



Report 8: Lighting

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The EFUS has been undertaken by BRE on behalf of the Department of Energy and Climate Change (DECC).

Report editors and lead authors: Jack Hulme, Adele Beaumont and Claire Summers.

Project directed by: John Riley and Jack Hulme.

Data manager: Mike Kay.

Supporting authors and analysts: Mike Kay, Busola Siyanbola, Tad Nowak, Peter Iles, Andrew Gemmell, John Hart, John Henderson, Afi Adjei, Lorna Hamilton, Caroline Buchanan, Helen Garrett, Charlotte Turner, Sharon Monahan, Janet Utley, Sara Coward, Vicky Yan & Matt Custard.

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Executive Summary

This report presents results from the Interview Survey component of the 2011 Energy Follow-Up-Survey (EFUS) which collected information about the lights in three of the main rooms of the house (living room, main bedroom and kitchen), as well as lights left on overnight and outside lights powered from the household electricity supply. Analysis is based on the interview sample, weighted to the national level using a weighting factor specific to the interview sample. The results presented in this report are therefore representative of the English housing stock, with a population of 21.9 million households.

Lighting in the main rooms

By combining the number of sets of lights and the number of bulbs per set in each room it can be seen that the living room and kitchen have significantly higher median numbers of bulbs per room than the bedroom (the median number of bulbs in each room are 5, 4 and 2, respectively). The greatest variability in the total number of bulbs in a room is seen for the kitchen, where half of all households with a kitchen that is lit have between 1 and 7 bulbs in that room; half of all households with a living room that is lit have between 3 and 7 bulbs in that room and the variability is least in the bedroom where half of all households with a main bedroom that is lit have between 1 and 3 bulbs in that room.

In the living room and main bedroom approximately 40% of light bulbs are still tungsten (traditional light bulbs – not of a low-energy type), and 30% low energy compact fluorescents (CFLs). In the kitchen however, halogen bulbs (50%) and fluorescent strip lighting (15%) are the dominant type of lighting.

Considering all sets of lights, median weekday and weekend use is very similar, but lights are on for about 2 to 3 times as long in winter as summer (typically 5-8 hours per day in the winter compared to 2-3 hours per day in the summer).

Overnight lighting

17% of households left lights on in one or more rooms overnight. Of these households, 92% left a light on in just one room and a further 7% in 2 rooms. The rooms in which lights were left on overnight are typically only the hallway/landing, bathroom with a WC or the second bedroom with nearly 40% of households who responded that they left lights on overnight doing so in the first hall/landing. Although not directly asked, it is assumed that this is likely to be for security reasons or for the comfort and safety of children or elderly people who may wake during the night.

For the households that leave lights on in either of the hall/landings overnight, just under 60% of them use low energy CFLs, a greater proportion than the overall number of low energy lights shown in any of the main rooms. This may reflect that households value the energy savings these bulbs provide for this type of usage. However, just over 20% of households leaving lights on in hallways overnight still use tungsten bulbs.

Outside lighting

Approximately 62% of households have outside lights powered by their mains electricity supply. Of these, almost half (47%) have 1 bulb and a further 37% have 2 or 3 bulbs. The most commonly-used type of bulb in outside lights was described as tungsten. This may indicate a preference for instant, brighter light for this purpose.

Manual switching is the most usual form of control with more than 60% of lights being switched manually. Almost half the lights have a movement sensor. These lights will be switched on at the main switch manually or by a timer, but will only be illuminated when movement is detected close by.

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1 Introduction

The main aim of the 2011 Energy Follow-Up Survey (EFUS) was to collect new data on domestic energy use, in order to update the current modelling assumptions about how energy is used in the home, and to inform energy efficiency policy. The 2011 EFUS consisted of a follow-up interview survey of a sub-set of households first visited as part of the 2010/2011 English Housing Survey (EHS). Additionally, sub-samples of these households were selected to have temperature loggers and electricity consumption monitors installed. A further stage of the EFUS was the compilation of gas and electricity consumption data from meter readings.

Analysis is based on the interview sample weighted to the national level, using a weighting factor specific to the interview sample. The results presented in this report are therefore representative of the English housing stock, with a population of 21.9 million households.

The EFUS contained a number of questions on ownership and use of lighting in three rooms of the house (living room, kitchen and main bedroom). Information on the length of time that particular sets of lights were in use was collected alongside data on the type of bulbs. Information was also collected on mains powered lights used outside the home.

This report provides the results of analysis of the section of the interview relating to use of lighting in the homes. This information is supplemented with data from the Meter Reading subsample of the survey. Electricity used to light the interior (and exterior) of dwellings is an important end use of energy, and is important to be understood to inform modelling and energy policy.

Key questions relating to lighting that are of particular interest for the development of energy modelling (including the key methodologies of SAP and BREDEM), and which may be able to be informed by the 2011 EFUS are:

- § What is the total length of time that key rooms in the house are lit?
- § What types of bulbs are in use?
- § How much energy can we estimate is being consumed in these rooms?
- § How common is outside lighting and how is it being used?

2 Methodology

The majority of results presented in this report use the data collected from the Lighting sections of the EFUS interview survey¹. Lighting in homes is a complex issue, and due to the limited time available for the EFUS, the amount of detail that could be recorded was necessarily constrained. For internal lighting, householders were asked about the lighting in the three main rooms in the house considered to be of most interest – in this case the living room, main bedroom and kitchen. They were also asked about any lights that were left on overnight, and about mains electricity powered external lighting.

For the main rooms householders were initially asked how many lights, or sets of lights, there were in each room. A set of lights was defined as a group of lights that could be operated by one switch. Table lamps and all electrically powered lights were included.

The householder was then asked about the number of bulbs in each set of lights (up to seven sets of lights could be recorded in each room). The householder was next shown a card with a list and photographs of different bulb types and asked to identify the type of bulb in each set of lights.

The householder was then asked about the time each set of lights was on. The questions covered weekdays, weekends and summer and winter. This question proved difficult for many households to answer for some sets of lights, and a relatively high number of unknown values were recorded. In the analysis presented here, use of these lights is assumed to be zero.

Additional questions were asked about lights left on overnight although timings were not recorded for these types of lights. Further questions were asked about outside lighting. Again, timings were not recorded for these types of lights.

2.1 Data quality

The raw outputs from the interview survey were generally complete (with the exception of the number of lit hours described above) and considered good quality. It should also be remembered that the analysis presented in this section is based on householders' *responses* to questions put to them in the EFUS 2011 Interview Survey rather than, for example, the number of hours of lighting being directly monitored, or the numbers and types of light bulbs being inspected by the interviewers.

An initial inspection of the histograms of the reported 'number of sets of bulbs' and 'number of bulbs per set' in each of the three main rooms and the derived 'total number of bulbs per room' showed that the distributions were positively skewed and therefore throughout this report, median values have been used to express central tendency. The 95% confidence intervals around the median value have been calculated following the 'notched' method described by McGill et al, 1978 using a value of 1.7 for the constant. A design factor of 1.1 has been used. Please refer to the EFUS 2011 Methodology report for further details of the design factor calculation.

¹ See the EFUS 2011 Methodology Report. The results in this report relate to responses given to questions q112 through to q127.

For all outputs, results which are based on an unweighted sample size of less than 30 have been highlighted with an asterisk (*) and should be treated as insufficiently robust for further analysis or reporting.

2.2 Weighting factors

The EFUS data have been scaled up to represent the national population (and to correct for non-response) using weighting factors. The results presented in this report are therefore representative of the English housing stock, with a population of 21.9 million households. See the EFUS 2011 Methodology report for further details of the weighting process.

3 Findings

3.1 Main rooms

Table 1 shows the occupants' responses to questions about the number of sets of lights in the living room, main bedroom and kitchen.

Table 1: Distribution of the numbers of sets of lights in living room, main bedroom and kitchen in households

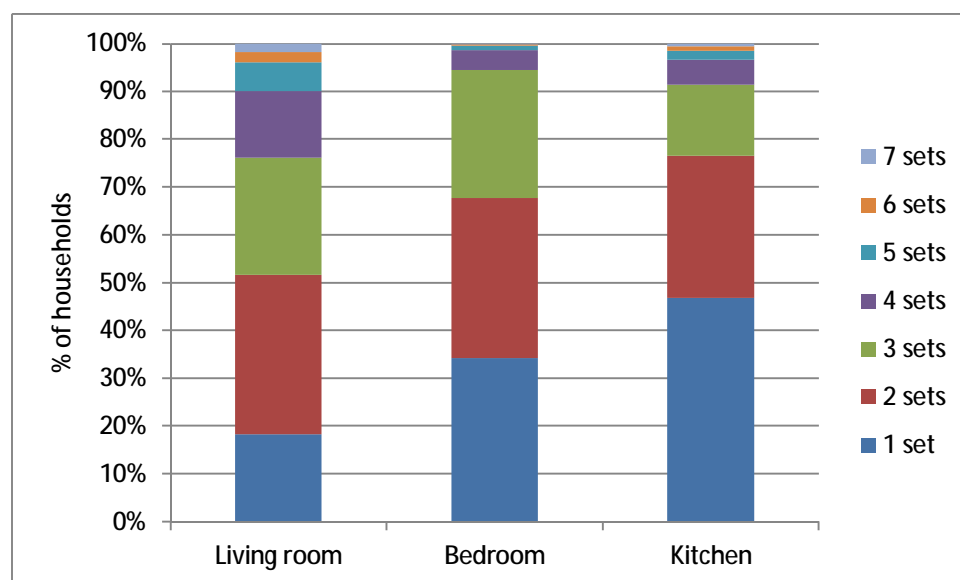
Number of sets of lights	Living room			Bedroom			Kitchen		
	Sample size	(%)	95% C.I.	Sample size	(%)	95% C.I.	Sample size	(%)	95% C.I.
1	487	18	(17, 20)	938	34	(32, 36)	1298	47	(45, 49)
2	873	33	(31, 35)	868	33	(31, 35)	750	30	(28, 32)
3	626	24	(23, 26)	653	27	(25, 29)	338	15	(13, 16)
4	347	14	(12, 15)	101	4	(3, 5)	122	5	(4, 6)
5	145	6	(5, 7)	22	*	*	42	2	(1, 2)
6	52	2	(2, 3)	6	*	*	24	*	*
7	38	2	(1, 2)	2	*	*	9	*	*

Base: All dwellings in the EFUS Interview Survey with a living room/bedroom/kitchen that is lit (n=2568/2590/2583).

* Sample responses are very small and subject to large sampling errors

In the main bedroom and kitchen, over 90% of households had between one and three sets of lights. Living rooms typically had more sets of lights, and 90% of households have up to four sets of lights in the living room (Figure 1).

Figure 1: Number of sets of lights in each of the three main rooms



Base: All dwellings in the EFUS Interview Survey with a living room/bedroom/kitchen that is lit (n=2568/2590/2583).

The median number of the bulbs for the first four sets of lights in each room is shown in Table 2 below. The first set of lights in the living room contains a median of 3 bulbs, the kitchen 2 bulbs, and the bedroom only 1 bulb.

Table 2: Distribution of the numbers of sets of lights in living room, main bedroom and kitchen in households

Light set number	Living room			Bedroom			Kitchen		
	Sample size	Median no. bulbs per set	95% C.I.	Sample size	Median no. bulbs per set	95% C.I.	Sample size	Median no. bulbs per set	95% C.I.
1	2568	3	(2.9, 3.1)	2590	1	(1, 1)	2583	2	(1.9, 2.1)
2	2081	1	(1, 1)	1652	1	(1, 1)	1285	2	(1.9, 2.1)
3	1208	1	(1, 1)	784	1	(1, 1)	535	2	(1.9, 2.1)
4	582	1	(1, 1)	131	1	(1, 1)	197	2	(1.9, 2.1)

Base: All dwellings in the EFUS Interview Survey with a living room/bedroom/kitchen that is lit (n=2568/2590/2583).

Combining the number of sets of lights, and the number of bulbs per set (for all sets), we can calculate the total number of bulbs per room (Table 3). The living room and kitchen have significantly higher median number bulbs per room than the bedroom.

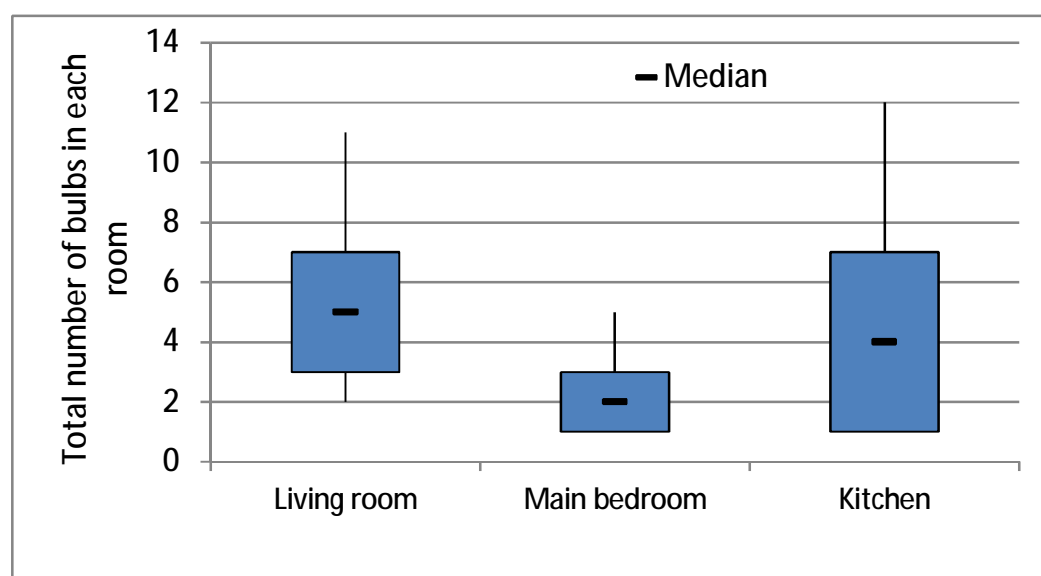
Table 3: Median number of sets of lights; bulbs per set; and total number of bulbs in each room

	Living room Sample size = 2568		Bedroom Sample size = 2590		Kitchen Sample size = 2583	
	Median	95% C.I.	Median	95% C.I.	Median	95% C.I.
Median total number of light bulbs in all sets in each room	5.0	(4.9,5.1)	2.0	(1.9,2.1)	4.0	(3.8,4.2)

Base: All dwellings in the EFUS Interview Survey with a living room/bedroom/kitchen that is lit (n=2568/2590/2583)..

The variability in the total number of bulbs per room can be seen in Figure 2, which shows a boxplot of the median, the interquartile range (box) and the 10th and 90th percentile (whiskers). The greatest variability is seen for the kitchen, where half of all households with a kitchen that is lit have between 1 and 7 bulbs in that room; half of all households with a living room that is lit have between 3 and 7 bulbs in that room and the variability is least in the bedroom where half of all households with a main bedroom that is lit have between 1 and 3 bulbs in that room.

Figure 2: Boxplot of the total number of bulbs in each of the three main rooms



Base: All dwellings in the EFUS Interview Survey with a living room/bedroom/kitchen that is lit (n=2568/2590/2583).

The householder was also asked about the types of bulb in each room, which are shown in Table 4. Both the bedroom and living room show a similar pattern in types of bulb in use, but the types of bulbs in use in the kitchen show a markedly different picture. Living rooms and bedrooms have approximately 40% of bulbs which are of the tungsten type (traditional light bulbs – not of a low-energy type) and approximately 30% that are low energy CFLs. However, in the kitchen about 50% of bulbs are halogen bulbs and 15% are fluorescent strip lights. Only about 15% are tungsten bulbs and 14% low energy bulbs in this room.

Table 4: Percentage that each bulb type reported to make up of the total number of bulbs in the living room, bedroom and kitchen

Type of bulb	Living room (%)	Bedroom (%)	Kitchen (%)
Standard tungsten bulb	43	38	15
Low energy CFL bulb	26	33	10
Low energy LED	6	5	4
Low energy -unknown type	4	4	2
Halogen bulb	15	16	50
Fluorescent strip	1	1	14
Mix of different types of bulb	1	1	2
Don't know (spontaneous only)	4	2	3
Total	100	100	100

Base: All dwellings in the EFUS Interview Survey with a living room/bedroom/kitchen that is lit (n=2568/2590/2583).

Table 5 shows the median number of hours each type of bulb was reported to be lit in summer and winter and during weekdays and at weekends.

Table 5: Median and 95% confidence intervals of the median number of hours per day each type of bulb is reported to be lit during summer and winter, weekday and weekend

Type of bulb	Summer weekday (hours)		Summer weekend (hours)		Winter weekday (hours)		Winter weekend (hours)	
	Median	95% C.I.	Median	95% C.I.	Median	95% C.I.	Median	95% C.I.
Standard tungsten bulb	3.0	(2.8, 3.2)	3.0	(2.8, 3.2)	6.0	(5.7, 6.3)	6.0	(5.6, 6.4)
Low energy CFL bulb	3.0	(2.9, 3.1)	3.0	(2.8, 3.2)	8.0	(7.7, 8.3)	8.0	(7.7, 8.3)
Low energy LED bulbs	2.0	(1.6, 2.4)	2.0	(1.4, 2.6)	5.0	(4.3, 5.7)	5.0	(4.2, 5.8)
Low energy bulbs – unknown type	2.0	(1.6, 2.4)	2.0	(1.5, 2.5)	5.0	(4.3, 5.7)	5.0	(4.3, 5.7)
Halogen	2.0	(1.9, 2.1)	2.0	(1.8, 2.2)	4.0	(3.7, 4.3)	4.0	(3.7, 4.3)
Fluorescent	2.0	(1.9, 2.1)	2.0	(1.9, 2.1)	4.0	(3.8, 4.2)	4.0	(3.8, 4.2)
Mixed types	2.0	(1.5, 2.5)	2.0	(1.5, 2.5)	4.0	(3, 5)	4.0	(3, 5)
Don't know (spontaneous only)	1.0	(0.5, 1.5)	2.0	(1.3, 2.7)	2.0	(1.1, 2.9)	3.0	(2.1, 3.9)

Base: Base: All dwellings in the EFUS Interview Survey with a living room/bedroom/kitchen that is lit (n=2568/2590/2583).. Where lighting hours could not be estimated by the householder zero hours were assumed, and results should be interpreted as a minimum number of hours. Hours of lighting were not reported for the first set of lights in between 5% and 35% of households (depending on the room and season).

The median number of hours per day for all bulb types is reported to be about 2 to 3 times as long in the winter as in the summer. For all bulb types there is no statistically significant difference in the reported hours for a weekday compared to a weekend day.

3.2 Overnight lights

Householders were also asked about any lights within their home that were left on overnight. 17% of households responded that lights were left on overnight in one or more rooms (Table 6). Of these, 92% left a light on in just one room and a further 7% in two rooms (Table 7).

Table 6: Percentage of households leaving any lights on overnight

Are there any lights inside the house (including corridors, halls and landings) that are typically left on overnight?	Sample size	% of households	
		(%)	95% C.I.
Yes	475	17	(15.6,18.7)
No	2141	83	(81.3,84.4)
Total	2616	100	

Base: All households in EFUS 2011 Interview Survey (n=2616)

Table 7: Number of rooms typically lit overnight

Number of rooms typically lit overnight	Sample size	% of households	
		(%)	95% C.I.
1	438	93	(90,95.2)
2	35	7	(4.4,9.4)
3	*2	*1	*(0,1.2)
Total	475	100	

Base: All households in EFUS 2011 Interview Survey leaving one or more lights on overnight (n=475)

* Sample responses for all other rooms not listed in the table are very small and subject to large sampling errors

Table 8 shows that the rooms in which lights were left on overnight are typically only the hallway/landing, bathroom with a WC or the second bedroom with nearly 40% of households who responded that they left lights on overnight doing so in the first hall/landing. Although not directly asked, it is assumed that this is likely to be for security reasons or for the comfort and safety of children or elderly people who may wake during the night.

Table 8: Percentage of households reporting that they leave lights on inside the house overnight, lighting this room

Room*	Sample size	% of households leaving any lights on overnight which light this room	
		(%)	95% C.I.
Bedroom 2	38	8	(5, 11)
Bathroom with WC 1	52	10	(7, 13)
Hall or landing 1	181	39	(34, 43)
Hall or landing 2	117	24	(20, 29)
Other	32	7	(5, 10)

Base: All dwellings in the EFUS Interview Survey leaving any lights on overnight (n=475)

For the households that leave lights on in either of the hall/landings overnight, just under 60% of them use low energy CFLs, a greater proportion than the overall number of low energy lights shown

in any of the main rooms (see Table 4). This may reflect that households value the energy savings these bulbs provide for this type of usage. However, just over 20% of households leaving lights on in hallways overnight still use tungsten bulbs.

3.3 Outside lights

Approximately 62% of households have outside lights powered by their mains electricity supply (Table 9). Of these, almost half (47%) have 1 bulb and a further 37% have 2 or 3 bulbs (Table 10). Table 11 shows that the most commonly-used type of bulb in outside lights was described as tungsten. This may indicate a preference for instant, brighter light for this purpose.

Table 9: Percentage of households with any outside lights

Are there any lights outside of your home that are powered from your electricity supply?	Sample size	% of households	
		(%)	95% C.I.
Yes	1613	62	(60,64)
No	1003	38	(36,40)
Total	2616	100	(100,100)

Base: All households in EFUS 2011 Interview Survey (n=2616)

Table 10: Number of bulbs in outside lights

Number of bulbs in the outside lights	Sample size	Percentage of households with outside lights (%)	
		(%)	95% C.I.
Don't know	*4	*0	*
None	*5	*0	*
1	784	47	(45,50)
2	413	25	(23,27)
3	180	12	(10,13)
4	88	6	(5,8)
5	50	3	(2,4)
6+	89	6	(5,7)
Total	1613	100	(100,100)

Base: All households in EFUS 2011 Interview Survey with outside lights (n=1613).

* Sample responses for all other rooms not listed in the table are very small and subject to large sampling errors

Table 11: Types of bulb used in outside lights

Bulb type	Sample size	Percentage of households with outside lights (%)	
		(%)	95% C.I.
Standard tungsten	504	32	(29, 34)
CFL	302	19	(17, 21)
LED	31	2	(1, 3)
Low energy -unknown type	39	3	(2, 3)
Halogen	297	19	(16, 21)
Fluorescent	50	3	(2, 4)
Mix of types	190	12	(11, 14)
Don't know	200	11	(10, 13)
Total	1613	100	

Base: All dwellings in the EFUS Interview Survey with outside lights (n=1613).

Table 12 shows the different types of controls used for these lights. Householders were allowed to pick more than one type of control and so, for instance, it is possible to have lights with a movement sensor that are manually switched on each evening and off in the morning.

Table 12: Controls used with outside lights – percentage of households responding yes to a particular control

Control type	Sample size	Percentage of households with outside lights ¹ (%)	
		(%)	95% C.I.
Have light level sensor to come on when dark	217	13	(12, 15)
Have movement sensor	729	46	(44, 49)
Have timer	41	3	(2, 3)
Manual switch	986	61	(58, 64)
Permanently on	*10	*1	*(0, 1)
Other	*17	*1	*(1, 1)

Base: All dwellings in the EFUS Interview Survey with outside lights (n=1613).

¹ Options could be multi-coded hence total does not equal 100%.

* Sample responses for all other rooms not listed in the table are very small and subject to large sampling errors

Manual switching is the most usual form of control with more than 60% of lights being switched manually. Almost half the lights have a movement sensor. These lights will be switched on at the main switch manually or by a timer, but will only be illuminated when movement is detected close by.

4 Conclusions

Lighting in the main rooms

- § 90% of main bedrooms and kitchens have between 1 and 3 sets of lights (a set of lights being defined as those accessed by a single switch). Living rooms typically have more sets of lights, with 90% of households having up to four sets of lights in this room.
- § The living room and kitchen have significantly higher median numbers of bulbs per room than the bedroom (the median number of bulbs in each room are 5, 4 and 2, respectively).
- § In the living room and main bedroom approximately 40% of light bulbs are tungsten (traditional light bulbs – not of a low-energy type), and 30% low energy compact fluorescents (CFLs). In the kitchen however, halogen bulbs (50%) and fluorescent strip lighting (15%) are the dominant type of lighting.
- § Considering all sets of lights, lights are on for about 2 to 3 times as long in winter as summer (typically 5-8 hours per day in the winter compared to 2-3 hours per day in the summer). Median weekday and weekend reported use is very similar.

Overnight lighting

- § 17% of households left lights on in one or more rooms overnight. Of these households, 92% report leaving a light on in just one room and a further 7% in two rooms. The rooms in which lights were left on overnight are typically only the hallway/landing, bathroom with a WC or the second bedroom with nearly 40% of households who responded that they left lights on overnight doing so in the first hall/landing. Although not directly asked, it is assumed that this is likely to be for security reasons or for the comfort and safety of children or elderly people who may wake during the night.
- § For the households that leave lights on in either of the hall/landings overnight, just under 60% of them use low energy CFLs, a greater proportion than the overall number of low energy lights shown in any of the main rooms. This may reflect that households value the energy savings these bulbs provide for this type of usage. However, just over 20% of households leaving lights on in hallways overnight still use tungsten bulbs.

Outside lighting

- § Approximately 62% of households have outside lights powered by their mains electricity supply. Of these, almost half (47%) have one bulb and a further 37% have two or three bulbs. The most commonly-used type of bulb in outside lights was described as tungsten. This may indicate a preference for instant, brighter light for this purpose.
- § Manual switching is the most usual form of control with more than 60% of lights being switched manually. Almost half the lights have a movement sensor. These lights will be switched on at the main switch manually or by a timer, but will only be illuminated when movement is detected close by.