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# Public acceptability of the use of hydrogen for heating and cooking in the home

## Technical appendix

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## Qualitative research phase

This section provides details of the qualitative research design including the sample design and fieldwork instruments used in the focus groups.

### Detailed sample breakdown

#### Study population

All participants within focus groups met the following criteria:

- Lived in homes connected to the gas grid
- Lived in densely populated areas, but not in the centre of cities
- Lived in homes that are gas heated
- Were the main person in their household managing bills

Those with certain job types were excluded in order not to bias results. These included those related to energy, utilities, engineering, local government, as well as marketing or advertising industries.

#### Sample criteria

A range of characteristics were considered as sample criteria for this study. The following primary criteria were seen as most likely to influence views on hydrogen heating and heat pumps, and therefore defined the structure of the focus group sample:

- *Housing tenure*: social renters, private renters, or home owners
- *Education*: varying levels of formal qualification
- *Location*: devolved nations across the United Kingdom (England, Northern Ireland, Scotland, Wales)

Other secondary criteria were also monitored during recruitment to ensure diversity, but no explicit quotas were set:

- *Key demographics*: gender, age, life stage
- *Household context*: household income, number living in the household, building type
- *Type of cooker*: whether households had a gas or electric cooker was taken into account at the qualitative stage, as this was an element that could potentially be impacted by the energy technologies. However, due to minimal influence at this initial stage, it was decided that this would not be screened on as part of the quantitative phase.

Table 1: Overview of qualitative sample

Group	Location	Age	Education	Housing Tenure
1	London	18-35	Up to A Level	Mix of private and social renters
2	London	36-65	Degree Level	Mix of private renters and owner occupier
3	Edinburgh	18-35	Degree Level	Mix of private renters and owner occupier
4	Edinburgh	36-65	Up to A Level	Owner occupier only

Table 2: Detailed breakdown of qualitative sample by group

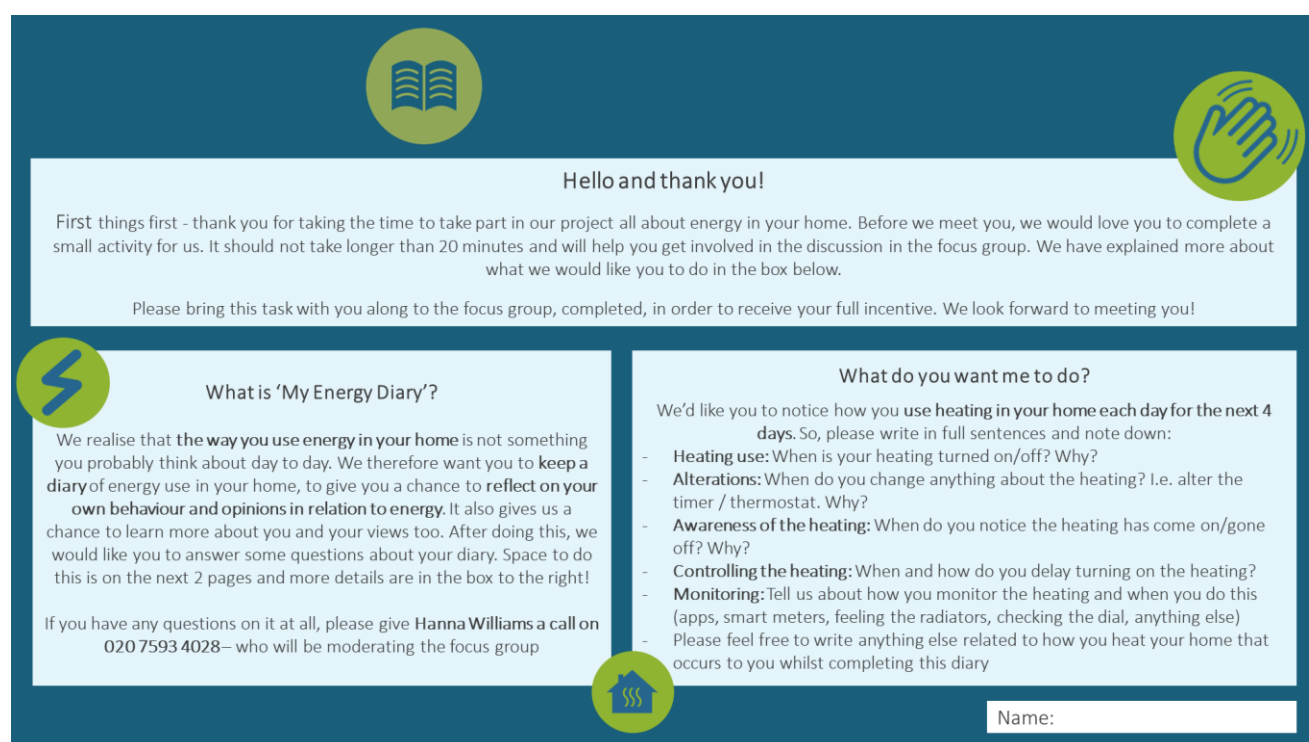
Characteristic	Group 1	Group 2	Group 3	Group 4
<b>Number of participants</b>	7	8	6	8
<b>Gender (M:F)</b>	3:4	4:4	3:3	4:4
<b>Age</b>	22-35	36-65	22-34	36-56
<b>Highest level of formal education</b>	Mix of those with formal qualifications either up to GCSE or A-Level	All educated up to Degree level	Mix of those with qualifications up to either up to Higher National Diploma, Foundation Degree, Degree level	Mix of those with either no formal qualification, or educated up to National Diploma level
<b>Children</b>				
None:	2	1	4	
Aged 0-12:	5	2	2	2
Aged 13-21:		4		5
Over 21:		1		1
<b>Type of cooker</b>				
Gas:	5	3	4	5
Electric:	2	2	1	2
Dual:		3	1	1
<b>Housing tenure</b>				
Social rent:	4			
Private rent:	3	2	2	
Homeowner:		6	4	8
<b>Type of building</b>				
Flat:	3	2	4	2
Terraced:	2	1		2
Semi-detached:	2	3	2	2
Detached:		2		2
<b>Number of people in household</b>	2-4	1-4	1-3	2-4
<b>Household income</b>	UNDER £20,000- £100,000	£20,001- £100,000	£20,0001- £80,000	£20,000- £60,000

## Focus group pre-task



This section shows the pre-task given to participants a week prior to the focus group. This required them to keep a diary of their heating behaviours for four days, and reflect on their attitudes towards heating afterwards. This was conducted in order to facilitate discussion within the focus groups around their household's heating behaviours and attitudes, which are often not considered day-to-day.

These images below show the template that was provided to focus group participants to fill out. The first page welcomes and thanks them for taking part in the research; the second page provides space to respond to key questions.

### Participant instructions




The form is a participant instructions template with a dark blue header and footer. The header contains two circular icons: a book on the left and a hand on the right. The main content area is white with a light blue border. It is divided into three sections: a top section with a title 'Hello and thank you!' and a paragraph of text; a middle-left section with a title 'What is 'My Energy Diary'?' and a paragraph of text; and a middle-right section with a title 'What do you want me to do?' and a list of questions. The footer contains a circular icon of a house with a flame and a text box labeled 'Name:'.

### Hello and thank you!

First things first - thank you for taking the time to take part in our project all about energy in your home. Before we meet you, we would love you to complete a small activity for us. It should not take longer than 20 minutes and will help you get involved in the discussion in the focus group. We have explained more about what we would like you to do in the box below.

Please bring this task with you along to the focus group, completed, in order to receive your full incentive. We look forward to meeting you!



### What is 'My Energy Diary'?


We realise that **the way you use energy in your home** is not something you probably think about day to day. We therefore want you to **keep a diary** of energy use in your home, to give you a chance to **reflect on your own behaviour and opinions in relation to energy**. It also gives us a chance to learn more about you and your views too. After doing this, we would like you to answer some questions about your diary. Space to do this is on the next 2 pages and more details are in the box to the right!

If you have any questions on it at all, please give **Hanna Williams** a call on **020 7593 4028**— who will be moderating the focus group


### What do you want me to do?

We'd like you to notice how you **use heating in your home each day** for the next **4 days**. So, please write in full sentences and note down:

- **Heating use:** When is your heating turned on/off? Why?
- **Alterations:** When do you change anything about the heating? I.e. alter the timer / thermostat. Why?
- **Awareness of the heating:** When do you notice the heating has come on/gone off? Why?
- **Controlling the heating:** When and how do you delay turning on the heating?
- **Monitoring:** Tell us about how you monitor the heating and when you do this (apps, smart meters, feeling the radiators, checking the dial, anything else)
- Please feel free to write anything else related to how you heat your home that occurs to you whilst completing this diary

 Name:

Blank templates completed by participants



# My Energy Diary

Please fill out your diary using the boxes below...


Friday

Saturday

Sunday

Monday

Now you've completed your diary,  
please answer the following questions!



What did you notice about your use of heating? Has anything surprised you?

How would you describe your approach to heating your home? How does this compare to other ways you use energy (i.e. cooking, hot water)?

What different factors impact how you heat your home? Try and tell us about things beyond weather and being in...

What is most important to you when it comes to heating your home? Cost? Comfort? Convenience? Something else? How do you prioritise these?

## Discussion guide

This section provides a copy of the discussion guide used by the moderator to facilitate the focus groups. Stimulus used throughout the discussion is shown in the following section.

### Project overview

#### Project background and objectives

Finding alternatives to natural gas for heating and cooking at home is a crucial part of meeting the UK's carbon reduction targets. Public acceptability is essential for enabling a smooth transition to a new energy source. As such, the CCC is interested to understand initial public reactions to hydrogen and heat pumps as alternatives to natural gas in the home.

#### Key research objectives:

- Understand householders' attitudes towards hydrogen and heat pumps as energy sources for heating and cooking;
- Describe attitudinal differences between different demographic groups and geographical areas;
- Identify likely barriers to acceptability of widespread deployment of either option, and how significant these will be to overcome; and
- Provide recommendations for how government could engage with households to overcome these barriers and what type of content and materials would be effective in doing so.

#### Dates of fieldwork

4 focus groups in 2 locations (2 per location)

- **London, England:** 22<sup>nd</sup> March
- **Edinburgh, Scotland:** 26<sup>th</sup> March

#### Sample

- **Focus group overview:** 4 focus groups; 2 hours in length; 8 participants in each
- **All participants to:** be the main person in household managing bills; live in homes on the gas grid; and live in densely populated areas, but not in the centre of cities.
- **All groups to include a mix of:** gender and household income.

Group	Location	Age	Education	Housing tenure	Other quotas
1	London	18-35	Up to A-level	Rental only, incl. min of 4 social rental	Minimum of 2 per group to use electronic cooking technology, such as induction hobs in their home alongside using gas for heating
2	London	36-65	Degree-level	Mixed – max 3 rental	
3	Edinburgh	18-35	Degree-level	Mixed – max 3 rental	
4	Edinburgh	36-65	Up to A-level	Owner occupier only	

#### How to use this guide

- This document will be used to guide conversation and is not meant to be used as a script
- This will ensure that all relevant issues are covered as part of the research group while allowing the conversation to be participant-led and flow naturally
- Following this guide will ensure consistency across the focus groups and countries
- *Moderator instructions are in italics. Text in bold, red text to mark introduction of infographics.*

## Discussion guide structure

Section	Section title	Objective of section	Stimulus	Timing
1	Introduction & ice-breaker	To put participants at ease, and explain purpose of research and how the focus group will run	- Energy pre-task for reference	10 mins
2	Current energy behaviours & preferences	To explore how participants currently use and understand energy systems, in order to help set up and enrich discussions later on; as well as for use in analysis purposes	- Energy pre-task for reference	20 mins
3	Knowledge & awareness of decarbonisation	To gauge to what extent people are aware of decarbonisation and how they see their role within that		10 mins
4	Introduction of the new technologies – initial reactions	To introduce initial reactions to the potential new technologies. To build up their understanding of heat pumps and hydrogen, and gauge reactions to different factors and implications	- Infographic: Decarbonisation and the need to switch from natural gas - Straw-man exercise - Infographics: Introduction to hydrogen and heat pumps	20 mins
5	Detailed reactions to the new technologies: benefits, concerns, barriers	To put participants ‘in situ’ using various research techniques, to understand more detailed reactions to the new technologies. Specifically identifying participants’ perceptions of the technologies’ benefits, challenges and barriers, grounded in real world experiences	- Hydrogen and heat pump scenarios (x4) - Infographic: summary of implications for each technology	40 mins
6	Communications & engagement	To explore ways in which government could engage households with the switchover. To identify types of materials and content that would facilitate understanding and overcome any barriers to the switchover identified as part of the discussion		15 mins
7	Summary	To capture key thoughts from the discussion		5 mins
8	Appendix	Examples of the scenarios to be used		n/a



## Discussion guide (2 hours)

### 1. Introduction and ice-breaker (10 mins)

*Objective: To put participants at ease and explain purpose of the research and how the focus group will run*

#### Moderator introduction

*Moderator to thank participants for agreeing to take part in the focus group, introduce self, and briefly introduce the research.*

- ***Provide information regarding logistics:***
  - Madano is an independent company
  - We are working on behalf of an independent public body
  - The discussion will last 2 hours and is being recorded with your permission
- ***Provide rules of engagement of the focus group:***
  - We aim to understand you better and hear what you think
  - There are no right or wrong answers. We are looking for honest opinions, every opinion given is valid and no judgements are being made. Positive and negative opinions are fine
  - You have the right to refuse to answer any questions or withdraw at any time, your participation is voluntary
  - Your identity and any information provided will be protected and treated as confidential. Your responses are anonymous
  - For the purposes of this research, we are conducting more interviews like this in this country, as well as in England / Scotland [as appropriate]
- ***Explain how the focus group will work:***
  - For most of the focus group we will encourage open dialogue
    - Sometimes this will be related to a particular topic
    - Occasionally we will be asking for your thoughts on different materials we have to show you to help ground our conversation
- ***Share and explain the topic of energy use:***
  - The organisation we are working on behalf of is seeking insights from the public to help them better understand attitudes towards energy use
  - The commonality between everyone we are speaking to today is that you all have gas heating supplied by the national grid
  - The discussion and the materials we will show you will relate to how you use energy now and how you might use it in the future

#### Participant introduction

- ***Moderator to ask participants to get out their energy diaries that they have completed***
- Moderator to ask participants to introduce themselves to the person next to them and to find out their:
  - Name
  - Who they live with, their job, what a typical day looks like
  - 1 thing that surprised them from your energy diary
- ***Moderator to then ask them to introduce one another and probe where relevant***

## 1. Current energy behaviours and preferences (20 mins)

*Objective: To explore how participants currently use and understand energy systems, in order to help set up and enrich discussions later on; as well as for use in analysis purposes*

### Current energy behaviours

- Thoughts from energy diary exercise:
  - Having completed your energy diary, how would you describe your attitude to heating your home?
  - What is most important to you when it comes to heating your home?
    - *Probe:* cost, convenience, comfort
    - How do you prioritise these?
  - How has completing your energy diary changed how you think and feel about energy use in your home, if at all? Has hearing the experiences of others in the group changed your perspectives at all?
- How does what we have just discussed compare to how you use hot water/gas or electricity for cooking in your home?
- When it comes to energy bills, how much attention do you pay to them?
  - How do you monitor them, if at all?
  - To what extent do you compare gas vs. electricity bills?
  - What % of the bill do you imagine is spent on heating? What are your reasons for this?
- *Within the discussion Moderator to probe on current:*
  - Preferences around the ways hot water / heating / cooking are used

Moderator to probe concerns or frustrations to do with energy. *NB. If safety comes up spontaneously, Moderator to check with the rest of the group, whether it is of interest*

### Switching energy systems

- Have any of you switched energy systems used in your home in the past? For example, switching from a gas cooker to electric cooker; or switching from an immersion boiler to a combi boiler?
  - If not:
    - Why not?
    - Would this ever be something you would consider doing? Why?
  - If yes:
    - What were your reasons for this? *Probe:* cost, convenience, efficiency, environmental reasons, whether they chose to, or landlord
    - What was the experience like? Benefits / frustrations? *Probe:* any experiences around removal of hot water storage tanks

## 2. Knowledge and awareness of need to change (10 mins)

*Objective: To gauge to what extent people are aware of decarbonisation and how they see their role within that*

### **Awareness of where the energy comes from**

- How often do you think about where energy comes from, if at all?
- What might prompt you to think about this?
- Do you know where it comes from? *Moderator to reassure that this is not a test*

### **Current understanding and awareness of de-carbonisation**

*If at any time during discussion participants become overly concerned with the idea of climate change, Moderator to state the following:*

“Climate change is a global issue and there will be different views as to what extent it is a countries responsibility to do certain things about it and to what extent it is a particular person’s responsibility to do so. In the UK we have the Climate Change Act, which was agreed by all political parties. While there might be different views on this topic, it is not the focus of the discussion today. Today’s discussion is focused around meeting the particular targets the UK government has agreed to and the implications that has.”

- What do you associate with the term “carbon emissions”?
- *Moderator to read out the following definition:* Carbon emissions are the release of greenhouse gases into the atmosphere. Carbon emissions contribute to climate change, which can have serious consequences for humans and their environment.
- *Moderator to ensure broad understanding of carbon emissions and their impacts in the group – and clarify any areas that are unfamiliar/unclear.*
- Are you aware of the need to reduce carbon emissions? Why? What impact do they have?
- Can you think of any examples of things that contribute to carbon emissions? *Probe:* natural gas
- Can you think of any ways that people could be supported to reduce carbon emissions?

### **Their own role and the role of the general public**

- Do you think you have a role to play in reducing carbon emissions? Why? Why not?
- How do you feel your energy use at home contributes? To what extent do you think about it? Does it concern you? Why? Why not?
- How do you think you could reduce carbon emissions in your home?
- *(If not already mentioned)* How might the natural gas you use in your home add to these emissions, do you think?

### 3. Reactions to initial concepts (20 mins)

*Objective: To introduce and understand initial reactions to potential new technologies. To build up their knowledge on what this means and understand reactions to different factors and implication*

#### **Introduce concept of energy system technology switch (slide 1)**

*Moderator to show board introducing the concept of the switch and the rationale behind it. Ask participants to not respond out loud yet – we will discuss it later*

#### **Private response – straw man exercise**

*Moderator to ask participants to write down their initial thoughts to the 3 questions below on a hand out*

- What are your first thoughts?
- How would you describe it to a friend?
- How would you feel about having to switch over from natural gas to a new energy system?

#### **Group discussion**

- What are your first thoughts on the energy technology switch?
- What do you understand this to mean? *Moderator to explain further if necessary*
- Why do think there is a need to do this?
- Thinking about it on a practical level, what do you think the switch would mean for you? For example how might we heat our homes / cook / have hot water?
- Can you see any benefits?
- Do you have any concerns or worries?
- What do you think might replace natural gas?

#### **Introducing hydrogen and heat pumps – (slide 2, 3, 4, 5 and 6)**

*Moderator to split the group into two and explain that we now want to show them one of the potential new technologies each. In the groups we want them to answer the following questions and present back to the group and discuss. One moderator to sit with each group during the break-outs in order to hear initial reactions first-hand.*

*If at any time during discussion participants become concerned with cost or safety, Moderator to state the following:*

- Cost:
  - At this point, the costs of using each technology are not known. We understand that this would have influenced your preference and choices for what we are discussing today. However, for the purposes of today we want you to imagine that the cost of using each technology will be the same
- Safety:
  - Hydrogen: The different properties of hydrogen versus natural gas mean that there would be different safety challenges, but the switch to hydrogen would rely on the technology being shown to be safe through research, trials and monitoring
  - Heat pumps: Heat pumps are already a common form of heating in many European countries. For example, 2.6 million homes in Germany are currently heated by heat pumps. Additionally, in some European countries 1 in 10 heating systems sold are heat pump systems
- Cold air/ground and heat pumps:
  - Moderator to listen out for any mention of heat pumps not working if the air or ground is cold and reassure participants by explaining that they will.

*Moderators to provide each group with handouts containing an overview of their allocated new technology: one group to have hydrogen; one to have heat pumps.*

*Moderators to ask groups to consider the following areas:*

- Their thoughts on first hearing about their technology
- What they initially associate with their new technology
- What they see as the potential benefits
- Concerns or frustrations they may have around using the new technologies
- What they would want to know more about / specific questions they have

*After this, each group to explain to the rest of the room in their own words the new technology and what their thoughts have been. Moderator to ask the groups not to react until both groups have fed back – after this there will be a time for discussion.*

*Once both groups have fed back...*

- What are your first thoughts on hearing about each of these technologies?
- Is one more preferable than the other? Which one and why?
- What do you see as the potential benefits / challenges to each?
- Was there anything the group mentioned that you particularly agreed / disagreed with?
- Have you got any further thoughts about these technologies, not already mentioned?
- How important is it for you to understand in detail the way in which the technology works?
  - How might this help you come to terms with the need to switch from natural gas?  
*Moderator to gauge to what extent they need to understand the detail of how it works before they accept it*

#### **4. Detailed reactions to the new technologies: benefit, concerns, barriers (40 mins)**

*Objective: To put participants 'in situ' using various research techniques, to understand more detailed reactions to the new technologies. Specifically identifying participants' perceptions of the technologies' benefits, challenges and barriers, grounded in real world experiences*

##### **Reactions to potential switch-over scenarios**

*Moderator to explain that we now want them to imagine that they will no longer be able to use natural gas to heat their homes any more. Moderator to explain that this is not the first time that this has happened in the UK. In the 1960's and 1970's there was a switch over to our current natural gas grid. Moderator to explain that we will now go through potential scenarios related to hydrogen and heat pumps, to help them understand what their experience of this might be like. Moderator to say that we want to hear their initial thoughts to what we are telling them. Moderator to alter the order that heat pumps/hydrogen are shown in across the groups. Moderator to emphasise that these are made-up scenarios to help us understand your different views.*

*For each 'layer' probe (where relevant):*

- How do you feel about this overall?
- What more would you want to know about this?
- What do you see as the main benefits to this, if any?
- What are your key concerns, if any?
- How might this be improved / your concerns be overcome?
- How do you feel about it vs. the other scenario? (*if previously shown*)
- To what extent does this change your mind on having hydrogen / heat pumps?

- Does it alter your preference? Why?

*Moderator to ensure all the following topics are covered in the scenarios discussion:*

**Switchover and information:**

- Individual decision / regional decision / national decision / national regulation
- Imagine your friends and family elsewhere in the country have already been through the switch over, how would this make you feel?
- How would you feel if they were not going to go through the same switch over as you?

**Installation process:**

Engineer:

- Imagine you were all asked to switch to hydrogen or heat pumps, instead of natural gas. What do you imagine the installation process to be like?
- The overall need for an engineer to visit your home to switch appliances
- Length of time installation process would take – how long do they imagine it would take?
- That person being a local independent tradesperson / from a well-known energy supplier / someone you know / someone from the heat pump company
- Autonomy in how process is scheduled / Lack of choice of time of switch over Hydrogen: differences in one or two week time period for switch over

No gas connection (hydrogen only):

- Having no gas connection for a few days
- Finding an alternative way to cook and use hot water
- Electric heaters being provided
- How government should support this probe: temporary accommodation / gas heaters, etc.
- Comparison to immediate access, if heat pumps were installed instead

**Changes in home during installation and afterwards:**

Heat pumps:

- Storage tank installation
- Underfloor heating installation (potentially)
- Larger radiators installed instead of current radiators (potentially)
- Having an electric cooker installed. *Probe experiences of those currently with electric cookers*

Hydrogen:

- Replacement of boiler, cooker, gas fire, pipes

*For both probe:*

- What choice in appliances might you expect to have?
- What type of compensation would you expect to be given?
- *Probe:* situation where the most basic appliances are provided by government; having to pay a top up fee for others

**Post switch over: hot water/cooking/heating experience:**

- Hydrogen:
  - The smell / look of the flame
- Heat pumps:
  - The faint noise (air source)
  - Using a storage tank for hot water
    - *Probe:* space / water running out?
  - Having the heating on for longer periods of time

**Summary once scenarios completed:**

*Moderator to introduce infographic summarising the key implications of each technology*

- Having learned more about the switch-over...
  - What are your main concerns overall?
  - Which factor would bother you the most out of this change?
  - What are your preferences for either technology at this stage?
  - *For those who definitely do not want hydrogen:* Would you consider installing heat pumps instead? Would you still consider this even if they cost you more to install than hydrogen installation?

## 5. Communications and engagement (15mins)

*Objective: To explore ways in which government could engage households with the switchover. To identify types of materials and content that would facilitate understanding and overcome specific barriers to the change identified as part of the discussion*

**Group exercise: information to overcome the barriers to switch-over**

*Moderator to ask participants to form 2 groups of 4. Imagine your team are responsible for explaining the switch over to the public. In your team we'd like you to think about how you would do this and use the following questions to help. One group to take heat pumps, one group to take hydrogen.*

First of all, think about what you would want to tell them about the switch over...

- How would they introduce the idea of changing energy systems in people's homes?
- How would they explain why there is a need to do so?
- What are the key bits of information that you think people should know about?
- How would you reassure people on some of the concerns they might have?

Now that you have a plan in place of what you would like to tell people. How would this happen...

- How would you tell people about it initially?
- Where would you direct them for further questions?
- Who or what organisation/s would tell people about the switch over initially?
- What are the places/people that they could go to for further information?

*Moderator to ask each group to present back and ask questions as necessary. Moderator to ask each group:*

- What are your first thoughts?
- What did you like about it?
- What about what you heard, concerned you?
- What reassured you?
- What were some of your concerns not overcome?
- What was missing, if anything?

## 6. Summary (5 mins)

*Objective: To capture key thoughts from the discussion*

- What will you do after leaving here?
  - Any further research? If so, what might you look up?
  - Tell friends/family? What will you tell them?
- How might you think differently about energy use in your home after today?

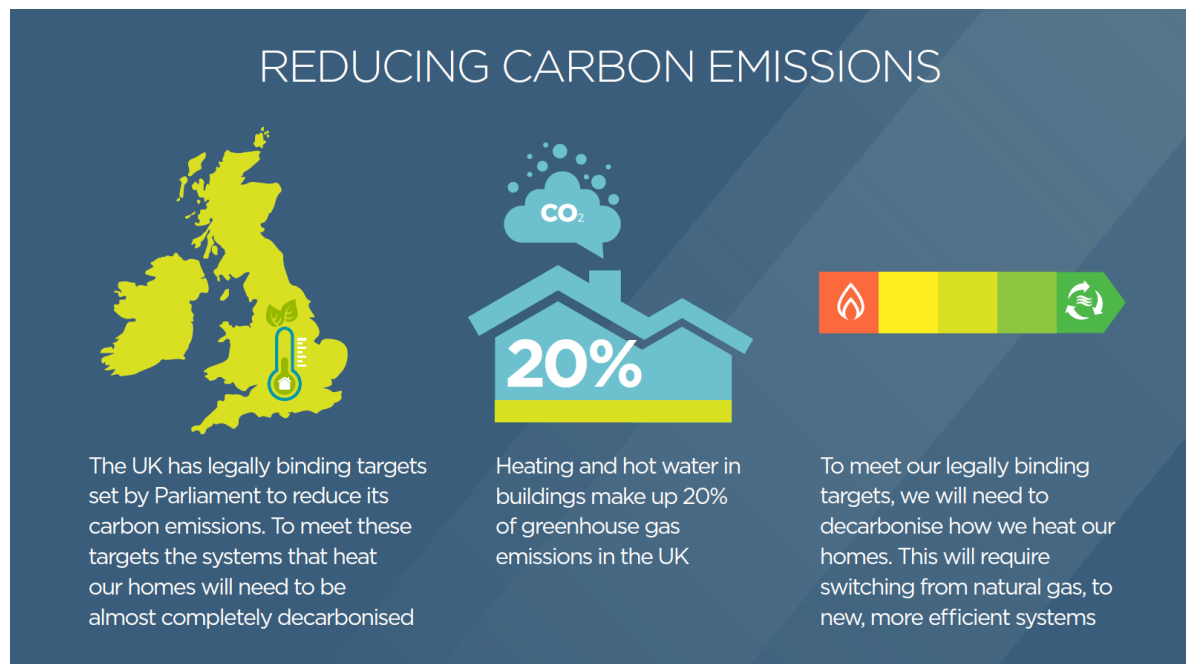
Thank and close



## Explanatory stimulus materials

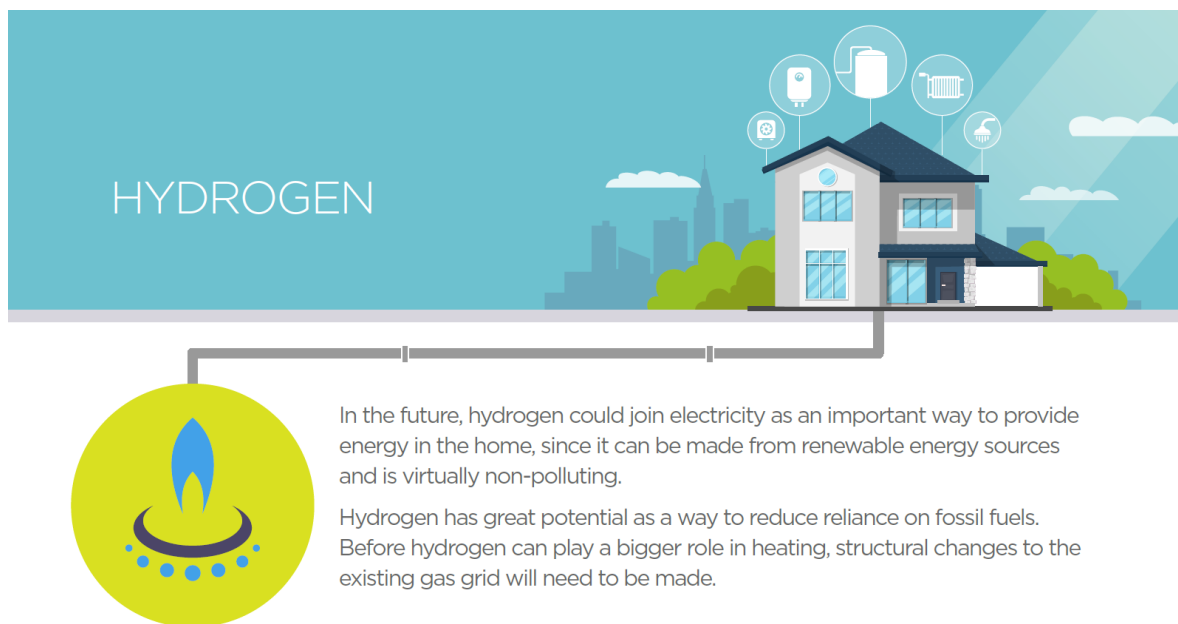
Within this section materials used to explain the concept of the switchover and introduce the types of heating technologies are provided. Additionally, real-life scenarios were developed to describe the implications of each heating technology and help put participants in-situ; these are also provided.

### Describing the concept of the switchover

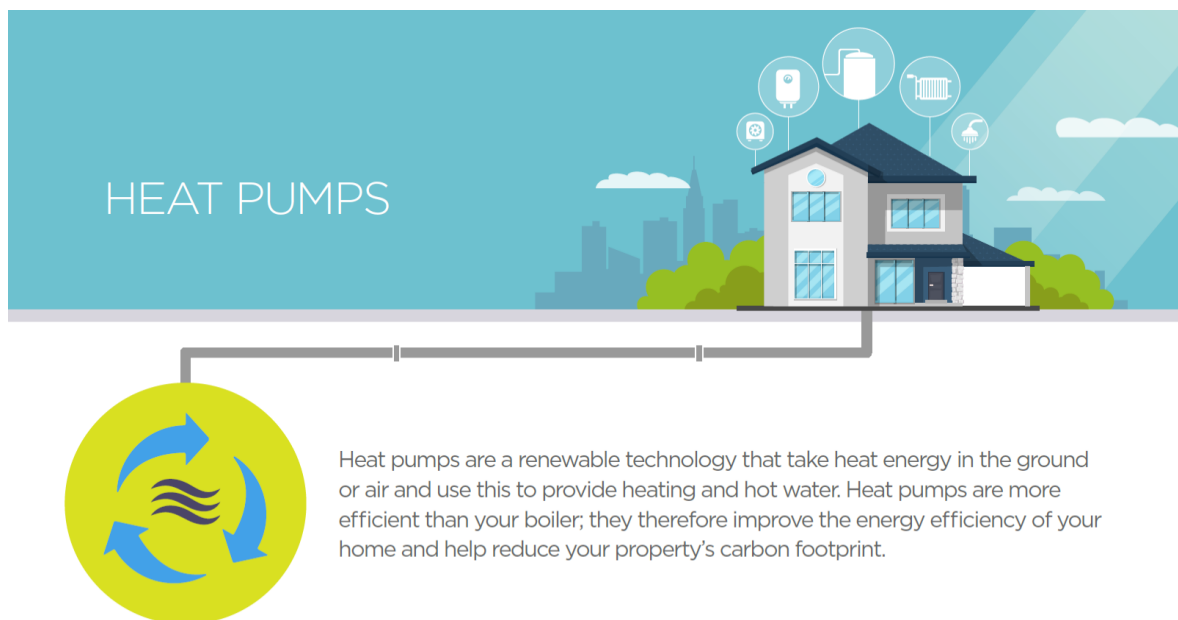


## Introducing the individual heating technologies







### Hydrogen heating



### Heat pumps



Summary of the lived experience for both heating technologies

Experience post-switchover		
	Heat pumps	Hydrogen
How it would work	<p>Your heating will need to be on more continuously in order to heat your home sufficiently</p> 	<p>There will not be a discernible difference vs. your current natural gas heating</p> 
What else to expect	<p>There is potential that the heat pump may make a small humming noise</p> 	<p>Flames when cooking may look visually different and have a different smell added</p> 
Additional items needed	<p>You will have a storage tank hot water system installed</p> 	<p>You might need alarms fitted, similar to carbon monoxide alarms</p> 

## Understanding the technologies in detail: Hydrogen

### Setting up the scenario

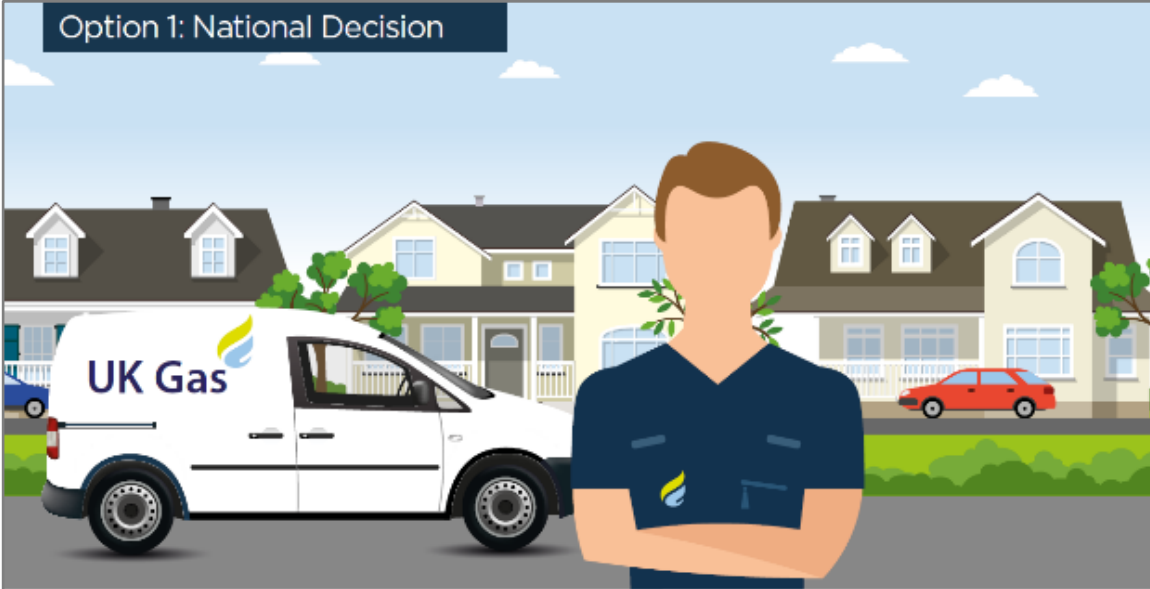


It's a hot summer's day in July 2034; your driverless car is on its way to pick you up for work. The event that you first saw on the TV ten years earlier is finally here – the area where you live in is switching over from a natural gas grid.

Option 1: National Decision	Option 2: Local Decision
A map of the United Kingdom in yellow on a blue background. In the center, there is a dark blue circle containing the word 'Hydrogen' in orange and a power button icon.	A close-up of a map showing the city of Edinburgh, with the name 'EDINBURGH' clearly visible in large green letters.
<p>Following a national public consultation, the decision was made that the whole of the UK would switch to hydrogen.</p>	<p>After a local democratic process, the decision was made that the whole of your region would switch to hydrogen.</p>

### The installation process


**Option 1: National Decision**



The illustration shows a man with brown hair, wearing a dark blue polo shirt with a small logo on the chest, standing with his arms crossed. Behind him is a white van with 'UK Gas' written on its side. The background features a row of suburban houses with brown roofs and white walls, a green lawn, and a red car parked on the street under a blue sky with white clouds.

The engineer, who works for a well-known energy supplier, is scheduled to be visiting your home this week to switch your home over to hydrogen.

**Option 2: Local Decision**



The illustration shows a man with brown hair, wearing a dark blue polo shirt and yellow overalls, standing with his arms crossed. Behind him is a yellow van with 'LOCAL HEATING SERVICES' written on its side. The background features a row of suburban houses with brown roofs and white walls, a green lawn, and a red car parked on the street under a blue sky with white clouds.

The engineer, who is a local tradesperson, is scheduled to be visiting your home this week to switch your home over to hydrogen.

### Option 1: National Decision



Mon	Tues	Wed	Thurs	Fri	Sat	Sun
	1	2	3	4	5	6
7	8 <i>INSTALLATION</i>	9 <i>INSTALLATION</i>	10	11	12	13
14	15	16	17	18		20
21	22	23	24	25	26	27

You understand that the engineer will need at least a day or two to do the work. The engineer is coming on Tuesday, this day was selected by you, after you were given a two week time slot to choose from.

### Option 2: Local Decision



Mon	Tues	Wed	Thurs	Fri	Sat	Sun
	1	2	3	4	5	6
7	8 <i>INSTALLATION</i>	9 <i>INSTALLATION</i>	10	11	12	13
14	15	16	17			
21	22	23	24			

UK Gas

Allocated installation date will be:  
TUES 8TH

You understand that the engineer will need two days to do the work. The engineer is coming on Tuesday and Wednesday, these were the days allocated to your part of the street.



### Option 1 & 2 National and Local Decision



The gas supply will have to be switched off for 1-2 weeks during the period that the local area is switched over.

What do you do whilst this is happening? What are your concerns about this? What support might you expect to have from the government whilst you have no access to a gas supply?


### Option 1 & 2 National and Local Decision



During the switch over your gas boiler will need to be changed to a new one that works with hydrogen. A new cooker will also be installed, this might be an electric appliance, or a gas one that works with hydrogen. Additionally, your gas fire will need to be changed, if you have one and you may also need some of the pipework in your home replaced.

Supporting the purchase of new appliances

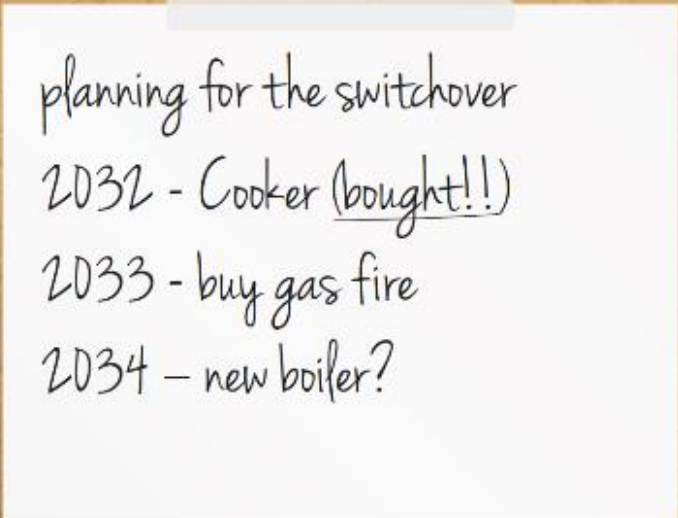
### Option 1: National Decision



The image shows three different models of electric cookers against a teal background. Each cooker has a red circular label indicating its compensation level: the leftmost (basic) is labeled '100% compensated', the middle one is labeled '50% compensated', and the rightmost (most advanced) is labeled '10% compensated'.

You were allowed to pick your new appliances. There was a range of choices – the most basic was most heavily compensated and you had to pay more to upgrade. They all looked similar to your natural gas hob.

### Option 2: Local Decision



The image shows a corkboard with a white sheet of paper pinned to it. The paper has handwritten notes in black ink. To the right of the paper, there are some small, partially visible notes and a green drawing on the corkboard itself.

planning for the switchover  
2032 - Cooker (bought!!)  
2033 - buy gas fire  
2034 - new boiler?

You had to pay for the new appliances yourself, so you bought your cooker a while ago to spread the cost, once you first heard about the switch over. You just recently paid for the new boiler system on a finance basis. You don't have a gas fire and you were lucky that you did not need the pipes replaced.



### The lived experience



## Understanding the technologies in detail: Heat pumps


### Setting up the scenario

Option 1 & 2 Refurbishment and Mandatory Regulation




It's a hot summer's day in July 2034; your driverless car is on its way to pick you up for work. Today is the day you will be coming off the natural gas grid and having heat pumps installed.

Option 1: Refurbishment



It's a hot summer's day in July 2034. Last year you decided to refurbish the house. As part of the refresh, you started looking into different heating options and researched a few that are available on the market. After exploring the options available, you decided that it made most sense to switch to heat pumps. There was a government subsidy to go towards some of the cost.

Option 2: Mandatory Regulation



It was 5 years ago the government announced that it was going to be a requirement under national legislation to have heat pumps installed over the next 10 year period. Over the last 5 years people up and down the country have slowly been switching their heating systems to heat pumps.

### The installation process

#### Option 1: Refurbishment



This week you will have an engineer visit to start the work and begin the installation process. The engineer works for the company you bought the heat pumps from.

#### Option 2: Mandatory Regulation



This week you will have an engineer visit to begin the installation process. The engineer is someone you have always used for heating related issues in your home.

Option 1 & 2 Refurbishment and Mandatory Regulation



Mon	Tues	Wed	Thurs	Fri	Sat	Sun
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15		17	18		20
21	22		24	25	26	27

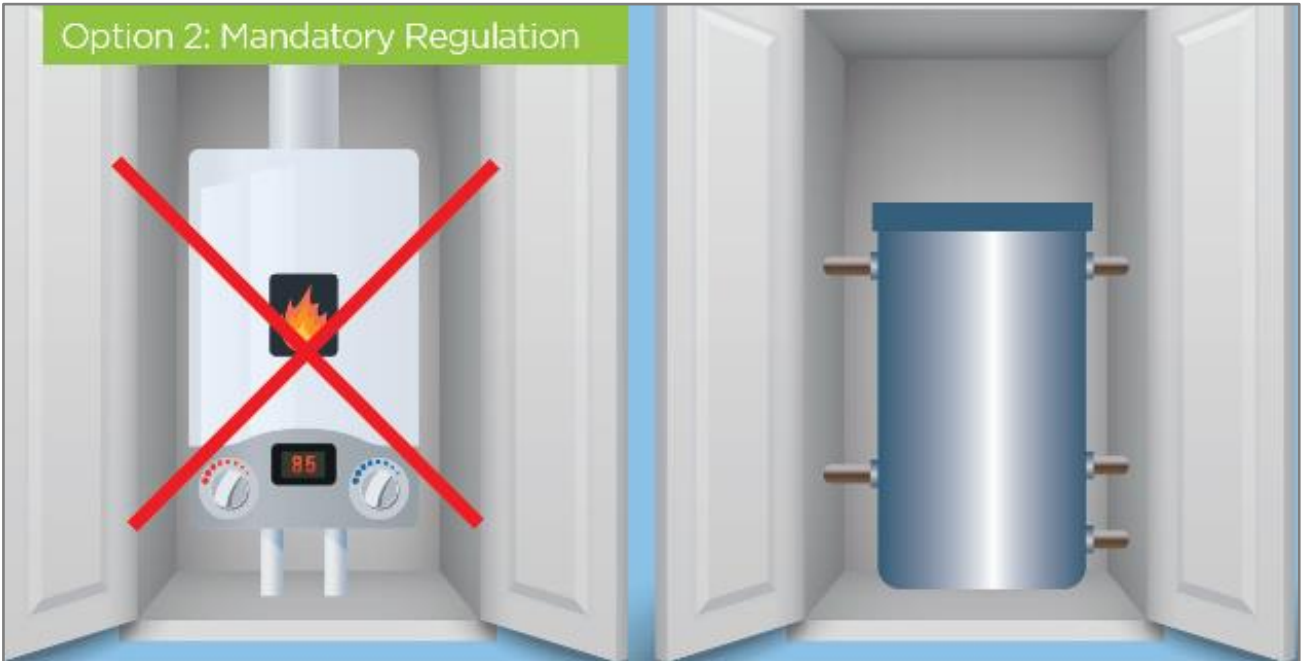
The engineer will be there for one day to complete the work.

Option 1 & 2 Refurbishment and Mandatory Regulation



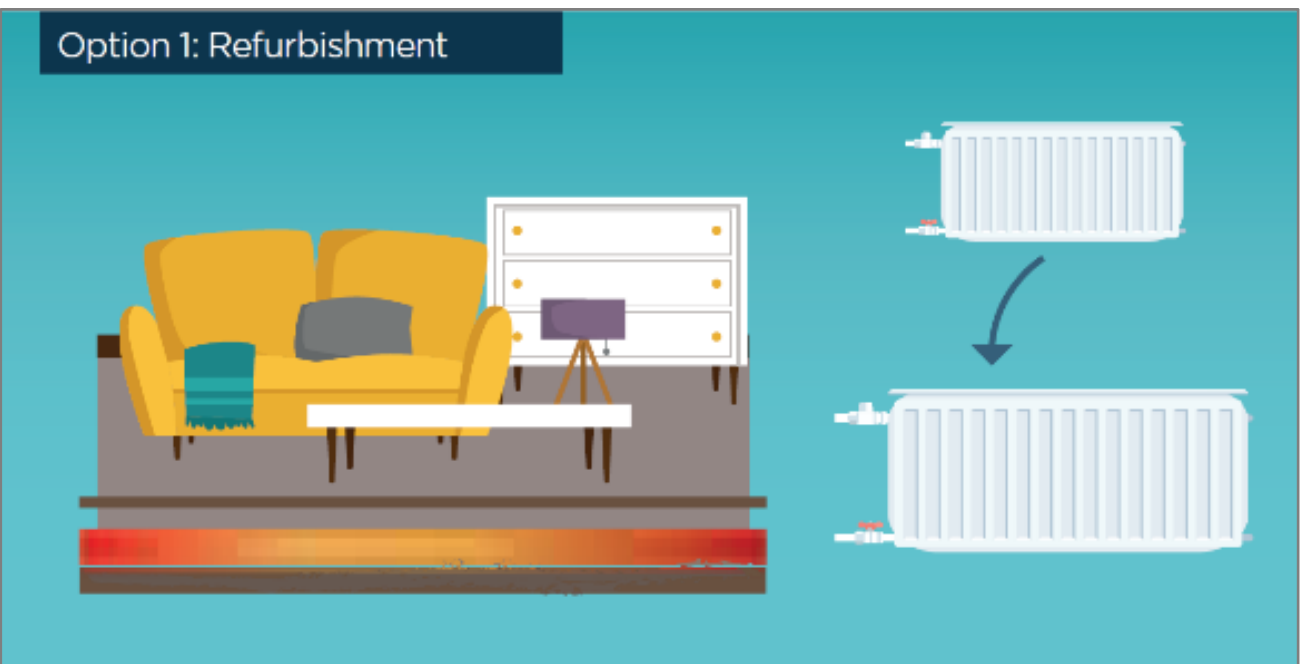
You will still be able to use your cooker, hot water and heating up to the installation and immediately again afterwards. But you will not during the day it takes for the engineer to complete the work.

### Option 2: Mandatory Regulation



As part of the installation, there will be a storage tank installed where your boiler used to be.

### Option 1: Refurbishment



As part of the installation you are having larger radiators installed. You might also choose to have underfloor heating installed as well.



### Option 1 & 2 Refurbishment and Mandatory Regulation



You will also need an outdoor unit installed on the outside of your home

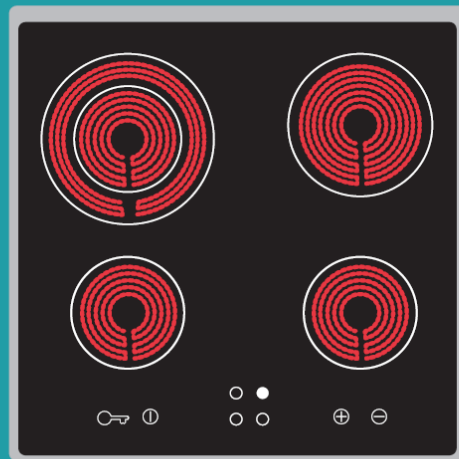
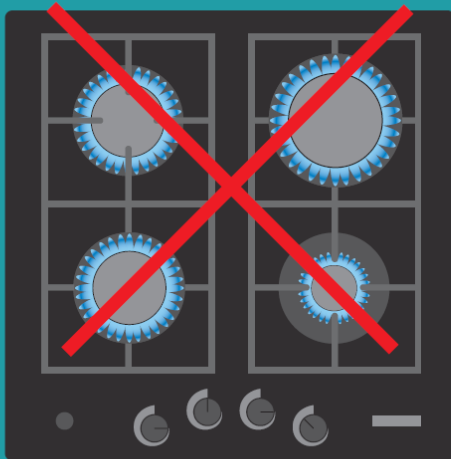
### Option 1: Refurbishment



You will also now have an electric cooker installed, as well as a storage tank. You have picked and paid for the ones you wanted from the website.

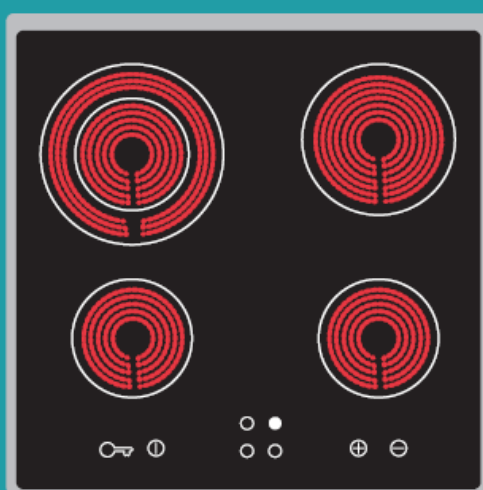
Supporting the purchase of new appliances

Option 2: Mandatory Regulation



You will also have an electric cooker installed instead of your natural gas one. Various levels of compensation will be provided by the government to support this.

Option 2: Mandatory Regulation



You will also have an electric cooker installed instead of your natural gas one. Due to the advanced notice provided you will pay for this yourself.

Option 1 & 2 Refurbishment and Mandatory Regulation



It's a cold frosty morning in January 2036, and you're getting ready for work. The house is warm. The heating has been on fairly constantly over the winter - you were given advice that this is the most effective way to use a heat pump, which is not as responsive as your natural gas system. It took a while at first to get used to not having to think about setting the timer each winter and switching it on and off depending on when you were in your home. However, now you are used to the way it works.

Option 1 & 2 Refurbishment and Mandatory Regulation




There's a faint hum in the background as you get out of bed. That's the sound of the heat pump working. However, you don't hear it now really, unless you were asked to listen for it.














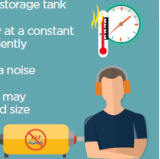

## The lived experience

**Option 1 & 2 Refurbishment and Mandatory Regulation**



You get in the shower and the water is lovely and warm. Having a storage tank for hot water was another element to get used to as part of having heat pumps installed, but now you're used to it.

## Summary and comparison of all implications associated with each heating technology

Installation Process			
	For both technologies 	Heat pump 	Hydrogen 
<b>You will..</b>	<ul style="list-style-type: none"> <li>Need an engineer to conduct the installation</li> </ul> 	<ul style="list-style-type: none"> <li>Need a storage tank, if you do not already have one</li> </ul> 	<ul style="list-style-type: none"> <li>Need to replace all gas-burning appliances (i.e. boiler, gas fire, gas cooker)</li> </ul> 
<b>You may..</b>	<ul style="list-style-type: none"> <li>Need Insulation installed</li> <li>Need to replace your gas cooker with an electric cooker</li> </ul> 	<ul style="list-style-type: none"> <li>Choose to have underfloor heating installed</li> <li>Need larger radiators fitted</li> </ul> 	<ul style="list-style-type: none"> <li>Need new piping in your home</li> </ul> 
<b>You won't..</b>		<ul style="list-style-type: none"> <li>Have access to hot water, heating or your cooker for 1-2 days, whilst the installation takes place</li> </ul> 	<ul style="list-style-type: none"> <li>Have access to heating, hot water or a gas cooker for 1-2 weeks, as the local gas supply is switched over</li> <li>Need additional radiators and storage tanks</li> </ul> 
Experience post-switchover			
	<ul style="list-style-type: none"> <li>Potential for hot water to run out due to storage tank system</li> <li>Increased storage space needed for storage tank</li> <li>Heating needs to be on continuously at a constant temperature to heat buildings sufficiently</li> <li>Air source heat pumps would make a noise</li> </ul> <p><b>Caveat:</b> in future scenarios, innovation may have improved issues around noise and size of storage space needed</p> 		<ul style="list-style-type: none"> <li>No discernible differences vs. natural gas</li> <li>Flames when cooking may look visually different and smell added to flame may differ to that of natural gas</li> <li>Might need alarms fitted, similar to carbon monoxide alarms</li> </ul> 

## Quantitative research materials

This section provides details of the quantitative research design included sample design and materials used for the survey.

### Detailed sample breakdown

#### Study population

All respondents who completed the online survey met the following criteria:

- Lived in homes connected to the gas grid
- Lived in homes that are gas heated
- Had some level of responsibility in managing their household bills

Those with certain job types were excluded, in order not to bias results, these included those related; to energy, utilities, engineering, local government, as well as marketing or advertising industries.

This is a nationally representative survey and the sample size and design mean that there is 95% confidence that the results fall within a plus or minus 3% confidence interval. Only statistically significant differences are provided in the full report.

Table 3: detailed quantitative sample breakdown

Respondent Characteristic	Number of respondents	% of respondents
GENDER		
Male	504	49%
Female	525	51%
AGE		
18-34	305	30%
35-54	363	35%
55-74	284	28%
75+	77	7%
COUNTRY CURRENTLY LIVING IN		
Northern Ireland	100	10%
Scotland	104	10%
Wales	101	10%
England	724	70%
HIGHEST LEVEL OF EDUCATION		
No formal qualification	38	4%
GCSE or equivalent	231	22%
A-Level or equivalent	261	25%
Undergraduate degree	297	29%
HOUSING TENURE		
Social rent	100	10%
Private rent	164	16%
Home-owner	765	74%
HOUSEHOLD INCOME		
Less than £20,000	171	17%
£20,001-£40,000	347	34%
£40,001-£60,000	232	23%
£60,001-£80,000	117	11%
£80,001-£100,000	66	6%
£100,001+	45	4%
BUILDING TYPE		
Flat / apartment	141	14%
Bungalow	86	8%
Terraced house	242	24%
Semi-detached house	318	31%
Detached house	240	23%
None of these	2	0%
PEOPLE WITHIN THE HOUSEHOLD		
Children under the age of 12	337	33%
Children over the age of 12	193	19%
People over the age of 75	92	9%
People who have a long-standing health condition that affects their ability to leave the house	67	7%
None of these	459	45%

## Questionnaire

This section provides details of the online questionnaire completed by respondents. This was designed to take around ten minutes to complete and consisted mostly of closed questions, although in a minority of cases there was an option to provide an open-ended response. Questions that required respondents to read information about the heating technologies had a timer, ensuring that respondents took time to consider the materials in front of them and preventing them from moving onto the next question too quickly.

### Project overview

#### Project background and objectives

Finding alternatives to natural gas for heating and cooking at home is a crucial part of meeting the UK's carbon reduction targets. Public acceptability is essential for enabling a smooth transition to a new energy source. As such, the CCC is interested to understand initial public reactions to hydrogen and heat pumps as alternatives to natural gas in the home.

#### Key research objectives:

- Understand householders' attitudes towards hydrogen and heat pumps as energy sources for heating and cooking;
- Describe attitudinal differences between different demographic groups and geographical areas;
- Identify likely barriers to acceptability of widespread deployment of either option, and how significant these will be to overcome; and
- Provide recommendations for how government could engage with households to overcome these barriers and what type of content and materials would be effective in doing so

#### Key details

- **Method:** Nationally representative, 15 minute online survey
- **Number of responses:** 1000
- **Dates of fieldwork:** 10<sup>th</sup> May – 15<sup>th</sup> May (Estimated)

#### Sample

- **All participants to:** be the involved in managing household bills; live in homes connected to the gas grid

Country	No. interviews	Age split	Level of education (highest level of qualification)	Renter / owner occupier
England	700	Even split between:  18-34 35-54 55-74 75+	Up to GCSE Up to A-Level Up to degree level Postgraduate	Minimum of 20% renters
N. Ireland	100			
Scotland	100			
Wales	100			

## Questionnaire structure

	Section title	Objective of section	Stimulus	Timing
1	Screening	To ensure the right participant profile	None	
2	Attitude to energy use	To understand awareness of current energy use in the home to use as an analysis variable for understanding different views to the switchover and technologies	None	
3	Household heating preferences	To understand more about respondents' household, approach to heating and drivers of their approach to heating to use as analysis variables for understanding different views to the switchover and technologies	None	
4	Introduction to the switchover	To measure prevalence of initial views on the concept of the switchover and initial preferences for the technologies	Switchover scenario Technology intros	
5	Details of the switchover	To measure prevalence of views on different aspects of the switchover and a more informed tech preferences	Technology scenarios	
6	Information gaps and comprehension	To understand what more people would like to know and how informed they now feel	None	
7	Attitudes to climate change	Assess views on climate change to use as analysis variables for understanding different views to the switchover and technologies	None	

## Question rationale

	Question name	Rationale	Priority
Attitude to energy use	EnSav1	Understand how much thought is given to heating the home to understand how this impacts on views of the switchover and specific technologies	High
	EnSav2	Measure prevalence of drivers of energy behaviours, in particular to understand how different behaviours impact on views of the switchover and energy technologies	High
	EnSav3	Measure prevalence of drivers of energy behaviours, in particular to understand how different behaviours impact on views of the switchover and energy technologies	High
	GreenBehav	Measure prevalence of current green behaviours to understand whether this impacts on views of the switchover	High
Household heating preferences and behaviours	HHComp	Capture household composition to identify whether this impacts on views of the specific characteristics of the energy technologies	High
	PropType	Capture property type to identify whether this impacts on views of the specific characteristics of the energy technologies	Med
	Comft1	Measure the prevalence of satisfaction with current heating technology to identify whether this impacts on views of technologies	Med
	Comft1a	Measure prevalence of barriers to having a comfortably warm home	Low
	Comft2	Measure the need for energy technologies to be able to cool homes	Low
The switchover from natural gas	SwitAwa	Measure awareness of various aspects to the switchover (i.e. the carbon emissions reduction targets, the need to switch from natural gas, heating/hot water as significant contributors to emissions)	High
	SwitRation	Measure level of importance given to specific elements of the switchover	High
	Techawar	Measure awareness and knowledge of heat pumps and hydrogen as potential ways to heat homes	High
	HPConc	Measure level of concern around key areas related to heat pumps, before providing detailed explanation on each energy technology	High
	HydConc	Measure level of concern around key areas related to hydrogen, before providing detailed explanation on each energy technology	High
	TechPref1	Understand prevalence of assumptions and comparisons made about each energy technology, before providing detailed understanding of each	High
	TechPref2	Measure initial preferences for each energy technology, without detailed understanding of each	High
Installation and living with the technologies	Section 4 (overall)	Identify the barriers to implementation of the two energy technologies, through measuring how reasonable specific elements of each are felt to be. Questions to cover following topic areas:	High
	TechExp	Lived experience of the two energy technologies	High
	HeatCool	Lived experience of a hot and cold heat pump	Low
	TechPref3-5	Measure preferences for each energy technology after different pieces of information about them has been described	High

## TECHNICAL APPENDIX: Public acceptability of the use of hydrogen for heating

	<b>TechGas1</b>	No gas supply for both heat pumps and hydrogen	High
	<b>TechGas2</b>	Measure preferences for the type of the support that could be provided during period of no gas supply	Low
	<b>TechApp</b>	New appliances required as part of switchover to heat pumps and hydrogen	High
	<b>TechPay</b>	Paying for new appliances	High
Information gaps and communication preferences	<b>TechPref6</b>	Understand which energy technology participants prefer overall, after hearing all the relevant information on each	High
	<b>TechPrefHP</b>	Identify main barriers to hydrogen heating to understand what put them off this heating option	High
	<b>TechPrefHyd</b>	Identify main barriers to heat pumps, to understand what put them off this heating option	High
	<b>Comprh1</b>	Understand to what extent participants have understood information provided in relation to heat pumps and where the biggest gaps are	Med
	<b>GapsHP</b>	Identify the most important areas of information for communications related to heat pumps	Med
	<b>Comprh2</b>	Understand to what extent participants have understood information provided in relation to hydrogen and where the biggest gaps are	Med
Attitudes to climate change	<b>GapsHyd</b>	Identify the most important areas of information for communications related to hydrogen	Med
	<b>CCview</b>	Measure prevalence of concern on climate change to understand if this impacts on views of the switchover	Med
	<b>CCcause</b>	Measure levels of scepticism in relation to climate change to understand if this impacts on views of the switchover	Med

## Questionnaire

### Questionnaire (10 minute, online survey)

Before we start, there are a couple of questions we need to ask to make sure you're eligible for this study.

### Profiling questions

ASK ALL

AGE/GENDER STANDARD QUESTION

S1. Are you...? [SINGLE CODE]

1. Male
2. Female

*Aim to achieve a 50:50 male:female split*

ASK ALL – range 0-99

AGE/GENDER STANDARD QUESTION

S2. How old are you? [OPEN CODE]

CLOSE IF S2 = 17 OR UNDER

*To categorise*

Under 18

TERMINATE

dAge. DUMMY TO PUNCH AGE

1. 18-34
2. 35-54
3. 55-74
4. 75+

*Aim to achieve an even split of ages*

ASK ALL

SC

S3. What is the highest level of education that you have attained? [SINGLE CODE]

1. No formal qualification
2. GCSE or equivalent
3. A-Level or equivalent
4. Undergraduate degree
5. Postgraduate degree or higher

*Representative across UK*



ASK ALL

SC

**S4. Where do you currently live?**

1. Northern Ireland
2. Scotland
3. Wales
4. England
98. Other

TERMINATE

CLOSE IF S4 = 98

ASK ALL

SC

**S5. Which best describes your current occupancy? [SINGLE CODE]**

1. Social rent
2. Private rent
3. Home-owner
98. Other

TERMINATE

CLOSE IF S5 = 98

ASK ALL

SC

**S6. What is your annual household income? (i.e. the combined income of all household earners) [SINGLE CODE]**

1. Less than £20,000
2. £20,001-£40,000
3. £40,001-£60,000
4. £60,001-£80,000
5. £80,001-£100,000
6. £100,001+
96. Prefer not to say

## Screening questions

ASK ALL

SC

S7. At any time in the past 5 years, have you or anyone in your immediate family worked in any of the following areas? [SINGLE CODE]

- |                              |           |
|------------------------------|-----------|
| 1. Advertising               | TERMINATE |
| 2. Marketing/Market Research | TERMINATE |
| 3. Energy                    | TERMINATE |
| 4. Utilities                 | TERMINATE |
| 5. Engineering               | TERMINATE |
| 6. Plumbing / Heating        | TERMINATE |
| 7. PR (firm or department)   | TERMINATE |
| 8. Local government          | TERMINATE |
| 99. None of the above        |           |

CLOSE IF S7 = 1-8

ASK ALL

Y/N QUESTION TYPE

S8. Is your home connected to the gas grid? (i.e. national networks supplying gas to your home) [SINGLE CODE]

- |        |           |
|--------|-----------|
| 1. Yes |           |
| 2. No  | TERMINATE |

CLOSE IF S8 = 2 (NO)

ASK ALL

SC

S9 . What is the main heating system that you use in your home? [SINGLE CODE]

- |   |           |
|---|-----------|
| 1. Gas; heated by a gas boiler                              |           |
| 2. Electric; heated with electric heaters                   | TERMINATE |
| 3. Renewable; heated by biomass/biofuel boiler or heat pump | TERMINATE |
| 98. Other   | TERMINATE |

CLOSE IF S9 – 2,3,98

ASK ALL  
SC

S10. Which of the following statements best describes who manages utility bills in your household?  
[SINGLE CODE]

1. I don't have much to do with them
2. I do only a little in terms of management, but do help pay them
3. I share managing of the bills and also help pay them
4. I manage the bills and am the main payer

TERMINATE

CLOSE IF S10 – 1

### Introduction to the survey

This survey has been commissioned by an independent public body to help understand public experiences and attitudes towards household energy use.

As part of the survey we will ask you questions about your views on the environment, how you heat your home and some alternative technologies for heating your home. For some of the questions, we will show you some text and images to gauge your reactions to them.

Our findings will help our client communicate with the public about any future changes to the energy technologies we use in our home.

### Section 1: Attitude to energy use

ASK ALL  
SC

EnSav1

Q1. How much thought, if any, would you say you give to the amount of energy you use to heat your home?

(tick only one)

- |                  |                 |
|------------------|-----------------|
| 1. A lot         | [GO TO EneSav2] |
| 2. A fair amount | [GO TO EneSav2] |
| 3. Not very much | [GO TO EneSav3] |
| 4. None at all   | [GO TO EneSav3] |

ASK IF Q1=1,2

SC

EnSav2.

Q2. You said that you pay **[PIPE IN ANSWER FROM Q1 - a lot/ a fair amount]** of attention to the amount of heating you use in your home. What is the main reason for this?

(tick only one)

1. To minimise the amount of money you spend on heat
2. To minimise the environmental impact of the heat you use
3. I want to make sure me/my household has sufficient heat to be comfortable
4. I struggle to control the amount of heat used
5. I want to keep control over the amount of heat used
6. Some/all of these reasons equally
97. Don't know

ASK IF Q1=3,4

SC

EneSav3

Q3. You said that you pay [PLEASE PIPE IN ANSWER FROM Q1 - not very much/ IF Q1=4 THEN PIPE IN 'no'] attention to the amount of heating you use in your home. What is the main reason for this?

1. I use as much heat as is needed to be comfortable
2. I don't know how to control the amount of heat used
3. My heating system doesn't allow me to control the amount of heat used
4. I'm just not interested in the amount of heat use
5. I set controls whenever seasons change and don't adjust them much after that
6. Some/all of these reasons equally
97. Don't know

ASK ALL

CARD SORT

GreenBehav

Q4. How often, if at all, do you personally do any of the following?

1. Leave the lights on when you are not in the room
2. Boil the kettle with more water than you are going to use
3. Wash clothes at 30 degrees or lower
4. Try to keep rooms that you are not using at a cooler temperature than those you are using
5. Leave the heating on when you go out for a few hours

1. Always
2. Often
3. Sometimes
4. Rarely
5. Never

97. (Don't know) [TICK BOX]

## Section 2: Household heating preferences and behaviours

ASK ALL

MC

HHComp

Q5. Are any of the following people currently living in your household? Select all that apply.

1. Children under the age of 12
2. Children over the age of 12
3. People over the age of 75
4. People who have a long-standing health condition that affects their ability to leave the house
99. None of these [EXCL]

ASK ALL

SC

**PropType**

Q6. What type of building do you live in? [SINGLE CODE]

1. Flat / apartment
2. Bungalow
3. Terraced house
4. Semi-detached house
5. Detached house
99. None of these

ASK ALL

SC

**Comft1**

Q7. During cold weather, do you find it difficult to keep your home comfortably warm?

1. Yes, often
2. Yes, sometimes
3. No

*Only to those answering Comft1 with 1) or 2)*

ASK IF Q7 = 1,2

SC

**Comft1a**

Q8. You said you find it difficult to keep your home comfortably warm, what is the main reason for this?

1. It costs too much to keep your heating on
2. Even with the heating on full, it is not possible to heat all of my home comfortably
3. My heating system takes a long time to warm up
99. None of the above

ASK ALL

SC

**Comft2**

Q9. During hot weather, do you find it difficult to keep your home comfortably cool?

1. Yes, often
2. Yes, sometimes
3. No

**Section 3: The switchover from Natural Gas**

ASK ALL

INFO NODE

*Please read the following text about heating your home in future, we will then ask you a few questions to get your opinion on it.*

*The countries of the UK have legally binding targets to reduce carbon emissions by 80% by 2050. Heating and hot water in buildings make up 20% of greenhouse gas emissions in the UK. To meet these legally binding targets, we will need to reduce carbon emissions from the way we heat our homes. This will require a gradual switchover from natural gas, to new, low carbon energy sources.*

**ASK ALL  
RATEMENT**

**SwitAwa**

Q10. Before today, how much did you know about the following...

**RANDOMISE ORDER OF STATEMENTS**

1. That the UK has legally binding targets to reduce carbon emissions
2. That the UK has legally binding targets to reduce carbon emissions by 80% by 2050
3. That the UK will have to switch from natural gas to an alternative low carbon energy source for heating our homes
4. That the heating and hot water in our homes makes up a substantial amount of carbon emissions in the UK

Scale

1. Knew a lot
2. Knew a little
3. Have heard of it of it but do not really knew what it is
4. Never heard of it

**ASK ALL  
RATEMENT**

**SwitRation**

Q11. Given the facts that you have been told, how important do you feel it is that the following take place? :

**RANDOMISE ORDER OF STATEMENTS**

1. The government sets legally binding targets to reduce carbon emissions
2. The government sets legally binding targets to reduce carbon emissions by 80% by 2050
3. Every home in the UK switches to alternative low-carbon energy sources for heating
4. The public in the UK have a say about the options for alternative low-carbon energy sources for heating their homes

Scale

1. Very important
2. Quite important
3. Neither important nor unimportant
4. Not very important
5. Not at all important

**ASK ALL  
RATEMENT**

**Techawar**

Q12. How much, if anything, do you know about the following ways to heat your home:

1. Air source heat pumps
2. Ground source heat pumps
3. Hydrogen fuel boilers
4. Biomass fuel boilers

Scale

1. Know a lot
2. Know a little

3. Have heard of it of it but do not really know what it is
4. Never heard of it

ASK ALL  
INFO NODE

As part of this survey, we are going to describe two energy technologies that could be used as alternatives to natural gas. We will introduce them briefly one by one before going into more detail. Firstly, we would like to understand your initial reaction to each.

*DRAND - RANDOMISE order descriptions of hydrogen / heat pumps and related questions are shown*

1. *SHOW HEAT PUMPS FIRST*
2. *SHOW HYDROGEN FIRST*

RANDOMISE Q13 AND Q14 BASED ON DRAND.

ASK ALL

[MULTI CODE; max 3]

Heat pumps

*Heat pumps are a renewable technology that take heat energy from the outside air and use this to provide heating and hot water. Heat pumps work like a fridge in reverse, keeping your home at a constant warm temperature, even when it is cold outside. A dedicated heat pump is fixed to each home and do not require a connection to the gas grid. They are very efficient and run on electricity, which can be produced from wind or solar power. They are already common in many other countries across Europe.*

When answering the following questions please assume that the technology will be as safe as your current system and running costs will be equivalent.

HPConc

Q13. Having read this description, do you have any concerns about having heat pumps in your home?

Select the 3 that are most important.

1. Physical changes required inside or outside your home
2. The reliability of the heating supply
3. How long it would take to install
4. How easy it will be to use
5. How effectively the technology will meet your heating needs in the home
6. How much it will contribute to meeting carbon reduction targets
7. How often it will need to be replaced or repaired
8. Whose responsibility it is to maintain
98. Other: please state [OPEN CODE]
99. None [EXCLUSIVE]

ASK ALL

[MULTI CODE; max 3]

Hydrogen

*Hydrogen could be an important way to provide energy needed for heating and cooking in the home. It can be made from renewable energy sources and it is virtually non-polluting. Hydrogen can be produced in various ways, either using renewable electricity to produce hydrogen from water or from fossil fuels through processes that capture and store carbon emissions rather than releasing them into the air. Hydrogen would*



## TECHNICAL APPENDIX: Public acceptability of the use of hydrogen for heating

*enter your home in a similar way to how natural gas does now; however, before hydrogen can play a bigger role, structural changes to the existing gas grid need to be made.*

**When answering the following questions please assume that the technology will be as safe as your current system and running costs will be equivalent.**

### HPConc

Q14. Having read this description, do you have any concerns about having hydrogen heating in your home? Select the 3 that are most important. **[MULTI CODE; max 3]**

1. Physical changes required inside or outside your home
2. The reliability of the heating supply
3. How long it would take to install
4. How easy it will be to use
5. How effectively the technology will meet your heating needs in the home
6. How much it will contribute to meeting carbon reduction targets
7. How often it will need to be replaced or repaired
8. Whose responsibility it is to maintain
98. Other: please state **[OPEN CODE]**
99. None **[EXCLUSIVE]**

### ASK ALL

#### SC PER STATEMENT - RATEMENT

#### TechPref1

Q15. Having read brief descriptions of both hydrogen and heat pumps, which do you feel would: **[SINGLE CODE]**

1. Most effectively meet your heating needs
2. Contribute the most to reducing carbon emissions
3. Be the most hassle to install
4. Be the most feasible for the whole country to switch to

Tabulate with:

1. Heat pumps
2. Hydrogen
3. I currently view both equally

### ASK ALL

#### SC

Q16. At this point, which of the energy technologies would you prefer to install and use, as an alternative to natural gas

1. Heat pumps **[randomize based on dRand]**
2. Hydrogen **[randomize based on dRand]**
3. I see both as suitable possible alternatives
4. I don't see either as suitable possible alternatives

## Section 4: Detailed reactions to technologies

Where there are two options, please randomise the order they are seen (based on dRand). This is indicated on relevant slides. If see hydrogen first, should see hydrogen first throughout to avoid confusion and vice versa for heat pumps.

#### ASK ALL INFO NODE

In the next section, we are going to show you what it might be like to have heat pumps or hydrogen to heat your home, instead of natural gas.

When introducing different parts of the process, we will ask you a question about it to understand your views. In some cases, we might display two different options on the same page and ask you to rate both at the same time.

Please pay attention to which energy technology we are referring to in the questions; some compare heat pumps and hydrogen, whilst others are about a specific technology and others are relevant for both.

#### ASK ALL – SLIDERS

##### TechExp

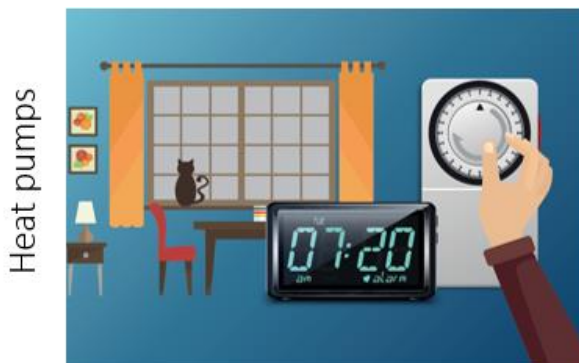
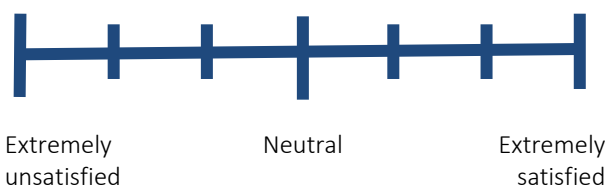
Q17. If you were to have heat pumps or hydrogen installed in your home, you would notice some changes in how you heat your home and how you get hot water. How satisfied would you be if your new heating system worked in the following ways described?



The way your heating and hot water works is very similar to your natural gas boiler. The noticeable differences are:

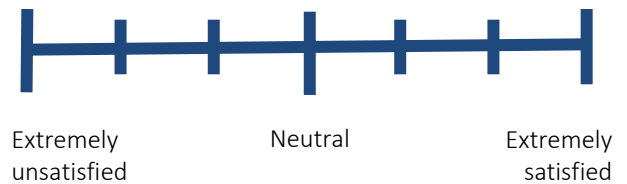
- The smell of the gas
- The colour of the flame on your cooker
- You might have to have a safety alarm fitted (similar to a carbon monoxide detector)

*Tell us how you would feel about having this heating system in your home, by selecting 1-7 on the following scale, where 1 is extremely unsatisfied and 7 is extremely satisfied.*



- Your hot water is heated via a storage tank system, so hot water is stored up
- The heat pump makes a faint hum (no louder than your fridge)
- It could take a couple of hours to heat up your home from cold, but a control system can ensure that it switches on early enough to ensure that you are warm enough when you need to be

*Tell us how you would feel about having this heating system in your home, by selecting 1-7 on the following scale, where 1 is extremely unsatisfied and 7 is extremely satisfied.*



#### ASK ALL - SC

##### TechPref3

Q18. At this point, thinking about everything you know about each technology, which of the energy technologies would you prefer to install and use, as an alternative to natural gas?

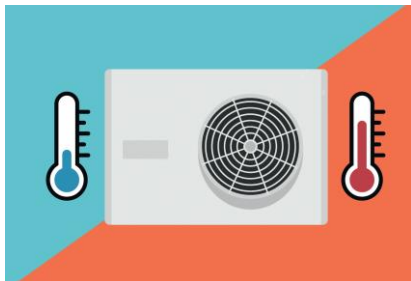
1. Heat pumps [randomize based on dRand]
2. Hydrogen [randomize based on dRand]
3. I see both as suitable possible alternatives [fixed]
4. I don't see either as suitable possible alternatives [fixed]

#### ASK ALL - SC

##### HeatCool

Q19. Depending on which heat pump you opt for, it could also cool your home, as well as heat it. Hydrogen would only be able to heat your home.

At this point, thinking about everything you know about each technology, which of the energy technologies would you prefer to install and use, as an alternative to natural gas?



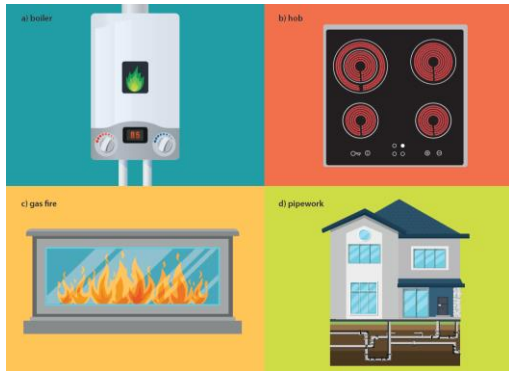
1. Heat pumps [randomize based on dRand]
2. Hydrogen [randomize based on dRand]
3. I see both as suitable possible alternatives [fixed]
4. I don't see either as suitable possible alternatives [fixed]

#### ASK ALL – SLIDERS – RANDOMISE BASED ON dRAND

##### TechApp

As part of the installation, new appliances would be required that work with your new heating system. Many of these can be replaced gradually over the period you prepare for the switchover, but will all need to be replaced by the time the engineer visits your home. In your opinion, how reasonable is each of the following?

Q20Hydrogen.

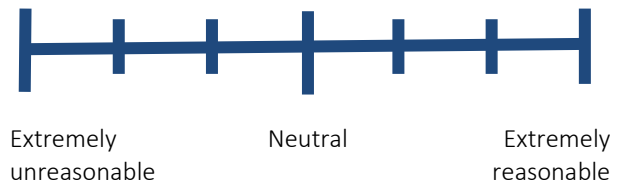


**All your gas appliances will need to have been changed to new ones that work with hydrogen.**

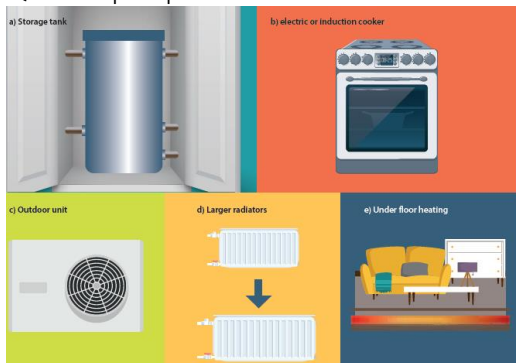
Depending on what you currently have in your home, this would mean replacing

1. Your gas boiler with a hydrogen boiler
2. Your gas hob/oven with electric, induction or hydrogen one
3. Your gas fire with a hydrogen compatible fire
4. It might also be necessary to replace some of the pipework inside your home

*Tell us how you feel about this option by selecting 1-7 on the following scale, where 1 is extremely unreasonable and 7 is extremely reasonable.*



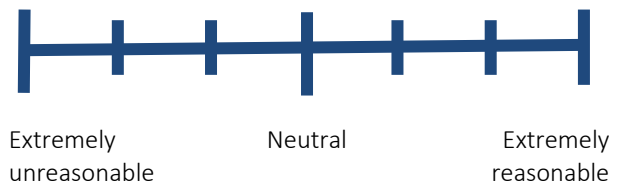
Q20Heatpumps.



**A new heat pump system would require the installation of:**

1. A hot water storage tank (if you do not already have one)
2. An electric, or induction cooker (if you do not already have one)
3. An outdoor unit (no larger in size than a washing machine, and around half this size for smaller homes) and an indoor unit (similar to current boiler)
4. It might also be necessary to install larger radiators (not hugely different from your current ones)
5. You could also choose to have underfloor heating

*Tell us how you feel about this option by selecting 1-7 on the following scale, where 1 is extremely unreasonable and 7 is extremely reasonable.*



**ASK ALL - SC**

**TechPref5**

Q21. At this point, which of the energy technologies would you prefer to install and use, as an alternative to natural gas

1. Heat pumps [randomize based on dRand]
2. Hydrogen [randomize based on dRand]
3. I see both as suitable possible alternatives [fixed]
4. I don't see either as suitable possible alternatives [fixed]

**ASK ALL - SLIDER**

**TechGas1**

Q22. During the installation process, you would need to be disconnected from the gas supply for different amounts of time for each technology. Please note that:

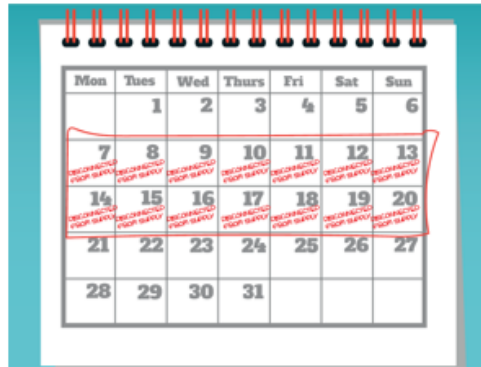
- This would be done in summer to ensure that the need to heat your home is minimal

## TECHNICAL APPENDIX: Public acceptability of the use of hydrogen for heating

- You will not be able to use any gas appliances during this time, but you will be able to continue to use all of your electrical appliances
- Some support will be available during this period (i.e. portable gas supplies; portable showers, etc.)

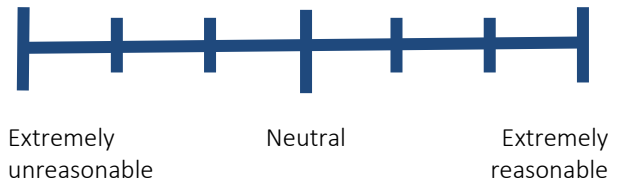
Bearing this in mind, how reasonable do you feel the following time frames are?

Hydrogen



The gas supply will have to be switched off for 1-2 weeks during the period that the local area is switched over so that all the natural gas can be drained from the system.

Tell us how you feel about this option by selecting 1-7 on the following scale, where 1 is extremely unreasonable and 7 is extremely reasonable.

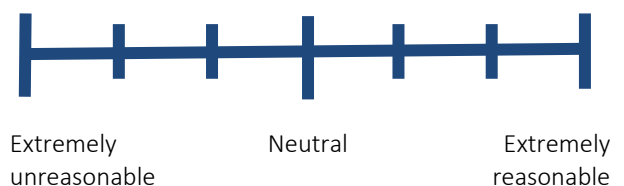


Heat pumps



The gas supply will have to be switched off for 1-3 days, whilst the engineer completes the work in your home. You will still be able to use your cooker, hot water and heating up to the installation and immediately again afterwards, but not during installation.

Tell us how you feel about this option by selecting 1-7 on the following scale, where 1 is extremely unreasonable and 7 is extremely reasonable.



### ASK ALL - SC TechPref4

Q23. At this point, thinking about everything you know about each technology, which of the energy technologies would you prefer to install and use, as an alternative to natural gas?

1. Heat pumps [randomize based on dRand]
2. Hydrogen [randomize based on dRand]
3. I see both as suitable possible alternatives [fixed]
4. I don't see either as suitable possible alternatives [fixed]

### ASK ALL - SLIDERS

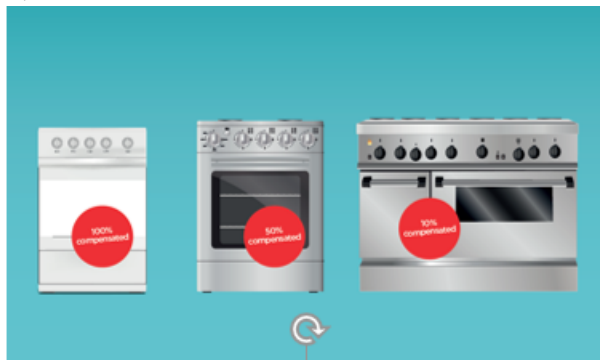
#### TechPay

You will need to plan for the switchover, whether the switchover is to hydrogen or heat pumps. This will involve purchasing replacement appliances that work with the new energy technology. Where relevant,

## TECHNICAL APPENDIX: Public acceptability of the use of hydrogen for heating

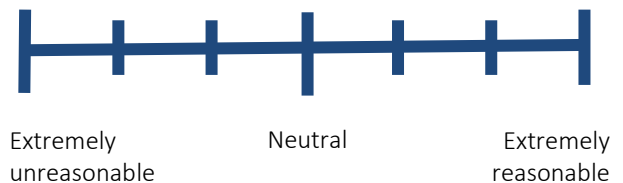
these would also be able to run on both heating systems in the lead up to the switchover. How reasonable do you feel the following ways to pay for the new appliances required are?

Q24x1.

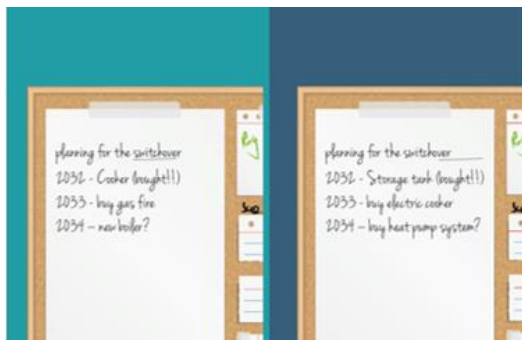


**The government provide a compensation scheme to help you pay for the new appliances.** You will be given range of a range of different appliances to choose from; the most basic will be the most heavily compensated and you will have to pay more to upgrade to other designs.

*Tell us how you feel about this option by selecting 1-7 on the following scale, where 1 is extremely unreasonable and 7 is extremely reasonable.*

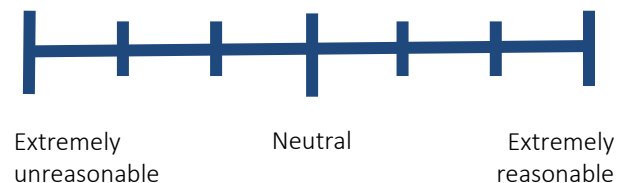


Q24x2.



**The government provided you with a 10 year advanced warning** of the switchover. You therefore had 10 years to plan for and pay for appliances yourself.

*Tell us how you feel about this option by selecting 1-7 on the following scale, where 1 is extremely unreasonable and 7 is extremely reasonable.*



### ASK ALL - SC

#### TechPref6

Q25. Thinking about everything you have learned today about hydrogen and heat pumps; which would you choose to have instead of natural gas?

1. Heat pumps [\[randomize based on dRand\]](#)
2. Hydrogen [\[randomize based on dRand\]](#)

### ASK IF Q25=1 - MAX 3 ANSWERS – MC - randomise

#### TechPrefHP

Q26. You say you would prefer not to have hydrogen heating in your home. What are **the main reasons you would not want hydrogen heating?** Please tick a maximum of 3.

*I do not like the sound of hydrogen because...*

1. The gas potentially smells different to natural gas
2. The flame potentially looks different to natural gas

## TECHNICAL APPENDIX: Public acceptability of the use of hydrogen for heating

3. I would have to get a new boiler and cooker installed, as well as a gas fire [if needed]
4. I would potentially have to have the pipework in my home changed
5. I would prefer not to be connected to the gas grid
6. I would not want to be disconnected from the gas grid for 1-2 weeks
98. Other [please specify] [\[OE CHA\]](#) [\[FIXED\]](#)

### ASK IF Q25=2 – MAX 3 ANSWERS – MC - randomise

#### TechPrefHyd

Q27. You say you would prefer not to have heat pumps in your home. What are **the main reasons you would not want heat pumps**? Please tick a maximum of 3.

*I do not like the sound of heat pumps because...*

1. Of the faint hum it makes
2. Of the space taken up by a storage tank
3. I would want to have instant access to hot water and may not always get this with a storage tank system
4. I would have to have an electric or induction hob
5. It would take longer to heat up my home from cold
6. I would have to get indoor and outdoor units
7. I would potentially have to have larger radiators installed
98. Other [please specify] [\[OE CHA\]](#) [\[FIXED\]](#)

### ASK ALL - SLIDERS

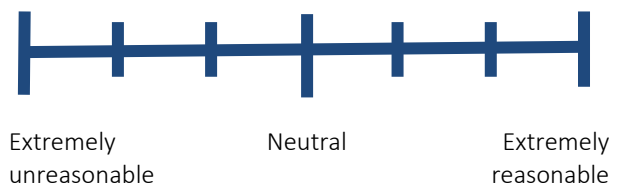
#### HydSwi

Q28. If it was decided that your gas supply will be switched from natural gas to **hydrogen**, this decision could be made in different ways. Thinking about how that decision was made, how reasonable do you feel each of the following situations are?



Following a national public consultation the decision was made that **all UK households connected to the gas network** would switch to hydrogen

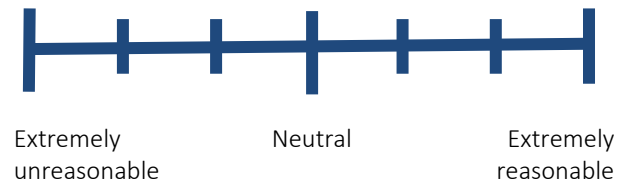
*Tell us how you feel about this option by selecting 1-7 on the following scale, where 1 is extremely unreasonable and 7 is extremely reasonable.*





After a local public consultation, the decision was made that **the whole of your region** would switch to hydrogen

*Tell us how you feel about this option by selecting 1-7 on the following scale, where 1 is extremely unreasonable and 7 is extremely reasonable.*



## Section 5: Information gaps and communication preferences

### ASK ALL SLIDERS – 7 POINT

#### Comprh1

Q29. Thinking about all the information you have heard about heat pumps, to what extent do you agree with the following statements:

1. I understand how installing heat pumps across the UK will contribute to meeting the UK's carbon reduction targets
2. I understand how installing a heat pump in my home will affect me and my household during the installation
3. I understand how installing a heat pump in my home will affect my ability to heat my home in the way I would like to

*Seven point scale from completely agree to completely disagree*

1. Completely agree
2. 2
3. 3
4. Neither agree nor disagree
5. 5
6. 6
7. Completely Disagree

### ASK ALL MC

#### GapsHP

Q30. What would you like to know more about in relation to Heat Pumps?

1. How heat pumps usefully extract heat from the air
2. How and when the technology would be installed
3. How the technology would work in my home



## TECHNICAL APPENDIX: Public acceptability of the use of hydrogen for heating

4. The impact of the technology on reducing carbon emissions
5. Other [please specify] [\[OE CHA\]](#)

*(Tick all that apply)*

### ASK ALL SLIDERS – 7 POINT

#### Comprh2

Q31. Thinking about all the information you have heard about hydrogen heating, to what extent do you agree with the following statements:

1. I understand how installing hydrogen heating across the UK will contribute to meeting the UK's carbon reduction targets
2. I understand how installing hydrogen heating in my home will affect me and my household during the installation
3. I understand how installing hydrogen heating in my home will affect my ability to heat my home in the way I would like to

1. *Completely agree*
2. *2*
3. *3*
4. *Neither agree nor disagree*
5. *5*
6. *6*
7. *Completely Disagree*

### ASK ALL MC

#### Gapshyd

Q32. What would you like to know more about in relation to Hydrogen heating in the home?

1. Where the hydrogen comes from
2. How the hydrogen gets to homes
3. How and when the technology would be installed
4. How the technology would work in my home
5. The impact of the technology on reducing carbon emissions
6. Other [please specify] [\[OE CHA\]](#)

*(Tick all that apply)*

## Section 6: Attitudes to climate change

### ASK ALL SC

#### CCview

Q33. Thinking about your views on climate change, how concerned, if at all are you about climate change, sometimes referred to as global warming?

1. Very concerned
2. Fairly concerned

3. Not very concerned
4. Not at all concerned
5. No opinion/not stated

ASK ALL  
SC

**CCcause**

Q34. Thinking about the causes of climate change, which one of the following statements best describes your own opinion?

1. I think climate change is entirely the result of human activity
2. I think climate change is largely the result of human activity
3. I think climate change is roughly equally the result of human activity and natural processes
4. I think climate change is largely the result of natural processes but partly because of human activity
5. I think climate change is entirely the result of natural processes
6. I do not believe in climate change

**Thank you!**

We appreciate you taking part in this survey. Your responses will help improve the way alternative heating technologies are communicated to the general public in the future.