

ONS Methodology

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Analysing low electricity consumption using DECC data

Karen Gask and Susan Williams
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1. Introduction

Low electricity consumption in a home over a period of time may indicate a vacant property, second home or perhaps a holiday home. Knowing the likelihood of encountering such homes in any given area could be of use to a Census or survey operation by ONS. This is because understanding the likely locations of such homes allows better targeting for enumerators and reduces Census follow up costs. To research this further, ONS has received counts of the number of households in each local authority, and in 48 smaller areas in England and Wales, grouped by annual electricity consumption. This report details the analysis undertaken on these data.

2. Data

The six biggest energy companies in the UK¹ supply the Department for Energy and Climate Change (DECC) with the annual energy usage for all their customers' gas and electricity meters² in England and Wales. DECC uses this data to [publish average estimates of annual domestic electricity consumption for regions and local authorities](#). Taking advice from DECC on what would be a very low level of annual electricity use, ONS sourced counts of domestic meters for all local authorities and 48 Lower Layer Super Output Areas (LSOAs) in England and Wales grouped by the following consumption levels:

- <0 kWh
- 0 kWh
- 1-500 kWh
- 501-1,000 kWh
- >1,000 kWh.

For context, median consumption across all domestic electricity meters was 3,206 kWh in 2013.

These counts are compared to official estimates of second homes or empty dwellings to see if any relationship exists. This comparison assumes that each meter represents a household.

Data have been received for 2011 and 2012.³

3. Analysis of local authority data

3.1. Analysis of count data alone

Table 1 shows the percentage of meters in each annual electricity consumption group and reveals that 0.2% of meters in local authorities England and Wales had negative electricity consumption in 2011 and 2012. The reason for such readings is not understood but these counts have been excluded from further analysis. The vast majority of meters (more than 92% in 2011 and 2012) used more than 1,000 kWh of electricity in a year.

¹ British Gas; EDF; E.On UK; Npower; SSE; Scottish Power

² Collectively representing over 90% coverage of homes in England and Wales

³ Data for 2011 actually covers 28/01/2011-27/01/2012 and data for 2012 actually covers 27/01/2012-26/01/2013

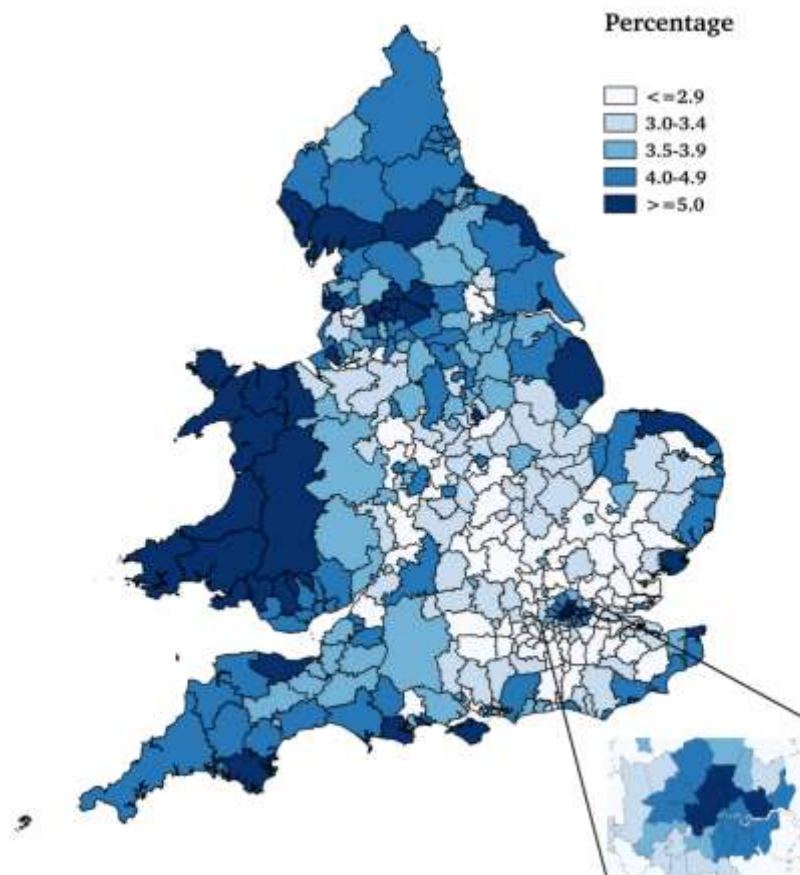
Table 1: Percentage of meters by annual electricity consumption grouping, 2011 and 2012

Annual consumption (kWh)	2011	2012
<0	0.2	0.2
0	1.0	1.2
1-500	2.8	2.8
501-1,000	3.5	3.7
>1,000	92.5	92.1

Research has concentrated on the 3.8% to 4.0% of households which used 0-500 kWh of electricity per year. While it is not known what percentage of households are vacant or second homes in England and Wales, the Census recorded a similar percentage (4.4%) of households as containing no usual residents in 2011.

Figure 1 shows that there is a geographic pattern in the percentage of meters which used up to 500 kWh of electricity in 2012. Higher percentages are observed in coastal holiday areas such as Wales, the Norfolk coast and Devon. Central London also has higher percentages. These may be areas with second homes which are used little or where [very wealthy people buy homes and leave them empty](#). A very similar pattern is observed in 2011.

Figure 1: Percentage of meters which used 0-500 kWh of electricity in 2012



There is little difference in the percentage of meters using 0-500 kWh between 2011 and 2012. The largest absolute percentage difference is in St Edmundsbury in Suffolk, where 2.5% of meters consumed 0-500 kWh of electricity in 2011 compared with 3.0% in 2012.

3.2. Comparison with Census data

The 2011 Census produces two outputs which have relevance to dwellings which might have low electricity use. The first is the number of household spaces with no usual residents, the second is the number of second homes. Both sets of data were compared with the count data on meters with low electricity use.

Household spaces with no usual residents

Household spaces with no usual residents may include second homes, holiday homes and long-term and temporarily vacant homes. This means that there is an overlap in definitions as a household can be a space with no usual residents and a second home.

A heat map showing the percentage of households with no usual residents is in Figure 2. Areas which have a similarly high percentage of such households and meters with low electricity consumption include:

- West and central Wales
- Norfolk coast
- Cornwall, and
- Central London boroughs such as City of London, Westminster, and Kensington and Chelsea.

Figure 2: Percentage of household spaces which contain no usual residents, 2011

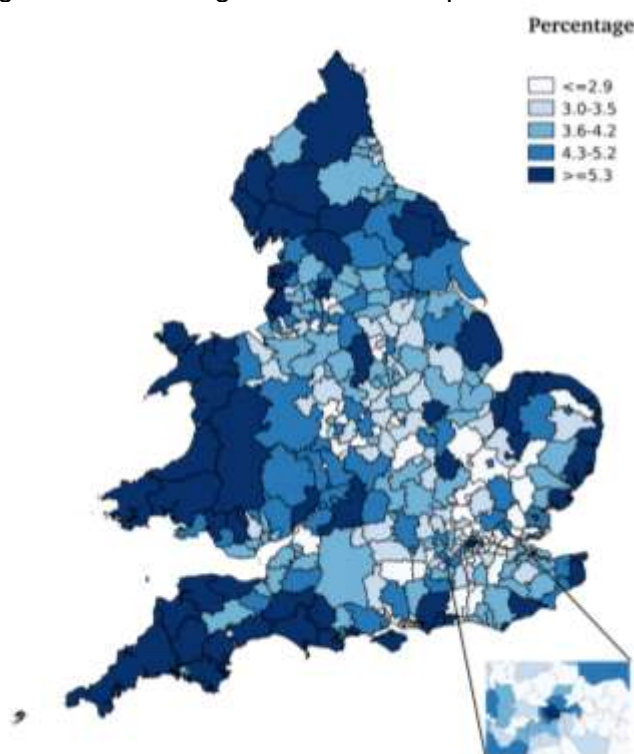


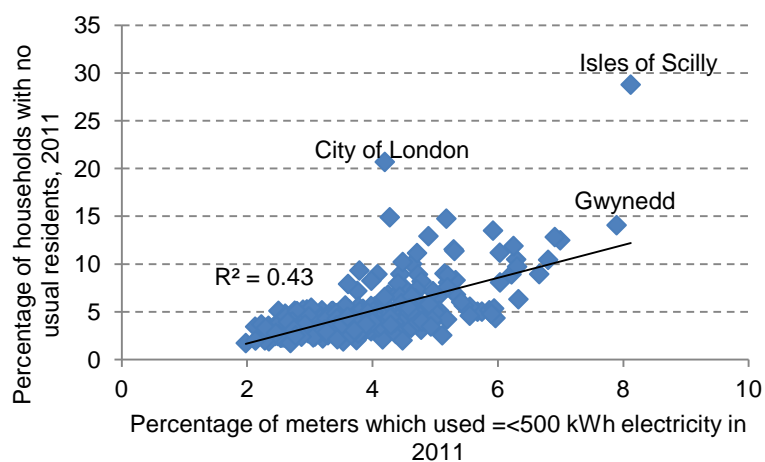
Figure 3 shows a scatter plot of the percentage of household containing no usual residents against the percentage of meters which used 0-500kWh of electricity. It reveals that there is

a reasonable correlation (R^2 value⁴=0.43) between the two sets of data. There are some outliers:

- Isles of Scilly where 29% of household spaces contained no usual residents. This is an area which contains a high proportion of second homes actively used for holidays
- Gwynedd (partly containing Snowdonia National Park) where 14% of household spaces contained no usual residents. Again, this contains a high proportion of second homes used for holidays
- The City of London where 21% of household spaces contained no usual residents. This is an area which contains a high proportion of second homes used for work.

It is noted that second homes used for holidays or work might have moderate electricity use over the year. This can explain why, in LAs containing large numbers of such homes, the percentage of meter counts of low electricity use are less than Census data on the percentage of dwellings containing no usual residents.

Figure 3: Percentage of households with no usual residents compared with percentage of meters which used 0-500 kWh of electricity, 2011, by local authority



Second address

The 2011 Census also asked residents whether they had a second address, and if so, what type of address this was. Specifically, the Census defined a second address as one at which a person stays for more than 30 days per year that is not a person's place of usual residence. This includes addresses that are in the UK and those outside of the UK. Typical second addresses include:

- armed forces bases
- addresses used by people working away from home
- students' term time addresses
- the address of another parent or guardian, or
- holiday homes.

In 2011, 1.6 million people had a second address in a local authority, and were usually resident outside of that local authority. Of those people:

- 188,837 (12%) had a working second home
- 165,095 (11%) had a holiday home

⁴ R^2 is a statistical measure of how close the data are to the fitted regression line. The measure ranges from 0 to 1 with 0 indicating that there is no relationship between the data series and 1 indicating that there is a perfect relationship between them.

- 1,216,296 (71%) had an 'other' second home.

For example 23,000 people had a second address in Cornwall who lived outside Cornwall. To enable comparisons between different areas, this figure was then divided per 1,000 usual residents. However care is needed as this definition does not match up to the number of second homes. For example, a child of separated parents may be a usual resident at his mother's home and spend more than 30 days per year at his father's home, making it his second home. However the father's home is not a second address for the father himself.

For each LA, the percentage of meters which used 0-500 kWh of electricity in 2012 was compared against published Census estimates. These Census estimates show the number of people (per 1,000 usual residents) with a second address in a local authority, who are usually resident outside of that local authority. This comparison was undertaken for all people with a second address, and split by different second address types (working, holiday and other).

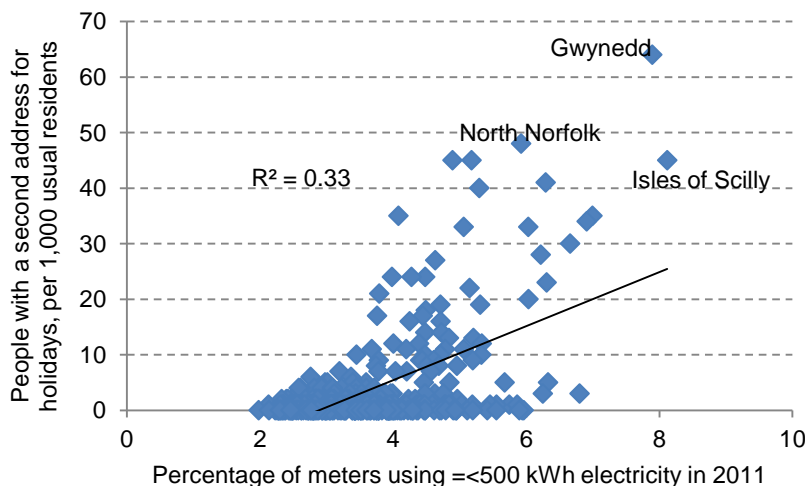
Figure 4 shows a scatter plot of this comparison for people with a second address for holidays, and illustrates that the relationship with the percentage of meters using 0-500 kWh is not as evident as in Figure 3, with an R^2 value of 0.33.

Three local authorities which stand out are:

- Gwynedd where 64 people per 1,000 have a second address for holidays
- North Norfolk where 48 people per 1,000 have a second address for holidays
- The Isles of Scilly where 45 people per 1,000 have a second address for holidays.

These are also areas where a high percentage of meters consumed 0-500 kWh of electricity in 2011.

Figure 4: Households with low annual electricity consumption compared with people with a second home used for holidays, by local authority



Lower R^2 values are observed when comparing the meter counts with all second addresses (0.10), second addresses used for work (0.02) and other second addresses (0.01).

3.3. Comparison with council tax data

Prior to April 2013 it was possible to get a council tax discount for a second home or an empty property in all LAs. Since then this discount is at the discretion of local councils. Council tax statistics are published by the [Department for Communities and Local](#)

[Government for all local authorities in England](#). Statistics showing the percentage of second homes and long-term empty dwellings in 2012 from this source should provide a reasonable comparison because there was a financial incentive for home owners to register their home as a second home or as long-term empty. The statistics showing the percentage of second homes, long-term empty dwellings and both combined were compared against the meter count data.

Figure 5 shows that there is some relationship between council tax data on second homes or long-term empty dwellings, and households with low electricity consumption as the R^2 value is 0.38. As in Figure 4, the Isles of Scilly is an outlier, as is the City of London. The City of London is known to have a high proportion of second homes for work.

Figure 5: Households with low annual electricity consumption compared with the percentage of second homes or long-term empty dwellings, by local authority, 2012

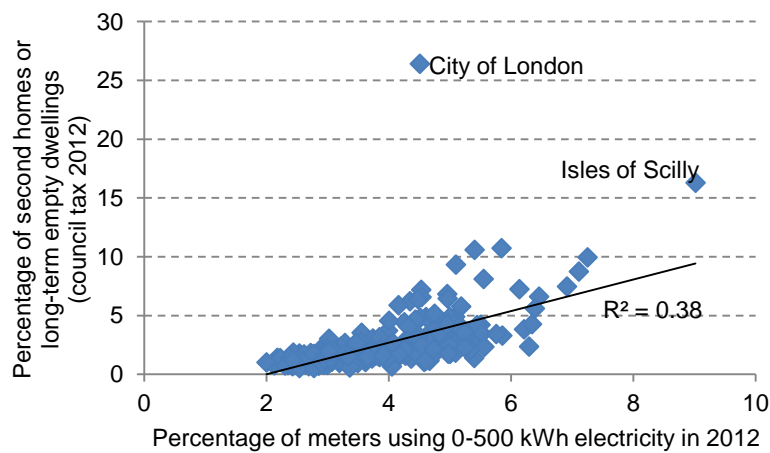


Figure 9 and Figure 10 in the Appendix show maps of second homes and long-term empty dwellings in England respectively. As might be expected, second homes are more common around the coast such as in Cornwall and the south of England, the Norfolk coast and inland areas such as the Cotswolds and Lake District. Meanwhile, long-term empty dwellings are more common across the north of England.

Lower R^2 values are observed when the meter count data is correlated against the percentage of second homes only (0.26) and the percentage of long-term empty dwellings only (0.25). This makes sense as it would be expected that a household using little electricity could be either a minimally inhabited second home or long-term empty. Correlating against the percentage of second homes or long-term empty dwellings (as in Figure 5) improves the R^2 value.

It should be noted that owners of self-catering or holiday let accommodation pay business rates⁵ and not council tax. As a result such properties are likely to be excluded from council tax data but may be included in Census data.

⁵ If self-catering or holiday let accommodation is in England and available to let for 140 days or more per year, it will be rated as a self-catering property and valued for business rates. If the same property is in Wales and both available to let for 140 days or more per year and actually let for 70 days, it will be rated as a self-catering property and valued for business rates.

4. Analysis of Lower Layer Super Output Area (LSOA) data

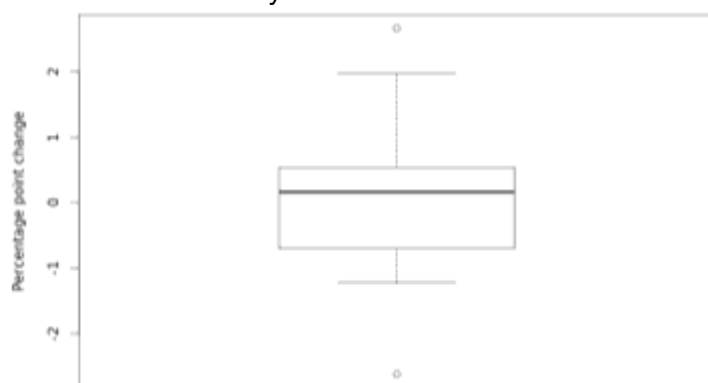
Lower Layer Super Output Areas (LSOAs) are small areas containing between 1,000 and 3,000 people. DECC have provided the same meter count information for 48 of these areas in England and Wales as was provided for local authorities. A mixture of areas were selected to be part of the 48 LSOAs; some areas are thought to contain a low percentage of vacant properties (such as Fareham in Hampshire), while others are thought to contain a high percentage of vacant properties (such as Cornwall or Norfolk). As in the above analysis, the percentage of meters which used 0-500 kWh of electricity in 2011 and 2012 was analysed.

4.1. Analysis of count data alone

On average 4.6% of meters in the selected LSOAs used 0-500 kWh of electricity in 2012. This ranged from 0% in Fareham 008F to 12.8% in King's Lynn and West Norfolk 003C.

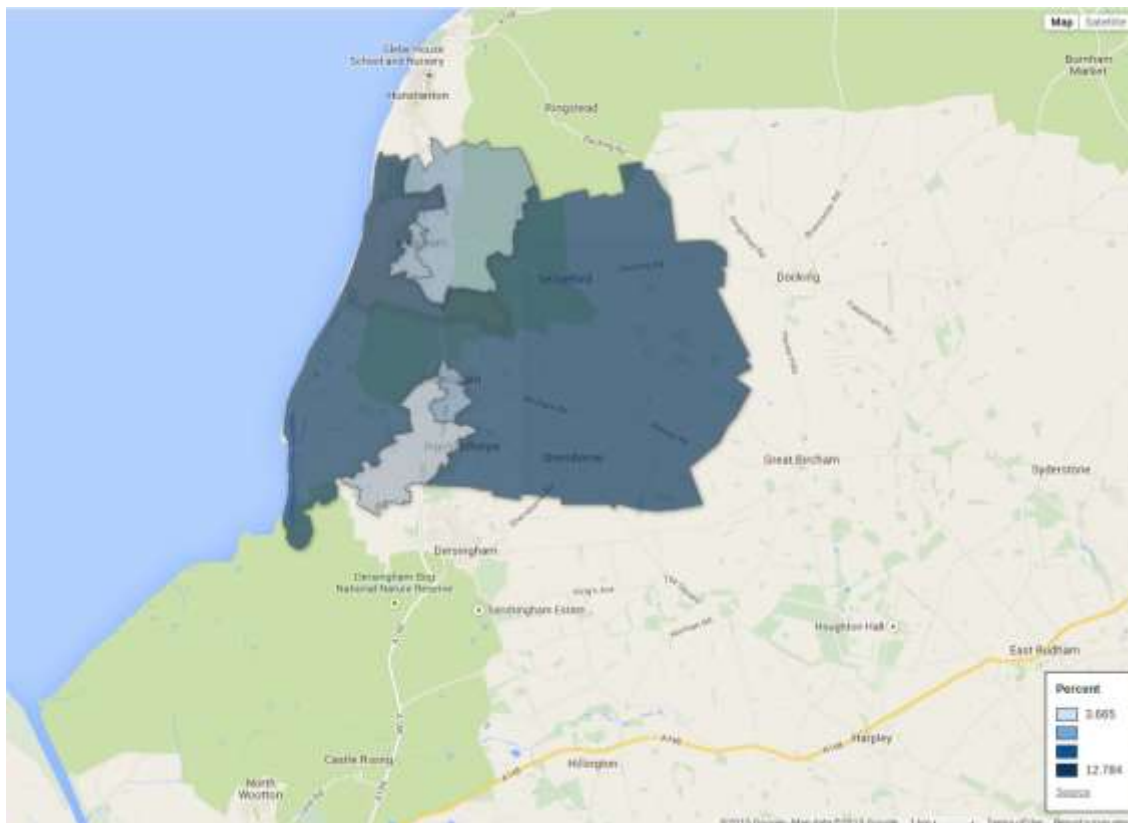
Between 2011 and 2012 there was little change in the percentage of meters which used 0-500 kWh of electricity across the LSOAs, as can be seen in Figure 6. The largest absolute percentage point difference was in Haringey 013D where 5.5% of meters used 0-500 kWh of electricity in 2011, compared with 8.2% in 2012.

Figure 6: Percentage point change between 2011 and 2012 in percentage of meters using 0-500 kWh of electricity



Because the LSOAs are small and spread around the country, showing a map of England and Wales would not be a good illustration. Therefore Figure 7 shows a map of just one area in King's Lynn and West Norfolk in 2012. This area was selected as two LSOAs have more than 10% of meters using 0-500 kWh of electricity. It is evident from the map that this is a rural, coastal area, and further research indicates that it is used for holiday accommodation.

Figure 7: Percentage of meters using 0-500 kWh of electricity in selected LSOAs in King's Lynn and West Norfolk in 2012



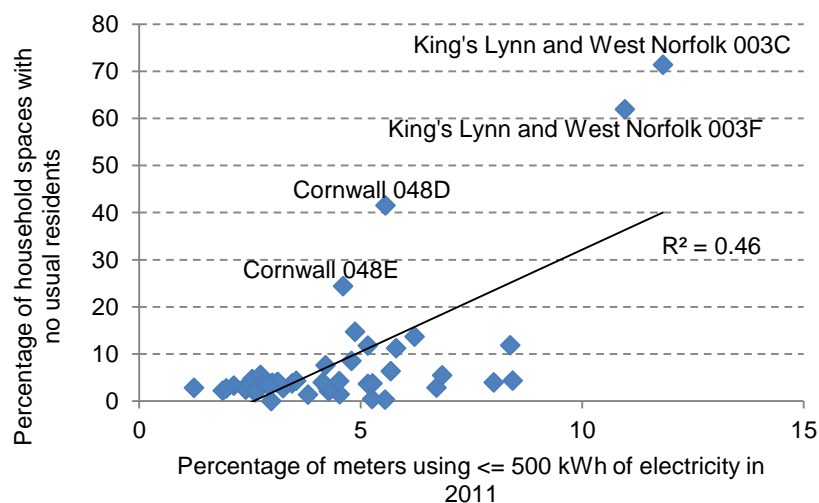
4.2. Comparison with Census and council tax data

Council tax data about second homes and long-term empty dwellings are only available at local authority and regional levels. Further, Census data about second homes is only available at local authority and regional levels. Therefore the only comparison which can be made for these LSOAs is with Census data about the percentage of household spaces with no usual residents.

Figure 8 illustrates that there is a reasonable correlation between the percentage of households with no usual residents and the percentage of meters which used 0-500 kWh of electricity in 2011, as the R^2 value was 0.46. This is very similar to the R^2 value of 0.43 between the same data sources for local authorities. However, this value is pulled up by four LSOAs; two in King's Lynn and West Norfolk and two in Cornwall. King's Lynn and West Norfolk 003C is the LSOA which has both the highest percentage of meters which used 0-500 kWh of electricity (at 12.8%) and the highest percentage of household spaces with no usual residents (at 71.4%).

There were 3,539 people who had a second address for holidays in King's Lynn and West Norfolk and who lived outside that local authority. This represents the 16th highest rate per 1,000 usual residents out of 348 local authorities. However similar data does not exist for LSOAs.

Figure 8: Percentage of households with no usual residents compared with percentage of meters which used 0-500 kWh of electricity, 2011, for 48 LSOAs



5. Conclusion

Knowing that a property is vacant, a holiday home or a second address reduces Census follow up costs for enumerators and brings down data collection costs. The [2011 Census Field Operations Evaluation](#) reported that this was not modelled but should have been taken into account in planning. It was hypothesised that data showing households which use little electricity may provide a good proxy for such dwellings. However, as described below, there is not necessarily a clear relationship between these two sets of data.

The analysis sources data from the Department for Energy and Climate Change which shows the percentage of dwellings using up to 500 kWh of electricity in 2012 by local authority, and for 48 LSOAs, in England and Wales.

There is some relationship between the percentage of dwellings using up to 500 kWh of electricity and the percentage of households with no usual residents. However larger differences appear in areas with a high number of second or holiday homes such as Norfolk, Cornwall and the Cotswolds. Second homes and holiday homes contain no usual residents but may be using more than 500 kWh of electricity in a year because when they are occupied, people may spend more of their free time in these properties.

Comparing the meter count data against council tax data on second homes and long-term empty properties indicated that there is some relationship between these two data sources. The relationship between the meter count data and Census data on second homes used for holidays is weaker.

These relationships appear to hold for larger areas such as local authorities and small areas such as LSOAs, which illustrates that such data could be beneficial to a future Census operation. Using these and similar data could bring down data collection and planning costs.

The next step in this research is to source the same data for LSOAs, or ideally even smaller areas, for the whole country. This will enable a fuller comparison with Census data about the percentage of household spaces with no usual residents to understand whether the relationship still holds.

6. Appendix

Figure 9: Percentage of households which are second homes (council tax data), 2012

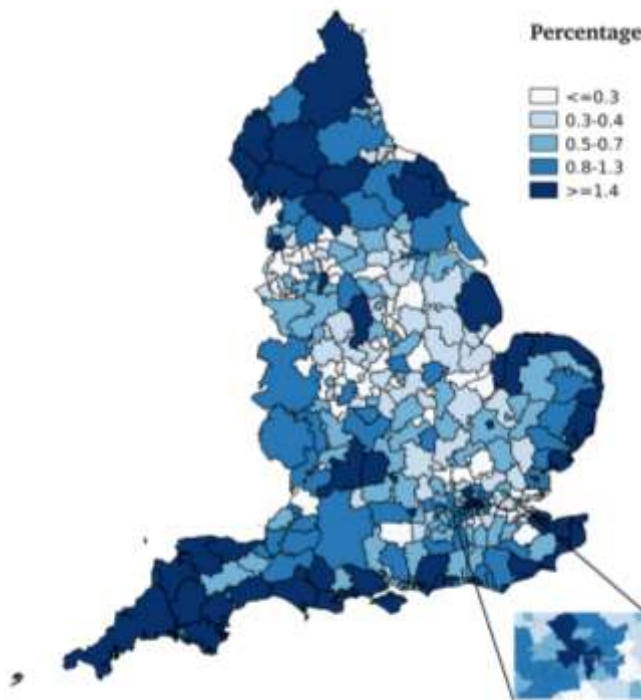


Figure 10: Percentage of long-term empty dwellings (council tax data), 2012

