Department of Energy & Climate Change

Advice on how to use heating controls:

Evaluation of a trial in Newcastle

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Any enquiries regarding this publication should be sent to us at Fraser.Macleod@decc.gsi.gov.uk

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Executive summary

This report presents findings of a Randomised Control Trial (RCT) that aimed to test whether tailored advice from a 'trusted messenger' on how to use standard heating controls can reduce energy consumption. Commissioned by DECC, the trial was designed by the Behavioural Insights Team and implemented by Newcastle City Council with the assistance of local partners. NatCen Social Research conducted a process evaluation alongside the trial and has been responsible for integrating the results of these activities into this report.

Overview of trial and methodology

Previous research[1] suggests that households find their heating controls, programmers and thermostats, confusing and difficult to use. Energy may be wasted as a result, for example when their home is unoccupied or where rooms are infrequently used. The aim of the trial was to test whether advice delivered by a trusted messenger on how to use heating controls more effectively can help households save more energy than a 'leave behind' information leaflet, or no intervention at all. In this case, boiler engineers that conduct annual gas safety checks were selected to fill the role of trusted messenger.

Specifically, the trial tested whether the provision of personalised in-home advice on the three main heating controls[2] led social housing tenants in Newcastle to change their energy use. It was carried out between October 2013 and May 2014. Levels of gas consumption were compared amongst three groups:

- **Control -** a control group with **no** intervention but the usual annual boiler check.
- **Leaflet Intervention** - gas boiler engineer visit, where engineer leaves behind an informative leaflet explaining to the occupant how to effectively use heating controls.
- **Advice Intervention –** gas boiler visit, where engineer provides personalised in-home advice on how to use controls and has the usual boiler check.

The main outcome measure was individual household gas consumption over the 2013/14 winter period, as measured by two gas meter readings. The first was an initial reading taken at the start of the trial that served as a baseline (from 1,556 households in total), and the second taken at the end of the trial (from 1,398 of the same households). In addition, NatCen carried out a series of in-depth qualitative research interviews to understand participants' use of heating controls and their views on the information and advice received.

What impact did the intervention have?

[1] DECC Smarter Heating Control Research Programme – Stage 1.

[2] Thermostatic Radiator Valves (TRVs), a thermostat, and a programmer/timer

The results from the trial show that the use of in-home advice or informative leaflets within social housing **did not significantly reduce gas consumption during the trial period**. The analysis was also refined to control for the different characteristics of the three groups, such as property type and size for example, described in the main report. No impact was identified through this analysis, though the findings (see technical annex) do provide coherent evidence on the predictors of energy use, such as number of bedrooms. This should increase our confidence in the robustness of the impact data collected.

As with any intervention trial, where no impact is identified this may be down to a breakdown in the theory behind the intervention or challenges in the delivery of the intervention. Our findings from the impact study and the qualitative research provide evidence on both:

- Factors related to a **breakdown in the theory of the intervention** included the fact that the while advice appears to have been effective at informing residents of how to use their heating controls, instead of reducing energy it may have resulted in increased thermal comfort for some households.
- **Challenges were experienced in delivering the intervention** according to the theory For example, the qualitative research identified that in some cases engineers faced barriers to delivering the intervention to its specification. Characteristics that are specific to the trial population may also explain a lack of impact, though further evidence gained from replicating the trial with a different study population is required to back up this assertion.

It is also worth bearing in mind the prevalence of under-heating within social housing, thereby limiting the scope for energy reduction and increasing the likelihood of increased energy use. In addition, social housing tenants are known to consume less gas on average than owner occupiers[3]. It is possible that providing advice on using heating controls would have a different result with other groups where there is more scope for reducing consumption.

Despite the statistically insignificant result from this trial on the energy consumption of trial participants as a whole, the qualitative research conducted as part of the process evaluation did find evidence of tenants finding their heating controls difficult to understand. The qualitative findings also show a range of **positive individual level outcomes from the advice** provided through the trial. Tenants reported benefits in three areas it was hoped the trial would affect:

- **Knowledge outcomes** – improved understanding of the purpose of controls, knowledge of the appropriate settings as well greater confidence in the way they are currently interacting with their controls.
- **Behavioural outcomes** – based on improved knowledge and confidence, tenants reported changing the way they interact with and use their controls, in some cases to better meet their heating requirements, comfort needs and routines.
- **Financial outcomes** – tangible reductions in energy bills were identified, although participants typically found it difficult to assess the impact of changes they had made or felt that reductions might be a result of other factors, such as the milder winter in 2013/14.

In addition to these expected outcomes the trial hoped to have, our evidence also points towards wider, unanticipated wellbeing gains achieved as a result of the trial through empowering tenants to ensure they keep themselves warm and health, and the ability to pass this guidance on to family and friends.

[3] DECC 2014. National Energy Efficiency Data-Framework (NEED).

There were a range of barriers to uptake of heating control behaviours. These included the degree of existing knowledge of controls, characteristics of people, aspects of the delivery, and aspects of the engineer's identity:

Degree of existing knowledge of controls

- People who were satisfied with their current heating system and those who rarely used their heating were less motivated to take on the behaviours.

Characteristics of people

- Younger people were perceived to be less concerned about being energy efficient, and older people were more reluctant to changing their heating controls routines.

Aspects of the delivery

- Early morning appointments: It was considered more difficult to engage with tenants when they were scheduled for appointments in the early morning because tenants were tired, getting ready for work or taking care of children and therefore distracted.
- English as a second language: Engineers covering areas with high levels of EAL found the intervention particularly difficult to deliver as language barriers made communication difficult.

Aspects of the engineer's identity

Association of the engineer as part of the council: This was believed by engineers to be both an advantage and a hindrance for acceptance of advice and therefore uptake of behaviours. For some, the 'council badge' was perceived to be a hindrance, depending on their perception of council services.

Learning for future trials

The main finding of this study is that the trial did not find strong quantitative evidence to support the hypothesis that the use of in home advice or informative leaflets explaining heating controls to social housing tenants can reduce energy consumption. However, the experience of conducting this trial and the findings that have been generated provide a rich set of lessons for DECC and others considering designing and conducting RCTs of interventions to reduce energy consumption.

- The robust analysis of the impact study provides **methodological learning** that it is possible to use meter readings to robustly measure energy consumption outcomes.
- There is important learning to be found in the qualitative data presented in this report relating to **engaging participants** in this kind of trial and **the crucial characteristics of a 'trusted messenger'**.
- There are also **practical lessons** that relate to the effective planning and implementation of a trial of this nature and a clear requirement to design method and implementation synchronously and iteratively.

In general this report provides a further contribution to the underdeveloped but growing evidence related to the relationship between the needs and behaviours of energy consumers and their interaction with heating systems and controls. There is sufficient learning from this study to suggest that the theory and implementation tested here needs refinement and testing with a population with greater capacity for reducing energy consumption rather than discarding.

1 Introduction

1.1 Policy Context

The UK's target to reduce greenhouse gas emissions by 80% by 2050 (relative to a 1990 baseline) is likely to require reducing emissions from buildings to close to zero by 2050. The majority of emissions from buildings come from energy used to heat space and water. Space heating accounts for approximately 60% of energy use in homes, which in turn accounts for over 15% of the total UK's energy use[4]. Seventy-nine per cent of the energy we use in our homes is for heating and 81% of this is delivered using gas-fired boilers.[5] However, a recent Consumer Focus literature review found that many heating systems are not intuitively designed, with displays difficult to read, controls positioned poorly, and a lack of effective supporting information and advice.[6] As a result, many households do not use their heating controls as intended, in a cost effective way, or in some cases, do not use them at all.[7]

While meeting the UK targets is likely to require close to complete decarbonisation of heating by 2050, it is likely that gas-fired technologies will supply the majority of our heat demand well into the 2020s. Measures that increase the effectiveness with which people use their heating controls could, therefore, play an important role in reducing emissions over the next decade. Recent DECC research suggests that changes in thermostat settings could save as much as 3MWh of energy per household per year.[8] Any improvement in how efficiently we use our heating systems and heating controls is likely to save some of this energy. For example, turning off heating in unused rooms could save about the same as loft insulation, and turning thermostats down 1^{o}C could save about the same as cavity wall insulation.[9]

As low-carbon heat technologies are rolled out, the potential emissions savings from effective use of heating controls will fall. However, the cost savings will persist. Investigating measures to improve the effectiveness of consumer use of existing heating controls has the potential therefore to yield immediate and long term benefits irrespective of technologies.

1.2 Background to the research

In this context, DECC commissioned the Behavioural Insights Team (BIT) to design a parallel randomised controlled trial to test whether heating advice delivered by a trusted messenger can help households reduce energy consumption more than a 'leave behind' information leaflet, or no intervention at all. Boiler engineers were selected to fill the role of the trusted messenger: it is assumed that they are at the household at an appropriate time (when tenants are expecting a visit about their boiler) and are seen as competent independent sources of advice.

To carry out the trial, DECC and BIT partnered with Newcastle City Council (NCC). NCC is engaged in a range of energy efficiency interventions, particularly amongst people in social

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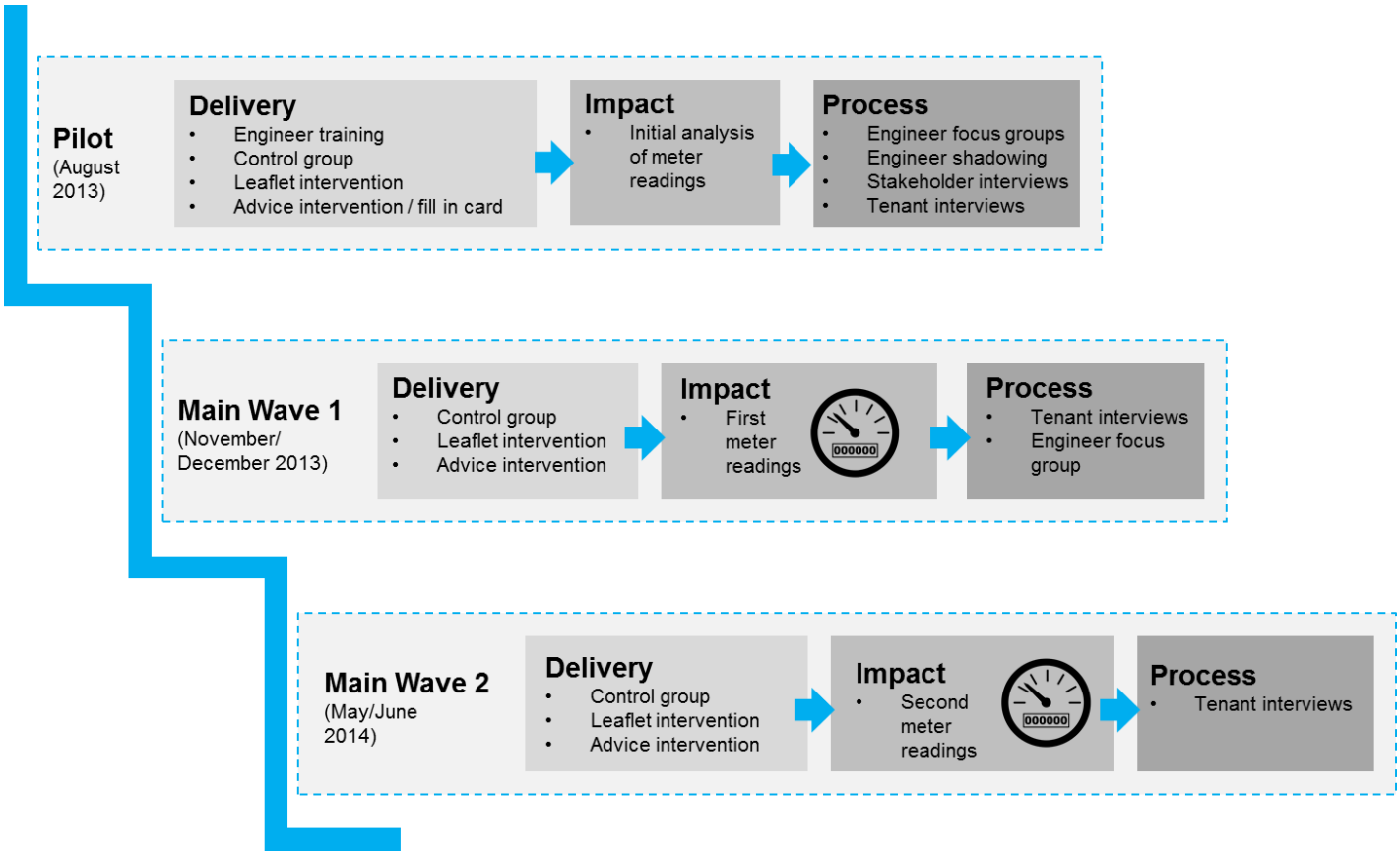
[4] DECC (2013) "Housing Energy Fact File".
[5] DECC (2013) *The Future of Heating*
[6] Consumer Focus (2012) "Consumers and domestic heating controls: a literature review".
[7] Consumer Focus (2012) "Consumers and domestic heating controls: a literature review".
[8] DECC (2012) *How much energy could be saved by making small changes to everyday household behaviours?*
[9] DECC (2012) "How much energy could be saved by making small changes to everyday household behaviours".

housing and possibly fuel poverty. A literature review by Consumer Focus had suggested that local authority households are more likely to find their controls difficult to use. And Newcastle City Council's willingness to test the provision of heating control advice provided a vehicle for administering the trial.

The trail was conducted among tenants of Your Homes Newcastle (YHN), an Arms-Length Management Organisation (ALMO). It was set up by NCC in 2004 to manage council homes on behalf of the local authority. This trial was integrated with the statutory obligations of NCC and YHN to complete a boiler safety check every twelve months for all social housing. This boiler check is carried out by Building and Commercial Enterprise, the local authority's in house service provider. NCC played a key role in the trial implementation by co-ordinating local and national partners.

To maximise learning and to assess the implementation of this trial, DECC also commissioned NatCen Social Research to deliver a process evaluation of the trial to collect views from engineers and tenants about how the trial worked in practice. Figure 1.1 provides an overview of the activities that took place as part of the delivery of the trial, collection of impact data and collection data for the process evaluation. The following sections explain each of the stages.

Figure 1.1 Overview of trial and evaluation activities



1.3 The trial

The trial is a traditional *parallel experimental design randomised controlled trial* (RCT). In these trials, the intervention and control groups are tested concurrently and the interventions are purposely designed. This type of trial enables the effectiveness of specific interventions to be accurately measured.

The concurrent testing of the interventions (i.e. in this case taking meter readings from treatment and control groups at the same time) is an important element of this design, in order to reduce external bias between groups. As such this traditional RCT format was selected over other designs that have multiple time intervals, such as crossover or step-wedge designs, which also have practical limitations.

The design is also ‘single-blind’ for the participants, meaning that the delivery partners know which households have been allocated to the intervention and control groups, while the participants themselves do not.

The trial aims were to:

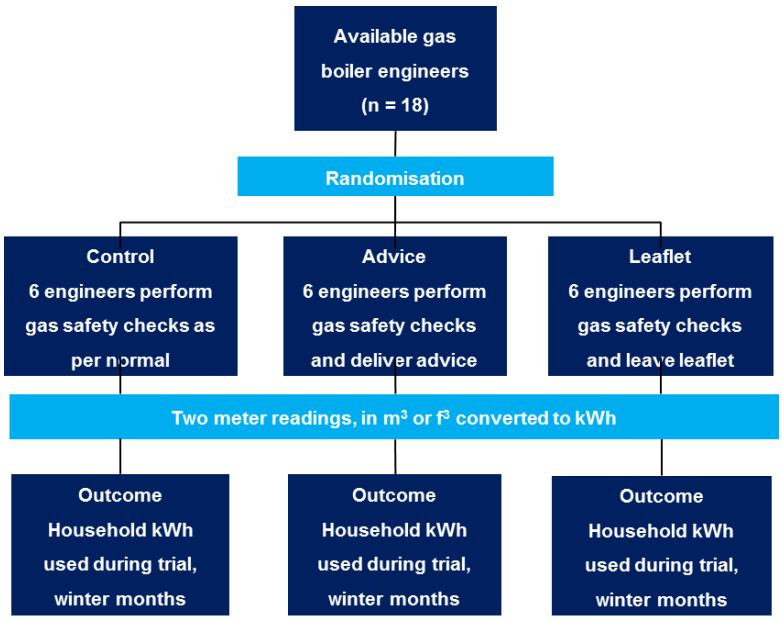
- test whether a direct intervention to provide in-home advice on heating controls from a trusted messenger saves more energy and money than a 'leave behind' information leaflet or no intervention at all; and
- learn about the logistical requirements to deliver personalised in-home advice on this scale, in order to inform future policy.

In order to meet these aims, the trial design comprised three arms:

- **Advice arm**: gas boiler engineer visit, where engineer provides advice to tenant about how to effectively use their heating controls, and asks occupant to demonstrate their knowledge back to the engineer
- **Leaflet arm**: gas boiler engineer visit, where engineer leaves behind an informative leaflet explaining 'leave-behind' information leaflet explaining to the occupant how to effectively use their heating controls
- **Control arm**: standard gas boiler engineer visit, no advice or leaflet provided.

Advice and leaflet arms of the trail aimed to provide tenants with guidance related to three heating controls: programmers or timers on the boiler; the central thermostat; and Thermostatic Radiator Valves (TRV). The advice arm aimed to tailor the advice to the specific circumstances of the households. The leaflet arm provided more generic information on temperature settings for example. Full details of the trial design and content of the leaflet and the advice are provided in the technical appendix. The randomisation approach is illustrated in Figure 1.2 below.

Figure 1.2 Overview of randomisation process



Each of the interventions was delivered by Building and Commercial Enterprise engineers. Engineers were selected at random to be assigned to the three arms and then trained and advised separately on the approach they should take. The household samples were randomly selected from the Your Homes Newcastle (YHN) social housing stock (approximately 22,000 gas heated homes). The interventions were delivered by Building and Commercial Enterprise boiler engineers during each household's annual boiler check. Households were randomly assigned to engineers (and, therefore, an arm of the trial) using Building and Commercial Enterprise's standard system for allocating jobs to engineers. This meant that any biases amongst engineers and households were distributed at random across the three groups, avoiding any systematic bias. The decision to randomise by engineer was because it would not have been practical to randomise by household and could have led to contamination effects.

The main outcome measure was individual household gas consumption over the winter period, as calculated by two gas meter readings: the first, an initial reading taken at the start of the trial, served as a baseline, and the second taken at the end of the trial. A pilot to test specific intervention designs took place during the summer of 2013, followed by the live trial over the 6 month winter heating period of 2013-14 (October to March). With consent, the engineers took the first meter reading during the boiler check and six months later a third party meter reading company, MeterPlus, recorded the second meter reading. The results were analysed to determine statistical significance and effect size.

Full details of the trial design and achieved sample are provided in the technical appendix.

1.4 Process evaluation

The process evaluation had three broad objectives:

- To assess how the Trial was delivered in practice and identify the factors affecting its outcome
- To synthesise data from the impact study, process evaluation and cost-effectiveness analysis to provide an overall assessment of whether the trial met its objectives
- To identify implications for future policy for DECC and its partners

The research comprised two main strands of fieldwork:

- interviews with trial recipients;
- discussion groups and observation with engineers.

Following a pilot that included stakeholder interviews, the main fieldwork was staggered over two waves to ensure that participants were not required to rely on recall over a period of months to respond to questioning about the details of the intervention. Within each wave, there was additional sequencing, with engineer discussion groups taking place first so that they could inform topic guide development for interviews with trial recipients.

Across the entire process evaluation we conducted:

- **Four stakeholder interviews** with partners delivering the trial
- **Three engineer focus groups**: two in the pilot with 12 engineers – one leaflet, one advice – and one with six engineers from both leaflet and advice groups following the completion of the intervention.
- **Eight engineer shadowing sessions** (three of which took place during the pilot) with NatCen researchers observing engineers in the field as they delivered the intervention.
- **61 tenant interviews**, 36 face to face and 25 over the telephone (seven of which took place during the pilot). During the trial, these took place in two waves: wave 1 interviews were conducted within two to four weeks of the intervention being delivered; wave 2 took place following the second meter readings.

1.5 The pilot

A pilot trial was carried out in summer 2013 to help refine the design of the trial for the main stage. The set-up of the pilot was intended to resemble the main trial as closely as possible. This enabled the pilot to identify challenges that might affect the implementation of the winter trial as well as assessing tenant engagement and testing variations in approaches to the leaflet and advice arms of the trial.

In total six engineers delivered four variations of home heating advice interventions with 160 returned check-lists; while six different engineers tested two leave-behind leaflet designs with 131 returned check-lists. The data were analysed by BIT; details are provided in the technical appendix.

NatCen also collected data during the pilot, conducting two engineer focus groups, shadowing three engineers as they delivered the intervention and carrying out interviews with seven tenants.

More detail on the specifics of the approach taken in the pilot and the lessons learned are contained in the technical appendix. As a result of findings from the pilot, improvements and changes were made to the design of the main trial, including:

- Engineer **checklists completed for each household were adapted**. This was to include: providing more options for why a tenant refused; more standardised check-box responses to improve consistency; and a requirement to record the gas unit of measurement.
- Engineer **training was refined to remove any reference to cost savings** in the leaflets and verbal advice. This decision was taken due to the vulnerability of the population and the likelihood of the households being in fuel poverty. It was not felt that the intervention could *guarantee* cost savings, even if the advice was followed as

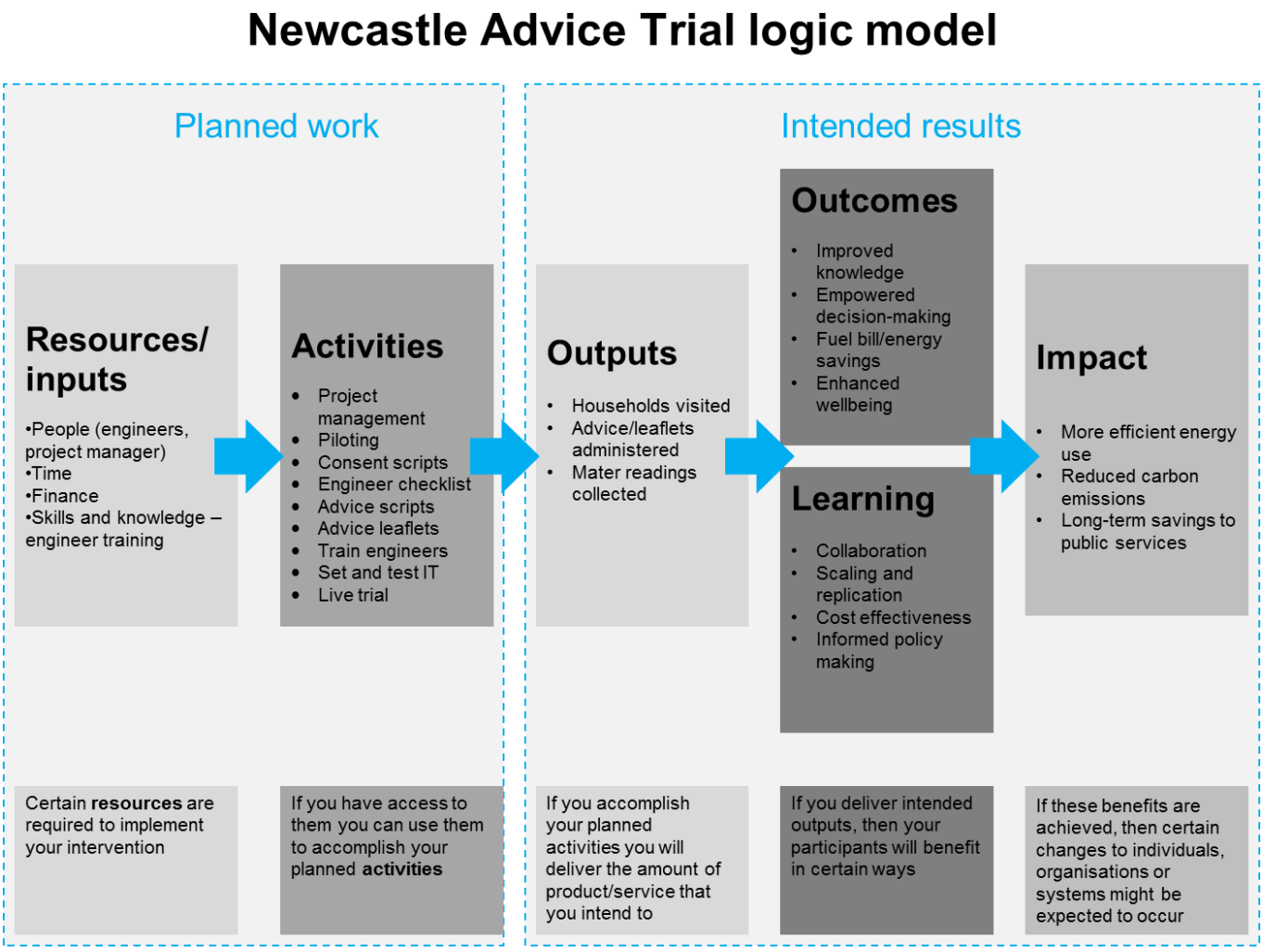
engineers would not be fully aware of how the household currently interacts with their heating – for example, tenants could keep it off on all but the coldest days.

- The **removal of the diagrammatic leaflet** without any text as this was not felt by engineers to be effective because of the variety of energy systems in these households. A single diagram could not be simply applied to all systems, particularly for households that had been operating the same system for many years.

1.6 Framework for the evaluation - Logic model

The framework for evaluation was developed using a programme logic model approach. BIT's behavioural model informed the trial design. NatCen developed this logic for the intervention to obtain a detailed understanding of the design of the project, its constituent activities/processes and how these activities are linked and presumed to lead to the outcomes the project is seeking to change. Figure 1.3 provides a summary illustration of the logic model used in this evaluation.

Figure 1.3 Summarised illustration of the logic model



1.7 Reading this report

The structure of this report is based on working through the logic model described above in reverse. We first look at who took part in the trial (Chapter 2) and then the impacts of the trial

(Chapter 3). Following this we describe the outcomes of the trial on tenants, drawing on the views of engineers and tenants (Chapter 4). Chapter 5 identifies lessons learned from the trial and parallel process evaluation and discusses opportunities for informing potential future trials.

2 Who took part in the trial?

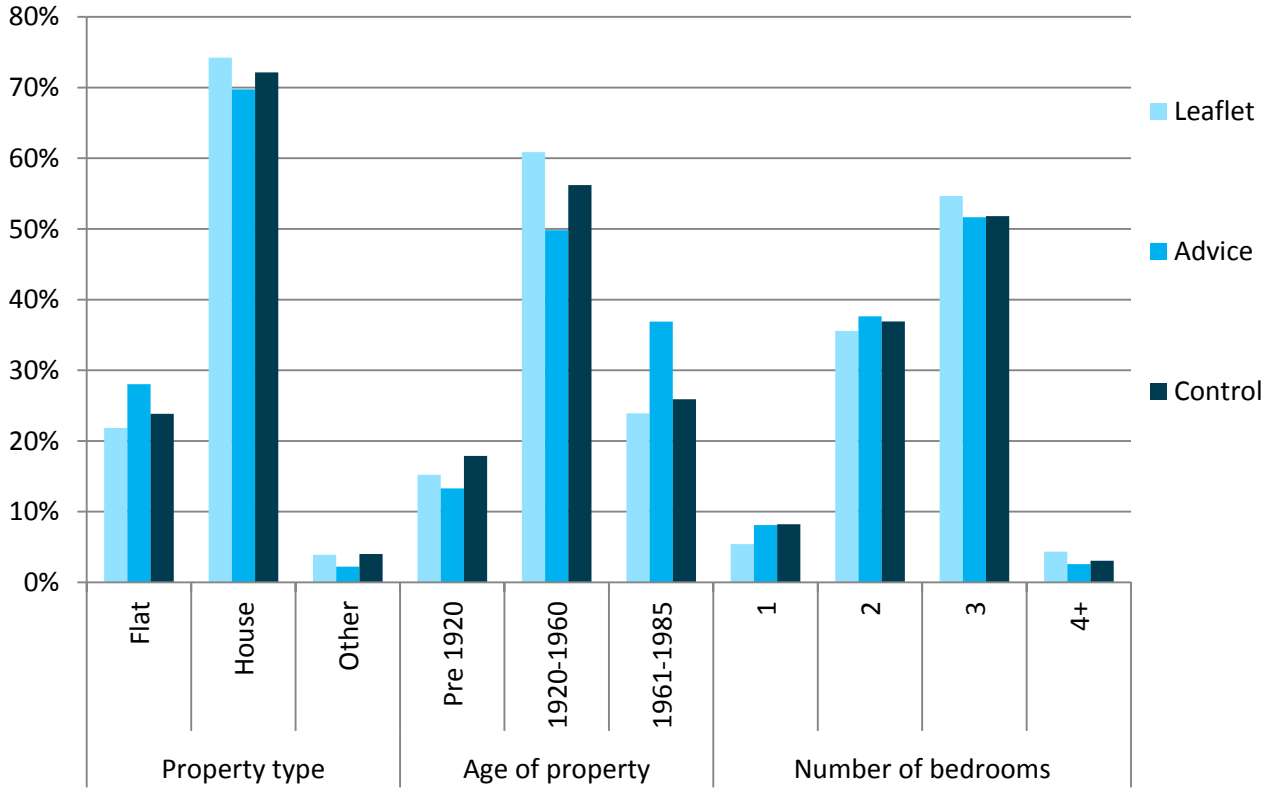
This chapter describes the profile of trial participants. It presents statistics on the profile and characteristics of participating households and properties and reports qualitative data on the range of levels of baseline knowledge tenants had in relation to their heating controls.

2.1 Characteristics of tenants taking part in the trial

As described in Chapter 1, tenants were randomly assigned to a particular engineer (and therefore to an arm of the trial) by Building and Commercial Enterprise's job allocation system. In theory, given the sample sizes the trial began with, this should mean that characteristics are roughly evenly distributed across the three arms of the trial. However, it is still worth comparing the profile of each of the arms of the trial in relation to the observable characteristics that are likely to influences outcomes of the trial.

Data from the engineer checklist and administrative data from YHN allow a comparison of characteristics of the three groups in relation to their property, the controls already in place in tenants' homes and location. Figure 2.1 below shows the profiles of property characteristics of households taking part in the trial. It demonstrates that the distribution of physical characteristics were roughly the same between groups with no substantial differences.

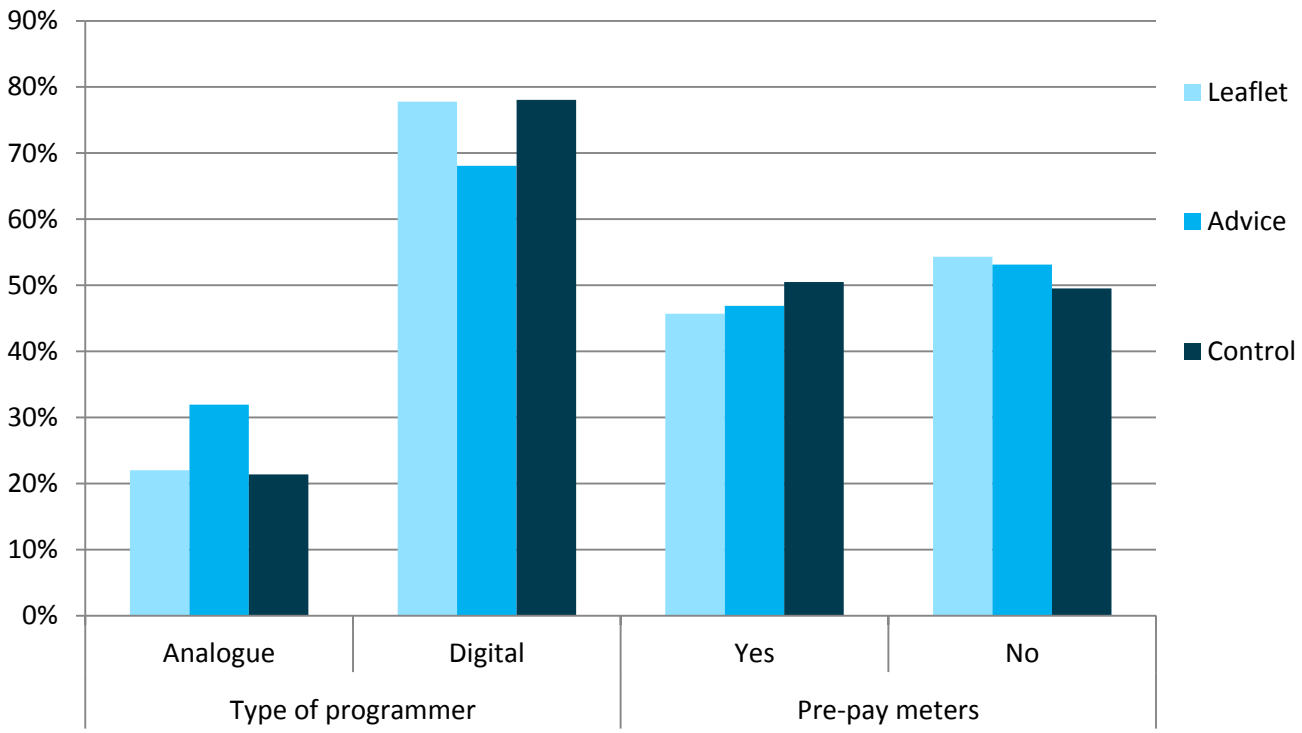
Figure 2.1 Characteristics of participating properties by trial arm at Wave 2.
Base: Number of homes that consented and meter reading achieved, N=1,398



Inside the home, properties also differed in respect to the type of programmer people had in place and whether tenants were using a pre-pay meter. Figure 2.2 below shows how these different control and payment methods were distributed across the three arms of the trial.

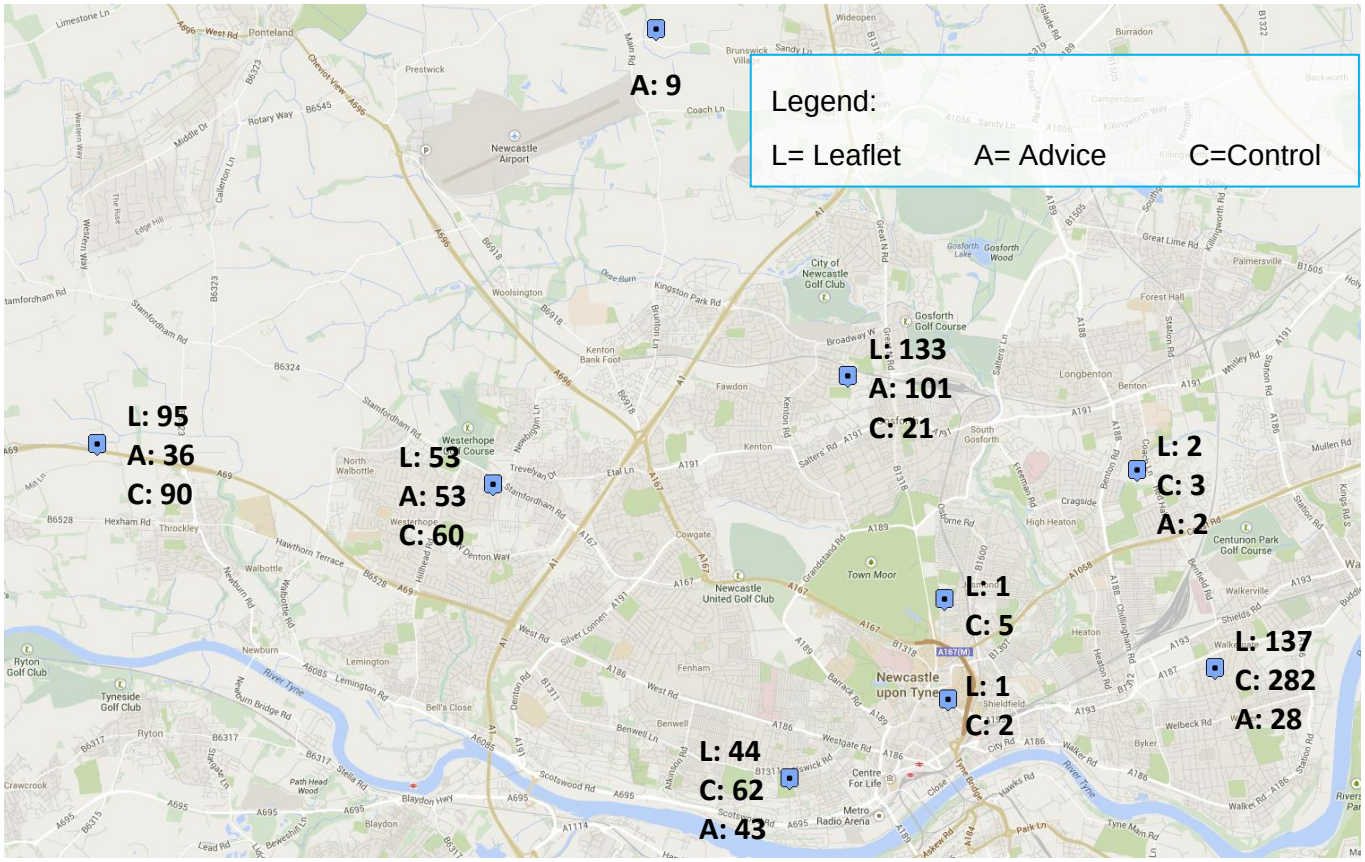
Figure 2.2 Types of control and payment methods by trial arm at Wave 2

Base: Number of homes that consented and meter reading achieved, N=1,398



Finally, in terms of location, the map in figure 2.3 below shows the broad postcode areas (rather than specific streets or addresses) where the meter readings took place. Proportionately, this is broadly in line with the distribution of council owned properties in the city.

Figure 2.3 Location of participating households by postcode sector



2.1.1 The tenants: a typology of existing knowledge

The quantitative data provide a detailed aggregate understanding of the property characteristics and controls in the homes of tenants taking part in this trial. Using the evidence from the qualitative data, it is possible to understand more about the nature of the population receiving the intervention in relation to their existing knowledge about their heating controls. This is important because it influences how engineers engaged with participants, the delivery and content of the advice and the nature of outcomes at a household level.

From focus groups with engineers, there was a sense that tenants could be divided into two groups:

- Those who had **little or no previous knowledge** of heating controls
- Those who had **a good understanding** of how the controls worked and wanted to confirm that what they were doing

While broadly similar, interviews with tenants instead suggest that those receiving advice can be described as falling into three groups:

- Those who had knowledge about **most** aspects of controlling their system
- Those who had knowledge about **some** aspects of controlling their system
- Those with **little or no prior knowledge** of controlling their system

The group tenants fell into impacted on engineer's engagement with tenants, their approach to delivering the advice and the content of the advice.

3 What impact did the intervention have?

3.1 Summary of trial findings

The results from the trial show that the use of in-home advice or informative leaflets within social housing did not significantly reduce gas consumption during the trial period. When the analysis is refined to control for the different characteristics of the three groups described in the previous chapter no impacts are identified, though the results of this analysis (see technical annex) do provide coherent evidence on the predictors of energy use, such as number of bedrooms. This increases our confidence in the robustness of the impact data collected.

As with any intervention trial, where no impact is identified this may be down to a breakdown in the theory behind the intervention or challenges in the delivery of the intervention. In this case, factors related to a breakdown in the intervention theory could include the fact that the interventions were effective at informing residents of how to use their heating controls, but instead of reducing energy it resulted in increased thermal comfort, such as enabling tenants to better manage when and how much heating they use in their household. In addition, there was subjective evidence of other positive well-being outcomes, such as a sense of sense of control and autonomy. Indeed, the supporting qualitative research conducted as part of the process evaluation of the trial provides evidence to this and is discussed in the Chapter 3 below.

Challenges in delivering the intervention according to the theory and characteristics specific to the trial population may also explain a lack of impact. For example, the qualitative research identified that in some cases engineers faced barriers to delivering the intervention to its specification. It is also worth bearing in mind the prevalence of under-heating within social housing, thereby limiting the scope for energy reduction and increasing the likelihood of increase energy use. In addition, social housing tenants are known to consume less gas on average than owner occupiers[10]. It is possible that providing advice on using heating controls would have a different result with other groups where there is more scope for reducing consumption. The qualitative evidence also supports the view that despite the statistically insignificant result from this trial on the wider population, there is evidence of individual tenants finding their heating controls difficult to understand and use and benefitting from the type of advice provided through the trial in a range of ways. Evidence also points towards wider, unanticipated well-being gains achieved as a result of the trial. Following the next section which outlines the analysis conducted to achieve the findings, we draw on evidence from the process evaluation to describe the types of individual outcomes the participants experienced as well as the factors that affected how and whether these outcomes were realised.

3.2 Analysing the impact data

This section briefly describes the steps taken in identifying the final impact results from standardising and cleaning the data to developed a number of multi-level models to try to

[10] DECC 2014. National Energy Efficiency Data-Framework (NEED).

identify statistically significant impacts. For further information on the approach taken, please consult the technical appendix.

3.2.1 Primary analysis

The primary analysis was carried out to determine if there was a significant difference of gas consumption between treatment groups in the trial. The analysis was carried out on the 1,398 observations across the three treatment conditions.

Standardising and cleaning the outcome measure: The first step was to standardise the outcome measure by number of days between meter reads, and then correct for weather differences. This was accomplished by using a basic method of standardising heating degree days (HDD)[11] allowing for a normalised comparison between groups as kWh per HDD. The analysis was also repeated without this correction with no difference in reported outcome (See Annex A for more details).

The data were then cleaned to remove observations that could not be used in the analysis, i.e. those that contained typos, inconsistencies or lacked values. In total 31 observations were dropped, 18 of which because of a meter change between the first and second meter reads. This leaves 1,367 observations. Of these, approximately 5% (79 observations) had second meter readings that were less than the first, i.e. not monotonic. Therefore these observations were also excluded. As a result, the final sample was 1288 observations allocated between treatments as shown in Table 3.1.

Table 3.1 **Summary of meter read return rates**

	First meter readings	Second meter reads	Success rate %	Final usable observations
Leaflet	570	518	91	478
Advice	312	291	93	280
Control	674	589	87	530
Total	1556	1398	90	1288

[11] See http://www.degreedays.net/ for an explanation

The data was then checked for outliers. Readings were removed where the amount of heat consumed was reported as over 25kWh/HDD, which is just over twice the average *annual* consumption.[12] Ultimately, this resulted in removing a further 24 observations from the analysis, leaving a total of 1264 households.

Variable derivation for model specification: Once a clean and standardised data set was available, the following list of variables was derived in order to define a regression model specification:

Covariates

- Number of bedrooms in the house
- Number of storeys in the building
- Energy Performance Certificate rating
- Year of construction
- Main wall construction type (solid brick, system built, etc.)
- Wall insulation type (external, filled cavity, as built, etc.)
- Property type (house, flat, maisonette, etc.)
- Type of heating programmer (digital or analogue)
- Whether the house has a pre-paid meter or not
- The engineer associated with each observation

Missing observations within each variable were dropped during analysis. The resulting changes to the sample size are reported in the detailed regression tables. The EPC ratings were only available for 266 of the properties in the sample, and so were not used in the balance checks and final analysis.

During the last week of first meter read/intervention delivery stage, two engineers were moved into the leaflet group from the control group. This was done to increase the sample size captured in the leaflet group while minimising contamination, since the control group engineers were not specially trained. For the analysis, all the engineers were coded individually, with two factor levels assigned to the moved engineers.

The specification for the primary analysis is detailed in the technical appendix. Table 3.2 presents the results from 4 regression models. For clarity, only the point estimates and standard errors of the treatment effect are presented, with the full regression table shown in the technical appendix. The 4 models are:

- Column 1: a basic model with no covariates. This just compares the aggregate results of the three treatments arms
- Column 2: the physical characteristic set of covariates are added to the model: this now controls for bedrooms; storey; construction year; main wall construction type; wall insulation type; property type; and type of programmer.
- Column 3: this controls for a pre-paid meter predictor.
- Column 4: this controls for the engineer covariate.

Table 3.2 Regression results

[12] https://www.ofgem.gov.uk/ofgem-publications/64026/domestic-energy-consump-fig-fs.pdf

	(1)	(2)	(3)	(4)
(Intercept/control group)	4.455***	5.563	5.601	9.597
	(0.099)	(7.123)	(7.352)	(8.228)
Leaflet	0.094	0.071	0.082	0.721
	(0.144)	(0.142)	(0.148)	(0.543)
Advice	0.220	0.215	0.194	0.721
	(0.169)	(0.171)	(0.176)	(0.541)
Physical characteristics		See Appendix	See Appendix	See Appendix
Pre-paid meter			See Appendix	See Appendix
Engineer				See Appendix

* p < 0.05, ** p < 0.01, *** p < 0.001, standard errors in parentheses

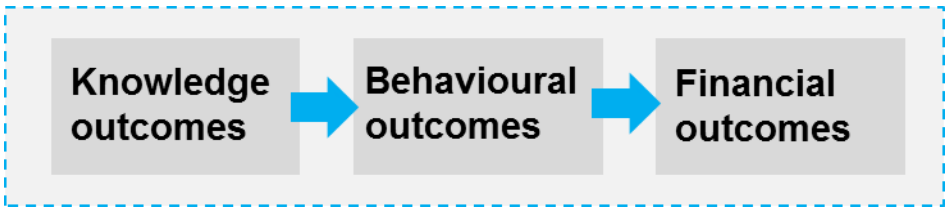
The results show that there was no significant difference in gas consumption between treatment groups. The implication for policy is that this trial did not provide clear evidence to support the use of in-home advice, or informative leaflets, to reduce gas consumption in social housing.

3.3 Individual and household level outcomes

Despite finding no evidence of impact at the aggregate level, the qualitative research did identify a range of outcomes experienced by individual tenants, reported largely by participants in the advice intervention. These outcomes illustrate the value of tailored and individualised advice given to tenants by engineers which was praised by some tenants as being considerate of their unique circumstances. While tenants were largely receptive to the idea of a leaflet, it was made clear that this would only be a welcome addition alongside the verbal advice. The leaflet should only serve as a reminder of the advice given by the engineer.

There were three main types of outcomes, each with their own mediators which influenced whether a tenant took up advice or decided against changing their behaviours. The three outcomes include knowledge outcomes, behavioural outcomes, and financial outcomes. Figure 3.1 illustrates the relationship between these outcomes with knowledge outcomes leading to behavioural outcomes and then to financial outcomes. The theory of the intervention being tested here is that knowledge would help change behaviour in a particular way, which may lead to a reduction in energy. It is possible, however, for this theory to break down between knowledge and behavioural outcomes, thereby stopping action to be taken or between behavioural and financial if changes in behaviour lead to tenants using more energy.

Figure 3.1 Outcome types



This chapter introduces each set of outcomes in turn and identifies how and why the links are made or breakdown. The outcomes are strongly influenced by three sets of mediating factors which influence different types of tenants in different ways:

- People factors related to existing knowledge, household composition and previous behaviour
- System factors related to complexity, inefficiency or location of system or controls
- Engineer factors related to the delivery of advice, the content of advice and engineer personality.

The next three sections describe the three sets of outcomes and refer to these mediating factors throughout, although more detail is provided in relation to the role of the engineer in Chapter 4 on the delivery of the interventions. The complex interplay of these factors makes it challenging to unpack the outcomes experienced by tenants with different characteristics; it was also the case that no outcomes were reported for some participants. We also describe these and the corresponding barriers to behaviour change where relevant.

3.3.1 Knowledge outcomes

The first set of outcomes relate to knowledge. These manifested at three levels:

- tenants acquiring the capabilities to support themselves in learning something new
- tenants having their knowledge reinforced, providing them with the reassurance that how they control their heating is appropriate
- tenants gaining the confidence they needed to pass on the heating controls advice to their friends and family through a shared network.

Gaining new knowledge

Tenants gained new knowledge, particularly around the different options for using their heating controls, such as setting the thermostat between 18 and 25 degrees will save energy but not impact on comfort, and different strategies for maximising the efficiency of radiators. One tenant described how he did not know what a TRV was or how to use it until he received information in the leaflet on how to adjust it (Leaflet, W2.13, Lives with young son, In full time employment). Another tenant explained, "*In the past I would just put the heating on and leave it. I didn't realise I could set timers or anything, until I was told [by the engineer]. [Now] I would set it on for when me son getting up, or me getting up. Brilliant* (Advice, W2.3, Lives with son, In full time employment).

Knowledge also increased confidence. Tenants described how the engineer showing them how use the thermostat had given them the confidence to do so that they would not have had just from reading a manual. One tenant, after the engineer's visit, made frequent use of the timer to have the heating on around their daily routine; previously they would have had to manually switch the heating on when they wanted it on. They explained that now the system *"…works for me, rather than the other way around"* (Advice, W1.51, Lives with adult son, In full time employment).

Improved knowledge was not limited to the three main heating controls targeted by the trial. New knowledge was also gained through general discussion with engineers in relation to managing boiler pressure, understanding water controls and bleeding radiators.

Reinforcing existing knowledge

The demonstration of how to use controls and the exchange of questions with the engineer during the advice intervention were reported by one group of tenants as helping to confirm what they already know. While no tenants we spoke to acted on every element of the advice they received, there was a general view that they now felt more confident if they ever wanted to change the way they control the heating. For example, one tenant explained that they now felt confident enough to set the programmer to different times throughout the course of a week and change this if their routine ever changed: "*He showed me again and again and again how to set the heat at different times then I copied him so he could check. I was never shown before and I didn't know it was possible. I don't have to worry anymore about my son turning the heat on or off because we pre-set it [the timer] like the engineer showed us"* (Advice, W2.3, Lives with son, In full time employment).

Establishing a shared network

Tenants indicated that confidence gained from the advice had made them more prepared to share information with others. For this group, tenants described the value in watching someone demonstrate heating controls provides you with the confidence to demonstrate it yourself. '*If you see someone do it, you think "Oh, I can do that"*' (Advice, W2.7, Lives with brother, Retired). Passing on the advice to friends and family was very popular with tenants, especially with those tenants who have experienced improved comfort levels or have saved money since implementing changes. For example, while a tenant explained she knew how to use the system for her own needs, she wanted to be reassured on how to use the heating so she could show her granddaughter in case the tenant was not at home (Advice, W2.9, Lives with two young grandchildren, Retired).

No change

There were three main barriers to knowledge outcomes. Firstly, these related to having other sources of knowledge or advice such as professional experience or friends and family or already knowing the best way to engage with controls. Secondly, where tenants had been in their properties for more than ten years, some participants had 'figured out' a way to use their controls that worked for them by the time of the engineer check and so reported no change in their behaviour. Finally, participants on low incomes had an existing approach to using their heating that gave them confidence and certainty in their bills. In these instances some participants chose not to make changes due to concerns over this increasing their energy bills.

3.3.2 Behavioural outcomes

Behavioural outcomes refer to actual changes in the ways in which tenants engaged with their controls. Within the advice intervention, tenants described three outcomes related to their behaviour:

- using their different heating controls in different ways;
- adjusting the settings on these controls in different ways; and

- no changes to their use of their controls.

We discuss these three outcomes below, as they relate to the three controls that were the focus of the intervention: thermostats, timers ad TRVs. Mediating factors influencing whether these outcomes occur are identified in each section.

Thermostat settings

There were three ways the intervention affected how tenants used their thermostat settings. These were setting thermostats to stay within range of 18 to 25 degrees, an uptake of controlling heat through the thermostat instead of through the boiler, and no change in behaviour:

> *'I dropped my temperature from 25 to 19 degrees and it hasn't changed how warm the house feels' (*Advice, W2.6, Lives alone, In full time employment*).*

Tenants who acted upon advice from the engineer about setting their thermostat between 18 and 25 degrees Celsius did so for three reasons: trust in the engineer's expertise, the ease of implementing this change, and to influence personal levels of comfort.

Trust in the advice and in the engineer's expertise played a key role in why this outcome occurred. While the advice is viewed to be intuitive and low risk, tenants believed the engineer when he said setting it within this range would use less energy and save money without the household losing out on a comfortable temperature. Pre-intervention settings amongst this group included setting thermostats at the full amount to quickly get the house warm, to 30 degrees, setting to 20 but when warm enough dropping it to zero degrees, and turning the thermostat until it clicks to indicate it has turned on. Following the advice, there was also a view amongst tenants that controlling the heat by using the thermostat was more effective and convenient than just using the boiler. A tenant explained how the household was more confident that when they alter the settings on thermostat this will meet their needs more quickly and conveniently. "*I always used to switch the heat on at the main, on the boiler, as we needed it. We didn't use the room thermostat or the switches on the radiators. The guy said the thermostat helps make heat go on and off faster and is better- he was full of information*" *(*Advice, W2.4, Lives with adult daughter, Retired).

A second mediating factor was the ease of taking up the advice. Tenants who adjusted their thermostat settings explained it was low risk and easy to do because the thermostat was centrally located. However, there was the view that this advice could not be taken up because the thermostat is not easily accessibly: for example when it is behind a door or in a less visible corner.

Finally, personal levels of comfort played a role in whether a tenant reported adjusting their thermostat settings. While one group explained that levels of comfort were not negatively impacted by adjusting their thermostat by a few degrees, another group explained that changing the settings had led to discomfort and their personal comfort overrides their motivation to save money or energy.

A group of tenants also reported no change in their behaviour and continued to put their thermostat up to 30 degrees in order to switch it on. While they received advice on alternative approaches, the tenants continue to understand the thermostat to function as an on and off switch.

Timer settings

The varying use of settings was also described in relation to timers. These included beginning to use a timer to manage when heat is on and off around the household's schedule, the occasional use of a timer when it was relevant to the household but otherwise controlling heat in other ways, and not using the timer at all to control heat. There were three reasons given for this variety in timer use: routines, levels of existing knowledge, and circumstantial factors.

Firstly, a group of tenants described using the timer to turn the heat on and off instead of just controlling the temperature through their thermostat. Tenants who followed this advice explained that it was because the use of a timer fitted well with their routines, for example, in households with children and single shift workers. In contrast, shift work also served as a barrier for using a timer in place of the thermostat for some tenants. For households with shift workers working different hours, timers proved irrelevant because they are in at different times and cannot predict when their shifts will be. "*There is always somebody in the house because of all our different shifts. We don't have it on a timer because it might be on when nobody is in. We tend to put it on with the thermostat when we need it"* (Advice, W2.11, Lives alone, In full time employment). This demonstrates the difficulty of illustrating how personal characteristics are more or less likely to encourage changing behaviour.

Existing levels of knowledge served as both a facilitator and barrier to uptake of advice. A facilitator was previous advice given by an engineer in past boiler checks. Where a tenant had previously heard from a different engineer that they could save on money by controlling through the timer rather than through the thermostat, they were more likely to use the timer following the advice in the trial. One view was that previous engineers advised on using the timer to save on money rather than controlling through a thermostat. However tenants also described previously learning that using the thermostat to control their heating was more efficient and allowed for greater control. '*What I was advised quite a few years ago- whether it's right or wrong, I don't know- I keep the control on and if I want heating on I go to the thermostat and turn it up to 20-21 degrees*…(Advice, W2.2, Lives with husband and young step-son, Not working).

As with the thermostat, there were reports of no change in the use of the timer. In some cases this included tenants who tried the new settings for a short period before reverting back to their original controls. An example of this was when the weather fluctuated and tenants felt switching heat on at the boiler was easier than setting the timer. Routines were again a main reason for this. The intricacy of household routines affected whether tenants would use the timer in place of a thermostat. For example, one tenant described how her household cannot use the timer because her and her husband are on different shifts. Instead they adjust the temperature at the thermostat so that the heat is on when they need it:

> "*He [her husband] wakes up at 3.30am to go to work…when I wake up I would switch the heat on. We don't use the timer, we never have done. I would still be in bed at 3.30am when he gets up and it would be too hot once I get up....If we used the timer the heat of it would wake me up. He uses the [electric] fire instead while he is getting ready*" (Advice, W2.1, Lives as a couple, In full time employment).

Lack of knowledge about the complexity of the timer also proved to be a barrier to uptake. In some cases, the advice provided did not give tenants either the knowledge or the confidence to be comfortable using their timer so they did not report any change in behaviour. In addition to routine and complex systems, practical reasons such as quickly fluctuating weather conditions barred tenants from taking up the user of their timer.

TRV settings

Tenants interpreted advice related to their TRV settings in different ways, causing the impacts to differ. There were four types of behavioural outcomes that tenants reported:

- leaving all radiators on a low setting
- leaving radiators on downstairs only
- zoning (i.e. turning off radiators in unused rooms)
- and optimising radiator efficiency by moving furniture.

One interpretation of the advice provided on radiators was for tenants to leave radiators on low in the expectation that this would use less energy overall and therefore save money. A tenant described having previously left all TRVs on the highest setting when needed but following engineer advice has adjusted this and leaves all TRVs on 3 because it will help keep the house warm but use less energy (Advice, W2.8). A second interpretation was to leave radiators on only in the main living spaces or downstairs since hot air rises and sufficiently warms upstairs spaces. As one tenant described, "*I never used to use TRVs until the man came and said to set the bedroom less than what the living room is. That was the first time I thought about it*" (Advice, W2.2, Lives with husband and young step-son, Not working). Tenants in some households described this as being sufficient to meet their comfort needs.

A third group of participants described using zoning after receiving advice from the engineer that this would improve comfort and help cut energy use. Tenants described that this led primarily to improved comfort by turning down or off radiators in unused rooms, and turning down radiators in rooms set high:

> '*Since turning down the TRVs in the bedrooms we feel much more comfortable at night…it is much easier to sleep'* (Advice, W2.2, Lives with husband and young step-son, Not working).

Finally, in particular circumstances, tenants also tried to maximise the efficiency of radiators following advice from engineers. The tenants received advice about moving their furniture to unblock radiators and ensure it is picking up temperature readings properly. Tenants that saw this as an easy win to save money decided to move the furniture. However, space constrictions of a property barred other tenants from doing this - there was no other practical location for the furniture.

There were also households where behavioural outcomes were not observed. These households had specific needs that overrode the desire to reduce costs, such as the flexibility required for shift workers, an emphasis on comfort or health over costs, and a risk aversion related to changing what they already do. Firstly, shift workers, referenced elsewhere in the report, described finding it difficult to take on advice related to TRVs as their routines were highly variable. Secondly, tenants also reported turning down their radiator settings but did not experience any cost savings or felt less comfortable and therefore reverted back to pre-intervention behaviours. For example, a tenant described that she would not set TRVs on low because she knows what is comfortable for her (Advice, W2.7, Lives with brother, Retired), while another had turned down the radiator in his room from 6 to 3 but did not feel any benefit- '*it's a waste of time and doesn't really save any money*'- and so has gone back to turning that radiator on full (Advice, W2.10, Lives alone, Long term sick). Finally, there was also a view that the cost saving benefits do not outweigh the risks of taking on advice related to TRVs. Risk averse tenants did not take up radiator advice for fear of negative financial consequences or reduced comfort; others were resistant to any change or because they had always acted in the same way.

3.3.3 Financial outcomes

Outcomes related to finances included cost savings and gaining efficiencies in energy use, while some tenants experienced no noticeable savings.

Cost savings

Tenants typically found it difficult to assess whether they had saved money having followed advice from the intervention, even during the wave 2 interviews which took place in May and June, over six months since the intervention took place. There was a view that it was too early for them to tell if there would be savings, or it was hard to determine whether any change in their behaviour had influenced bills. For example, where households were on a programme such as 'Stay Warm', they are allowed to use unlimited gas and electricity for a set monthly cost so their bills remain stable. However, cost savings were reported. A tenant reported a reduction in their gas bill from £52 to £39 and as a result will continue to keep the thermostat set between 18 and 22 degrees and all TRVs set to a low setting (Advice, W 2.8, Lives with young son, In full time employment). It is also the case, however, that other confounding factors may have led to cost reductions in the examples that emerged from the qualitative research. For example, a tenant had begun to implement advice and saw a cost savings but had also spent considerable time over the winter in the property of her son so had not needed her heating on as often (Advice, W2.13, Lives alone, Retired).

Alternatively, there were a range of reasons reported by tenants for why they had not experienced cost savings. Firstly, tenants felt that this was not a particularly cold winter and so they did not need to utilise their heating controls or the advice as much. Secondly, other tenants were already using their controls in a financially conscious way and so any small, subtle changes would have led to savings too small to be noticeable - such as putting the frost setting on TRVs. Finally, other tenants felt that increasing gas prices or the inefficiency of their heating system meant that savings were unlikely to materialise.

Efficiencies

Tenants also described outcomes in relation to efficiency rather than explicitly as cost savings (though this may have been the result). There were two ways in which efficiency was described: stopping waste and improving the use of existing heat. For example, one tenant explained that by not unnecessarily opening the windows their temperatures are better managed now and they had stopped wasting energy (Advice, W2.3, Lives with son, In full time employment). Alternatively, tenants also described making the most out of the heat they generate by turning off radiators upstairs and directing more heat to lower levels so heat can rise and heat higher levels.

4 Delivering the intervention

This section explores the operation and delivery of the intervention, providing evidence on the resources and activities sections of the logic model. It begins by describing engineers' initial engagement with tenants in the advice and leaflet arm of the trial and the factors that mediate tenant's initial engagement with engineers. It then describes the delivery of advice, highlighting the process of engineers assessing both tenant's existing knowledge and household composition and then taking a patchwork approach to the order and content of the advice based on this assessment. Finally, it considers views on the advice, highlighting consistency of the delivery content across engineers and the perspectives of tenants on the advice they have received. This section draws on data from wave 1 interviews unless otherwise noted.

4.1 What was delivered?

This section describes the activities that took place to deliver the intervention. It focuses on the training engineers were given to provide the advice, including their approach to engaging participants, the engineer checklists and the content of the advice. A whole range of other project management activities took place behind the scenes to make this run smoothly but the aim of this section is to describe the actual delivery of the intervention to provide some context for the engineers' and tenants' views presented in the remainder of the chapter.

To recap, the trial comprised three arms:

- Advice arm: a 'trusted messenger' provides advice to tenant about how to effectively use their heating controls, and asks occupant to demonstrate their knowledge back to the them
- Leaflet arm: a 'trusted messenger' provides tenants with an informative leaflet explaining to the tenant how to effectively use their heating controls
- Control arm: standard gas boiler engineer visit, no advice or leaflet provided.

The boiler engineers completing the statutory annual boiler check for Your Homes Newcastle (YHN) were selected as the trusted messenger to deliver the advice. In order to do so, they required training as the activities involved in providing the advice are additional to their standard professional responsibilities. All the training was provided by the Behavioural Insights Team, with NatCen conducting a group discussion as part of the programme. Training was given prior to the pilot and before the main trial as a refresher and to work in learning from the pilot (see Chapter 1). The training of engineers in each arm of the trial took place separately.

For **advice engineers** the training included on the following elements:

- Recap on progress to date and summary of lessons learned from the pilot
- Group discussion and reflections on the pilot
- Explanation of the Winter Trial timeline

- Recap on the intervention
- Importance of accurate data collection
- Questions and Answers session

The main learning for the recap on the intervention was to focus the advice on more specific actions that the engineer felt would be most appropriate for the household. This meant that engineers were not required at every household to run through the full advice programme if they did not think it was relevant or useful. Instead, specific messages were to be emphasised at each stage:

- Turn thermostat down to a temperature you're comfortable with, for example 18ºC[13]
- Tell tenant how they can stop losing heat.
- Then when in front of thermostat, adjust it!
- Turn off TRVs in rooms that remain unused for long periods
- Tell tenant how they can stop losing heat
- Then, when in unused rooms, show them!
- Use your programmer to set your heating on/off.

The advice scripts that engineers used (see technical annex for exact wording), required them to try to engage the participant following the boiler check by offering the tenant the opportunity for them 'to explain how to control the heating in your home better'. If the tenant consented to receiving the advice, then the engineer would start with the thermostat, then the TRVs and then the programmer, providing advice in two stages at each of the three controls:

- Rehearsal: the engineer shows the tenant how the controls work and recommends a particular way of using it that may suit the household
- Demonstration: the tenant is asked by the engineer to demonstrate how they would now set the control to help embed the learning.

Engineers in **the leaflet arm** of the trial also received training, though due to the nature of that intervention, less detail was required. The training for leaflet engineers included the following elements:

- Recapped progress to date
- Summarised pilot results and lessons learned
- Group discussion and reflections on the pilot
- Winter Trial Timeline
- Intervention recap
- Importance of accurate data collection
- Questions and Answers session

There were limited changes for the leaflet engineers between pilot and main stage trials, apart from in relation to the content of the leaflet, which did not necessarily affect how they delivered the intervention. As with the advice arm of the trial, leaflet engineers were required to complete the boiler check first and then say to tenants 'I am also giving you a leaflet which will help you to use your heating controls better'. Once the meter reading was taken, the engineer was not required to have any further engagement with the tenant that diverges from the normal delivery of the boiler check. This was because we were trying to simulate a typical

[13] Engineers to give advice as follows: set the thermostat at 18 degrees and only increase by 1 degree until the home reaches a comfortable temperature. If prompted by tenants, the engineer would advise setting the thermostat no higher than 25 degrees. This is consistent with current Department of Health advice.

scenario for when the tenant would receive the leaflet, such as through direct mailing or picking one leaflet up.

Engineers visiting the **control group** had no involvement in the pilot but received training before the main trial. The training covered:

- Purpose of the trial; to see whether we can help people in social housing to use energy more effectively.
- Role of a control group in an RCT
- Ask of the engineer
- Delivery timescale
- Seeking consent to obtain meter readings
- Accurate data collection

The remainder of this chapter describes the views and experiences of engineers in delivering these interventions and tenant's experiences of receiving them.

4.2 Engagement

4.2.1 Encouraging engagement: advice arm

The initial approach of the engineers to delivering advice played an important role in how they encourage tenants to take part in the intervention. During the interviews, tenants described engineer approaches as varying from liberal and opportunistic to authoritative and legalistic, illustrated by Figure 4.1.

Figure 4.1 Spectrum of engagement approach

At the **liberal** end, tenants described that during the intervention engineers noticed that they were not using particular controls and used this as an opportunity to ask tenants whether they wanted advice. Other tenants spoke of how engineers checked controls during their routine, asked tenants about how satisfied they were with their settings and offered tenants advice but also the opportunity to decline the advice if the engineer was satisfied with how they used their controls. When an opportunity presented itself they used existing setting on controls as a 'hook' for their advice. This included noticing an incorrectly set control or evaluating tenants' existing knowledge based on what their settings currently were. Tenants were then offered the advice or the opportunity to opt-out based on these observations.

At the **mid-point,** between the liberal and authoritative ends, tenants described engineers whose approach to engagement was closer to the training they had received. Engineers engaged tenants by telling them that they would like to check how they were using their controls, that they could talk them through how to use their controls, or that they would like to show and explain to them how their heating controls worked. Some tenants recalled being told by engineers that they could show them how to save money by using their controls, while others recall the intervention being described simply as a new initiative by the council. While not retaining absolute fidelity, when engineers adopted the mid-point approach to

engagement they were closest in their observance of the training programme, while also offering tenants an opportunity to opt-out.

At the other end, tenants spoke of engineers who adopted an **authoritative** approach to delivering the advice. One tenant, who felt confident with their knowledge of controls, described how when they tried to decline the engineer's advice, the engineer insisted that they had to check whether they were using their controls rightly or wrongly. Another tenant described a situation in which after they declined the advice, the engineer explained how they were legally required to show them how to use their controls. Where it was reported that engineers adopted this approach, they were perhaps furthest away from fidelity to the program and, in not offering an opportunity to decline, were giving tenants no choice about whether they wanted to receive the advice.

4.2.2 Encouraging engagement: leaflet arm

In contrast, those tenants interviewed as part of the leaflet arm of the trial described receiving leaflets at the end of the engineer visit and **engaging very little with engineers** about the leaflet. One tenant described the leaflet as 'junk mail', particularly as it was handed to them by the engineer with 'other bits of paper'. Similarly, some engineers felt tenants tended to put the leaflet aside as soon as they received it and would not subsequently look at it. They did also feel that because they delivered the leaflet at the end of the visit, there was little opportunity to offer tenants the chance to engage with them about the content of the leaflet. They did however feel that it was much easier, and a more 'streamlined' process, to leave the leaflet at the end of their visit.

4.3 Factors influencing participation

4.3.1 Successfully engaging with tenants

Engineers did not feel that there was a specific type of tenant likely to take up the advice. Instead they reported that circumstantial issues such as timing were the most important factors. Engineers felt that if they caught the tenant at a good time, it was much easier to engage with them and deliver the advice. They did however find it most difficult to engage with older and much younger tenants. Engineers felt that older tenants tended to have a very set routine around their heating system that they were reluctant to change, while younger tenants seemed less concerned or engaged with being more efficient with their use of controls.

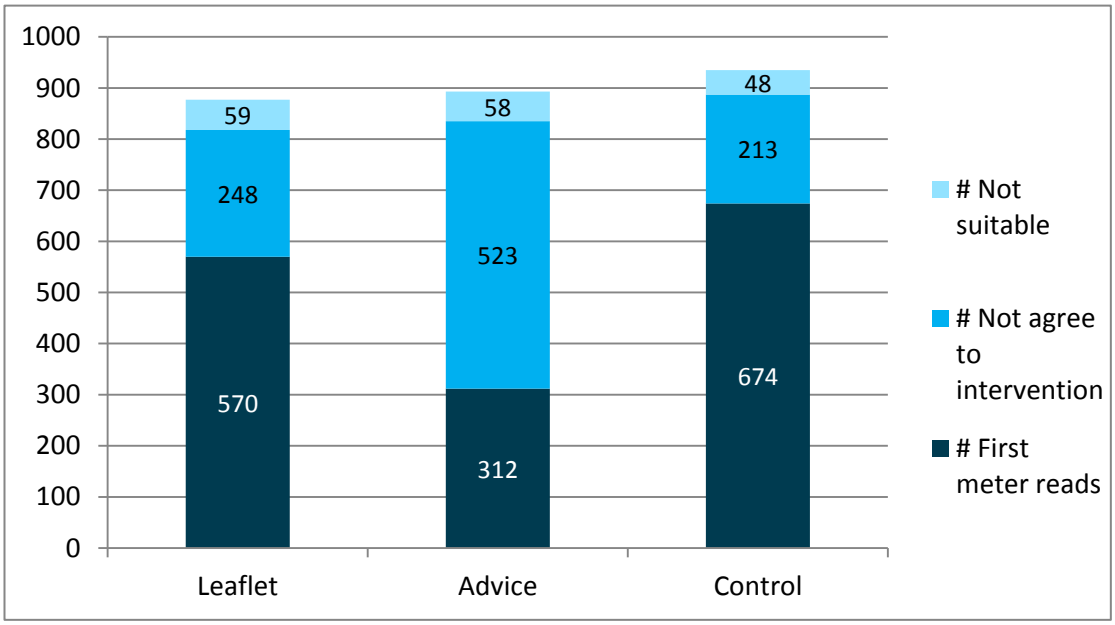
The approach engineers adopted in their initial engagement seemed to have little effect on the experience of tenants in the advice arm of the trial. Even amongst those tenants where engineers adopted an authoritative approach, they subsequently described engineers in often glowing terms. One tenant who was told they *had* to listen to the advice still described their engineer as *"…a 10. All the others [engineers giving previous boiler checks] were a 5."* (Advice, W1.76, Lives alone, Not in employment).

Amongst tenants in the leaflet arm of the trial, some did not even remember receiving the leaflet. Where tenants did remember receiving it, some of them were unable to describe anything in detail about the design or content. This suggests that a tenant's initial engagement with the engineer and the leaflet did not effectively encourage their engagement with the content of the leaflet.

4.3.2 Why did some tenants not participate?

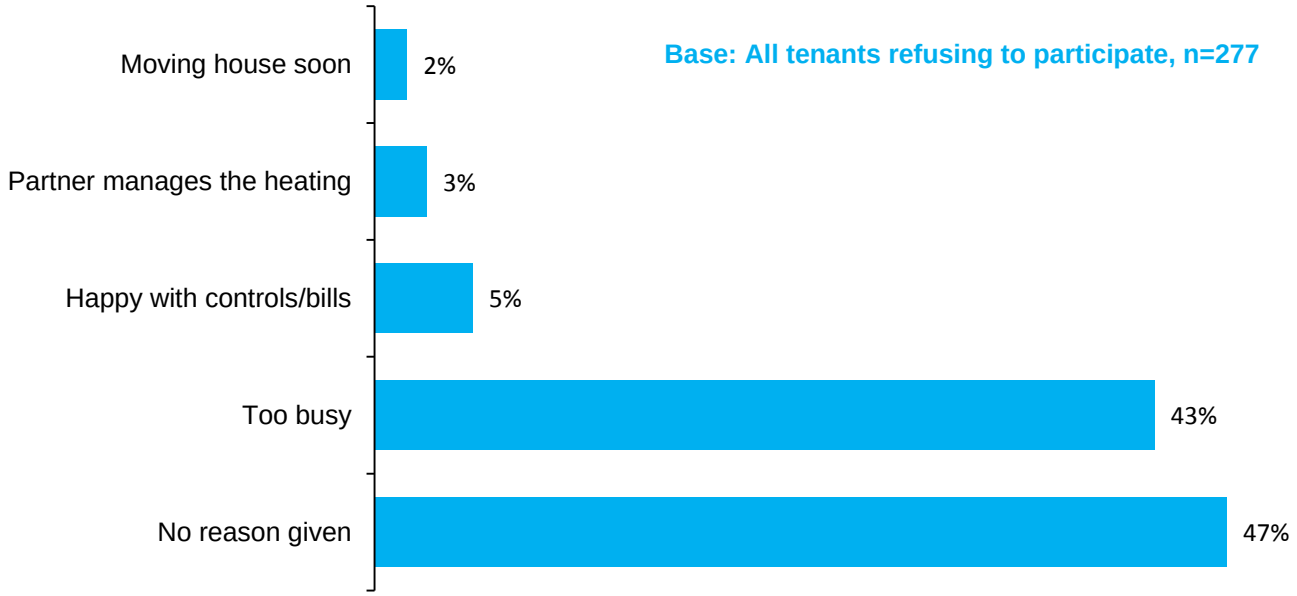
As part of the engineers' checklists when delivering the intervention, they were required to record reasons why tenants who were in when visited by the engineers did not participate in the intervention. There are two main reasons that this could happen: the tenant refuses to take part or the engineers determines that the intervention is not appropriate. Figure 4.2 below shows the proportion of tenants that refused to take part or were deemed unsuitable in each arm of the trial.

Figure 4.2 Proportion of refusals and unsuitable households by trial arm



The chart illustrates a significantly higher refusal rate for the advice arm. Data from the process evaluation suggests that this is likely to be related to the nature of the intervention. It requires more of the tenant's time to complete compared to the leaflet and even if participants may have in principle have wanted to take part, it may not have been convenient to do so at the time the engineer visited. Tenants may have been considered unsuitable for the trial for a number of reasons, but most prevalent were the age of the tenant, difficulties with speaking English or concerns over safety. Checklists completed by engineers provide more detail on why tenants refused to take part, which chimes with these qualitative findings. Figure 4.3 shows the reasons for refusal recorded by engineers. This shows that where a specific reason was given, time was overwhelmingly the most common, given by more than 80 per cent of those giving a reason.

Figure 4.3 Reasons given by tenants for refusing to participate in the trial



Tenants may have also been considered unsuitable for the trial by engineers for a number of reasons, but most prevalent were the age of the tenant, difficulties with speaking English or concerns over safety. Despite this, the profile of the households participating in each of the trial arms is similar across all known characteristics (see Appendix 6.1.2 for further details).

4.3.3 Engineers as trusted messengers?

This section draws on both wave 1 and wave 2 interview data to highlight the importance of the **engineer** as a mediator for taking on the advice. Tenants often had subtle, complex and occasionally contradictory views about the engineer, reporting that demeanour, personality and expertise were key factors in determining their view.

Firstly, tenants commented on how, simply because the engineer delivering the advice appeared to be happy, or cheery, they were willing to engage with them on the advice. One tenant explained:

> *"It's like music. Some music is hard to listen to, some music is easy to listen to, and he was like, easy listening'* (Advice, W2.12, Lives alone, Long term sick).

The engineers were also described as *'a very pleasant lad'* or *'a nice, friendly, regular lad'* by some tenants. They also described the engineer's as caring about them, giving them the *'time of day'* and wanting to help them to save money. There was also a general feeling that because it was a gas engineer's job to understand their system, they were best placed to deliver the advice.

Tenants also made a sharp distinction between the engineer that visited as part of the trial and engineers that had previously simply conducted boiler checks. Tenants described previous encounters with '*grumpy'* engineers who were not very talkative or who were just coming to *'get in and out'* and do their job as quickly as possible. While some tenants had sympathy for the engineers and were conscious that they were doing a necessary job, their demeanour had created an impression that they did not want to engage with tenants, despite being in their homes. This was a sharp contrast to the visits from the advice engineer who were described as engaging and talkative. Past experiences of other engineers also had an effect on some tenants' willingness to participate in the trial. One tenant described a situation where they had previously been made to feel 'stupid' by an engineer because of how they had been using their controls, and this experience had prevented them from accepting advice

from the engineer during the trial stage because they felt *'silly'* about the previous experience and were worried that the engineer would treat them in the same way.

Secondly, there were mixed views on the expertise of the engineers. In general, tenants felt that you should trust engineers to deliver their advice because it was their job to know what they are talking about, but that they should also have the necessary education and qualifications to do so:

> *'If I walked in to the property for the first time I wouldn't have a clue…they know better than me and that's their job to know what's right'* (Advice, W2.7, Lives with brother, Retired)

Conversely, there was a view that simply 'being an engineer' meant nothing. This appeared to be based on past experience of engineers and tenants with this view were keen that engineers should be able to show their registration with an official body such as Corgi.

In summary it appears that both the delivery style of the engineers and the content of their advice were important for tenants; the approach the engineer adopted and their engagement with tenants on an emotional level was also an extremely important indicator of trust and a strong mediator for engaging with what they actually said:

> *"…if they said to me, do you want us to show you how to do these controls, and if they were friendly I'd say I wouldn't mind, but if they were like the last guy, miserable, I'd say, oh no, it doesn't matter, I know what I'm doing"* (Advice, W2.12, Lives alone, Long term sick).

4.3.4 Money, efficiency and knowledge

In the advice arm of the trial, tenant engagement with the engineer's approach was also mediated by a range of factors not related to the engineer: saving money, developing more efficient ways of operating their system, and gaining greater knowledge.

One view was to see the advice as an opportunity to **save money**. In some cases this was reinforced by engineers that told tenants that the advice might help them save money, while in other cases, tenants were already worried about the cost of their system, or price rises, and they felt that the engineer's advice could help them to learn how to save money. During focus groups with engineers, they also felt it was important to mention the word 'saving' in some capacity, otherwise they felt that tenants would not be interested in taking part. While this echoed their training to frame the possible benefits of following the advice as 'loss aversion', references to costs savings (see Chapter 1) were removed from the advice group, and cost savings were not claimed by engineers. While this was removed for ethical reasons (i.e. following the advice would not *guarantee* savings for the tenant), if this can be included as part of revised advice in the future it is clear that it would help the engagement of some tenants:

> *"Being a gas man, you believe it more because they know what they are talking about… I don't mind listening for a few minutes if it's going to save you money…It was the first time anyone had explained anything about the heating and it was helpful (Advice, W1.49, Lives alone, Not in employment).*

As well as an opportunity to save money, tenants also saw advice as a way of gaining **greater efficiency** and **greater knowledge** about how their controls work. One view was that it was important to know how to operate their system efficiently and that the engineer could show them how to do this. In other cases, tenants were interested in knowing more about how their system worked, either in general or about specific items. For example, one tenant who felt confident about some aspects of controlling their system saw it as an opportunity to learn more about the timer, which they had previously known little about and lacked the confidence to learn on their own.

4.4 Delivery

This section describes how engineers delivered the advice and the factors that influenced their decisions. It focuses on how they established levels of knowledge and contextual information about the household, the ordering and detail of the advice provided, and challenges they faced in delivery.

4.4.1 Establishing knowledge and context

As highlighted previously, tenants' knowledge of the controls in their household varied from those who were confident with most aspects of their system to those who had little previous advice or knowledge about their system. This was also reflected in the engineers' delivery. Tenants described how engineers **assessed their knowledge** about different controls as well as their **household context** and based on this adapted their approach to the individual tenants' needs. This varied not just by engineer, but also by the approach taken by an individual engineer to the different controls in different households. For example, one engineer did not cover the programmer element of the advice because the tenant told them they had been using it effectively for a number of years. In contrast another engineer visited each room in a household, assessed how each control was being used and, satisfied with the thermostat and TRVs, focused their advice on explaining the timer to the tenant. Where tenants could clearly demonstrate that there was no value in explaining a particular control, engineers did opt to skip that part of the intervention. For example one tenant reported how when asked about the timer, they explained that because they work shifts, it was not useful for them to use it. The engineer did not offer any advice or demonstration because of this. Overall, the demonstration element of the advice in particular was more appropriate in cases where tenants **felt less confident about their knowledge** with certain controls. There were also cases where no demonstration took place at all, although in these cases tenants were comfortable with this given that they felt they had the necessary knowledge to confidently use their controls.

The variation in engineers' initial delivery, based on an assessment of tenants' existing knowledge and household contexts, resulted in a **tailored** approach to the actual delivery of advice. This means that engineers delivered different combinations of the three main steps of the advice (rehearsal, spacing, and demonstration) in relation to the three main controls (programme, thermostat, TRVs). However, it was up to the engineer themselves to identify the best time in their visit to deliver the intervention. The original implementation plan had a much more prescriptive breakdown, but the pilot revealed that the inflexibility caused problems for the engineers. As a result, the decision was made for the main stage that the engineer should have the freedom to adapt to the situation. For example, if at the start of the visit a tenant is on the phone, they can do the boiler check and then when the tenant becomes free, deliver the advice. As opposed to having to wait until the tenant is ready to begin their work. Further examples of this and the reasons for choosing particular combinations are described below.

One approach included cases where engineers 'missed out' on steps in the advice process and individualising advice based on the tenants existing knowledge and household context. Tenants described how engineers only explained how to use certain controls, but did not show or ask tenants to demonstrate using their controls, while others went through all three steps of delivery but only on one type of control but not others. For example, one tenant described a visit in which the engineer explained, showed and asked the tenant to demonstrate the use of the timer; in contrast, another tenant described how an engineer

explained the timer control, but then set the timing around their typical routines. This tenant felt that because of the way the advice was delivered they would not remember how the controls worked or be likely to try to change it, because the engineer had already set it around their daily routine. Furthermore, no tenant described a distinct rehearsal *and* spacing element. Where tenants were asked to demonstrate controls back to the engineer, this was done immediately after the engineer had shown them. This tailored approach also extended to the ordering of the advice. Tenants described different accounts of the order of delivery, but gave examples which suggest that the order depended on where the engineer decided to introduce the trial. For example, some engineers introduced the advice while doing the boiler check and would tend to start the delivery at the programmer or water temperature control, while other engineers would start with delivering the advice and then go to controls that tenants had specific issues with.

4.4.2 Challenges delivering the advice

Finally, some tenants did also highlight challenges with the delivery of advice. In particular where engineers did not observe or 'pick up on' anything about the context and dynamics of a household initially, it sometime led to challenges later on. For example, a tenant described how the engineer altered settings on their timing controls, which they then had to change back to fit their routines. Secondly, some of the barriers identified in relation to engaging participants also apply in relation to delivering the advice. For example, older tenants could find it more difficult to demonstrate the advice or showed a lack of willingness to follow the advice; in households with younger children tenants were not always able to fully concentrate fully on the advice being provided. In both of these circumstances, engineers felt that it would be preferable to have been able to provide the leaflet as well as the advice.

4.5 Views on content

An assessment of the existing knowledge of tenants and their household circumstances, as well as a tailored approach to the delivery of advice, influenced not just the delivery of the advice, but also the content. The next three sections describe variation in the consistency of the controls that engineers referred to, the details of the advice and advice provided on things other than the three main heating controls.

4.5.1 Consistency of advising about different controls

As a product of the tailored approach, tenants described being advised on some controls and not others. As described above, this related to their existing level of knowledge. For example, one tenant described the engineer taking time to talk through how to control the timer but when it came to the TRV controls, the engineer was satisfied that the tenant knew how to use them already based on how they were being used, and so did not offer any advice. Another tenant explained that the engineer asked the tenant to show them how they use the timing controls, and having seem them operate it, seemed to be satisfied with what they were doing and did not offer any additional advice. For other tenants, this was to do with their level of confidence about controls, for example one tenant told an engineer that it would be a waste of their time to try to explain how it worked because they described themselves as *'thick when it comes to things like that'* (Advice, W1.77, Lives alone, In full time employment). The timer in particular was mentioned by several tenants as a control which they refused advice on, either because they felt it was too complicated to operate or because using a timer wouldn't fit with their lifestyle.

4.5.2 Consistency in the detail of advice

The level of detail engineers provided tenants with during their advice also varied by engineer and tenant. At one end of the spectrum, engineers went into **specific detail** about the workings of the controls. For example one tenant spoke about how the engineer went through each control in the household and at each one followed the trial process of explaining the control, showing the tenant how to use it and then asking the tenant to use it. In addition, the engineer explained how the controls could improve the conditions in the household, explaining for example that the tenant could use TRVs to regulate heat in different rooms throughout the house and keeping the rooms they occupy most frequently the warmest. In other cases, engineers only touched on **broad details**. For example, while some engineers showed tenants how to switch the room thermostat on and off as well as offering advice and an explanation of how it worked, other tenants described engineers' approach to the room thermostat as simply advising them to keep it anywhere between 18 and 25 degrees, either because they said it was enough for them to keep warm or because it was the most efficient or cost effective way of using it. In more extreme cases, engineers went into **little or no detail**, or even simply set controls for tenants. For example, one engineer only asked about the setting of the room thermostat, and then chose not to give any advice because it was set at the temperature he would have recommended.

4.5.3 Additional advice

Engineers also delivered advice on **additional items** as part of the intervention. In particular, engineers advised several tenants around bleeding their radiators and controlling the water pressure. For example, one tenant was asked about how regularly they bled their radiators and then shown how to bleed the radiator during the advice delivery on TRVs. Another tenant was advised on how to check the water pressure on their boiler, and what to do if it drops by an engineer. Again, this additional advice was delivered during the advice on the boiler, and where engineers did deliver additional advice on items, it was when they were already delivering advice on a particular item.

4.5.4 Views on the leaflet

This section describes views on the written and visual content of the leaflet, the 'fill-in-the-blanks exercise' and the longer-term value of the leaflet.

In general, the leaflet was considered to be well designed and the textual information was described as clear and accessible. However, one tenant with literacy issues described struggling to understand the content, and explained that during the engineer's visit, the engineer also delivered advice when they realised that it was difficult for the tenant to understand the leaflet. There was also general a view that a leaflet was a good idea when helping people to work things out for themselves. In fact, tenants in some cases felt that images alone could have conveyed the information more effectively. Alternatively, the colourful nature and inclusion of animated characters were seen in a less positive light, with some tenants feeling that it made the leaflet made it feel like a comic book. For these tenants, this made the leaflet feel unimportant and pitched at the wrong level.

None of the tenants interviewed as part of our process evaluation had completed the 'fill in the blanks' exercise. There appear to be three reasons for this. Firstly, time was an issue, with tenants describing how they would not get round to doing this once the engineer left. Secondly, it was not always clear to tenants that this is what the leaflet was asking them to do – only when prompted by interviewers did they realise that part of the process was to fill in

the blanks. More fundamentally, a final view was that being asked to fill in the blanks was condescending and patronising and more suitable for children to complete.

When asked across both tenants in the advice and leaflet arm of the trial, there was a positive feeling towards having the leaflet, but tenants tended to see it as a ‘back up’ to an engineer visiting and delivering advice, something that they could refer to at a later point to refresh their memory of the engineer’s advice.

5 Learning for future trials

The experience of conducting this trial and the findings that have been generated provide a rich set of lessons for DECC and others considering designing and conducting RCTs of interventions to reduce energy consumption. There are practical lessons that relate to the effective planning and implementation of a trial of this nature and a clear requirement to design the methodology and implementation synchronously and iteratively. The findings of the impact study provide clear evidence that it is possible to use meter readings to robustly measure energy consumption outcomes. There is also important learning to be found in the qualitative data presented in this report relating to engaging participants in this kind of trial and the crucial characteristics of a 'trusted messenger'. In general this report provides a further contribution to the underdeveloped but growing evidence related to the relationship between the needs and behaviours of energy consumers and their interaction with heating systems and controls.

This final chapter describes the specific learning related to implementation, methodology and behavioural findings.

5.1.1 Implementation

As a multi-stakeholder trial and 18-month project, clear lessons have emerged around the planning and implementation of this kind of trial:

- The experiences of the stakeholders indicate there was good partnership working in this trial and clear leads were essential for effective project management. This experience makes clear the importance of partnership working and planning from the inception of the project. Crucial to have in place are clear project leads and clear lines of responsibility to eliminate duplication and delay.
- Implementation plans for a multi-stakeholder project like this need to be developed synchronously and iteratively alongside with the methodology. All delivery stakeholders should be involved in the development of these plans from the outset in order to take account of operational constraints of partners and commercial context within which partners may be working (for example, in this trial Building and Commercial Enterprise). These issues set the parameters for what is realistic in terms

of the methodology. The challenge is to sufficiently standardise the delivery of the trial without undermining the RCT methodology.

- The experience of the trial also illustrates the value of a pilot. The details of the learning from the pilot are described in Chapter 1 and the technical annex, but it ensured that all partners understood the aims of the intervention and how it should work and provided an opportunity for reflection and refinement of the trial. The face to face training of engineers prior to the main stage of the trial was deemed invaluable in ensuring consistency of intervention arms and to obtain buy-in from those delivering the trail. This also allowed partners to gain insight into the engineer-tenant relationship, to help inform subsequent data collection and analysis.
- Furthermore, if a pilot is conducted, it is important to build in time to implement pilot findings in relation to trial design and trial delivery. It is also be useful for all partners in a project of this kind spend time in the field, (e.g. with engineers to see the delivery in practice) as part of pilot and seek feedback from stakeholders and participants to refine trial design.

Methodology

This trial provides strong evidence that trials of interventions to reduce domestic energy consumption can be conducted efficiently and rigorously:

- The quality and coherence of the meter data suggests that it is possible to measure actual behaviour through meter readings for RCTs of interventions to reduce energy consumption. This is a comparatively cost effective alternative to installing expensive and sometimes temperamental monitoring equipment.
- It is important to consider the particular characteristics of the available study population for this kind of trial. In this case, social housing tenants may have had limited capacity to reduce their energy consumption relative to the general population. Therefore, the overall theory could be less likely to hold for the available study population. In general, consideration needs to be given to whether there is anything about the population or housing stock that might make implementation of this kind of trial more challenging or mean that there is only limited available data and intelligence on which to base this methodological decisions.
- Data from the qualitative research suggests that the approach and personality of individual engineers was an important mediating factor in tenants' experience of the intervention. The way this trial was designed could not detect differences in engineers' achievements because of the sample sizes when broken down by engineer. Future trial designs testing 'trusted messengers' should, where resources allow, consider sample sizes that facilitate this kind of analysis.
- It is important to clearly specify how the meter should be read in advance. For example, engineers should be trained to clearly mark down the number of units to record, the decimal place, and the units for gas.

Behavioural findings

The qualitative data collected for this study generates useful findings for behavioural trials more generally and interventions to reduce energy consumption in particular:

- The qualitative data provides some evidence of a breakdown in the theory of the intervention for this population but also challenges with implementation. This suggests that the theory and implementation tested here needs refinement and testing with

another population with greater capacity for reducing energy consumption rather than discarding.

- Important general findings were identified in relation to the concept of a ‘trusted messenger. The qualitative data described in Chapter 3 and 4 suggest that three main ingredients appeared important for the engineer to be considered trusted and, therefore, listened to: a neutral or objective affiliation that gave credibility to their offer of help (in this case to the local authority); relevant and demonstrable skills and expertise (in this case the responsibility for conducting the boiler check); and their manner of delivery (in this case it was important to be friendly and personable).
- When delivering advice in a short time frame, particularly in relation to more complex issues (in this case in relation to the programmer, for example), more detail and less breadth in the information provides appears to be more effective. No tenants acted on all the advice they were given, but focused on a particular control or change that they felt would make the most difference in their personal circumstances.
- The qualitative findings also show the value of involving those delivering the intervention in its design. When engineers and tenants described successful visits, these appeared to make the most of the engineer’s intuition to pitch the advice and select the particular control to focus on.
- A leaflet alone does not appear to be sufficient to encourage changes in energy consumption behaviours; this arm of the trial lacks the aspects that made tenants engage with the advice arm of the trial (personalisation, rapport, specific detail). The leaflet is competing for attention with a plethora of other material that tenants are given or that drops through their letterbox; even where tenants were initially interested in the content, the leaflet was simply treated as another leaflet or piece of junk mail that they choose not to read. However, the leaflet could be incorporated into the advice intervention as a useful general memory aid following personalised advice.
- For ethical reasons the reference to the intervention as a saving money opportunity to tenants was removed. As noted in Chapter 4, while understandable, this unfortunate given that the qualitative evidence that suggest that BIT’s original design to focus on ‘loss aversion’ would have been an effective hook for tenants.
- Despite this, while the trial did not identify impacts on energy consumption, qualitative evidence suggests that the intervention did lead to important outcomes for individuals related to improved comfort, well-being and people’s confidence in keeping themselves and their family warm.

Appendices

This technical annex provides further detail on the methodology and presents instruments and materials used in the implementation of the trial and the research conducted as part of the evaluation. The contents are as follows:

Annex A: Methodology

- The pilot trial
- The main trial design and impact analysis
- The process evaluation

Annex B: Research instruments

- Recruitment materials
- Topic guides (W1, W2, Engineers)

Annex C: Trial materials

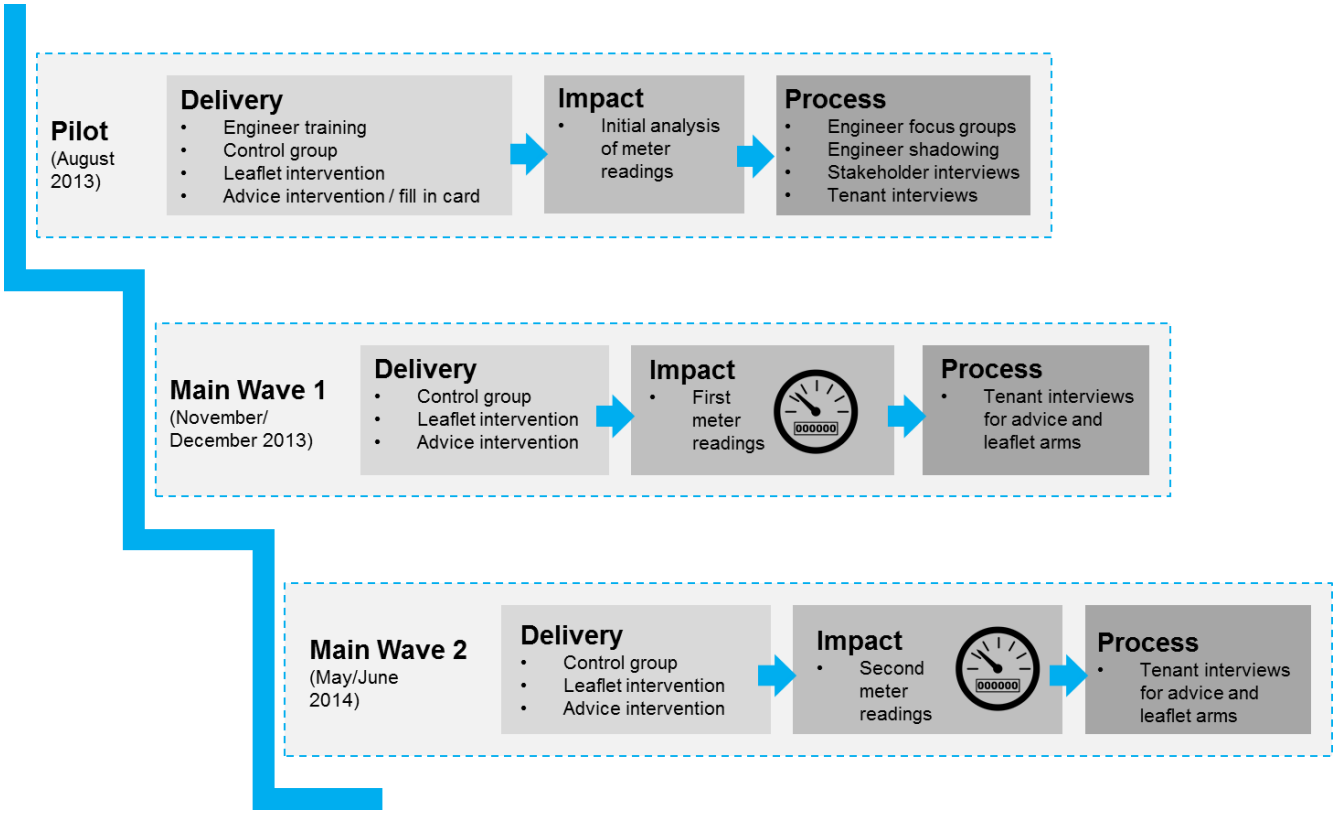
- Leaflets

5.2 Annex A: Methodology

5.2.1 Methodology

This section describes the data collection methods and achieved sample for both the trial and the process evaluation. Figure 6.1 provides an overview with subsequent sections describing the detail the different stages of the project – pilot, wave 1 and wave 2. Further detail is provided in the subsequent sections.

Figure 6.4 Trial and process evaluation design summary



5.2.2 The pilot

Piloting implementation of the trial

The set-up of the pilot was intended to resemble the main trial as closely as possible. Different intervention variations were tested and the main outcome measures included a meter reading, duration of the visit, and the household response to different advice/leaflet designs.

The purpose of the pilot was to test the six different intervention designs: two advice interventions and two leaflet interventions. These interventions included,

1. Advice 1 – Rehearsal plus spacing and fill in cards with no loss aversion script
2. Advice 2 – Rehearsal only plus fill in cards with no loss aversion script
3. Advice 3 – Rehearsal plus spacing, fill in cards and loss aversion (heat & money)
4. Advice 4 – Rehearsal only plus fill in cards and loss aversion (heat & money)
5. Leaflet 1 (Written) Digital and analogue

6. Leaflet 2 (Diagrammatic analogue version only)

There were two main aims of the pilot. One was to understand the time required to deliver personalised heating control advice, and the implication of this on the main trial roll out. The second aim was to learn which intervention designs are the most effective. A secondary aim was to identify and overcome any administrative or logistical challenges that may undermine the main trial.

Boiler engineers were to invite tenants to take part in the intervention at the time of their annual boiler check. Because of this, engineers needed training to support them in how to deliver the intervention.

The **advice engineers** were divided into two sub-groups; rehearsal plus spacing and rehearsal only. Training was segregated to ensure each sub-group employed one of the two respective methods.

Pilot training included the following elements:

- Behavioural science theory and its application in public policy making
- Trial overview
- The intervention should be delivered to all households, excluding those homes that are deemed to be unsafe for the engineer, house a very vulnerable tenant, or where the tenant has substantial language issues. The final decision for including a tenant in the intervention rested with the engineer.
- Data collection (checklist criteria)
- A role play exercise enabled BIT to observe how the engineers demonstrated efficient use of heating controls and engaged reluctant participants.

Written versions of the **leaflet** were produced for analogue and digital programmers, coupled with TRVs and room thermostats. A diagrammatic leaflet illustrated the use of TRVs, thermostats and analogue heating timers. However a number of audiences reported difficulties understanding the leaflet messaging. Moreover, the complexity of digital meant that it was too difficult explaining how to use a digital programmer visually. Consequently this option was dropped.

Designing and implementing the leaflet arm of the trial was challenging for several reasons.

YHN's asset register quantifies the number of properties which contain gas central heating systems, but it does not hold data about the types of devices installed. Also, due to the randomised job scheduling process, the team could not anticipate which heating controls the engineers would encounter on visiting people's homes. Consequently we were unable to verify the proportion of homes using digital or analogue programmers and therefore only two aspects of the leaflet were relevant to households in the leaflet pilot.

The cost of producing multiple booklets containing all of the different types of control would have been exorbitant in relation to design and print costs, officer time and translation into accessible formats suited to a range of audiences.

These factors combined presented a risk that not all of the written or diagrammatic leaflet content would be relevant to the target audience. In view of such limitations and ongoing budget constraints it was proposed that the leaflet engineers visited fewer homes during the pilot (300 as opposed to 500 households).

- BIT did not prescribe a process or sequence for the leaflet engineers to follow during the pilot. The engineers were required to distribute the leaflet at a time of their choosing, ask tenants to fill in a questionnaire and obtain consent to record a meter reading. No formal training was undertaken.
- Control group engineers were not involved in the pilot.
- Pilot training did not consider the level of discretion engineers should exercise when delivering advice and leaflets in the home. Effectively they could choose when to give advice or hand out leaflets.
- Engineers were also asked to recruit tenants for the qualitative evaluation towards the end of the pilot.
- Changes to Loss Aversion Scripting

Aspects of the loss aversion scripts generated ethical concerns. While financial incentives can induce behavioural change, the project team recognised that financial savings could not be guaranteed simply because people adopted energy efficiency advice. This was especially true of the social housing population targeted for intervention. Concerns about the pervasiveness of fuel poverty amongst this group were consistently raised. In response it was agreed to omit statements about the potential to save money from the information leaflet.

Engineers reported that the advice intervention was adding time to the average gas safety check and the leaflets required a degree of explanation, which resulted in delayed appointments. This was difficult to quantify because we had not assessed the cumulative effects over the course of a working day and the checklist only recorded arrival and departure times. We could not differentiate with any degree of certainty between the amount of time spent imparting advice and servicing the heating appliances installed.

To ensure engineers had sufficient time to impart advice and distribute leaflets in the winter trial, Newcastle City Council calculated a revised working pattern based on the average amount of time spent in a property. This reduced the number of gas safety checks an engineer could feasibly carry out in a standard working day. Compensation was calculated to reimburse Building and Commercial Enterprise for needing to reschedule completion of the service programme at another point in the year.

Pilot research on implementation

NatCen carried out a number of research activities to understand how the pilot stage of the trial was implemented and delivered in practice – whether it was carried out in accordance with the training or whether certain constraints or unanticipated consequences meant that this wasn't possible. NatCen also explored the experiences of tenants who took part in the pilot to identify which elements of the pilot were effective and what else might have enabled or hindered impact.

Two engineer focus groups were conducted, one with engineers delivering the leaflet intervention and one with engineers delivering the advice intervention. Topics covered in the groups included coordination and content of training, advice and leaflet discussion, impact of the trial on the engineers and their views on the trial and the research overall.

Researchers undertook three shadowing opportunities to view engineers in both leaflet and advice arms engaging with a tenant. Not intended to be a test, these opportunities helped shape a richer picture of how the trial at the pilot stage worked in practice.

Four stakeholder telephone interviews were conducted with delivery staff and focused on their role, views on delivery of the pilot, key successes, challenges and expectations.

Finally, NatCen interviewed seven tenants representing the different pilot intervention types- tenants who received advice, tenants who received a diagrammatic leaflet and tenants who

received text and a diagrammatic leaflet. Interviews covered topics on the tenant's background including who they live with, what they do day to day, how long they lived in the property and their past knowledge of heating controls. Targeted discussion around the relevant topics - leaflet or advice - and covered topics like content, approach of engineer, what the delivery was like, timing and order of delivery.

Learning from the pilot

The average household participation rate was lower than expected, but varied substantially between engineers; therefore there is scope to improve by sharing best practices and making the initial ask more interesting to the tenant.

- For the advice intervention, two variants were tested: rehearsal only and rehearsal and spacing. The results based on the current data indicates that the average time for an engineer visit, including the boiler check, was not significantly different between both variants and was less than 60 minutes (the maximum allowed time).
- For the leaflet intervention, two variants were also tested: diagrammatic leaflet and fill-in-the blank leaflet. There were not enough completed questionnaires to carry out a statistical comparison between the two leaflets; however, a descriptive comparison indicates that both leaflets were found to be useful, helpful, and informative.
- The general participation rate (number of homes agreeing to participate in the trial) was found to be 49%. This rate is lower than expected but not a result of the interventions. Feedback from the engineer check-lists indicate that most households were simply not interested in participating, as opposed to lacking time. There were also significant differences between engineer participation rates. Therefore, it may be possible to substantially improve the participation rate by sharing best practices between engineers and providing guidance on how to make the trial more interesting and relevant to households.
- The pilot data shows that approximately 44% of homes had a prepay meter installed. This is in line with the average pre-paid meter propensity for the North East of 40-50%. Homes in fuel poverty may still benefit from heating control advice; although, care should be taken to ensure that the intervention does not negatively impact their fuel bills. This risk can be minimised by not changing pre-set heating defaults, and instead focusing on the information aspects of the advice intervention.

Recommendations

Based on the findings of the pilot trial, the following recommendations were proposed for the winter trial:

- Since there was no significant difference between the advice intervention variants, it was recommended that the winter trial use the rehearsal and spacing variant. This variant maximises the behavioural insights to improve memory retention.
- Since there was no substantial descriptive difference between leaflet variants, either could have been used for the trial. It was recommended that the engineers be consulted to capture any insight that can help with the decision. It was recommended it may be possible to blend both leaflets together to combine their strengths which is what was done for the main trial.
- It was also recommended that engineers in each of the groups (advice, leaflet) share best practice among themselves to improve participation rates. Similarly, it was decided that the tenant should be told about the non-monetary benefits, such as

warmth and reduced heat loss, in order to potentially make the trial more relevant to them.

- The initial sample size was set at a more conservative target in the implementation plan, 3,405 households. This is based on second meter reading success rates (60%), and practical engineer resource and time constraints.
- The engineer check-lists were modified to be simpler for the engineer to complete in order to minimise reporting errors.

5.2.3 The main trial

The full trial began in October 2013 following the summer pilot and ran until June 2014. Two waves of meter readings and data collection as part of the process evaluation took place following the main intervention in October and November 2013.

Design

The aim of the main trial was to test whether a direct intervention to provide in home advice on heating controls from a trusted messenger can save more energy and money than a 'leave behind' advice leaflet or no intervention at all. As such, this trial adopted a randomised controlled design, drawing on lessons learned from the pilot, with the following three treatment arms:

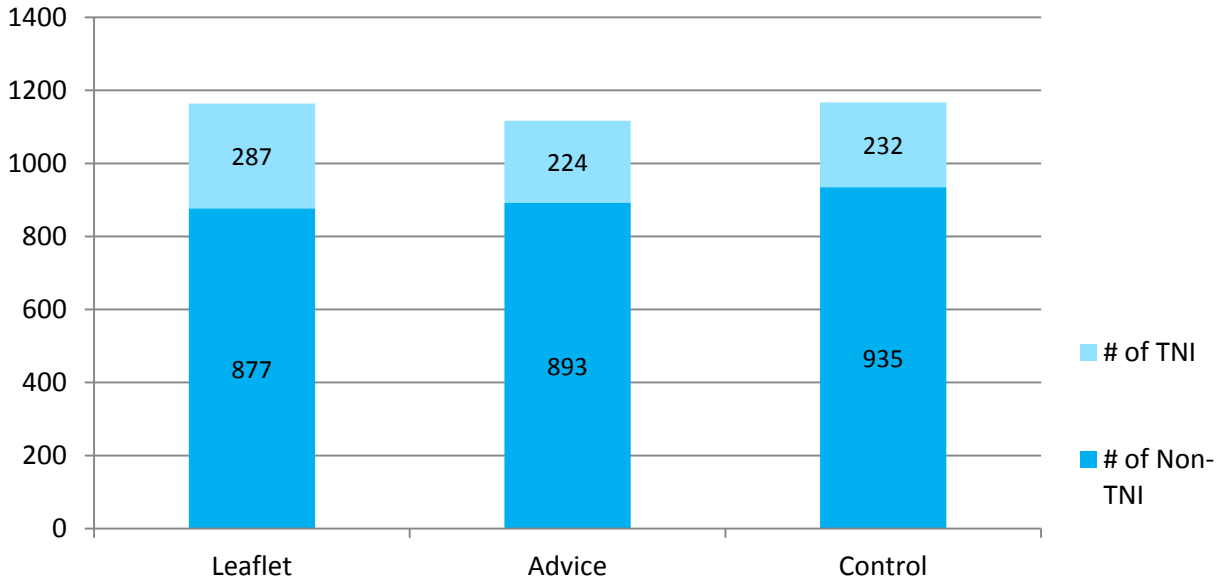
- Personalised in-home advice with a 'leave-behind' advice leaflet
- A 'leave-behind' advice leaflet alone
- A control group with no intervention.

The main outcome measure was individual household gas consumption over the winter period, as measured by 2 gas meter readings: The first, an initial reading taken at the start of the trial, serving as a baseline, and the second taken at the end of the trial. The interventions were delivered by Building and Commercial Enterprise boiler engineers during each household's annual boiler check. With consent, the engineers took the first meter reading during the boiler check, and 6 months later a third party recorded the second meter reading. The household samples were randomly selected from the Your Homes Newcastle (YHN) social housing stock (approximately 22,000 gas heated homes).

Recruitment and attrition

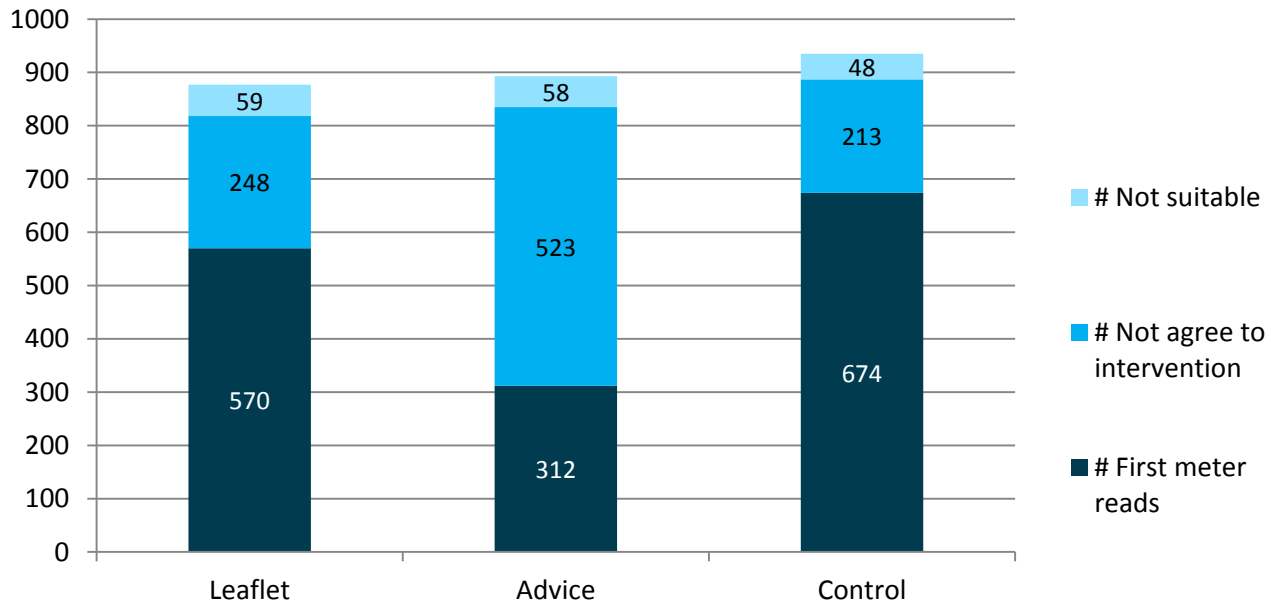
In wave 1 of the trial engineers delivering the trial visited a total of 3,448 homes. Of this total, just over a quarter of properties were recorded as TNI (Tenant not in). The distribution across the three arms is illustrated by Figure 6.2 below.

Figure 6.2 Proportion of tenants not in for each arm of the trial



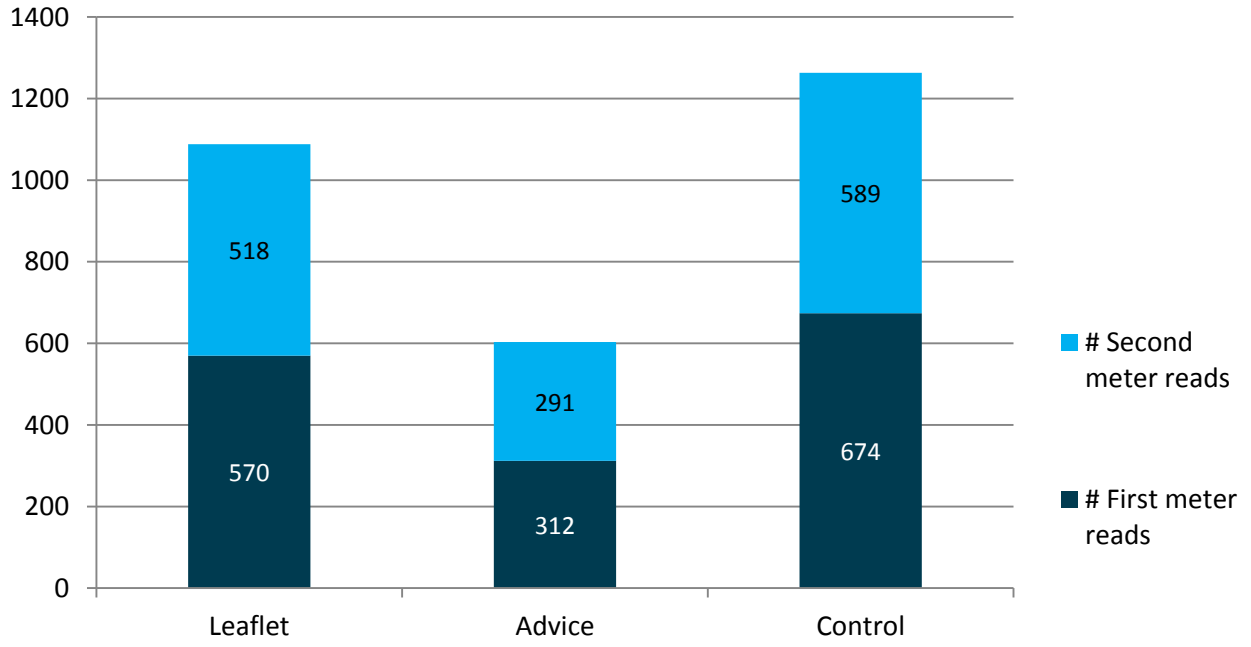
Of the tenants that were in when the engineer visited, Figure 6.3 illustrates the proportion of tenants that who had a first meter reading taken at wave 1. It also presents data on the proportion of tenants who refused to take part in the intervention or deemed unsuitable for the trial by the engineer and those. The chart illustrates a significantly higher refusal rate for the advice arm. Data from the process evaluation suggests that this is likely to be related to the nature of the intervention. It requires more of the tenant's time to complete compared to the leaflet and even if participants may have in principle have wanted to take part, it may not have been convenient to do so at the time the engineer visited. Tenants may have been considered unsuitable for the trial for a number of reasons, but most prevalent were the age of the tenant, difficulties with speaking English or concerns over safety.

Figure 6.3 Proportion of households opting out of the trial or deemed unsutiable



At wave 2, around nine in ten tenants across each of the three arms of the trial agreed to a providing a second meter reading. The numbers of readings achieved at each wave are presented in Figure 6.4 below.

Figure 6.4 Number of first and second meter readings



During Wave 1 of the trial, a total of 18 boiler engineers from Building and Commercial Enterprise visited 3,448 homes in the Your Homes Newcastle (YHN) social housing stock. These visits took place for about eight weeks from mid-October to early December 2013. After removing homes where the tenant was not in, refused consent or the how was not suitable (e.g. Warm air heating system), the total number of achieved meter readings was 1,556. See Table 6.1 for a breakdown of details from the first meter reading.

Table 6.1 First meter read return rates

	Homes visited	TNIs*	Refused intervention	Not suitable	Successful first meter reads	# of prepay meters
Leaflet	1164	287	248	59	**570**	290
Advice	1117	224	523	58	**312**	156
Control	1167	232	213	48	**674**	343
Total	3448	743	984	165	**1556**	789

**TNI = Tenant not in*

A third party meter reading company, *MeterPlus*, was contracted to conduct the second save of meter reads. The company received a list of first meter read addresses while tenants received a Newcastle City Council and YHN branded letter explaining the purpose of the second visit. The success rate of the second meter reads was 90%, compared to the industry average of 60%. See Table 6.2 for a breakdown of details from the first meter reading.

Table 6.2 Second meter read return rates			
	First meter readings	Second meter reads	Success rate %
Leaflet	570	518	91
Advice	312	291	93
Control	674	589	87
Total	1556	1398	90

Analysis

Standardising and cleaning the outcome measure

The first step was to standardise the outcome measure by number of days between meter reads, and then correct for weather differences using heating degree days (HDD). As each meter reading was done over a 4-8 week period, the number of days between meter reads was not necessarily consistent for all households, i.e. the number of days between meter reads for each household varied. Therefore, the gas consumption data for each household, converted from m^3 and ft^3 to kWh, was divided by the total days between reads to standardise the outcome measure to kWh/day – allowing for a normalised comparison between groups.

Following this standardisation, the kWh/day data was then corrected for outdoor temperature using heating degree day data from the Newcastle airport weather station (base 15.5oC EGNT) with a standard linear correction. After this standardisation the final outcome measure used during analysis was kWh/HDD. The analysis was also repeated without this correction with no difference in reported outcome.

The final step was to clean and remove observations that could not be used in the analysis, i.e. those that contained typos, inconsistencies or lacked values. In total 31 observations were dropped, 18 of which because of a meter change between the first and second meter reads. This leaves 1,367 observations. Of these, approximately 5% (79 observations) had second meter readings that were less than the first, i.e. not monotonic. Therefore these observations were also excluded. As a result, the final sample was 1288 observations allocated between treatments as shown in Table 6.3, including the average HDD per group per day.

Table 6.3: Final allocations for analysis		
Treatment	**Sample size (N)**	**Average HDD per day**
Control	530	9.23
Leaflet	478	9.26
Advice	280	9.25

Identifying outliers

After cleaning and standardising the data, the distribution of the outcome measure is then observed to identify outliers. Figure 6.5 maps the distribution of the outcome measure where the monotonicity condition is met.

This distribution is far from normally distributed and is heavily weighted towards a small number of incredibly large values. In fact, the largest observation, with a value of 198973.9, most likely a measurement error, is a substantial outlier. For the analysis, a cut-off of 25 kWh/HDD was selected as the lower bound threshold since values greater than this represent very improbable high gas consumption values. For example, the average HDD over the trial period was 1,560 HDD and a typical home uses approximately 20,500 kWh/year[14]. Therefore if a typical home in the trial used this average *annual* consumption all during the winter it's kWh/HDD would only be 12.84.

Figure 6.5 Sample distribution of outcome measure by kWh/HDD

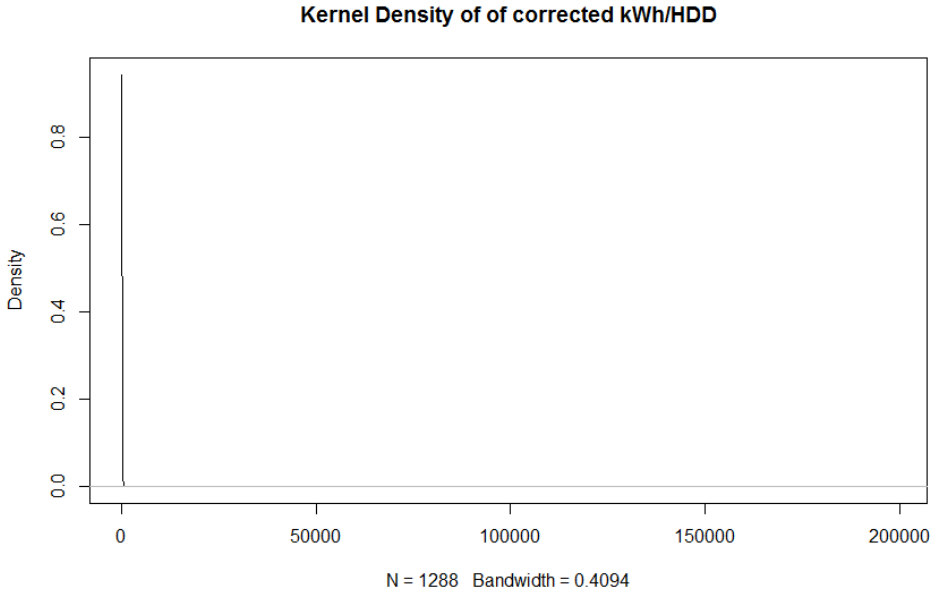
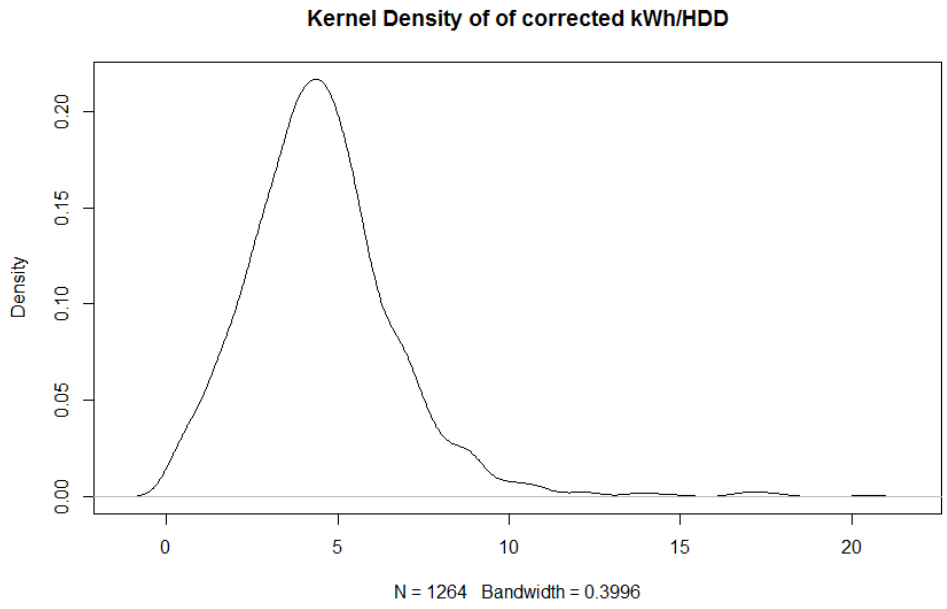


Figure 6.6 maps the distribution of the outcome measure after excluding observations greater than 25 kWh/HDD while density plots for other thresholds (10, 100, and 1,000 kWH/HDD) are shown in Appendix C. The distribution is still positively skewed, but closer to normal. Using 25 kWh/HDD, a further 24 observations were excluded from the analysis, leaving a total sample of 1264 households.

[14] https://www.ofgem.gov.uk/ofgem-publications/64026/domestic-energy-consump-fig-fs.pdf

Figure 6.6 Distribution excluding households with > 25 kWh/HDD



Variable derivation for model specification

Using the cleaned and standardised dataset, the following list of variables is derived for the regression model specification of covariates:

- Number of bedrooms in the house
- Number of storeys in the building
- EPC rating
- Year of construction
- Main wall construction type (solid brick, system built, etc…)
- Wall insulation type (external, filled cavity, as built, etc…)
- Property type (house, flat, maisonetted, etc…)
- Type of heating programmer (digitial or analogue)
- Whether the house has a pre-paid meter or not
- The engineer associated with each observation

These variables are encoded appropriately and de-stringed. Missing observations within each variable were dropped during analysis. The resulting changes to the sample size are reported in the detailed regression tables. The EPC ratings were only available for 266 of the properties in the sample, and so were not used in the balance checks and final analysis.

During the last week of first meter read/intervention delivery stage, two engineers were moved into the leaflet group from the control group. This was done to increase the sample size captured in the leaflet group while minimising contamination, since the control group engineers were not specially trained. For the analysis, all the engineers were coded individually, with two factor levels assigned to the moved engineers.

Primary analysis

The primary analysis for our in-sample observations follow a model estimated as:

$$Y_i = \alpha + \beta_1 T_i + \beta_2 X_i + u_i$$

Where

Y_i is the value for our outcome measure for household i.

α is a constant, to be interpreted as the average level of our outcome variable for the omitted category, the control group.

T_i is a vector of binary treatment variables, set to 1 if that treatment is active and 0 else.

X_i is a vector of covariates, if active in the specification

u_i is an i.i.d. error term

Table 6.4 presents the results from 4 regression models. For clarity, only the point estimates and standard errors of the treatment effect are presented, with the full regression table shown in Appendix D. The 4 models are:

- Column 1: a basic model with no covariates.
- Column 2: the physical characteristic set of covariates are added to the model: bedrooms; storey; construction year; main wall construction type; wall insulation type; property type; and type of programmer.
- Column 3: a pre-paid meter predictor is added.
- Column 4: the engineer covariate is added.

These models are also estimated with 10, 100 and 1,000 kWh/HDD cut-offs to examine the sensitivity of the 25 kWh/HDD model to outliers. The full results are presented in Annex B.

* p < 0.05, ** p < 0.01, *** p < 0.001, standard errors in parentheses

Table 6.4: Summary of results from four regression models

	(1)	(2)	(3)	(4)
(Intercept)	4.455***	5.563	5.601	9.597
	(0.099)	(7.123)	(7.352)	(8.228)
Leaflet	0.094	0.071	0.082	0.721
	(0.144)	(0.142)	(0.148)	(0.543)
Advice	0.220	0.215	0.194	0.721
	(0.169)	(0.171)	(0.176)	(0.541)
Bedrooms		0.628***	0.644***	0.599***
		(0.122)	(0.126)	(0.126)
Storey		-0.056	-0.053	-0.038
		(0.075)	(0.076)	(0.078)
Year of construction		-0.001	-0.001	-0.003
		(0.004)	(0.004)	(0.004)
Main wall construction: solid brick		0.155	0.253	0.197
		(0.387)	(0.397)	(0.404)

Main wall construction: system built		-0.038	-0.066	-0.049
		(0.390)	(0.406)	(0.412)
Wall insulation: external		-0.168	-0.171	-0.141
		(0.342)	(0.355)	(0.370)
Wall insulation: filled cavity		-0.079	-0.064	-0.019
		(0.210)	(0.215)	(0.219)
Wall insulation: internal		-0.210	-0.172	-0.243
		(0.842)	(0.853)	(0.886)
Property type: flat		-1.497**	-1.576***	-1.740***
		(0.463)	(0.476)	(0.485)
Property type: house		-0.691	-0.775	-0.871
		(0.470)	(0.483)	(0.490)
Property type: maisonette		-1.551*	-1.641*	-1.859*
		(0.789)	(0.803)	(0.809)
Programmer: Digital		-0.068	-0.023	0.010
		(0.150)	(0.155)	(0.160)
Programmer: Other		-1.235	-1.206	-1.161
		(1.091)	(1.101)	(1.110)
Pre-paid meter			-0.127	-0.132
			(0.131)	(0.132)
Engineer A/ Engineer B				-0.727
				(0.461)
Engineer C/ Engineer B				0.335
				(0.732)
Engineer D/ Engineer B				-0.561
				(0.406)
Engineer E/ Engineer B				-0.219
				(0.391)
Engineer F/ Engineer B				0.328
				(0.532)
Engineer G/ Engineer B				0.811
				(0.536)
Engineer H/ Engineer B				-0.520
				(0.473)
Engineer I / Engineer B				-0.875
				(0.634)
Engineer J / Engineer B				-0.214
				(0.382)
Engineer K / Engineer B				-0.834*
				(0.357)
Engineer L / Engineer B				-0.046

				(0.380)
Engineer M / Engineer B				-0.310 (0.551)
Engineer M / Engineer B				-0.702 (0.732)
Engineer N / Engineer B				0.232 (0.529)
Engineer O / Engineer B				0.281 (0.537)
Engineer O / Engineer B				0.720 (1.016)
Engineer P / Engineer B				-0.168 (0.360)
N	1264	1198	1140	1139

Table 4 shows that under all models the leaflet and advice group coefficients were positive, i.e. that from a directional point of view the treatment is trending toward increasing energy use. Because the regression is a standard OLS, the coefficients can be interpreted in a straight forward manner. For example, in the most parsimonious model (model 1) the advice group used 0.220 kWh/HDD more than the control group value of 4.455 kWh/HDD. The values in parenthesis are the standard errors associated with each coefficient. Despite the trend, it is important to note that the results were not statistically significant, so it is not possible to determine if the result is due by chance or the intervention alone.

As a result, we fail to reject the Null hypothesis, i.e. there was no significant difference in gas consumption between treatment groups. The implication for policy is that this trial did not provide clear evidence to support the use of in-home advice, or informative leaflets, to reduce gas consumption in social housing.

Secondary Analysis

An inspection of the full regression table in Table 6.5 reveals that the number of bedrooms (a proxy for house size) was a significant covariate, as well as property type. This result is not surprising given the existing evidence that house size and house types are significant moderators of energy use.

To examine this effect in more detail, a secondary analysis is conducted on the subgroups of the sample based on the Table 4 primary analysis, i.e. column 1. The secondary analysis is presented in Table 6.5, which partitions the data by the number of bedrooms, and Table 6.6 by property type. For bedrooms, the data contained 9 properties with missing number of bedrooms and 5 with 5 bedrooms, these properties were excluded as these cells are too small for analysis. Similarly, for property type, the data contained 7 properties with missing values and 1 property classed as “Bed”. These 8 properties were also excluded from the property type analysis.

Table 6.5 Secondary Analysis: results by number of bedrooms

	1 bed	2 bed	3 bed	4 bed

Leaflet	0.602 (0.641)	0.015 (0.210)	-0.048 (0.463)	0.231 (1.319)
Advice	0.180 (0.668)	-0.055 (0.242)	0.463* (0.220)	-1.052 (1.809)
Control	3.261*** (0.388)	3.913*** (0.142)	4.938*** (0.129)	6.125*** (1.017)
N	90	459	663	38

* p < 0.05, ** p < 0.01, *** p < 0.001, standard errors in parentheses

Table 6.6: Secondary Analysis: results by property type

	Bungalow	Flat	House	Maisonette
Leaflet	1.803 (1.197)	0.264 (0.249)	-0.063 (0.165)	0.617 (0.596)
Advice	4.175* (1.566)	-0.094 (0.271)	0.252 (0.197)	0.240 (1.077)
Control	3.317*** (0.764)	3.335*** (0.166)	4.883*** (0.114)	3.670*** (0.440)
N	32	302	910	12

* p < 0.05, ** p < 0.01, *** p < 0.001, standard errors in parentheses

Table 5 and 6 show no significant treatment effect for the leaflet intervention across the sub-groups. On the other hand, the secondary analysis reveals that for the advice group, the average kWh/HDD was slightly larger in 3 bedroom properties (+0.463 kWh/HDD) and substantially larger in bungalows (+4.175 kWh/HDD). However, given the results from 2 and 4 bedroom properties, it may be that the 3 bedroom result is a chance finding. This is supported by the observation that even though the advice treatment effect was significant in 3 bedroom properties, it was not significant in houses; despite the sample of houses containing mostly 3 bedrooms houses. Similarly, the bungalow result is most likely due to segmentation in-balance given the small sample size of 32. This is what we would expect and does provide quality assurance on the data analysis conducted to unpack the finding of statistically insignificant outcomes.

5.2.4 Process evaluation design

The process evaluation comprised a range of qualitative methods to collect different types of data from a range of participants. The process evaluation had three broad objectives:

- To assess how the Trial was delivered in practice and identify the factors affecting its outcome
- To synthesise data from the impact study, process evaluation and cost-effectiveness analysis to provide an overall assessment of whether the trial met its objectives

- To identify implications for future policy for DECC and its partners

The research was comprised of two main strands of fieldwork:

- interviews with trial recipients;
- discussion groups and observation with engineers.

Following a pilot that included stakeholder interviews, the main fieldwork was staggered over two waves to ensure that participants were not required to rely on recall over a period of months to respond to questioning. Within each wave, there was additional sequencing, with engineer discussion groups taking place first so that they could inform topic guide development for interviews with trial recipients.

Across the entire process evaluation we conducted:

- **Four stakeholder interviews** with partners delivering the trial
- **Three engineer focus groups**: two in the pilot with 12 engineers – one leaflet, one advice – and one with six engineers from both leaflet and advice groups following the completion of the intervention.
- **Eight engineer shadowing sessions** with NatCen researchers observing engineers in the field as they delivered the intervention.
- **61 tenant interviews**, 36 face to face and 25 over the telephone

Table 6.7 below illustrates the key research questions associated with the evaluation, and the elements of the evaluation design which addresses each question.

Table 6.7: Research questions and evaluation elements

Aim	Research questions	Evaluation element
Assess delivery	What was the experience of staff delivering the intervention? Did staff understand the intervention? Did the delivery of the intervention vary by engineer?	Process evaluation – Engineer focus groups Administrative data – Engineer checklists
	What was experience of different groups of recipients of the intervention? Which aspects of the intervention were useful and why; what could have worked better? Why did people choose not to take part? Did people receive the intervention as planned?	Process evaluation – Customer interviews Administrative data – Engineer checklists
Synthesise data	Was the intervention more effective for some types of people or households?	Process evaluation – Customer interviews

	Were there differences in the trial groups that could have affected the trial outcome?	Assessment of trial data Cost-effectiveness
Future implications	How might an intervention like this be improved? How cost effective was the intervention? Were the assumptions of the behavioural model being applied correct?	Process evaluation – all elements Cost effectiveness analysis Findings workshop

Wave 1 process evaluation

NatCen conducted one engineer focus group to explore engineer's views on the coordination and content of the training they received. It also looked at the impact of the trial on engineers and their views on the trial and the research overall. Five shadowing opportunities, similar to those carried out in the pilot, were conducted across both leaflet and advice arms of the trial.

The main data collection strand was with tenants. As part of the Wave 1 meter reading, engineers asked tenants at the end of their visit whether they could provide their details to NatCen in order to take part in the process evaluation interviews. Tenants provided written consent to be re-contacted and this sample was transferred to NatCen by Newcastle City Council. Participants were then purposively selected on the basis of whether they had received the leaflet or the advice and the engineer that had visited them. Recruitment calls where then made by NatCen researchers, where further screening took place to achieve some diversity on a range of other characteristics illustrated in Table 6.8 below. In total, twenty-six tenants were interviewed (18 face to face and 8 over the telephone) shortly after they received the advice or leaflet intervention. Interviews explored tenant backgrounds, the approach, delivery, content and impact of the interventions tenants received.

Table 6.8: Wave 1 achieved sample characteristics – detailed breakdown

Criteria	Achieved interviews
Intervention type • Advice • Leaflet	• 18 • 8
Gender • Male • Female	• 9 • 17
Age • 18-35 • 36-45 • 46-59 • 60-75 • 76+	• 6 • 5 • 11 • 4 • 0

Household income • Under £13k • Between £13k and £30k • Above £31k	• 16 • 8 • 0
Employment status • In paid employment • Unemployed • Full time education • Retired • Long term sick or disabled • Doing something else	• 11 • 7 • 0 • 2 • 6 • 0
Living as a couple • *Yes* • *No*	• *6* • *20*
Children at home • *Yes* • *No*	• *12* • *14*
Meter type • *Pre prepaid* • *Direct debit*	• *13* • *12*
Total	• *26*

The nature of the recruitment approach, an opt-in approach, represents a pragmatic solution given the constraints of the trial. Opt-out approaches, where a larger sample frame is purposively selected and then given the opportunity to opt-out of the research is preferable to an opt-in approach as the latter can introduce biases. An Opt-out approach was not possible in this instance primarily due to data security. Personal details could not be passed directly from YHN, to NCC and then to NatCen for recruitment due to data protection protocols; the tenants had to consent explicitly to this specific use of their personal data

While this approach may introduce response bias into the sample, there are two reasons that we are confident about the robustness of the achieved samples at wave 1 and wave 2:

- Firstly, we have no evidence that the possible bias generated by the opt-in approach is in anyway systematic and likely to skew findings in one direction or the other.
- Secondly, key characteristics on which we sampled are likely to be more influential in explaining diversity amongst tenants and we achieved good coverage across these characteristics.

Wave 2 process evaluation

About six months after receiving the intervention (between May and June 2014), and following the time of the second meter reading, researchers recruited a further twenty-eight tenants (18 face to face and 10 over the telephone). Of these, eight were ‘re-contacted’- they were interviewed at wave 1 and followed up with at wave 2; twenty respondents ‘opted in’ at wave 2. Having provided consent at Wave 1 to be re-contacted, advance letters were sent to householders who then got in touch with NatCen to express their interest in participating.

Table 6.9: Wave 2 achieved sample characteristics – detailed breakdown

Criteria	Achieved interviews
Intervention type	• 18

• Advice • Leaflet	• 10
Gender • Male • Female	• 8 • 20
Age • 18-35 • 36-45 • 46-59 • 60-75 • 76+	• 2 • 6 • 9 • 10 • 1
Household income • Under £13k • Between £13k and £30k • Above £31k	• 21 • 4 • 1
Employment status • In paid employment • Unemployed • Full time education • Retired • Long term sick or disabled • Doing something else	• 11 • 4 • 0 • 7 • 4 • 1
Living as a couple • *Yes* • *No*	• *8* • *20*
Children at home • *Yes* • *No*	• *10* • *18*
Meter type • *Pre prepaid* • *Direct debit*	• *7* • *21*
Total	• *28*

5.3 Annex B: Research Instruments

5.3.1 Recruitment materials – Main stage

Tenant Information Sheet

NatCen
Social Research that works for society

What is involved in taking part?

You are invited to take part in a study looking at people's experiences of their last boiler check visit. The study is being carried out by an independent research organisation, NatCen Social Research, who is working with Newcastle City Council to involve people in the study.

Taking part would involve either a face to face interview (like a discussion) with a NatCen researcher lasting no longer than 45 minutes or an interview via telephone lasting no longer than 20 minutes. In the case of the face to face interviews, we would usually talk to people at their home or at a nearby location at a convenient time and date.

During the interview the researcher will ask about your views and experiences of your last boiler check and any advice you were given at the time. As a thank-you for your time you will receive either £45 for taking part in a face to face interview or £20 for taking part in a telephone interview.

We will ask to audio record the interview so that we can be sure that we correctly remember everything that you tell us. The audio recorder will be stored safely and only those involved in carrying out the research will have access to it.

Do I have to say 'yes' to taking part?

It is up to you whether you decide to take part in an interview. If you decide to take part and later change your mind, any data you have given will be destroyed.

Accepting any engineer advice does NOT mean that you have to take part in this study.

What will happen to the information collected?

Everything you tell us during the interview will be confidential. Taking part is anonymous – no one but NatCen will know you have taken part.

We will write a report based on what everyone who has taken part in the study tells us. Your name or any other information which may allow someone to identify you will not be included in the reports.

Who will know I have taken part?

Only the research team at NatCen Social Research will know who has taken part. They will not share the identity of participants or their contact details with anyone else.

What will happen next?

If you have signed the accompanying consent form, a NatCen researcher will call you in the next week or so to provide you with further information and set up a convenient time for your interview. In the meantime, If you would like to speak with a researcher at NatCen about the study, you can call free and direct on 0808 178 9051.

To help ensure we speak to people with a range of different experiences we may ask you for some basic information about your household when we contact you. However, you do not have to answer any questions if you would prefer not to.

It is possible that we will not be able to carry out an interview with everyone who is interested in taking part in the research.

Tenant Opt-in Letter – Qualitative research

Page 1-

NatCen
Social Research that works for society

Newcastle City Council

«Full_Name_»
«House_Number» «Street»
NEWCASTLE-UPON-TYNE
«Post_Code»

«Asset_ID»

Dear «Full_Name_»,

Following on from the recent meter reading taken at your property, we would like to invite your household to take part in a research study to learn more about people's experiences of their last boiler check visit. We are working with Newcastle City Council and the Department for Energy and Climate Change on the project.

What does taking part involve?
We would like to speak with the **person present at the last boiler check for the property** (this was in either October or November 2013). This may be you or someone else in your household.

Taking part involves an interview over the phone or in person with a researcher from NatCen at a time convenient for you. During the interview we will ask about your views and experience of your last boiler check and any advice you were offered at the time.

How long will it take?
An interview in person will last no longer than 45 minutes and you will receive £40 as a thank you for taking part. A telephone interview will last for a maximum of 30 minutes for which you will receive £30 as a thank you for taking part. Taking part will not affect any benefits you may be claiming now (or might claim in the future).

How do I get involved?
NatCen will not contact you without your permission, so **you will need to get in touch with NatCen if you would like to take part.**

If you would like to take part please contact NatCen on either 0808 178 9051 or via email on heatingcontrols@natcen.ac.uk leaving your full name, address and whether you would like to take part in an interview in person or via telephone.

What happens then?
A researcher from NatCen will contact you with some further information about the study and ask you some basic questions about your household. They will then arrange a date and time for the interview. We may not be able to do an interview with everyone that is interested in taking part in the research.

Yours sincerely,
Fay Sadro

Why have I been selected to take part?
During your last boiler check you completed a consent form giving us permission to contact you about the research.

What will we talk about during the interview?
During the interview the researcher will ask about your views and experiences of your last boiler check and any advice you were given at the time. We will ask to audio record the interview so that we can be sure that we correctly remember everything that you tell us. The audio recorder will be stored safely and only those involved in carrying out the research will have access to it. It is up to you whether you decide to take part in an interview. If you decide to take part and later change your mind, any data you have given will be destroyed.

What will happen to any information I give?
Taking part is anonymous – no one but NatCen will know you have taken part. We will write a report based on what everyone who has taken part in the study tells us. Your name or any other information which may allow someone to identify you will not be included in the reports. Taking part will not affect any benefits you are claiming now (or might claim in the future).

Who will know I have taken part?
Only the research team at NatCen Social Research will know who has taken part. They will not share the identity of participants or their contact details with anyone else.

Who is NatCen Social Research?
NatCen Social Research has been carrying out high quality social research for 40 years and is a non-profit organisation that is independent of all government departments and political parties.

Where can I find out more about NatCen?
For more information on NatCen you can visit their website at www.natcen.ac.uk.

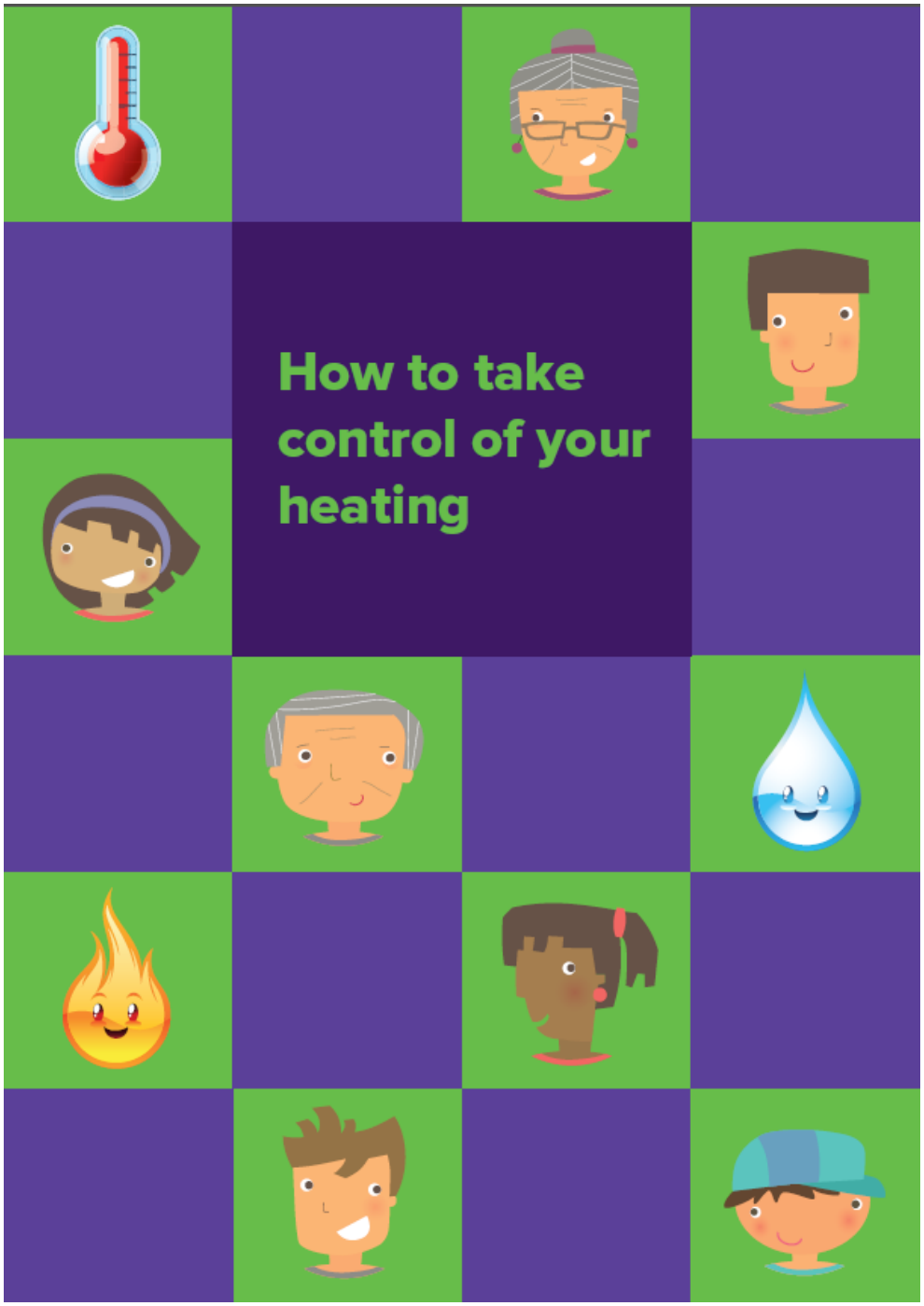
5.3.2 Summary of qualitative topic guides – Main stage

Area of questioning	Non participant tenants	Tenants - Advice	Tenants - Leaflet
Background and existing knowledge - Who they live with, activities day to day, length of time in property, confidence around controls, existing control use	X	X	X
Why they decided not to take part - Main reason, engineer approach, timing of advice, relevance of advice, confidence with controls, elements that would have convinced them to take part, suggestions for improving advice/leaflets	X		
Advice giving - Engineer approach, experience of advice delivery, content of advice, short term impact of advice		X	
Leaflets - Views on engineer engagement (i.e. introduction to taking part and about what 'sold it'), on design and content of leaflet (i.e. language, length, missing, fill in the blanks exercise, relevance, comprehensiveness), impact of leaflet (i.e. reference it/kept it, whether remember content, learn anything new)			X
Reflections - Impact of advice (longer term, on family/friends, other learnings)		X	X

5.4 Annex C: Trial materials

5.4.1 Leaflets

Heating Control 8 Page Booklet – Digital



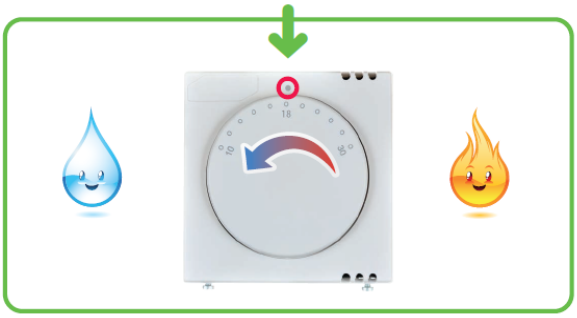
1 So, what is a ROOM THERMOSTAT?

A ROOM THERMOSTAT simply switches the HEATING SYSTEM ON and OFF to maintain a TEMPERATURE that YOU SET.

Now, how do I use it?

FIRST, you set the TEMPERATURE. Simply find the LOWEST TEMPERATURE SETTING that you are comfortable with, and then LEAVE the thermostat to do its job:

Turn the CIRCULAR DIAL RIGHT, until your comfortable temperature, for example 18°C or higher, is under THIS MARK.



If this temperature is not right, you can adjust the setting by TURNING the circular dial by ONE DEGREE each day until you are comfortable with the temperature.

By REGULARLY ADJUSTING the room thermostat, you will be MORE IN CONTROL and WASTE LESS ENERGY.

1 So, what is a ROOM THERMOSTAT?

A room thermostat simply switches the _____ _____ _____ _____ and _____ to maintain a _____ that _____ _____

Now, how do I use it?

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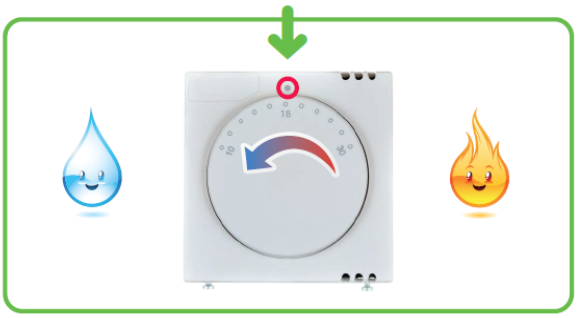

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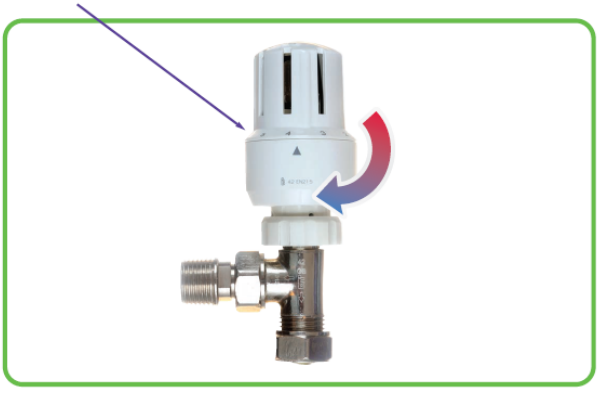
By _____ _____ the room thermostat, you will be _____ _____ and _____ _____ _____.

3 What are TRV's?

TRV's essentially regulate the temperature in a ROOM. TRV's are located at the EDGES of a RADIATOR, and have NUMBERS going around their bottom, as you can see:

Now, how do I use it?

These NUMBERS indicate the amount of HEAT that will go into a ROOM. That means that if you set your TRV to 4, that room will be WARMER than another where the TRV is at 2.



But, doesn't the ROOM THERMOSTAT do this?

The ROOM THERMOSTAT sets the TEMPERATURE you want your house to be heated to; the TRV does NOT DO THAT. The role of the TRV is to simply decide WHICH ROOMS will be heated.

TRV's can put you MORE IN CONTROL of your HOME HEATING! How? You can SET your ROOM THERMOSTAT and then turn the TRV's OFF (NUMBER 0) in rooms you are NOT USING for long periods.

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TRVs essentially regulate the temperature in a _____ _____ are located at the _____ of a _____, and have _____ going around their bottom, as you can see:

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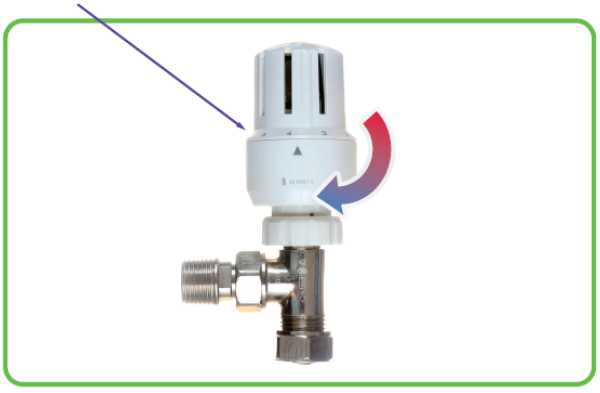

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_____ can put you _____ _____ _____ of your _____ _____! How? You can _____ your _____ _____ and then turn the _____ _____ (_____ _) in rooms you are _____ _____ for long periods.

If you want this information in your own language we will arrange for an interpreter to help you on 0191 278 8633. This information is also available in easy read, large print, Braille and audio tape. We can also arrange for you to see a British Sign Language interpreter.

Heating Control 8 Page Booklet – Analogue

1 **So, what is a ROOM THERMOSTAT?**

A ROOM THERMOSTAT simply switches the HEATING SYSTEM ON and OFF to maintain a TEMPERATURE that YOU SET.

Now, how do I use it?

FIRST, you set the TEMPERATURE. Simply find the LOWEST TEMPERATURE SETTING that you are comfortable with, and then LEAVE the thermostat to do its job:

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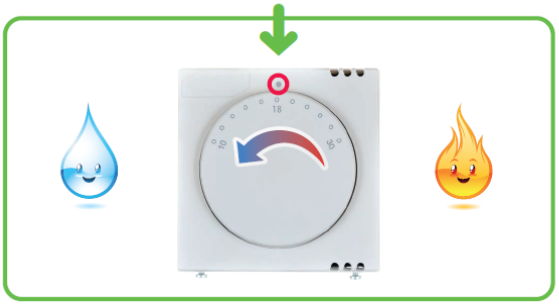

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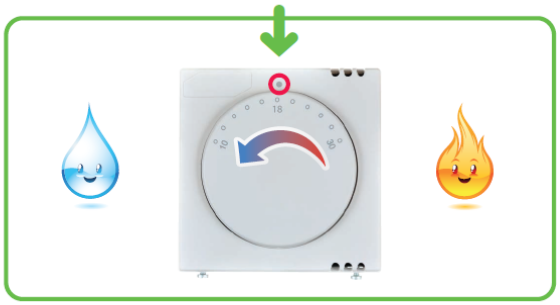

If this temperature is not right, you can adjust the setting by _____ the circular dial by _____ _____ each day until you are comfortable with the temperature.

By _____ _____ the room thermostat, you will be _____ _____ and _____ _____ _____.

2 What is a PROGRAMMER?

A PROGRAMMER simply lets YOU SET the TIME you want your HEATING to be ON and OFF.

Now, how do I use it?

The dial in the MIDDLE is A CLOCK. You ADJUST the buttons AROUND this clock to determine WHEN your HEATING is to be switched ON.

Generally, RED buttons switch the HEATING ON, and BLUE buttons switch it OFF.

For example, on this PROGRAMMER, heating STARTS at 7:15am, (BUTTON A) and then SWITCHES OFF at 10:00am (BUTTON B).

Any questions?

Want to know more about heating controls?
Call: 0191 278 3842 or email: energy@yhn.org.uk

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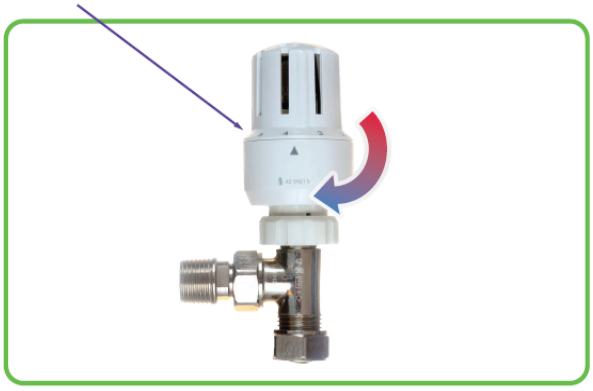

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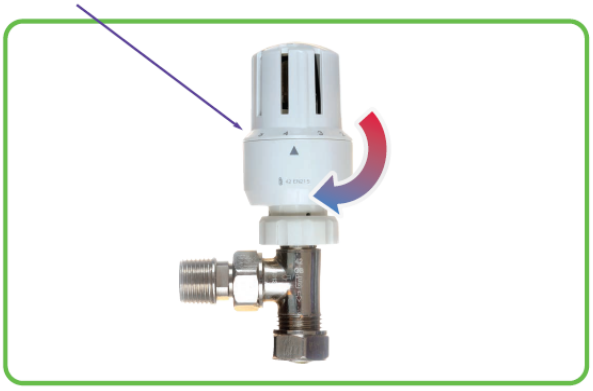

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Department of Energy & Climate Change
3 Whitehall Place
London SW1A 2AW
www.gov.uk/decc
URN 14D/334