show that generally the mean and median consumption is higher for properties assessed as being less energy efficient. However, this is not always the case. For electricity and gas, the typical (median) consumption for properties assigned to band A is higher than for band B. For gas, the typical consumption for properties in band G (10,200 kWh) is lower than bands D (11,300kWh), E (13,300kWh) and F (13,900 kWh). These results are likely due to the small number of properties in band A, B and G, as shown in figure 2.

Energy consumption across EPC band reflects energy prices across these bands in 2015. Band F shows the highest energy bills for gas at £710 and band G for electricity at £950, on average. Band B showed the lowest average energy prices for both gas and electricity at £420 and £540, respectively.

Figure 3 above shows gas and electricity consumption in isolation, they do not take into account consumption of other fuels. The less intuitive results shown for typical gas consumption in band G households can partly be explained by the main heating fuel for properties in this category. All properties included in figure 3b have a gas consumption recorded as valid in 2015, that is, between 100 and 50,000 kWh¹⁰, but not all of them use gas as the main heating fuel. Of the properties included in this analysis, EPC data shows that 86 per cent of properties with a valid gas consumption in 2015 used gas as the main heating fuel. However, for band G properties, only 12 per cent used gas as the main heating fuel. It is also possible that more band G households have a secondary heating fuel, and therefore have a lower requirement for gas.

Figure 4 shows the typical (median) gas consumption, for each energy efficiency band, for properties with a valid gas consumption for which gas is the main heating fuel in 2015. This is compared to properties where the main heating fuel was not gas in 2015.

Figure 4: Median annual gas consumption by energy efficiency band and main heating fuel, 2015



As can be seen from Figure 4 properties that do not use gas as the main heating fuel have the highest typical gas consumption in band G (10,600 kWh). This is 6 per cent more than the typical gas consumption of properties in band G that do use gas as the main heating fuel (10,000 kWh). As mentioned previously, this may be due to more band G properties having a secondary heating fuel. For energy efficiency bands B to F, properties that use gas as the main heating fuel show

¹⁰ Gas consumption is considered valid if it is between 100 and 50,000 kWh (inclusive). Electricity consumption is included as valid if it is between 100 and 25,000 kWh.

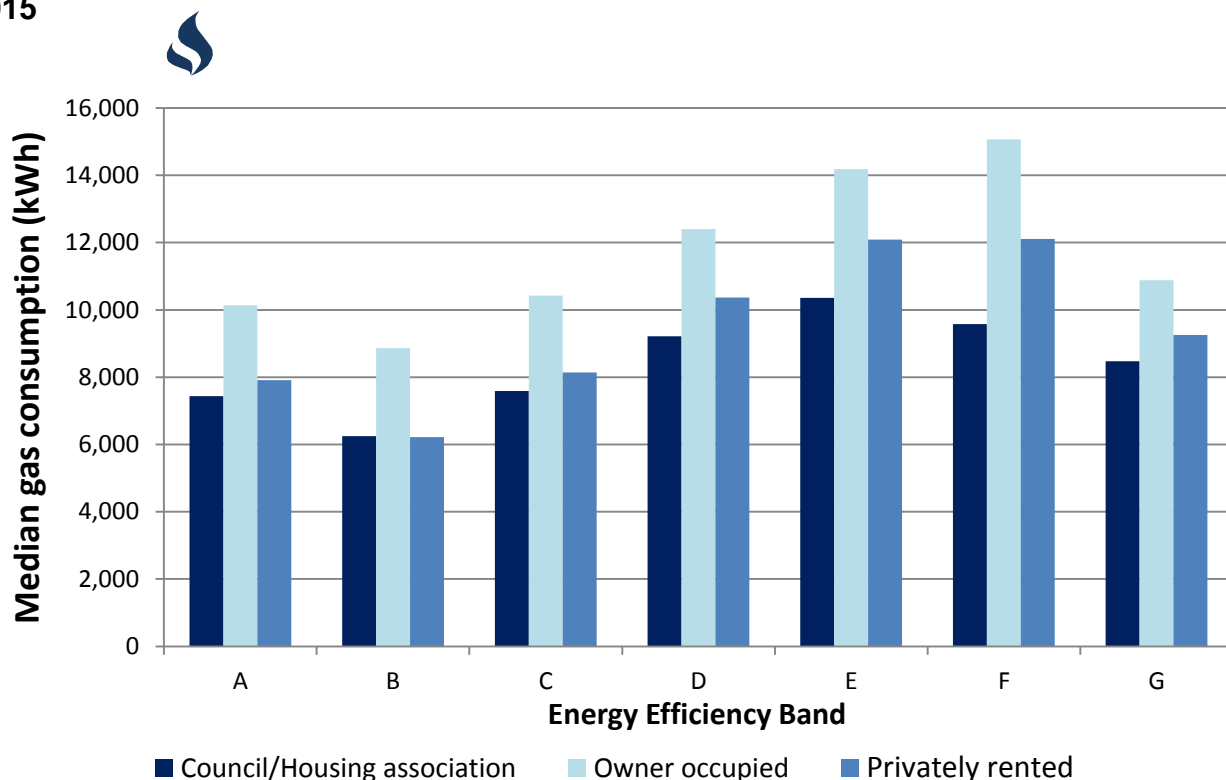
Special feature - Energy consumption and EPC's

between 39 and 51 per cent more gas consumption than properties that do not use gas as the main heating fuel.

In contrast to findings on 2012 data (published in 2014), behaviours of household occupants are unlikely to account for differences in energy consumption across EPC bands in 2015. The previous data for 2012 showed that the demographics of occupants in band A properties differed from those in bands B and C, which may have accounted for the differences in energy consumption. For example, 60 per cent of band A properties were owner occupied, relative to 36 per cent in band B and 46 per cent in band C in 2012. It was shown that within these groups properties in band A had a higher consumption than properties in band B.

In 2015, despite median gas consumption being the highest for owner occupied band F properties, at 15,100 kWh, the modelled data from Experian shows that the proportions by tenure are similar across bands. Therefore, tenure is unlikely to account for the differences in gas consumption across these bands (seen in Figure 3). Across EPC bands owner occupied properties account for 38 to 42 per cent of properties, Council/housing association between 26 and 30 per cent of properties and 29 to 33 per cent of Privately rented properties. This shows very similar proportions of tenure across EPC bands (see figure 5 below).

Figure 5: Median annual gas consumption by energy efficiency band and tenure, 2015

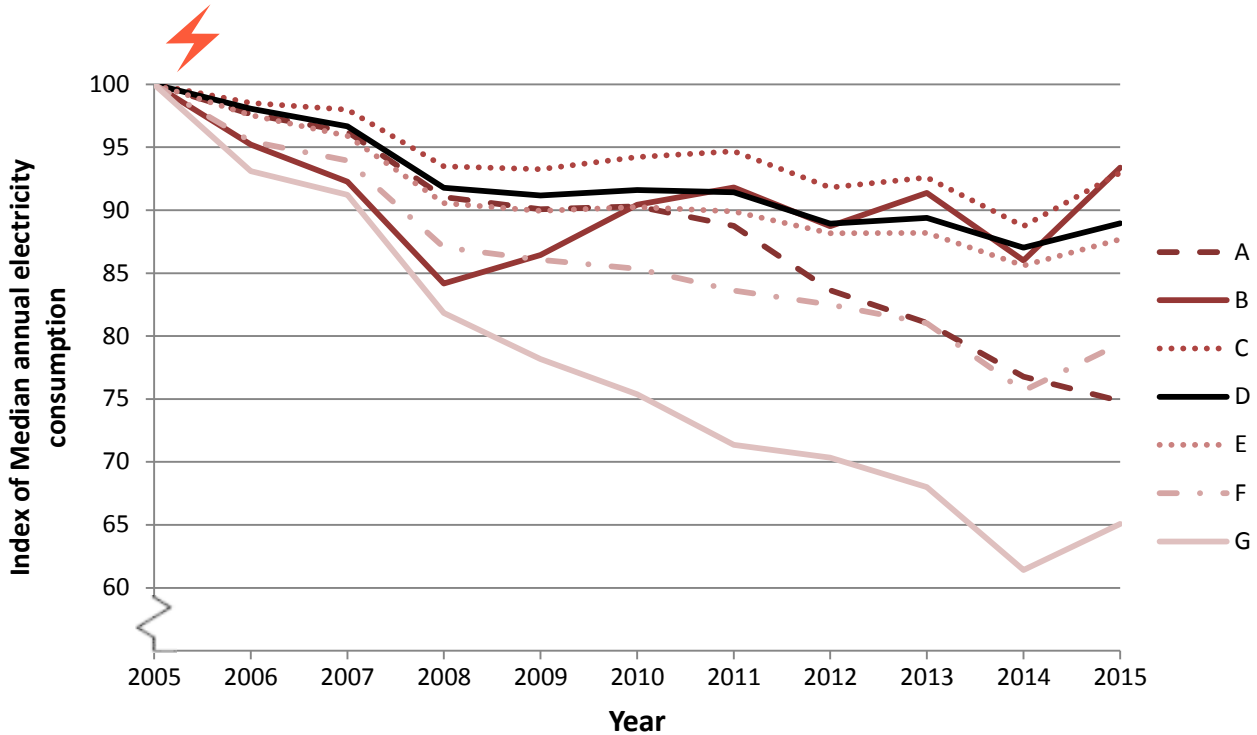


The modelled Experian data also shows that Property Type is unlikely to account for differences in gas or electricity consumption. Very few properties of any type fall within bands of extreme high or low energy efficiency. That is, less than 1 per cent of all properties fall within EPC band A and just over 1 per cent band G. In addition to this, a large proportion of semi-detached, 48 per cent, and of terraced properties, 47 per cent, fall within EPC band D. As a result, the property types across EPC bands do not reflect the energy consumption seen in figure 3.

The smaller sample of properties in bands A and G mean there is more uncertainty around the estimates and this may explain the results seen. Further work is required to understand to what extent these findings can be explained by the behaviours of occupants or whether there is another cause.

Figure 6 shows how typical energy consumption has changed over time for properties in different energy efficiency bands.

Figure 6: Median annual electricity consumption by energy efficiency band, 2005-2015 (2005 indexed at 100)

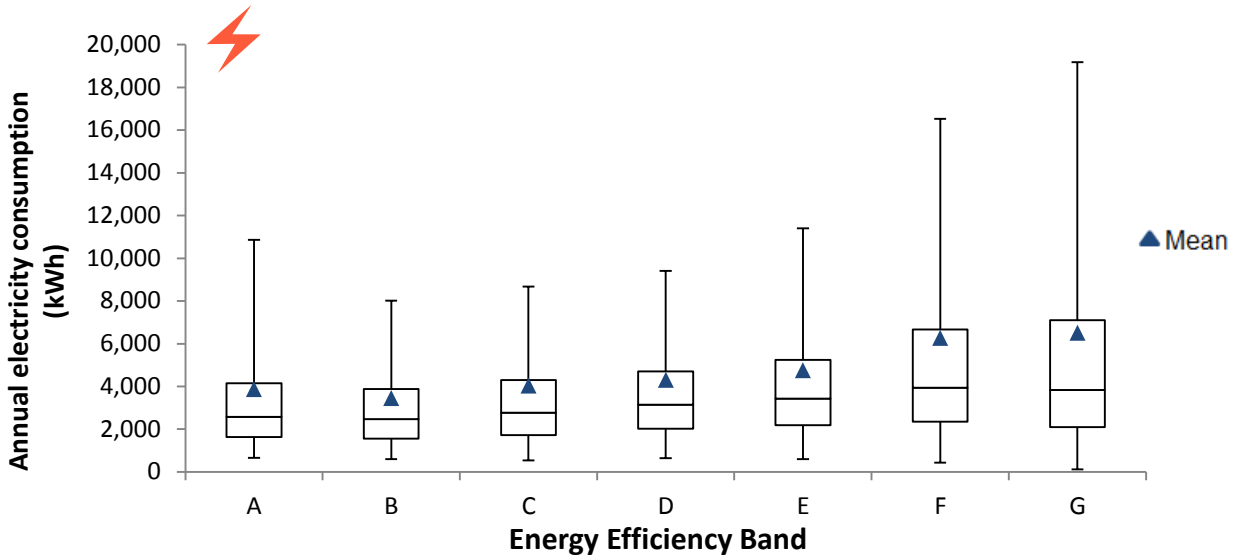


Properties in band G have had a greater reduction in consumption between 2005 and 2015 than properties in other bands. Median electricity consumption in band G reduced by 35 per cent over this period, compared to 19 per cent for all properties and 25 per cent for the group with the next biggest reduction (band A). This could in part be due to properties becoming more energy efficient during the period¹¹.

The focus on median and mean consumption masks the variation in consumption for different households. As with other results from NEED, there is variation in consumption for properties in each energy efficiency band. Figure 7 below shows the variation more clearly. It shows the mean, median, upper and lower quartiles and 5th and 95th percentiles.

¹¹ Some properties may have changed energy efficiency band between 2005 and 2015. Properties are included in the energy efficiency band given on the most recent EPC for the property, as at the end of December 2015.

Figure 7: Annual electricity consumption by energy efficiency band 2015



It is clear that within each band there is a range of consumption, and that the range is greater for less efficient properties. The inter quartile range (difference between the upper and lower quartiles) for band G properties is 5,000 kWh compared to 2,300kWh for band B properties.

Consumption by environmental impact band

This section provides information on energy consumption by environmental impact band, grouped by bands A (most environmentally friendly) to G (least environmentally friendly). While the energy efficiency band takes into account the cost of fuel bills, the environmental impact band only considers the impact on the environment. So, for example, a property moving from conventional panel heaters to a storage heating system may be considered more energy efficient but less environmentally friendly. The property has an improved energy efficiency rating because the storage heaters are cheaper to run as they can use low-rate night time electricity. However, the amount of electricity required by a storage heater system is greater and therefore the environmental impact rating would be higher.

Figure 8 shows the mean and median electricity and gas consumption by environmental impact band for 2015.

Figure 8: Average annual consumption by energy environmental impact band, 2015

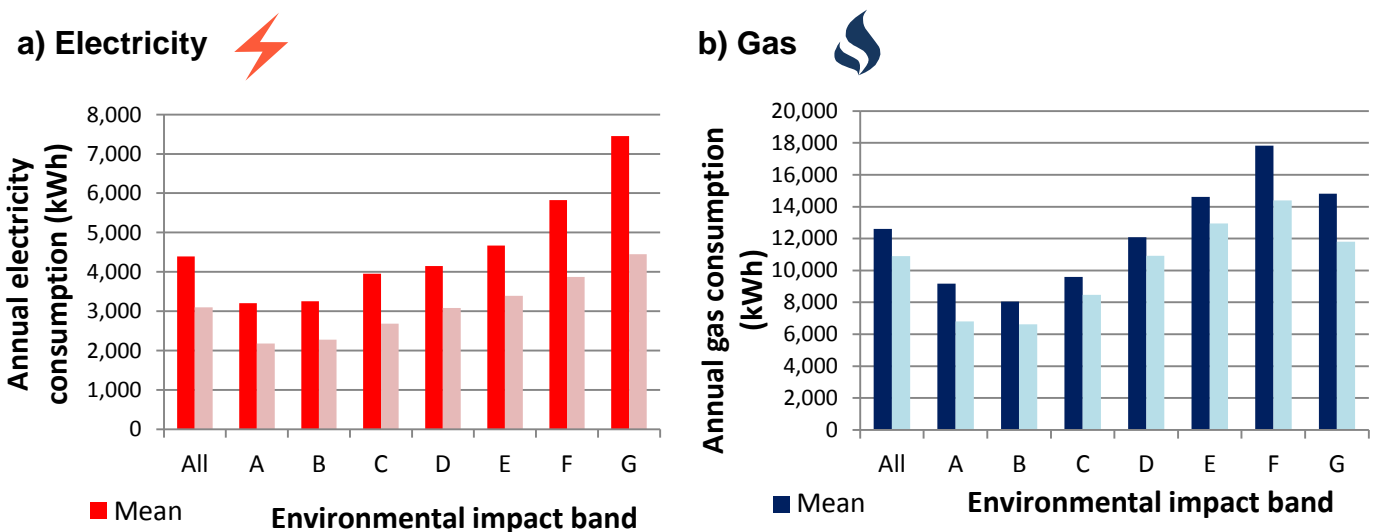


Figure 8 shows a very similar picture to the equivalent charts for energy efficiency band (figure 3). In general, average consumption is greater for properties with a poorer environmental impact rating, with the exception of band A for gas and electricity and band G for gas. As with energy efficiency band, the lower consumption in band G for gas is being influenced by the main heating fuel. Only 34 per cent of properties in band G use gas as the main heating fuel, compared to at least 67 per cent for bands A to F.

Energy efficiency band compared with environmental impact band

This section compares typical consumption for properties by energy efficiency band and environmental impact band. Figure 9 shows median annual electricity consumption for both ratings.

Figure 9: Median annual electricity consumption by energy efficiency band and environmental impact band, 2015

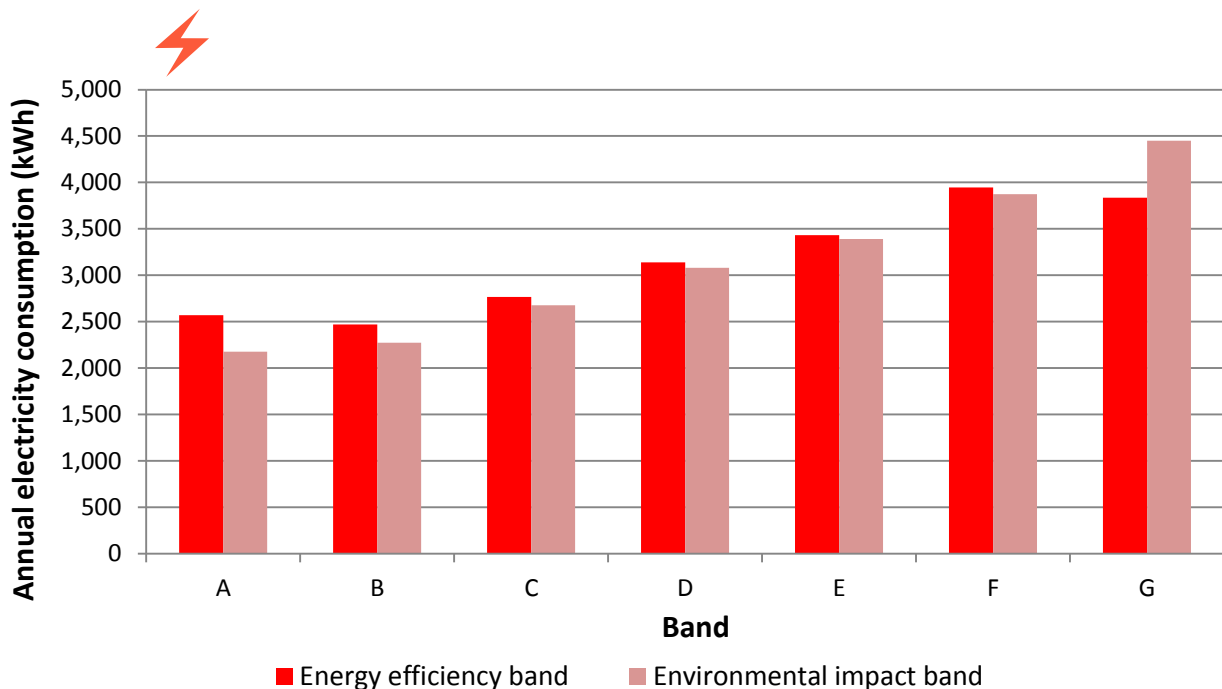
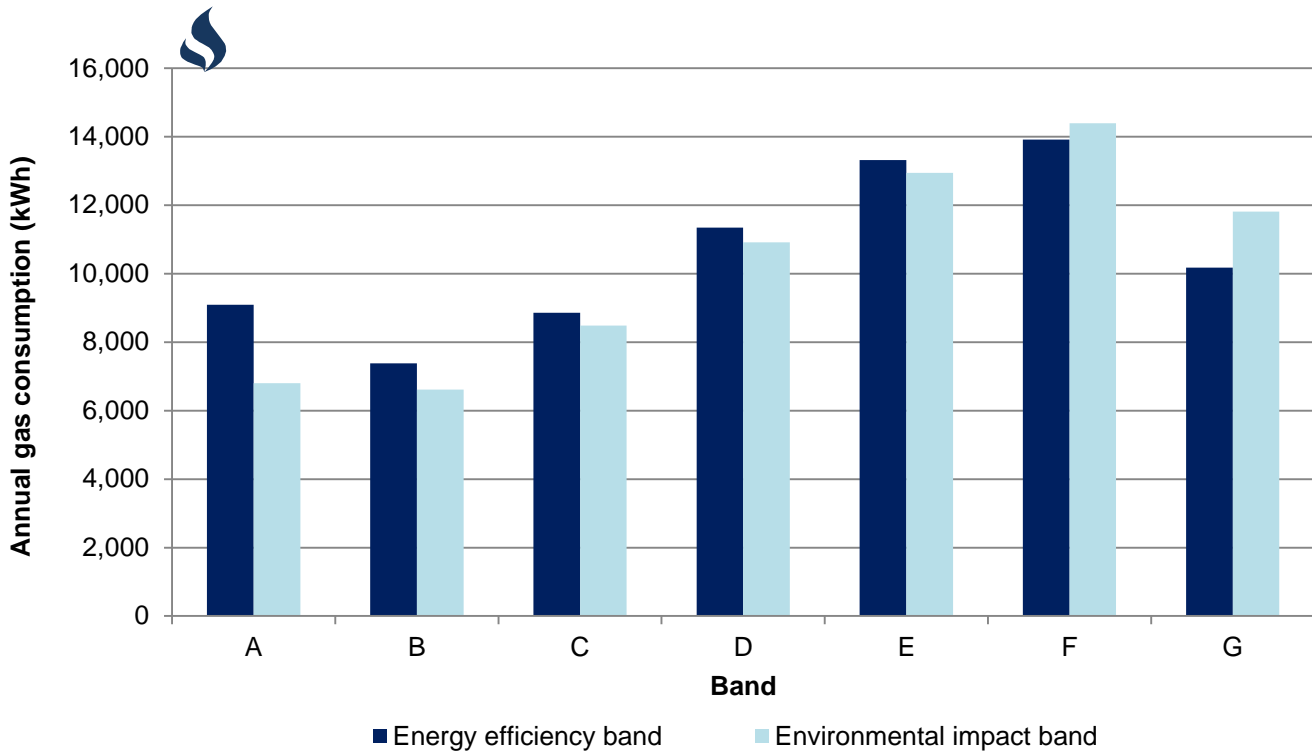


Figure 9 shows that for bands A to F consumption for properties in the specified environmental impact band is slightly lower than properties in the same named energy efficiency band. For band G the opposite is seen. Median consumption for properties with environmental impact band G is 16 per cent higher than for properties in energy efficiency band G. These findings reflect the difference in the way the two measures are calculated. The energy efficiency band takes into account the costs of the fuel used while the environmental impact band only considers the impact on the environment. This means that properties could be in a worse energy efficiency band if a more expensive fuel is used to heat the property (e.g. oil) even with the same impact on the environment.

Figure 10 compares median gas consumption by energy efficiency band and environmental impact band.

Figure 10: Median annual gas consumption by energy efficiency band and environmental impact band, 2015



Similar to electricity consumption shown in figure 8, the typical gas consumption for any given environmental impact band is lower than the typical gas consumption for the equivalent energy efficiency band for most bands. However, the median gas consumption for properties with environmental impact band F is 3 per cent and G 16 per cent higher than for properties in energy efficiency band F and G, respectively. These findings are a result of the difference in the way the two measures are calculated and reflect the fact that 16 per cent of properties with valid gas consumption in energy efficiency band F and 12 per cent in band G use gas as the main heating fuel, compared to 67 per cent and 34 per cent for properties with environmental impact band F and G, respectively.

Summary

This analysis sets out results for energy consumption by energy efficiency band and environmental impact rating in 2015. This has been made possible by the use of energy performance certificate data. This analysis now also includes figures on fuel prices, to help better understand the impact on energy bills of consumption and energy efficiency in homes in England and Wales.

The analysis confirms the natural expectation that, generally, households that are less energy efficient and less environmentally friendly tend to use more gas and electricity. However, this is not always the case with 'Band G' properties (the least efficient and least environmentally friendly) tending to use less energy than the band D-F properties. These less intuitive results can partly be explained by the fact that very few of these properties use gas as the main heating fuel, but there may be other factors in play.

Access to the EPC data provide a wealth of possibilities for future analysis and the preliminary findings have highlighted a number of areas which would benefit from further investigation. The EPC dataset enables others to undertake analysis themselves using record level data.

Any insights or comments resulting from this analysis would be welcomed and can be provided by email to: energyefficiency.stats@beis.gov.uk.

Or by completing our Survey: www.surveymonkey.co.uk/r/ZNPC2QT