

# Field Trial Learnings:

## Insight Report

## Introduction

Decarbonising heat is one of our biggest energy challenges.

The most cost-effective way to meet our carbon targets is for practically every household to replace their heating system with lower carbon alternatives. Heat services - like those we tested in our field trials - could be one way to accelerate this process.

The market for heat is changing.

Digitalisation and decentralisation are already transforming how energy is generated, distributed, used and paid for.

The heat sector can do better for consumers.

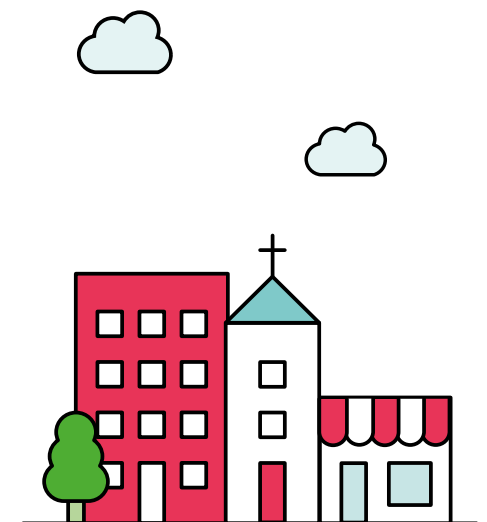
People find it hard to control how much time, effort and money they spend on trying to get what they want from their heating system. They buy units of fuel when what they care about is the quality of their experiences: getting comfortable in a warm lounge; getting refreshed in a power shower; winding down in a hot bath. At the moment, many put up with damp, drafts and overheating, presenting opportunities for improvement.

Our work has shown how new business models could give consumers better control of how much they spend getting the experiences they want from their heating. Data could enable industry to design high-quality low carbon solutions that consumers will want because they are as good as, or even better than, what they have today.

## About this report

During 2017/18, Energy Systems Catapult carried out a field trial with a unique Living Lab of 108 households. This report summarises what we learned about:

- How different people use heat in their homes
- How digitalisation can help people choose how much to spend on their heating
- Which consumers are most open to new business models and why
- How much consumers will be prepared to pay to buy Heat as a Service
- How new ways of buying and using heat could accelerate uptake of low carbon heating solutions.

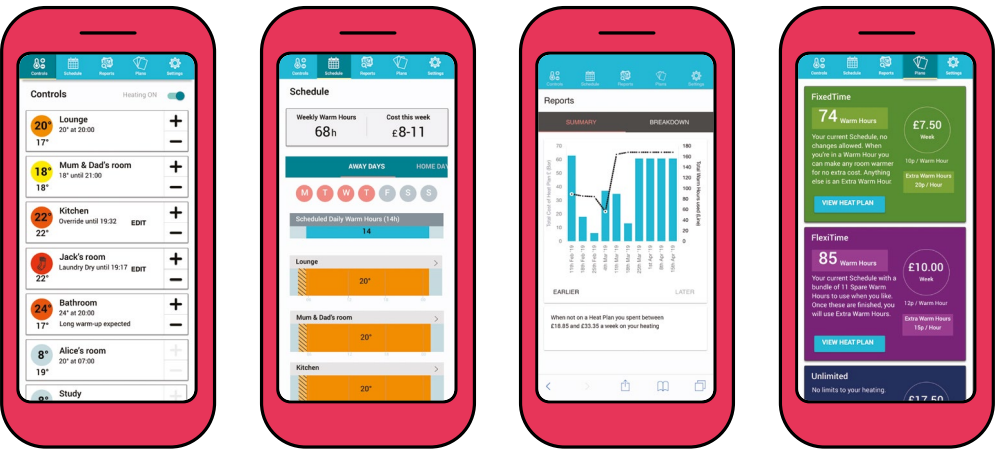


# What we did

We created a unique Living Lab of 108 households between October 2017 and June 2018. Each household received advanced heating controls so they could set the temperature in each room at different times using a mobile, tablet or laptop. They were then offered the chance to buy Heat as a Service in Warm Hours instead of kilowatt hours via Heat Plans.

For a quick introduction to Heat as a Service, read our 'Introduction to Heat as a Service' Insight Report.

You can read more about the people who took part in the trial, how the controls worked, the design of the energy service and the research we did in the technical report 'HESG Trial: System Test Reports and Trial Conclusions' (available on request).



a) Controls                      b) Schedule                      c) Report                      d) Plans

Figure 1

Our Living Lab offers businesses a rich and realistic test environment to test innovative ideas around energy products and services. You can find out more at [es.catapult.org.uk/living-lab](https://es.catapult.org.uk/living-lab).

“We created a unique Living Lab of 108 households between October 2017 and June 2018.”

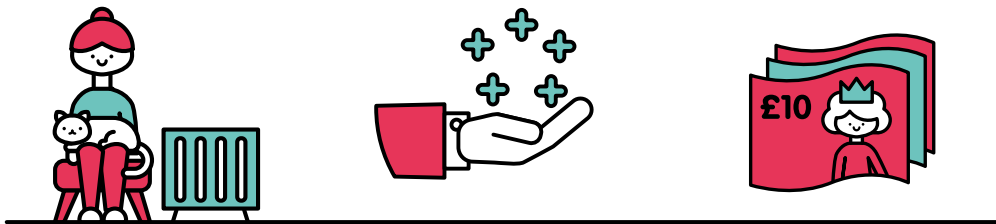
# Understanding how people buy heating in their homes

There were three priorities people considered when choosing how much to spend on their heating:

- **Comfort:** Some people were primarily interested in getting the most comfort from their heating. They had relatively little concern about how much energy they used or how much it cost. Their main goal was to optimise their well-being through their heating.
- **Cost:** Some people sacrificed their (and their household's) comfort to try to save money. They put up with discomfort to keep costs low.

- **Value:** Some people were more focussed on getting value for money. They talked about cost being important but did not put up with discomfort to try and save money. They were less aware of what they spent on their energy and less sensitive to temperature.

People were influenced by a combination of all three elements - comfort, cost and value. When asked to choose their priority, the majority said they were focussed on comfort.



62%

**Comfort focussed**

Thermally sensitive, willing to pay for comfort.

17%

**Value focussed**

Neither thermally sensitive nor sacrificing comfort.

21%

**Cost focussed**

Cost sensitive willing to sacrifice comfort.

Figure 2

**People controlled three aspects of their heating to create their own heating experience:**

- The times when they want to be warm;
- The spaces they keep warm; and
- The temperatures they want in each space.

Figure 1: People could use their controls to (a) adjust the temperature in each room, (b) set a schedule, (c) review what they had spent on their heating and (d) switch to a Heat Plan. The interface showed households how many Warm Hours they used, what temperatures they liked and how the cost of their heating varied with the weather.

Figure 2: The proportion of people who prioritised comfort, value or cost when it came to their heating

# Understanding how people buy heating in their homes

## Time

Most people in the field trial kept their homes warm for between either 6-7 hours or 9-10 hours each weekday and for more hours on weekends. The number of hours they used was influenced by whether they were motivated more by cost, comfort or value.

People who were cost-focussed used their heating for fewer hours. They often spent time at home with the heating off and felt it was best to use the heating when the whole household would benefit. This often led to short periods of heating of between three and four hours.

People who were comfort-focussed used more hours of heating and more consistent temperatures whenever anyone in the household was at home. This led to longer periods of heating in the evenings of between 6-8 hours, from the time people got home until bedtime.

Around 75% of people used more heating in colder weather, either increasing the time the heating was on or both the time and the temperature. No-one increased the temperature alone.

## Space

Everyone in the trial had thermostatic radiator valves on their radiators before the trial. However, they rarely adjusted them because it was time-consuming to go from room to room and adjust each radiator. They generally heated every room in their home when their heating was on, as most valves were always open to some extent.

Nearly everyone heated fewer rooms at a time after their digital controls were installed. People generally thought about when they wanted different rooms warm at different times of day and scheduled their heating in advance. They heated more rooms during the morning and evening than the middle of the day.

People who were cost-focussed tended to only heat rooms that their households used most of the time. By contrast, those who were more comfort-focussed heated most of their rooms at once so that they would be comfortable moving from one room to another.

## Temperature

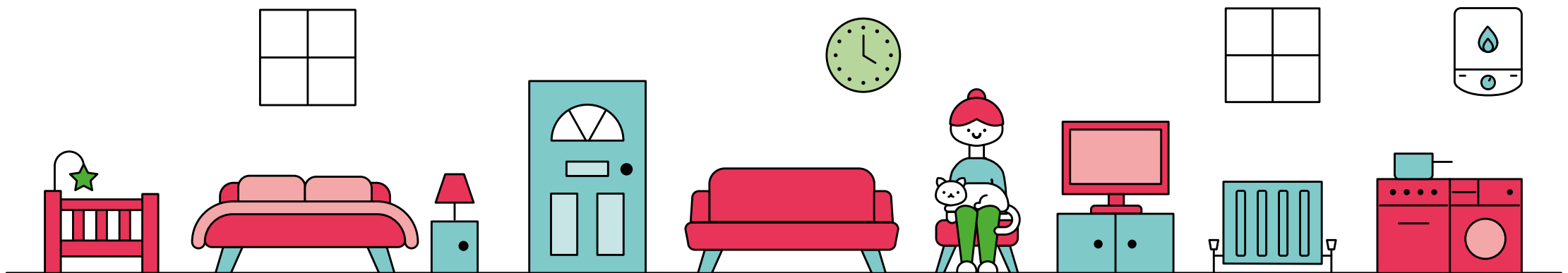
There was huge variation in the temperatures people chose to heat their homes to. Comfort-focussed people tended to set higher temperatures than cost-focussed people. However, the ranges of temperatures people chose also varied for other reasons.

Some households used as many as six or seven different temperatures, either because they liked to adjust the temperature depending on how they felt, or to:

- 'Crank up' the temperature to try and warm a room up more quickly;
- Keep radiators hot to dry laundry;
- Cope with an unusual or highly variable household schedule;
- Make people with different preferences feel comfortable.

Other households used an intermediate range of four temperatures because they found these comfortable and pre-planned their heating with a schedule.

Lastly, some used a very small range of just two temperatures because they preferred to keep things consistent and were not very sensitive to temperature. They rarely felt too warm or too cold and, when they did, a single degree change was enough to keep them happy.



# Six types of heat consumers

The field trial collected a vast amount of data about how people used their heating and why. We generated powerful insights by using data science to combine what people said with how they used their controls. This enabled us to classify people into the six types of heat customer shown in Figure 3 depending on:

- The range of temperatures they set in their homes,
- When they were typically at home and how they tended to use their heating controls (for example, scheduling ahead or making more ad hoc decisions),
- Whether they were cost, comfort or value focused, and
- What temperature they found most comfortable.

We illustrate three of these types below. The full set are described in more detail in the technical report 'HESG Trial: System Test Reports and Trial Conclusions'.

## On-Demand Sizzlers

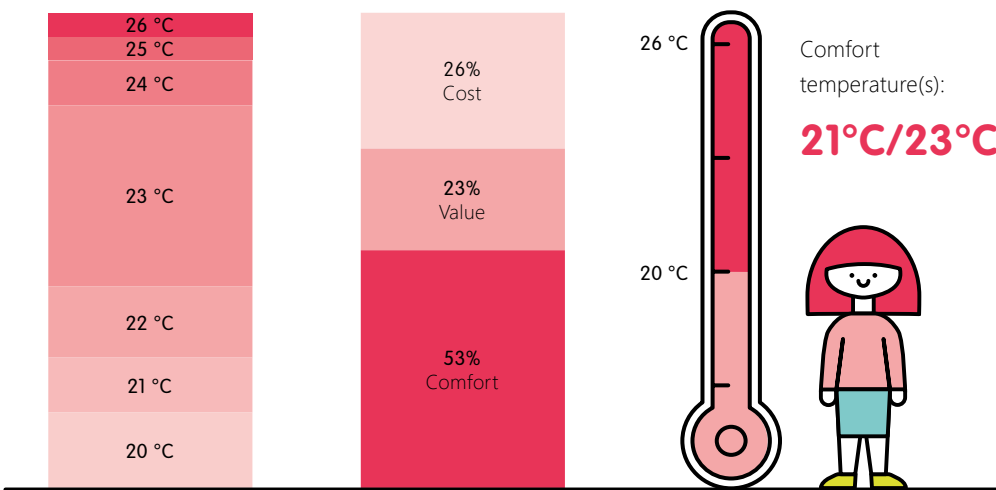
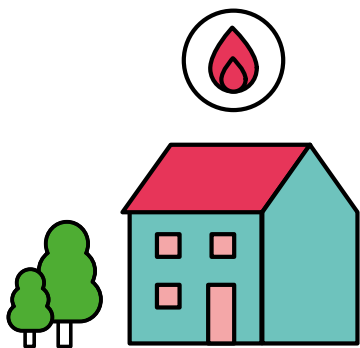


Figure 4 shows the range of temperatures On-Demand Sizzlers set in their homes (left); the proportion who prioritised comfort, cost and value; and the temperatures they found most comfortable.

On-Demand Sizzlers hated feeling cold, but they also disliked waste. They set a basic heating schedule and often overrode it depending on who was at home. They ended up setting a broad range of temperatures and heating their homes for many hours each week.

What On-Demand Sizzlers want most from their heating is responsiveness so they can warm up rooms quickly at a moment's notice.

The biggest problem they face is keeping different people in their household comfortable.



"On-Demand Sizzlers hated feeling cold, but they also disliked waste."

Figure 3: Distribution of types of heat consumers within the field trial participant sample

“Cool Conservers often focussed on the cost of their heating. They set a regular schedule with a low fall-back temperature.”

“Toasty Cruisers were often comfort-focussed. They scheduled most of their rooms to 21-22°C...”

Cool Conservers

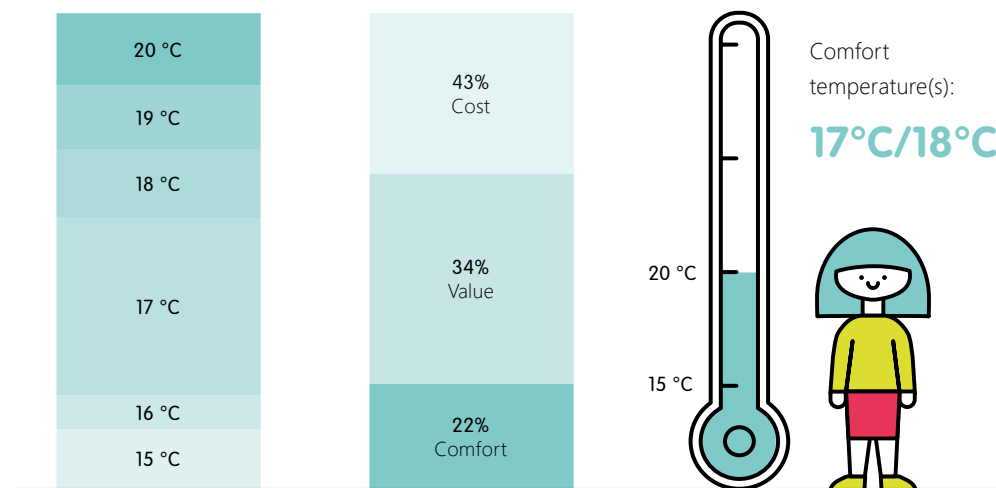


Figure 5 shows the range of temperatures Cool Conservers set in their homes (left); the proportion who prioritised comfort, cost and value; and the temperatures they found most comfortable.

Cool Conservers often focussed on the cost of their heating. They set a regular schedule with a low fall-back temperature, often 17°C which they found uncomfortable. They increased the temperature temporarily when they wanted to be warm and only added hours to their schedule when it was exceptionally cold.

What Cool Conservers want most from their heating is the confidence that they will get the heat they want for a predictable price that they can afford.

The biggest problem they face is the fear their bill will be more than they can afford.



Toasty Cruisers

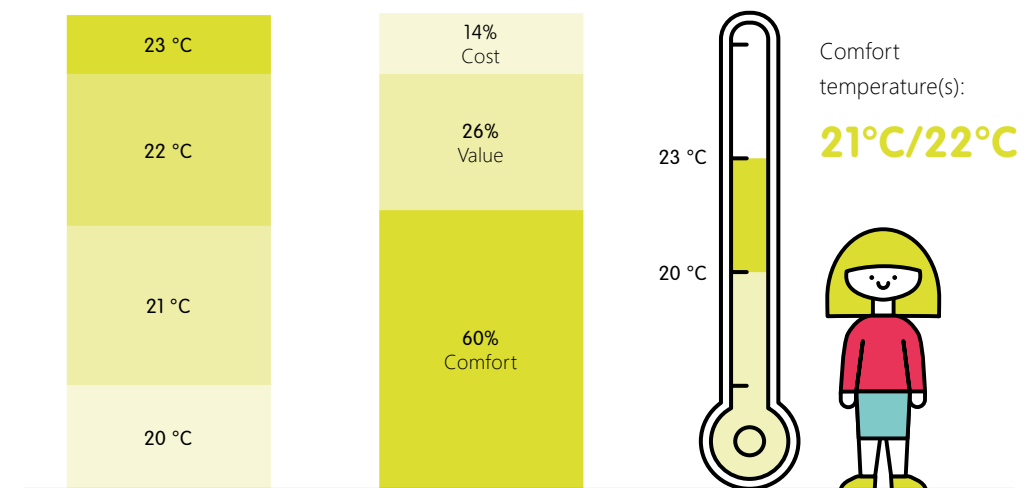


Figure 6 shows the range of temperatures at which Toasty Cruisers keep their homes; their priority when it comes to heating; and the temperatures at which they typically feel comfortable.

Toasty Cruisers were often comfort-focussed. They scheduled most of their rooms to 21-22°C for most of the time with lower temperatures in rooms they used less often. They only adjusted their heating when they were very uncomfortable.

What Toasty Cruisers need most from their heating is comfort and convenience.

The biggest problem they face is having to adjust their controls to get comfortable.



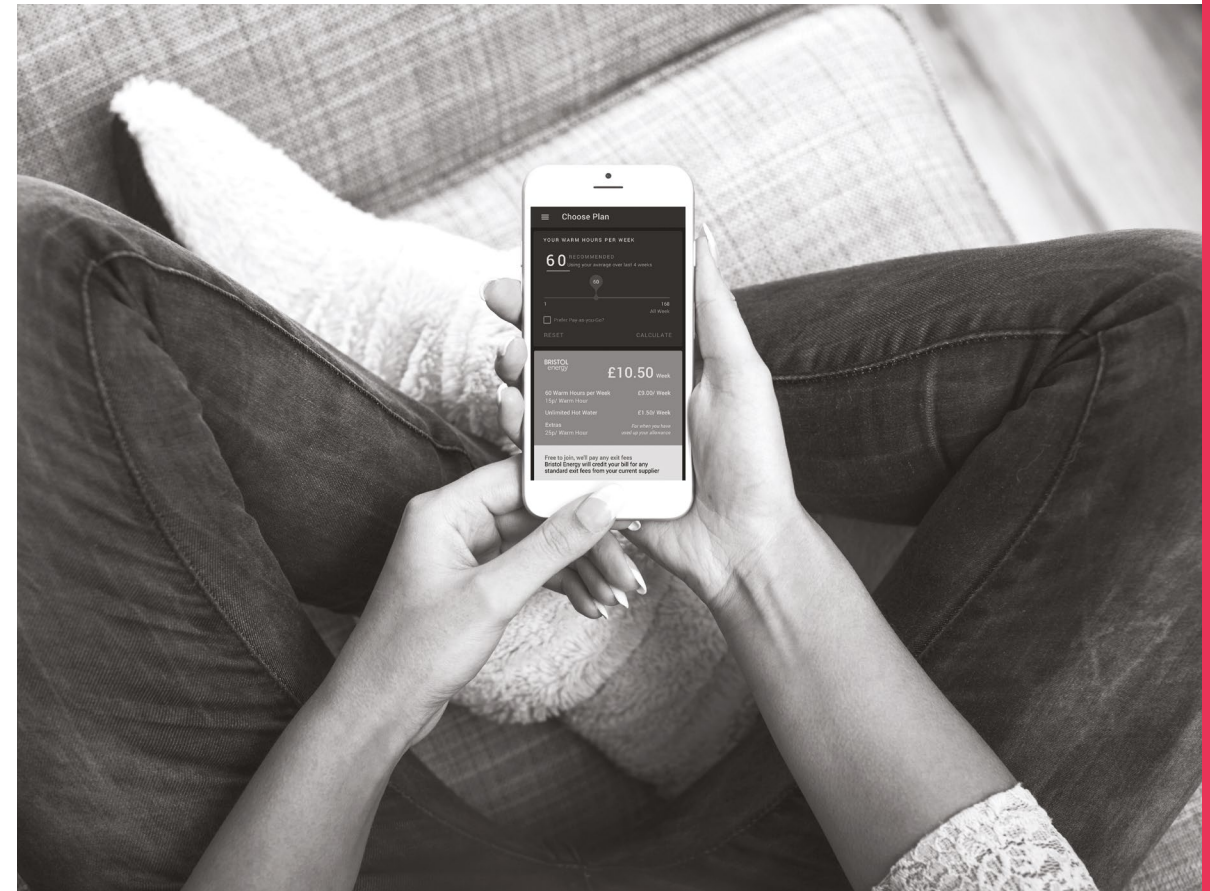
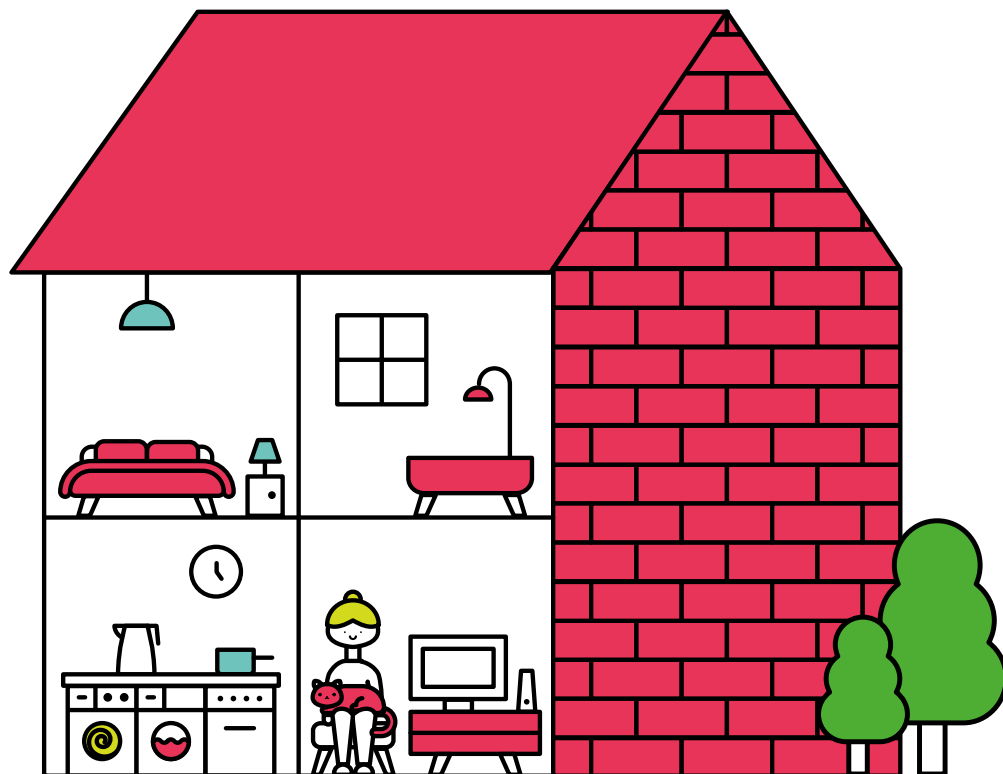
## Reactions to room by room control

People universally enjoyed improved control.

For some, this was the first time they had ever felt in control of their heating or that they could achieve a better heat experience. People used this new-found control in different ways; adjusting temperatures, timings and which spaces were heated to suit their different preferences. 56% reported that they were experiencing higher levels of comfort.

For many people, the value of a smart heating control was difficult to recognise until they had experienced a warmer, more comfortable home for themselves. Once they had, they started to appreciate and value the experience they were receiving. 63% said that they would be prepared to pay more on top of their heating bills to keep their smart heating controls.

Data from digitalised heating controls could be used to improve the design of low carbon heating solutions by guiding the design of a heating system that integrates components to deliver an experience tailored to what the household wants and to the characteristics of the building. This could help to overcome problems of damp, drafts and overheating which are very widespread across the nation.



## Reactions to Heat Plans

### Heat Plan design

We designed a starter-for-ten Heat as a Service called Heat Plans to find out what consumers thought of them and how they used them in the real-world.

Heat Plans offered consumers the chance to buy Warm Hours in their schedule. Consumers normally pay more for their heating on a cold day, but with a Heat Plan they pay a fixed price whatever the weather. Warm Hours are an hour when any room is kept warm, so there is a maximum of 24 in a day. We created three types of Heat Plans and made tailored offers to each person based on their schedule and the cost of heating their home:

1. **FixedTime** was the cheapest plan as the schedule was fixed. People could adjust the temperatures or buy extra Warm Hours if they wanted.
2. **FlexiTime** was the mid-range plan. It came with a bundle of spare Warm Hours which could be used whenever they liked.
3. **Unlimited** was the most expensive plan and came with no restrictions.

You can read more about our Heat Plans and how they were used in the technical report 'HESG Trial: System Test Reports and Trial Conclusions'.



## Reactions to Heat Plans

Around half of the people on the field trial bought a Heat Plan. This was far more than we had anticipated for something so novel, where adoption is normally restricted to a small minority of early adopters. It suggests that people are open to new ways of buying their energy.

Most people paid more for their Heat Plan than they were previously paying for their heating, however 83% felt that the price they paid was “fair” or “cheap”. This suggests that some people are willing to pay more for Heat as a Service than for supplying units of fuel.

The FlexiTime plan was the most popular with people paying on average £5 more per week for the freedom to use their heating when they liked. People who were either cost-focussed or did not think they needed the flexibility preferred the FixedTime plan. Unlimited was the least popular as it was the most expensive and offered more freedom than many people wanted.

People generally found it easy to understand what they were paying for and felt a greater level of certainty from having a set number of hours as a foundation for their heating use.

However, it was difficult to explain how something so new worked, especially amidst widespread confusions about how people currently paid for their energy. There were also some concerns about whether a fixed price offered value for money and about being tied into a 12-month contract, particularly as the trial was due to end in a few months’ time.

People on Fixed Time plans were more likely to be consistent in the number of hours they used over the course of each week but were more likely to buy extra Warm Hours.

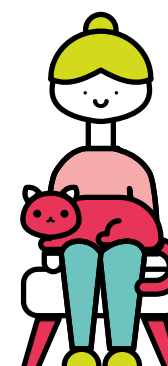
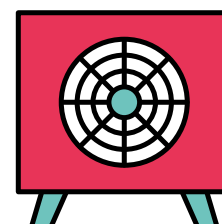
People on FlexiTime plans showed a much greater fluctuation in the number of hours used week to week, but usually stayed within their allocation of spare flexible hours and, in many cases, did not use all of their core hours. They valued these spare hours as providing “peace of mind” and a “useful contingency”.

We also observed that participants were learning throughout the process. While they were uncertain about Heat Plans to begin with, they came to understand the benefits and know more about what they wanted through experience of Heat as a Service.

## Heat Plans as a path to decarbonisation

We wanted to understand if a Heat Plan would be an effective vehicle for encouraging the shift to low carbon heating solutions.

We asked people who had purchased a Heat Plan whether they would be open to an alternative heating system when it came to replacing their gas boiler. 58% said they would be as compared with around 33% of owner-occupiers in the general population. This increased to 85% if they could be given a guarantee that they would get the comfort they wanted for a predictable price (which is exactly what Heat Plans are designed to do).



# 58%

Would be open to replacing their gas boiler with an alternative heating system.

# 85%

Would be open to an alternative heating system if they would get the comfort for the right price.



## How you can get involved

We would be delighted to work with you as you think about how you might shape your product or service offering to thrive in future market, policy and regulatory conditions. Please email us at [ssh@es.catapult.org.uk](mailto:ssh@es.catapult.org.uk)



**Energy Systems Catapult supports innovators  
in unleashing opportunities from the transition  
to a clean, intelligent energy system.**

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