



# Report on the outcomes of the C.H.E.E.S.E. Project

Covering Phase 2 (2016/17) and Phase 3 (2017/18)

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## Executive summary

This report analyses action taken by householders to reduce heat loss from homes during the winters of 2016/17 and 2017/18 (Phases 2 and 3 of the project), according to recommendations made by their CHEESE thermal-imaging surveyor. Of 111 householders for whom remedial data was collected at one month (Phases 2 and 3 combined), 72 paid, and 39 received a free survey.

Satisfaction with the surveys was high. Phase 3 householders were asked one month after the survey to rank, on a range from 1 (poor) to 5 (excellent), the usefulness of the survey recording, conduct of the surveyor, value for money and overall satisfaction. The mean score was 4.6 and the mode (the score most often selected) was 5. Ranking for the usefulness of the CHEESE box loaned to Phase 3 householders (containing thermometers, mains and socket electricity monitors and a Haynes Eco-house manual) yielded a score of 3.1. In this case, responses were less consistent but the mode was still 5. Reasons for lower scores included previous use of energy monitors, already had a smart meter, and lack of available time to use the meters or read the manual. Customer testimonials support this positive feedback.

Low-cost remedial action (cost £250 or less, usually DIY) consisted mainly of draught proofing, sealing of cracks or holes, simple insulation jobs (e.g. loft hatch), film double glazing and changing to LED lights. High-cost changes (cost greater than £250, likely to require a contractor) consisted of larger areas of insulation (wall, floor or loft), replacement or refitting of windows and/or doors, secondary glazing, boiler or solar PV installation. By one month, a total of 64% of the 111 respondents in Phases 2 and 3 had taken low-cost remedial action and 17% had taken high-cost action. The extent of remedial work completed at one month was broadly similar in Phases 2 and 3, but somewhat fewer householders took high-cost action in Phase 3 (13% vs 22%). Remedial work completed by one year after a survey was determined by collating questionnaires returned by 50 Phase 2 householders at one month and 10 Phase 2 householders at one year. This revealed that 68% (34/50) had taken low cost action and 32% (16/50) had taken high cost action by one year. Actions additional to those completed at one month had been taken, but the overall number of householders who had taken action hardly increased.

Actions taken by paid-survey householders and free-survey householders were recorded separately. Paid-survey householders took more actions than free-survey householders, but most free-survey householders were in rented property and some were still waiting at one year for landlords (private, council or housing association) to implement recommended changes. Other reasons why changes had not been made included illness, time constraints, expense and changes to be part of a larger future renovation.

Behavioural changes since the survey which may save energy were also sought in one year questionnaires. Changes recorded concerned appliance use, such as more efficient use of kettle or washing machine; or heat conserving measures, such as keeping doors closed, change in use of space, turning the thermostat down or closing curtains.

Householders were asked to provide energy consumption figures (usually gas and electricity) for the year before and the year after the survey so energy saving could be assessed. Unfortunately insufficient numbers of householders returned energy consumption figures in the one-year follow-up questionnaires for meaningful analysis. Reliable data on energy consumption will thus not be available at least until the end of the 2018-2019 season.

# Introduction

## Outline of the data used in the report

This report analyses the outcomes in terms of remedial action and behaviour change over two years of the CHEESE Project:

- During the 2016-2017 survey season (Phase 2), one-month and one-year after a survey;
- During the 2017- 2018 survey season (Phase 3) one month after a survey (one year responses for Phase 3 will not be due until winter 2018-2019).

Survey satisfaction scores were also collected.

The data from the one-month feedback from Phase 2 and Phase 3 of the project was recorded and collected by the energy tracers in person. The data from the one-year feedback survey from Phase 2 of the project was collected by the author over the phone.

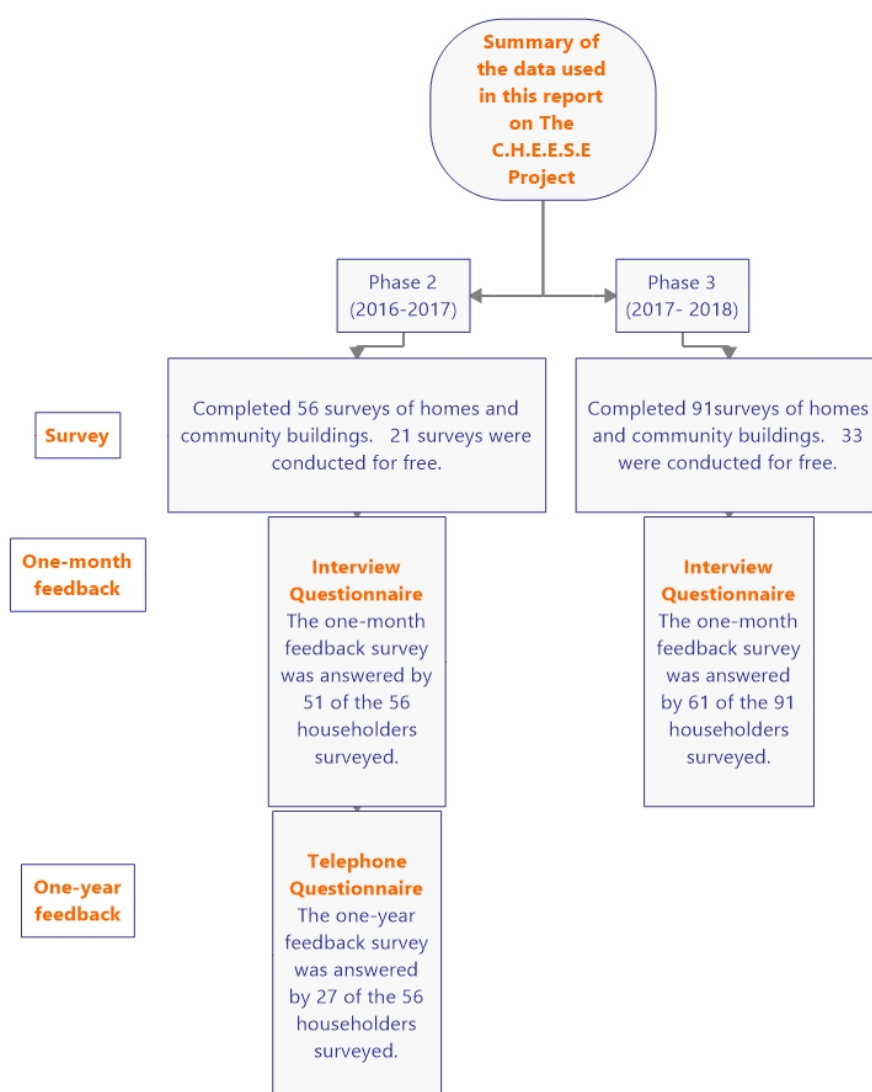


Figure 1: Flow diagram showing the data analysed in this report and the response rate for each feedback survey.

## **Background on the CHEESE Project**

The C.H.E.E.S.E. Project (Cold Homes Energy Efficiency Survey Experts, or TCP) began on 1st November 2014 as part of the Bristol Energy Network (BEN). It was formally founded as a separate Unincorporated Association on 17<sup>th</sup> August 2016, governed by a five-member volunteer Management Committee working to a formal constitution adopted on the same date. TCP became a Community Interest Company (CIC) on 14<sup>th</sup> February 2018.

During the winter of 2016/17 (November to April), the not-for-profit project completed 56 surveys of homes and community buildings. 21 Surveys conducted for free for low-income homes were in part subsidised by the fees charged for the paid surveys (paid householders). The surveys were carried out by Brian Harper or by pairs of surveyors trained by Brian, some being representatives of other community interest groups such as Re: work and Ambition Lawrence Weston.

The survey process is based on a unique methodology developed by Brian Harper, who has been working in thermal imaging for 45 years and has surveyed over 400 homes. Brian's methodology has been adapted by the project to be delivered with low-cost equipment and bespoke software by Jeremy Birch. Surveys are carried out by trained Energy Tracer (ET) surveyors.

Before the survey, a large extractor fan is fitted to an external door and run continuously to reduce pressure inside the house. This causes cold air to be drawn in through any cold gaps in the home. During the survey a thermal-imaging camera attached to an iPhone 5s is used to look for cold spots in the homes. Many cold spots are caused by draughts and are exaggerated by the fan to be made clear on a thermal image. Other cold spots can be caused by cold bridging due to construction faults or poor quality remedial work by contractors, etc.

The householder, accompanied by two surveyors, is able to see first-hand on a WiFi-linked tablet computer how heat moves around the home and where it is lost. The entire survey is recorded as a video on an iPhone, with audio of the surveyor's commentary and of any discussions between the householder and surveyor.

Following the survey, a briefing is carried out with the householder on the main problems that were identified and how they might be remedied. The householder is also loaned for at least one month a CHEESE Box with items that are expected to help reduce the householder's energy consumption by bringing about behaviour change.

## Testimonial analysis from feedback

Householders were asked for their overall feedback on TCP. The word cloud below summarises the words that were used in the feedback, with larger words being used frequently. The word cloud is based on results from 51 of the 56 householders that answered the one-month feedback survey and 27 of the 56 householders that answered the one-year feedback survey.



Figure 2: Word cloud drawn from testimonials from one-month and one-year feedback surveys (Phase 2).

## The CHEESE Box

Included in the CHEESE Box is a USB stick with recorded survey audio and video, a Haynes 'Eco-house Manual', a total electricity consumption logging meter, a socket meter, which can measure the energy used by different appliances, and two thermometers for measuring inside and outside temperature. The latter can be used to correlate energy used for heating with outside temperature.

Householders from Phase 3 of TCP were asked to rank how useful they found the CHEESE Box (1: least, to 5: most) in the one-month, Phase 3 survey feedback and were also asked to explain their score. Three of the householders that responded to this question received the survey for free. The other 15 respondents paid for the survey.

The CHEESE Boxes received a mean satisfaction score of 3.1. However, most people gave a usefulness score of 5 when the mode for the results was calculated.

Item	Paid survey	Free survey
All items	2	
Energy meter	3	
Haynes Eco manual	2	1
Socket monitor	2	
Thermometers	1	
USB stick and video	1	

Table 1: Items paid and free householders liked the most in the CHEESE Box (Phase 2).

Item	Paid survey	Free survey
All items	3	2
Energy meter	16	1
Haynes Eco manual	4	2
Socket monitor	7	1
Thermometers	2	1
USB stick and video	3	

Table 2: Items paid and free householders liked the most in the CHEESE Box (Phase 3).

Respondent	CHEESE box usefulness score	Reason stated for score
1 (Paid)	1	Did not use as already aware of electricity use.
11 (Paid)	1	Already had used the monitors. Found the socket monitor did not work.
16 (Paid)	1	No reason.
43 (Paid)	2	Already have a smart meter. Could not use socket monitor because it did not fit with sockets. Thought book could be useful but did not read it.
45 (Free)	1	Did not have time to use the energy meter.
48 (Paid)	1	Only used electricity meter.
56 (Free)	2	Already had an energy meter.
59 (Paid)	2	Only used the plug meter with the kettle.

Table 3: The lower CHEESE Box satisfaction scores from paid and free surveys.

## Analysis of remedial work

Changes are recommended to the householder following a survey by the ETs. Householders are asked to complete questionnaires at one month and one year after the survey. Remedial action taken was recorded in terms of numbers of householders who took remedial action (Table 4) and types of action taken (low or high cost, see Figures Figure 3 to Figure 13).

This section analyses the answers to the remedial work questionnaire at one-month (Phase 2 and Phase 3) and one year (Phase 2).

The one-month survey results from Phase 2 are based on the 51 householders that answered the one-month feedback questionnaire of the 56 households that were surveyed. The one-year survey results from Phase 2 are based on the 27 householders that answered the one-year feedback questionnaire.

The Phase 3 results are based on the 61 householders that answered the one-month feedback survey of the 91 people surveyed.

The remedial work has been divided into two categories of cost and complexity:

- **Low-cost:** costs around £250 or less and can be implemented by a competent DIY person.
- **High-cost:** costs more than £250 and likely to require a specialist installer.

## Remedial action by household

Actions taken by paid and free householders were recorded separately and are shown for Phases 2 and 3 in Table 4. When data at one month for Phases 2 and 3 were combined (111 householders) 64% had taken low cost remedial action and 17% high cost action. The number of householders taking action was broadly similar in Phases 2 and 3 except that fewer took high cost action in Phase 3 (13% vs 22%).

By one year 68% of householders had taken low cost action and 32% had taken high cost action. Of householders responding at one year, 90% (9/10) had taken low cost action not completed at one month and 50% (5/10) had taken high cost action, though not all had taken all actions they said were planned at one month. Because of the low number of householders completing the questionnaire at one year compared with one month, the results at one year may be an underestimate of overall remedial work completed.



Phase 2				Phase 3			
<b>Households at 1 month</b> 50 respondents (32 paid, 18 free)				<b>Households at 1 month</b> 61 respondents (40 paid, 21 free)			
Low cost		High cost		Low cost		High cost	
Paid	Free	Paid	Free	Paid	Free	Paid	Free
24/32	6/18	8/32	3/18	27/40	14/21	8/40	0/21
(75%)	(33%)	(25%)	(17%)	(68%)	(33%)	(20%)	(0%)
<b>Additional households at 1 year</b> 10 respondents (8 paid, 2 free)							
Low cost		High cost					
Paid	Free	Paid	Free				
3/8	1/2	4/8	1/2				
<b>Total households at 1 year</b>							
Low cost		High cost					
Paid	Free	Paid	Free				
27/32	7/18	12/32	4/18				
(82%)	(39%)	(38%)	(22%)				

Table 4: Number of households that had taken remedial action at one month and one year after their survey.

## Types of remedial action taken: Phase 2, one month

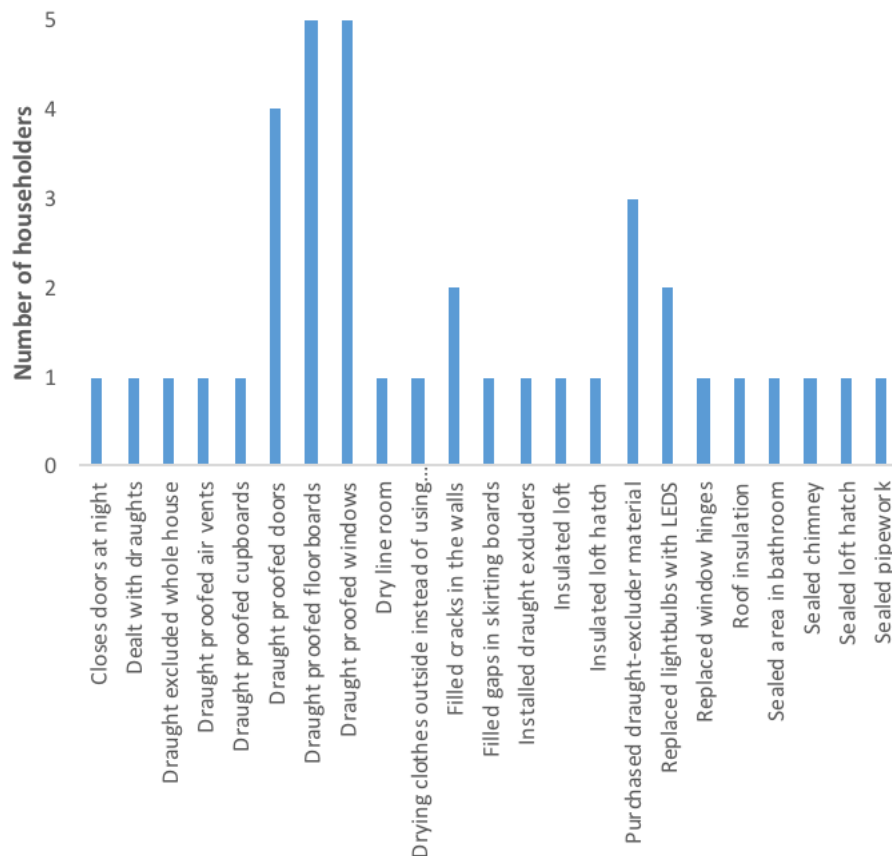


Figure 3: Low-cost changes made by paid-survey householders as recorded in the one-month feedback (Phase 2).

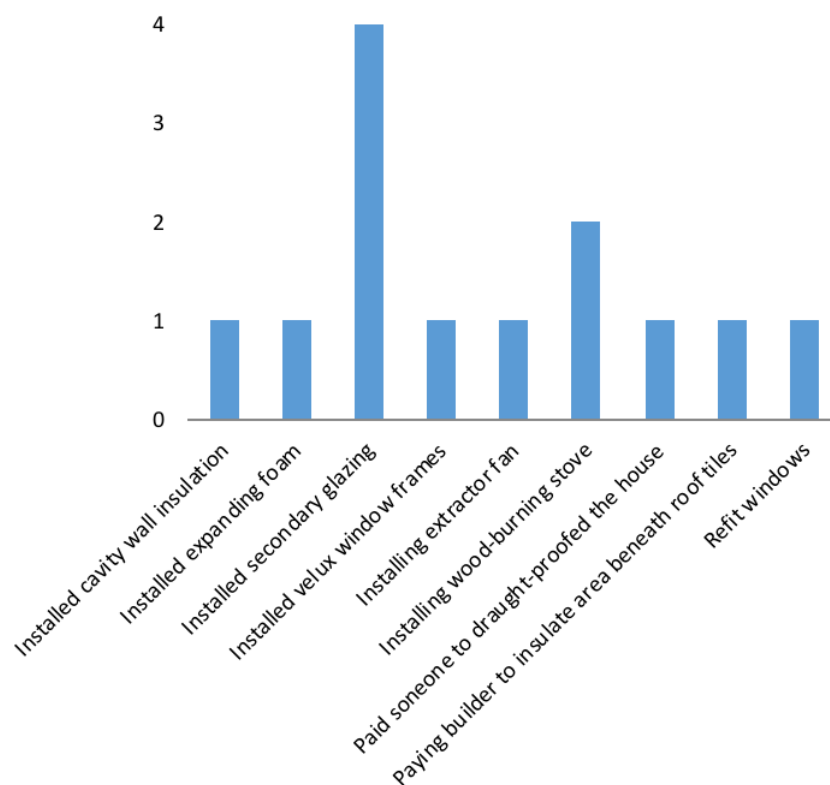


Figure 4: High-cost changes made by paid-survey householders as recorded in the one-month feedback (Phase 2).

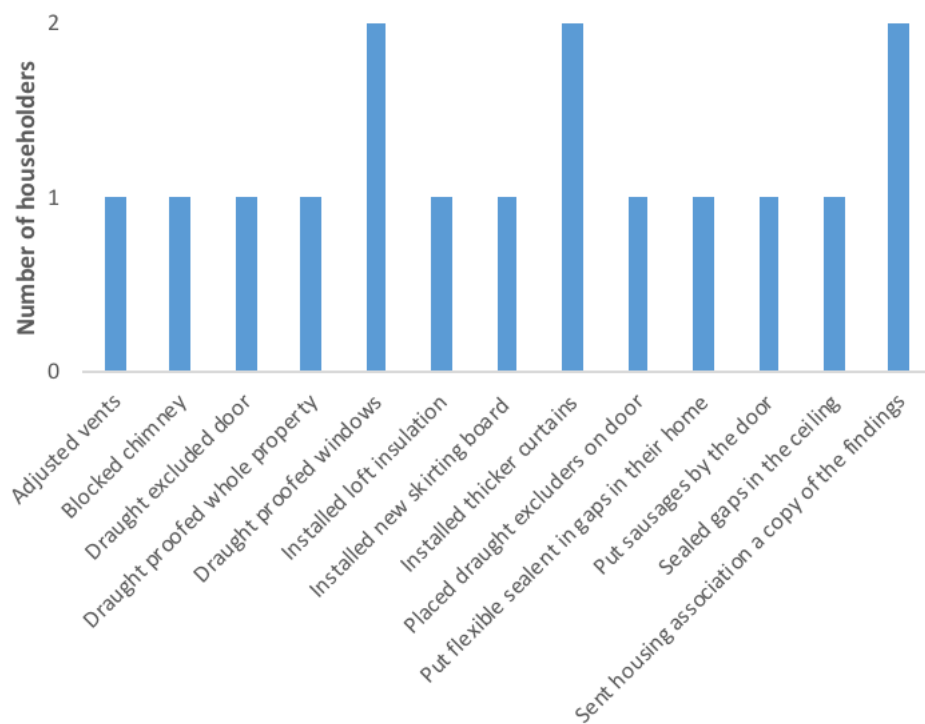


Figure 5: Low-cost changes made by free-survey householders as recorded in the one-month feedback (Phase 3).

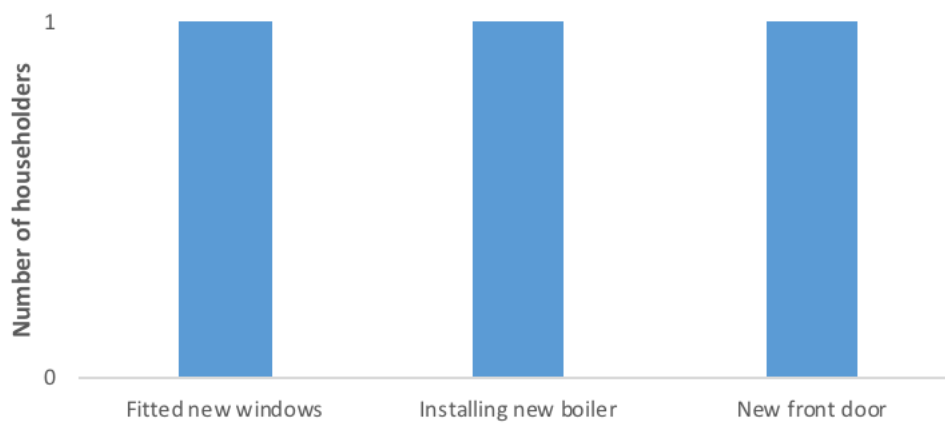


Figure 6: High-cost changes made by free-survey householders as recorded in the one-month feedback (Phase 3).

## Types of remedial action taken: Phase 3, one month

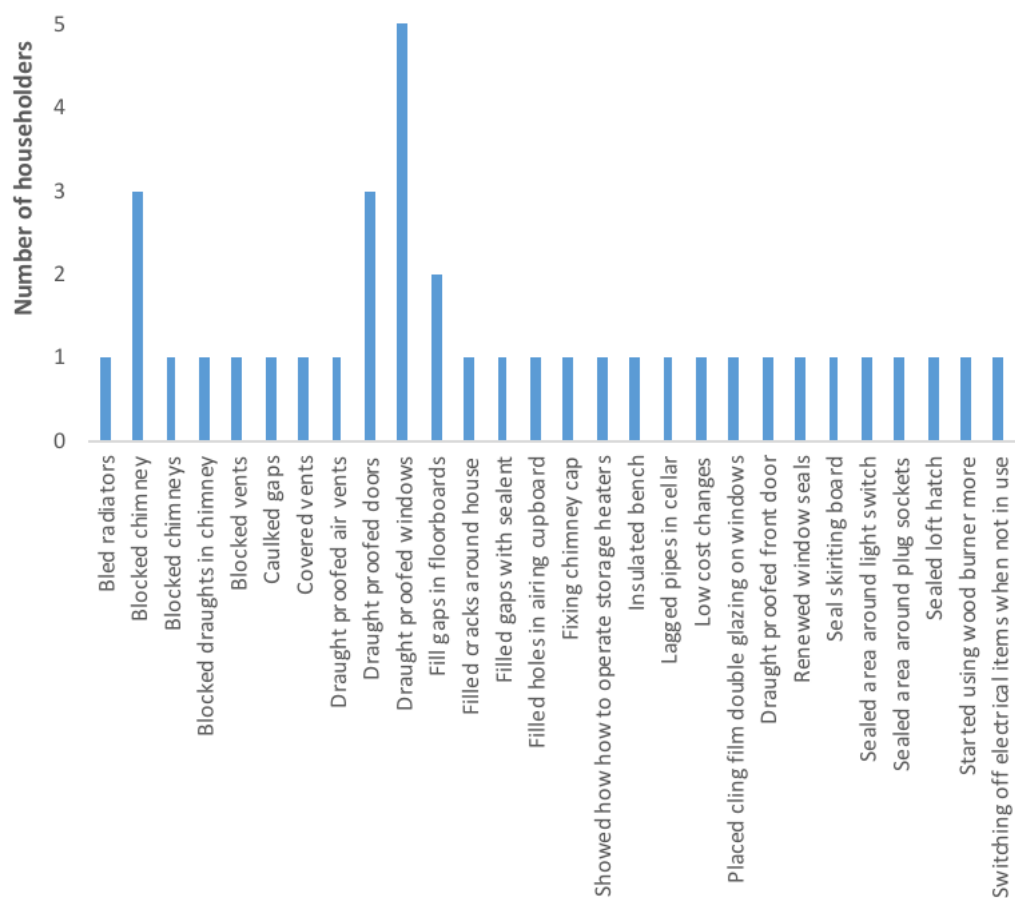


Figure 7: Low-cost changes made by paid-survey householders as recorded in the one-month feedback (Phase 3).

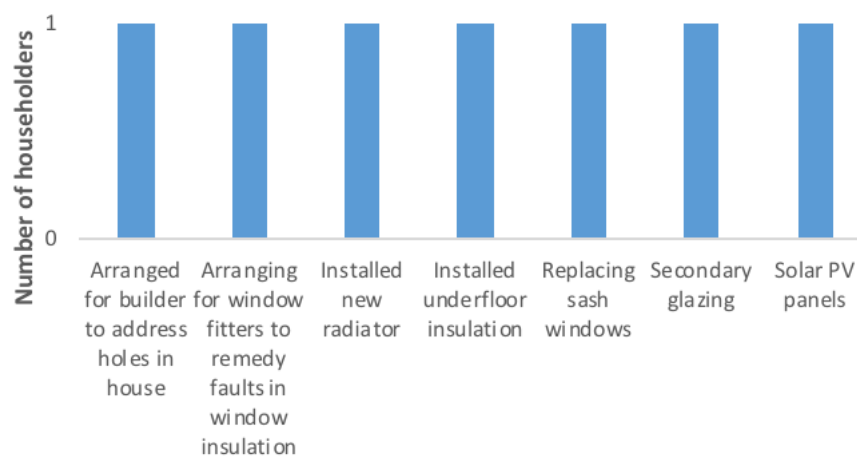


Figure 8: High-cost changes made by paid-survey householders as recorded in the one-month feedback (Phase 3).

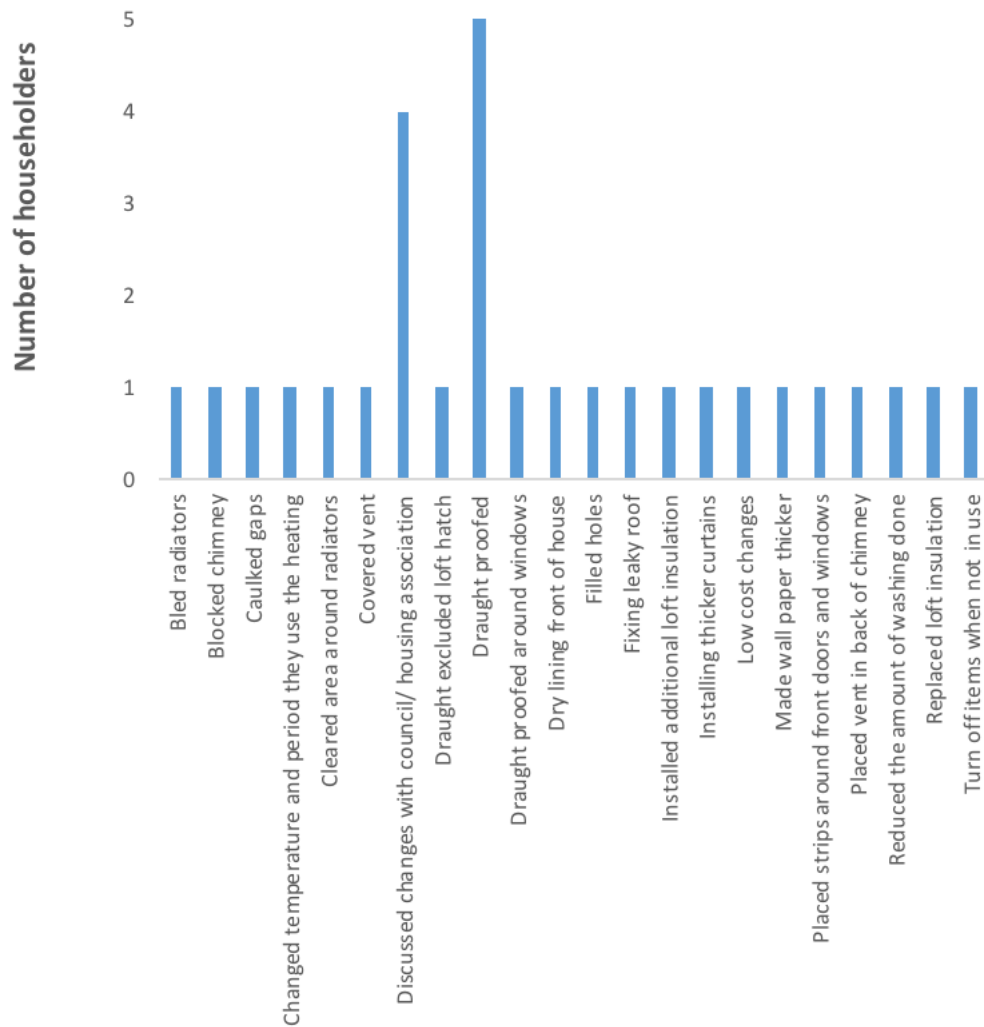


Figure 9: Low-cost changes made by free-survey householders as recorded in the one-month feedback (Phase 3).

There were no high-cost changes made by free survey householders in one-month feedback from Phase 3.

### Types of remedial action taken: Phase 2, one year

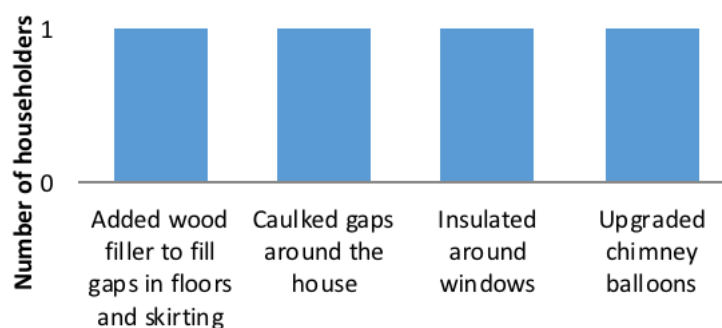


Figure 10: Low-cost changes made by paid-survey householders as recorded in the one-year feedback.

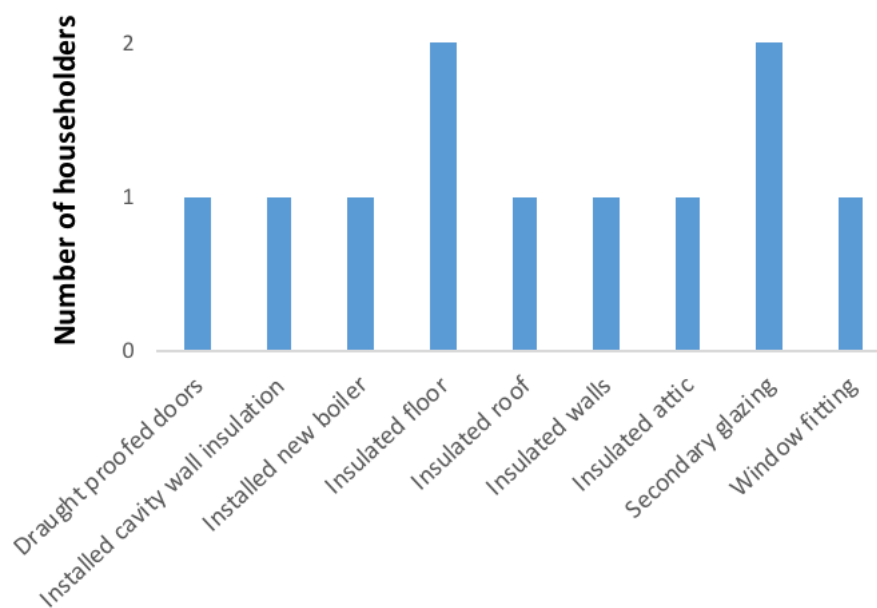


Figure 11: High-cost changes made by paid-survey householders as recorded in the one-year feedback.

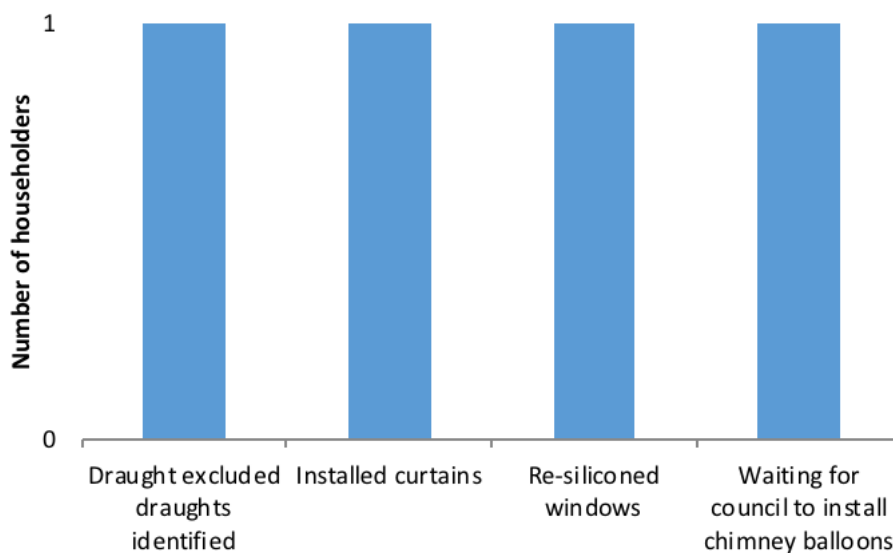


Figure 12: Low-cost changes made by free-survey householders as recorded in the one-year feedback.

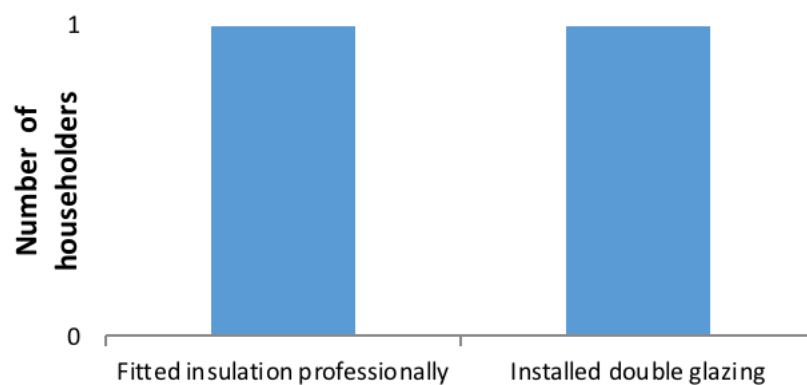


Figure 13: High-cost changes made by free-survey householders as recorded in the one-year feedback.

## Behaviour changes

Householders were asked in the one-year feedback survey for Phase 3 of the project if their behaviour had changed following the survey. This question was not asked in the one-month feedback survey for Phase 2 or Phase 3 of the project; however some householders mentioned behaviour change as spontaneous comments in the feedback.

Behaviour change	Paid surveys	Free surveys
Became more aware of energy and appliance usage	3	4
Closes doors to reduce air flow through the house	1	
Makes sure to only turn the washing machine on when it is full		1
Purchased parts of the CHEESE Box to monitor energy usage	2	
Put less water in the kettle		1
Replaced all lightbulbs with LED lights	5	

Table 5: Behaviour changes mentioned in one-month feedback (Phase 2).

Behaviour change	Paid surveys	Free surveys
Make sure to keep the door closed	1	
Use space in their home differently now- converted one of the warmer unused rooms into a lounge area	1	
More conscious of turning thermostat down	1	
More conscious of drawing the curtains	1	

Table 6: Behaviour changes mentioned in one-year feedback (Phase 2).

<b>Behaviour Change</b>	<b>Paid surveys</b>	<b>Free surveys</b>
Became more aware of energy usage	6	1
No longer takes water for the mop from the electric shower		1
Turns off plug sockets and lights at night	1	1
Uses tumble drier at night		1

Table 7: Behaviour changes mentioned in one-month feedback (Phase 3).

## Reasons why householders did not make changes

The results in this section are based on spontaneous comments or were filled out in the remedial work section of the one-month feedback survey. There was not an explicit question on the one-month or one-year questionnaire asking why householders did not carry out any actions to their home following the survey.

<b>Reason</b>	<b>Paid surveys</b>	<b>Free surveys</b>
Been busy working		1
Moving house		1
Illness		1
Children	1	
Plan on waiting until next winter	1	
Changes are too expensive	1	
Plan on making changes as part of larger renovation	1	

Table 8: Reasons why householders could not make changes as stated in the one-month feedback (Phase 2).



Reason	Paid surveys	Free surveys
Waiting for housing association to make changes		3
Waiting for landlord to make changes	1	1
Waiting for council to make changes		1
Waiting to make changes as part of large scale project	1	
Does not think home needs wall insulation due to the materials that the walls of the house are made from	1	1
Changes are expensive	1	
Warmer weather	1	1
Time constraints	1	
Constrained due living in a flat and listed building		1
Moving out of the property soon		1

Table 9: Reasons why householders could not make changes as stated in the one-month feedback (Phase 3).

## Quantitative and qualitative feedback

### Satisfaction scoring

Householders from Phase 3 of TCP were also asked to rank:

#### How satisfied they were with the survey overall (1: least, to 5: most)

18 householders responded to the satisfaction question and the survey received a mean satisfaction score of 4.6. However, most people gave the survey a satisfaction score of 5 (when the mode for the results was calculated).

#### How useful they found the survey video (1: not at all, to 5: very)

18 householders responded to the question regarding how useful they found the survey video and the video received an average satisfaction score of 4.5. Most people gave the video a usefulness score of 5 (when the mode for the results was calculated).

### **How they found the conduct of the surveyor (1: poor, to 5: excellent)**

19 householders responded to the question and the surveyors received an average score of 4.5. Most people gave the surveyors conduct a score of 5 (when the mode for the results was calculated).

### **Whether the survey was good value for money (1: disagree, to 5 agree)**

18 householders responded to this question and regarding the survey value and the average score was 4.55. Most people agreed with this statement and scored the surveys value for money 5 (when the mode for the results was calculated). 17 people that answered this question paid for the survey and 1 person received the survey for free.

### **How likely they were to recommend the survey to a friend or neighbour (1: unlikely, to 5: definitely)**

18 people responded to this question and the score was 4.6. Most people stated that they would recommend the survey to a friend and answered 5, definitely (when the mode for the results was calculated).

### **Sample testimonials**

*"Didn't realise how much energy the TV uses!"*

*"A really valuable service, represented excellent value for money. It was fascinating to see the energy consumption of various household appliances using the CHEESE box energy monitor. The friendly, very helpful surveyors suggested simple remedies that will make a big, positive impact on the warmth of our house. A massive thank you to all involved."*

*ETs were "on time, enthusiastic and very polite". "Whole service was brilliant".  
"Good to know that we're using the best, most agile technology."*

*"Value for money excellent! I have seen how quick rooms heat up now..  
useful !"*

*"The most striking aspect of the survey for me was the focus on cold draughts... I think this is a particularly positive message as the kind of things that usually come to mind are big and potentially daunting projects like getting double glazing or insulation of some kind."*

*"I'm so happy with what you did, you should do it to everyone, especially when people are buying houses." The experience of seeing the thermal images was "mind boggling", "it says it all", "it opens your eyes to everything".*

*"Cannot thank the CHEESE project for your time and effort. Everyone was very friendly, professional and courteous tracers. Providing a great service to minimise wasted energy and improve house warmth. I have given out C.H.E.E.S.E leaflets to friends."*

*"I recommended survey to lots of people. Found the video useful to show my partner"*

*“Survey was rigorous, professional and knowledgeable. Recommended CHEESE on Next Door app.”*

*“Both surveyors were really friendly, communicative, talkative and able to talk through what they had to do. The video was great and had lots of practical/ DIY rather than just recommendations for contractors to do improvements.”*

*“Playing back the video and listening to commentary highlighted that the surveyors were very precise and professional.”*

*“Was impressed throughout the survey by the surveyors combined knowledge. Very happy with their job and have recommended the CHEESE project to neighbours.”*

*“Survey was very good and the information provided was great. The CHEESE box led to the installation of LEDS.”*

## **Reliability of the data**

### **Feedback questionnaires**

Not all questions were answered by the 27 people that answered the one-year feedback due to time constraints on the householders' part. Such as having other commitments which they were due to attend to when called over the phone by the author and asked to answer the feedback survey.

The response rate for the one-month feedback survey was higher than that of the one-year feedback. This may be due to the data from the one-month feedback survey being collected in person when The CHEESE Box was also collected (which meant obtaining results was easier as householders are less likely to say no to providing the feedback when faced with the ET) and the one-year feedback survey being carried out by the phone meant it was easier for householders to politely decline answering.

The one-month feedback survey data for both the one-month feedback surveys from Phase 2 and Phase 3 of the project is a robust data set as more questions were answered by the householders, and a larger number of respondents [Sax L. 2003].

### **Energy consumption data**

To assess energy savings, householders were asked for energy consumption figures (usually gas and electricity) before and after the survey. Consumption for the year before the survey was collected at survey. They were asked to provide figures for the year following the survey in the one year follow-up questionnaire. However, only two householders were able to provide energy consumption data at one year, too few for a reliable assessment to be made. Therefore conclusions about energy saving achieved will await the accumulation of more data in forthcoming survey seasons. Reasons given for not being able to provide figures included changes in energy supplier since the survey, installation of a smart meter, too difficult to access the data, lack of time.

## References

- Nicholls, Sue (2016) C.H.E.E.S.E. Project report for 2016/17 season
- Sax Linda, Gilmartin Shannon and Bryant Alyssa (2003) Assessing Response Rates and Nonresponse Bias in Web and Paper Surveys Research in Higher Education, Vol. 44, No. 4