Boiler alert

Addressing the challenges and trade-offs from the decarbonisation of home heat

Richard Hyde
Amy Norman

SMF Social Market Foundation

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ABOUT THE AUTHORS

Richard Hyde

Richard joined the SMF in August 2019 as senior researcher. Before that he was a Senior Policy Advisor at FSB (Federation of Small Businesses) with responsibility for a diverse range of small business policy issues including the small business regulatory environment, data protection and cyber security, crime and civil justice. Prior to FSB, Richard was a Policy Officer at the Law Society of England and Wales. He has also held policy and research roles at Which? and the Small Business Research Centre (SBRC) at Kingston University.

Richard holds an LLM in law from the University of London and an MA in Global Political Economy from the University of Hull.

Amy Norman

Amy joined the SMF research team in April 2020. Prior to joining, Amy worked at an education charity advising on the delivery of the free schools policy and challenges across the academies sector.

Amy holds a MSc in International and Social Public Policy from the London School of Economics and Political Science and a BSc Hons in Sociology and Anthropology from Oxford Brookes University, where she conducted social research on wellbeing econometrics, school choice and economic migrants.

ABOUT THIS REPORT

This document is based on a roundtable event hosted by the Social Market Foundation in July 2020, as part of the Net Zero project we are undertaking in partnership with ScottishPower. These events, held under the Chatham House rule, bring together senior policymakers and experts in climate policy and other sectors and policy areas. The names of those attending are private, but attendees included members of the Government and parliamentarians from multiple parties. While this paper reports some of the views expressed at the event by attendees, the conclusions and recommendations made here are those of the SMF authors alone. This report also draws on desk research and a consumer survey commissioned from Opinium as part of this study.

CONCLUSIONS AND POLICY RECOMMENDATIONS

Decarbonising the home will take a collaborative and sustained effort from several actors across industry, regulators and the public with shared responsibility to achieve Net Zero by 2050. However, ultimately, the legal obligation of reducing emissions falls on the Government to deliver, therefore urgent measures must be taken to kickstart the market of home heat.

Leadership from the centre - The Government needs to take a national leadership role, working with devolved administrations, to increase public awareness, give confidence to business, and support the development of a low-carbon home heat market for consumers. Leadership efforts need to step up in the next year or so, if the extensive changes that the Government wants to make are to be delivered in a timely manner.

A clear national roadmap - Part of the Government's leadership on Net Zero and de-carbonising home heating needs to involve setting out a clear national roadmap for achieving the objective.

This roadmap should contain milestones including a date for the **mandatory phaseout of natural gas boilers**, in order to give consumers and suppliers certainty about future demand and supply. However, this transition should be **conditions-based**: before ministers move to prohibit the installation of natural gas boilers, they must ensure that the country is ready.

Conditions for beginning mandatory phaseout

- **Higher public awareness of the Net Zero concept** - Our polling finds that around two-thirds of people have limited or no knowledge of the concept, and many who do recognise the term cannot correctly recognise its meaning. Any policy requiring significant change and cost in voters' homes in the name of Net Zero is at risk of encountering significant resistance if Net Zero is not better understood.
- **Higher public awareness of home heat's role in Net Zero policy** - Beyond the limited awareness of Net Zero, more than 30% of the public are not familiar with alternatives to conventional gas heating, and 30% say they "don't know enough" to offer a view. Although two in five respondents in our poll supported mandatory "switchovers", we are concerned this support rests on fragile foundations that must be significantly reinforced before such a phaseout begins. A marketing campaign would inform consumers of the potential benefits for themselves and the environment of "switching" to alternative heating systems, including the promotion of industry leading certification schemes such as the Microgeneration Certification Scheme (MCS).
- **Commitment to a comprehensive package of financial support to help low-income and vulnerable households with the upfront costs transitioning to low-carbon heating systems** - The Government should continue to evaluate the effectiveness of current grant schemes (such as the Renewable Heat Incentive) and consult on ways to help poorer households finance the transition to alternative low-carbon heating systems. Schemes should avoid being designed as technology specific as not to bar access for ineligible households.

- **The establishment of local-level plans showing each area's suitability for different forms of low-carbon heat** - Technological solutions to the challenge of low-carbon heating will vary predominantly by geography. The Government needs to set a timetable for the development of local energy strategies led by local authorities in partnership with relevant organisations, such as housing associations. Plans should include commitments by local authorities and obligations on housing associations to convert their own buildings and housing stock to stimulate local demand for local installers. Additional and specific funding would be required to ensure the integration of decarbonisation within local planning activity.
- **A framework for building a trusted market with guaranteed protections for consumers and greater certainty to industry** - A "transparency guarantee" would enable consumers to make informed choices with consumer-friendly independent guidance available through trusted sources (such as the Energy Savings Trust (EST) and Citizens Advice). A consultation on current installation standards, such as those of the MCS and relevant performance standards, should also be undertaken to identify where new rules might improve the minimum standards in the industry. Such standards would give confidence to providers and help build trust among consumers, helping dispel scepticism about the product offering.[1]
- **Direct stimulation of demand by mandating the conversion of all government buildings to alternative heating systems** - Such a move would have a stimulatory effect on the market, initially helping to guarantee a minimum demand level and incentivise investment and expansion. It will require the Treasury to make funds available to the relevant departments and agencies to enable it to happen. This conversion will also help raise public awareness, creating a "model" for the transition and installation of low-carbon heat technology. The House of Commons, for example, should be a priority for a Government committed to achieving Net Zero and would demonstrate clear leadership.

Paying for it

The Government must decide and communicate its strategy for meeting the cost of transitioning UK households to low-carbon heating systems. Policymakers should consider:

- Allocating costs in a progressive way to avoid allowing undue costs falling on low-income or vulnerable households and/or those who cannot afford or access the low-carbon heat market. **Learning from previous green energy policies, policymakers should find revenue to support low-income households through general taxation, rather than levies on energy bills.**
- Encourage more novel green financing solutions to develop a mixed approach to the financing of the roll-out of alternative home heating systems over the medium to long term.[2]

CHAPTER 1 - INTRODUCTION

Decarbonising home heat presents numerous significant challenges to delivering the Net Zero agenda at scale and urgently.

Over the past decade, the UK has been successful in reducing its greenhouse gas emissions faster than any other G20 economy, largely due to the decarbonisation of the power sector.[3] Despite significant progress nationally, the buildings and domestic heating sector has received far less public and political attention; consequently, it has struggled to keep pace with the rate of decarbonisation across the rest of the economy.

Energy use in homes accounts for about 14% of UK greenhouse gas emissions with an additional 6% attributed to electricity consumption in homes. By 2030, home emissions need to have fallen by at least 24% from 1990 levels to be on track to meet the 2050 target; however levels[i] rose between 2016 and 2017.[4] Thus far, the majority of emissions reductions from this sector occurred prior to 2015 as a result of EU standards and condensing boiler regulation. Limited domestic policy has left the low-carbon home heat market under-developed and ill-equipped to meeting Net Zero targets without meaningful policy action.

The scale of the home heat challenge is huge – just 7% of homes in the UK currently have low-carbon, electric heating while nearly 85% (24.5 million homes) are heated by natural gas.[5] A near-full decarbonisation of heat will require replacing gas boilers at a rate of nearly 1 million a year. Yet, the Committee for Climate Change (CCC) places current UK deployment below 30,000 heat pump units a year, just 2% of annual boiler replacement sales.[6] Transitioning heating systems to low/no-carbon alternatives also requires mass-disruption and cost to millions of homes over the next few decades; therefore, designing fair funding policies will be critical to keeping public support for home decarbonisation and thus the Net Zero agenda.

In July 2020, the Social Market Foundation hosted a roundtable with politicians, policymakers, green energy experts and industry professionals to discuss the challenges facing the decarbonisation of home heat in the UK. A consumer survey was also commissioned from Opinium as part of this study, using a nationally representative sample of 2,004 UK adults from 20th to 24th March 2020. This report summarises the key themes that emerged from the SMF roundtable in the following chapters.

- **Chapter two** - explores the current state of public understanding of Net Zero and attitudes towards alternative home heating systems.
- **Chapter three** - identifies the challenges facing industry leaders with a concentration on home heat technologies and developing the supply chain.
- **Chapter four** - explores the challenges and experiences of different consumers, focusing specifically on different tenure types and vulnerable households.
- **Chapter five** - describes the role of the Government in supporting the UK's transition to low-carbon household heating and identifies specific ideas proposed by contributors for policymakers to consider as they develop the policy framework.
- **Chapter six** - explores policy options for funding home heat decarbonisation fairly.

[i] Annual temperature-adjusted emissions from buildings.

CHAPTER 2 - PUBLIC OPINION

Public awareness of Net Zero

The UK Government's Net Zero policy objective implies a considerable amount of disruption for the public and the economy as a result of the changes in lifestyles, adaptations to property (e.g. buildings, vehicles, etc), energy infrastructure and business models, that will be needed to bring about the end goal.[7] One roundtable participant posed the fundamental question:

> *"...how do you get people to accept that this is an important societal thing to do?".*

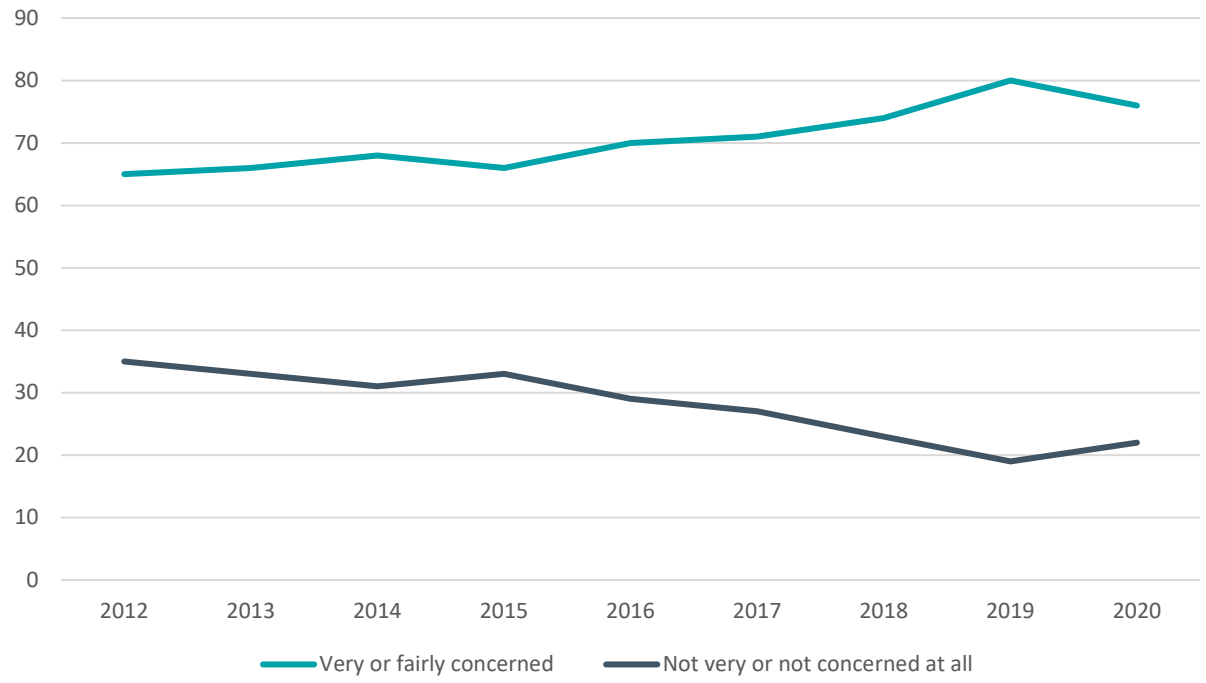
He went on to suggest that:

> *"...it is a dance between public opinion and political acceptance...".*

There was consensus among attendees that successful achievement of the Net Zero ambition is going to require high levels of public support. Building and sustaining such levels of public support will not only require the public to be aware of the existence of the Net Zero objective but to understand what it means and why it is considered important.

Data published by the Department for Business, Energy and Industrial Strategy suggests that, currently, concern about climate change is high among the British public. Figure 1 shows the trend in the levels of concern about the issue, over the past eight years. The relative consistency in the proportion of the public professing to be worried about climate change suggests that the public is likely to be sympathetic to policies aimed at tackling it, such as the Net Zero ambition and the measures needed to deliver the latter.

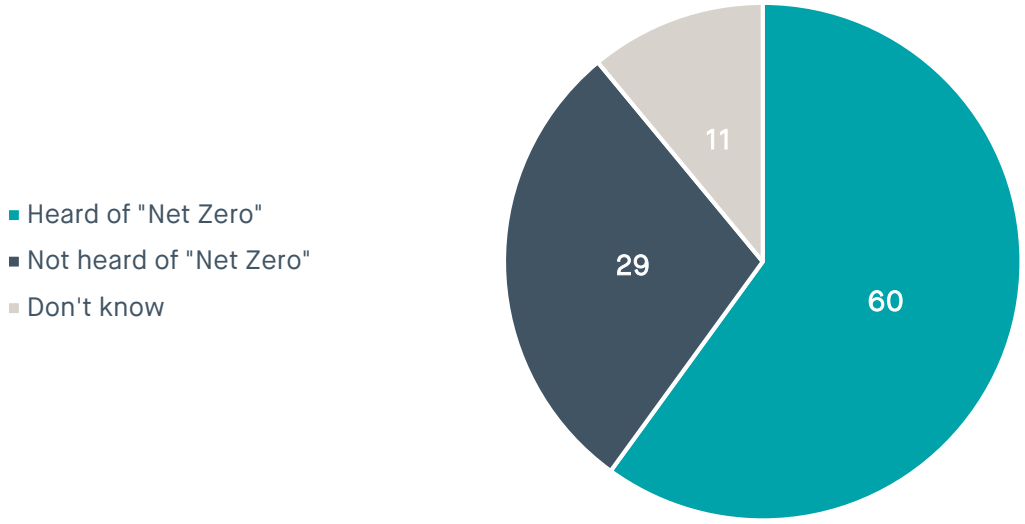
Figure 1: Concern about climate change (%)



Source: BEIS

Further, a majority of the population are aware of Net Zero as Figure 2 illustrates, with a clear majority of respondents recognising the term.

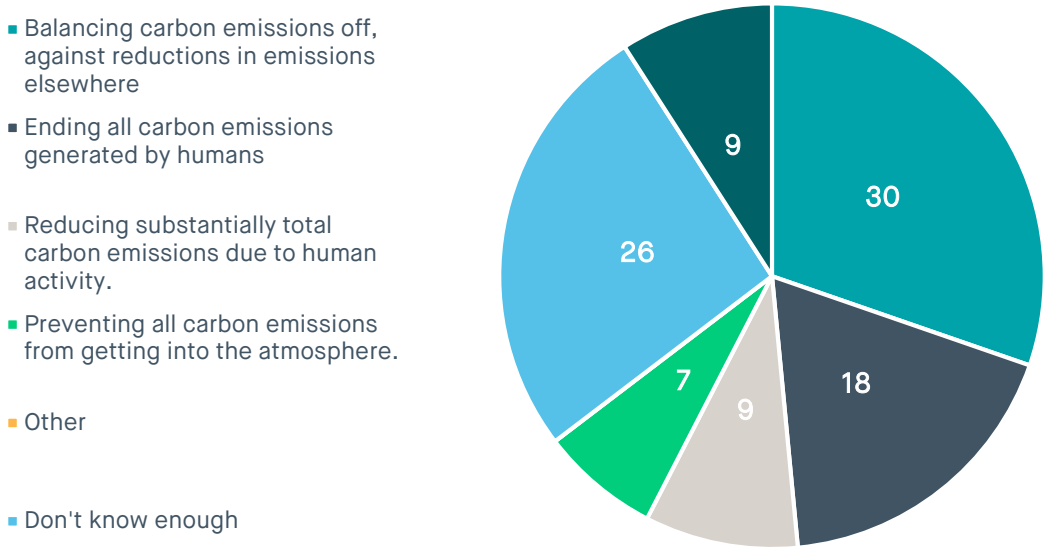
Figure 2: Proportion of people who have heard of the Net Zero objective (%)



Source: Opinium

Research published by BEIS earlier this year found that nearly two-thirds (63%) of people had heard (with varying degrees of awareness) of Net Zero.[8] However, recognition of the phrase among the public, does not translate into a clear understanding of what it means, as Figure 3 illustrates. SMF-commissioned polling showed that only a third of respondents were able to select the most accurate explanation for Net Zero from a list of options. The second most frequently selected option (26%) was people saying they "did not know enough" to be able to say with any certainty what the phrase meant.

Figure 3: Public understanding of Net Zero (%)



Source: Opinium

On the one hand, relatively high levels of awareness and professed support for Net Zero are likely to be seen by the Government as encouraging. Survey evidence from Citizens Advice suggests that there is considerable "good will" towards the ambition of Net Zero, with around eight in ten people surveyed professing support for the Net Zero target.[9] Although, with limited understanding of Net Zero among the public, there is a long way to go before policy-makers can reliably claim to have solid public support for the kinds of disruptive and costly measures (at least in the short and medium-term) needed to achieve Net Zero – as highlighted in the SMF's earlier report of this series.[10]

Public willingness to take measures which reduce household energy use

Understanding of the contribution of home heating to CO2 emissions

While understanding of Net Zero is not widespread across the UK population, several participants in the roundtable highlighted how understanding of the size of the contribution of home heating systems to the UK's carbon-dioxide emissions, was likely to be even lower. One contributor noted that:

> *"From the polling I've seen...people don't seem to correlate that basic fact... [that gas boilers contribute to climate change] ...which suggests we need...to really explain to people how lifestyle choices and different technologies in their life contribute to the problem."*

Another concurred:

> *"There is limited public understanding of the consequences of heating on carbon emissions, gas and climate change. Even though many people want to do the right thing and are aware of climate change and the challenges it imposes, they don't know much about what causes climate change – regarding greenhouse gas emissions and the fact that their own boilers and heating systems contribute to this".*

Public willingness to make changes to homes to reduce carbon-dioxide emissions

Opinion research conducted for the SMF roundtable focussed, in-part, on the public's willingness to take practical steps to reduce carbon dioxide emissions associated with energy use by households. Figure 4 sets out the findings from the survey.

Asked about their willingness to make adaptations to their homes to cut energy usage, most respondents said they'd either "already taken measures" to reduce their home's use of energy, were "definitely willing to take measures" or were "open" to doing so.

More than one in ten survey respondents had already had their existing insulation upgraded or new insulation added to their property to improve its energy efficiency. A similar proportion had upgraded their windows for the same reason. Nearly 30% had installed a SMART meter to help them keep track of their energy usage. Very few survey participants reported having had an alternative to their traditional gas boiler installed.

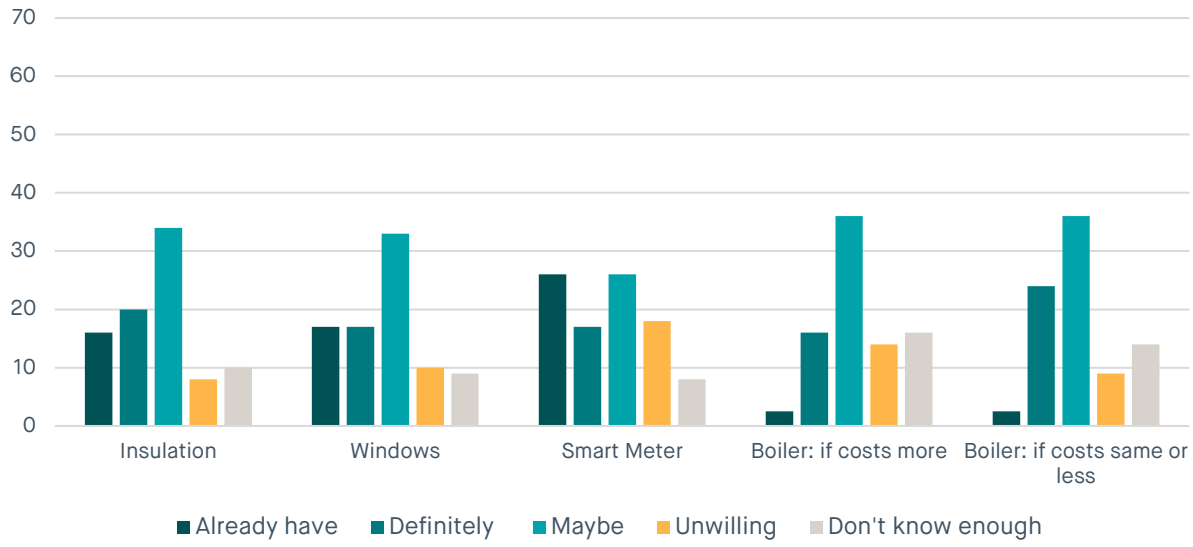
Between one in seven and one in four respondents said they would "definitely" be willing to have better insulation installed; upgrade their windows; have a SMART meter installed; or buy and install a low-carbon alternative to a traditional gas boiler. Conceivably, then, over half of the public are willing to invest in at least one energy efficiency measure, based

on the proportion of respondents who said they would be either “definitely” or “maybe” willing to install new or upgrade existing measures. This represents good news for a Government trying to increase uptake of energy efficiency measures.

Notably, the proportion of those saying they were "definitely" willing to purchase a low-carbon (alternative) heating system fell by 8% when the likely cost of such a system was higher than a traditional gas boiler. The proportion of those respondents explicitly "unwilling" to switch to a lower-carbon alternative increased by 5% if the cost was expected to be higher. Across all the energy efficiency measures respondents were asked about, there was a proportion who were “unwilling”, under any circumstances, to take new or upgrade existing energy efficiency measures in their homes:

- Nearly one in five respondents said they would be “unwilling” to have a SMART meter installed.
- 14% of respondents said they would be “unwilling” to have a low-carbon heating system installed if the cost is greater than that of a gas boiler.
- 9% say they would not be willing to have one installed even if the low-carbon alternative cost less or the same as a traditional heating system.

Figure 4: Willingness to take actions which increase household energy efficiency: insulation, windows, "Smart Meters" and boilers (%)



Source: Opinium

The "highly reluctant" minority, identified in the survey data, was a group familiar to several of the roundtable contributors. One participant, who had been involved in trying to persuade tenants in social housing to switch their boilers to low-carbon alternatives, explained his experiences with the "highly reluctant":

> *“The standard policy when it comes to the end of life on oil boilers is …to pay for and replace it with a heat pump and retrofit [the home] to match the system, but there is a significant proportion of people who don’t want that for various reasons…[we]…struggle to ‘convert’ many tenants in social housing to greener alternatives like heat pumps – about a 20-30% refusal rate from those on oil boilers. Some tenants are unwilling to accept the work that needs to be done*

> *despite not needing to pay for it. Some reasons are rational e.g. people afraid of the cost of systems. Some are irrational: people do not like change, simply put".*

Another participant highlighted how:

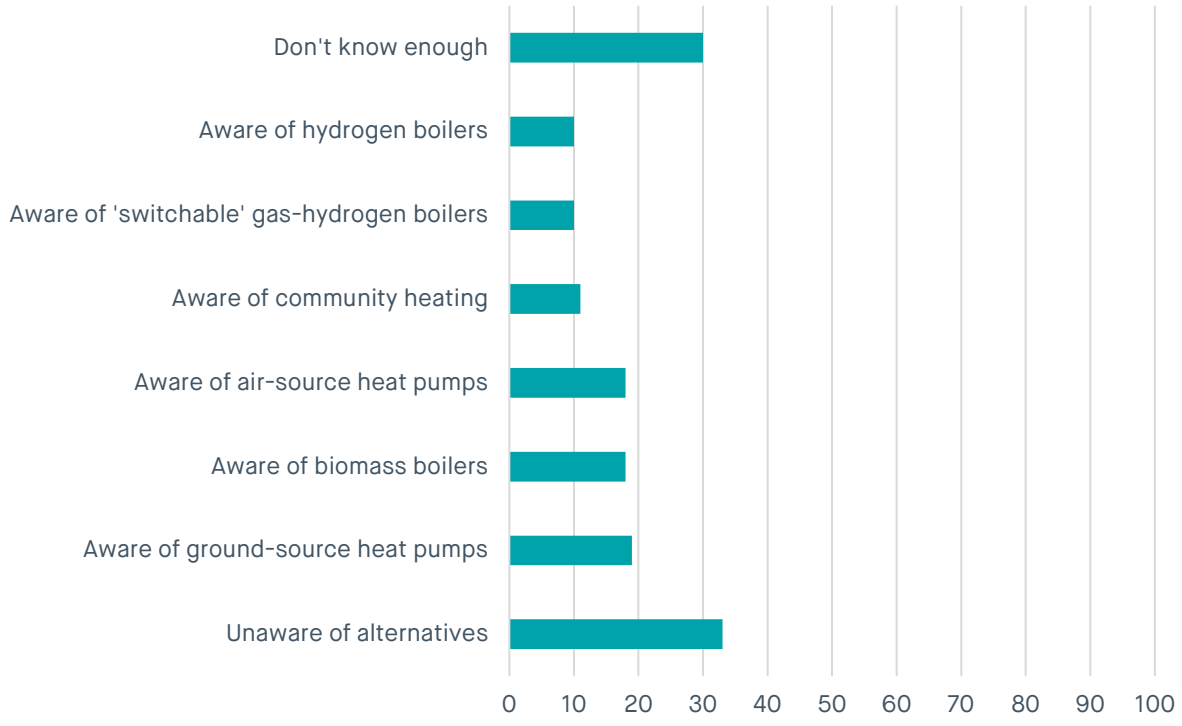
> *"Knowledge of normal heat pump retrofits is limited…[it]…has been a struggle trying to convert some [residents] off traditional oil boilers and they're not engaging…".*

Others at the roundtable discussion noted that refusal even occurs in circumstances where there are similar levels of disruption, running costs and zero installation costs (to the tenant) between a traditional gas boiler and a low-carbon alternative. It was suggested that this reluctance, in-part, stemmed from a lack of knowledge, and therefore insufficient trust, in the alternative technologies.

Public understanding of low-carbon heating systems

If the take-up of alternative heating systems is to grow significantly, the process of growth has to begin with awareness of their existence among consumers, followed by an understanding of their potential benefits, and ultimately, a ready market able to supply what consumers want. Figure 5, below, shows the extent to which members of the public are currently aware of low-carbon home heating alternatives to the traditional gas boiler.

Figure 5: Awareness of alternative (to traditional gas boilers) low-carbon heating systems (%)



Source: Opinium

The results presented in Figure 5 confirm the point (quoted above) made by one of the roundtable participants; awareness about alternatives such as heat-pumps is low among the general public. The alternative heating system that had most recognition among the public was "Ground-source Heat Pumps". Closely followed by "Biomass boilers" and "Air-

source Heat Pumps". However, none of the alternatives presented to survey respondents was known by more than one in five of survey sample.

Consumer decisions are inherently social. In addition to more traditional factors like price, other factors such as personal networks and the "social milieu" within which an individual is situated, all influence purchasing decisions. Consequently, phenomena like "social proofing"[ii] can often play a role in increasing take-up of some products especially unfamiliar ones, which low-carbon heating system might be considered to be. Consumer behaviour also has a tendency towards the familiar with consumers often displaying considerable inertia in their consumption patterns. Therefore, it is perhaps unsurprising that in the context of low levels of awareness about alternative heating systems, heating being a necessity and potentially considerable upfront costs and disruption, that some people are suspicious (as observed by some roundtable attendees) of "taking the leap" and adopting a different and (to the overwhelming majority of households) un-tried heating technology.

[ii] "Social proof" was a term coined by psychologist Robert Cialdini. It describes the phenomenon of people copying the actions of others.

CHAPTER 3 - INDUSTRY

The roundtable also included industry leaders in energy, offering their expert opinion on the supply-side challenges of decarbonising home heat. Most contributors were of the view that currently, industry is not prepared for the significant deployment of low-carbon technologies needed to meet Net Zero targets, but that this in part is due to lack of clear direction and signals from government to the market. This chapter explores some of the recurring challenges raised by contributors, such as the right technology and developing the supply chain.

Technology

The technology for decarbonising home heat is far from homogenous. There are a range of low-carbon heat sources that will contribute to the transition away from traditional oil and gas heating, such as electric heat pumps, direct electric heating, hydrogen, bioenergy and heat networks.[11] The local asset infrastructure, housing stock and weather of an area will influence which low-carbon technology best suits its households – whether that is household-level deployment of heat pumps or restructuring local energy and heat delivery networks. A Government representative at the roundtable was clear that a mixed technology approach would be most effective, contributing that:

> "it's not a question of either or [technology]. We've got a country today where 85% rely on natural gas, we're not going to get complete electrification in 30 years. Electrification is an important story but so is decarbonising the gas network itself, so it's a question of both."

Most roundtable contributors were of the view that the road to Net Zero will be facilitated by a mixed heat economy, not only due to geographical, technical and occupancy differences but also because of the scale and urgency of the challenge. One contributor echoed this viewpoint, noting the significant scale of the home heat challenge if it were reliant on a single technological solution:

> "If you decide *[heat pumps are]* the only technology you should use, then to get us from where we are today to 2050, *[we estimate*] you would have to install twenty-three million heat pumps. If you strip that down, that is three thousand a-day, every day, from now until 2050."

With over 24 million UK homes currently using gas boilers, a mix of technologies will be necessary to transition to low-carbon alternatives by 2050. The CCC calls for electrification as the primary route to zero-carbon heating systems with supplementary roles for hydrogen and regional or network solutions.[12] Some contributors were of the view that the government should send clear market signals on prioritising certain technologies to secure business confidence and encourage investment in innovation, manufacturing and deployment.

While other contributors agreed policy intervention was necessary to develop the supply chain, they cautioned industry from delaying action in lieu of clear government signals. The scale and urgency of the home heat challenge will not permit further delays; contributors suggested that industry leaders should identify what areas of the market could see faster and more definitive action and *"be a bit more ambitious on heat pump*

deployment in off-gas grid areas where there isn't hydrogen potential". Similarly, another contributor added:

> "the issue will always be, how far do you want to go down the electric heat pumps road or how much do you want to wait and see if the hydrogen answer works and build that network? But there are a lot of unanswered questions. We need to keep pushing the electrics for now and if hydrogen comes along, great, but you can't risk waiting for it. We need to drive this transition and get the cost of electric heat pumps down as quickly as possible."

Overall, contributors expressed the sentiment that while product innovation is still needed to develop an exciting, low-cost, high-quality market, both government and industry should not delay action for confirmation of a "winning" technology.

Supply chain

The current state of the domestic heating market is underdeveloped, with varied consumer experiences. To date, adoption of low-carbon heating technologies has been sluggish with deployment rates now lower than their peak in 2014/15.[13] Furthermore, evidence suggests the supply chain has contracted with 16% fewer Microgeneration Certification Scheme (MCS) accredited installers of heat pumps compared to 2011.[14]

For the low-carbon heating market to succeed, roundtable contributors agreed on the need to develop the supply chain from end to end. Changes to the market will need to be policy-driven and iterative to make the most efficient use of capital in the time available. Successes and failures on one side of the market should quickly inform policy for the other side; overstimulating demand without a skilled workforce in place to implement home changes could risk damaging long-term public buy-in. Similarly, policymakers will need to be cautious of investing in training workers where demand has not yet developed to provide work for them. One contributor summarised this stating:

> "Giving certainty and standards [to empower consumers] is important but we need to be aware that the skills base has a long journey to go on."

Currently, there is not a large enough pool of workers with the skills to carry out a full home heat decarbonisation offer. Another participant also attributed the market slump to skills:

> *"There is a skills issue getting in the way of progress. Previously, [my employer researched] the small but growing set of skilled people who are the alternative to the traditional supply chain and construction. [We found that] the traditional supply chain was relatively low-skilled, atomised and did things it was used to doing – while there's a small and growing set of people who can do this whole house approach, it's too small at the moment."*

Developing the supply chain will require a cross-departmental approach, linking in the Department for Education for skills and training policy and perhaps apprenticeships. Regen estimates there are over 135,000 registered gas engineers in the UK who are well-placed and could be mobilised to move 1.5 million homes a year onto low-carbon heating.[15] Beyond reskilling existing traditional engineers, policymakers should look to create jobs and develop a new workforce as part of a green recovery from COVID-19.

Clear leadership from Government is essential to reduce some of the uncertainty currently holding industry back from investing in the technology, recruitment and training needed to undertake the transition from conventional gas boilers to alternative systems.

CHAPTER 4 - CONSUMERS

Conversely, developing the low-carbon home heat market also requires a kickstart to the demand-side. The consumer experience of decarbonising home heat will be critical to ensuring the long-term political stability of the Net Zero agenda. This chapter explores the varied consumer experiences of decarbonising the home, from the responsibility of project managing to the role of landlords and protecting the vulnerable.

Consumers as project managers

One attendee of the roundtable raised the important issue of the technical complexity of making the changes to a home that are required to achieve the full carbon dioxide reduction benefit for the country.

That complexity comes in-part because replacing a gas boiler is not necessarily the simplest task. However, complexity is increased by the desirability for complementary energy efficient improvements in homes too, which will maximise the possible household financial savings for those who change their heating system. This contributor noted:

> "...on the heat side, there's not enough to the equivalent of getting a loft conversion, which is relatively straightforward – you don't have to be your own project manager as you do with heat decarbonisation".

The current market conditions place the onus of transitioning on the consumer to project manage their own low-carbon heat offer across multiple suppliers from the initial planning to installation. This planning and installation complexity can easily act as a further disincentive beyond having the right information and understanding the pros and cons of "switching". These additional "transaction costs" might, for some, keep the balance tipped against changing and the demand-side smaller than it might have been. One attendee contributed:

> *"Getting some of the big [industry leaders] to say, 'we're going to sort out your full heat offer' might be the demand-pull that develops the supply chain further, but that will take time to do."*

Another contributor concurred:

> *"An easy and simple market of products with an easy consumer journey is very important. [The market needs to] get to the point where [a consumer] can go online and book [a low-carbon installation]."*

Relying on individual consumers to organise full decarbonisation plans is unsustainable and insufficient for the scale of the decarbonisation challenge at hand. A blended approach of Government-enabled market conditions and industry-led innovation is needed here to ensure consumers have an easy and untaxing experience.

Lessons from SMART metering

Participants in the roundtable were conscious of learning from the SMART meter programme while acknowledging some of the differences between SMART meters and transitioning households to low-carbon heating systems. For example, the scale of the latter is much greater than the former. Consequently, participants suggested that now

there is a greater imperative to gain public consent for the policy objectives and measures considered necessary to achieving Net Zero. One attendee noted the specific lesson that policymakers should take heed of:

> *"Smart metres are very different – they are just a box with a digital infrastructure behind it. It's not the same as external cladding or a heat pump, but at the same time it suffers from the same issue of a multiplicity of actors that you have to deal with for information and installation."*

Rented sectors

The changing landscape of housing tenure in the UK means that a significant challenge for decarbonising home heat will increasingly fall on landlords as consumers. Transitioning to low-carbon alternatives poses challenges for owner-occupiers from handling the installation process to financing costs however, they will also benefit from lower energy bills and potentially higher property values over time. In the case of landlords and renters, responsibility for transitioning is reliant on a less direct relationship between investment and returns.

While private and social landlords face their own unique challenges, representatives from both sectors expressed the view that government needs to quickly indicate what the long-term goals are. Whether that is amending Energy Performance Certificates (EPCs) or gas boiler phaseouts, landlord contributors were of the view that dated standards are needed to allow for effective planning and financing and to avoid investment in technologies that will need to be replaced. Facing the challenge of decarbonising 85% of their housing stock, the housing association in attendance noted that greater innovation and awareness of different low-carbon technologies would inform government goals and industry transition plans respectively. This contributor noted:

> *"[There's a need to] pursue an innovation-based approach to try stuff that works because [the right approach] is currently unknown across the diversity of building types that we have that exactly fit what we are trying to do. […] A key issue is setting out targets for energy efficiency [… and] combining low-carbon and retrofit together."*

Private landlords

Over 4 million households in Britain rent in the private sector, but less than a fifth of these homes are let by landlords with five or more properties. Where social landlords need to plan for decarbonising large concentrations of homes, nearly half of private landlords own just one property. This poses a range of different challenges on an individual level of procuring technology and installation services as well as on a market level to ensure accelerated and effective transition.[16] Contributors noted the current reality of the boiler replacement decisions for private landlords stating that:

> *"A landlord has a legal duty to provide heating to a property – the cheapest option is normally the one taken as the purchase is often a distress purchase like the tenant saying the boiler is broken."*

In order to plan and finance transitioning the housing stock, contributors emphasised the need for government backed long-term goals. Contributors noted that in order to build

progressive and sustainable plans, government and regulators should consider 'building roadmaps' for each property with an end date (2035) including no regrets policy on property advancement. One contributor shared:

> *"Landlords need to know what the correct order that improvements should be done. […] They all know they had to hit an EPC E this year, but after that they don't really know the direction, so they just do the minimum. There is a shortage out of there of what to do and when to do next."*

Drawing on an industry survey of around 80,000 private landlords, a contributor stated that *"most haven't got a clue about what to do and where to go".* Consequently, one contributor expanded on the potential for roadmaps whereby a logistical programme of work is established for making properties energy efficient and low-carbon modelled on building archetypes at a local level. These archetypes could then inform 'building passports', a bespoke plan for each individual property. A contributor from the private rented sector explained further:

> *"What we have suggested is having passports…an assessment of properties and then a passport to go with that property which sets out what can be done to that property and when it should be done and what order to do things. That enables landlords to know where to go and understand the cost and help them decide whether to stay in the sector or leave. They need to know what to do…it's the biggest challenge we've got."*

Additionally, this contributor noted that building passports could support the green recovery from coronavirus through job creation:

> *"A building passport would help people get to an [EPC rating] A and stimulate short-term job creation by having the people to actually go out and assess properties."*

Building passports would allow landlords to make informed investment choices on the cost of improvements and understand the scale of disruption necessary to decarbonise their property. A private rented sector representative contributed during follow up comments:

> *"There is a risk to properties that have a value of under £100,000 with improvements potentially costing up to £35,000. How much are landlords going to be expected to invest in properties – is it to be a percentage of the value of the property or an actual figure. A cost cap needs to be developed and [communicated] with lenders. […]*
>
> *"There needs to be a fair process taking into account relative property values, and access to additional funding for those who need it to avoid properties becoming worthless, unlettable or creating fuel poverty at a large scale with the move to electric heating."*

Equipped with this knowledge, there is a risk that some private landlords may choose to leave the sector, which could alter the tenure landscape and delay the transition of lower-valued properties. Alternatively, they may choose to offset these costs through higher rents, which could have strong negative implications for low-income renters in the private sector.

This could lead to a growing gap in the market between low-carbon and gas-heated homes, where the former sees a 'green premium' reflected in the property value. To date, such a premium has not developed in the market, however one contributor noted that the point of sale of a property should be the moment for intervention and therefore, a green premium should be reflected in property taxes:

> *"It will become a mixed heat economy which will be complicated. Should we not be including in EPCs whether homes are climate enabled so that it becomes a certification and we can start linking it over a long time to stamp duty to build clarity. At the point of sale and the point of purchase is when you're much more likely to make these investments and disruptions [to your home]. […] While [the policy] would only covers homes within the stamp duty eligibility, it would start to build a supply chain that markets itself to those lower income households.[…] If we reduce the base of demand by optimising our properties and ensuring we're using less, we actually reduce the overall systems cost."*

Policymakers should carefully consider the implications such a policy would have on lower-income households across all tenue types. The political risk of linking low-carbon heating to property values will depend on how decarbonisation costs are funded (such as through energy bill levies or regressive carbon taxes); public resistance to Net Zero could rise if it is perceived that low-income households were in part funding the transition of wealthier homes without access to affordable improvements.

Social landlords and housing associations

Across all tenure types, the social rented sector already benefits from stronger regulation (Decent Homes Standard) and thus more energy efficient homes.[17] Furthermore, the size and governance arrangements of many housing associations make the sector well primed to support decarbonisation at scale. One contributor from the sector said:

> *"There are a lot of ready and willing housing associations who are ready, standing by to [decarbonise], have programmes of work and contractors who are engaged. From a stimulus point of view, that is the good news."*

Yet, despite this, the same contributor noted a level of uncertainty across the sector about how to approach long-term decarbonisation plans:

> *"The only thing that is clear is that the pathway to Net Zero is very unclear. What do we need to do now to prepare ourselves for a significant transition in a five to ten-year period?"*

The emphasis of this uncertainty across both rented sectors and industry poses a real risk of continued delayed action of decarbonising home heat unless the Government indicates a clear roadmap with a set of expected outcomes and standards that landlords should meet to give them the confidence to bolster the nascent market.

The central issue to the social rented sector is the cost implications of decarbonisation for their lower-income tenants. Once contributor said:

> *"What is the target of affordability for the lowest quartile income occupants. What should they be expecting to spend as a proportion of their income on energy and heat? That's a key issue for us in terms of what package of measures or targets*

should we be setting for energy efficiency. [How does the] cost of hydrogen energy [differ] to the price of natural gas? There is nothing clear yet. What is clear is what is affordable for the most vulnerable."

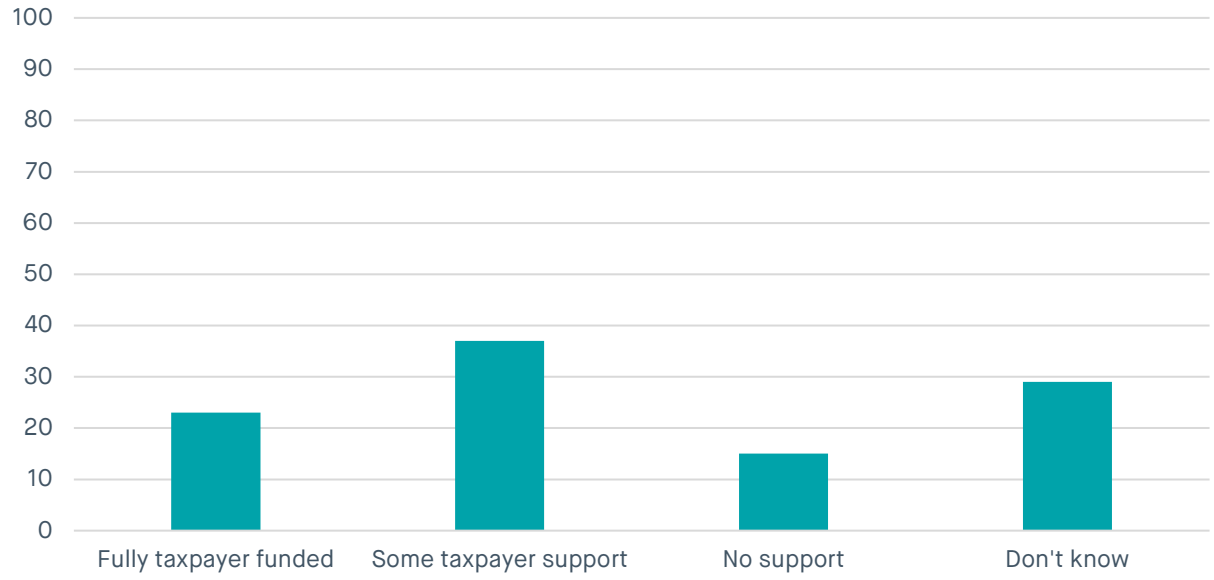
Ensuring there is targeted support for vulnerable and low-income households will be central to the challenge of decarbonising home heat.

Support for the vulnerable

Greater energy efficiency in tandem with low-carbon heat technologies will in most cases lead to lower energy bills over the long-term;[iii] however, retrofitting the home requires a significant upfront cost estimated at up to £15,000.[18] While the cost structure of decarbonisation and energy efficiency depends on the chosen or available method (heat pumps, hydrogen or networks) for a given household, substantial funding support will be needed to ensure undue costs of installation do not fall on those who cannot afford it.

Data from a survey of members of the public suggest that most people in the UK consider it reasonable to provide some support for poorer households to cover the costs of replacing their gas boiler system, with an alternative when the former comes to the end of its "operational life".

Figure 1: Measures to help poorer households transition to alternatives to traditional gas boilers (%)



Source: Opinium

Comfortably over half of respondents supported providing, at least, a degree of support for the poorest households. Specifically, 23% favoured fully subsiding the costs for poorer people of installing an alternative heating system. While 37% supported offering some taxpayer funded support to help the poorest replace their traditional gas boilers at an appropriate time. Only 15% consider that no support should be given. Given the urgency and financial scale of transitioning to low-carbon heating alternatives, the Government

[iii] Excluding the potential additional cost of consumer levies on energy bills.

should consider what comprehensive package of financial support could be provided to low-income and vulnerable households, whether through grants or schemes.

Furthermore, when developing the supply chain, regulators and industry leaders should aim to ensure that standards for heat offers are consistent across the market to create fairness across all consumers, with further government for low-income households. One participant noted their research findings on the consumer experience of previous green technologies:

> *"the consumer experience of smart meters has been quite mixed. The difficulty is that you get different responses based on the company or network provider about what costs are included in the retrofit. Fairness here is worth exploring."*

Policymakers and regulators should consider how they would ensure consumer protections for a fair consumer experience, while similarly encouraging competition within the market to drive down the cost and increase the quality of home heat technologies.

CHAPTER 5 - GOVERNMENT AND REGULATORS

Most contributors to the roundtable were of the view that the Government must have a central role in leading the public and industry towards seeing the importance of and achieving the Net Zero target by 2050. The consensus among roundtable attendees was that the role for the Government should embrace several components:

- First and foremost, it was argued, should be leadership. This should include the setting out of an unambiguous roadmap to get the UK to its home heating decarbonisation objective and ultimately help deliver the Government's Net Zero aim.
- Secondly, it was suggested by many of the attendees at the roundtable, that government should take steps to help stimulate the market in alternative home heating systems through public policy measures. Such stimulation should involve efforts to help consumers (e.g. homeowners, landlords, etc) become better informed about Net Zero and alternative home heating systems and improve the incentives faced by households and industry in order to help overcome the kinds of challenges outlined in the "Industry" and "Consumers" chapters of this report.

Leadership

A common sentiment among roundtable attendees was that appropriate leadership is the prerequisite for achieving the Government's Net Zero ambitions. Specific policy measures, it was argued, will only gain traction and ultimately a vibrant market for alternative heating systems will only develop in the context of clear leadership.

Setting out the big picture

As previously stated, there was a sense among some at the event that industry couldn't move forward with confidence until the end goals - and framework needed to deliver the end-goals – were more clearly established. Such a move would create more certainty about the route forward for both industry and consumers, providing a foundation on which to plan and invest. As one participant said:

> *"We need to be clear about the destination and the dates at which we will arrive at that destination so we can start ramping up the supply chain and certainty in business investment".*

Participants were clear that, in addition to the supply side (i.e. industry), the demand-side (i.e. consumers such as households or landlords) needed to become more aware of and have greater clarity about how the future of low-carbon household heating systems is likely to unfold and why. Roundtable attendees argued that that the Government is best placed to lead in helping ameliorate these informational deficiencies. As the following extracts from the roundtable discussion show:

> *"[Net Zero] is a big public policy problem and cannot be solved without public buy in. The prerequisite for doing this is clear messaging and leadership from the centre".*

Another added:

> *"Government has to take a lead, educate people and have a dialogue. At the moment, consciousness is quite low, but things need to get a bit clearer and inject some urgency.*

Encouraging take-up

As part of its leadership role, several contributors suggested that the Government could and should get more deeply involved in driving-up the take-up of alternative heating systems. Measures which, to varying degrees, would help "stimulate and shape the market" for low-carbon heating systems were discussed by participants.

Mandating low-carbon heating systems

One potential intervention would be to mandate the "transition" of UK households and commercial and other types of properties over to low-carbon heating alternatives. As one contributor stated:

> *"One way is to interfere with crude mechanisms, - you set a date and you outlaw the fitting of a gas boiler and you bring that date forward..."*

This option was not universally popular however, among roundtable participants. However, "mandation" was more popular than might be expected among the public. The representative survey carried out to help inform the roundtable discussion on which this report is primarily focussed suggested that four in ten of the public would be happy with the Government mandating the installation of low-carbon alternative heating systems, over a period of time. As Figure 8, shows, 23% of respondents were explicitly opposed to such an idea and 37% indifferent. While not a majority, 40% is a sizeable minority supporting the most forceful of measures.

The levels of support for mandating, evident in the survey, were questioned by some at the roundtable. As one attendee argued:

> *"We treat public opinion to a mandatory switchover with quite a lot of caution. It is easy to say today to a pollster that you think all boilers should be switched over in future, versus are you doing to do it yourself?"*

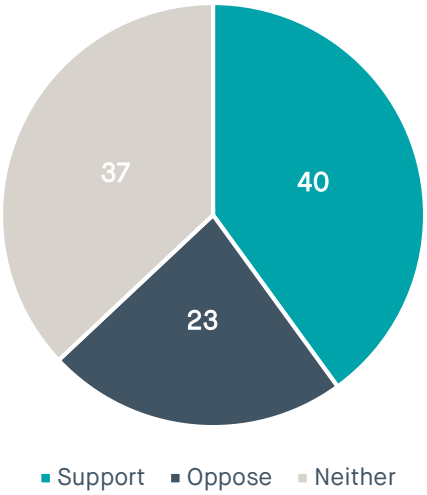
Another concurred with the concern, highlighting that:

> *"The former... [legislating to end the fitting of gas boilers] is never a politically popular thing to do and it's not a great way of getting buy in as you're forcing people to do it."*

A third contributor pointed out that:

> *"Moving to a mandatory system of enforcing technologies does not bring about consumer buy in."*

Figure 2: Support among the public for mandating the "switchover" from traditional gas boilers to low-carbon alternatives (%)



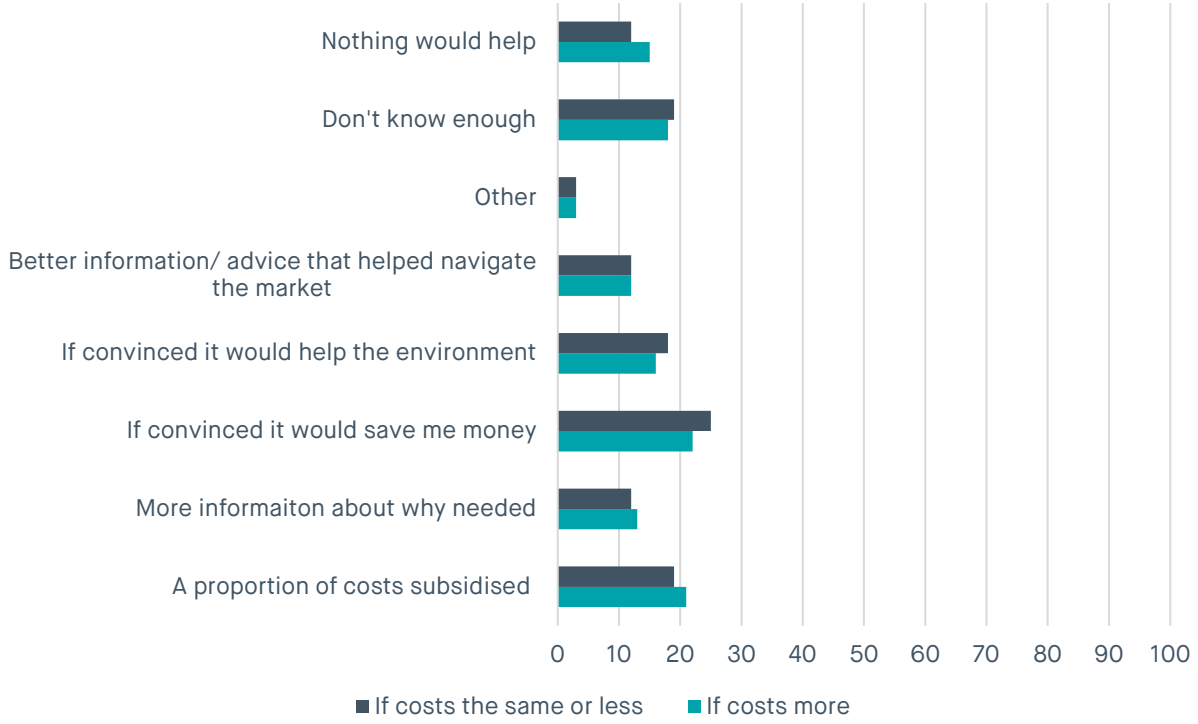
Source: Opinium

Despite the relatively positive response (a plurality although not a majority supported the idea) from the public on "mandation", the lack of a clear majority and the concerns raised by a number of experts at the roundtable about mandating a phased "switchover" indicate that the evidence for implementing such a policy is "balanced". In other words, the evidence does not suggest outright rejection of the idea of mandating a "transition" from gas boilers to low-carbon heating systems. However, neither does it indicate solid support, such that a government could confidently implement such a measure without considerable "groundwork" first which ensured it was done fairly and effectively and "with the grain" of public opinion. Such a policy may be aided by the growth of the "social proofing" of alternative heating systems i.e. increasing installation and use by households will encourage other households to follow suit.

Factors inhibiting take-up

The preference among roundtable participants was for an "active" role for Government in stimulating the currently nascent market in alternative low-carbon heating systems. However, in order to "intervene" effectively the authorities have to have insight into what factors it is that consumers consider are likely to be influential on their decision-making about whether to "switch" (at an opportune moment) to a low-carbon heating system or not. The publicly representative survey which accompanied the roundtable identified a range of factors which respondents said would influence their "willingness" to have an alternative to a traditional gas boiler installed in their homes.

Figure 6: Factors that would encourage take-up of low-carbon alternatives to traditional gas boilers (%)



Source: Opinium

Figure 6 outlines what respondents who had previously professed to be "open to switching" away from a traditional gas boiler or who had stated they were "opposed" to investing in an alternative to their gas boiler replied, when asked about what measures might encourage them to shift their position towards becoming more positive about making the change. Respondents were presented with two different scenarios about which to provide answers. One, where the alternative heating systems cost the same or less than a current gas boiler system. A second where the alternative cost more than a traditional gas boiler. The survey results suggest that, while, in some cases, the difference in the potential cost between an alternative to a traditional boiler does make a small difference in the proportion of respondents choosing particular answers, the margins of difference are small in relation to almost all the factors which might "influence" them to be more positive about low-carbon home heating and take it up.

The three most frequently cited factors likely to make respondents more willing to change their current home heating system to an alternative one were: if that alternative would save them money in the long run, if the costs they would incur as a result of "switching" could be shared (i.e. subsidised) and people saying they didn't feel they knew enough to offer any answers about what may or may not encourage them to make a change.

Filling the information "gap"

A well-functioning market is in many ways an effective information transmission mechanism. This requires the right kind of information being available to the market actors. Figure 6 suggests there are numerous categories of information that could help consumers become more informed about the nascent market for alternative heating

systems and ultimately encourage them to engage with it and "switch" away from a traditional gas boiler to a low-carbon system.

The survey results presented in Figure 6 provide evidence to corroborate the proposal of one participant at the roundtable, who argued that the demand-side of the, currently small, market for alternative heating systems could benefit from:

> *"Promoting this agenda through information campaigns...a necessary prerequisite for public support...".*

Any attempt to stimulate the demand-side with better information would need to consider the kinds of factors, listed in Figure 6, that are currently hindering the willingness of consumers to be more positive about low-carbon heating systems. In other words, it would need to convey to consumers how households "switching" from their gas boiler to a low-carbon heating system would be good for the environment and save consumers money in the long run. Filling these kinds of "information gaps" is a prerequisite for getting consumers to engage with the alternative heating systems market, such as it is, and purchase a low-carbon heating system for their property or properties.

However - as Figure 6 shows – the information needed by consumers, in order to play their part in helping the alternative heating system market take-off, is not limited to the two categories briefly noted above. Transparent purchase terms and conditions are also required, as is clear and comparable pricing. Finally, for any market to durable the products that it is based around must be good quality i.e. alternative heating systems, whatever technology they're based upon, must be reliable and deliver the levels of heating that consumers want, as gas boilers have successfully managed to do for many decades.

Cost

As touched upon in the previous section, Figure 6 highlights how the barriers to taking-up low-carbon alternatives are not just based upon "information gaps" but are also incentive (i.e. cost) based.[iv] This point was made in stark terms by one roundtable participant, who noted that:

> *"...genuine, long term consumer buy-in will only come when the low-carbon option is in fact also the simplest and cheapest option too".*

Figure 6 shows that around one in five of those who were "open to switching" to an alternative to a gas boiler or were "against" doing so, would like to see the likely costs that will be incurred by changing their boiler to be reduced (e.g. through some sort of cost sharing scheme) in order to encourage them to make such a change. Further, in a scenario where the alternative system costs the same or less than a traditional gas boiler, one in four respondents said they would need more information about how low-carbon-dioxide heating systems can "save money" on their heating costs before being willing to consider more positively the possibility of "switching".

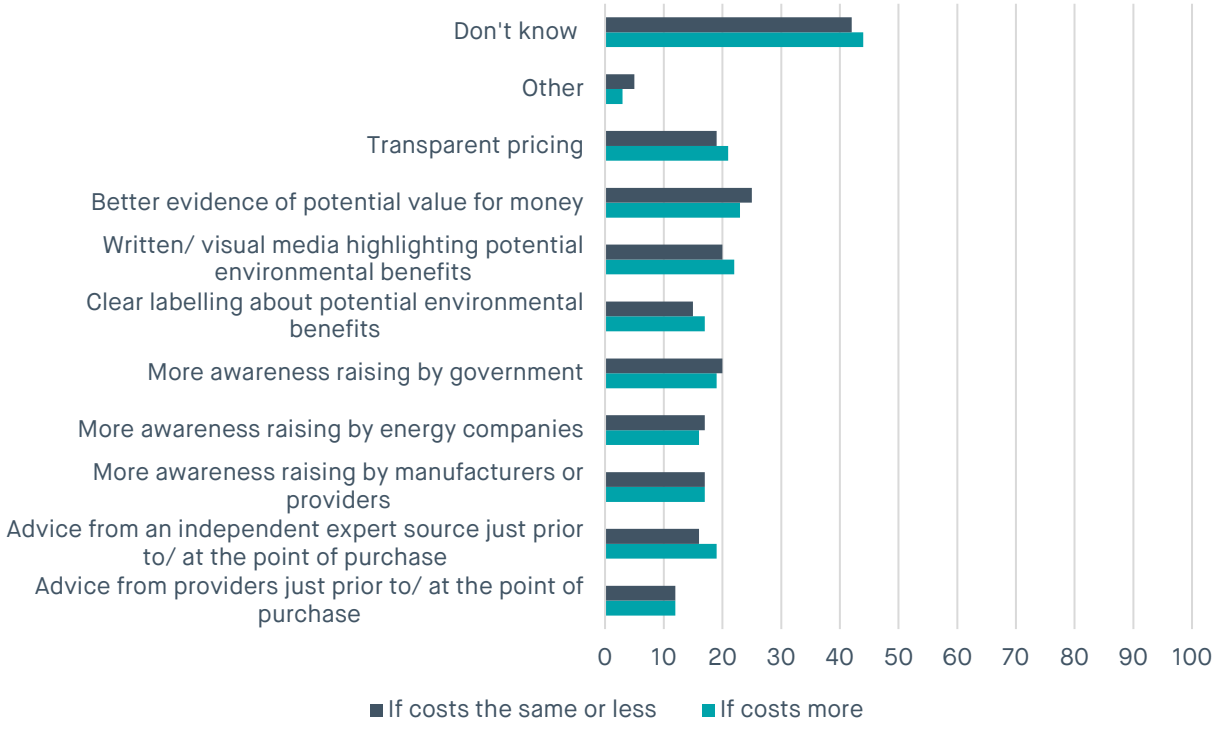
[iv] Incentives (e.g. prices and profits) are another form of information, but for simplicity in this report they are talked about separately to other, more typically understood, forms of information.

Information measures

Figure 7 shows the different types of information measures that consumers would find most useful to helping them understand and make decisions about whether to “switch” their property heating system and subsequently navigate the market. The types of information measures that consumers would benefit from (set out in Figure 7) span different parts of the “consumer journey”, from measures that would help consumers understand why low-carbon alternatives are important (sometimes referred to as recognising the initial “need” or “want” by analysts of consumer behaviour), through information that would help reduce costs associated with “searching the market”, information that helps with the “sifting” of the “initial consideration set” of options and then ultimately to making the appropriate choice at the “decision point of purchase”.

Figure 7 provides a useful guide to policymakers and industry as to which kinds of informational measures to focus on, if the Government and industry want to stimulate consumer interest in and demand for low-carbon heating.

Figure 7: The types of information measures that would help consumers make the choices about home heating systems, that policymakers would like them to (%)



Source: Opinium

Figure 7 shows that a plurality of respondents (who professed a desire for "more information" or stated they "didn’t know enough" before being willing to say what measures might encourage them to embrace "switching" to low-carbon heating systems) feel unable to say what information measures would help them improve their understanding of alternative home heating systems. This suggests that both the Government and industry have a significant challenge ahead to identify the best way of communicating more information to the population. Trialling different methods to see which gain traction with them, could be considered.

The second most frequently cited "type of information measure" that would prove helpful to consumers, was the kind that would enable them to better understand whether "switching" to a low-carbon heating system for their property or properties would be "value-for-money". This is consistent with the salience of cost as a factor which influences the willingness of consumers to be more positive about “switching” to a low-carbon heating systems and taking up the opportunity (see Figure 6).

Notably, price transparency, which would allow easy cost comparisons by consumers, was selected by around one in five respondents, as was the usefulness of “written” and other "visual" materials (e.g. TV advertising, online campaigns, etc) which helped explain the environmental benefits of alternative heating systems, i.e. measures which help raise awareness and enable people see the “need” for changing their heating system.

Finally, 19% said that if low-carbon heating systems are going to cost more than traditional gas boilers then "access to independent expert advice" particularly “near” or at the “point of purchase” would be helpful i.e. at the near-culmination of the consumer journey. 16% of respondents agreed this would still be useful if alternatives were going to be cheaper or cost about the same as traditional gas boilers.

Possible policy interventions

One roundtable participant made the point that a vibrant market for low-carbon heating systems would only develop if there was a “dialogue” between consumers, industry and government about how a change in heating systems in homes (and also commercial properties) might help contribute to the UK’s efforts to reach the Net Zero target, how such a change might most effectively be brought about and how it will impact the cost of heating for consumers, landlords and businesses. He argued that this kind of approach requires an emphasis on persuasion and therefore relies on the optimal deployment of information and incentives in order to achieve the large-scale transition by households and commercial properties away from gas and towards alternative heating systems that many believe is needed.

A key role for policymakers was, it was suggested by one participant, to encourage the take-off of the alternative heating systems market as quickly as possible. To do this, he suggested, it would require:

> *"...a mix of policy and regulation...giving signals to the market – whether it’s subsidies, long dated standards about buildings etc. – which give people the commercial confidence to have ambitious propositions in the market".*

The market for alternative heating systems is like any other market. The demand-side is a symbiotic relationship between awareness among potential consumers of the products and their availability on the one hand and sufficient confidence to spend on them, on the other. The demand-side factors interact with the supply-side. The latter is driven by the experience and expectations of producers and sellers, which give them the confidence to invest in production and developing and maintaining the most effective channels to market and the availability of appropriate quantities of capital to undertake that investment. Together these factors, in combination, propel a market forward.

One attendee suggested government-backed certifications could help bolster the demand-side, by helping reduce some of “information gaps" that consumers face, and in-turn build trust (which is not currently present) in the products offered on the market. Attendees put forward several suggestions about the best way to design “trust enhancing” mechanisms. One possible proposal, was for:

> *“…the establishment of a government-backed scheme focused on giving people confidence to install low-carbon heating systems or energy efficiency measures. The guarantee would help people to make informed decisions, and establish simple, enforceable protections so people can engage with confidence".*

With incentives as important as information to a successful market, the issue of the cost to a household of "switching" a heating system from a traditional gas boiler to an alternative, is of crucial importance to consumer decision-making. Policymakers need to be cognisant of this, when trying to “encourage” a market to develop. Consequently, one attendee, summed up the view of most of those partaking in the event, when he suggested that the successful emergence of a market for low-carbon heating system will largely be dependent on:

> *"…rapidly bring[ing] down the cost to make the choice a no brainer so when you’re looking to retrofit your boiler, the obvious choice from an environmental point of view, but also as a consumer from a cost point of view, green is the answer…"*

It was noted by a several contributors that the cost of alternative heating systems and their installation will likely fall over time, if the industry can achieve scale and product, production and installation efficiencies. However, scale and other efficiencies will fail to be achieved if there is insufficient demand in the short to medium term that allows those efficiency generating processes to "play out" over time and deliver a reduction in costs. A question for policymakers therefore is how can help industry achieve the scale and efficiencies that will help cut the price of low-carbon heating systems, when demand is likely to remain limited until prices fall as a result of those efficiencies being achieved? This is a coordination problem, that policy may be able to ameliorate.

Finally, attendees of the roundtable were keen to emphasise the importance for the efforts of policymakers to coordinate with the available capacity and capability of the industry. It was said that it is vital that the demand and supply-side are in "lock step" with each other, so that constraints on either side do not hold overall progress back, too much. Therefore, policymakers may want to consider taking an approach where measures to stimulate the market (especially on the demand-side) are piloted and, if successful, rolled-out in stages, with progress at each stage evaluated to see if the intended results are being achieved, with outcomes reported publicly to ensure accountability. With enough flexibility in the methods being utilised so that those devising and driving policy can adjust in-light of experience and evaluation, should help avoid any major policy errors and ensure value for money for any public resources involved.

Taking account of geographical differences and the importance of local action

As policymakers consider measures that could help “kick-start” growth in the market for low-carbon heating systems, an important consideration is the complicating factor of geography i.e. the variations in local circumstances which make a “one-size-fits-all”

approach challenging if not entirely inapplicable. As one contributor to the roundtable event pointed out:

> *"Heat is a geographically specific, local challenge. The heat challenge of Cornwall is very different to the heating system of Glasgow"*

Therefore, the same contributor argued, there is likely to be a need for different solutions for different areas of the country. He suggested:

> *"...you need to really think hard about what the pathway is in a particular area and what's the potential for district heating – what is the state of the building stock, the electricity network etc., so you can work that through. It all needs to fit together and...[we]...see that local activity is a missing part of the government structure and is really essential".*

The Netherlands was raised, as an example of how the UK might think about approaching the "transition" to low-carbon household (and other property) heating systems. It was noted that the Dutch had found a balance between national planning and local action, which could serve as a template for the UK. While the details would be different, the broad approach taken by the Dutch was considered to be practical and likely to be effective. As a participant explained,

> *"The Dutch are...setting regional dates for shutdown because if you look at the system over there, it is a regional network with natural areas which you will need to switch off area by area if you are going to transition...But if you use it as an example – setting a date for that area, making it competitive, putting the market mechanisms in place could help, and the setting of deadlines helps organisations (like housing associations) plan".*

The Dutch approach and the lessons from it that the contributor described, suggest there is a balance that needs to be found between national leadership and planning and local action, tailored to local circumstances. This broad approach was endorsed by another attendee, who argued that the inevitable local and regional variation in circumstances in the UK did not abrogate the need for an overarching national framework, which set the objectives and outlines. The contributor elaborated:

> *"Local area energy really needs some sort of national framework – how you move from energy plans and strategy nationally and how we think, and act locally could have different implications of cost and fairness for different people. Central government should be working on these local plans".*

The balance of opinion among those at the roundtable discussion indicated that while much of the most effective activity will necessarily be "local", tailored to the circumstances that prevail in a particular area, the impetus for action and its broad timetabling, and many of the key standards that must be worked to should, ideally, be set nationally.

CHAPTER 6 - COST

The cost of decarbonisation is significant and the question of how it will be paid for remains unanswered by government. The CCC prices decarbonising buildings at £15bn per annum until 2050 (0.4% of GDP).[19] While, National Infrastructure Commission estimate that decarbonising home heat specifically will cost £120-300bn[v] by 2050, rising up to £450 billion for worst case assumptions.[20] In addition to the scale of funds that needs to be raised, policymakers should consider the timing of funding, given the high upfront costs that are necessary to mass-roll out of low-carbon heat technologies.

This chapter explores how government might distribute the cost of financing and funding the decarbonisation of home heat fairly, without bearing undue costs on low-income or vulnerable households.

Who pays?

In the short-term, decarbonising home heat needs quick up-front capital, which could be financed through public borrowing at low interest rates as part of a green recovery package from COVID-19. However, policymakers need to work through who will ultimately fund this borrowing over time. There are various options for distributing the cost of transitioning such as direct consumer levies, industry levies (that are ultimately paid for by shareholders or the consumer) or general taxation, as well as more novel financing solutions for the medium to long term.

Consumer levies

Taking the first of these listed options, direct consumer levies, contributors discussed previous green home policies that placed obligations-based costs on consumers. One contributor noted the lessons learnt from the distribution of energy levies:

> *"What can we learn from some of the past measures, such as [...] putting the cost of things on bills? Transparency; when it comes to putting costs on utility bills, in the past [industry leaders] were really slow to understand that a lack of transparency was a problem. But we've probably hit the limit of what we can do [...] with putting more and more things on bills."*

Another contributor also echoed this point:

> *"We've reached the limit of public and political tolerance of things being added to bills to pay for improvements."*

In the past, levies on consumer energy bills were used to pay for renewables through schemes such as Feed-in Tariffs (FiT). Poorer households are typically hit hardest by increasing energy costs; therefore, additional levies could likely place cost burdens on more vulnerable households. In their final report on the FIT scheme, the Department for Energy and Climate Change said:

[v] Under its central cost assumptions in addition to the status quo.

> *"Policies such as the FIT that encourage the diffusion of immature technologies and target emissions through levies on energy bills generally increase average household electricity bills as they are a form of regressive tax."*[21]

The use and cost of energy varies significantly depending on the quality and energy efficiency of the housing and the weather across the UK. Fuel poverty remains a critical challenge with 10-13% of UK households forced to choose between 'heating and eating'.[22] Policymakers must ensure the transition to low-carbon heating systems does not have further negative distributional implications on low-income and vulnerable households or they could risk damaging the political stability of the Net Zero agenda.

Taxation

Following on from the comments on transparency, the same contributor added: *"for this issue, taxation is probably the best way to go."* If it became necessary to raise more money through tax revenue, policymakers should consider utilising income tax in order to maintain the progressivity of resourcing.

Carbon pricing through taxation is also offered by the CCC as another option for raising revenue for the cost interventions needed to Net Zero targets. However, one contributor cautioned against the deployment of a carbon charge:

> "A boiler tax would be politically very difficult but ultimately, we do need to look at how so many carbon charges and renewable levies are on electricity bills and there's barely anything on gas bills, which will make it harder for us to shift away from gas. I think gently, sensitively and giving a long lean-in time for this is something government needs to address."

Policymakers should also consider the current economic outlook of the UK and its households when designing plans to raise tax revenue or implement a carbon charge as perceived harm could spark political resistance to the agenda entirely. Allocating the cost of Net Zero will be politically challenging, nonetheless. However, there are potentially greater risks from ineffective policy or delays making it more expensive. One contributor emphasised the need to realise the financial value of the green energy that is not used:

> *"BEIS is currently calibrating the avoided cost of energy including balancing services, network charges and generation costs avoided. [We're working on] ensuring we're fully costing both sides to this argument [i.e. implementing low-carbon alternatives, or not] to unlock revenue streams for energy efficiency that can support those householders or renters that find it more difficult."*

Contributors noted that there should be scope here for greater financial innovation. Novel financing solutions from the private sector could help support financing and funding over the medium and long term to build a coalition of blended public-private financing.

ENDNOTES

[1] https://shop.bsigroup.com/ProductDetail/?pid=000000000030362160

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