# The Energy Follow Up Survey (EFUS)

Summary of key findings from the survey

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**Part of the BRE Trust**

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## Presentation structure

1) Objectives of survey

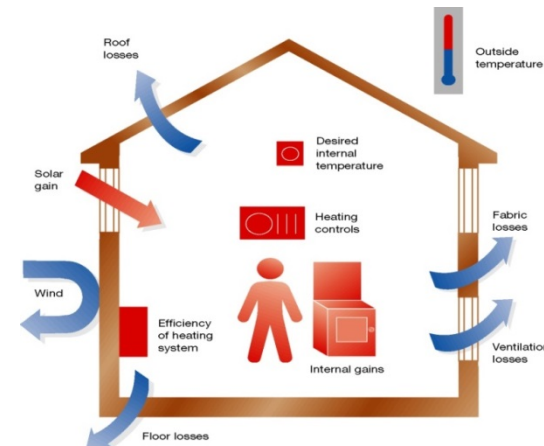2) Structure of survey

3) Key findings

# Objectives of study

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## Introduction

– The Energy Follow-Up Survey 2011 was large survey to collect new data on patterns of household and dwelling energy use in order to update the current modelling assumptions about how energy is used in homes.

  - National Calculation Methods (SAP and BREDEM)
  - Informing policies of Department of Energy and Climate Change.

– EFUS 2011 comprised an interview survey, meter readings and placement of temperature loggers and electricity consumption meters in sub-set of households.

– This was then supplemented by in-situ wall U-value measurements in further homes.

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## SAP and BREDEM

– SAP (Standard Assessment Procedure) is the UK Government's approved system for energy rating of dwellings.

– It is used as basis for EPCs
  - Fixed conditions
  - Allows comparisons on like-for-like basis

– BREDEM (BRE Domestic Energy Model) is the more flexible methodology underpinning SAP and the majority of other energy models in use in the UK

# Structure of the survey

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## Follow-up survey

- EFUS is a follow-up to the English Housing Survey (EHS)

- EHS is a large national survey (6,000 per annum) of physical condition of dwellings in England, and characteristics of their households.

  - EPC for each home
  - Income, household type etc.
  - National statistical survey: representative.

- Follow-up and revisit:

  Offers significant additional value: do not need to re-collect physical data or all household data

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## The Household Interview (2,616 cases)

- Ownership

- Patterns of use

    – Heating
    – Appliances
    – Cooking
    – Cooling
    – Lighting
    – Conservatories

# EFUS monitoring

- Internal temperature (3 rooms)
  - Every 20 minutes for 1 year
  - 823 households

- Gas and electric meter readings
  - 1,345 households

- Electricity monitoring
  - Every 10 seconds
  - 6 to 9 months data
  - 79 households

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## U-values monitoring

– A follow-up to the follow-up survey!

– Direct measurement of wall U-values

- Measurements for two weeks
- Heat flux transducer, thermistor sensors, loggers.
- Allows determination of wall U-values
- 300 properties of different wall types.
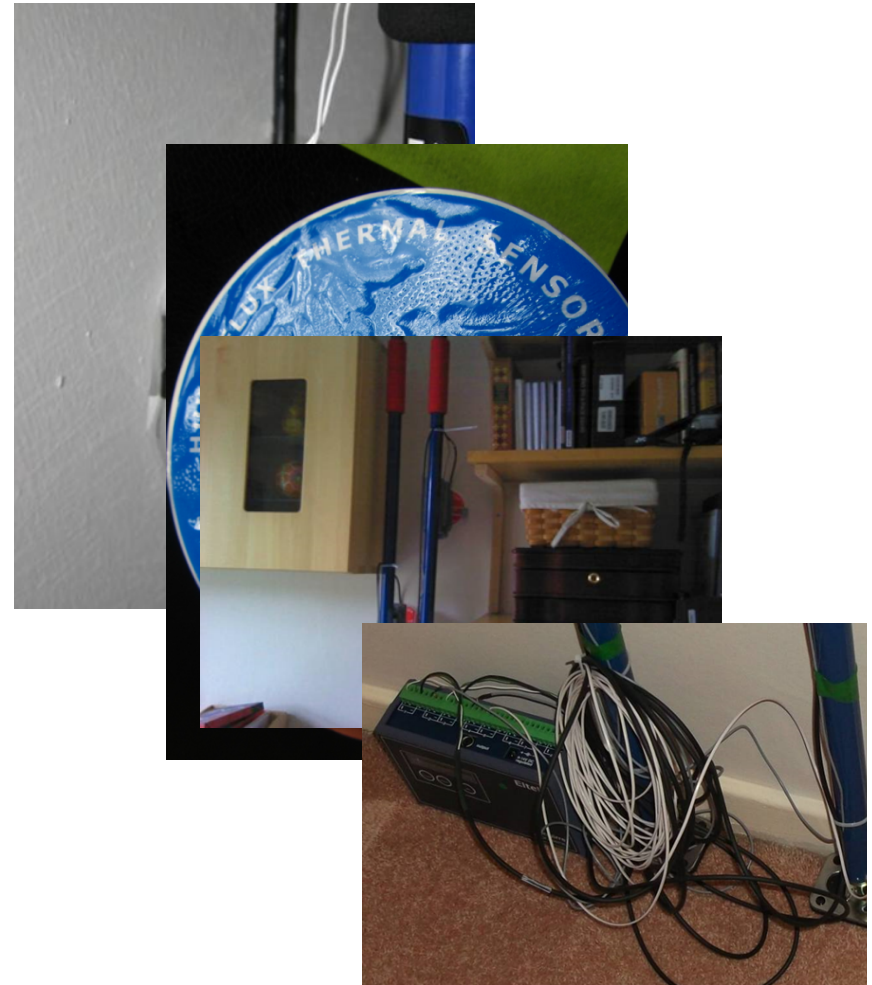
# Summary of key results

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# Key results presented today

1. Heating
   - Main heating patterns
   - Internal temperatures
   - Conservatory heating

2. U-values
   - Results from U-values studies
   - Follow-up and future work

   -

# Heating patterns summary

| | | Sample size | Temperature logger data | Sample size | Householder reported interview data – regular heaters only |
|---|---|---|---|---|---|
| | | | Median | | Median |
| All households | All days | 823 | 9.4 | 1873 | 8.7 |
| | Weekdays | | 9.0 | | 8.0 |
| | Weekends | | 10.0 | | 8.3 |
| Centrally heated households | All days | 754 | 9.3 | 1715 | 8.6 |
| | Weekdays | | 9.0 | | 8.0 |
| | Weekends | | 10.0 | | 8.0 |
| Non-Centrally heated households | All days | 69 | 12.9 | 158 | 13.0 |
| | Weekdays | | 12.5 | | 13.0 |
| | Weekends | | 13.0 | | 13.0 |

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## Some key findings from heating

– Standard assumptions are 16 hours heating at weekend, 9 on weekdays.

– We found 8-9 hours on all days.
- From both reported and temperature data.
- Mirrors findings from similar surveys.

![bre logo]

# Mean 24hr temperatures:
## Comparison of SAP to mean EFUS temperatures

**Living room**

**Other rooms**

| | SAP 2009 mean internal temperatures for 'typical' semi-detached house (°C) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| Zone 1 | 18.7 | 18.9 | 19.2 | 19.6 | 20.1 | 20.6 | 20.9 | 20.8 | 20.4 | 19.8 | 19.2 | 18.8 |
| Zone 2 | 17.4 | 17.5 | 17.9 | 18.3 | 18.8 | 19.2 | 19.4 | 19.4 | 19.1 | 18.5 | 17.8 | 17.5 |
| Z1- Z2 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.4 | 1.5 | 1.4 | 1.3 | 1.3 | 1.3 | 1.3 |
| | Mean temperatures determined from EFUS 2011 data (°C) | | | | | | | | | | | |
| Zone 1 | 19.0 | 19.0 | 20.0 | 20.0 | 20.9 | 21.4 | 21.5 | 20.8 | 20.1 | 19.3 | 18.6 | 18.7 |
| Zone 2* | 18.5 | 18.7 | 20.0 | 19.9 | 21.0 | 21.5 | 21.5 | 20.6 | 19.8 | 18.8 | 17.9 | 18.1 |
| Z1- Z2 | 0.6 | 0.3 | 0 | 0.1 | -0.1 | -0.1 | 0 | 0.1 | 0.3 | 0.5 | 0.6 | 0.6 |

Predicted zone1/zone2 temperature difference in SAP larger than the mean difference seen in EFUS data for winter months.
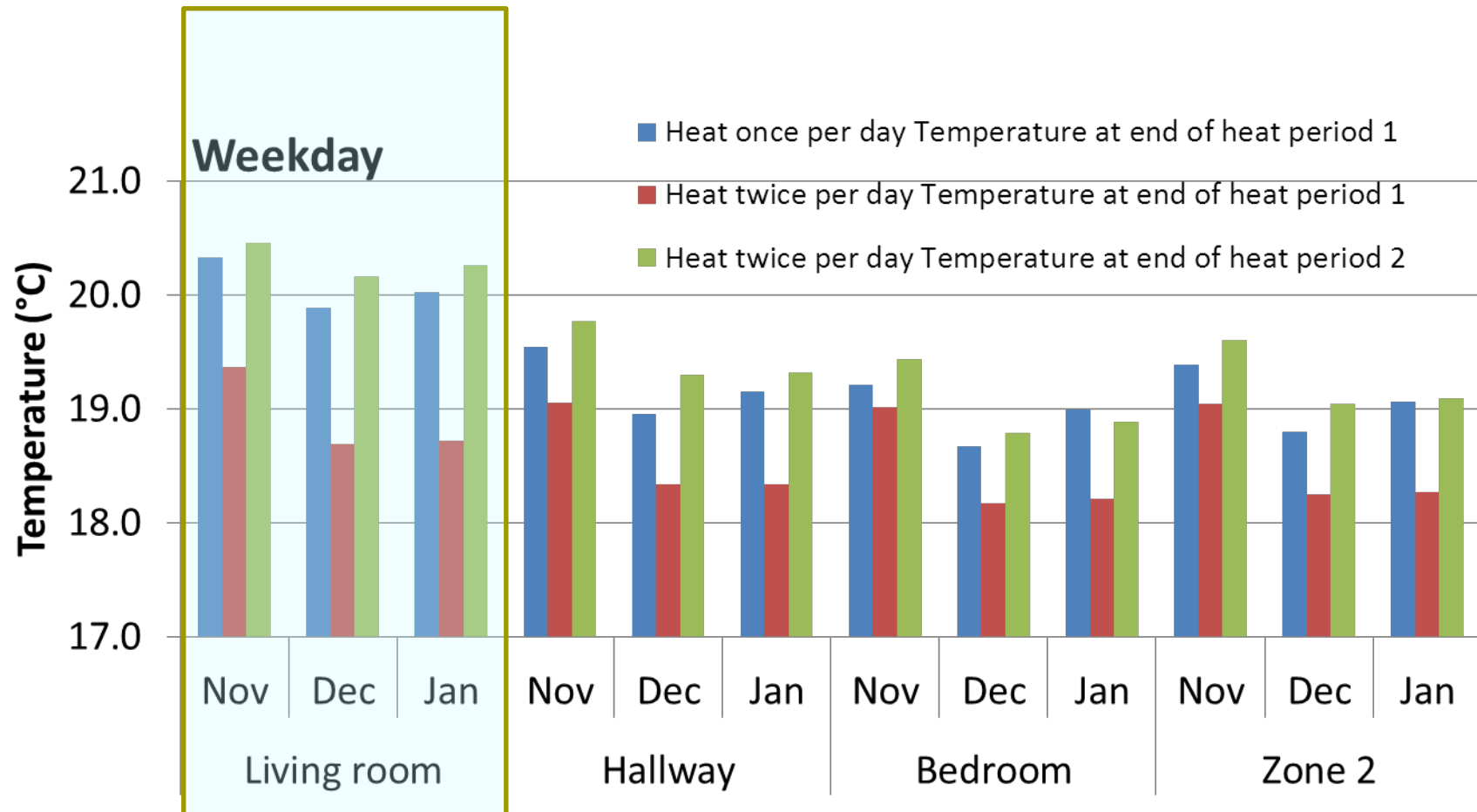
# Demand temperatures

| All households | SAP demand temperature | EFUS 2011 data (achieved at end of heating period) | Difference |
|---|---|---|---|
| | | Mean | |
| Living room (Zone 1) | 21⬚C | 20.2⬚C | -0.8⬚C |
| Zone 2 | 18⬚C | 19.1⬚C | +1.2⬚C |

| | Characteristic category | N (raw sample size) | Mean temperature (⬚C) |
|---|---|---|---|
| Age of householder (HRP) (years) | 16 - 34 | 70 | 19.7 |
| | 35 - 44 | 125 | 19.7 |
| | 45 - 54 | 187 | 19.8 |
| | 55 - 64 | 181 | 20.1 |
| | 65 - 74 | 171 | 20.8 |
| | 75 or more | 89 | 21.7 |

# Conservatories

- Conservatories are generally not considered as sources of heat loss

- EFUS suggests heating of conservatories is normal.

- **18%** of households in England have conservatories.

- Around **77%** of conservatories have heating.

- In winter, **56%** of conservatories with heating are heated every day in the winter.
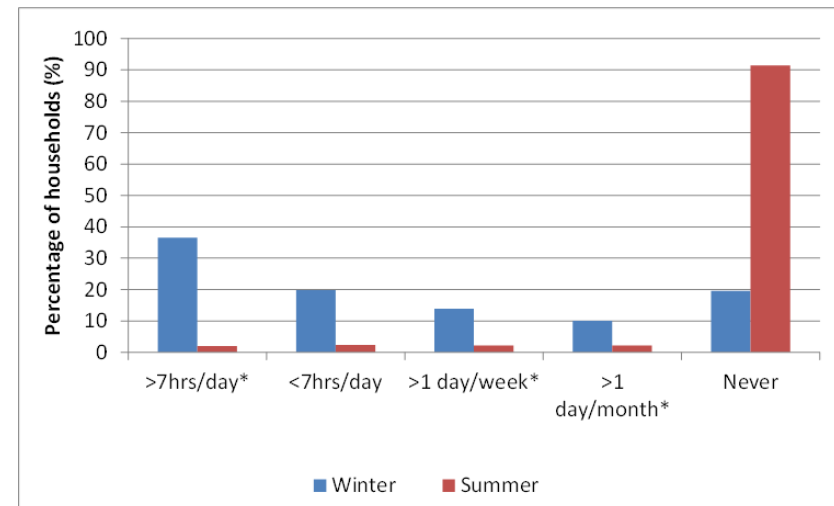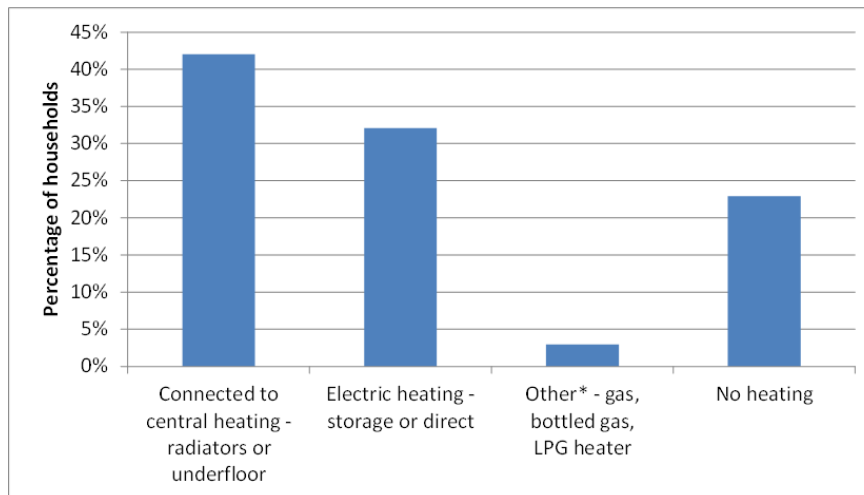
# U-values

| Wall type | Number of cases | Typical RdSAP U-values W/m²K | Measured U-values: mean W/m²K* | Difference to typical RdSAP value |
|---|---|---|---|---|
| Solid wall, standard[b] | 85 | 2.1 | 1.57 | -25% |
| Solid wall, non-standard[b] | 33 | 2.1 | 1.28 | -39% |
| Uninsulated cavity | 50 | 1.6 | 1.38 | -14% |
| Insulated cavity | 109 | 0.5 | 0.67 | +34% |



Measured U-values for standard solid walls
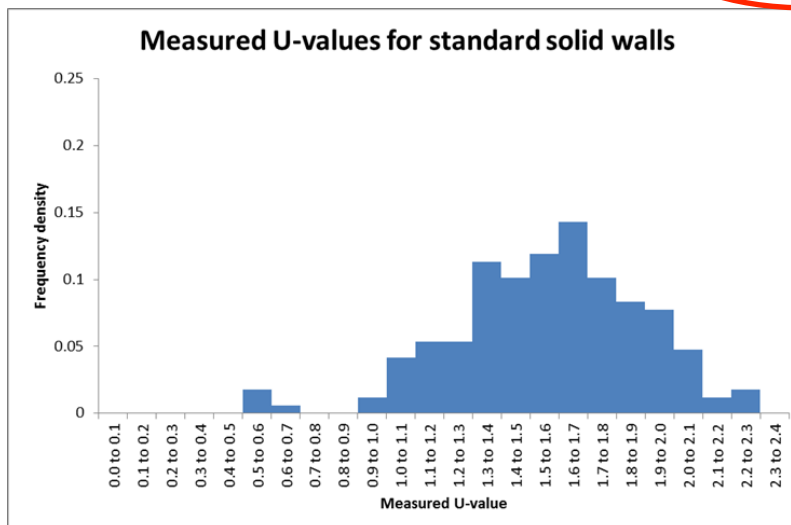
Default U-values are significantly different to reality.

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## U-values follow-up (Work In Progress)

Much more detailed work ongoing relating to solid walls

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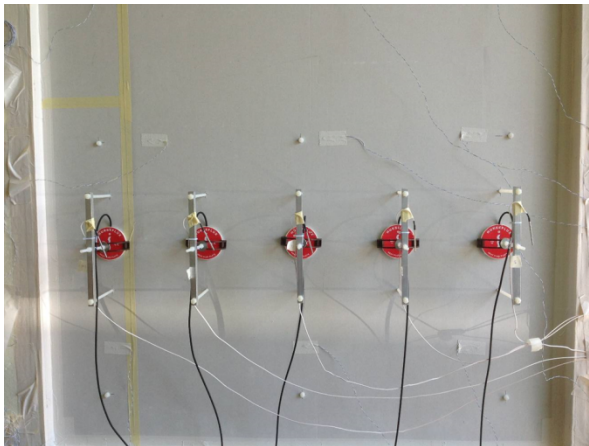
## Future work

Ongoing analysis and learning from EFUS.

- Working with SAP and BREDEM teams and others.

Long lead time to these projects. Survey prior to 2011 EFUS was 1998.

- A need to consider data collection in the future.

- Keen on extending this type of work to other nations (Horizon 2020 etc.)

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## Find out more:

**EFUS:**

https://www.gov.uk/government/statistics/energy-follow-up-survey-efus-2011

**U-values:**

https://www.gov.uk/government/publications/in-situ-measurements-of-wall-u-values-in-english-housing

**Ongoing solid wall work:**

http://www.bre.co.uk/swi

**Or email me:**

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