HM Government

Net Zero Public Dialogue

A Report by Newgate Research and Cambridge Zero

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The views, opinions and recommendations expressed in this report are those of the authors and do not necessarily reflect the official policy or position of BEIS, Defra or any other department of Her Majesty's Government.

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1. Executive summary

Research background and context

The Department for Business, Energy and Industrial Strategy (BEIS) and the Department for Environment, Food and Rural Affairs (Defra) commissioned Newgate Research, working alongside Cambridge Zero, to undertake research with members of the public to:

- establish people's understanding and perceptions of what reaching climate targets in the UK will mean for them individually, and for society as a whole.
- gain insight into people's attitudes and preferences towards the role that individual behaviour change should have in reaching net zero.
- identify the easiest and toughest areas for behaviour change to help reach net zero.
- set out how people would prefer to engage with net zero policies and also to identify initiatives that could help facilitate the societal change required for net zero.

Newgate Research managed a public dialogue process, involving a total of 93 participants drawn from across the UK, in two waves of reconvened deliberative research conducted online. This process involved bringing members of the public together to discuss net zero and the ways in which the 2050 carbon emission target could be met. Stimulus included illustrative presentations on examples of changes across different sectors that may be needed to reach net zero, information on example pathways to net zero and exercises covering individual-led versus industry or government-led action to explore people's views toward more explicitly behavioural or technological solutions.

A significant body of research exists around the technical (or supply side) aspects of tackling carbon emissions, as well as research with members of the public to explore views on sector specific actions (e.g., smart meters, electric vehicles, low carbon heat); more recently an emergent body of research has begun to look at public views around net zero as a whole - most notably the recent work of the Climate Assembly UK[1]. This research complements the existing literature by focusing on public views toward how we reach net zero – with a more holistic focus on what could help to facilitate the range of behaviours and actions that could contribute towards reaching the target, rather than focusing in detail on the adoption of specific behaviours.

The summary which follows details the key findings from across the public dialogue and is structured in the same way as the main report for ease of reference.

[1] See https://www.climateassembly.uk/

Baseline understanding and expectations

The participants in this public dialogue were recruited to reflect the attitudes of the broader public toward climate change. As such the majority of participants expressed concern at the current and future impact of climate change on the environment. However, it was also seen to be such a large issue that it was unclear how individual actions could help address the scale of the challenge facing not just the UK, but countries around the world.

There was a relatively high level of awareness of net zero reported by participants, although through discussion it was apparent that there was a very mixed understanding of what net zero constitutes (i.e., balancing out the emissions produced and taken out of the atmosphere). Once clarified, there was broad agreement that the legally binding 2050 net zero target for the UK was a positive show of commitment to addressing a time-critical issue. There was an accompanying degree of scepticism as to the likelihood of meeting this target given actions would likely be needed across all sections of UK society.

Before being given further information about the range of current and future potential actions that could help the UK to reach net zero, participants were asked what actions they anticipated would be the most important. Those actions that were top-of-mind related to their own behaviours – for example, reducing waste, increasing recycling, reducing car travel, making their homes more energy efficient – though this quickly led to implications for others: such as improving public transport, reducing plastic packaging, and reducing incentives for encouraging unsustainable behaviours amongst people (e.g. cheap flights abroad). Actions which contribute comparatively more carbon emissions, such as a low carbon heating transition and the use of energy in the home, were mentioned less frequently.

Routes to reach net zero

Participants envisaged a net zero society in 2050 to be one which is less polluted, greener, with greater biodiversity and less extreme weather events[2]. It was also a society in which local communities are more integrated, where active travel is more commonplace and where people are generally more physically healthy. These were all seen to be positive outcomes. If this were to be achieved predominantly through changes to individual behaviour, there was a fear this could require a high degree of compulsion (e.g., through restrictions and penalties), and potentially impact people's independence and social relationships. Participants perceived that technology may help society achieve similar outcomes, with less of a direct impact on how people live their lives, including limitations to personal freedoms (such as reductions in choice, independence, and spontaneity). There was a concern however that relying on technology would not solve the underlying driver of carbon emissions: essentially (over)consumption. There was also a fear that people may become more physically disconnected from one another in a society with advances to technology, automation, and online connectivity. In

[2] Participants were asked to imagine scenarios where net zero had been achieved through changes to behaviour and technology. They were not asked to make an overt comparison between different 2020 and 2050, or with other scenarios, though the comparator appears largely to have been with the present day.

reality, there was an expectation that a net zero society in 2050 would most likely have been achieved through a combination of changes to behaviour and accompanying technological innovations.

In considering potential actions to address carbon emissions, some were seen to be more socially acceptable than others. There was strong support for industry-led innovation in: energy generation predominantly through renewables, manufacturing efficiencies, technologies to minimise any reduction to air travel and carbon capture and storage (although participants were provided with very limited information on this). Participants were also highly supportive of actions that they could take themselves to minimise waste through reducing consumption and recycling more, and for installing measures that could increase the energy efficiency of homes. There was little appetite among participants for reductions to air travel, or in using less electricity or hot water – at least to the extent that this would require compromising on comfort within the home.

Two areas were more divisive in splitting opinion between participants:

- The first was car ownership. Depending on personal circumstances, including location and the perceived sufficiency and desirability of both current and expected future alternative options, travelling by car could be seen as a necessity. Those in the youngest and oldest groups, and those living in urban areas were much more likely to be supportive of reducing the use of cars in favour of public transport or active travel. With improvements in performance and affordability, electric vehicles were seen as an acceptable alternative to petrol/diesel vehicles, though there was scepticism whether the necessary infrastructure will be in place to support large-scale changes over the next 30 years.
- The second area was freedom of choice over diet, including the consumption of meat. Participants who ate meat and dairy enjoyed them, also considering them part of a healthy diet, and often disliked alternatives. However, participants realised that it could be desirable for people to reduce meat consumption, and thought they could cut down, if this was not imposed but left to personal choice. Participants expected reductions would occur naturally over time as alternatives to meat improved.

Ultimately people wanted net zero to be achieved in ways which respected individual choice and promoted wellbeing, which were seen to be fair in their distributional impact, and which did not restrict interpersonal relationships or result in the widening of social inequalities. There was some concern that there would likely be distributional impacts of actions to reduce carbon emissions, and that these would have the greatest impact on lower income households, people with specific needs or vulnerabilities, and those living in flats and/or older properties.

Facilitating behaviour change toward net zero

Achieving net zero was felt to require a combination of both individual actions and technological developments led by industry and facilitated by government. While industry was seen by participants to have the biggest influence on emissions and to play a fundamental role

in instigating and facilitating change, government was perceived to have the power to set the direction, legislate and monitor. Participants believed it will be imperative to have strong and united political leadership delivering a clear and consistent message on the actions that will get us to net zero.

There are a number of challenges for motivating the changes in individual behaviour necessary to reduce carbon emissions. As evidenced through this dialogue, there is limited (accurate) awareness, knowledge or understanding of either net zero or the behaviours (including technology adoption and demand reduction) that may be required to achieve net zero. The size and complexity of the climate change issue also means that it can struggle to get cut-through in an environment where people's attention is pre-occupied with a wide variety of other current issues (notably COVID-19 during this study). Actions which were perceived by participants as having immediate financial implications (e.g., replacing boilers) or convenience/comfort implications (e.g., reducing temperature on thermostats) are relatively easy for people to immediately rule out. Alongside this, tackling climate change is seen to be a massive, global issue; people not only have a bias for the present, but they also need to feel that their actions are meaningful, and are aligned with the actions of others, including both industry and other countries. In facilitating behaviour changes it will be important to focus on clear, shorter-term, manageable actions, and for feedback mechanisms to leverage social norms and rewards.

Engaging people in the journey to net zero

There is very limited awareness of national or more localised policies/measures to reduce carbon emissions, or on mechanisms through which the public are being engaged on the issue of climate change (e.g., Climate Assembly UK). Participants were clear on the value of engaging members of the public in dialogue to understand and account for their perspectives, especially on policies which will have a direct impact on the way they live their lives. However, meeting net zero targets was felt to be so important and time-critical that it should not be left to lay people to decide on the best route through which to make progress.

2. Research background

2.1. Policy context

In June 2019, the UK set a net zero greenhouse gas emissions target for 2050. This target binds the UK to reducing its share of global emissions to limit global warming to 2°C or below, relative to pre-industrial levels. This level of warming is the limit beyond which risks to ecosystems and human life become catastrophic. The net zero target is internationally ambitious and necessitates a programme of changes to our lives beyond those that have already been enshrined in policy. The 2020 Climate Change Committee (CCC) progress report[3] identified that, whilst significant progress has been made in reducing emissions in some areas, such as electricity generation, little progress has been seen resulting from shifts in citizens' behaviour (including technology adoption and usage as well as demand reduction). Globally, household consumption contributes to almost three quarters of emissions; facilitating shifts in behaviour represents a substantial opportunity to reduce societal emissions[4]. Whilst in the UK the Climate Change Committee's 6th carbon budget report, 'the Balanced Net Zero Pathway' estimates around 59% of emissions reductions will require some form of behaviour change[5].

This report is timely as the government has recently set out its 10-point plan for a green recovery[6] to the COVID-19 pandemic with commitments for spending on this agenda, which are largely directed at achieving net zero by 2050. The CCC has also made a number of recommendations on policy interventions that could help to foster a transition to a net zero future as we transition out of COVID-19.

The study focuses predominantly on the social and behavioural dimensions of net zero at both individual and societal levels. The UK has already introduced a number of policies which focus on promoting behaviours that minimise greenhouse gas emissions and other environmental aims. These range from the recently discontinued feed-in tariff which used a financial incentive to promote installation of solar power in residential homes, through to the more current Green Homes Grant where householders could receive up to £5000 to make energy improvements to their homes. Whilst these approaches have tended to focus on energy use in the home, other schemes have focussed on different environmental issues with a strong behavioural element. This includes the plastic bag charge, where shoppers are charged 5p for the use of a plastic bag, leading to widescale reductions in use of plastic bags. The current study sought to

[3] CCC (2020) Reducing UK emissions – 2020 Progress Report to Parliament. Accessed at: https://www.theccc.org.uk/publication/reducing-uk-emissions-2020-progress-report-to-parliament/
[4] It starts at home? Climate policies targeting household consumption and behavioural decisions are key to low-carbon futures, Energy Research & Social Science, 2019, 52, 144-158, https://www.sciencedirect.com/science/article/pii/S2214629618310314#bib0005
[5] CCC (2020) The Sixth Carbon Budget. Accessed at: https://www.theccc.org.uk/wp-content/uploads/2020/12/The-Sixth-Carbon-Budget-The-UKs-path-to-Net-Zero.pdf
[6] BEIS (2020) The Ten Point Plan for a Green Industrial Revolution. Accessed at: https://www.gov.uk/government/publications/the-ten-point-plan-for-a-green-industrial-revolution/title

understand public views of a broad range of public behaviours that could affect carbon emissions in the UK.

Strategies for facilitating behaviour change by developing measures that may be effective in reducing greenhouse gas emissions have already been identified in various reports[7], with the UK CCC report identifying three areas where individual action would have the greatest impact in supporting net zero[8]. These include:

- Home (encompassing behaviours and choices relating to heating and energy use)
- Travel (choosing more active modes of local transport, adoption of electric vehicles (EVs) and shared services, and minimising flights)
- Consumption (including both choices around food, recycling/reusing, and purchasing behaviours)

There are different pathways that can be taken to reach net zero (for example, see the Clockwork and Patchwork pathways identified by the Energy Systems Catapult in Innovating to Net Zero[9]); these pathways require varying degrees of change to individual and societal behaviour interfacing with supply-side changes.

2.2. Existing evidence base

There has already been substantive research on the behavioural and societal dimensions of reaching net zero. These studies show a number of consistent themes arising, such as (i) people are concerned about climate change; (ii) the importance of fairness; (iii) the need for education and training; (iv) people's loss aversion both in terms of cost and inconvenience; and (v) the types of changes people are willing to make to their lives.

Deliberative processes, such as citizens' assemblies and juries, have been used for the purpose of adding value to and informing policy that relates to behavioural and societal change. The most comprehensive example of this in the UK is the recent work of Climate Assembly UK[10] but there are also many other sector specific examples of this. The programme of discussions for the Climate Assembly had a less specific focus on behavioural and societal changes than the current study but was also longer with more opportunity for detailed stimulus. As well as looking at changes and policies across different sectors, the Climate Assembly prioritised recommendations for achieving net zero with the top three recommendations being:

- Informing and Educating Everyone

[7] Carmichael, R. (2019) Behaviour change, public engagement and net zero. Accessed at: https://www.theccc.org.uk/wp-content/uploads/2019/10/Behaviour-change-public-engagement-and-Net-Zero-Imperial-College-London.pdf
[8] CCC (2019) Reducing UK emissions. Accessed at: https://www.theccc.org.uk/publication/reducing-uk-emissions-2019-progress-report-to-parliament/
[9] Catapult Energy Systems (2019) Innovating to net zero. Accessed at: https://es.catapult.org.uk/reports/innovating-to-net-zero/
[10] See https://www.climateassembly.uk/

- Fairness within the UK
- Leadership from Government

Several groups have also conducted survey work on public attitudes to the actions that could help to reach net zero. For example, in a survey by the Copper Consultancy[11], whilst people are concerned about climate change and support investment in projects that bring the UK closer to net zero, the majority did not believe that the UK is currently doing enough. While the younger cohorts had more confidence in the ability of the UK to reach net zero and were willing to pay more tax to achieve this, the majority of people were unwilling to pay additional taxes and did not view this as their responsibility. In common with other sources, it was found that people were more supportive of renewable energy sources like wind and solar than they were of nuclear and hydroelectric schemes.

The Department for Business, Energy and Industrial Strategy (BEIS) also track public attitudes annually. At the time of writing, the most relevant recent update[12] was completed in November 2020, so may have been influenced by the COVID-19 pandemic. At that time 82% of people said they were either very concerned or fairly concerned by climate change. Around two thirds of respondents were aware of the UK's net zero targets. When subjects were asked what behaviour changes they have already made in a March 2020 version of the tracker, minimising food waste (54%), minimising energy use at home (51%), and choosing to walk or cycle instead of using a car were most common (46%). Meanwhile driving an electric or hybrid car (6%), avoiding or eating less dairy produce (15%), avoiding or minimising air travel (18%) and avoiding or eating less meat (27%) were less frequent. Those in higher social grades were more likely to carry out these behaviours than those in lower social grades. Just under half of people surveyed felt that it was up to government to take responsibility for action to reach net zero, whilst a quarter felt that it was the general public who has most responsibility for making lifestyle changes.

Attitudes towards low carbon behaviours were also explored by the Energy Systems Catapult[13]. They found that most people believe climate change is a global emergency and that they have a personal responsibility to do something about it, although the role of government is also important. However, people's perceptions of what contributes to climate change are not entirely accurate, for example people tended to downplay the importance of gas central heating and agriculture and overestimate the importance of recycling in achieving the UK net zero targets. The actions that people have already taken were broadly consistent with other studies, such as the aforementioned Public Attitudes Tracker findings.

These types of findings were also reflected in a recent report by Bright Blue[14] which found similar patterns in the behaviours which people are currently carrying out and misconceptions

[11] Copper Consultancy (2019) Public attitudes to net zero emissions in the UK. Accessed at: https://www.copperconsultancy.com/wp-content/uploads/2020/03/copper-public-attitudes-to-net-zero-emissions-in-the-uk-web.pdf
[12] BEIS Public Attitudes Tracker (November 2020, Wave 35) and (March 2020, Wave 33, UK). Accessed at: https://www.gov.uk/government/collections/public-attitudes-tracking-survey
[13] Catapult Energy Systems (2019) Innovating to net zero.
[14] Bright Blue (2020) Going greener? Accessed at: http://brightblue.org.uk/wp-content/uploads/2020/10/Going-Greener-FINAL.pdf

with people overvaluing behaviours like recycling and undervaluing behaviours like reduction in consumption of meat and home insulation. It also found that people were likely to prefer measures with financial incentives rather than punitive policies and again measures to ensure fairness of access to net zero initiatives through, for example, government support for home improvements were popular. As in other reports the public thinks that renewable energy sources like wind and solar are desirable, whilst nuclear is divisive and less popular, hydrogen and biomass are seen as necessary but less well understood.

A recent report by Ofgem 'Consumer attitudes towards decarbonisation and net zero'[15] found that, whilst participants demonstrated high concern about climate change, many were not aware of the net zero target or the approaches that may be required to reach them. Most people were supportive of the targets once they had been explained, but there was a sense of scepticism about whether they could be reached. In general participants felt that they were not ultimately responsible for reaching net zero, defaulting instead to government or energy companies to make this change. There was a proportion who recognised that they would need to play some part to reach this goal, but many were unsure how to take steps to minimise their energy use and also voiced concerns that, if others are not doing their bit, then taking action feels like a waste of time.

While these studies have been more general in focus, there are several themes that are of relevance to the current study. People are concerned about climate change however, although they might feel that they have some personal responsibility, are more likely to feel that it is the government's, and to a lesser extent business's, responsibility to do something about it. People have a low understanding of net zero (and the net zero target) and may also have misconceptions surrounding the impact of their current environmental behaviours, with recycling and minimising waste in particular being seen as more impactful than they are. There is also a general lack of knowledge of the importance of changes in the home and day to day energy use in tackling the climate issue. Otherwise, patterns seen in current behaviours are fairly consistent across studies. When considering willingness to engage in new behaviours in the future there is a reasonable degree of consistency across studies with actions like cycling and walking more being popular and eating less meat and flying less being less so.

The current study fills a gap as it is clear that getting to net zero will require a holistic, systems-wide approach, that incorporates both supply-side changes to services and production of goods, demand-side changes to individual behaviours in the use of services and goods, and a policy environment which is supportive of both of these efforts. This study will supplement existing research that goes into more detail on specific policy areas, technologies and behaviours. This study particularly focuses on public perceptions of the behaviours and technologies that people may need to engage with both individually and at a societal level to reach the UK's net zero targets.

[15] Ofgem (2020) Consumer Opinion about Climate Change and Decarbonisation. Accessed at: https://www.ofgem.gov.uk/system/files/docs/2020/10/consumer_opinion_about_climate_change_and_decarbonisation.pdf

2.3. Research objectives

In moving toward a net zero society there is a need to think about a system-wide approach and how interlinked social shifts can be embedded into everyday life rather than focusing on discrete or disconnected actions. To achieve these shifts and to address the issues surrounding climate change there is increasing recognition of the importance of meaningful engagement with members of the public[16].

This current project seeks to focus on the societal dimensions of net zero. While much research has been undertaken to understand these dimensions, particularly at a sectoral level, there are some important evidence gaps that still exist. In particular, the importance that members of the public place on societal change in reaching net zero and what individuals are, in principle, willing to do to achieve this. In summary, the key objectives for this research included:

- To establish people's understanding and perceptions of what reaching climate targets in the UK will mean for both them as an individual, and for society as a whole.
- To gain insight into people's attitudes and preferences towards the role that individual behaviour change should have in reaching net zero.
- To identify the easiest and toughest areas which require behaviour change to reach net zero.
- To set out how people would prefer to engage with or access net zero policies, and to identify initiatives that could help facilitate the societal change required for net zero.

This piece of research forms an important part of the research literature, by: (i) meaningfully engaging with people about their understanding of net zero and what they want a net zero future to look like; and (ii) exploring the different routes through which net zero may be achieved to understand what is most socially desirable and acceptable (as opposed to what is technically or economically feasible), including possible trade-offs between different actions.

Individual behaviour change is notoriously challenging to achieve, however, as has been illustrated through the public response to COVID-19, it is possible to achieve rapid behaviour change at a societal level. The current context of the COVID-19 pandemic presents an important point in time to explore what a systemic societal transition to net zero might look like, and the key barriers and facilitators to behaviour change.

2.4. Overview of methodology

Public dialogue is an established form of qualitative research grounded in the principles of open policymaking, notably facilitating the participation of a broad cross-section of people in collaborative, participatory decision-making around a specific issue of public relevance. The public dialogue process brings members of the public together with professionals to collectively

[1616] See for example: https://www.oecd.org/gov/innovative-citizen-participation-and-new-democratic-institutions-339306da-en.htm

discuss the issues surrounding a given topic – in this case net zero – and to develop an informed understanding of public preferences and implications to help inform policy decisions. In this case we used a deliberative method where we provided participants with increasingly detailed information on climate change, net zero, carbon emissions and potential actions to reach net zero, before participants 'deliberated'[17] to try and reach a consensus on particular topics. This method enabled us to capture both immediate, less-informed views and more considered responses to the net zero challenge, both of which are critical to understand.

This dialogue involved a total of 93 participants[18] recruited to represent a variety of different attitudes toward climate change, socio-demographic backgrounds, and regional representation from across the UK. Participants were organised into 12 break-out groups reflecting pre-agreed location and socio-demographic criteria to enable more meaningful analysis.[19] See Appendix A for more information on the sample and the overall methodology.

Across half-day online workshops[20] held between 1-3 weeks apart from one another, participants engaged with academic stakeholders from Cambridge Zero as well as a range of stimulus materials aimed at building their understanding of climate change, net zero and examples of actions that could be taken to help the UK reach net zero. The content of this stimulus was focused on sectors where members of the public could have the greatest influence on net zero and included manufacturing and consumption, domestic and international travel, residential buildings, food and waste[21]. Fieldwork took place between 26th September and 17th October 2020, before the government announcement of the ten-point plan for a Green Industrial Revolution[22].

As is typical with public dialogue processes, the programme of workshops followed an iterative path, with stimulus materials developed over the course of the dialogue by colleagues at Cambridge Zero, responding to participant views through structured Q&As, and providing additional information when the need arose. Cambridge Zero drew on input from experts across Cambridge University throughout the process, including participation in a stimulus development workshop prior to the first wave of public dialogue to ensure that information materials accurately represented the evidence base. This input, helped ensure that materials used to prompt discussion were credible, balanced and reflected up-to-date thinking.

Participants were tasked with completing activities in between workshops. These included calculating individual carbon footprints, prioritising a list of individual behaviour changes in

[17] 'Deliberation is an approach to decision-making that allows participants to consider relevant information from multiple points of view. Deliberation enables participants to discuss the issues and options and to develop their thinking together before coming to a view, taking into account the values that inform people's opinions'. For further information on deliberation and deliberative research see: https://www.involve.org.uk/resources/knowledge-base/what/deliberative-public-engagement

[18] A total of 94 participants started the dialogue, with 93 completing both Waves.

[19] Groups of interest were split by location (England, Scotland, Wales and Northern Ireland), age (16-17, 18-29, 30-44, 45-59, 60 and over), income (higher and lower income households) and whether in urban or rural settings

[20] Workshops were held using the video-conferencing platform Zoom. This enabled a combination of plenary presentations and independently moderated break-out group discussions involving an average of 7-8 participants.

[21] It should be noted that whilst all of these actions are relevant to net zero, not all of them will necessarily be needed, as that would depend on the pathway that is taken to reach net zero

[22] See: https://www.gov.uk/government/news/pm-outlines-his-ten-point-plan-for-a-green-industrial-revolution-for-250000-jobs

terms of their desirability, and responding to different potential pathways to net zero (individual-led versus industry or government-led). This both provided greater individual insights to help contrast with the group-level discussions, and kept people engaged in the process between waves.

All plenary sessions and breakout group discussions were digitally recorded enabling researchers to review the video, audio, chat and polling. Notes were also taken during workshops by moderators and any workshop materials annotated by moderators were kept and analysed. Analysis involved a series of researcher brainstorms using notes and stimulus materials, followed by ‘matrix mapping’, an approach entailing entry of all summarised data into an analytical framework to allow systematic coding, sorting and thematic analysis. Assessments on the relative strength or prevalence of participant views within this report are reflective of the extent to which these views were evident both within and between groups.

All findings are qualitative and aim to represent the range of attitudinal responses to potential measures to reduce carbon emissions, with a focus on understanding the role that behaviour change could have as part of these measures. The findings presented here are indicative rather than representative of the broader population; we have aimed to incorporate views from a broad cross-section of UK public in relation to socio-demographics, attitudes to climate change, and location. Throughout we have included participant quotes, with details of the relevant break-out groups from which these were drawn. At a minimum these reference:

- Age (16-17, 18-29, 30-44, 45-59, 60 and over, or mixed age groups where relevant)
- Location (England, Scotland, Wales, Northern Ireland)

They may also reference income (higher or lower income) and urban/rural locations which were used as specific criteria for a small number of break-out groups.

3. Baseline understanding and expectations

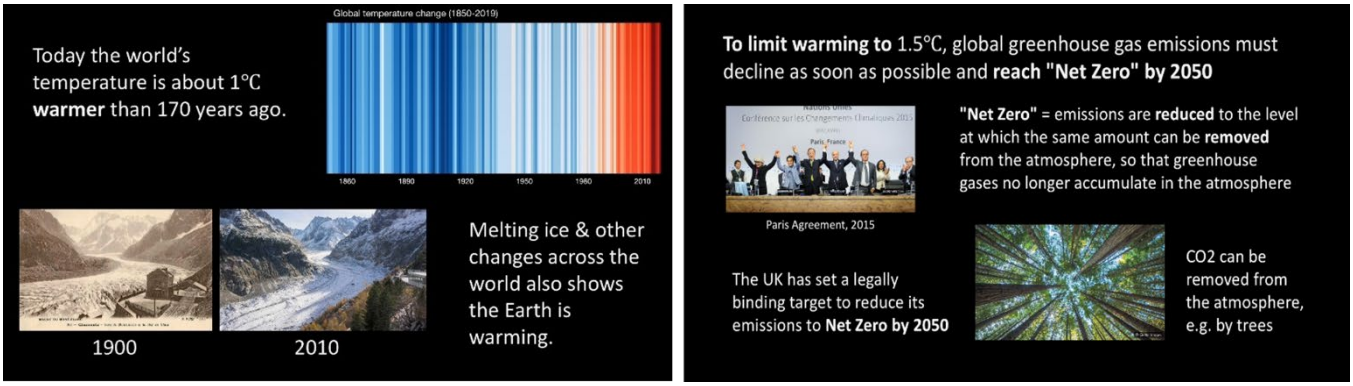
This section details the incoming views of participants toward climate change, net zero and the actions they expected would have the greatest influence on reducing carbon emissions.

3.1. The climate challenge facing the UK

Of the participants recruited to participate in this research 13% were 'not concerned' about climate change, with the remainder either 'concerned' (40%) or 'very concerned' (47%). This is reflective of the general population based on the most recent nationally representative polling at the time of writing[23]. Regardless of their incoming level of concern with climate change, through discussions there was a common view amongst participants that climate change reflected changes in weather patterns across the UK (and globally), notably a rising average temperature.

At the outset of the first workshop participants received a plenary presentation which briefly presented evidence of climate change, the causes and environmental impact of climate change, including future risks to the UK (e.g., flooding, biodiversity loss, risks to food production etc.). Figure One (below) provides some example screenshots of the information provided to participants.

Figure One. Example of stimulus provided in Wave One plenary introduction



In subsequent discussions there was overall agreement that climate change was an issue that has affected the weather experienced in the UK and abroad, and acknowledgement that wider impacts will become more evident over time. For most participants this was not new information. However, presented in this way - with a clear cause and effect - was a concern for many participants, particularly in thinking about the impact on future generations.

[23] Ipsos MORI (2019). Accessed at: https://www.ipsos.com/ipsos-mori/en-uk/concern-about-climate-change-reaches-record-levels-half-now-very-concerned

> *"The word I would use is 'alarming'. An eye opener, really, it's quite a wake-up call, very concerning, really when you put it into that amount of context." (Mixed Age, Higher Income Households, England)*

> *"I thought it was quite shocking, actually, how bad it actually is, I don't think I realised the severity of the situation, as I saw, and how high the emissions were." (Mixed Age, Rural, England)*

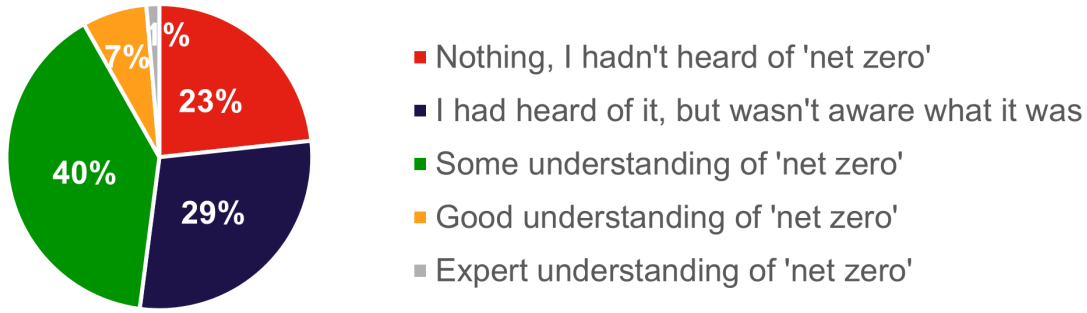
Among a small minority of participants there was also a view that the urgency of the situation and the need for human intervention is still unclear.[24] Amongst these participants there was scepticism that climate change was a man-made issue, instead seeing it as a natural occurrence and one which humans as a species could have limited influence over, or should not look to interfere with.

> *"Whatever I do will be wiped out 100 times over by industry or by a family being born in India, there is not a lot I can do about it." (45-59 years old, England)*

> *"There are bigger and more important things to worry about. Changes to the climate are just natural and there is nothing that I can do to change that." (45-59 years old, England)*

The initial plenary presentation also introduced the concept of net zero - where 'emissions are reduced to the level at which the same amount can be removed from the atmosphere, so that greenhouse gases can no longer accumulate in the atmosphere' – and the UK's legally binding target to reach net zero by 2050. Prior to this explanation participants were asked to report on their level of awareness and understanding of net zero via a snap Zoom poll. The results of this poll are illustrated in Figure Two and indicate that despite relatively high levels of reported awareness, relatively few participants felt they had a strong understanding of net zero.

Figure Two. Participant awareness of net zero prior to participation in public dialogue (n=73)[25]



The poll results above aligned with the subsequent break-out group discussions held with participants. Approximately half of participants reported awareness of 'net zero' and that this

[24] This is similar to proportions found in the general public. For example: BEIS (2020) https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/884028/BEIS_PAT_W33_-_Key_findings_Final_.pdf

[25] Note that participation in polling activities was optional, so responses don't reflect the views of all participants

related to reducing carbon emissions. However, understanding was limited as to what this meant either for individuals or for the UK more broadly. A very small number of participants, typically those aged over 45, made a connection between net zero and the Paris Agreement. In these cases, net zero awareness was formed because of media awareness generated from countries' non-support of the Paris Agreement, such as the USA.

Through discussions with participants it was clear that the concept of net zero was not immediately understood, despite the definition provided in the plenary presentation. When subsequently asked to explain net zero in their own terms, participants tended to fall relatively evenly into one of three groups:

- those who were unable to provide an explanation that had any alignment with the concept of net zero;

  "I've heard of it, but I don't know the details and I don't really understand it to be honest." (45-59 years old, England)

- those who believed that net zero meant producing zero carbon emissions; and

  "The damage that we as a human race are doing to the planet has to be down to zero amounts so that we can maybe start repairing damage we have previously done." (Mixed Age, Scotland)

- those who correctly explained that net zero involved balancing out emissions produced and taken out of the atmosphere.

  "The amount of dirt we put into our planet, we need to clean the same amount." (Mixed Age, Higher Income Households, England)

  "We're always going to emit emissions into the atmosphere but what things can we do to reverse it so it comes out equal?" (30-44 years old, England)

Having clarified the concept of net zero through a brief moderator statement, there was broad positivity toward the ambition of reaching net zero and that the UK had set a legally binding target to achieve this by 2050. This was seen to illustrate that climate change was an issue that the Government took seriously and was committed to addressing. Having a timeframe attached to this ambition was seen to add credibility and convey a degree of urgency that aligned with the need for action (at least as it was positioned through the introductory plenary presentation materials).

There was, however, a general feeling that the 2050 target would be hugely challenging to achieve, and potentially unrealistic given the wide range of actions potentially required[26] across all aspects of not just UK society but globally. The actions envisioned as needed to address climate change felt so large in scale and scope that it was challenging for people to see the impact (and therefore contribution) of their own individual actions, particularly in the context of perceived (in)action in other countries. These challenges are discussed further in the next

[26] It is likely that these initial views were influenced in part by information presented during the plenary presentation that highlighted the minimal changes in emissions that had occurred across various key sectors since 2008, with the exception of the energy sector.

subsection (3.2. ‘Expectations for reaching net zero’) and throughout the remainder of this report.

> *“I was in China last year and there was rubbish everywhere. Now if they’re not going to clean up their act then it’s pointless us doing anything because we are so small in comparison.” (Mixed Age, Urban-only, England)*

Nonetheless there was a relatively clear generational pattern in responses to this challenge, with those in the youngest and oldest age groups most likely to be receptive to taking actions. In both cases this was to help ensure a viable, healthy environment for future generations.

Within the sample of participants for this public dialogue there were a number of participants, regardless of socio-demographics, who reported having adopted more environmentally friendly behaviours in recent years. These included actions such as switching to greener or more sustainable energy tariffs, installing insulation and energy efficiency measures, reducing or eliminating meat consumption, using reusable nappies and cutting down on car use. While these actions were all discussed in the context of their positive environmental impacts, the primary driver in almost all cases – with some exception for meat reduction, where a small subset talked about ethics and health - had been the immediate financial benefits conveyed.

3.2. Expectations for reaching net zero

Participants were asked what actions they anticipated would be the most important in reaching net zero before they were given further information about the range of current and future potential actions that could help the UK to reach net zero by 2050. There was a wide range of knowledge and understanding of what activities contributed toward carbon emissions across the range of individuals participating in this research, with no obvious differences between socio-demographic groups. While some of the same actions were mentioned across multiple groups, these actions were spontaneously raised by participants in discussions, therefore we cannot draw conclusions on the extent to which these represent the views of the group as a whole.

The typical starting point for participants in identifying actions for reducing carbon emissions was with their own behaviours (i.e., ‘demand-side’ action), though this quickly led to implications for others (i.e., ‘supply-side’ actions) which either enabled or were seen to supersede individual actions in terms of their impact. Participants demonstrated awareness of some of the key aspects of reaching net zero. Actions mentioned are organised in Table One below in broad order of frequency of mentions.

Table One: Actions to reduce carbon emissions spontaneously mentioned by participants

Sector	Action
Waste	People increasing their levels of domestic recycling and reducing the corresponding amount of waste generated. This was seen as an outcome of

Sector	Action
	increased use of recycling facilities but also required support from local authorities and shops (in providing recycling facilities), from cost-effective repair options being available and from shops and manufacturers reducing the use of plastic packaging. This was typically prioritised as the first or second highest priority action in terms of expected impact on carbon emissions
Travel	Reducing the use of private petrol-diesel vehicles for local journeys and commuting purposes, switching instead to public transport and more active travel options; here participants acknowledged that there was a high degree of reliance on cars and that many households owned multiple vehicles (especially outside of cities). Improving the accessibility and reliability of public transport options, and incentivising their use, were seen to be actions that could help to move people away from cars
Homes	The installation of energy efficiency and renewable energy measures in residential buildings, notably insulation and solar panels; this was felt to have been facilitated through incentives and subsidies (e.g., government grants for installing loft insulation)
Food	Eating less meat (particularly red meat) and dairy products; typically raised by those who were vegetarian/vegan or practised alternative diets
Industry	Mandating increased efficiencies in the industrial manufacturing processes to reduce waste and minimise the carbon footprint of production, with penalties for those companies that do not abide by regulations
Travel	Reducing air travel and preventing companies from promoting unsustainable behaviours, such as through heavy discounting of flights
Energy generation	Reducing use of fossil fuels in generating energy and replacing this with renewable energy sources such as wind power, “wave” power and solar power. Consumers could also opt for renewable energy tariffs
Travel	Adoption of Electric Vehicles (EVs) in place of private and public petrol-diesel alternatives, with sufficient supporting charging infrastructure
Food and Waste	People buying and consuming more locally produced food products, and reducing their use of single-use plastics in shopping

Sector	Action
Urban planning	Authorities taking a long-term view in planning for sustainable environments, ranging from planting more trees to urban planning which actively discourages car use

Across the range of measures raised by participants, one common barrier to change was the immediate cost implications of adopting more environmentally friendly, alternative solutions. For example, this could include switching from petrol-diesel vehicles to EVs, installing energy saving measures in the home, or switching to renewable energy tariffs. In each of these cases participants felt that discounts or subsidies would be important to promote action.

> *"I want to do all these solar panels and electric bikes – I haven't got the finance there to do it, but the heart's there." (Mixed Age, Lower Income Households, England)*

> *"I think it's just like a question of cost. I think a lot of people who would like to make changes just simply can't afford to…unless you bring out like massive government subsidies." (Mixed Age, Rural-only, England)*

> *"[You need] subsidies, government grants, and incentives to have these things installed. So that encouragement has got to be a major factor in getting people to see the benefits. And but again, to have it installed, so it's not just a cost burden, but it's more of a benefit." (Mixed Age, Higher Income Households, England)*

It is interesting to note that there were certain actions which could be important for reaching net zero that appear to be less prominent for people in terms of their top-of-mind expectations. These include some forms of energy generation (and particularly here the role of nuclear energy), reducing the use of energy within the home (e.g., usage of heating), and the use of alternative heating technologies such as heat pumps or hydrogen boilers. Conversely, there were some actions, notably recycling and food importation, in which participants placed much greater stock in their contribution to reducing carbon emissions than is actually the case.

At this early stage of the dialogue process, participants believed that everyone needed to "play their part" with companies and government taking responsibility for helping people make the "right choices". Changes to people's behaviour were recognised as influencing supply chains - from energy sources to products and services - and therefore ultimately carbon emissions. Participants felt that reaching net zero would likely need to involve a combination of incentives, penalties, legislation and technological/(infra)structural developments, which were directed at influencing both the supply-side (i.e., industry) and the demand-side (i.e., citizens/consumers).

Despite common agreement that net zero was a desirable outcome and would help in realising a healthier, "better" environment for people, there was scepticism around achieving this. Participants recognised that companies develop and market products to create an environment

where people need to purchase products (e.g., due to planned obsolescence of technology) or feel the need to purchase products to respond to social expectations. Participants, across groups, also reflected on a perceived short-term risk/reward approach of both businesses and politicians. The short-term pressures of variously satisfying investors and the electorate were seen as presenting a huge challenge given that the changes needed were expected to result in short term cost implications. This in turn was felt to undermine intentions and actions at an individual level to minimise carbon footprints (this is again evidenced in the wider literature base[27]).

> *"We're living in a society where people just keep buying things all the time… because our economy is based on production and depends on consumption it's a difficult cycle to break." (30-49 years old, England)*

> *"It seems like it's, it's targeted at the individual when they say we need to do this, and you need to do that. But obviously, the big companies are the ones causing the most damage." (Mixed Age, Higher Income Households, England)*

> *"I also feel like, do I on my own have much input into it compared to the big companies that the factories are putting carbon dioxide out, is my recyclable bag going to make a difference. You're a drop in the ocean. I have a lot of internal debates about it." (Mixed Age, Higher Income Households, England)*

[27] For example: Lorenzoni et al. (2007). Accessed at: https://www.sciencedirect.com/science/article/abs/pii/S0959378007000209

4. Routes to reach net zero

This section presents participants' views toward the respective role of behaviour change and technology in reducing carbon emissions to achieve net zero by 2050. This includes what 2050 might look in light of low carbon behaviours and technological innovations.

4.1. Pathways to net zero

As part of the dialogue process, academics at Cambridge University presented on the relative contribution that different 'sectors' made to carbon emissions, as well as an indication of the range of actions that could be taken within these sectors to minimise emissions. These sectors included: energy generation, industry/manufacturing, car and air transport, buildings, waste, and agriculture and forestry. Participants were also introduced to the concept of 'pathways' to net zero[28], with actions which were driven either by individuals or by others, notably industry and through broader technological developments.

Participants accepted that reaching net zero would require a combination of actions across all aspects of their lives, and that this would have significant implications for them, and for society, but also expected that the wider 'system' would both facilitate these changes and take action in helping to reduce carbon emissions. During both waves of public dialogue, we used the concept of pathways to net zero to help participants to structure their understanding of the types of actions that individuals could do versus those that would rely on industry innovation. Throughout the dialogue process participants held a view that achieving net zero would require a combination of inter-related action from individuals, industry and government.

4.2. The role of behaviour change

4.2.1. Tackling net zero through behaviour change

Participants were asked to envisage and discuss a world in which net zero in the UK is reached by 2050 through a high degree of behavioural change across society. Achieving net zero predominantly through changes to individual behaviour was expected to result in a society that felt more physically healthy, with less pollution and noise, more biodiversity and 'greener' land, and less extreme weather events both in the UK and globally[29]. Participants envisaged that people would eat more vegetables (grown locally), they would either not own a car or it would be an EV, they would walk or cycle more often and make use of a more extensive public

[28] Note that these pathways were developed as stimulus to prompt discussion and debate, and were loosely aligned to those produced by the Energy Systems Catapult (for example, see https://es.catapult.org.uk/wp-content/uploads/2020/03/ESC_Innovating_to_Net_Zero_report_FINAL.pdf). It was not within the remit of this research to authoritatively test pre-defined pathways to net zero and aspects of these were exaggerated for discussion purposes.

[29] The first plenary presentation highlighted the increase in deforestation, extreme weather events, and risks to water availability and biodiversity from global warming which may have influenced views on a net zero 2050.

transport network and shared services. Local communities/networks might be more likely to thrive as people worked and spent more time within their local community, and participants envisaged possible reductions to international air travel linked to greater domestic tourism. Within the home people would install more energy-efficiency measures and adopt energy-saving behaviours. For older participants (those in the 60+ age group) this visioning of 2050 harks back to 'simpler' times which were seen to be happier and less stressful, though with some acknowledgement that this may be a sentimental and unrealistic recollection of life when they were younger.

While there were a wide range of positive aspects to a net zero UK society achieved through changes to individual behaviours, there were also significant concerns raised at how such behaviours could feasibly be shaped. Participants were not given information on how wider system and policy changes could facilitate different behaviours. Without this information, adult participants (i.e., those over 18 years old) had concerns about whether it would be due to a highly restrictive environment; with losses to personal freedom, independence and spontaneity, to physical connection to friends and family, to convenience, and to cultural diversity and intercultural appreciation that is gained through travel abroad.

There was concern expressed by a majority of participants that a society in which people have fundamentally altered their behaviour to reach net zero would be less fun and would need to be policed in an autocratic manner, with penalties imposed for behavioural transgressions. While this form of enforcement was unappealing to participants, it was also seen by many – typically those aged 30-59 years old - to be necessary as they would not expect everyone in society to make these changes of their own volition.

In Wave 2, audio accounts of three participants were used as stimulus to bring to life a 2050 where net zero had been achieved through many changes to individual behaviours. Participants felt that the society being depicted in the audio accounts was almost 'too perfect', with people behaving in a communally minded way that felt too great a departure from society in 2020. There were a number of positives elements to these accounts, in particular examples of communal heating systems, local food and a greater sense of community conveyed important benefits: health, safety, family-friendliness, local networks and connection with nature. However, in the absence of any information on the transition to 2050, these were assumed to have been achieved through "re-educating" or "re-programming" people. Many participants contrasted this vision of 2050 with the recent COVID-19 pandemic lockdown restrictions which people had experienced. While some people willingly adopted new behaviours, a large proportion were seen to resent being told what to do, and some to actively rebel against it. This view explains why this society could variously be seen as utopian or dystopian at one and the same time.

> *"I think it could go one of two ways, right? It's either gonna be really good or really bad." (Mixed Age, Higher Income Household, England)*

> *"We'd be staying in the same area more, and only going somewhere within walking or cycling distance. But we'd be getting together more with friends more*

locally, as despite whether we can eat meat or not, we can still have a nice meal together." (16-17 years old, England)

"It sounded like Victorian times to me. It sounded like I would be losing out on things especially the not flying and not eating meat" (Mixed Age, Urban-only, England)

"It will feel like another lockdown if you're being forced to stay at home or stay local. But you'd then need to find the balance between encouraging people to do this as it's an opportunity to do something really good for the environment, to make it better, but still make them feel like they're in control." (16-17 years old, England)

Given participants fears about the means through which changes to behaviour might be achieved to reach net zero in 2050, a range of questions were raised which they would want to ask of people living in this 2050 scenario to help them understand if this was a society they themselves would want to live in. These were broken into four broad areas:

- how net zero has been achieved (including the technological changes and what motivated changes to individual behaviour)
- people's happiness and well-being (including perceived freedom, mental health, ease of living, life outlook and work/life balance)
- the financial impact of changes (including positive or negative changes to individual and public finances, and whether societal inequality had increased or decreased)
- specific questions relating to personal interest (including how energy is generated, how people travel, how people see friends and family that do not live locally, and whether they can afford to eat meat)

  "I was gonna say, are you happy? Because it seems like 'I've got to do this. And I've got to do that.' And they can't just relax. I don't know whether or not they're actually just happy doing it." (Mixed Age, Higher Income Household, England)

4.2.2. Relative acceptability of changes to behaviour

As part of the dialogue process we explored participants' responses to a range of actions that individuals could take (in terms of changes to their behaviours) to reduce carbon emissions. These are detailed in Table Two below. These were loosely based on external reports[30] but it should be noted that not all of these actions are necessary to reach net zero. The focus of these actions is solely on changes to current behaviours rather than how technologies might support these changes (covered in section 4.3.2.).

There was limited time to explore these, and the information provided on what these actions would comprise was relatively high-level, however participants' responses are instructive in understanding what factors influence acceptability, and which actions intuitively appear easiest

[30] Notably Energy Systems Catapult (2020). Accessed at: Innovating to net zero

to address from a behavioural perspective. It is worth noting that there has been a range of work undertaken to explore many of these actions with members of the public in more detail than was possible within this research[31].

Table Two: Participant responses to hypothetical behavioural changes

Sector	Action	Participant views
Industry (and Waste)	People buy fewer new products, use products for longer and repair products where possible	Intuitively this felt like a desirable action (particularly amongst older participants) as levels of consumerism and consumption were seen to be much higher than was necessary to satisfy needs. However, this was also seen to be one of the hardest actions to undertake due to the social and marketing pressures placed on people to purchase new products, in-built obsolescence and in the lack of cost-effective repair options. As such both business and government would have to be supportive of this action. *"People want to upgrade their phones every year…it's very much driven by industry, industry can't survive if you're not buying, it's a vicious circle. The whole economy is based on consumption, if we stop consuming, the economy collapses." (Mixed Age, Scotland)* *"People feel under pressure that they need the next product, there is that culture of wanting the next thing because we're marketed to on a daily basis." (Mixed Age, Northern Ireland)* A very small minority of participants from across various groups highlighted that reducing consumption would have financial implications not just for businesses but also for the economy more broadly. Specifically, if people spent less money this would impact the amount of money the government took in taxes from business, reducing demand for services and products, and therefore impacting the public purse and people more broadly in terms of job and incomes. As such, even if it were a desirable action from an individual perspective, there was a sense that it would be unfeasible from an economic perspective.

[31] For example: Ofgem (2020). Accessed at: https://www.ofgem.gov.uk/publications-and-updates/energy-consumers-experiences-and-perceptions-smart-time-use-tariffs. BIT/TRL (2020). Accessed at: https://www.gov.uk/government/publications/using-behavioural-insights-to-increase-uptake-of-electric-vehicles-in-the-uk. BEIS (2019). Accessed at: https://www.gov.uk/government/publications/smart-meters-progress-on-realising-benefits-for-consumers

Sector	Action	Participant views
Travel	People fly less than they did in 2019 (pre-COVID-19 levels), using trains more often for long distance travel	Across all socio-demographic groups and locations this action was seen to be a compromise that very few would willingly make. Air travel to take holidays abroad was seen as something that participants look forward to and have 'earned the right to' through hard work throughout the year. It was a pleasure and freedom which would be sorely missed by those who are used to it and seen as something of a necessity for those with close friends or family abroad. Interestingly, a common reaction to this action was a concern at the loss of cross-cultural interaction and understanding that could occur from reduced flights (and therefore a perceived lack of international travel). This was seen, across all age groups, as having a larger impact on younger people who have had less opportunity to benefit from travel abroad. *"People enjoy their travel. But if we can try and make them fly less often, in the short term, that is better, because I think some people find it hard to pack it in entirely." (Mixed Age, Rural-only, England)* *"Having to stay in your own country, not being able to go on holiday, people looking at you if you get on a plane, I wouldn't like that, I like to have one holiday a year, that's all…you'd like to think that you could go on one holiday a year, I don't think that that's unreasonable." (Mixed Age, Northern Ireland)* Transitioning from flights to train was seen by most participants to be a "regressive" step which would have implications for travel/leisure time (i.e., holiday time would be lost to the process of travel). One potential implication of this could be that more people would holiday in the UK which could prove problematic unless the transport and tourism infrastructure was improved (and potentially changes were made to traditional holiday patterns, school holidays etc.). Assuming it was not more expensive, some participants were not averse to using trains in place of air travel. *"I'd be open to trains, I suppose the journey would become part of the holiday." (Mixed Age, Lower Income Household, England)*

Sector	Action	Participant views
		A small number of BAME participants highlighted discomfort at the prospect of restricted international travel both due to their connections abroad and lack of comfort in domestic tourism (e.g., due to experiencing racism in the UK). *"I once went to Wales and it was horrific as a person of colour, I was not welcome at all. Travelling in the UK is not an option for me, I would rather travel overseas". (45-59 years old, England)* There was an expectation here that individual behaviour changes would need to be facilitated by business and government. This included ensuring that trains were at least equivalent, if not cheaper, than flights, and that the international train network was sufficient in its coverage and accessibility. Ideally, under this scenario, participants would expect to see a situation in which everyone had reduced their flights to a fair, equal level (i.e., no special dispensation for wealthier households and businesspeople).
Travel	There is much less car ownership/ travel (those that do use cars use electric vehicles); instead, people adopt more active travel, shared services and public transport	Participants recognised that car travel was a significant contributor to carbon emissions, and that in an ideal world people would be able to travel using alternative modes of transport. However, this was a highly divisive action with those in urban areas and in early or later adulthood being more willing to forego car ownership than those in middle adulthood; in these cases, the alternatives (active travel, shared or public services) were seen as realistic options. The main reported barrier for reducing car ownership was a perception that the alternatives are not as convenient, effective or cost efficient, and that with increased future demand this situation would likely worsen. As has been evidenced in other research[32] participants here also had safety and privacy concerns with public and shared transport (now likely exacerbated by COVID-19). These relate to close proximity to other passengers being seen as a risk to personal comfort and safety. Participants also resented the potential for restrictions to freedom of movement that car ownership is seen to afford people. There was largely agreement that public transport and

[32] DfT (2018). Accessed at: https://www.gov.uk/government/publications/future-roads-public-dialogue

Sector	Action	Participant views
		active travel is not appropriate for everyone, and that those individuals that are most in need (for example due to age, disability or isolation) would be most disadvantaged by restrictions to car ownership. There were also some concerns that the variable UK weather makes active travel unappealing for many people. *"We're out in the country. We do use public transport sometimes but it's not ever so convenient. I'm certainly not going to lug back a week's shopping on the bus. That's not going to happen. We're two miles from the main station and 7 miles from the supermarket." (Mixed Age, Scotland)* *"The norm is becoming three cars to the home…so saying you can't have a car is going to cause friction." (Mixed Age, Scotland)* *"There's also electric bikes as well. So people of all ages would still be able to get around and I think people would feel a lot more comfortable doing it if there is less vehicles on the road in the first place." (Mixed Age, Rural-only, England)* A minority of participants also highlighted that this action was likely to exacerbate financial divisions in society, with wealthier people able to travel independently by car, whereas others had to make do with (inferior) public transport. *"Those who can afford £24,000 electric cars will buy them and those who can't afford them will have to take public transport". (45-59 years old, England)* While everyone could envision a future where the range of travel options open to people were sufficient to make car ownership redundant, there was scepticism as to whether the investments and infrastructure required to realise this vision could be established in time for 2050. Participants reflected on the cost and timing for other major infrastructure projects in the UK (such as HS2) in coming to this conclusion.
Homes	People use less hot water	There was a strong aversion to using less hot water or heating in homes and minimal debate around this action.

Sector	Action	Participant views
	and heating in their homes	The ability to heat their home and water to a comfortable temperature was seen as a basic "right" by participants which they were unwilling to compromise on. This action was also seen as potentially posing a threat to those in more vulnerable situations due to age and financial security. Given the likelihood that home working will become more commonplace for many people, and with potential restrictions to travel, there was some expectation voiced across groups that people would invest more in ensuring homes are both comfortable and energy efficient. In the shorter term though this may mean more heating rather than less. *"Cold showers…it's not going to fly in the winter is it?!" (Mixed Age, Lower Income Household, England)* *"There's already pensioners living with hardly any heating or hot water. This would make it worse." (Mixed Age, Scotland)*
Homes	People use less electricity in their homes	While there was acknowledgement that people could do more to reduce electricity use (e.g., switching off lights and turning appliances off) this form of deliberate action was not seen – by the vast majority of participants - as realistic to expect from people. There was very limited discussion around this as a viable option for participants. *"I feel like a lot of it, we're going backwards. I feel like we've taken like 10 steps back, like using no hot water and less electricity. Now I've got electricity, everyone can heat their homes whereas like 50 years ago, we weren't able to do that… We've come so far, surely we can do more with the technology, we've got to change things instead of having to change each individual life." (Mixed Age, Rural-only, England)*
Food	People reduce their consumption of meat and dairy products by 50%	As mentioned earlier in this report, there was some awareness of the contribution of meat and dairy to carbon emissions, though this was typically from individuals that had cut these out from their diets (and who were generally more informed about the benefits of this at an individual and environmental level). Among many other participants there

Sector	Action	Participant views
		was surprise around the impact of meat/dairy consumption on the environment. This was a highly contentious and divisive action relative to the others discussed. Participants who consumed meat and dairy products enjoyed the experience of eating and drinking these products and disliked the alternatives they had experience of. There was also a recurring argument that these products were a necessary part of a healthy diet. While participants anticipated that reductions to meat and dairy consumption may occur naturally over time, this was felt to be a deeply personal choice which should be left to the individual to make. *"No. NO…I like sausages, I like bacon, I eat a lot of eggs, stew. I like all that and I don't see why I should change if other people aren't doing the same. It's a definite no. I might cut down, but I won't stop altogether." (Mixed Age, Scotland)* *"If you're working long hours with commuting time, sometimes it's just handier to eat meat, people don't have time, basically. But if things were a bit more relaxed, maybe we could enjoy vegetables more." (Mixed Age, Wales)* Across each of the groups – regardless of age and the strength of existing views – there was a gradual softening toward the possibility of consuming less meat over time, with people acknowledging that they could cut down. The objection was largely around this being a measure that was imposed on people as opposed to a personal choice. *"I don't think I'd become a full vegetarian or vegan, but I can see that cutting it down is important. It's not just one extreme for me, just finding a balance in your home and preferences. Maybe just have meat once a week, or once a month." (Mixed Age, Scotland)*
Waste	People significantly minimise household waste (including food	Participants were unanimously in agreement with this action, which was seen to be largely maintaining the status quo albeit tied in to supporting actions from business and the manufacturing industry (i.e., recyclable packaging, better quality products, reduced advertising etc.). The general consensus was that if changes were seen in the actions of

Sector	Action	Participant views
	waste) through changes in purchasing habits and much greater recycling levels	business/industry that this will facilitate the reduction of household waste. Participants were generally supportive of recycling and the vast majority recycled dry recyclables and food waste where their local authority provided the necessary facilities. These were not universally available and were seen to be critical to enabling this action both in terms of local authority recycling collection services and similar facilities within shops. There was also a majority view that packaging should be reduced or recyclable as a default. *"With waste, people will be doing less shopping, and there will be less plastic packaging anyway. And with food, I expect we'd have composters for the skins and shells. There'd also be a circular economy for using older products again." (Mixed Age, Wales)* *"How we get rid of our waste at the moment is just shocking, land fill sites and all the rest of it. Government has to find a way to deal with all of that and help companies actively recycle and bring in a subsidy type thing." (30-44 years old, England)*

Many participants felt that in a perfect world people would change their behaviour and proactively adopt each of these actions in pursuit of net zero and therefore for the wider good of society. However, this was seen to be naïve and unrealistic. Participants acknowledged that people can be selfish and reluctant to change as, they reflected, was evidenced by their own reaction to these different behavioural options which would reduce individual carbon emissions.

> *"It's the 'what's in it for me?' ideology. If you can demonstrate to people that there are benefits to them in enacting these changes, then it's far easier for them to take the steps to do it. Like saving money, and better health and wellbeing…cleaner air so people won't have those diseases anymore, like asthma and allergies." (Mixed Age, Northern Ireland)*

The fundamental challenge exposed through discussions with participants is that they perceived there to be a trade-off to make between the environment and personal freedom (of thought, expression, action and choice). These changes may result in environmental progress, but participants were concerned at what cost – their comfort, independence, relationships, or pleasures? The actions which were seen to be least acceptable or desirable tended to be

those that involved some form of perceived loss, for example: restrictions to travel, reductions in meat consumption, comfort within the home. As previously mentioned, in the absence of any further information, participants top of mind reflections were that these would be difficult to achieve voluntarily without some form of legislation and enforcement, or through financial incentives (or disincentives such as increasing the cost of flights or meat).

> *"I think we'd be living in a kind of community world where you're forced to do this or you'd get fined, if you recycle incorrectly, you'll get fined. If you drive you get fined. It's like everything you do is wrong, so you'll just say ok I'll stay at home." (Mixed Age, Higher Income Households, England)*

4.3. The role of technology

4.3.1. Tackling net zero through technological development

Participants were also subsequently asked to envisage and discuss a world in which net zero in the UK is reached by 2050 predominantly through the implementation of new and different technologies. Achieving net zero predominantly through technological innovation was expected to feel more similar socially to 2020 than was the case where net zero was achieved through various behaviour changes. Participants felt we would continue on the current trajectory of incremental technological innovation/evolution so everything is more (virtually) 'connected', efficient and there has been a general raising of baseline access to relevant services and technologies (e.g., heat poverty may be eliminated).

The environment in 2050 where net zero was facilitated through large amounts of technological developments was perceived to look similar to present, though there would be notable reductions in pollution, improvements in air quality and people would feel physically healthier as a result. However, the vast majority of participants (across all groups) expressed concern that this society could be one in which people are more physically disconnected from one another – instead, relying more on virtual connections – which could exacerbate issues with isolation and mental health that have been influenced by the COVID-19 pandemic lockdown response. Again, it is worth noting that this research was undertaken during the pandemic, where issues of isolation were relatively top-of-mind.

Industry investment in new technologies was expected to encourage innovation and creativity, to lead to new jobs, and potentially provide a boost to the economy. Alongside EU Exit and post-COVID-19 the 'government' was seen to have a huge opportunity to invest in future-proofing UK industry and the economy, and participants were positive about investments in sustainable energy solutions.

Participants felt that, in an ideal world, these investments would widen access to eco-friendly technologies, making these accessible through cost savings (specifically in relation to energy efficient products/services). However, some concerns were expressed that these technologies would come at a significant cost to industry which would simply be passed on to consumers/citizens. This would restrict access for lower-income households (who may then be

further penalised for not adopting these technologies) or people less comfortable with technology (notably older people were mentioned), leading to greater inequalities.

There was an underlying concern expressed by participants across all groups that while people possibly would not notice the change, the reliance on technology could lead to gradual disempowerment at an individual level, ultimately leading to a loss of control by 2050. This can be seen as playing into participants fears around automation, artificial intelligence and technology taking over from human beings.

Audio accounts of three people were again used as stimulus to bring to life a 2050 where net zero had been achieved through changes to technology. Participants responded that 2050 achieved through technological change would be a fairly natural progression from where we are now, with no huge changes to people's behaviours or to their surroundings. However, the trend for home working was seen as more established in 2050, which was perceived to have upsides (cost savings and time with family) and worrisome potential downsides (social isolation and mental health issues). Participants also felt that automation was more commonplace within this society which had the potential to be a transformational force, both negatively (in terms of redundancies) and positively (in increasing the time people have for themselves and their families).

> *"I honestly don't think it's that different here in term of how you lead your life, apart from the fact you are more aware of the impact of your actions." (Mixed Age, Scotland)*

> *"I'd think this would encourage innovation, creativity and new ways of thinking. Which in turn, should be good for the economy." 16-17 years old, England)*

> *"With technological innovations, finding an alternative that benefits us and the planet too, why wouldn't you go down that route?" (Mixed Age, Low Income Household, England)*

There was an expectation that many of the technological developments that would lead to reductions in carbon emissions would come at significant direct or indirect financial costs to citizens/consumers. Participants, in particular those in the lower income groups, considered this a significant barrier to widespread adoption by people. Incentives were felt to be important in enabling people to make the necessary changes (e.g., to properties and transportation).

> *"The key message I took out of these [audio] accounts was that this is all affordable, i.e. the cars and the heat sources and that is great." (45-59 years old, England)*

> *"Taxes would be sky high." (Mixed Age, Scotland)*

As mentioned previously, there was still an underlying concern amongst a substantial minority of participants that by relying on technology people will become less self-sufficient, and that freedoms to take decisions would become more limited. This is less through control being

imposed through regulations and laws imposed by government, and more through technology influencing choices and behaviours in ways which people are not fully aware of.

> *"There seemed quite a lot of technological innovation, which I would say controlled people's lives in the background more. So, less individuality there and more of a collective sheep kind of behaviour with all the choices have actually been made for them." (Mixed Age, Rural-only, England)*

Participants were again asked what they would want to ask of people living in a 2050 scenario, with a particular focus on hypothetical technological changes, to help them understand if this was a society they themselves would want to live in. Similar questions arose in relation to people's happiness and wellbeing, and the financial impact of changes. In addition to this there were very specific questions relating to the impact of automation on work, and the safety, operation and experience of certain technologies (e.g., of hydrogen planes, cost and operation of heat pumps, chemicals used in farming, lab-grown meat). It is well documented that unfamiliar - and potentially controversial - technologies are more likely to be perceived as risky compared to the status quo[33], so it was unsurprising that a lot of questions were raised around the specifics of different technological solutions. Finally, a number of participants also wanted to understand how people who did not adopt these new solutions and behaviours were treated, and whether there was stigma attached to not being seen to act in a 'green' way.

4.3.2. Relative acceptability of changes to technology use

As part of the dialogue process we explored participant responses to a range of hypothetical technological changes to reduce carbon emissions. These are detailed in Table Three below.

There was limited time to explore these, and the information provided on what these actions would comprise was relatively high-level so participant views were still largely uninformed. However, participants responses are instructive in understanding what factors influence acceptability, and which actions appear easiest to address from a public perspective.

Table Three: Participant responses to hypothetical technology solutions

Sector	Action	Participant views
Industry	Innovation in manufacturing and production processes of goods mean that people's shopping habits	This was seen to be the 'easy' option, enabling people to continue consuming in the same way as they have done in the past. While this was attractive in maintaining the status quo, there was significant support for stemming what is seen to be a "throwaway culture" and therefore only minority support for this being the primary route by which emissions are reduced within industry. Instead, participants desired a balance where there was both

[33] For example: Flynn et al., (2006). Accessed at: https://www.qualitative-research.net/index.php/fqs/article/view/58/119#g61

Sector	Action	Participant views
	remain as they are today	(expected) innovation within manufacturing and production processes, alongside a change in behaviour. There was some scepticism that companies will either self-fund the required innovations, or whether sufficient financial support will be provided to companies to invest in new technologies. Instead, the expectation here would be that the costs incurred would be passed on to consumers.
Travel	Technological innovation means that people continue to fly as much as in 2019 (airlines are electric or use new low-carbon fuels like hydrogen)	As discussed previously, there was a strong desire among participants to retain the freedom to travel abroad so there was strong support for investing in technologies which had the potential to enable this. However, there was also a high degree of caution around the safety of hydrogen-powered planes with many participants needing to be reassured before committing to travelling by air using this form of energy. There was also a degree of concern amongst a smaller subset of participants – typically within the younger and oldest age groups - at relying on an untested technology in addressing carbon emissions. *"I just think it sounds a bit weird that they can talk about hydrogen planes or electric planes. It's all like a projection, an imaginary book that needs to be invented." (16-17 years old, England)*
Travel	People travel in similar ways to today; where people do drive, they use electric vehicles	There is already a significant body of evidence that illustrates commonly held concerns with EVs, both in terms of performance, cost, and the supporting infrastructure. These were evident in the discussions held with participants during this research. In principle, car drivers were very positive about the opportunity to retain the level of freedom they feel they currently hold, however there was significant scepticism that the infrastructure for EVs would be sufficiently developed to make this feasible for reducing carbon emissions by 2050.
Energy	UK energy is generated either largely (75%) or	The vast majority of participants wanted the UK to be ambitious and try to generate energy almost entirely through renewables. The difference between 75% and

Sector	Action	Participant views
	almost entirely (95%) through renewables (air, wind, water, nuclear)	95% felt relatively negligible and there was limited understanding of what the downside might be to reaching for 95% (beyond failing to achieve that target or, among a small minority of participants, compromising our energy security due to perceptions of relative instability of renewable sources). *"There's no downside to that we can just put a bit more money into it. And it could be done. It's very realistic. It's something that's achievable." (Mixed Age, Rural-only, England)* A small number of participants raised some concerns specifically around nuclear energy (specifically safety issues and their visual presence) and wind turbines (both their visual presence and immediate environmental impact), but in principle participants felt it makes sense to aim for as much renewable energy as possible. *"Trying to achieve as close to 100% renewable energy as possible is an absolute must, we have no excuses" (30-44 years old, England)*
Homes	Almost all homes have highly efficient insulation measures installed (such as insulation in the floor, roof and walls)	There was an expectation amongst all participants that mandating minimum levels of energy efficiency measures on new builds (over and above what is currently required by building regulations) was both desirable and would be relatively easy to implement. However, for existing properties this was felt to be much more complex and dependent on a wide range of factors that were specific to the properties in question. In an ideal world it would be possible to achieve reductions in carbon emissions through ensuring all homes had appropriate insulation measures in place. In reality, this was seen to be very expensive, impractical and in some cases unfeasible (particularly for older properties). There was also a concern here that there would be limited incentives for landlords to invest in these measures for properties on the rental market due to the lack of an immediate return on investment.

Sector	Action	Participant views
		"You also talk about homes having highly efficient installation measures? Is that going to be subsidised? Is it going to be done for free? Not everybody's got the money just to put the hand in the pocket? Not all houses can be insulated to the ambition standard" (Mixed Age, Rural-only, England) *"Trying to get all the owners of a private block of flats to agree to get a central heating system put in, and to get the money off them, would be a nightmare...and retro-fitting in a tenement would be really difficult and risky." (Mixed Age, Scotland)*
Homes	All homes have smart meters and smart technologies. People are charged much more for using electricity during the day.	In contrast to self-directed actions to reduce energy use, participants were largely supportive of greater use of smart technology and recognised that these could help them manage energy in an efficient way without feeling that they were compromising on comfort. A small proportion of participants had smart meters, and of these not all were using them actively due to a lack of understanding which led participants to posit that these are possibly not being used to their full potential. There was interest in using this technology in circumstances where traditionally it has been harder to do so (e.g., where prepayment meters are in place). *"All homes having smart meters and smart technologies. And it's okay for both younger but you know, my generation and older and not going to be able to understand how these things work and what we're going to do with them." (Mixed Age, Rural-only, England)* *"Smart meters which are being rolled out. I think they're great. I mean, you look at your smart meter, see I'm using 85p per hour for this, let me switch off a few appliances. So, you get more awareness of how much your appliances are actually using in terms of energy and the cost." (Mixed Age, Higher Income Household, England)* Participants raised objections around charging people 'much more' for using electricity during the day. This was felt to be "unfair" and to penalise older people and the higher volume of people expected to be working remotely

Sector	Action	Participant views
		from home. Some participants voiced an expectation that with greater use of smart technologies that this would balance out the need for increased charges by automating energy use/storage more efficiently. *"We have to protect the most vulnerable in society, and unfortunately a lot of people in society now have the choice of heat or eat, so I don't think it would be morally right to increase the cost of electricity for them." (Mixed Age, Northern Ireland)*
Homes	Heat pumps or hydrogen gas boilers replace natural gas boilers, and hydrogen is used in the gas grid. Those not on the gas grid use heat pumps.	Participants were largely indifferent to whether homes in the future were heated via heat pumps or hydrogen boilers, though there was an expectation that either would be a comparably affordable replacement to their existing gas boilers and undertaken at the end of the natural life of the boiler. For new-build properties the decision was simpler, and participants were supportive of one or other of these measures being installed as standard. The choice between heat pumps and hydrogen boilers revolved around cost, feasibility (in terms of flats vs houses) and the perceived risk of the measures. Hydrogen 'sounded' dangerous while heat pumps 'sounded' expensive and potentially problematic to install. *"I am sitting here in my house with a coat on, that is how I reduce my heating in my home. I cannot afford one of those underfloor heat pumps!" (45-59 years old, England)* *"My husband and I have got solar panels, and we have looked to air source heat pumps to replace the gas boiler that we currently use. But in the event of a power cut in the depths of winter, what would our contingency plan be to heat the house?" (Mixed Age, Rural-only, England)* *"I would echo again about the safety aspect. To me heat pumps would be safer than a hydrogen boiler, which to me is a disaster waiting to happen." (Mixed Age, Scotland)* Participants also liked the ideas of changes to heating systems that were deemed to make both economic and

Sector	Action	Participant views
		environmental sense, for example communal and district heat networks.
Food	Innovations in farming practices mean people have similar meat and dairy consumption to 2019.	As previously discussed, participants were keen to retain the freedom of individual choice around food and diet, in particular around the consumption of meat and dairy products. Technological innovation in the area of farming and agriculture which enabled similar consumption patterns was attractive in principle, however there were significant concerns raised around what this meant for how meat was produced. *"Innovations in farming practices such as protein sources etc. We've got to find a much more clever way of providing a protein source for an increasing population." (30-44 years old, England)* Where innovation was assessed as meaning "pumping drugs" or "additives" into meat, then participants strongly objected to this and demanded transparency in how food was produced. In the same way they objected to chlorinated chicken and seemingly lower standards of animal welfare in the USA as compared to the EU. There was also widespread aversion to lab-grown meat which was felt to be "unnatural" and "weird". *"If that's what they call innovation then I want nothing to do with it." (Mixed Age, Northern Ireland)*
CO2 removal	Technological innovation is developed that filters carbon dioxide from huge volumes of air.	Investing in carbon capture and storage technologies which have the potential to remove large volumes of greenhouse gas from the atmosphere was universally seen as a worthwhile investment due to the large gains that could potentially be achieved. However, participants were presented with little information on this process and therefore there was a lack of clarity as to how this would work, what risks or costs would be involved, or what gains could reasonably be expected.

Overall, technology solutions were seen as potentially enabling the fastest and largest reductions in carbon emissions – particularly when led by industry – as well as minimising the

changes required of individuals. This was seen as reducing the risk of relying on individuals to change their behaviours, which many participants felt was unrealistic. However, there was a reluctance to rely solely on technological solutions for three reasons.

- Firstly, there was scepticism whether 'industry' would comply with (or could achieve) the changes and efficiencies required without being forced through legislation and regulation, which participants anticipated would be difficult to put in place. The alternative would be high levels of investment from government.
- Secondly, there was an underlying unease at relying on technology to treat the symptoms of carbon emissions rather than the cause: human behaviour.
- Finally, as previously discussed, there was a concern that focusing predominantly on technological advancements could both result in short term job losses and, in the longer term, influence our own autonomy and decision making in ways we cannot anticipate.

  "I think we will have less self-sufficiency; we will be a lot more reliant on other people's advancements and other companies. Like, we're relying on technology companies' a lot more than what we are now; right now we have the freedom to make decisions and shop around and say yes or no to things. I think by then we won't have a choice." (Mixed Age, Higher Income Household, England)

  "[These actions] seem more feasible, a lot of the onus seems like it's aimed at the individual but it's companies that have given us this throwaway culture that's contributed to the damage of the environment, so if it starts at their level, technology-based, it's more feasible and not as guilt driven on the individual." (Mixed Age, Higher Income Households, England)

  "Those things would be beneficial [people buying fewer products], but people may not want to do those things to get to net zero. Which is why it's probably better to go with innovation so we're not relying on individuals." (16-17 years old, England)

4.4. The relative acceptability of different actions to reduce carbon emissions

Through discussions with participants - facilitated by a trade-off exercise focused on the different sectors in which impactful changes could occur - it was clear that there were certain actions, and a corresponding balance of responsibility, that were more socially acceptable across all groups:

- **Carbon capture and storage** was seen as a desirable and acceptable action, though currently little understood. Note that limited information was provided on this action and wider research[34] suggests that, with more information, the views of people are relatively more balanced.

[34] E.g. Sciencewise (2019) Public attitudes on clean growth. Accessed at: https://sciencewise.org.uk/wp-content/uploads/2019/06/Public-attitudes-on-clean-growth_full-report-May-2019.pdf

- **As much energy should be generated through renewables as possible** taking account the concerns of people as to the site of infrastructure (particularly nuclear and wind turbines)
- **Industry/manufacturing efficiencies and reduction in consumption** were seen to be two-sides to the same coin and both were required to help continue to **minimise waste**. There was a desire among many participants to reduce what was commonly described as 'over-consumption' but that this was only achievable within a supportive environment (i.e., higher quality products and reduced advertising), otherwise only incremental gains will be achieved
- **Maintaining the ability to fly internationally** at similar levels to 2019 through investments in technology, though potentially balanced with some reduction in flights as this technology is developed and tested
- **Supporting homeowners to install more environmentally friendly heating measures** (including insulation) which will differ in scope/feasibility by individual property. This will be supported by **widespread adoption of smart technologies**

There were two specific areas where there was much less agreement within and between groups, and where a single socially acceptable solution would be harder to achieve:

- **Car ownership** was variously seen as a right, a necessity and a key facilitator of independence. However, this differed substantially by circumstances, with those in the youngest and oldest age groups, and those in areas with effective public transport connections, both least likely to own a vehicle and also most willing to give this up if needed. For many others, particularly those in more rural locations, this was simply not acceptable, and the alternatives not sufficiently cost effective, efficient, extensive or comfortable. As the cost of **EVs** reduces and they become more commonplace this will likely be a relatively easy transition for people, particularly where incentives and infrastructure are in place
- **The choice over diet** and what food to consume was also seen as a highly personal issue though there was limited appetite for trading the perceived quality (or safety) of meat off against volume/availability. Participants recognised the need to allow freedom of choice here, though participants would be willing to reduce their meat intake, particularly if this enabled them to continue eating meat that was not grown in a lab

Participants also discussed the adoption of low carbon heating technologies such as heat pumps or hydrogen boilers. In principle, participants were happy to replace their existing gas boilers with a different form of technology though there was very little information provided on the technologies to allow for a considered view on which would be most preferential or suitable.

In between the two waves of public dialogue, participants were asked to undertake an activity where they independently ranked 30 behaviours/actions in relation to how personally desirable they would be to undertake in helping reach net zero by 2050[35]. These were broadly aligned to the relative balance of support that emerged within groups, with many low cost and low risk

[35] See Appendix C for details of the task and a summary table of results

actions amongst the top 10 desired actions (e.g., reducing food waste, switching off appliances, longer use of products and active travel), alongside more commonplace efficiency measures (e.g., home insulation, energy efficient appliances, zonal heating and EVs). More divisive were those actions that involved the intervention of smart technologies or where participants were "losing" something they enjoyed (e.g., meat, air travel, heating temperature).

4.5. The distributional impacts of actions to reach net zero

The majority of groups came to a relatively easy consensus around which behavioural actions were most- and least-socially acceptable. However, there was recognition that there would likely be distributional impacts[36] of actions to reduce carbon emissions, regardless of whether they resulted from individual behaviour change, from technological developments or a combination of both. While people may "get used to it", in the short term at least, participants saw there as being several groups of people most impacted by the journey to net zero:

- **Lower-income households** were commonly identified as likely to have the hardest time implementing changes without access to heavily subsidised technologies at a significant discount. Those on lower incomes were seen as both likely to be most disadvantaged in the transition to net zero and those whose situation presents the greatest challenge – at least at an individual level - to reaching net zero (due to lack of awareness/prioritisation of net zero as an issue relative to other concerns, consumption patterns and ability to undertake actions to minimise carbon emissions)
- **Individuals living in older properties and flats** may find that the measures required to improve energy efficiency or facilitate EV use are either unfeasible or expensive to implement, limiting the measures that are put in place. In a similar way, private landlords may struggle to justify the expense of retrofitting rental properties
- **People with specific needs or vulnerabilities** which may relate to personal circumstances, age and life-stages and those in **rural locations** may have greater need for access to private transport

Conversely, the one group perceived to be least likely to be impacted by the transition to net zero were wealthier households who were seen as both able to afford the technologies/measures to reduce their carbon footprint, and to pay more for the privilege of undertaking actions that emit higher levels of greenhouse gases. As we transition to net zero there was a sense that this journey had the potential to further exacerbate the inequalities that are already present in society.

Across all of the participants we spoke with, those in the younger age brackets (16-17 years old and 18-29 years old) and those in the oldest age bracket (60+ years old), were the most willing to adopt actions to minimise their carbon footprint, and accepting of the need to make changes for the benefit of their/future generations.

[36] I.e. the variance of impact across different sections/groups in society (such as age, gender, income etc.)

“I’m more than happy to make the changes, it’s all fine by me. This will be the new normal for the next generation.” (16-17 years old, England)

5. Facilitating behaviour change toward net zero

This section includes analysis of the factors influencing behaviour and actions which participants see as having the greatest potential to facilitate changes to behaviour.

5.1. Actions from all parts of UK society will be needed to help achieve net zero

Participants recognised that achieving net zero would require a combination of both individual actions and technological developments led by industry and facilitated by government. While industry is seen to have the biggest influence on emissions and plays a fundamental role in instigating and facilitating change, government has the power to set the direction, legislate and monitor. Participants were very vocal in their belief that both government and industry are driven by short-term goals so it would be imperative for people to drive action through making their priorities clear (e.g., through voting intentions and purchasing decisions).

There was also widespread agreement that “we” (society) cannot rely on individuals to be “good” and to reduce their individual carbon footprint without some form of incentivisation or pressure. Participants believed people will need government to show that net zero is a priority and to work with industry to implement changes (via laws and incentives to coerce their action if needed) which in turn enable individuals to make changes in their day-to-day lives. Relying solely on people or industry to change their behaviours was seen to be doomed to failure due to the complex interrelationship that exists between supply and demand.

> *“Everyone has to act to the best of their ability to achieve what they can achieve…any contribution at any level, individual, organisational, governmental or international, so we need to persuade people that even if they make one small change, it’s a change for the better.” (Mixed Age, Scotland)*

> *“I think majority [responsibility] is from the industry. But we do have our part, I mean, part to play. The contribution from our side, maybe like 15, or 20%. But the 80% is from industry. But if we just ask them to do it, and we don't do it, I think that doesn't work. So, it should be like effort from all of us, and industry and corporate putting a lot of effort, because they have damaged a lot.” (Mixed Age, Higher Income Household, England)*

> *“The Government has to get it right, otherwise they will not take the majority with them. It is down to strong leadership. Like COVID, if you get the messaging wrong, some go one way and some go another.” (45-59 years old, England)*

There was some, more limited, enthusiasm over the role of an independent body to raise awareness of net zero, to lay down guidelines, provide regular updates, and to have the power

to hold both government and industry to account. It was not clear that participants were aware of the Committee for Climate Change, but participants equated such a potential body as akin to the Scientific Advisory Group for Emergencies (SAGE), though with greater powers so government is in less of a position to choose what actions to take to reach net zero. Participants also mentioned the World Health Organisation as a comparable body, reiterating the desire for this to be a body that could help enforce responses at a global level.

> *"It should be headed by a by climate scientists and people who understand the science, and also, you know, ethics committees and things like that, to work out how it would affect people on a day-to-day basis. I think it does need to be very sort of based strongly within the expertise of people who study their stuff, and people who know what they're doing". (Mixed Age, Rural, England)*

5.2. Facilitating behavioural changes in pursuit of net zero

5.2.1. Behavioural influences

Across all groups there was almost universal agreement that commitment to net zero by 2050 was a positive step, except among those small number of individuals who believed that climate change was a natural occurrence. Amongst others there was acknowledgement of the need for change and that, in time, the changes being made would become normality.

> *"I don't think it's something I'll get angry over. You've got to find a way around this problem. We've got to re-evaluate our choices, so whilst it may not be exactly what I want, if it needs to happen, then that's the way it is. It won't make me angry as there's a good reason for it." (Mixed Age, Higher Income Household, England)*

In reviewing participant responses to the various actions and combinations of actions that could be taken to reach net zero there are some clear common themes that emerged which are instructive in understanding where the key opportunities and barriers exist for behaviour change in respect of carbon emissions. We present these at a high level in the table below and align these with the Capability, Opportunity and Motivation model of behaviour change (COM-B)[37].

Table Four: Challenges and opportunities for behaviour change

Area	Challenges and opportunities
Capability	There was **limited awareness, knowledge or understanding** of net zero in terms of either the urgency of required action or the practical steps required from people to achieve net zero. Tackling this lack of awareness was seen by participants to be the first step to address in driving a process of behaviour

[37] See Michie et al., (2011) The behaviour change wheel: A new method for characterising and designing behaviour change interventions. Implement Sci. 2011; 6: 42

Area	Challenges and opportunities
	change. It will be important for people to be made aware of both the individual and societal impact of climate change, and practically what can be done to address it. This information needs to be tailored for different audiences and communicated via different channels, but a clear lesson from the COVID-19 pandemic is that a high degree of repetition and coverage will help ensure it is seen as a priority. The other key area of capability that presents a barrier to behaviour change was around the **perceived financial cost** of taking actions to reduce carbon emissions. Many of the actions discussed in the dialogue were perceived as likely to carry a direct (or indirect) cost to the consumer/citizen which would be a net increase on the costs that were currently incurred in maintaining their existing lifestyle. This was particularly the case for "large" purchases such as EVs, heat pumps and home insulation measures, but was also evident in response to potential increases in energy charges for daytime electricity use. Tied to loss aversion (which is discussed below), actions which required increased short-term expenditure are easily discounted by people as being out of reach regardless of the longer-term personal return on investment or benefits to the planet. *"I would love to do more, but I cannot afford it at the moment." (45-59 years old, England)* *"It is a wonderful goal to aim for. And we know it's that is absolutely necessary. But how are we going to get the public's mindset to achieve that? Unless the prices come down? It's an ideal to have sustainably sourced products in hundred percent recycled packaging, but who can afford that?" (Mixed Age, Rural-only, England)*
Opportunity	Particularly with the COVID-19 pandemic, but also in day-to-day life there are **(too) many other issues which can be seen to be competing for people's attention** and which are perceived as more pressing with higher opportunity costs attached. People have a **'present bias'** which results in a tendency to discount future benefits in favour of the present – despite acknowledging climate change as an issue, it was still felt to be having a relatively minimal impact on people's daily lives as compared to other issues. *"The biggest challenge will be getting people to think about - let alone do - the things they need to do to achieve net zero" (Mixed Age, Scotland)* A number of the future actions discussed with participants involved replacing something which was less energy efficient (e.g., private cars, gas boilers) with something that was more efficient (e.g., public transport, heat pumps).

Area	Challenges and opportunities
	However, these actions were also easily **discounted as unfeasible or impractical** either because there were current or expected practical barriers (such as a lack of accessible transport) or because the technologies under discussion were still theoretical. A further related opportunity barrier was that some properties were simply unable to accommodate certain technologies (such as heat pumps).
Motivation	People are keen to **avoid losses** ("loss aversion") – actions which are positioning in a way where people feel like they are losing something will be harder to achieve. For example, reducing international air travel, car ownership, meat consumption and temperature of hot water were seen to be the hardest areas for people to accept change. *"My house can get really cold. And even the other day, when it was feeling cooler, I suggested we didn't turn the heating on straight away, but my parents were like, 'we're already wearing jumpers, we're turning the heat on now!' So yeah, I don't see how we can really rely on individual human behaviour to make this work." (16-17 years old, England)* People are motivated to **maintain a positive self-image** and one which is congruent with their beliefs. While current levels of consumption were recognised as being problematic, for many participants consumerism was both pleasurable and a way of compensating for other things (such as an inability to save money or make more substantive purchases like a house or car). While participants may feel disappointed in themselves at a lack of ability to curb these habits there was also recognition that this behaviour is linked to people's values and mental health. *"I've personally tried to cut down on a lot of the products that I buy and stuff like that. But if you're in a situation where you literally don't have anything good about your life, buying a new dress can give you that instant burst of happiness that makes you think it can get better." (Mixed Age, Rural-only, England)* **Habit** plays a large role in influencing people's behaviours and many people will default to set attitudes and behaviours to help minimise cognitive burden. This was particularly evident amongst participants aged 30-60 years old and where lifestyles were relatively static, with no significant life events which may prompt changes to lifestyle (such as new relationships, children, health issues, personal loss etc.). **Social norms** also play a strong role in undermining or facilitating action. In the case of adopting behaviours to reach net zero, people will be influenced

Area	Challenges and opportunities
	by not just the behaviour of other individuals but also by the perceived action/responsiveness of UK businesses and government, and by that of other countries. If there is a perception that others are not contributing in a like-for-like manner – which was the concern of participants - this can be seen to undermine the perceived feasibility of reaching net zero and therefore the motivation for starting or maintaining a new behaviour. *"Why should I make changes and compromise my lifestyle if corporates are doing nothing to help with the problem?" (45-59 years old, England)* *"It just feels like we're asking a group of completely corrupt old white men to try and change something that there's no benefit personally to them or their corporate friends to do it. They will all be dead by the time that this has any major impact. So that's why the focus is on lining their pockets while they can." (Mixed Age, Rural-only, England)* A related concept here is that of **social justice** – participants think that people will be less motivated to adopt or support behaviours which are seen to unfairly disadvantage certain groups within society, particularly the more vulnerable such as the elderly or lower income. This has specific implications for those measures relating to heating and domestic transport where there is the potential to disadvantage the elderly, those with disabilities and/or those on lower incomes. This argument was often raised by participants who disagreed personally with the behavioural changes discussed.

5.2.2. Implications for changing behaviours

In overcoming challenges and facilitating changes in behaviour, participants articulated the need for strong and united political leadership, with politicians putting party politics to one side[38] and delivering a clear and consistent message on the actions that will get us to net zero (including on more controversial technologies such as hydrogen power). At the time at which this dialogue took place, participants did not feel climate change was a priority for government or the public, particularly in the context of EU Exit and the COVID-19 pandemic. While participants were aware of the climate change issue, the UK response to this and actions required to achieve net zero were felt to have received minimal coverage. Note this research was undertaken prior to the government announcement of the 'ten-point plan for a green industrial revolution'. The public were not felt, by participants, to have been directly addressed on net zero to lay out the implications/expectations for individuals, society and businesses. It

[38] This was particularly apparent in Northern Ireland, where participants saw it important that all messaging around net zero should be bipartisan.

will be important to have this clearly set out by national and local government, alongside the support that will be provided to start to raise awareness and buy-in.

There was consistent feedback from participants that while it was positive for us to have 2050 as a target for net zero, there needed to be interim milestones for people to be able to assess progress and for politicians and businesses to be held to account before it is too late. This was seen to enable people to focus on their role in achieving net zero rather than seeing it as an issue for future generations and "kicking the can down the road". By breaking the goals and actions down into smaller steps it also helps action feel less of an externally imposed shock to the system, and more of a natural progression.

> *"Short term makes more sense. Because you will have your responsibility, rather than just saying 30 years and you will disappear." (Mixed Age, Higher Income Household, England)*

> *"Better to start talking about the next 10 years, then it pushes people to start cracking on with building software for example. Otherwise they might say 30 years is ages away, we don't need to be strict on ourselves yet." (16-17 years old, England)*

> *"I think with it being 2050 people think 'oh that's way in the future it doesn't apply to me. By the time we get to 2050 I'll be in my 80s, so people think it won't affect them." (Mixed Age, Northern Ireland)*

While a lot of the discussions that took place during this public dialogue had deliberately removed cost from the equation, participants regularly identified cost as being a major barrier to taking more 'environmentally friendly' actions. There will need to be careful consideration of the cost implications of any actions required from people, with explicit incentives and subsidies provided alongside ways for people to assess the costs and savings of any new behaviours/technologies.

The extent to which actions are seen to be fair was important to participants. For example, taxing people taking multiple flights per year a premium was mentioned by several participants as fairer than having a blanket tax rise on all flights. Perceived unfairness was viewed as having the potential to create obstacles for behaviour change. For example, where particular individuals or subgroups are seen to be unduly penalised for not adopting new technologies, or anywhere where the burden of responsibility is not equally distributed. In a similar manner there is the expectation that businesses are seen to pull their weight and to lead by example, with regulation and penalties for those who do not meet agreed targets.

> *"We are just going to carry on as normal, we find the easiest option going forward. If the Government are promising that by 2050, to be carbon neutral it's in their interest to make sure that we will be provided with the right incentives." (Mixed Age, Higher Income Household, England)*

A range of other supporting measures were also mentioned by participants as being important facilitators of behaviour change, with a notable focus on reducing waste and consumption

(which may reflect what participants feel is easiest to achieve and where the relative balance of responsibility lies). These included:

- Addressing safety concerns relating to new technologies (EVs, hydrogen and automation) by thorough testing from industry, enabling early take-up and roll-out of new technologies
- Establishing advertising regulations to control what can be marketed and to who, helping to minimise the constant pressures people felt to consume and thereby resulting in less wastage
- Encouraging industry to manufacture higher-quality, longer-lasting products, again to minimise consumption
- Ensuring that manufacturing processes reduce reliance on single-use plastics and that recyclable packaging is standardised for use in retail
- Encouraging re-use and recycling through promoting apps and services where individuals can post about things for sale or to give away
- Standardising the recycling services available to people across all local authorities and property types. In particular this included ensuring facilities and services for glass, plastics and food waste, which are currently seen to be variable in availability.
- Raising people's awareness of the carbon footprint of food items (e.g., through labelling) as well as helping expose people to a wider range of sustainable food products (e.g., through food pop-ups, recipe cards using plant-based ingredients, cooking classes in school etc.)

One of the independent activities participants undertook between the two waves of public dialogue was to complete a basic carbon footprint calculator.[39] Many participants highlighted the 'shock' and 'distress' at how poorly they performed relative to the UK average or worldwide, but also some frustration that the suggestions provided for improving their score were ones which they were already taking.

> *"Even though I thought I did as much as I could to reduce my carbon footprint, I realise I know nothing and can do much more. This has been a change of perspective…I didn't expect transportation would have such a massive impact, that was the shocking part." (Mixed Age, Scotland)*

> *"I found the calculator quite distressing. You think you do a lot more and then you get the result. It was a bit frustrating…a lot of the tips that it gave me I already do, so kind of felt a bit hopeless that I couldn't change anything. That was one thing that I've been thinking about since." (Mixed Age, Higher Income Household, England)*

Across the majority of groups participants spontaneously returned to this as a potential facilitator for change (potentially tied to smart meters) that could provide people with

[39] The WWF calculator (https://footprint.wwf.org.uk/#/) provides a calculation across four areas of people's lives including home, travel, food and 'stuff'

information on their personal carbon emissions, how this compares with others and whether they are above or below their individual/household target. This calculator could further breakdown the relative carbon emission contributions of specific aspects of their life (e.g., car travel, heating, food consumption etc.), the associated financial costs of these actions and alternatives. This was something that participants said they would use as it had the potential to be beneficial both for the environment and personally in terms of the expenditure.

A calculator-type mechanism that was diagnostic and personalised may be helpful to provide people with the necessary information and motivation to make changes to their personal emissions. There is also the potential here to take this a step further and, alongside individual targets, to implement technology to capture accurate data of carbon emissions for individuals, and incentives for targets being achieved.

> *"How about if they had something to monitor your carbon footprint and at the end of every year you'd get a score and you get an incentive based on the score…everyone is competitive…it's a psychological thing you want to strive to achieve it." (30-44 years old, England)*

6. Engaging people in the journey to net zero

This final section details participants' current understanding and engagement with carbon reduction policies, their desired role in contributing to the policy development process and overarching implications for achieving net zero.

6.1. Current engagement with carbon reduction policies

There was very limited spontaneous awareness of national or more localised policies/measures that were being implemented to reduce carbon emissions. Within any one group there were at most two policies/measures that were mentioned by participants (after having been asked to name initiatives that they were aware of).

Subsidies for home energy efficiency measures (notably insulation) and energy generation measures (specifically solar panels) were mentioned most frequently by participants (though in England specifically[40]) however there was limited awareness of how these subsidies could be accessed and used. A very small number of participants who were homeowners had benefited from these subsidies however others reported difficulties getting contractors to provide the quotes needed to qualify for the subsidies.

Various transport-related policies or initiatives were mentioned, though again only in a couple of groups. These included car taxes being based on emissions, and the Ultra Low Emission Zones (ULEZ) and congestion zones in Birmingham and London. There was general negativity toward these schemes where they were raised in groups as being more about income generation than environmental benefit. The Cycle to Work scheme and bike share schemes (e.g., in London and Belfast) were also mentioned and seen to be positive for encouraging active travel.

Of the 93 participants involved in this public dialogue only four were aware of the Climate Assembly UK, and of these none were able to describe the aims or operations of the Assembly. This was asked about as the research was carried out shortly after the findings from the Climate Assembly had been reported and received media attention. Further to a short description, participants were supportive of the Assembly and felt that dialogue processes, with a representative and diverse range of people participating, were an important part of policy development.

[40] Note that the availability of energy efficiency subsidies varied between the nations, with participants in England most aware of their availability

6.2. Future engagement with net zero

Participants felt that ‘net zero’ is a useful term for engaging the public on an ongoing basis around actions to reduce carbon emissions and tackle climate change. It is catchy, memorable and clearly highlights the target that we need to reach with no room for misinterpretation. However, as previously mentioned, fewer participants had heard of it before this public dialogue as compared to climate change and global warming, and many had difficulty understanding/reciting it even after having had it explained. There is therefore the potential for misinterpretation without further clarification in communications.

As a starting point for engagement with net zero there is a need to raise awareness of the issues to be addressed and to present a clear and concise course of action. The current communications around climate change – largely media accounts and social media stories - are disparate and conflicting. Participants stated that people needed to see net zero in both the mainstream media and social media on a consistent basis - similar to the COVID-19 pandemic with consistent news bulletins and *“public service-type broadcasting to get the information across in small little understandable bursts”.* Participants suggested a need for clear communications on what is expected from them, including the individual level changes required.

> *“I feel like there needs to be a huge educational drive I guess by the Government because there’s a lot of things people don’t realise they can do in their own homes.” (Mixed Age, Lower Income Household, England)*

As younger people will play a crucial role in the UK meeting the 2050 target participants also felt there needed to be much stronger coverage of this issue within schools. Younger participants themselves reflected on how little exposure and understanding they had gained of climate change through the curriculum.

> *“They need to bring even more attention about climate change into schools, as we’re the generation that’s going to deal with it. We’re the ones that are going to have to start producing solutions to change.” (16-17 years old, England)*

At a macro level there was a view that government should not look to leave the decision as to how we reach net zero up to the public. While consultation (including through public dialogues) was seen as important to account for people’s perspectives in the delivery path for achieving net zero, single question public polling was felt to be inadequate in producing the clear and timely decisions on actions necessary given the urgency of the situation. This view was influenced by the recent referendum on exiting the EU, which was seen by participants to have spread misinformation, distrust and split society.

> *“The public should be involved initially, but as it goes further up in the decision making process because people’s views are so different it would be a stalemate…so eventually it would have to go with government to make the decision but based on initial public feeling, otherwise you could be there forever and a day trying to please everyone but pleasing no one.” (Mixed Age, Scotland)*

> *"I think it's helpful to ask for public opinion, because we are the ones who ultimately have to make the changes. It will help make us aware of what's going to happen, and we then might be able to promote the new ideas as well." (16-17 years old, England)*

Participants did however want to be more actively involved in decisions that they saw as having a more obvious and immediate impact on their lives, especially if there are personal financial implications. This could include actions such as proposed changes to residential heating systems, household waste facilities, road charging, road closures, cycle paths etc. In these cases, there was felt to be a role for local community hubs that could help people discuss and action more localised (or individual) net zero targets. These actions were not being tied back to national policy decisions which illustrates a general lack of awareness of the policy-making process at a systems level.

> *"If people get told what to do then they will revolt against it but if they are involved in making decisions it's more likely to stick." (30-44 years old, England)*

Public dialogue of the kind had during this process, but also forums such as the Climate Assembly UK, were seen as having a very important role in our achieving net zero. Not only were they seen to serve as important opportunities to hear from experts and 'have your say', but they were felt to expose people to the perspectives and lived experiences of others, helping to shape a more considered, shared understanding of responses to net zero and ultimately increasing buy-in for actions.

> *"Events like this [the public dialogue on net zero] are good as it gives government a chance to know what people think and reassures people that change is being made, and hear the steps government are taking that they may not have heard about before." (16-17 years old, England)*

6.3. Implications for achieving net zero

At a broad level, the findings of this public dialogue align with those of the Climate Assembly UK, and of numerous other studies that have been undertaken into specific actions that can be taken to reduce carbon emissions.

People, given the space for reflection, recognise there is an urgent need to address climate change. However, the issue currently feels so large, intractable and tied up with the actions of people, governments and industry operating, not just in the UK but globally, that it feels beyond the reach of people to respond to. It is also not an issue that is as present in people's minds as exiting the EU has been in recent years, or the COVID-19 pandemic more recently, both of which have had a sense of urgency created through consistent media and political coverage.

We saw from participants' engagement in this process that, given the opportunity (which includes the time, space and relevant information) to reflect on their views, most participants wanted to help address the issue of climate change. There is recognition of the individual, community and environmental benefits that could come through achieving net zero by 2050

and participants were pleased that the government has committed to these targets. However, there is also a view that achieving net zero should not come at the expense of people's freedom and happiness (e.g., eating meat, having hot showers, holidaying abroad), and should not inadvertently increase inequalities and widen factions within society. Participants expressed willingness to make changes to their individual behaviours but only so far as they felt this to be fair, meaningful and achievable.

This public dialogue illustrated the challenges that exist for people in envisaging future change scenarios, particularly in the medium-term (i.e., 20-30 years away). This timeframe feels both far ahead enough that people can accept that things will be different, but close enough that they can envisage some of the challenges of transitioning from where we are currently to where we want to move to. The initial reaction of participants in this dialogue to any scenario which involved people being seen to 'give up' or compromise on something they currently had a choice over (car ownership, flights abroad, meat consumption, home heating temperatures), was a defensive one. Participants struggled to see how such changes to behaviour could be achieved without government resorting to coercion or more punitive measures. A related point is accounting for the sensitivities in cost implications associated with any potential changes. Particularly at a point in time where there is pressure on the economy, employment market and household incomes, any measures which are perceived as having personal financial implications, especially up-front costs, could face resistance.

Some behaviours were more within the grasp of individuals to implement than others, notably how they use energy in the home, how they move around, what food and products they consume and how they manage their waste. These were also many of the behaviours that people assumed would have the greatest impact on reducing carbon emissions, potentially influenced by the level of communication and engagement that has already taken place around these. Others, such as the use of EVs, smart meters and installation of new energy efficiency measures were both more novel and involved wider considerations (such as comfort with new technologies, home ownership and property specifics). Each of these behaviours is influenced by a wide variety of factors including perceptions of cost, availability, convenience, habit and social norms. All of which are, in turn, influenced by government, industry and wider society.

Three distinct themes emerged from this dialogue are worth reflecting on specifically here. The first relates to human connection. An underlying concern that was consistent across all demographics was a future that was more physically disconnected and where interpersonal relationships had been reduced as a result of changes in behaviours or technology. The second is the tension that exists for people around consumption. Participants in this dialogue largely agreed that we lived in a "throw-away society" characterised by overconsumption, which was disheartening and felt to be driven in large part by marketing and social pressures. The third theme relates to control and the need for people to feel like they have the freedom (and right) to take decisions around how they live their lives at an individual level. For the UK to make progress toward net zero it will be important to account for these, and look at ways in which the context can be more conducive to encouraging behaviours which reduce carbon emissions while also fostering a sense of personal wellbeing and empowerment. Establishing a very clear net zero goal that is aligned with people's desires for a healthier, happier and more connected society – rather than the environment per se - will be important in this.

Throughout the process of this public dialogue there was a consensus that reducing carbon emissions will not be achieved exclusively through behaviour change or technological solutions but a combination of both. The changes in behaviour that will be required to move the UK to net zero need to be supported by technologies that make these behaviours easier, and incentives/subsidies that enable people to feel it is viable to do what many feel to be ‘the right thing’. In doing this people both need and expect government and industry to lead the way, for leaders to be publicly in agreement on the way forward, and for the views of citizens to be understood and accounted for in these decisions. This isn’t to say participants expect ‘others’ to solve the climate issue, but rather that individual changes to behaviour will only happen at scale if there is a belief that this is being actively supported by changes at what is considered to be the ‘macro level’. Without this, both the issue and changes needed will lack the prominence required to make it a priority and people will feel individual efforts are ‘wiped out’ by the actions of others.

For the UK to realise the ambition to achieve net zero by 2050 it will require a course of action that is supported by both government and industry, and which brings people along on a journey to achieve a shared vision for a society which is more connected, more inclusive and healthier (both mentally and physically). The concern is that addressing climate change is out of the hands of individuals, or indeed the UK more broadly, instead requiring global co-operation. At the end of this dialogue process there was however optimism that if there is a clear will, led by government and supported by industry, then it will be possible for society to find a way to achieve net zero.

Appendix A

A note on method, sample and stimulus development

Method

The subject of feasibility pathways to net zero and behavioural responses is complex, and prompted the adoption of a deliberative approach, where participants were reconvened twice (i.e. two waves of dialogue). This enabled exploration of both top of mind reactions but also responses to new information, presented in different ways, without overwhelming people.

The public dialogue involved two waves of online discussions (via Zoom) with a total of 96 participants split across break-out groups which reflected different criteria thought to potentially influence views toward net zero (this included age, location, household income and whether living in more rural or urban environments).

The first wave involved a three-hour workshop which involved a mixture of plenary presentations and smaller group discussions in which people were split into 12 break-out groups. Despite standard recruitment practice in contacting participants to confirm participation in advance of the qualitative research there was a significant level of non-attendance at this first workshop. Out of the 96 participants recruited, 23 did not attend which is a much lower than would typically be expected; drop-out rates of 5-8% are more common for this type of research. Further to discussion with BEIS and Defra, the first wave workshop was re-run with a new cohort of participants recruited to fulfil required quotas. At this session a total of 21 of the 23 participants recruited attended (split into three break-out groups). This resulted in a total of 94 participants completing the first wave.

All participants were set three independent activities to be completed via an online platform called Recollective which is designed for qualitative research. These tasks included the following activities, which moderators commented on online and reviewed in advance of the second wave of workshops:

- using an online carbon footprint calculator to look at some of the personal factors that contribute toward carbon emissions and to comment on these
- ordering a variety of statements by the extent to which these were seen to be personally desirable actions in helping move the UK to a net zero society (see also Appendix C)
- review different 2050 scenarios in which net zero might be achieved to indicate which aspects they felt more or less positive toward

The second wave focused more concretely on actions needed to move toward net zero again combining expert presentations, stimulus review and live group discussions to debate, and prioritise, the most desirable and realistic pathways and actions to reach net zero. A total of 93 participants attended this second wave (representing an overall attrition rate of 1%).

Sample

Quota type	Criteria	Quota	Attended
Location	England	70	71
	Scotland	8	7
	Wales	8	8
	Northern Ireland	8	7
Location type	Urban	70	68
	Rural	26	25
Age	16-17	8	6
	18-29	23	20
	30-44	23	23
	45-59	21	25
	60+	21	19
Household Income	Less than £20,000	24	27
	£20,000-£39,999	36	36
	£40,000-£59,999	18	18
	More than £60,000	18	12
Attitude to climate change	Very concerned	48	44

Quota type	Criteria	Quota	Attended
	Concerned	34	37
	Not concerned	14	12
Qualifications	No qualifications/ L1	40	25
	L2/L3/Apprenticeship	32	33
	L4 and above	24	35
Ethnicity	White	80	76
	BAME	16	17
Gender	Female	48	52
	Male	48	40
	Non-Binary		1
Region	South East	9	9
	London	9	10
	North West	9	10
	East of England	8	8
	West Midlands	8	9
	South West	8	7
	Yorkshire and the Humber	7	6
	East Midlands	7	7

Quota type	Criteria	Quota	Attended
	North East	5	5

Stimulus development

Cambridge Zero led on the development of a broad range of stimulus materials produced by climate change experts at Cambridge University including infographics, case studies and 'snapshots' of successful behaviour, contextual data and narratives, and other reference materials. The stimulus material was developed from a number of sources including materials already in the public domain (e.g. Imperial College's report to the Committee Climate Change: 'Behaviour change, public engagement and net zero', the UK Climate Assembly, Defra's 'Citizen engagement with the environment', etc.), academic literature, and the advice and output of a stakeholder workshop held in advance of the first workshop.

Wave 1 stimulus development

Stimulae were developed for the Wave 1 workshop to ensure that all participants had an understanding of (i) what prevailing climate science means for the environment; (ii) what the UK's net zero targets are; and (iii) what actions may need to be taken across a number of sectors for the UK to reach net zero. The sectors considered included: residential homes, industry, transport, aviation, land-use and food, and waste.

An initial stakeholder workshop was held with input from stakeholders at BEIS and Defra as well as subject specific experts from across the University of Cambridge. At this workshop the subject specific experts presented their visions for short videos covering the required material at a lay level. These visions were critiqued by the group and the final videos were developed with input from Cambridge Zero, BEIS/Defra and Newgate. Seven final videos were produced, covering:

- Introduction to climate science and the net zero goals
- Changes needed to get to net zero in residential homes
- Changes needed to get to net zero in industry
- Changes needed to get to net zero in transport and aviation
- Changes needed to get to net zero in land-use and food
- Changes needed to get to net zero in waste
- Summary of introductory climate science and net zero, introduction of the idea of a pathway

Wave 2 stimulus development

Stimulae for the Wave 2 workshop were developed to prompt participants to think about what their lives might look like in 2050 under different pathways and explore what actions might be more or less socially feasible. Narrative accounts of life in a net zero 2050 were developed for three characters based on pathways that focussed either on behavioural change or

technological innovation. The three characters were (i) a female in her early-mid twenties living in a rented urban flat share; (ii) a female in her mid-forties living with her partner and children in a suburb; (iii) a retired male farmer living on his own in a rural environment. An introductory video reminding participants of the key messages on climate change and net zero was also developed for this workshop.

Appendix B

Wave 1 Topic Guide

Timings	Content	Stimulus needed
10.00 - 10.15am	Welcome (PLENARY) Purpose: To introduce format for day and purpose of public dialogue • Newgate and University of Cambridge introduction • Housekeeping • Ground rules • Purpose of workshop/dialogue (to include what we are as well as what we are not setting out to do) • Role of different parties • BEIS/Defra introduction Brief Zoom poll: Before today, how much did you know about the UKs net zero target? (1-10 scale) Please use the chat function to briefly detail what you know about net zero. Introduce 'issues' board and use of Zoom chat function for questions/clarifications	Introduction presentation slide/s
10.15 – 10.25am	Introducing net zero (PLENARY) Purpose: To provide participants with a brief introduction to the concept of climate change, the urgency of the climate crisis and a description of net zero	Cambridge speaker to provide 10-minute introductory presentation detailing nature of the climate crisis and what net zero is
10.25am	Climate change discussion (BREAK OUT) – Note participants and moderators will be automatically transferred into breakout groups from plenary Purpose: To get top-of-mind thoughts on climate change and net zero ambitions	

	Moderator welcome Remind of ground rules Explain to participants that the discussion may move quickly and so to please make use of the chat function if they do not have an opportunity to share their point/or if they have additional thoughts when others are speaking Group introductions and ice breaker – tell us one thing about how your carbon footprint changed over the past few years? Moderator to explain that your personal carbon footprint is the amount of greenhouse gases (in particular carbon dioxide) given off by your activities.	
10.35am	What are your views on what you have just heard? Gauge: • Immediate thoughts • Questions or anything confusing What does climate change mean to you, at a personal level? Gauge awareness • What topics people relate climate change with and probe how important an issue it is (personally vs socially) Before today, how aware were you of the Government ambitions to get to net zero by 2050? • Sources of information How would you explain net zero in your own words? • If you were to try and explain it to a 10 year old child what would you say, what examples would you use.	
10.50am	What do you think are likely to be the most important actions to take for the UK to reach net zero over the next 30 years? Unprompted, then probe on: • Demand-side actions (i.e. what people will need to do themselves) • Supply-side actions (i.e. what 'industry' will need to do)	Researcher to 'flipchart' / note down actions on PPT and share screen with participants (bold those seen to be highest priority and

	• Perceived importance of different actions Only where needed, refer to themes mentioned in first presentation (like transport, heating, waste management, food choices) to encourage discussion. Note that this breakout group will automatically close at 11.05 and participants will be transferred into the plenary	focus on their actions)
11.05 – 11.15am	Comfort break	
11.15 – 11.50am	Sectoral briefings (PLENARY) Purpose: To provide participants with a short introduction to each of the sectoral themes in which actions can be taken to address carbon emissions Note that we will encourage participants to respond to Zoom polls, write comments and pose questions in chat function during each of the presentations.	Speakers to provide 5 x 6-8 minute presentations covering: • Industry • Residential buildings • Transport and aviation • Agriculture and land use • Waste
11.50am – 12.05pm	Q&A response to points raised and questions posed. With relevant participants able to participate in dialogue with experts.	
12.05pm – 12.15pm	Introducing feasibility pathways (PLENARY) Purpose: To provide participants with a short introduction to feasibility pathways for achieving net zero	Speaker to provide a 10 minute presentation on the different feasibility pathways to outline how sectors could contribute to reaching net zero in different ways

12.15pm	Discussing feasibility pathways (BREAK OUT) – Note participants and moderators will be automatically transferred into breakout groups from plenary Purpose: To gather immediate understanding and reaction to feasibility pathways, and likely impacts What are your views on what you have just heard in terms of the feasibility pathways and range of actions needed to meet net zero? Gauge: • Anything new/surprising • Anything concerning or confusing	
12.30pm	You heard about the different pathways through which we might reach net zero. These were designed to illustrate how interconnected each of the actions are that are needed to reach net zero. What might 'society' look like in 2050 under (i) the more people-focused Yellow pathway, and (ii) the more technology-focused Orange pathway? Probe on: • What would be similar or different about how you/your family lived/worked • What would be gained (societal and personal) • What would be lost (societal and personal) • What they would miss and/or resent, and why Which pathway would you prefer that we follow within the UK, and why?	
12.55pm – 1pm	Thank and close	

Wave 2 Topic Guide

Timings	**Content**	**Stimulus needed**
10.00 - 10.10am	Welcome (PLENARY) Purpose: To introduce format for day and restate the purpose of the public dialogue	Introduction presentation slide/s

	• Newgate and University of Cambridge introduction • Housekeeping • Ground rules • Recap on Wave 1 • Purpose of Wave 2 workshop/dialogue (to include what we are as well as what we are not setting out to do) Reminder of 'issues' board and use of Zoom chat function for questions/clarifications	
10.10 – 10.15am	Setting the scene (PLENARY) Purpose: To provide participants with a brief recap of net zero ambitions, feasibility pathways and pace of change	Cambridge speaker to provide 5-minute recap presentation
10.15am – 10.30am	Reflections on net zero (BREAK OUT GROUPS) Purpose: Warm-up discussion to get reflections since the previous wave, to download from the homework task and to revisit top of mind barriers to change Moderator welcome Remind of ground rules Explain to participants that the discussion may move quickly and so to please make use of the chat function if they do not have an opportunity to share their point/or if they have additional thoughts when others are speaking Group introductions – there will be new people in most groups What stood out for you after the first workshop, either in terms of what you learned or what you were most interested in? And what about the independent activities? Was there anything you felt that you had learned? Any changes to views or behaviours? What do you think will be the greatest challenge in the UK reaching net zero by 2050? Probe on:	

	• Challenges at an individual level (i.e. personal changes in behaviours required, adoption of new technologies, services) • Challenges at a community level (i.e. local-level changes in behaviours) • Challenges at a societal level (i.e. societal changes in behaviours required) • Challenges at a 'market' level (i.e. changes required to technology or by industry) Do you think it is a good thing that the UK has signed up to a net zero target by 2050? Probe extent to which people feel it is achievable.	
10.30am - 11.00am	2050 (BREAK OUT GROUPS) Purpose: To help deepen understanding of perceptions of what people think reaching climate targets will mean for society. There will be audio-visual accounts from the perspective of six people, three under each pathway. Projective questions will look to understand how people anticipate it may be for people living in a net zero environment, achieved through different paths. Moderator to explain: We would now like you to listen to three peoples accounts of what it would be like to live in 2050 based on us having reached net zero under the Yellow/People pathway. As you listen we would like you to note down your thoughts about what it would be like to live in this society in 2050 (e.g. what home would feel like, what people would do for fun, how they would travel around etc.) Moderator note: play audio/video for Yellow pathway. Which account did you most identify with and why? Get show of hands for (i) student/young professional, (ii) parent/family, and (iii) retiree. Prioritise coverage of accounts that people most identified with. Taking each account (student or young professional / parent in middle age / retiree) in turn: • Thinking about this person, (student or young professional / parent in middle age / retiree), what would it be like living in 2050 for this person?	6 x audio-visual accounts: 3 under the Yellow pathway 3 under Orange pathway

11.00am - 11.30am	How might their life be different from a (student or young professional / parent in middle age / retiree) living in 2020? Probe on: • Where they live, study or work • Their local environment • How they spend time in evenings and weekends • How they spend their holidays • Hopes and fears for the future What do you think are likely to be the key differences and similarities in 2050 as compared to now? Probe on the physical and social environment (buildings, land-use, relationships, institutions, culture) and how people live their lives? • Which differences do think are more positive? • Which differences are less positive? And do you think these still be an issue in 2050? Now imagine that you have been transported into this vision of 2050. Like Marty McFly from Back to the Future, you've arrived in 2050. What questions would you want to ask them about their life to help you to understand whether you would like to stay? I'd like to now understand what do you think would have had to have happened in the preceding 30 years (i.e. between 2020 and 2050), for this vision of 2050 to have been achieved and why? Moderator note: play audio/video for Orange/Technology pathway and repeat above questions.	
11.30am – 11.45am	Comfort break	
11.45am – 12.10pm	Revisiting the yellow and orange pathways (BREAK OUT) Purpose: To gain further insight into people's attitudes and preferences towards different plausible pathways for meeting net zero.	

	Moderator to explain: We now want to revisit the Yellow and Orange pathways. Building on the independent activities you undertook between the first workshop and this one, we want to understand in more detail your views on the actions required to reduce emissions in line with targets to get to net zero. Looking at the variety of actions listed here under the Yellow pathway: What do you think are the key barriers to people making the changes that are needed? How might this differ for people based on: • Personal circumstances (income; disabilities; life-stage) • Location (urban/rural; flats/houses) • Living circumstances (individual/shared accommodation; rental/owner/social tenancy) If you took cost out of the equation, where will the key barriers be for people? If you were tasked to do a risk assessment of the Yellow pathway on behalf of the Government – what areas would you say were at the highest risk of failure and why? • What do you think could be done to reduce risk of failure? Looking at the variety of actions listed here under the Orange pathway: What do you think are the key barriers to achieving the changes that are needed under this pathway? How might this differ for people based on: • Personal circumstances (income; disabilities; life-stage) • Location (urban/rural; flats/houses) • Living circumstances (individual/shared accommodation; rental/owner/social tenancy) Again, if you took cost and the accessibility of technologies out of the equation, where will the key barriers be for people?	Stimulus 1A: 1 x PowerPoint slide with constituent elements of Yellow pathway Stimulus 1B: 1 x PowerPoint slide with constituent elements of Orange pathway

	If you were tasked to do a risk assessment of the Orange pathway on behalf of the Government – what areas would you say were at the highest risk of failure and why? • What do you think could be done to reduce risk of failure?	
12.10pm – 1.10pm	Co-creating a shared feasibility pathway (BREAK OUT) Purpose: To understand the least and most socially feasible path to net zero, including the key barriers and trade-offs that people are willing to make to reach net zero. Moderator note: Screenshare Stimulus 2A Moderator to explain: Many of you highlighted in the first workshop, and in the independent tasks, that you felt a combination of both the yellow and orange pathways would make the most sense in helping us to achieve net zero. I.e. they are not mutually exclusive routes. We should look to encourage both people to change their behaviours while industry invest in technological solutions to reduce carbon emissions. We would now like you to help identify the most acceptable route for achieving net zero. What we'd like you to do is imagine that this is a game where to reach net zero by 2050 we need to take a combination of actions, across various different 'sectors' (such as energy generation, transport use, waste, our homes etc.). Certain actions are riskier than others – these are indicated by an exclamation mark – and we'd like to understand how acceptable you think it is to take on this risk. Essentially we are wanting you to identify, within each sector (i.e. in each row), whether the yellow/people action is more or less acceptable than the orange/technology action. We will do this as a group, but before we do so, please take a couple of minutes to look at the slide on your screen and think which actions are both most desirable and acceptable to our achieving net zero in the UK. Moderator note: Take a quick hands up tally of preferences running through each pair of actions in turn. You can note this on the PPT slide.	Stimulus 2A: 1 x PowerPoint slide with 19 actions.

	Moderator to explain: What we'd now like you to do is work together as a team to build your own pathway to net zero by drawing on the range of actions available. Discuss which actions you feel are both most desirable and acceptable to our achieving net zero. Please assume that actions are cost neutral – i.e. they don't require any additional investment at an individual level. To get started maybe we can start with those activities that had the highest number of votes in the group and discuss why that is the case. Moderator note: Allow participants to control discussion and give 20-30 minutes to undertake this activity. Moderator to minimise input at this stage, and leave participants to discuss amongst themselves though help to facilitate building of pathway through use of PPT and document decision making. Help keep to time and ensure everyone remains involved. Moderator note: Screenshare Stimulus 2B and highlight those preferred actions from stimulus 2A Moderator to explain: Now not all actions are equally impactful on reducing carbon emissions. To get to net zero we would need to take a set of actions that would get us to 20 points. If you add up all of the points of those actions you have selected, where would that get us to? NOTE. If participants pathway adds up to less than 20 points then moderator to facilitate discussion on what they would change to get us to net zero, including what trade-offs they would be most willing to make and why. Once this activity has been completed: Please could someone explain the decisions you have taken? Probe: • How easy or difficult was the process of getting to a decision / or a consensus agreement on this pathway? • Were there any actions or sectors which were harder than others to agree upon between yourselves? I.e. which are most or least 'acceptable' and why?	Stimulus 2B: 1 x PowerPoint slide with 19 actions and scores.

	• Which riskier actions did you select and why? • Which sections of our society would this pathway be most attractive to and why? • Which sections of our society would this pathway be least attractive to and why? Overall, where does the relative balance of responsibility lie between individuals and others (e.g. industry and government) and why? Probe: • how, if at all, this differs between sectors • where behaviour change is still required under Orange (tech) solutions What if any, policy or laws would be needed to enable this pathway? What other actions would help to make this pathway more attractive for people? Assuming this pathway was taken to reach net zero in 2050. What do you think we could gain? And what would we lose? How do people feel about this?	
1.10pm – 1.30pm	Comfort break	
1.30pm - 1.55pm	Engaging with net zero policies (BREAK OUT) Purpose: To understand how people want to engage with net zero policy making. Finally, you have seen over the course of these two workshops that to achieve net zero will require a considerable amount of change at both an individual and societal level. Who do you believe is responsible for making decisions around what changes are needed and how best to achieve these? For example, is it Government, Industry, an independent body (UK or international) or the public themselves?	

	What role should people – i.e. members of the public - play in setting pathways to reach net zero? Probe: Do you think that people should have a say on the changes that will need to take place? If so how? What role should people have in actively shaping the policies that might be required to prompt the actions required? Looking at the pathway which you constructed, are there certain sectors or actions that you believe are more important for people to have a say on than others? What current policies are you aware of which are designed to reduce carbon emissions (e.g. in relation to vehicle emissions, active travel like cycling, home heating and insulation measures etc.)? How would you want to find out about policies in relation to reducing carbon emissions? Probe: • extent to which interested • whether communications and public engagement on these policies is needed Going forward, how would you want to be engaged or communicated with around the changes that will be being considered to enable us to reach net zero? Probe: • who should be leading this engagement (e.g. Government/Industry)? • interest on policy-by-policy engagement (e.g. sector specific actions), versus broader thematic engagement (e.g. on net zero pathways)? • whether focus of communications should be on actions needed to reduce carbon emissions by 2030, or 2050 (i.e. long vs short term goals)? • whether net zero helpful term, or not? Quick show of hands, how many of you have heard of the Climate Assembly UK? Explain that CAUK is a citizen assembly, similar to this one, which involved 108 people in six weekend-long meetings (i.e. around 12 days) hearing from experts and debating the range of actions that we could take in substantially more detail than we have during	

	these workshops. Sessions were undertaken face-to-face pre-COVID, and more recently online. Explore: • Do you think this is a good idea? • Would you want to be involved in a process such as this? • What are the pros and cons of engaging with people in this format? • Any other ideas of ways to engage people – thinking about friends, family, others? Any final thoughts that anyone would like to share about anything we have covered during these workshops, or the process overall?	
1.55pm – 2pm	Thanks and Close (PLENARY)	

Appendix C

Independent activity behavioural ranking exercise

A vision for the future.

Achieving net zero carbon emissions by 2050 will require people to adopt a range of behaviours, some of which may be easier, more attractive or more acceptable than others. We would like to understand your personal preferences for what society ‘looks like’ in the next few decades.

Below you will find a series of statements that relate to individual or societal behaviour. We would like you to order these by the extent to which you feel they are personally desirable actions in helping move us to a net zero society. Please sort these statements into three categories (Undesirable, Neutral, and Desirable). Once you have completed this please then order these statements within each category (e.g. order those in the Undesirable category starting with the most Undesirable).

1	Converting gas and oil boilers to hydrogen; a low carbon fuel. (Needs an alarm to detect leaks, no central or water heating when installing.)
2	Replace gas/oil boilers with electric heat pumps (look like an aircon unit). May need larger radiator and heating on more for enough warmth.
3	People have zonal heating in their home, so they only heat the rooms that are being used
4	Double or triple glazing of windows to help keep homes warmer
5	People make their homes more energy efficient (e.g. putting insulation in the loft, walls, or under the floor).
6	Where possible, connect homes to district heating systems heating via pipes from a nearby source instead of gas/oil boilers in people's homes.
7	People install radiators that can automatically detect and control room temperatures
8	People reduce the temperature to which they heat their homes.
9	People reduce the number of hours they heat their homes.
10	People no longer have gas cooking hobs, and only use electric/induction hobs.
11	People use less hot water in the home such as by having shorter showers and using cold water when washing up.

12	People use electric vehicles instead of petrol or diesel vehicles
13	People walk, cycle or use public transport instead of cars where possible
14	People make more use of car pooling (where more than one person travels in a car)
15	Fewer people own a car and are instead members of electric car clubs (where different people can use the same a car).
16	People holiday in the UK rather than internationally
17	People travel less by plane (compared to 2019 levels, before the pandemic)
18	People get solar panels for their homes
19	Energy efficient appliances (fridges, TVs etc) are commonplace
20	Smart, internet-connected appliances (such as washing machines and fridges) are commonplace
21	People have 'time of use energy tariffs' with cheaper rates at times during the day when demand is lowest, and higher rates when demand is high.
22	Almost everyone has a smart meter
23	People work from home more.
24	People use low flow showerheads (which reduces the flow of water that comes out of showers)
25	Doing lots of small things to cut electricity use at home e.g. line-drying clothes, switching off appliances when not in use and handwashing dishes.
26	People put money into green savings accounts - these may have lower interest rates but the money that the banks hold is used to support low carbon businesses.
27	People reduce the amount of food that they throw away/waste, for example by adopting better meal planning
28	People use more second-hand products than rather buy things from new.
29	People eat half as much meat and dairy as they do today
30	People use products and clothes for longer

Results from this ranking exercise are displayed in average rank order below (i.e. from most to least desirable).

Rank	Action	Split
8.7	People reduce the amount of food that they throw away/waste, for example by adopting better meal planning	Desirable 81 Neutral 5 Undesirable 0
9.5	Doing lots of small things to cut electricity use at home e.g. line-drying clothes, switching off appliances when not in use and handwashing dishes.	Desirable 73 Neutral 11 Undesirable 2
9.8	Double or triple glazing of windows to help keep homes warmer	Desirable 75 Neutral 7 Undesirable 4
10.1	People make their homes more energy efficient (e.g. putting insulation in the loft, walls, or under the floor).	Desirable 71 Neutral 14 Undesirable 1
10.2	Energy efficient appliances (fridges, TVs etc) are commonplace	Desirable 73 Neutral 12 Undesirable 1
11.5	People use products and clothes for longer	Desirable 71 Neutral 11 Undesirable 4
12.3	People walk, cycle or use public transport instead of cars where possible	Desirable 65 Neutral 16 Undesirable 5
12.7	People have zonal heating in their home, so they only heat the rooms that are being used	Desirable 56

		Neutral 24 Undesirable 6
13.1	People use electric vehicles instead of petrol or diesel vehicles	Desirable 54 Neutral 24 Undesirable 8
13.3	People work from home more.	Desirable 51 Neutral 28 Undesirable 7
14.2	People use more second-hand products than rather buy things from new.	Desirable 55 Neutral 18 Undesirable 13
14.7	People install radiators that can automatically detect and control room temperatures	Desirable 55 Neutral 26 Undesirable 5
15.0	Almost everyone has a smart meter	Desirable 43 Neutral 33 Undesirable 10
15.2	People reduce the temperature to which they heat their homes.	Desirable 46 Neutral 23 Undesirable 17
16.0	People get solar panels for their homes	Desirable 41 Neutral 38 Undesirable 7
16.5	People travel less by plane (compared to 2019 levels, before the pandemic)	Desirable 40 Neutral 27

		Undesirable 19
16.6	People reduce the number of hours they heat their homes.	Desirable 41 Neutral 33 Undesirable 12
17.1	People eat half as much meat and dairy as they do today	Desirable 36 Neutral 29 Undesirable 21
17.4	People use low flow showerheads (which reduces the flow of water that comes out of showers)	Desirable 43 Neutral 22 Undesirable 21
17.8	Where possible, connect homes to district heating systems heating via pipes from a nearby source instead of gas/oil boilers in people's homes.	Desirable 28 Neutral 44 Undesirable 14
17.9	People make more use of car pooling (where more than one person travels in a car)	Desirable 37 Neutral 31 Undesirable 18
18.6	People no longer have gas cooking hobs, and only use electric/induction hobs.	Desirable 29 Neutral 39 Undesirable 18
18.7	People have 'time of use energy tariffs' with cheaper rates at times during the day when demand is lowest, and higher rates when demand is high.	Desirable 29 Neutral 38 Undesirable 19
18.8	Smart, internet-connected appliances (such as washing machines and fridges) are commonplace	Desirable 28 Neutral 40 Undesirable 18

18.8	Converting gas and oil boilers to hydrogen; a low carbon fuel. (Needs an alarm to detect leaks, no central or water heating when installing.)	Desirable 23 Neutral 45 Undesirable 18
19.1	Replace gas/oil boilers with electric heat pumps (look like an aircon unit). May need larger radiator and heating on more for enough warmth.	Desirable 33 Neutral 31 Undesirable 22
19.3	People holiday in the UK rather than internationally	Desirable 27 Neutral 36 Undesirable 23
20.4	People use less hot water in the home such as by having shorter showers and using cold water when washing up.	Desirable 24 Neutral 34 Undesirable 28
20.6	People put money into green savings accounts - these may have lower interest rates but the money that the banks hold is used to support low carbon businesses.	Desirable 20 Neutral 43 Undesirable 23
21.3	Fewer people own a car and are instead members of electric car clubs (where different people can use the same a car).	Desirable 25 Neutral 23 Undesirable 38

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