KANTAR

Burning in UK Homes and Gardens

Research Report

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Disclaimer

The views in this report are the authors' own and do not necessarily reflect those of the Department for Environment Food and Rural Affairs.

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Glossary

Appliance	The device or piece of equipment used to burn solid fuels. Indoor appliances include stoves (also known as burners, log or wood burners or enclosed fireplaces), open fires, range cookers and biomass boilers, among others. Outdoor appliances include barbeques, firepits, chimeneas and bonfires.
BAME	A UK demographic category that stands for 'black, Asian and minority ethnic' people.
Burner	This report refers to people who burn indoors and/or outdoors as 'burners'. This should not be confused with the appliance commonly referred to as a log or wood burner.
Chimenea	An outdoor free-standing fireplace or oven that has a bulbous, hollow body connected to a narrow smoke vent.
Coal	In this study coal is an encompassing term for house coal, smokeless coal and their variants. If clarification was needed, survey participants were told that coal included anthracite, manufactured fuels, briquettes (coal or coal like), smokeless ovoids and non-smokeless ovoids. In the core activity survey the only sub-categories of coal included as answer options when asking about solid fuels burned in the last 7 days were house/bituminous coal, smokeless coal and coal/coal-like briquettes. House coal (smoky or bituminous coal) is not smokeless and should not be used in smoke control areas, unless in an exempt appliance.
Core activity survey (CAS)	A survey of burners and non-burners conducted as part of this research. The main aim was to identify whether or not they burned at their property and if they did, what solid fuels and appliances they used in the last week, if any. This information was collected in order to provide data that could be used to estimate UK domestic solid fuel use in 2018-19. This estimation was done separately by Defra using the data collected. An outline of the method used and discussion of the results is included in Annexe A.
Domestic combustion	The act of burning solid fuels at a domestic property (indoors or outdoors) for practical and/or aesthetic purposes for example, heating.

Exempt appliance	Appliances that can burn an unauthorised or smoky solid fuel without emitting smoke. They have been exempted under the Clean Air Act 1993 or Clean Air (Northern Ireland) Order 1981 and can be used in smoke control areas.
Firepit	A pit which is either dug into the ground or encased in a surrounding structure, in which a fire is made for cooking food or warmth.
Full / half load of wood	If clarification was required during the survey, respondents were told that: ➢ A full load was equivalent to a crate, 3 or more bulk or builders' bags, a 70-bag pallet or 1.5m^3 or more. ➢ A half load was equivalent to 1 or 2 bulk or builders' bags, a 50-bag pallet, or load less than 1.5m^3.
HETAS	The acronym stands for Heating Equipment Testing and Approval Scheme. It is a national industry body whose stated purpose is to promote the safe and effective use of solid fuels, biomass and related technology. It works closely with government, appliance and chimney manufacturers, installers, fuel producers, distributors and associated parties from across the biomass sector to advance training, raise awareness and improve end-user safety.
Point-in-time survey (PiT)	Two separate surveys, one of burners and one of non-burners conducted as part of this research. The main aim of each was to capture a snapshot of behaviours and attitudes relating to burning (and non-burning).
Primary burners	In this report, this term is used to describe those that use solid fuels for all or most of their heating as self-reported in the survey.
Secondary burners	In this report, this term is used to describe those who use solid fuels for some of their heating (but not most or all) and/or for some other indoor burning purpose (such as heating water or cooking) as self-reported in the survey.
Smoke control area (SCA)	An area in the UK where residents are not permitted to emit smoke from a chimney unless they are burning an authorised fuel or using an exempt appliance. The analysis on SCAs in this report focuses on urban areas, meaning urban areas that are SCAs as opposed to urban areas that are not SCAs.

Social grade	A demographic classification of people in the UK. Classification is based on the occupation of the chief income earner of the household, where: ➢ A: higher managerial, administrative or professional; ➢ B: intermediate managerial, administrative or professional; ➢ C1: supervisory or clerical and junior managerial, administrative or professional; ➢ C2: skilled manual workers; ➢ D: semi-skilled and unskilled manual workers; and ➢ E: State pensioners, casual and lowest grade workers, unemployed with state benefits only.
Solid fuel	Types of solid material used as fuel to produce energy through combustion. The solid fuels specifically identified in this study were: wood, including logs, pellets, wood-based briquettes and wood chips; coal, including house coal, smokeless fuels and coal-based briquettes; charcoal; green or garden waste; waste wood, including both fallen wood and treated wood; household waste or rubbish; and peat.
Stove	A 'stove' in this report refers to an appliance that burns solid fuels in an enclosed space. Users may also commonly refer to them as log or wood burners, burners, or enclosed fireplaces.
Unseasoned wood	For the purposes of this report, unseasoned wood is defined as wood that has been freshly cut and not been dried or left to dry.
Urban / rural population density	The urban and rural classifications used in this report are based on ONS definitions. A rural area is a village with fewer than 10,000 people or open countryside. An urban area is a town or city with at least 10,000 people.
Wet wood	Following existing Defra guidance[1], wet wood is defined in this report as any wood that has been left to dry naturally for less than a year or has not been seasoned at all (meaning it is unseasoned as defined above). It is important to note that the new solid fuels legislation requires wood to be dried for two years in line with advice from industry and definitions used in the consultation. Defra guidance is being updated to reflect this.

[1] https://uk-air.defra.gov.uk/assets/documents/reports/cat09/1903131256_Seasoning_Wood_Web_Feb_2019_V5.pdf

Wood	For the purposes of this study, the term 'wood' refers to logs, briquettes, pellets, manufactured wood logs[2] and wood chips. It excludes waste wood.
Waste wood	For the purposes of this study, waste wood includes pallets, salvaged wood (meaning wood that has been discarded, for example, from building sites or skips), old furniture, fence posts and other items from the home, all of which are likely to be treated and therefore contain contaminants that may be released on burning. In addition, for this research, the waste wood category also includes fallen wood from trees that is untreated and may be gathered or given for free, distinct from garden waste (a separate response category).
Non-burners	People that have not burned solid fuels at their property, indoors or outdoors, in the last 12 months.

[2] Included in the definition of 'wood' for the CAS, but not for the PiT.

Executive summary

Introduction

Burning in a domestic setting (so called 'domestic combustion') creates a number of toxic emissions which have a significant impact on human health and the environment. In particular, fine particulate matter ($PM_{2.5}$), has been associated with higher mortality rates for people with cardiovascular and respiratory diseases. Drawing on solid fuel quantity estimates based on a study of indoor residential burning conducted by the Department for Business, Energy & Industrial Strategy (BEIS) in 2014-15 and figures for indoor solid fuel appliance installations, the National Atmospheric Emissions Inventory suggests burning at home is a very significant source of $PM_{2.5}$ emissions in the UK.

This research was designed to update understanding of how much solid fuel burning is happening domestically in the UK, including of non-wood solid fuels and of burning outdoors in gardens, as these aspects were not addressed in the previous BEIS study. Another major aim for this research was to develop greater insight into public knowledge, attitudes, behaviours and motivations in relation to burning at home (indoors and out) in order to improve the evidence base and inform policy in this area.

The research involved:

- Primary qualitative research
  - 35 in-depth face-to-face interviews with a diverse group of people across Great Britain who burn at home, in order to explore indoor and outdoor burning behaviours and related attitudes and motivations.
  - 4 focus groups with people who did not burn indoors to understand their attitudes towards indoor domestic burning.
- Primary quantitative research using representative samples of the UK adult[3] population
  - A face-to-face omnibus survey of over 46,000 people across the UK spread over 10.5 months[4], called the **core activity survey** (CAS), to understand the incidence of burning at home (what percentage of people burn, what they burn, where and when). Approximately 7,500 of these respondents said they had burned (indoors and/or outdoors) in the last year, roughly 2,000 of whom had burned in the 7 days before they were surveyed, allowing exploration of what fuel they had burned and how much.
  - A more in-depth phone-based survey (mid-January to end March 2019), called the **burners' point-in-time survey** (PiT), which involved approximately 1,800 adults who had burned in the last year, in order to better understand the reasons people burn and the range and distribution of burning behaviours.
  - A face-to-face omnibus survey with over 700 non-burners (January 2019), called the **non-burners' point-in-time** (non-burners' PiT), which explored their attitudes and experiences of burning.

[3] Over 16 years of age.

[4] The first wave of 22 started on 4 April 2018 and the final wave ended on 17 February 2019 (see Annexe E for details of waves).

- Secondary analysis
  - Secondary analysis of the English Housing Survey (2003-2016) and Energy Follow-Up Survey (2011), in particular to explore changes in solid fuel appliance ownership over time.

Greater detail on methodology can be found in Chapter 1 and related appendices.

It is important to note that survey findings in this report are presented as proportions (/percentages) of research participants providing a particular response. In many cases they were able to give several responses to a given question. The proportion of people giving an answer relating to the use of a fuel is not the same as the proportion of fuel that answer applies to. For example, if half of those who burned wood lived in a smoke control area (SCA) this would not be the same as saying that half of wood burned was burned in an SCA: those living in an SCA might each burn a lot less than those living outside SCAs. Similarly, if half of those burning indoors used coal, this would not mean that coal accounted for half of the fuel they used: it may be that most of those using coal only used it on an occasional basis and/or in conjunction with other fuels.

This means that this report should not be used to infer conclusions on quantities. *The quantification of domestic solid fuel used (using respondent estimates, collected through the core activity survey, of the weight or bulk of the solid fuels they had burned in the previous week and the hours their appliance had been lit over that period) was conducted by Defra as a separate piece of work. It is not included in this report, which was undertaken by Kantar. Results of Defra's work can be found in Annexe A.*

Chapter 2: Patterns of burning in the UK

This chapter starts with a brief overview of the key insights from the qualitative research that informed the design of the quantitative surveys. It suggests there are a wide range of household burning practices (including appliances and solid fuels used), and varied levels of knowledge of the technical aspects of burning. Interviewees often presented their burning behaviours and decisions as being based on practical common sense, even where these did not reflect guidance on good practice (which few seemed actively to seek this out), and their burning routines appeared often to have become habitual. However, a few did seek advice from appliance or solid fuel suppliers, installers and/or chimney sweeps.

The chapter then draws on the core activity survey data to provide an overview of the incidence and spatial distribution of indoor and outdoor burning in the four UK nations and English regions, as well as in rural and urban areas and smoke control areas (SCA). It also summarises the findings on the seasonal and weekly patterns of indoor burning. The main finding is that this study suggests that 19% of UK adults burned indoors and/or outdoors at home at some point during the year preceding the survey: the proportion burning *indoors* was 8%, whilst the proportion burning *outdoors was* 14%[5]. Burning indoors tended to occur more in the winter and outdoors burning was more usual in the summer.

The incidence of *indoor* burning was much higher in Northern Ireland (27% of the Northern Irish population) than for the UK as a whole. However, because of the size of the English population, English indoor burners made up 76% of those who reported burning across the UK. Whilst it was more common for a household to burn indoors if they lived in a rural area (13%) versus an urban area (7%), the survey suggests 68% of indoor burners lived in urban areas in the UK (as opposed to 32% in rural areas), again because of the higher proportion of the UK population who lives in towns and cities.

[5] 2% of the UK population reported burning inside and outside in the 12 months prior to being surveyed : included in figures here.

The incidence of *outdoor* burning was particularly high in the South East of England (21%). There was little difference in the incidence of outdoor burning between urban and rural areas (14% of the urban population and 13% of the rural population burned outdoors), but because of differences in the sizes of population, this means that 82% of outdoor burners identified in this research lived in urban areas and 18% in rural areas.

Chapter 3: Solid fuel systems and appliances used indoors

This chapter starts with an analysis of changes in burning appliance ownership in England between 2003 and 2016 based on the English Housing Survey (EHS). This suggests that the presence of solid fuel systems in English households increased slightly from 13.4% in 2003 to 14.7% in 2016, and that by 2016 there were more households with stoves than open fires. However, the presence of a solid fuel appliance does not necessarily mean that it is used: the EHS' 2011 Energy Follow-Up Survey (EFUS) found that c.9.5% of all English households were using their burning appliance in that year[6].

This chapter then goes on to present findings from the Kantar research in relation to indoor appliance usage. The main one is that almost two-thirds (58%) of UK adult respondents who had burnt indoors in the previous year listed a stove as their main burning appliance, whilst a third (31%) listed an open fire[7], which may suggest that there has been a change in the UK appliance mix since the BEIS study[8]. However, it is important to note this does not mean that they used their burning appliance as their primary source of heating; according to the PiT, most respondents had access to an alternative source of heating such as gas, electricity or oil, and the vast majority used these alternatives too. Only 4% of indoor PiT respondents said they burned solid fuel for all their heating.

Chapter 4: What solid fuels are being burned indoors

This chapter outlines the main findings relating to the types of solid fuels respondents said they used. The main findings relate to wood, waste wood and coal; however, this chapter also briefly looks at what the data suggests about the burning of household rubbish, garden waste and peat. *As highlighted earlier, this chapter presents findings in terms of the percentage of respondents who are using a particular solid fuel; this should not be equated to the percentage or quantity of that fuel being used.*

A key finding is that most indoor burning respondents sometimes burned some form of wood (logs, briquettes, pellets and/or chips) and/or waste wood (fallen and/or salvaged), and almost half of PiT indoor burners burned some form of coal at least on occasion. Indeed, a quarter of those who burned in the last week burned both some form of wood and some form of coal[9], according to the CAS. Although the surveys are not able to clarify whether those who did burn both wood and coal burned them on the same fire, the qualitative research found that this was common among the sample of interviewees.

The CAS also suggests that of those who burned coal in the previous week, 35% of coal users said they only used house coal and 38% said they only used smokeless coal; 26% used both. The CAS found the percentage of UK burners who burned only coal-based

[6] This Kantar research indicates that 7% of the English population made use of a solid fuel appliance indoors in 2018-19.

[7] 10% of PiT respondents said they used more than one type of indoor solid fuel burning appliance. The survey did not gather data on whether they used more than one indoor burning appliance they categorised as the same.

[8] The use of open fires was much more common amongst burners in Northern Ireland (73% of burners in Northern Ireland).

[9] A small percentage who also burned another form of solid fuel the previous week.

solid fuels in the previous week was 13%, though only 4% of PiT indoor burners suggested they burned coal exclusively when they burned.

Another key finding is that whilst almost two-thirds (59%) of CAS respondents who burned wood (in particular logs) in the previous week said they had bought most or all of it, usually from a specialist or general supplier. Almost a third (32%) gathered it or salvaged it or was given it, suggesting they had accessed it for free[10]. 13% of PiT respondents only gathered, salvaged or got given the solid fuel they burned, whilst 17% said they both bought solid fuel and got it free. Half (51%) of the wood burning CAS respondents[11] said they bought the wood they had burned that week pre-dried or seasoned, whilst a quarter (25%) said they had seasoned it themselves. However, 20% of those who burned wood had either seasoned it for less than 12 months (9%) or not seasoned it at all (11%), burning what in this report is classified as wet wood.

Chapter 5: Burning practices -- the prevalence of good practice

This chapter makes links between some of the findings presented above and guidance provided by Defra and others on what constitutes good burning practice, drawing also on PiT survey responses to questions about respondents' burning behaviours. The findings suggest that for each recommended burning behaviour, the majority of indoor burner respondents were following what is seen as good burning practice from an emissions perspective (though not necessarily consciously). However, for each area identified (for example, installation and use of air vents, correct use of air controls, chimney lining installation, frequency of chimney sweeping, use of cleaner solid fuels, use of more efficient stoves), some indoor burner respondents were not (and it was not necessarily the same respondents in each case). The reasons why indoor burners did not follow recommended practice were not always clear. Their knowledge of recommended practices was not tested during the surveys.

Chapter 6: Why burn indoors – Respondent reasons

This chapter looks at the reasons respondents gave for using solid fuels. The PiT indicates that most burners use their solid fuel appliances for heating (87%) and some for heating water, cooking and/or waste disposal, a small percentage who only use it for one or more of these other purposes. However, as mentioned, only 4% of PiT indoor burning respondents relied solely on solid fuel burning to heat their home, with 11% using solid fuels for most or all of their heating. Almost all respondents therefore had access to an alternative heating option and many said they used other sources of heating alongside solid fuel. The most common reasons they gave for choosing to use their indoor burning appliance when they did was: to create a homely feel, so they could heat just one room, to save money, and/or because they liked the look of a fire.

Unsurprisingly, opportunity to burn indoors (such as living in a house with a chimney) appeared to play a role in respondent decisions to burn. However, habit also seemed important: the majority (79%) of indoor burners reported having a fire at home when growing up as opposed to 23% of non-burners.

[10] This question was not asked of those who said they had burned only waste wood in the previous week.

[11] Ibid.

Chapter 7: Who burns indoors -- A segmentation of indoor burners

This chapter starts with a brief description of indoor burners overall: almost half of all indoor burners (46%) were from the highest AB social grades. Indoor burners were also considerably more likely to own their home outright (42%) and less likely to be renting (8%) than non-burners (24% of whom were from AB social grades, 33% of whom owned their home outright and 35% of whom rented).

The rest of the chapter describes the outcome of a segmentation of indoor burners that was conducted to identify different types of indoor burners through comparison with figures for all indoor burners. Five segments were identified as a result, though it is important to note that there were overlaps between the groupings:

- *Necessity* (8% of the population) – burning is the main source of heating (often through lack of choice) for this less affluent, more rural, older (on average) segment of very experienced and intensive burners.
- *Thrift & self-sufficiency* (24% of the population) – burning to save money/deal with waste, & for a sense of self-sufficiency, this segment is a little less affluent, more experienced, & burns more than usual.
- *Supplement* (23% of the population) – burning to supplement their main source of heating, this segment is relatively inexperienced, younger (on average) and may well have installed their stove recently.
- *Tradition* (18% of the population) – burning is about family experience, nostalgia, identity & creating a homely atmosphere, ideally with an open fire, for this relatively affluent, largely English segment.
- *Aesthetics* (28%) – burning is about socialising & creating a homely atmosphere; it is a lifestyle choice for this considerably more affluent & largely English segment who burn least.

Chapter 8: Exploring possible levers and potential barriers in changing indoor burning behaviour

Responses to potential policy levers or changing market conditions were also sought through questions in the PiT survey. The questions focused on exploring possible respondent responses to: increased solid fuel prices; paying for cleaner fuels; an annual chimney sweeping requirement, and requirement for stoves to be tested once a year; and potential intentions if they could no longer heat a home with solid fuels or use house coal. This chapter provides a summary of these findings, although caution should be used in interpreting these results as they involve immediate responses to hypothetical scenarios when actual behaviour in such situations may be difficult to predict, and some of the sample sizes are small.

Drawing particularly on analysis of the qualitative research, it also attempts to identify the potential barriers to reducing reliance on solid fuels or adopting recommended burning practices and related technology (particularly for those who use them for most or all of their heating). Those identified are: a lack of alternative heating infrastructure (such as connectivity to gas grid and/or central heating system in home); a household's financial situation (expense of installing an alternative heating system, cost of hiring a chimney sweep); family tradition and habit; self-confidence in knowledge and skills around burning; identification with, and/or emotional appeal of, having a fire; the financial and/or practical benefits of using a fire (such as access to free fuel to run a solid fuel system). The extent that each of these factors constitutes a barrier are likely to differ from indoor burner to

indoor burner depending on the type of burner they are and their household's particular circumstances.

Chapter 9: Outdoor burning

This chapter summarises the findings in relation to *outdoor* burners: what they burn, how they burn and why they burn. Though a higher proportion of the UK population burned outdoors than burned indoors (14% as opposed to 8%), outdoor burning occurred less frequently (particularly bonfires) and the seasonality of burning was different, with barbequing peaking in summer and bonfires being more of a year-round activity, but most common in autumn.

Looking at the motivations for burning outdoors, 61% of outdoor burners said they chose to burn outdoors as they enjoyed cooking (often using charcoal-based barbeques), 27% for waste disposal, and 19% because it was sociable. Very few outdoor burners reported receiving complaints about outdoor burning, though 79% said they would burn less outdoors if they thought they were being a nuisance to their neighbours.

Chapter 10: Non-burners

This chapter focused on the attitudes of non-burners to burning, their experience of burning and their intentions in relation to burning. The findings suggest that whilst the majority of the UK population (81%) did not burn at home, many non-burners in the non-burner PiT survey had positive views of fires (for example, 65% seeing it as sociable) and 55% thought people had the right to burn in their own homes. However, a reasonable proportion of non-burners (41%) thought that burners did not think about their impact on people around them, and 44% of non-burner respondents thought that some form of restriction on outdoor burning was necessary. A similar proportion (45%) did not support any specific restrictions on outdoor burning.

These non-burner respondents were also asked about whether they had intentions to burn in the future. The vast majority said that they had not considered installing an indoor burning appliance, primarily because their current heating system worked well (42%). In addition, 20% appeared to have some concerns or dislike of indoor burning as a method of heating. However, 16% of non-burner respondents said they *would* burn solid fuels in their home if they were able to, with 5% saying they were likely to start burning indoors in the next 5 years. This is a small proportion when compared to the 92% of the population who do not burn indoors, but would represent a large increase in the current indoor burning population (8%). This said, these results are based on questions that are hypothetical, so should be treated with caution.

Chapter 11: Conclusions

This chapter addresses the research questions that informed the research. Many of the main findings used to answer these questions have already been outlined in the chapter summaries above and therefore are not repeated here. The ones that are not, based on PiT responses, are as follows:

- *What are the drivers of purchasing decisions for materials and appliances?* In descending order, the efficiency, look/design and/or size of an appliance were the key factors in appliance purchasing decisions, whilst cost and quality of solid fuel were the most important drivers when buying indoor burning fuel.

- *Are people aware of whether they are in a Smoke Control Area (SCA)?* There were mixed levels of awareness: a third of indoor burners in urban areas did not know whether they lived in an SCA or had not heard of SCAs; and among indoor burners living in urban areas who thought they did live in an urban SCA, only 70% actually did so. Meanwhile, 13% of those who did not think they lived in an urban SCA actually did.
- *To what extent are people aware of the environmental and health impacts of burning?* About half of burner and non-burner PiT respondents seemed to have some awareness that domestic burning is a significant source of air pollution (burners less so than non-burners); fewer (less than a third for burners) said they were concerned about the impacts burning might have on their health or those around them.

1. Introduction

1.1 Policy context for undertaking research

Under the Ambient Air Quality Directive (2008/50/EC) the UK has an obligation to reduce air pollution concentrations. Furthermore, the National Emissions Ceilings Directive (2016/2284/EU) sets out a commitment to reduce emissions of five air pollutants[12]. In early 2019, the government published the Clean Air Strategy[13] which emphasised the harm that poor air quality causes to human health, the economy and the environment, and set out plans to reduce concentrations of key pollutants.

Fine particulate matter ($PM_{2.5}$) is the air pollutant widely acknowledged as having the greatest impact on human health[14]. Studies have shown a significant association between exposure and premature death from heart or lung disease, as well as links to chronic heart or lung conditions[15]. After 20 years of progress in reducing primary emissions, levels of $PM_{2.5}$ have recently plateaued. Current emissions estimates suggest domestic combustion is a major source of $PM_{2.5}$.

Emissions from domestic burning are influenced by the type and amount of fuel burned, the type and purpose of the appliance used and the moisture content of the fuel. Particulate matter from the combustion of coal in particular has been shown to have often high levels of volatile organic matter. The combustion of coal can also release and/or form additional components within the smoke that are, in themselves, toxic or carcinogenic – for example polycyclic aromatic hydrocarbons (PAHs).

The design, frequency of cleaning and age of the appliance affects the temperature and efficiency of combustion, and therefore the quantity of emissions produced. Newer appliances have lower emissions, in part because of legislation such as Eco Design[16], Building Regulations (Part J), planning standards[17] and the Domestic Renewable Heat Incentive (RHI)[18]. However, whether an appliance is installed and used appropriately also affects the efficiency of combustion and therefore the emission levels. Patterns of use and user burning behaviour are therefore also important factors.

The UK National Atmospheric Emission Inventory (NAEI), is the compendium of annual estimates of UK emissions to the atmosphere from a variety of sources including the residential sector[19]. It draws on a range of data to compile the inventory, including solid fuel sales statistics. However, wood – a major domestic solid fuel – can be self-gathered or traded informally so data from sales statistics do not provide a full picture. The degree to which it is seasoned also impacts emissions generated.

[12] Nitrogen oxides (NOx), non-methane volatile organic compounds (NMVOCs), sulphur dioxide (SO_2), ammonia (NH_3) and fine particulate matter ($PM_{2.5}$)

[13] https://www.gov.uk/government/publications/clean-air-strategy-2019

[14] 2007 Air Quality Strategy for England, Scotland, Wales and Northern Ireland, paragraph 6.21.

[15] https://www3.epa.gov/airquality/particlepollution/designations/basicinfo.htm; https://uk-air.defra.gov.uk/assets/documents/reports/cat11/1212141150_AQEG_Fine_Particulate_Matter_in_the_UK.pdf; http://www.euro.who.int/__data/assets/pdf_file/0006/189051/Health-effects-of-particulate-matter-final-Eng.pdf

[16] http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32015R1185&from=EN

[17] http://www.planningni.gov.uk/index/policy/supplementary_guidance.htm

[18] https://www.gov.uk/domestic-renewable-heat-incentive

[19] http://naei.beis.gov.uk/about/

The DECC Domestic Wood Use Survey (DWUS), published by the Department for Business, Energy & Industrial Strategy (BEIS) in 2016[20], which collected data on indoor household wood burning therefore went a long way to improving the evidence base for wood fuel consumption. However, gaps and uncertainty remain in the solid fuel use evidence that underlies the NAEI. This study was designed to fills gaps and reduce uncertainty by broadening the focus to all solid fuels burned domestically, indoors and out, and by providing insight into the behaviours, attitudes and rationale of burners and non-burners so as to inform policy to reduce emissions from this sector.

1.2 Research aims and questions

This research provides robust up-to-date burning incidence rates, and an unprecedented range of data on burner practices, motivations and attitudes. It also produces evidence on the technical and solid fuel usage aspects of domestic burning to improve emissions estimates. More specifically, the research was designed to[21]:

- Provide data which can be used in the National Atmospheric Emissions Inventory (NAEI);
- Improve understanding of historic domestic combustion activity;
- Improve the accuracy of emissions mapping;
- Inform policy development on domestic combustion, including on:
  - The promotion of better burning practices; and
  - The targeting of any communications, including on burning behaviours.

To meet these research aims, the study set out to answer the following questions:

1. What proportion of the population burn in their home and garden respectively?
2. What do people burn when, where and in what quantities? (Defra's estimation of quantities burned, produced using the data collected through the research, is included in Annexe A).
3. How do they obtain the materials that they burn?
4. What are the reasons why people do and do not burn at home?
5. What are the drivers of purchasing decisions for materials and appliances?
6. To what extent do people use efficient burning methods when they burn? (for example, fire lighting, seasoning, management of fires once lit, maintenance of appliances)
7. Are people aware of whether they are in a smoke control area (SCA)?
8. To what extent are people aware of the environmental and health impacts of burning?
9. What is the likely future uptake of domestic combustion behaviours amongst those who do not burn? (for example, desire to burn in current / future home)
10. What are the barriers to stopping burning, reducing the amount of fuel being burnt and adopting burning behaviours with lower environmental impacts?

[20] https://www.gov.uk/government/publications/summary-results-of-the-domestic-wood-use-survey

[21] The objectives of the research that were also outlined in the tendering process were:

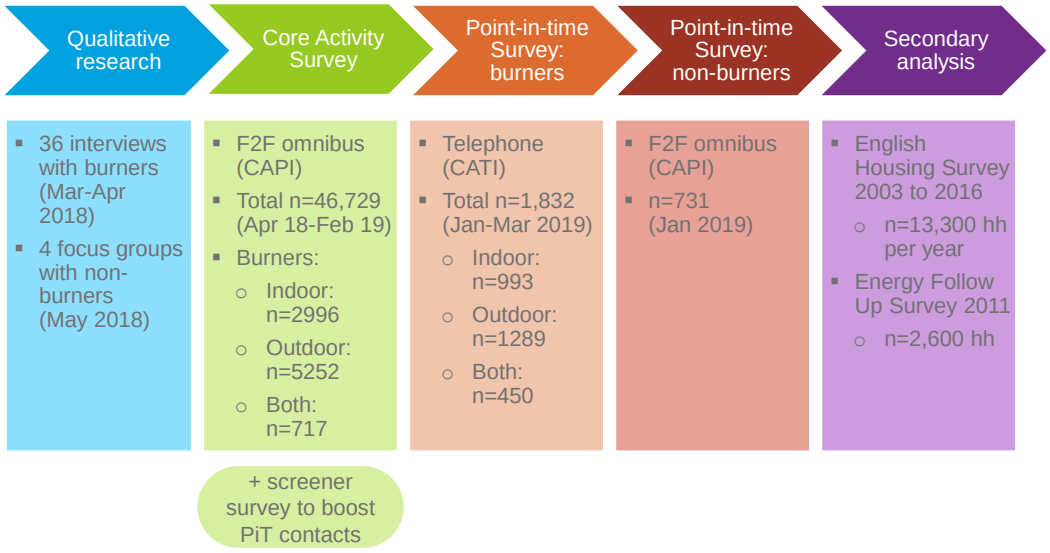
- Provide reliable data (at urban and rural level within each of the four nations of the UK) on the type and quantity of material being burnt and how this is being burnt.
- Provide detailed understanding of knowledge of and attitudes towards burning at home.
- Provide detailed understanding of the links between burning behaviours and socio-economic factors (e.g. fuel poverty).
- Provide detailed understanding of barriers to behavioural change (e.g. costs, availability of alternatives, willingness/ability to switch to alternatives; awareness of issues, credibility of messages, and role of burning in the home).
- Provide data on the change in burning practices over time (specifically, a comparison pre/post 2005 e.g. for those living in their own homes since that time).

11. What would lead to changes in behaviour? (for example, greater awareness of impacts; negative impacts on self/ neighbours; wider social pressure; Local Authority action; regulatory changes; etc.)

1.3 Methodology

The research was designed to address existing knowledge gaps and the difficulties of collecting accurate data based on participant recall. It combined a substantial qualitative investigation with a high frequency core activity survey and a detailed point-in-time survey. It also included segmentation analysis to better understand the differences between indoor burners. Furthermore, secondary analysis of existing survey datasets generated insight on burning trends over time. The research programme was led by Kantar Public[22]. Figure 1.1 provides an overview of the different aspects.

Figure 1.1: Overview of research programme



1.3.1 Preliminary qualitative research

The overarching aim of the qualitative research was to develop a better understanding of the knowledge, attitudes and behaviours towards domestic burning among current burners and non-burners to inform the design of the surveys. It also provided insight into the degree of diversity in burning practices and potential reasons and drivers for this. A number of areas were explored:

- A range of current indoor and outdoor burning behaviours in different parts of GB;
- The needs and drivers that appeared to underpin respondent burning behaviours;
- Respondent attitudes towards and perceptions of domestic burning, for example, the values that support it (for example, thrift, environmental concerns, etc.);
- Interviewee understanding of the regulatory environment and good burning practice;
- Respondent awareness of the health and other impacts of burning;

[22] https://www.kantar.com/public/

- Respondent responses to various scenarios, for example, changes to fuel costs or prevalence of alternative energy sources or government policy;
- Potential barriers to improving burning practice amongst these respondents.

In total, thirty-five 75-minute in-depth interviews with current burners were held in participants' homes (incorporating observations and visual ethnography) in six locations across the UK from 19 March to 27 April 2018. Participants were selected to achieve variation in the sample by location, social grade, rural/urban area and fuel type burned. Four 90-minute focus groups with individuals who did not burn indoors were also conducted: two groups in Newcastle on 9 May 2018 and two groups in London on 11 May 2018, with interviewees from a mix of social grades and from both rural and urban areas.

Different data collection methods were used for burners and non-burners to address the different aims for each audience. Interviews were used with burners to explore their individual experiences and burning behaviours in depth. Focus groups were used with non-burners to explore their knowledge, attitudes and behaviours towards burning, recognising that this was likely to be a low salience topic and that group interactions would help to surface perceptions.

The following factors were key in the design of the methodological approach:

- **Ensuring the qualitative research included a broad range of burners**. This meant setting recruitment quotas to reflect a range of burning behaviours known from the 2014 Domestic Wood Use Survey (DWUS) and the English Housing Survey Energy Report, while allowing for broad demographic and geographical coverage (see Annexe C for full sample breakdown). This allowed identification of similarities and differences that resulted in the development of indicative typologies, which were used to inform behavioural and attitudinal inputs into the Point-in-time surveys and into the statistical quantitative segmentation that resulted from the analysis of indoor burners' responses. The inclusion of non-burners also allowed exploration of their attitudes to, and experiences of, burning, and whether they had desires or intentions to burn in the future.
- **Being sensitive to participant circumstances and avoiding implying judgement on people's burning behaviour**. This involved employing tried and tested methods to encourage participation and to move discussions beyond knee-jerk or socially acceptable responses. For example, personas of different types of burners were used to help participants explore and articulate their views from other perspectives because experience suggests people can find it easier to 'project' their views onto others, particularly when discussing sensitive or socially undesirable behaviours.
- **Supporting participants to recall decisions and behaviours that happened in the past** and that may not have been previously verbalised. This was addressed with exercises and techniques such as a pre-interview diary, calendar 'mapping', and prompts during the interview.
- **Interviewing burners in their home in order to better understand their burning practice and context.** Heating and energy issues are not typically front of mind for participants and it can therefore be difficult to identify and articulate influences on behaviour and decisions. Visual ethnography (observing and photographing appliances and burning behaviour) was used to help better understand the context of participant behaviours.

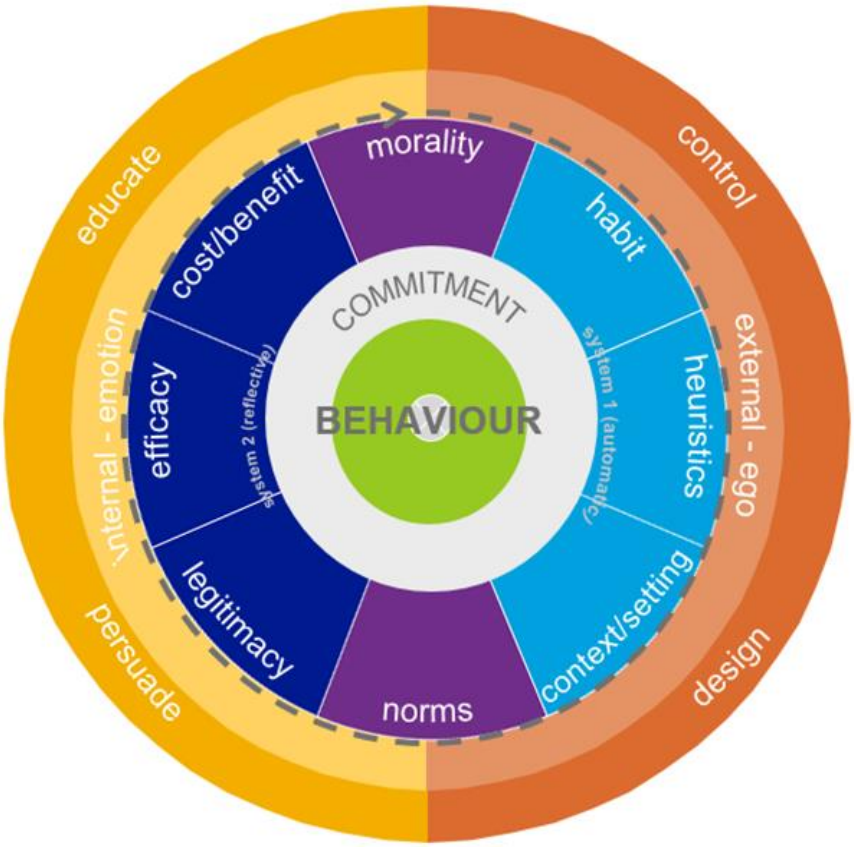
Directly after each burner interview, researchers completed short pro forma notes to assist with top level analysis. After roughly two thirds of the interviews and two focus groups had

been completed, interim feedback on emerging themes was provided to Defra in an interim presentation.

Once all fieldwork was completed, the project team held an analysis session with the full team of researchers to discuss findings and start to build key themes. A subsequent analysis session was held with members of the Defra team in attendance, there both to observe, and to pose questions that helped stimulate the discussion and draw out points of interest and challenge.

Figure 1.2 presents the Kantar Behavioural Framework, which was used to identify and explore influences on burning behaviour and attitudes, on how they manifest, and to guide the development of analysis of potential levers for change. Different forms of influence were identified and a process of mapping of behaviours and attitudes assisted to underpin the identification of burner typologies, which were then used to inform the development of the quantitative segmentation. After the content analysis, an analytical framework was developed to distil the data, using the interview transcripts.

Figure 1.2: Kantar Behavioural Framework



Qualitative research is able to provide 'rich description' of particular practices, how it fits into everyday life and what meanings it has for some of the individuals engaged in it. Further detail on the methodological approach is in section 2.1. However, such studies are not designed to be able to provide insight into how representative the experiences described are, and this is where quantitative research comes into its own.

1.3.2 Core activity survey (CAS): quantitative research

The purpose of the core activity survey was to provide up-to-date and reliable data on the quantities of different solid fuels being burned, inside and outside the home, across the country and across the year[23]. A short set of core questions, repeated on a recurring basis over a 10.5 month period, provided estimates of burning activity in the previous week, a period of time in which recall was likely to be strong. Data was collected on fuel type (including seasoning), quantities, appliance type and length of operation over the period of the survey (almost a full calendar year). Defra supplied draft questions, which were developed and tested by Kantar in collaboration with the project advisory group.

Core activity survey data was collected via the Kantar face-to-face omnibus survey[24]. An omnibus survey offers a robust yet cost-effective approach to data collection. Interviewing was conducted on customised hand-held Computer Assisted Personal Interviewing (CAPI) machines. The omnibus uses a random location sample design, which is a high-quality form of quota sampling. The sampling program integrates the Postcode Address File (PAF) with 2011 Census area statistics to generate sampling points.

The whole omnibus sample was weighted to be representative of the UK population according to demographic variables: region, gender, age, working status, marital status and tenure. The sub-sample of burners (meaning those who reported having burned solid fuels at their property in the 12 months prior to being interviewed) could then be considered representative of the UK adult population of burners (see Annexe E for further detail on the method).

The omnibus survey achieves interviews with a cross section of UK adults aged 16+. Around 2,100 interviews are achieved in each wave. In most weeks Kantar conducts one omnibus wave, but occasionally two waves are run. The core activity survey questions were included in 22 waves to measure variations in domestic burning over the course of a year. Overall 46,729 interviews were completed among the UK population of burners and non-burners. The first survey question asked participants if they or anyone in the household had burned at the property in the last 12 months. Those who said no one had were classified as non-burners and were asked no further questions.

Table 1.3 shows the 95% confidence intervals[25] associated with the main core activity survey results on the incidence of burning in the UK[26]. It is important to note that the confidence intervals on other CAS questions tend to be larger because the sample sizes (n) for these other questions are smaller. For example, the confidence interval for the question on what quantities of solid fuels were used for burning in the last seven days, which was asked of those who burned indoors exclusively, those who burned outdoors exclusively and those who burned both indoors and out, is ±2.4% (max) on a sample size of 2,083.

[23] Quantitative estimates of fuel use are not presented in this report. Analysis based on the Kantar core activity survey has been conducted by Defra and a summary of the results are published as an annexe to this report (Annexe A).

[24] In an omnibus survey, clients reserve space to ask a small module of questions. In a single omnibus wave, participants can be asked questions on a range of topics. The total interview is generally no more than 30 minutes.

[25] This means that there is a 95% probability that if the whole UK adult population were surveyed the result would fall within the range of the confidence interval (for example, there is a 95% probability that the actual percentage of indoor burners in the UK adult population lies between 7.7% and 8.3% [8% + or - 0.3%]) if the weighted sample accurately reflects the wider population.

[26] These percentages have been interpreted in this research as reflecting the incidence of burning in the UK. The incidence figures used here do not include the data collected in the Screener Survey for the same question. This is because incidence of solid fuel burning was further validated in the CAS: CAS respondents were asked what types of fuel they had burned in the last 12 months, and if they had burned no solid fuels they were reclassified as a non-burner.

Table 1.3: Level of confidence in main core activity survey statistics

Statistic	Weighted	95% confidence interval (+/-)	Sample of burners (un-weighted)	Total sample size (n)
% of sample who burned in previous 12 months (yr)	19.4%	±0.4%	7,531	46,729
% of sample who burned indoors in last year	8.0%	±0.3%	2,996	46,729
% of sample who burned outdoors in last year	13.6%	±0.3%	5,252	46,729
% of sample who burned both indoors & out in last year	2.2%	±0.1%	717	46,729

Since one of the main objectives was to provide data on solid fuels being burnt across the year, the fieldwork took place between April 2018 and February 2019. Given the relevance of weather to domestic burning, it is worth bearing in mind that according to the Met Office[27], 2018 was the joint hottest summer on record for the UK, and the hottest ever for England. This may have influenced the extent of outdoor cooking and socialising over this period. There is further detail on weather in section 1.5.1.

1.3.3 Point-in-time survey (PiT): quantitative research

The purpose of this research strand was to provide more in-depth understanding of the attitudes, behaviours and reasons of burners and non-burners as they related to burning. It comprised two national surveys, one of burners and one of non-burners, which were collectively known as the Point-in-time Surveys. Questionnaire content for both surveys was based on the objectives of the project, and further informed and refined using the findings from the qualitative research. Kantar developed the questionnaire with input from the project steering group and it was cognitively tested (see details in Annexe D).

A Computer Assisted Telephone Interviewing (CATI) survey was conducted with burners in early 2019. There was no existing sampling frame for domestic burners so contacts were generated from the core activity survey and a separate screener survey that was run on alternate (nationally representative) omnibus waves. The screener survey asked participants if they, or anyone in the household, had burned anything at their property in the last 12 months. Qualifying burners identified in the core activity survey or screener survey that gave consent to re-contact were invited to take part in the point-in-time survey. Fieldwork for the point-in-time survey (burners) ran from 14 January to 18 April 2019. The average interview length was 16 minutes 40 seconds.

Prior to fieldwork, the target number of burner interviews was 2,200. A sample of this size would have provided overall survey estimates for burners, with 95% confidence intervals, of around ±2.1 percentage points (not accounting for the effect of weighting). However, in practice achieving interviews proved challenging (see Table 1.4).

[27] https://www.metoffice.gov.uk/weather/learn-about/past-uk-weather/summaries/2018-monthly-summaries/summer-2018

Table 1.4: Point-in-time survey fieldwork outcomes

Outcome	No. of cases	Proportion of issued sample
Total number of issued sample	5331	100%
Invalid telephone numbers	796	15%
Ineligible (no longer a burner)	222	4%
Unresolved sample	1751	33%
Resolved sample		
Refusal	554	10%
Communication barrier	56	1%
Unavailable during fieldwork	120	2%
Completed interviews	1832	34%
Adjusted response rate[28]	45%	

Several measures were in place to maximise survey participation, including offering to interview at the respondents' convenience and advance survey notification being provided via SMS text message. However, despite participants agreeing to re-contact and providing contact details in the CAS or Screener Survey, 15% of cases had a non-working or wrong number[29]. A further third (33%) of cases were unresolved, meaning an interview could not be obtained, primarily because participants could not be contacted. 13% of the sample was resolved without an interview taking place due to a refusal, communication barrier or unavailability during fieldwork. During fieldwork a supplementary sample of burners was generated from an online panel. Overall 217 Point-in-time Survey interviews were completed from this sample source.

In total 1,832 interviews of outdoor and indoor burners were achieved. A sample of this size provides estimates for the whole sample of burners with a maximum 95% confidence intervals of ±2.8 percentage points. Table 1.5 shows the confidence intervals associated with indoor and outdoor burning statistics. The confidence intervals (CI) for sub-groups are wider than for the overall sample due to lower base sizes (for example, the maximum CI for primary burners -- those who burn for most or all of their heating -- is ±11%). Further detail on the method is provided in Annexe D.

Table 1.5: Level of confidence in main point-in-time survey (burners) statistics

Statistic	Sample size (n)	95% confidence interval (+/-)
Statistics on indoor burners	993	±3.8% (max)
Statistics on outdoor burners	1,289	±3.3% (max)

Weights for the burners' point-in-time survey were calculated in two stages. First, the full CAS sample was weighted to be representative of the UK population by demographic variables: region, gender, age, working status, marital status and tenure. The sub-sample of burners was then considered representative of all UK burners. Second, likelihood to complete the point-in-time survey was modelled using the same demographic variables, to

[28] Disregards invalid numbers and applies an eligibility assumption to unresolved cases and cases that were resolved but not interviewed.

[29] This could be due to the telephone number going out of service in the period between CAS and PiT or the respondent and/or interviewer inaccurately relaying or recording the telephone number during the CAS or screener survey.

generate response weights. This compensated for any systematic observed differences in the type of respondents that took part.

The supplementary survey of non-burners was run on the Kantar face-to-face omnibus in January 2019. A total sample of 731 non-burners was achieved. A sample of this size provides estimates for non-burners with maximum 95% confidence intervals of ±4.5 percentage points. Weights constructed as part of the CAS were appended to the non-burner sample so that it was representative of all non-burners in the UK.

1.3.4 Quantitative analysis

The analysis of the CAS and PiT presented in this report describes the incidence or proportion of the adult population surveyed, whether that be the total population or a particular sub-group. The proportions do not represent other bases, for example, of a type of fuel or a type of appliance.

All quantitative analysis was conducted using SPSS. Bivariate analysis of all survey data by sub-groups of interest, as agreed by Defra, was done in the first instance. Follow-up bivariate and multivariate analysis was done in areas that required additional insight. Statistically significant differences were identified using t-tests. This analysis indicates whether any difference between the averages of two groups reflects a 'real' difference in the population from which the groups were sampled. Multivariate regression analysis was done to determine the key characteristics associated with certain behaviours (more detail in in Appendix D). PiT data was used to for a segmentation analysis to identify key sub-groups within the population of indoor burners (more detail in in Appendix C).

1.3.5 Secondary analysis

Secondary analysis was conducted by BRE[30] on data from two different national surveys on housing and energy; the English Housing Survey (EHS) and the Energy Follow-Up Survey (EFUS). Data from the EHS from 2003 to 2016 was examined to assess changes in the number of households with solid fuel burning heating systems. Additional analysis was conducted on data from the 2011 EFUS to examine how and when these systems were used by householders.

The EHS is an annual national survey of the English housing stock (unlike the CAS and PiT which focus on respondent from across the UK). It collects information about people's housing circumstances and the condition and energy efficiency of housing in England. The EHS has two main components. Each year, around 13,300 households take part in the face-to-face survey. About 6,000 of the participating households also take part in a physical survey. The physical surveys are carried out by a qualified surveyor and involve a visual inspection of the property and include the identification of primary and secondary heating systems. Statistics reflect appliance ownership rather than use.

The EFUS is a less regular national survey. It examines the way households use energy in their homes in much more detail. The main aim of the 2011 EFUS was to collect new data on patterns of household and dwelling energy use to update modelling assumptions about how energy was used in the home. For example, the survey asked participants what forms of heating they used rather than simply recording what systems are present within the dwelling, as well as questions on how they tended to use their heating and how much they spent on fuels.

[30] https://www.bregroup.com/

1.4 Research challenges and limitations

The quantitative elements in particular depend on participant self-reporting of behaviour and reasons for it, not actual observation of what they do. Accurate responses depend on memory, and ability or willingness to report, which can be impacted by several things including their understanding of the question, their rapport with the interviewer, perceptions of what is expected, social signalling and how busy they are.

1.4.1 Minimising recall bias

One of the challenges of this research was to collect accurate data on the types and volumes of fuels burned. To maximise accuracy and minimise recall bias, where respondents simply do not remember what they have done, these questions used a reference period of one week. In the CAS, therefore, respondents were asked questions specifically about their burning practices in the last seven days.

1.4.2 Maximising the accuracy in estimates of fuel burned

The survey required the respondent to estimate the amount, ideally the weight, of the fuel they burnt in the last seven days. The survey asked this in two ways within the CAS interview. In the first instance respondents were asked how many kilograms of a particular fuel they burned. If they were unable to answer in kilograms, they were asked how many buckets that fuel would fill. To help elicit an accurate response, that was also consistent across the sample, they were shown a scaled image of a 10l bucket being held at arm's length against a standard brick wall with a tin of beans as a reference. Despite these survey aids, the data is still subject to error, whether it be from incorrectly estimating the weight or volume of the fuel or misidentifying the fuel altogether. This must be borne in mind when interpreting the findings.

Indoor burners were also asked to estimate how long their appliance had been running each day in the previous week. This measure was used in DECC's Domestic Wood Use Survey (DWUS) to establish a proxy estimate of the quantities of fuel burned.

1.4.3 Predicting future behaviour

One of the areas covered by the point-in-time survey and the qualitative research was how burners and non-burners anticipated their burning practices changing and what they might do if circumstances or policies changed. Responses to questions about future behaviour or hypothetical situations carry additional uncertainty, which must be taken into account when interpreting the results to these questions.

1.4.4 Low sample sizes

Where findings are based on a small number of responses, for example relating to a low-incidence sub-group, there is additional uncertainty around point estimates and confidence intervals. Findings should be treated with caution in these instances. They are reported as indicative only to reflect this.

1.4.5 Supplementary method of data collection

As indicated earlier, the sample size of indoor burners in the point-in-time survey was smaller than desired because of a lower than expected re-contact rate from the core activity survey and screener survey. Therefore, in addition to re-contacting burners from the Kantar omnibus, the sample for the point-in-time survey was supplemented with extra contacts screened from the Kantar online panel. These participants earned 'points'[31] by agreeing to be screened but received no additional incentive if they took part in the point-in-time survey. All responses from these interviews were weighted to the burning population as estimated through the core activity survey separately from the rest of the PiT sample to combat any potential bias in the sample using this mode of screening. More detail about this can be found in the Annexe D.

1.4.6 Lack of a full year of data from the core activity survey

For resourcing and timing reasons, the CAS covers 10.5 months of the year rather than a full year, which makes interpreting seasonal differences more complex, and has meant additional analysis has been needed for the quantification to take account of this missing period.

1.4.7 Question routing issues

An error was made in the routing of two questions in the CAS so those who only burned waste wood in the last week were not asked about the seasoning or sourcing of the waste wood they accessed. The CAS questionnaire in Annexe E note the routing that was actually used, and the report makes clear when this is likely to have impacted on a finding.

1.4.8 Identification of smoke control areas

Smoke control area (SCA) postcodes for the three countries of Great Britain came from Ricardo based on updates done in 2017/18. Ricardo also created a postcode file of SCAs for Northern Ireland for this project, with the following caveats: that the SCA boundaries were compiled from public sources over several years and therefore they were unable to guarantee the completeness or accuracy of this data. Ordnance Survey (GB) also only make postcodes for Northern Ireland available as point locations, not polygons. Due to the nature of the point data, this list may not be complete where the centre of a postcode area falls outside a smoke control area. It is also possible that the list includes a small number of non-affected postcodes, for example postcode points that fall inside a smoke control area boundary where properties they relate to are physically not within it. The easting/northing coordinates in the file are projected to OSGB national grid.

Northern Ireland local authorities therefore were contacted though the Northern Ireland government to confirm the locations of their SCAs. Not all local authorities responded, but where postcodes were provided a Defra statistician compared them to the Ricardo postcodes he plotted. On this basis, he deemed that Ricardo's postcode file was relatively accurate and captured all of the updates to SCAs since 2008, the date of a map of Northern Irish SCAs that Defra had obtained. As with the postcode file generated by Ricardo, the main caveat is that each postcode point represents the centre of the postcode, so for properties on the edges of SCAs whether they have been included or not depends on where the centre point for their postcode is.

[31] Points have no cash value but can be exchanged for rewards.

1.5 Contextual information

The core activity survey collected data between April 2018 and February 2019. It asked participants what, if anything, they had burned over the previous 12 months and in the previous seven days. 2018 saw relatively extreme conditions with both severe winter weather in February and March and a summer that was the warmest and driest in over a decade[32]. Overall, 2018 was warmer (0.6C), drier (92% of rainfall) and sunnier (115% of sunshine) than the historical averages over the period from 1981-2010, which might be expected to have an impact on the incidence of burning (for example, on the use of barbeques over the hot summer period)[33]. Data collection started after the cold period in 2018, but this spell may nevertheless be relevant to the numbers of respondents who had burned indoors in the previous 12 months. The survey then continued into the first couple of months of 2019, which were around the average temperature for January and milder than normal February[34]. Findings should be considered in this context.

1.6 Reporting notes

The following points should be borne in mind when reading this report:

- Percentages for single-response questions do not always add to 100% due to the effect of rounding.
- Responses of 'don't know' and question refusals are included in the reported findings.
- Zero per cent (0%) represents a value greater than zero but less than 0.5%, whereas '-' represents the exact value 0.
- Most differences reported between groups are statistically significant at the 95% confidence level, which means that we can be 95% confident that the differences observed are genuine and have not occurred by chance.

Key groups referred to in this report have been classified based on the following definitions:

- Indoor burners: those who lived at a property where solid fuels had been burned indoors in the last 12 months, either by themselves or someone in the household.
- Outdoor burners: those who lived at a property where solid fuels had been burned outdoors in the last 12 months, either by themselves or someone in the household.

Smoke control area: administrative data on SCAs was appended to the survey datasets, matched on postcode.

[32] https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/summaries/uk_monthly_climate_summary_annual_2018.pdf

[33] Ibid.

[34] https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/summaries/uk_monthly_climate_summary_winter_2019.pdf

2. Patterns of burning in the UK

2.1 Key findings from exploratory qualitative research

This section briefly outlines key findings from the qualitative research (35 in-depth interviews with burners in their own homes and 4 focus groups) that helped to inform the questions used in the quantitative surveys, and the approach taken to the segmentation of indoor burners into different typologies based on their reasons and motivations for using a burning appliance. The purpose is to provide context in which to interpret the rest of the chapters, which largely focuses on the quantitative analysis. This aspect of the research is discussed further in relevant chapters where qualitative data is drawn on to illustrate particular findings, to provide further explanation of quantitative data or to provide insight on aspects of interest related to the research aims and questions that the quantitative analysis was not able to address.

Case studies of different burners are also provided based on the in-depth interviews of a range of burners conducted as a core part of this qualitative exploratory stage of the research[35]. The purpose of this is not only to illustrate the differences in why and how people burn in the UK, but also to show how the separate findings on solid fuel use, appliance usage, or other burning-related behaviours and practices are combined in different configurations in the everyday lives of different burners. The case studies chosen also help to confirm that the groups identified in the segmentation are reflected in lived experience, though there are overlaps between groups and variations within them. These case studies can be found in Chapter 7. Photographs related to burning that were collected as part of the interviews to provide visual ethnographic data are also interspersed across the findings.

The qualitative research found both similarities and differences between the 35 interviewees. Overall, it is clear that there are a wide range of circumstances in which people burn solid fuels at home in the UK and a lot of variation in the motivations for doing so and in the burning practices adopted. However, most of the burners interviewed expressed strong emotional engagement with fire, regardless of the extent to which they burned, positive associations that were also echoed by many of the non-burners in the focus groups. What was different about these burners in comparison with the non-burners in the focus groups was that the non-burners tended to see burning, particularly indoor burning, as an expression of a different and in some ways distant lifestyle from their own. For those who burned, however, it was integrated, if in varied ways and for different reasons, into their everyday lives, and for a few appeared to have become integral to their identity.

As suggested, the in-depth interviews revealed both similarities and differences between burners.

- They could be differentiated based on their underpinning reasons for burning (for example, burning for necessity due to a lack of access to the gas grid, burning to manage expenditure, and burning for pleasure), and these differences seemed to play out across burning behaviours, suggesting it might be possible to identify different types of indoor burners based on their reasons for burning.

[35] The case studies are anonymised summaries of a number of the qualitative interview transcripts. They were chosen and summarised by Defra to provide real-world examples to complement the descriptions of the segments provided by Kantar.

- Most of the burners interviewed, whether they burned to provide all their heating or just occasionally, expressed a strong emotional attachment to fire.
- This was interwoven for a number with a strong sense of empowerment or independence derived from heating their own homes.
- Many of the burners indicated they (or someone in their household) were knowledgeable about and confident in their approach to burning and appeared protective of it.
- These burners relied on a "common sense" approach to their burning behaviour, underpinned by learning from trial and error (heuristics) and eventually habit.
- Experts, such appliance suppliers/installers, fuel suppliers and chimney sweeps played a role for some of these interviewees on occasion in influencing how they went about their burning practice (e.g. how often they swept their chimneys, what stove to install, etc.), for example.
- The impacts of burning on health and the environment were not something participants had given much thought to prior to the interview; for many these were new narratives to engage with.

2.2 Incidence and spatial distribution of burning

Participants in the core activity survey were asked if they or another household member had burned at their property in the 12 months prior to being surveyed. Based on over 46,000 responses, around two in ten UK adults (19%) were found to have burned solid fuels at their home according to this definition. More reported burning outdoors than indoors (14% and 8% respectively, including 2% who reported burning in both environments)[36]. We can be confident about the robustness of these findings due to the large sample size (see Table 1.5 for confidence intervals).

2.2.1 Distribution of burning by UK nation and by English region

Table 2.1 below presents the self-reported incidence of burning in the UK in the year prior to the survey, by nation (England, Wales, Scotland and N. Ireland)[37], based on analysis of the CAS question above.

[36] The findings for the proportion burning indoors are a little lower than the 2011 Energy Follow-Up Survey findings (which cover England only and focused on households). These found that approximately 8.6% of all households were using solid fuel burning secondary systems.

[37] Note that there tends to be a small proportion who burn both indoors and outdoors and these percentages are identified separately but included in the total figures for indoors (total), outdoors (total), and all burners (total).

Table 2.1: Spatial distribution of incidence of burning within UK adult population in 2018-19 (self-reported incidence, % of adult population - CAS)

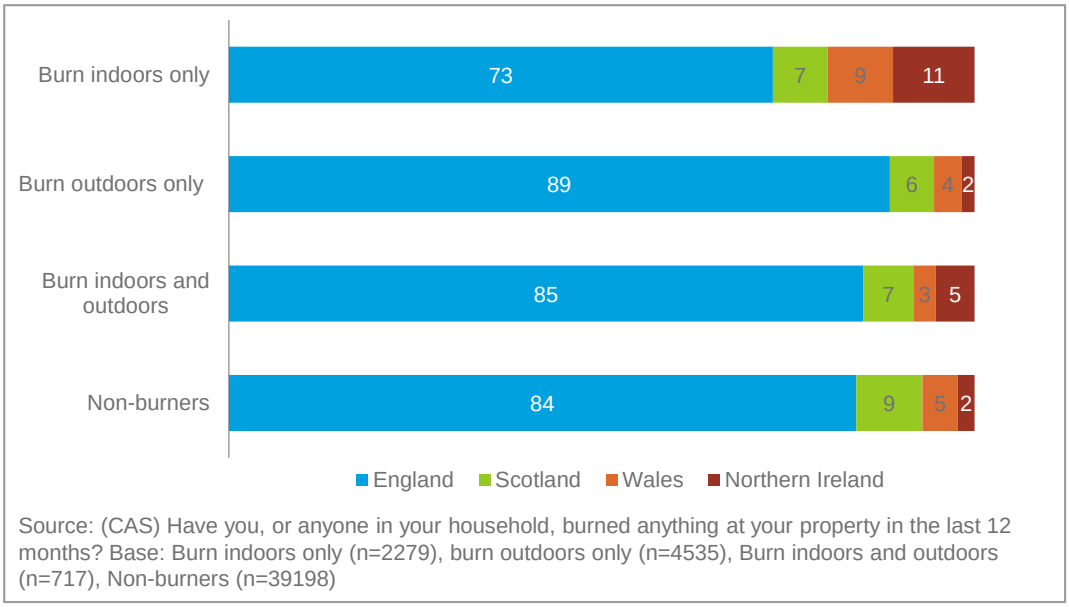
		Nation			
All respondents	**All UK**	**England**	**Wales**	**Scotland**	**N. Ireland**
Unwtd base	*46729*	*38930*	*2201*	*4241*	*1357*
All burners (total)	19.4%	19.3%	20.9%	14.9%	34.2%
Indoors (total)	8.0%	7.3%	12.0%	6.8%	27.1%
Indoors only	5.8%	5.1%	10.7%	5.1%	23.1%
Both indoors and outdoors	2.2%	2.2%	1.3%	1.7%	4.1%
Outdoors (total)	13.6%	14.3%	10.2%	9.8%	11.2%
Outdoors only	11.4%	12.1%	8.9%	8.0%	7.1%
Non-burners	80.6%	80.7%	79.1%	85.1%	65.8%

Key: Orange: significantly higher than all UK; blue: significantly lower than all UK

As can be seen above, the most striking statistic is that a significantly greater proportion of those living in Northern Ireland reported burning indoors (27%) than the UK average. This may be linked to levels of gas grid connectivity in Northern Ireland, which is much lower than other parts of the UK. According to PiT data, 14% of burner respondents in Northern Ireland were connected to the gas grid compared with 82% across the UK.

However, whilst the proportion of indoor burners was higher in Northern Ireland (and to a lesser extent, in Wales too), they made up a relatively small proportion of the UK indoor burning population, because of the smaller population sizes of these two countries. Therefore, as Figure 2.2 below indicates, 73% of UK indoor only burners lived in England as did 85% of those who burned both indoor and outdoor.

Figure 2.2: Percentages of UK adult burners in each burning category, by nation (% of burners, non-burners)



Source: (CAS) Have you, or anyone in your household, burned anything at your property in the last 12 months? Base: Burn indoors only (n=2279), burn outdoors only (n=4535), Burn indoors and outdoors (n=717), Non-burners (n=39198)

Within England, overall burning in the year prior to the survey was particularly prevalent in the South East (where 26% of respondents burned in comparison to the UK average of 19%), driven largely by higher levels of outdoor burning (21% compared with 14% on average, see Table 2.3 below).

Table 2.3: Spatial distribution of incidence of burning within UK adult population by region in 2018-19 (self-reported incidence, % of adult population - CAS)

		English region								
All respondents	**All UK**	**North East**	**North West**	**Yorks & Humber**	**East Mids**	**West Mids**	**East of England**	**London**	**South East**	**South West**
Unwtd base	*46729*	*2128*	*5292*	*3938*	*3313*	*3996*	*4359*	*5610*	*6362*	*3932*
All burners (total)	19.4%	16.2%	19.3%	15.3%	18.6%	18.3%	19.3%	17.4%	26.3%	18.1%
Indoors (total)	8.0%	6.1%	8.5%	7.0%	9.3%	6.3%	7.2%	2.9%	9.3%	9.2%
Indoors only	5.8%	5.0%	6.3%	5.1%	6.5%	4.6%	5.0%	1.7%	5.7%	7.1%
Both indoors & outdoors	2.2%	1.1%	2.2%	1.9%	2.8%	1.8%	2.3%	1.2%	3.6%	2.1%
Outdoors (total)	13.6%	11.2%	13.0%	10.2%	12.1%	13.8%	14.4%	15.8%	20.6%	10.9%
Outdoors only	11.4%	10.1%	10.8%	8.3%	9.3%	12.0%	12.1%	14.6%	17.1%	10.1%
Non-burners	80.6%	83.8%	80.7%	84.7%	81.4%	81.7%	80.7%	82.6%	73.7%	81.9%

Key: Orange: significantly higher than all UK; blue: significantly lower than all UK

2.2.2 Distribution of burning by rural and urban areas

Table 2.4 below displays the reported incidence of burning in the UK in the year prior to the survey according to whether people lived in rural or urban areas (see glossary for ONS-based definition of rural and urban[38]). In general, it shows a greater propensity to burn in less built-up areas. In particular, it indicates that whilst in rural areas the proportion of inhabitants who burned indoors (13%), was higher than the national average, the proportion of urban dwellers who burn indoors was lower (7%). There was less variation in the overall levels of outdoor burning (notwithstanding differences in the *type* of outdoor burning taking place, which will be discussed later), though the percentage of those burning outdoors *only* in urban areas was higher and the percentage burning only outdoors in rural areas was lower (12% and 9% respectively) than the national average.

[38] Urban and rural classification was derived according to the postcode of the sampled residence based on ONS classifications.

Table 2.4: Spatial distribution of incidence of burning within UK adult population by urban and rural areas in 2018-19 (self-reported incidence, % of adult population - CAS)

		Population Density	
All respondents	**All UK**	**Urban**	**Rural**
Unwtd base	*46729*	*37909*	*8820*
All burners (total)	19.4%	18.7%	22.6%
Indoors (total)	8.0%	6.7%	13.3%
Indoors only	5.8%	4.8%	10.0%
Both	2.2%	1.9%	3.2%
Outdoors (total)	13.6%	13.9%	12.5%
Outdoors only	11.4%	12.0%	9.3%
Non-burners	80.6%	81.3%	77.4%

Key: Orange: significantly higher than all UK; blue: significantly lower than all UK

The proportion of indoor burners in rural areas (32%) was higher than the proportion of the UK population living in rural areas (19%), whilst the proportion of outdoor burners was a little higher in urban areas than the proportion of the UK population living in urban areas (see Table 2.5 below). This means that indoor burners are over-represented in rural areas, and that outdoor burners are slightly over-represented in urban areas. This said, because the UK's urban areas are more populous (accounting for 81% of survey respondents), 22% of all burners lived in rural areas and 78% lived in urban areas. In absolute terms, this means that more people were burning in urban areas, be it outdoors or indoors, than in rural areas.

Table 2.5: Distribution of burners and non-burning respondents by rural and urban areas in 2018-19 (% of UK adult population, burners, non-burners - CAS)

		Burners						
All respondents	**All UK**	**All Burners**	**Indoors**	**Indoors only**	**Indoors & outdoors**	**Outdoors only**	**Out-doors**	**Non-burners**
Unwtd base	*46729*	*7531*	*2996*	*2279*	*717*	*4535*	*5252*	*39198*
Urban	80.8%	77.7%	68.1%	66.9%	71.1%	84.4%	82.3%	81.5%
Rural	19.2%	22.3%	31.9%	33.1%	28.9%	15.6%	17.7%	18.5%

Key: Orange: significantly higher than all UK; blue: significantly lower than all UK

Table 2.6 shows the reported incidence of burning in each nation according to whether people lived in rural or urban areas. In all nations the incidence of indoor burning was higher in rural areas than in urban areas. In England a higher proportion of urban residents burned outdoors (15%), compared with rural outdoor burners (13%). In Wales, incidence of outdoor burning was lower in urban areas (8%) than in rural areas (16%). There was no significant difference in the incidence of outdoor burning in urban and rural areas in Scotland and Northern Ireland.

Table 2.6: Spatial distribution of incidence of burning within UK adult population by nation and urban/rural areas in 2018-19 (self-reported incidence, % of adult population - CAS)

		Nation / Population Density							
		England		Wales		Scotland		N. Ireland	
All respondents	**All UK**	**Urban**	**Rural**	**Urban**	**Rural**	**Urban**	**Rural**	**Urban**	**Rural**
Unwtd base	*46729*	*32819*	*6111*	*1610*	*591*	*2560*	*1681*	*920*	*437*
All burners (total)	19.4%	19.0%	21.2%	16.9%	31.0%	12.4%	18.5%	28.7%	45.1%
Indoors (total)	8.0%	6.4%	11.8%	10.2%	16.6%	4.0%	10.9%	21.2%	38.8%
Indoors only	5.8%	4.5%	8.3%	9.2%	14.6%	2.8%	8.5%	17.4%	34.3%
Both	2.2%	1.9%	3.5%	1.0%	2.1%	1.3%	2.4%	3.8%	4.5%
Outdoors (total)	13.6%	14.5%	12.9%	7.7%	16.5%	9.6%	10.0%	11.4%	10.8%
Outdoors only	11.4%	12.6%	9.4%	6.7%	14.4%	8.4%	7.6%	7.6%	6.3%
Non-burners	80.6%	81.0%	78.8%	83.1%	69.0%	87.6%	81.5%	71.3%	54.9%

Key: Orange: Urban significantly higher than rural by nation; blue: urban significantly lower than rural by nation

Table 2.7 shows the reported incidence of burning in each region in England by whether respondents lived in rural or urban areas. London is excluded as it is a wholly urban area. Similar patterns emerge: the incidence of indoor burning was higher in rural areas in all regions than in urban areas, whereas outdoor burning was higher in some urban areas (the South East, East of England and the North East).

Table 2.7: Spatial distribution of proportions of UK adult population who burn indoors and outdoors by region and urban/rural areas in 2018-19 (self-reported incidence, % of adult population [% sign omitted for space] -CAS)

		English region / Population Density: Urban (U) / Rural (R)															
		North East		North West		Yorks & Humber		East Midlands		West Midlands		East of England		South East		South West	
All respondents	**All UK**	U	R	U	R	U	R	U	R	U	R	U	R	U	R	U	R
Unwtd base	*46729*	*2063*	*65**	*5154*	*138*	*3116*	*822*	*2289*	*1024*	*3302*	*694*	*3373*	*986*	*5726*	*636*	*2186*	*1746*
All burners (total)	19.4	15.8	27.7	19.1	26.3	13.8	20.7	18.0	19.9	17.3	23.1	18.7	21.4	26.8	22.4	16.3	20.3
Indoors (total)	8.0	5.5	23.4	8.3	14.1	5.6	11.8	8.6	10.9	5.1	12.0	6.1	11.2	9.0	12.2	7.0	11.9
Indoors only	5.8	4.5	20.8	6.1	10.6	3.8	9.9	6.3	6.8	3.8	8.1	4.3	7.2	5.5	7.3	5.7	8.9
Both indoors & outdoors	2.2	1.1	2.6	2.2	3.5	1.9	1.9	2.2	4.1	1.3	3.9	1.8	3.9	3.4	4.8	1.3	3.0
Outdoors (total)	13.6	11.3	6.9	12.9	15.7	10.0	10.8	11.7	13.1	13.5	15.0	14.4	14.2	21.2	15.1	10.5	11.4
Outdoors only	11.4	10.3	4.3	10.8	12.2	8.2	8.9	9.4	9.0	12.2	11.1	12.6	10.3	17.8	10.2	9.3	8.4
Non-burners	80.6	84.2	72.3	80.9	73.7	86.2	79.3	82.0	80.1	82.7	76.9	81.3	78.6	73.2	77.6	83.7	79.7

Key: Orange: Urban significantly higher than rural by region; blue: urban significantly lower than rural by region

* Treat findings for this subgroup with caution due to a low base size.

2.2.3 Burning in smoke control areas (SCA)

Overall, CAS respondents were evenly split between living in a smoke control area (SCA) and not (both 50%). Among those living in an SCA, 4% reported burning indoors compared with 12% of those not living in SCAs. Overall, 25% of indoor burners lived in an SCA and 75% did not.

The analysis on SCAs in this report focuses on urban areas: that is urban areas that are SCAs compared with urban areas that are not SCAs. This was done to ensure comparisons between SCA and non-SCA respondents were based on similar contexts, and the majority of SCAs are in urban areas. In urban areas, 57% of respondents lived in an SCA. In rural areas 19% lived in an SCA.

Tables 2.8 and 2.9 below represent the key CAS results on the incidence of urban burning within the UK by smoke control areas (SCAs). These show that although a greater proportion (57%) of urban survey respondents, both burners and non-burners, lived in an urban SCA, only 4% of those living in an urban SCA reported burning indoors compared with 10% of those living in an urban area that was not an SCA. Put another way, 34% of indoor burners who lived in an urban area lived in a SCA and 66% did not.

Table 2.8: Spatial distribution of incidence of urban burning within UK adult population, by SCA, in 2018-19 (self-reported incidence, % of urban adult population - CAS)

	All UK urban areas	**Live in SCA[39] (urban areas only)**	
All respondents		**Yes**	**No**
Unwtd base	*37909*	*21764*	*15936*
All burners (total)	18.7%	15.7%	22.9%
Indoors (total)	6.7%	4.0%	10.5%
Indoors only	4.8%	2.9%	7.5%

Key: Orange: significantly higher than all UK; blue: significantly lower than all UK

What these two tables (above and below) show is that the differences between the proportion of those burning in an urban SCA and the proportion of urban dwellers overall is statistically significant. This could suggest that the SCAs are having an impact in people's choices to burn. However, it may be associated with other factors, such as the nature of housing in urban SCA areas and the ability to store solid fuel. Certainly, responses in the PiT demonstrated a relative lack of awareness among both burners and non-burners about whether they lived in an SCA or not (see Chapters 5 and 10 for details) and this may suggest that there could (also) be other reasons why the proportion of urban burners who live in SCAs is significantly lower than the overall percentage of people in urban areas who live in SCAs.

[39] SCA classification was derived according to the postcode of the sampled residence.

Table 2.9: Distribution of urban burners living or not living in an (urban) SCA in UK in 2018-19 (% of urban adult population, burners - CAS)

	All UK urban areas	Burners (in urban areas)		
All respondents		All Burners	Indoors	Indoors only
Unwtd base	*37700*	*5846*	*2028*	*1523*
Yes in SCA	57.3%	47.9%	33.6%	33.7%
Not in SCA	42.7%	52.1%	66.4%	66.3%

Key: Orange: significantly higher than all UK; blue: significantly lower than all UK

Table 2.10 shows the reported incidence of burning in urban areas according to whether people lived in an urban SCA or not. In England, Scotland and Northern Ireland the incidence of indoor burning was higher in urban non-SCAs than in urban SCAs. The base size of respondents in urban SCAs in Wales was too low to report.

Table 2.10: Spatial distribution of incidence of burning within UK population by nation and urban SCA areas (self-reported incidence, % of adult population -- CAS)

	All UK urban areas	Nation/Urban SCA							
		England		Wales		Scotland		N. Ireland	
All respondents		Urban SCA	Urban non-SCA	Urban SCA	Urban non-SCA	Urban SCA	Urban non-SCA	Urban SCA	Urban non-SCA
Unwtd base	*37909*	*19856*	*12825*	*	*1587*	*1400*	*1094*	*490*	*430*
All burners (total)	18.7%	16.1%	23.4%	*	17.1%	9.4%	16.2%	14.1%	43.3%
Indoors (total)	6.7%	4.0%	10.0%	*	10.3%	2.3%	6.2%	7.1%	35.2%
Indoors only	4.8%	2.9%	6.9%	*	9.3%	1.5%	4.4%	6.5%	28.1%

Key: Blue: Urban SCA significantly lower than urban non-SCA by nation

* Base size too small to report.

Table 2.11 shows the reported incidence of burning in each region in England by whether people lived in an urban SCA or not. Incidence of indoor burning is higher in urban areas that are not SCAs in all regions except for the North East where it is similar regardless of whether the urban area is an SCA or not.

London is all covered by SCAs. There, 17.4% of the adult population burned in the year prior to the survey, but largely outdoors. 2.9% of London's adult population burned indoors in total; only 1.7% burned exclusively indoors.

Table 2.11: Spatial distribution of incidence of burning within UK population by region and urban SCA areas (self-reported incidence, % of population [% sign omitted for space] - CAS)

All respondents	**All UK urban areas**	**English region / Population Density: Urban SCA (S) / Urban non-SCA (N)**															
		North East		**North West**		**Yorks & Humber**		**East Mids**		**West Mids**		**East of England**		**South East**		**South West**	
		S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N
Unwtd base	*37909*	*1773*	*287*	*3068*	*2064*	*2677*	*426*	*1264*	*1020*	*2502*	*774*	*1051*	*2313*	*1557*	*4143*	*408*	*1761*
All burners (total)	18.7	16.0	14.7	15.4	24.4	11.3	27.9	13.8	23.1	16.6	19.7	15.6	20.0	22.7	28.3	12.1	17.3
Indoors (total)	6.7	5.3	6.8	5.4	12.4	4.2	13.4	5.3	12.5	3.9	9.0	3.0	7.3	3.7	10.9	4.6	7.6
Indoors only	4.8	4.4	5.1	4.1	9.0	2.9	8.2	3.9	9.2	3.0	6.4	2.3	5.1	2.4	6.7	4.4	6.0

Key: Orange: Urban SCA significantly higher than urban non-SCA by region; blue: urban SCA significantly lower than urban non-SCA by region

2.3 Temporality of indoor burning: when and for how long indoor burners burned

This section explores when respondents said they burned indoors during the year and during the week. The timing of outdoor burning is explored in Chapter 9.

Suffice it to say, this research suggests, unsurprisingly, that the peak period for indoor burning is winter, and the peak period for outdoor burning is summer. The exception is bonfire lighting, which peaks in autumn.

The CAS fieldwork was run over a 10.5-month period[40]. In each wave indoor burners were asked how long they burned in each of the last seven days. 19%[41] of indoor burners burned (for at least one hour) in spring[42], 7% in summer, 33% in autumn and 61% in winter (see Table 2.12). This indicates that indoor burners did not necessarily burn every week in the winter.

The seasonality of burning was also apparent when considering the total number of hours respondents said they had burned in the previous seven days in the CAS. This rose from a low of 8.7 hours on average in the summer to a high of 27.9 in the winter[43]. Table 2.12 below shows average daily use by season and the percentage of indoor burner respondents that burned that day. This data suggests that slightly more respondents burned at weekends than on weekdays in winter – though not in summer.

[40] Fieldwork was not run in March which probably means that figures for spring is not wholly representative of the full three months.

[41] As above: also the sample size for spring will have been smaller than the other three seasons. Moreover, because of the classification of seasons below it means that data from the CAS waves for April 2018 was combined with data from the CAS waves for Feb 2019.

[42] The seasons were classified as Spring – Feb-Apr, Summer – May-Jul, Autumn – Aug-Oct, Winter – Nov-Jan.

[43] This result only includes those who used an indoor appliance in the last seven days and gave a valid answer (between 1 and 168 hours).

Table 2.12: Mean number of hours indoor burners burned and proportion of indoor burners that burned on that day during the previous week by season in 2018-19 (mean and % of indoor burners - CAS)[44]

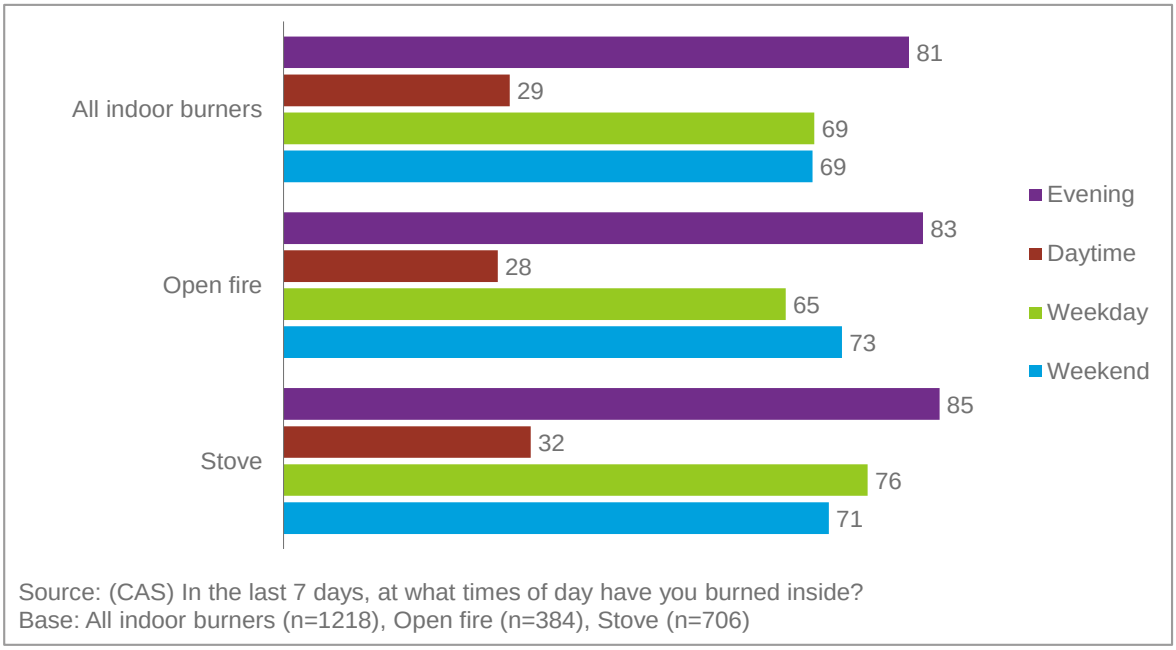
Day	Spring		Summer		Autumn		Winter	
	Mean	%	Mean	%	Mean	%	Mean	%
Monday	2.1	12%	0.9	2%	2.7	21%	3.7	42%
Tuesday	1.6	10%	0.8	2%	2.7	20%	3.7	43%
Wednesday	1.7	11%	0.8	2%	2.6	20%	3.6	41%
Thursday	1.5	10%	0.7	1%	2.7	20%	3.7	42%
Friday	1.5	9%	1.1	3%	2.8	20%	3.9	43%
Saturday	1.5	9%	1.1	3%	3.3	24%	4.5	50%
Sunday	1.7	10%	0.9	2%	3.3	23%	4.5	49%
Total	**15.1**	**19%**	**8.7**	**7%**	**20.8**	**33%**	**27.9**	**61%**

Compared with those with an open fire, stove users tended to use their appliance for longer in the peak season, but less in the summer. During winter, on average stove users lit their appliance for 29.0 hours a week compared with 21.3 hours for those who used an open fire. This is not a significant difference, so should only be treated as indicative.

Indoor burners were also asked in the CAS what times of day they had burned inside during the previous seven days. Burning was focused in the evening, with four in five (81%, see Figure 2.13) having burned in the evening and three in five (60%) having burned *only* in the evening. Around three in ten indoor burners (29%) had burned during the daytime. There was little difference by whether they used an open fire or stove. However, there appears to be relatively little difference between the percentages of indoor burners who burned during the week and the percentages who burned during the weekend.

[44] Fieldwork for the CAS ran from early-April to mid-February, so figures for spring are not wholly representative.

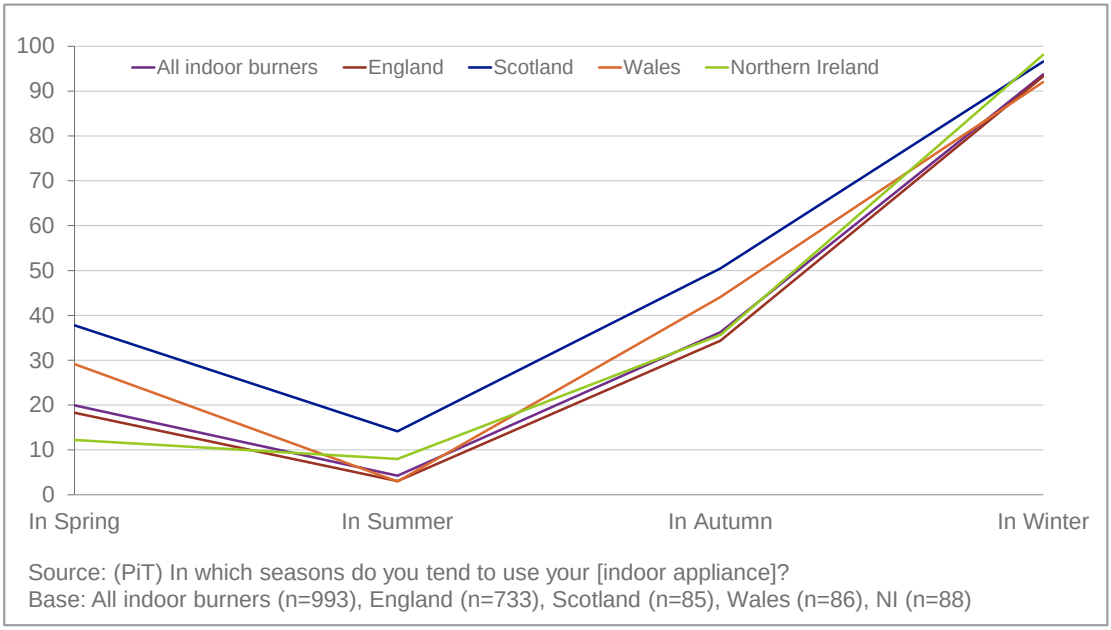
Figure 2.13: Time of day & week indoor burners burned by appliance in 2018-19 (% of indoor burners, multi-response allowed)



Source: (CAS) In the last 7 days, at what times of day have you burned inside?
Base: All indoor burners (n=1218), Open fire (n=384), Stove (n=706)

In the point-in-time survey indoor burners were asked what seasons they tended to use their appliance and, during that period, for how many days a week and how many hours a day they had their fire lit. Unsurprisingly, winter was by far the most common time that respondents said they burned (94%) and summer the least (4%, see Figure 2.14). Most (87%) of the 4% who said they burned in the summer were indoor burners who burned all year; they tended to be more likely to burn solid fuels to heat their water or for cooking. In contrast, just over half of indoor burners said they *only* used their appliance in winter (56%). Most of the rest said they used them in spring and/or autumn too. One in twenty (5%) said they used their appliance 'only once or twice a year'.

Figure 2.14: Season indoor burners tended to use their appliance by nation (% of indoor burners, multi-response allowed)

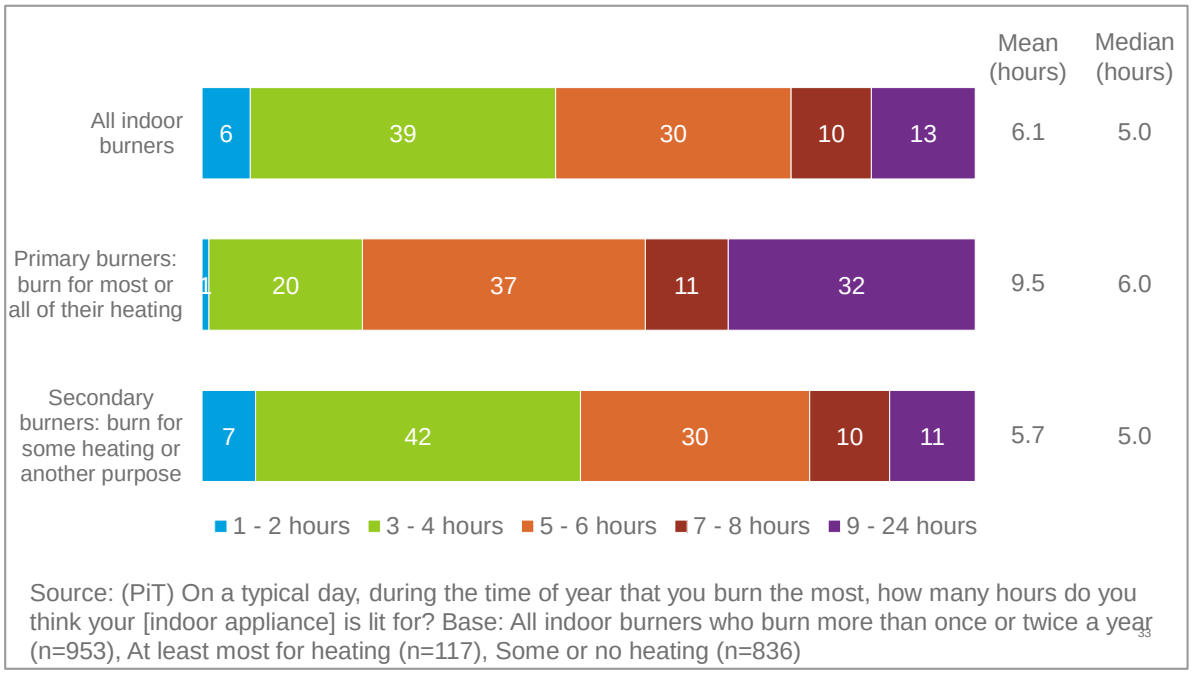


Source: (PiT) In which seasons do you tend to use your [indoor appliance]?
Base: All indoor burners (n=993), England (n=733), Scotland (n=85), Wales (n=86), NI (n=88)

Indoor burners who burned more than once or twice a year were asked in the PiT how many hours per day they lit their fire on a typical day during the period they burned the most. The mean response was about 6.1 hours. Those who said they burned to provide most or all of their heating (termed 'primary burners' in this report) said they burned on average 9.5 hours a day during the time they burned the most, compared with 5.7 for those who burned for some heating or for another purpose (see Figure 2.15 below).

However, the median hours of burning were much closer (6 and 5 hours respectively), suggesting a sub-group who burned much more than 6 hours drove the average hours up: indeed a third of all burners who burned for most or all of their heating (32%) said they lit their fire for nine hours or more a day during peak usage times of the year, compared with 11% among burners who did not use solid fuels for as much of their heating. There was a small proportion who said they were burning almost 24 hours a day. Reflecting this picture of a group of frequent/heavy burners, two in five (39%) of those who burned throughout the year said they burned for nine hours or more a day in the peak season (winter), compared with less than a tenth (9%) of those who burned only in winter.

Figure 2.15: Number of hours per day appliance lit for by different type of burner (% of indoor burners)



Source: (PiT) On a typical day, during the time of year that you burn the most, how many hours do you think your [indoor appliance] is lit for? Base: All indoor burners who burn more than once or twice a year (n=953), At least most for heating (n=117), Some or no heating (n=836)

Primary burners tended to use their appliance for a longer period during the year (see Figure 2.15). Six in ten (59%) secondary burners only used their appliance in winter compared with a third (34%) of primary burners. Primary burners were more likely to use their appliance year round (9% compared with 3% of secondary burners), from autumn to spring (23% compared with 12% of secondary burners) or in autumn and winter (29% compared with 17% of secondary burners).

During the time of year indoor burning PiT respondents lit their appliance most often, over half said they used it at least three days a week (58%) and around half of these used it six or seven days per week (28% overall). The proportion of the most frequent burners varied by nation: around half (52%) of indoor burners in Scotland and 42% of those in Wales burned six or seven days a week in the period they burned the most. The proportions who

said they burned this often in England and Northern Ireland were half this figure (25% and 23%, respectively). The proportion of indoor burners in rural areas who said they burned six or seven days a week (36%) was higher than that in urban areas (25%). The percentage of stove users who burned this often was also higher than for those who used an open fire (31% as opposed to 17%).

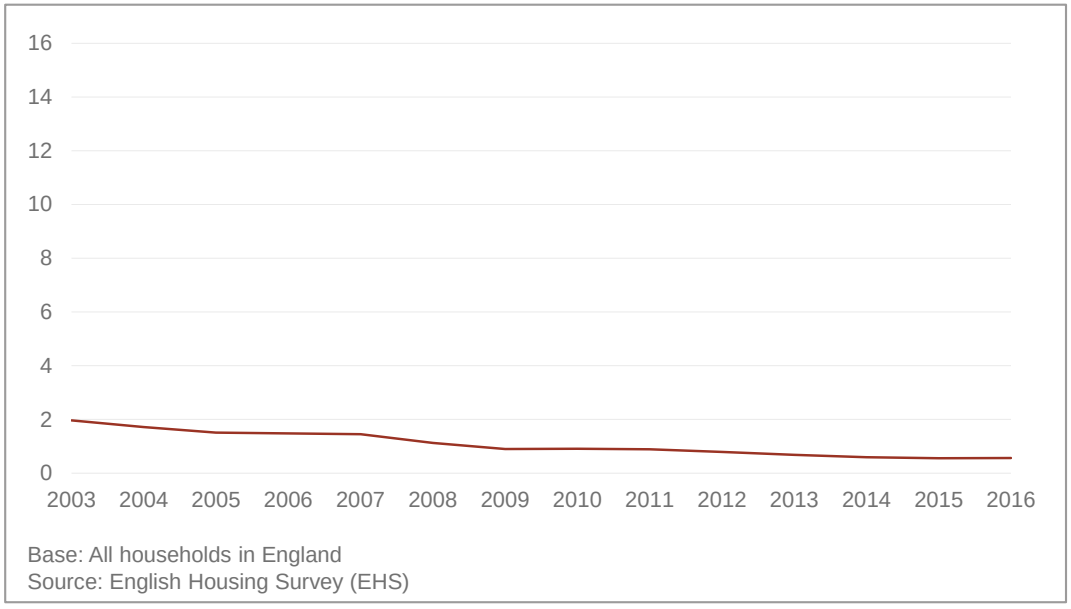
3. Solid fuel systems and appliances used indoors

3.1 Trends in primary and secondary solid fuel appliance ownership

Secondary analysis was conducted by BRE on data from two different national surveys on housing and energy, the English Housing Survey (EHS) and the Energy Follow-Up Survey (EFUS), to explore trends in the ownership of solid fuel heating systems. Data from the EHS from 2003 to 2016 was analysed to assess whether there had been changes in the number of homes with solid fuel burning heating systems. Additional analysis was conducted on data from the 2011 EFUS to examine how and when these systems were used by householders.

Already, by the turn of the twenty-first century, very few households were classified as having solid fuel burning systems as their primary heating system in England[45]. As Figure 3.1 illustrates, analysis of the EHS data revealed that the decline in the presence of solid fuel burning primary heating systems in English households continued between 2003 and 2016, from 2% to 0.6%. It is important to note, however, that this may not reflect what has happened in the other UK nations, particularly Ireland and to a lesser extent Wales, where there is less gas grid connectivity[46].

Figure 3.1: Dwellings in England with a solid fuel burning primary heating system (% of households in England)



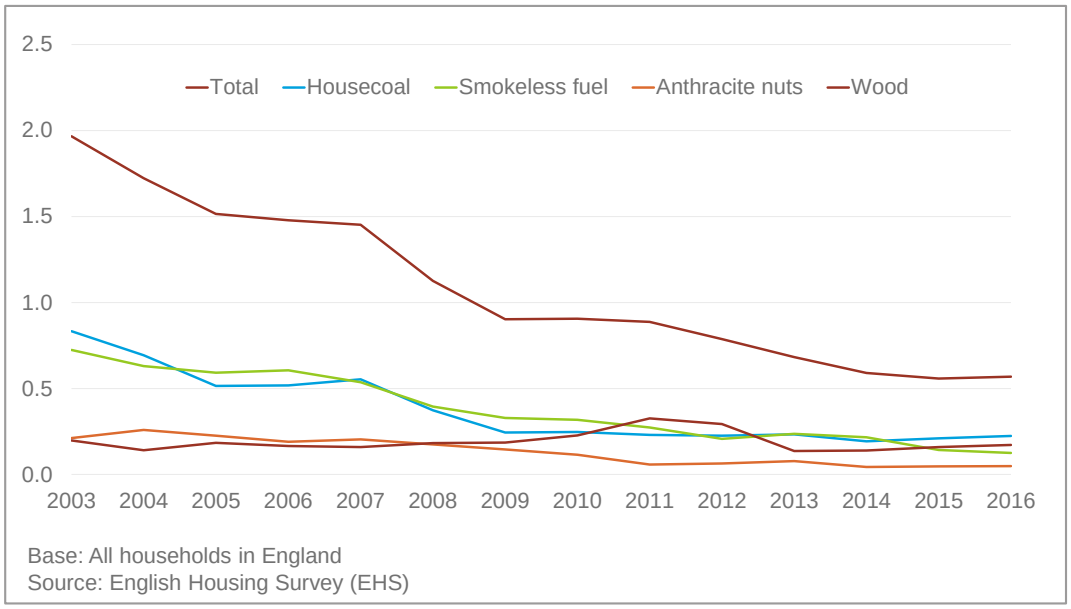
The decrease in prevalence of solid fuel burning primary heating systems since 2003 seems associated with a steady decline in the percentage of households with primary

[45] In the EHS, heating systems are categorised into the 'main'/'primary' heating system, and 'secondary' heating systems; a heating system is referred to as a "primary heating system" if either there is a distribution system sufficient to provide heat to two or more rooms or there are storage heaters in two or more rooms, or other heaters that use the same fuel in two or more rooms. A secondary heating system might be used in addition to the primary heating system or in specific rooms where the primary heating system is not p resent. This is a different to the "primary burner" terminology used elsewhere in this report to indicate people who provided most or all of their heating through burning.

[46] The study did not have access to similar data sets for Ireland, Wales or Scotland.

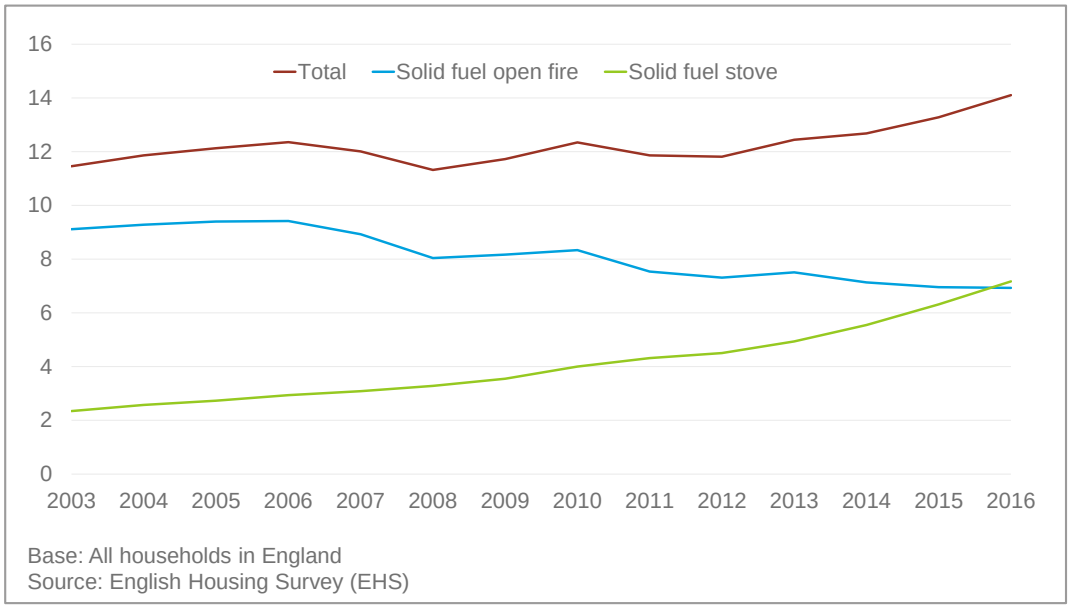
heating systems that burn house coal and/or smokeless fuel (Figure 3.2). Usage of other solid fuels was already well below 1% and has stayed there.

Figure 3.2: Dwellings in England with a solid fuel burning primary heating system by fuel type (% of households in England)



In contrast, as Figure 3.3 shows, the EHS data indicates an increase in the presence of solid fuel burning secondary heating systems between 2003 and 2016 from 11.5% to 14.1%. Whilst some of this increase may be partly explained by households shifting to another form of primary heating and therefore their existing solid fuel appliances becoming a secondary form of heating, the growth appears to have been driven by a marked increase in the number of dwellings with stoves as a form of secondary heating.

Figure 3.3: Dwellings in England with a solid fuel burning secondary heating system by heating type (% of households in England)



The EHS data indicates that in 2003 around 500,000 households had a stove (2.3%), but this figure had risen to around 1,700,000 (7.2%) by 2016. In contrast, there was a slight decline in the percentage of homes with an open fire present, from 9.1% in 2003 to 6.9% in 2016. As a result, by 2016, there were more households in England with stoves than with open fires. This means that overall the presence of domestic solid fuel systems in England increased slightly from 13.4% in 2003 to 14.7% by 2016.

However, the presence of a solid fuel system does not necessarily mean that it is used, particularly if there are other forms of heating available. Whilst the EHS does not provide data on usage, the EFUS does. In the 2011 EFUS, c.9.5% of households used a solid fuel burning system for secondary (8.6%) or primary heating in England, when ownership was at about 12% as Figure 3.3 shows. As the previous chapter has highlighted, the current research (undertaken within 2018-19) found that 8% of the UK adult population (7.3% of the English adult population) had used a solid fuel burning appliance indoors in the year before they were surveyed. This suggests that a proportion of households that have a solid fuel appliance in England do not use them, and that possibly this proportion is growing.

It also suggests that the percentage of the UK households burning indoors may have remained relatively stable between 2011 and 2018-19 (as also supported by the BEIS Domestic Wood Use Study), and possibly even declined slightly, although direct comparisons are difficult because of the nature of the questions. However, a question in the PiT that asked when burners had started burning found that 36% of indoor burner respondents had begun to burn in the last five years (6% in the last 12 months), whilst 17% had started between 6 and 10 years ago, 7% between 11 and 15 years ago, 7% between 16 and 20 years ago, and 32% over 20 years ago. It is not known whether these proportions have changed over time or whether there is a tendency for recent burners to give up burning indoors. However, for such seeming stability in the percentage of adult burners in the UK to continue it will require that the percentage of households that start burning are offset by the percentage that stop.

The BRE analysis of the 2011 EFUS also highlighted another interesting finding. Over 50% of households with solid fuel burning secondary heating systems said they used them regularly between November and February, but that they used their main heating over a longer period (between October and April). This suggests they were using their solid fuel system to supplement their heating, not instead of their primary system to delay turning it on. However, households who had a solid fuel burning secondary heating system tended to use it for more of the year than those with other types of secondary heating systems (for example, electric or gas fires), despite using their primary heating for the same number of months. This may indicate that the solid fuel systems were being used for more than just providing additional heat (such as for aesthetic purposes). However, another possibility is that it may be that these systems were present in older, less well insulated and less airtight dwellings.

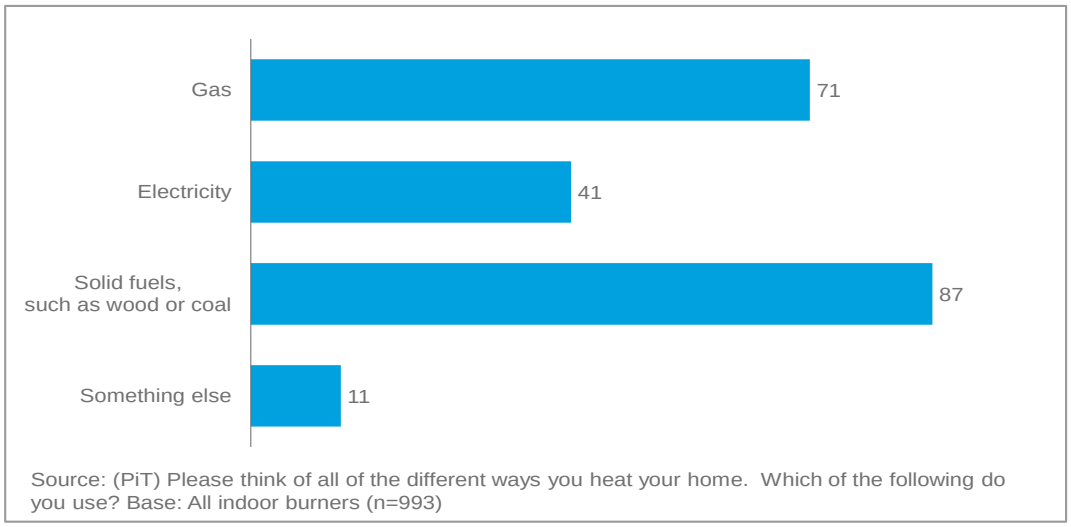
3.2 The role of solid fuel systems in heating

This section now focuses exclusively on the findings from the Kantar surveys and what they suggest about the role of solid fuel systems in heating in 2018/19.

Figure 3.4 shows the different forms of heating that indoor burners said they used when asked about this in the PiT survey. Nine in ten (87%) indoor burner respondents said they used their solid fuel for heating. However, 71% mentioned using gas for heating, 41% electricity and 11% something else (such as oil), often as well as their solid fuel system, reflecting that many used a combination of two or more forms of heating. Overall, four in five respondents (79%) who burned indoors burned solids fuels for heating *and* used

another source to heat their home. 13% of indoor burners said they did not use their solid fuel system to heat their home, tending to use it for cooking and/or hot water instead[47].

Figure 3.4: Heating system in indoor burners homes (% of indoor burners, multi-response allowed)



Only 4%[48] of indoor burners said they used solid fuels for all their home heating[49]. Among those who said they used solid fuels for most or all of their heating (11%), more than a third used some gas (35%) or electricity (40%) for heating.

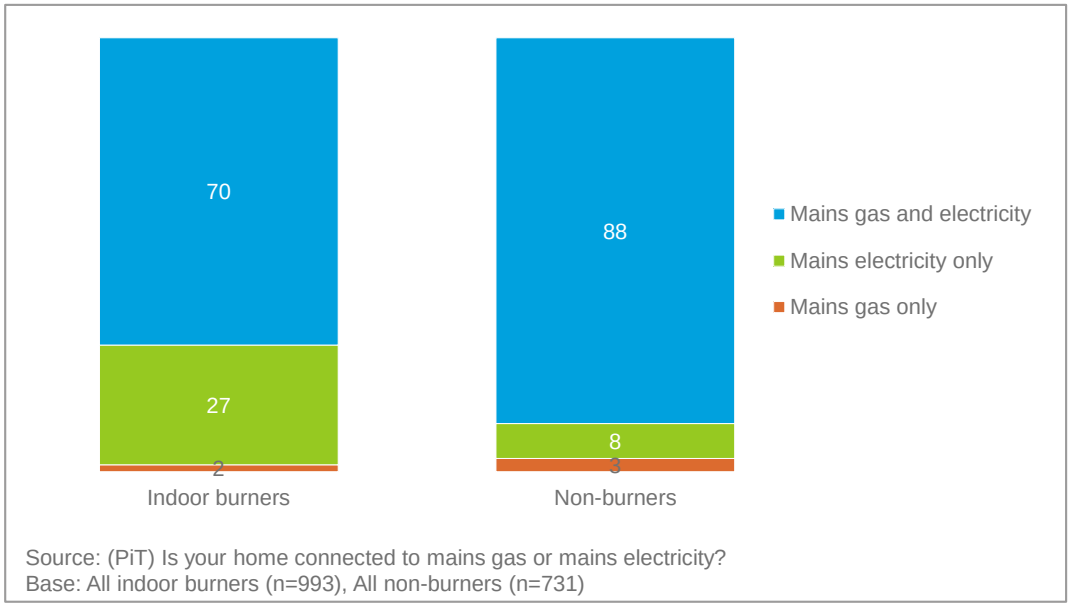
A quarter (27%) of indoor burners (see Figure 3.5) said they were not connected to the gas grid (compared with 8% of non-burners). Some indoor burners not connected to mains gas said they used electric heating and/or other forms of heating (49% and 36% respectively) as well as their solid fuel systems to heat their homes. Of indoor burners connected to mains gas, nearly all used it for heating (95%), usually in combination with their solid fuel appliance.

[47] A later question, 'in the last 12 months, have you burnt solid fuels inside your home for any other purpose?', revealed that those who did not use their indoor burning appliance for heating, tended to use it for heating water and/or cooking (the description of the range of appliances in the glossary shows this can refer to a solid fuel range cooker or biomass boiler, for instance).

[48] The question on how people heated their homes which allowed choices of more than one answer -- the results from which are given in Figure 3.4 -- suggest that 7% only used their solid fuel system for heating. We have chosen to use the 4% result for exclusive solid fuel use for heating because this is the result of a question where respondents were asked directly whether they used solid fuels for none/some/most or all of their heating, and only a single answer response was possible. The result is therefore more robust.

[49] Confusingly, a number of respondents who said they only used solid fuels for their heating, also reported that they only used this for 'some' of their heating. It is not clear what they meant.

Figure 3.5: Gas and electric grid connectivity by type of burner (% of indoor burners, non-burners)



Source: (PiT) Is your home connected to mains gas or mains electricity?
Base: All indoor burners (n=993), All non-burners (n=731)

3.3 Types of appliances used in indoor burning

3.3.1 Distribution and incidence of different types of indoor burning appliance

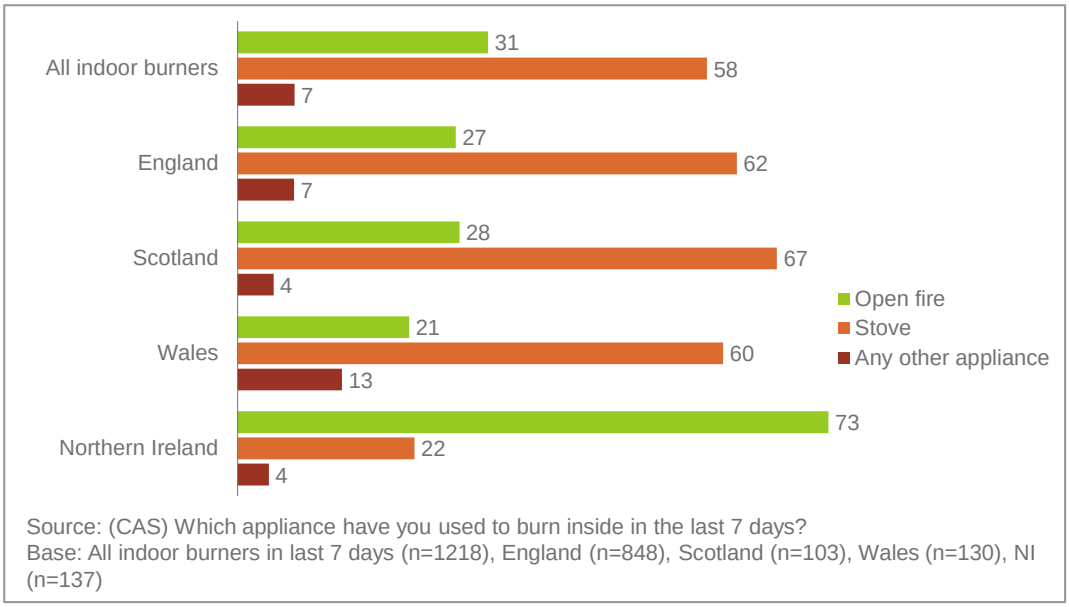
The main categories of indoor burning appliances asked about in the CAS were an open fire and a 'burner or enclosed fireplace' (sometimes known as a 'wood burning stove' or 'log burner'). Biomass boilers were also included as a distinct category, and there was also an 'other' category that included range cookers and pellet stoves. In the PiT, respondents were asked to identify their main appliance from a list that had separate categories for stoves, burners, and enclosed fireplaces, which are different terms for the same type of appliance[50]. Other possible appliance categories provided were open fires, biomass boilers, range cookers and 'other'.

In the analysis presented here, the main focus is on two types of indoor burning appliance: open fires and stoves, where the term 'stove' includes 'burner' or 'enclosed fireplace' as these terms refer to the same type of appliance. This is because only 7% of the indoor burning respondents in the CAS used other types of appliance as their main appliance (see Figure 3.6), most of which were categorised as 'other'. It is not possible to determine which of the other categories these 'other' responses referred to (for example, respondents could have been referring to a pellet stove or range cooker). Only 1% specifically mentioned that their main appliance was a biomass boiler.

Figure 3.6 presents the incidence of open fires and stoves being used in the previous week as main appliances across the UK by nation, as identified through the CAS. Overall, 31% of CAS respondents had used an open fire as their main appliance in the week prior to being interviewed and 58% had used a stove. However, the use of open fires as the main appliance was more than twice as common in Northern Ireland (73% of respondents had used an open fire), and less common in Wales (21%). Indoor burners in Scotland were most likely to have used a stove (67% of respondents), whilst burners in Northern Ireland were least likely to have done so (22% of respondents).

[50] Burners, stoves and enclosed fireplaces are different terms for the same thing, but because familiarity with each term varies, for clarity it was decided to tailor the question wording according to the respondent's terminology.

Figure 3.6: Main appliance used to burn solid fuels in previous seven days, by nation (% of indoor burners)



Source: (CAS) Which appliance have you used to burn inside in the last 7 days?
Base: All indoor burners in last 7 days (n=1218), England (n=848), Scotland (n=103), Wales (n=130), NI (n=137)

The main appliance mix used in the previous week in urban and rural areas was very similar. There was no difference in stove use (Table 3.7), but open fires were slightly more commonly used in rural areas (34% compared with 29% in urban areas). There was little difference in the type of main appliances used in smoke control areas (SCAs) and non-SCAs within urban areas[51].

Table 3.7: Main appliance used to burn solid fuels in last seven days by population density and SCA (urban areas) (% of indoor burners, CAS)

		Area			
All respondents	**All indoor burners**	**Urban**	**Rural**	**SCA (urban)**	**Non-SCA (urban)**
Unwtd base	*1218*	*775*	*443*	*238*	*535*
Open fire	31%	29%	34%	27%	31%
Stove	58%	59%	58%	62%	57%
Other appliance	7%	8%	6%	5%	9%
Don't know	4%	4%	2%	6%	3%

Key: Blue: significantly lower (urban vs rural and Urban SCA vs Urban non-SCA)

Whilst the PiT survey did not explicitly ask how many appliances an indoor burner used, they were asked about the different *types* of appliances they used. Most indoor burners used a single type of appliance for burning (90%).

[51] In an SCA, residents are not allowed to emit smoke from a chimney unless they are burning an authorised fuel or using an 'exempt' appliance.

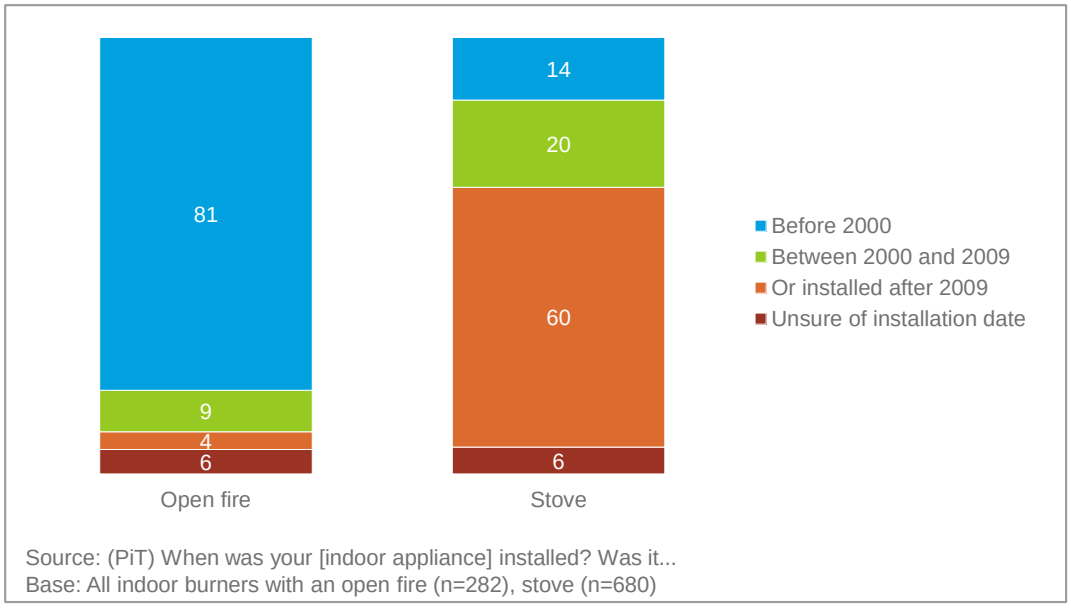
3.3.2 Age of appliances

In the PiT, around half of indoor burners said they were not living in their home when the appliance was installed (48%). This was strongly associated with the type of appliance, with nine in ten (89%) of those with an open fire saying it was already there when they moved in, but two-thirds (68%) of those with a stove saying they had had it installed.

Respondents were asked when their main appliance was installed, and if they said they had not been living in the home at the time, they were asked to respond 'as far as you know'. The relatively high percentage of those who were not resident when the appliance was installed may mean that the information on installation dates is not completely accurate. The qualitative interviews suggested that burners who had inherited a burning appliance when they moved into their home were typically unsure how old it was.

The 2011 EFUS had indicated a relatively high proportion of the stoves in homes (~20%) were less than one year old and more than half were under 5 years old, indicating a trend for buying and using stoves, which the EHS data showed continued after 2011. Responses in the 2019 PiT reflect this. Three in five (60%) indoor burners with stoves and 4% with open fires said they were installed after 2009, and 20% with stoves and 9% with open fires saying they were installed between 2000 and 2009. The majority of indoor burners with open fires (81%) and a minority with stoves (14%) said they were installed[52] before 2000 (see Figure 3.8). Nearly all indoor burners who installed an appliance after 2009 installed a stove (96%). In contrast, half (49%) of indoor burners who installed an appliance in 2009 or earlier installed an open fire.

Figure 3.8: Appliance installation date by type of appliance (% of indoor burners)



Source: (PiT) When was your [indoor appliance] installed? Was it...
Base: All indoor burners with an open fire (n=282), stove (n=680)

Three-quarters (73%) of indoor burners with an open fire installed before 2000 said it was not at all likely they would replace their appliance in the next five years, compared with half (50%) of those with a stove. Table 3.9 shows the distribution of different types of appliances (and their age) by country and region.

[52] It is unclear what installation might mean in relation to an 'open fire'; it is possible respondents may conceptualise installation as referring to updating the surrounds or restoring a previously existing fireplace, rather than a new installation.

Table 3.9: Appliance type and age by region (% of indoor burners) (CAS)

	Country				Region of England								
	England	**Scotland**	**Wales**	**Northern Ireland**	**North East**	**North West**	**Yorks & Humber**	**East Midlands**	**West Midlands**	**East of England**	**London**	**South East**	**South West**
Unwtd base	*848*	*103*	*130*	*137*	*49**	*134*	*105*	*104*	*75**	*90**	*34**	*156*	*101*
An open fire	27%	28%	21%	73%	24%	28%	32%	19%	14%	28%	56%	28%	28%
Stove installed before 2000	6%	3%	7%	1%	5%	9%	6%	4%	10%	8%	7%	5%	3%
Stove installed between 2000 and 2009	11%	13%	8%	1%	6%	9%	9%	11%	9%	13%	4%	13%	17%
Stove installed after 2009	39%	47%	38%	19%	47%	37%	38%	58%	49%	38%	10%	32%	39%
Stove unsure of installation date	5%	4%	8%	2%	7%	5%	5%	5%	12%	4%	2%	5%	4%
A biomass boiler	0%	0%	1%	1%	1%	0%	2%	0%	0%	0%	0%	0%	2%
Other (for example, range cooker, pellet stove)	7%	4%	12%	3%	6%	6%	4%	3%	3%	6%	10%	14%	5%
Don't know	4%	1%	6%	1%	3%	6%	6%	0%	3%	3%	12%	4%	3%

* Treat findings for these subgroups with caution due to the low base sizes.

A few interviewees in the qualitative research reported that they bought a new burning appliance because of the need to replace legacy malfunctioning open fires or oil heating systems that were becoming too expensive to maintain (although a couple stated how much they liked using their oil range). Those who had no existing central heating system felt it was easier to update their appliance, rather than overhaul the entire heating system, especially in very old houses, even when it was not perceived to be efficient.

3.3.3 Appliance usage

Compared with those with an open fire, stove users tended to use their appliance for longer in the peak season, but less in the summer. During winter, on average, those stove users who lit their appliance did so for 29.0 hours a week compared with 21.3 hours for those who used an open fire (see Table 3.10). Whilst overall there is a similar pattern in the proportions of those who used either stoves or open fires at different times of the year (with the highest percentage of appliance users in winter and the lowest in summer), there may be slight differences between the proportions using stoves versus open fires at different times of the year, although the sample sizes make this difficult to confirm.

It is also worth noting that the median figures for the hours an open fire or stove were lit were lower than the mean in every season for both appliance types. This suggests that there was a small percentage of burners who burned many hours and therefore pushed up the average hours of burning.

Table 3.10: Mean and median of hours indoor burners burned during the week prior to being surveyed, by season (mean and median of indoor burners, CAS)[53]

	Number of hours burning in the last 7 days							
	Open fire				**Closed stove**			
	Spring	**Summer**	**Autumn**	**Winter**	**Spring**	**Summer**	**Autumn**	**Winter**
Unwtd base	*47**	*25**	*96*	*137*	*59**	*18**	*155*	*343*
Mean	15	8	22	21	18	5	19	29
Median	10	3	15	14	6	2	14	21

* These sample bases are small so the results should be treated with some caution.

3.3.4 Choice of burning appliance

The qualitative interviews suggested that burner interviewees who had bought their appliance more recently tended to choose stoves over open fires, as these were perceived to be more efficient to use (with a door and/or appliance air vents), more attractive and less messy. Price was a factor in decisions as to which brand of appliance to buy, alongside capacity to heat the space they required it to heat and/or aesthetics. A few mentioned the reputation of certain makes or their country of origin. Some burners in newer-build homes (who would normally have access to other forms of heating) deliberately chose smaller capacity models to avoid having to build a vent in the room.

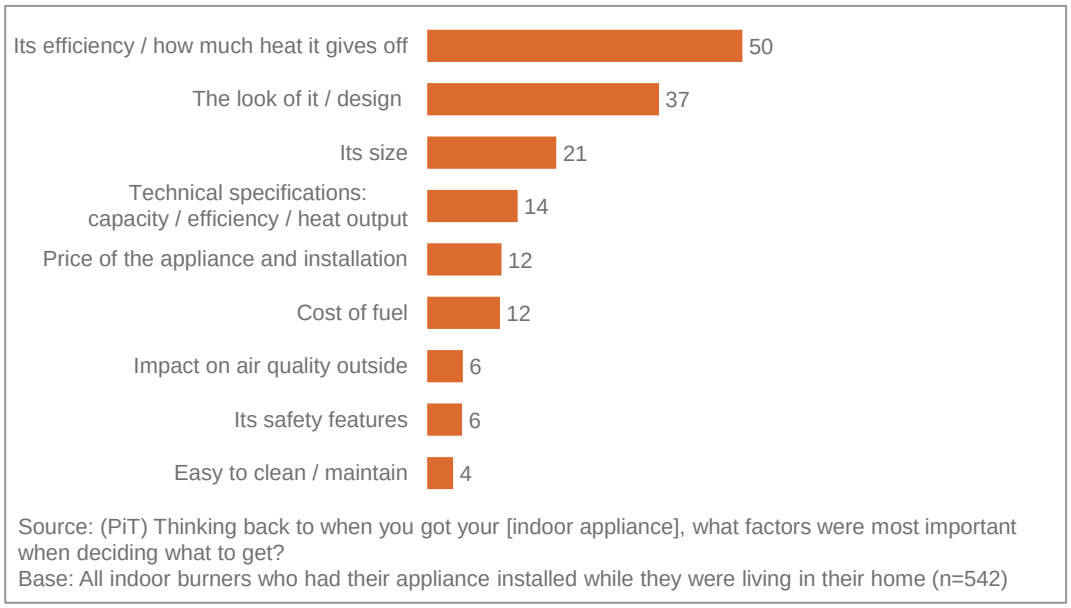
[53] Fieldwork for the CAS ran from early-April to mid-February, so figures for spring includes less survey waves than the other seasons and do not cover the full season.

The driver(s) behind the choice of appliance appeared to vary according to whether the interviewee had been replacing a malfunctioning system or installing an appliance for the first time. The former group often described an emotional attachment to their previous appliance and sought to replicate the feeling it gave them as far as possible, whilst also seeking to reduce maintenance and running costs. For those acquiring an appliance for the first time, who were largely burning for pleasure, how the stove looked appeared to play a stronger role in purchasing decisions. Overall, these burners tended to be inspired by appliances seen in friends' or relatives' houses, during online research or in a showroom. However, most were unaware of whether their stove was Defra exempt or what that meant (see glossary for meaning), and a couple did not know the make of their stove.

Nine in ten (93%) PiT respondents who had had their appliance installed while living in their home said that they had bought their appliance new, and most had bought it in-store (75%). Indoor burners who had had their appliance installed were asked about what the most important factors were when choosing it. As shown in Figure 3.11, efficiency and heat output were mentioned by half of respondents (50%), though the look and design (37%) of the appliance was also mentioned frequently. The price of the appliance appeared to be less important for many of these respondents, with only 12% mentioning this as a reason they chose it. The factors mentioned as important in the purchasing decision in the survey varied by appliance type. Those installing or refurbishing open fires

were less likely to mention the efficiency or how much heat it gives off and instead focused more on the look of it[54].

Figure 3.11: Most common reasons for choosing appliance (% of indoor burners, multi-response allowed)



Note: Only responses equal or higher than 4% included in chart.

Four in five respondents (82%) whose installation occurred after they moved into the home, had had their appliance installed by a HETAS registered installer. This percentage was higher in urban smoke control areas (90%, compared with 80% in urban non-SCAs). Overall, 13% of indoor burners said their appliance was installed by a non-HETAS registered installer, and 5% did not know whether their installer was HETAS registered or not.

In the CAS, those who had a stove were asked whether it was Defra exempt or an Eco-design appliance. As the qualitative research indicated, recognition of these concepts was by no means universal, with nearly half of stove owners saying they did not know (46%). In particular, as Table 3.12 shows, while over half of the stoves in urban smoke control areas (SCAs) were said to be Defra exempt and 7% said to be an Eco-design appliance, 5% were not and 34% of respondents did not know whether their stoves were Defra exempt, Eco-design or neither.

[54] These findings are indicative only due to low base (n=40)

Table 3.12: Type of stove owned by area (% of indoor stove burners) (CAS)

	All stove owners	Urban	Rural	Urban SCA	Urban non-SCA
Unwtd base	*706*	*457*	*249*	*150*	*305*
An appliance approved by Defra for use in smoke control areas (a Defra exempt appliance)	35%	42%	24%	53%	36%
An 'Eco-design Ready' or Eco-design appliance	9%	10%	7%	7%	11%
Or neither a Defra exempt or Eco-design appliance	10%	8%	14%	5%	9%
Don't know	46%	40%	56%	34%	43%

Key: Orange: significantly higher than all stove owners; blue: significantly lower

3.3.5 Links between appliance type and respondent circumstances

Multi-variate analysis was conducted to better understand what factors were most strongly associated with use of open fires and older stoves (pre-2010), which tend to be more polluting than newer stoves (if the latter are appropriately used). See analysis in Appendix D for more detail.

It found that using:

- an open fire was most strongly associated with respondents who lived in houses built before 1966, were not connected to the gas grid, owned their home outright (meaning they did not have a mortgage) and who found it fairly or very difficult to meet fuel and energy costs. Moderately associated circumstances were: living in a household where the adults were students or unemployed, living in a household with children and having a mortgage.
- an older stove was most strongly associated with not being connected to the gas grid, burning for all or most heating (what this report calls being 'a primary burner'), living in a household of retired adults and owning the home outright (meaning not having a mortgage). Moderately associated variables were living in a house built before 1966, living in a rural area, having a mortgage and living in a detached house or bungalow.

4. Solid fuels burned indoors

This chapter focuses on the solid fuels used by respondents who burned indoors. It is important to note that the figures presented here relate to the percentages of respondents who provided a given answer to questions about solid fuel use (for example, the percentage of the rural adult population who burn coal). The percentages do not relate to the quantities of solid fuel used by that population (for example, the percentage of coal burned by the rural adult population).

Analysis of the quantity of solid fuels burnt in domestic settings has been conducted separately by Defra, based on the data collected as part of this study. It is being published as a separate annexe (Annexe A) to this report.

4.1 Types of fuel used for indoor burning

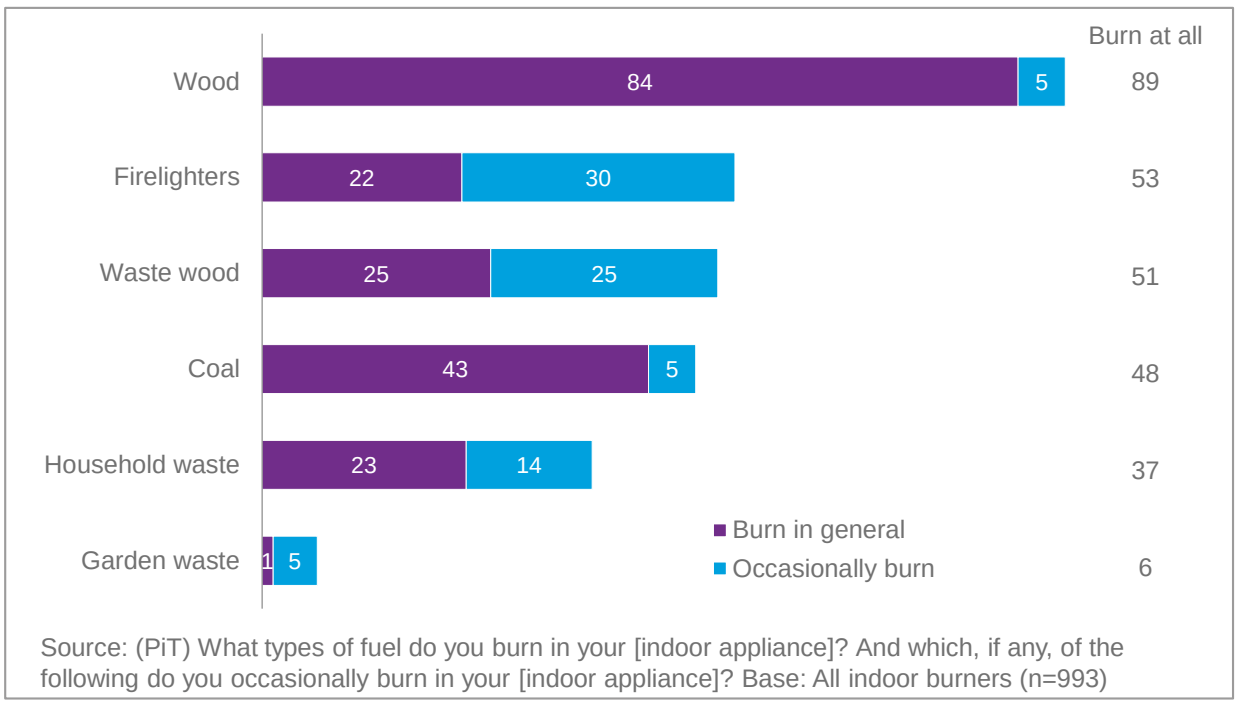
As Figure 4.1 indicates, a range of solid fuels were used by PiT respondents who burned indoors (though most were wood or coal-based). As specified above, these figures present the prevalence of burning among respondents (as weighted to the adult population), not the frequency of burning or the quantities of each material burned[55].

Indoor burners were asked what fuels they burned in two ways. In the first instance, they were asked for a spontaneous response, although they were prompted with fuel types to clarify any uncertainty. Secondly, they were asked which fuel types they occasionally burned. In this case, a list of fuels was read out.

Five in six (84%) spontaneously mentioned that they burned wood (a category which included logs, briquettes, pellets and wood chips) with logs being predominant (see wood section later). This rose to 89% once those who occasionally burned wood were added in. Half of indoor burners (51%) said they at least occasionally burned waste wood (which included both wood from fallen trees and treated or contaminated wood such as pallets or fencing). A similar proportion (48%) burned coal, either generally or occasionally.

[55] Estimates of quantities of fuel is not covered in this report. There will be further analysis on this aspect, however, that is likely to be published separately by Defra.

Figure 4.1: Types of solid fuels generally and occasionally used by indoor burners (% of indoor burners, multi-response allowed)



Note: Only responses equal or higher than 6% included in chart.

Each of these categories are discussed in greater detail below. The important point here is that the majority of indoor burners burned wood in some form, particularly logs, at least at times, but many were also burning other forms of fuel at least on occasion. Indeed, three-quarters of indoor burners used a mix of different fuels (including a high use of firelighters, though these were probably largely used to start a fire).

Figure 4.2 shows the percentages or PiT indoor-burning respondents who used these different solid fuel combinations:

- **wood** only (for example, logs, pellets, briquettes and/or wood chips)
- **wood mix** only (the previous wood category *and/or* either waste wood or garden waste)
- **wood** (as defined in 'wood only' above) and **coal** (smokeless coal, house coal or anthracite)
- **wood mix** (as above) and **coal** (as above)
- **coal** (as above) only
- **other mix** of fuel not reflected in the above categories (for example, only household waste)

One in five (22%) burned only wood (as defined above) and one in twenty-five (4%) burned only coal (as defined above). Around three in ten (28%) burned waste wood and/or garden waste, often with wood as well. 45% burned wood (20%) or a wood mix (25%), in combination with coal. In the qualitative interviews, many had reported using a mix of wood and coal to keep their fires going for longer (for example, using coal as well as wood to extend time between fuel top ups) or when extra cold.

Figure 4.2: Percentage of indoor burners using different combinations of solid fuels (% of indoor burners)

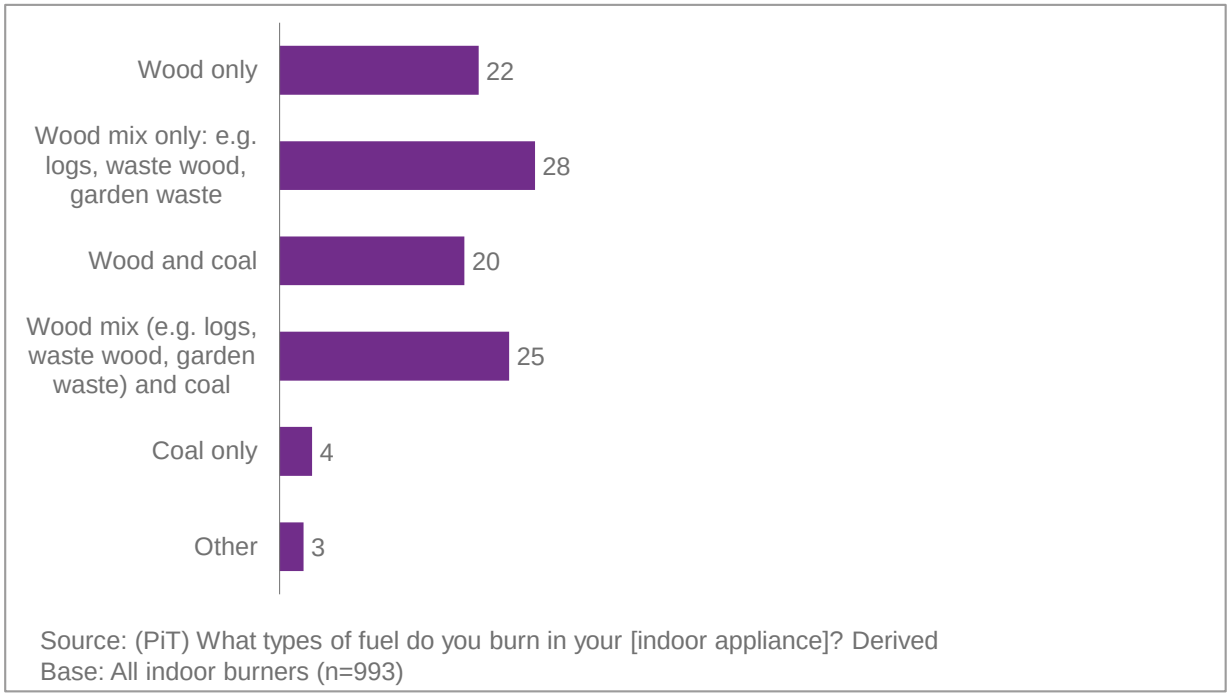


Table 4.3 below shows the regional pattern of fuel use based on this sample in terms of percentages of those who burned different solid fuel combinations. Some differences were statistically significant, as denoted by the colours, though a number of the sample sizes at national and regional level are small and therefore these results should be treated with caution. What is worth noting is that coal use, on its own or with wood or a wood mix, is indicated in London, despite the small sample size.

Table 4.3: Mix of solid fuels generally & occasionally used by indoor burners, by region (% of indoor burners -- PiT)

		Country				Region								
	All indoor burners	**England**	**Scotland**	**Wales**	**Northern Ireland**	**N. East**	**N. West**	**Yorks & Humber**	**East Mids**	**West Mids**	**E. of England**	**London**	**S. East**	**S. West**
Unwtd base	*993*	*733*	*85**	*86**	*88**	*37**	*101*	*71**	*55**	*64**	*92*	*39**	*153*	*98*
Wood only	22%	21%	32%	24%	12%	26%	15%	12%	33%	25%	17%	9%	27%	23%
Wood mix only	28%	29%	30%	32%	4%	10%	30%	27%	23%	32%	34%	26%	32%	32%
Wood and coal	20%	19%	10%	11%	43%	20%	14%	33%	16%	25%	14%	17%	16%	23%
Wood mix and coal	25%	25%	21%	28%	28%	40%	37%	26%	27%	11%	26%	26%	22%	17%
Coal only	4%	3%	3%	1%	11%	1%	5%	1%	0%	5%	6%	12%	0%	1%
Other	3%	2%	4%	4%	3%	2%	1%	0%	1%	2%	3%	9%	2%	3%

Key: Orange: significantly higher than all indoor burners; blue: significantly lower

* Treat findings for these subgroups with caution due to low base sizes.

Whilst the findings above refer to what solid fuel indoor burners in the PiT reported burning (generally or occasionally), analysis of CAS responses on the question of what solid fuels were burned in the previous week on their main appliance (which covers different respondents at different times of the year) provides the following picture: in the week prior to being surveyed, 58% burned wood and/or waste wood only, 13% burned only coal (smokeless, house and/or briquettes), and 25% burned some form of coal and some form of wood (including waste wood) – though it is not known whether there were burned together. The remaining 4% burned wood and another solid fuel or coal and another solid fuel or solely another solid fuel. It is these findings that have informed the quantification of solid fuels that Defra has done because they provide a more accurate and reliable reflection of solid fuel use over the year. (This is because the CAS, which was run twice a month using a different nationally representative sample at each wave, asked about how much solid fuel respondents used in the previous week. This enabled seasonal variations to be accurately captured).

4.2 Sourcing of fuel used for indoor burning

Indoor burners in the PiT were asked where they generally got their fuel from. Multiple responses were permitted. Where respondents burned more than one fuel, the survey did not identify what supplier was used for what fuel. We have however drawn out what fuel is (or combination of fuels are) used by people who acquire their fuel in a particular way.

The most common ways that these respondents sourced their solid fuels (see Table 4.4) was through purchasing them through a specialist supplier (43% mentioned a wood or coal merchant) or general supplier such as a supermarket or petrol station (38%). Just over half, 57% of indoor burners said they *only* bought their solid fuel through a general or specialist supplier and did not get their fuel any other way. 12% of respondents said bought their solid fuel (probably largely wood-based) from a landowner or farmer; a small percentage (1%) also bought their solid fuel online. The other main ways of accessing solid fuel identified (presumably much of it waste wood) were being given it by friends or family (15%), gathering it in their own garden or public places (15%) and/or salvaging it, for example from skips, (9%), all presumably for free.

Table 4.4: Main sources of solid fuel by fuel mix (% of indoor burners, multi-response allowed -- PiT)

	All indoor burners	Wood only	Wood mix only	Wood and coal	Wood mix and coal	Coal only
Unwtd base	*993*	*223*	*252*	*195*	*256*	*39*
Specialist supplier	43%	45%	38%	46%	46%	47%
General supplier	38%	28%	21%	48%	54%	57%
Given by friends / family	15%	8%	22%	9%	18%	0%
From my own garden	14%	8%	25%	2%	18%	0%
Bought from landowner or farmer	12%	13%	18%	7%	11%	1%
Salvaged wood	9%	3%	17%	2%	13%	0%
Fallen wood from trees in public places	5%	3%	6%	2%	8%	0%
Online	1%	1%	0%	1%	0%	0%
Other	2%	4%	2%	1%	1%	0%
Don't know	1%	0%	0%	3%	0%	0%
None of the above	2%	5%	0%	0%	0%	0%

Key: Orange: significantly higher than all indoor burners; blue: significantly lower

Analysis of the PiT data indicates that two-thirds (65%) of indoor burners bought all their fuel (including those who bought from a landowner or farmer). Around one in ten (13%) said they gathered or got given their fuel (from friends and family, their own garden, salvaged or fallen wood), and therefore got all of their fuel for free. A further, 17% both bought and gathered/were given fuel. The remaining 4% were unsure of where their fuel came from.

The qualitative interviews highlighted that burners were typically enthusiastic about sourcing free wood rather than paying for it. Participants described acquiring wood from a variety of sources, including from their own land, their work (for example, offcuts from a joinery) or a neighbour's garden. While this was often opportunistic, some participants described going online to source free wood from local tree surgeons or Freecycle, or were part of a wider burner community who shared information about sources of free wood.

The qualitative interviews also suggested that burners found it easier to quantify how much fuel they used if using coal as it is bought in bags, or if purchasing logs from a supplier on a regular basis. But if they gathered wood, salvaged it or had it donated, there seemed to be little perception of how much they actually used – and this did not seem to matter to them as such fuel was considered to be free.

4.2.1 Amounts spent on solid fuel

As Table 4.5 shows, 17% of all indoor burners in the PiT said they had spent nothing on fuel in the last 12 months, this rising to 33% of those who burned a wood mix (that includes waste wood). A further 23% spent less than £50. At the other end of the spending scale 17% said they spent between £200 and £499, and a further 6% said they spent over

£500. A third (33%) of those who burned a mix of wood, waste wood and/or garden waste said they did not pay anything annually for solid fuel.

Table 4.5: Spend on solid fuel by fuel mix used in the last year (% of indoor burners - PiT)

	All indoor burners	Wood only	Wood mix only	Wood and coal	Wood mix and coal	Coal only
Unwtd base	*993*	*223*	*252*	*195*	*256*	*39*
£0	17%	18%	33%	4%	6%	9%
£1-£49	23%	19%	22%	21%	28%	20%
£50-99	14%	14%	10%	17%	17%	13%
£100-£199	19%	19%	19%	21%	20%	25%
£200-£499	17%	17%	12%	22%	18%	19%
More than £500	6%	6%	3%	10%	7%	5%
Don't know	4%	7%	2%	4%	3%	9%

Key: Orange: significantly higher than all indoor burners; blue: significantly lower

4.3 Solid fuel used in appliances

Table 4.6 provides an overview of the percentages of CAS respondents who burned different combinations of solid fuels in the previous week prior to when they were surveyed. What this shows is that 58% burned either wood or any type and/or waste wood (this does not include garden waste), but no other solid fuels, 13% burned only coal of the types identified in the survey, and 25% burned coal and wood (including waste wood).

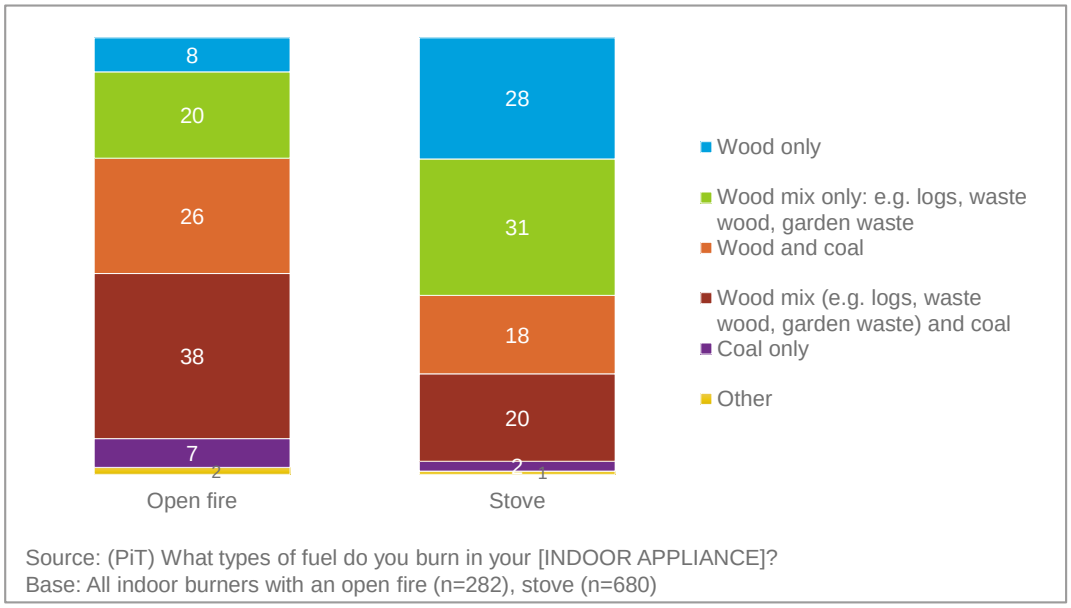
Table 4.1: Proportion of CAS respondents who burned different fuel combinations in the previous week

Proportion of respondents who burned solid fuels in the previous week	Weighted %
% who burned wood fuel (including waste wood) only	58%
% who burned coal of any type only	13%
% who burned wood and coal (including other fuels)	25%
% who burned other combinations of fuel used[56]	4%

Figure 4.7 shows the types of fuels used in open fires and stoves, according to PiT responses about what burners burned on their appliance at least occasionally. Four in ten (38%) open fire users burned a coal and wood mix (that may include garden waste), as opposed to 20% of stove users. Coal was more often used in an open fire (by 71% of open fire owners overall as opposed to 40% of stove users). Stove owners were more likely to burn only wood (28% versus 8% of those using open fires) or a wood mix (31% versus 20%).

[56] Wood and other fuels, coal and other fuels, and other fuels only.

Figure 4.7: Fuel used by appliance type (% of indoor burners)



Source: (PiT) What types of fuel do you burn in your [INDOOR APPLIANCE]?
Base: All indoor burners with an open fire (n=282), stove (n=680)

4.4 Wood burning

4.4.1 Incidence and patterns of wood burning

There are a number of different forms of wood burned in homes. The main categories used in the CAS were wood (including logs, pellets, wood briquettes and wood chips) and waste wood (including wood/branches from fallen trees or wood that had been discarded, for example, from building sites or in skips). 58% of indoor burning CAS respondents had burned only wood and/or waste wood in the previous week. As mentioned, whilst 89% of indoor burners responding to the PiT said they burned wood at least on occasion in the last year, only 22% reported using wood (logs, pellets, briquettes and/or chips) exclusively (using no other type of solid fuel including waste wood).

Within the 'wood' category, the CAS found that three-quarters (73%) of indoor burners who burned in the last week had burned wood logs, 16% burned wood briquettes, 14% pellets, and 13% wood chips. Garden waste may also include wood but is discussed separately. Table 4.8 shows the spatial distribution of weighted proportions of the population by location who said that they had burned wood and/or waste wood (fallen from trees or salvaged) indoors in the past year, based on data from the CAS.

Table 4.8: Spatial distribution of proportions of UK adult population that burned wood and/or waste wood indoors in the last year by nation, region and population density (incidence, % of population - CAS)

	All UK	Nation			
All respondents		**England**	**Scotland**	**Wales**	**Northern Ireland**
Unwtd base	*46729*	*38930*	*4241*	*2201*	*1357*
Wood burned indoors	6.5%	6.0%	5.8%	9.6%	19.7%
Waste wood burned indoors	1.8%	1.7%	1.7%	3.9%	1.4%

	All UK	English region								
All respondents		**North East**	**North West**	**Yorks & Humber**	**East Mids**	**West Mids**	**East of England**	**Lon-don**	**S. East**	**South West**
Unwtd base	*46729*	*2128*	*5292*	*3938*	*3313*	*3996*	*4359*	*5610*	*6362*	*3932*
Wood burned indoors	6.5%	4.5%	7.0%	5.3%	8.0%	5.2%	6.0%	1.6%	8.3%	8.3%
Waste wood burned indoors	1.8%	1.9%	2.8%	1.3%	1.6%	0.9%	2.0%	0.2%	2.4%	1.9%

	All UK	Population density			
All respondents		**Urban**	**Rural**	**Urban SCA**	**Urban non-SCA**
Unwtd base	*46729*	*37909*	*8820*	*21764*	*15936*
Wood burned indoors	6.5%	5.5%	10.9%	2.9%	9.1%
Waste wood burned indoors	1.8%	1.5%	3.0%	0.6%	2.6%

4.4.2 Sourcing of wood and waste wood

According to CAS data, 32% of indoor burners bought most of the wood they burned in the last week from a specialist supplier (see Figure 4.9). A further 19% bought most of their wood from a general supplier. Around one in ten (8%) indoor burners said they bought most of their wood from a landowner or farmer. It may be that in some instances such purchases were made informally (and as such formed part of the grey economy), but this cannot be confirmed by the survey data. In total, therefore, 59% of CAS respondents had bought most of the wood they burned the previous week.

However, many of the remainder appear to have accessed much of the wood they burned the previous week for free: 11% of indoor burners said they had been given most of the wood they had burned by friends or family and 9% had salvaged wood from skips, etc. Other free sources mentioned by indoor burners were 'from my own garden' (6% of indoor burners) and the gathering of fallen wood from trees (6%). In total, therefore, 32% of indoor burners who had burned wood[57] in the past week had accessed most of it for free. It is important to stress, however, that this is the percentage of respondents and does not necessarily equate to the amount of wood burned.

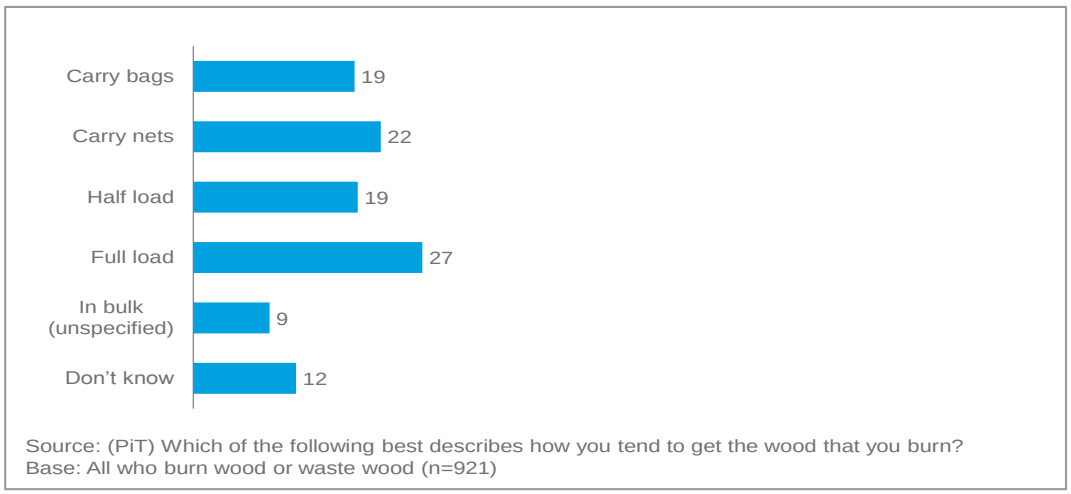
[57] This question was not asked of those who only burned waste wood in the previous week.

Figure 4.9: Main source of wood burned in the last seven days (% of indoor burners)

Note: Only responses equal to or higher than 5% included in chart.

In the qualitative interviews, wood burners talked about how they tended to source wood (logs) in bulk, sometimes online (if urban based) or through a local farmer if more rural. These findings were echoed to some extent in the PiT survey, with just under three in ten (27%, see Figure 4.10) wood or waste wood burners getting full loads delivered, particularly those who burned for most or all of their heating (45%). However, there was not a lot of evidence of buying wood online: 1% of wood only burners in the PiT did mention doing so. The qualitative interviews also suggested that price-conscious burners who bought rather than salvaged wood tended to buy when wood was cheapest, usually in the summer. These interviewees seemed to derive a strong sense of satisfaction from knowing exactly how much they spent on fuel in a year and how much they had saved.

Figure 4.10: Typical volumes of wood sourced (% of indoor burners who burned wood or waste wood, multi-response allowed)

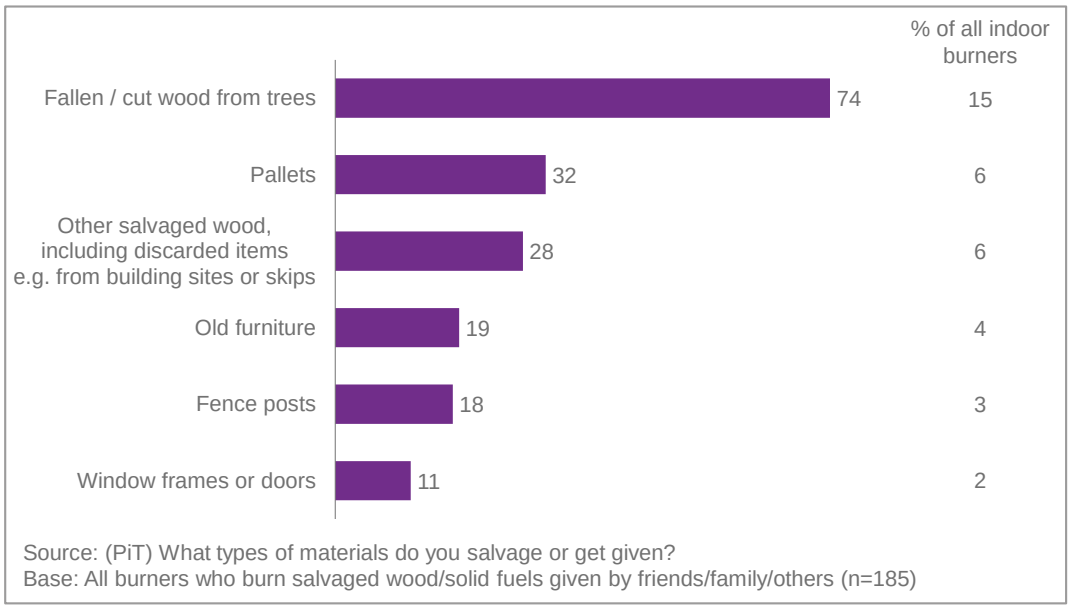


According to the CAS, 12% of those who burned indoors in the last week had burned waste wood (on its own or with other solid fuels) and 27% of indoor burners had burned

waste wood in the last year. (The actual figure could be higher because other responses suggest that some of those burning what this report is defining as *waste wood* may simply have classified it as *wood*[58]). As indicated earlier in Figure 4.1, 51% of PiT respondents who burned indoors said they some burned waste wood[59], at least on occasion and 25% indicated this was a regular solid fuel they used.

Where indoor burners in the PiT said they were salvaging or being given free fuel, they were asked what kind of material they got. Although three-quarters (74%) got given or collected fallen or cut wood from trees, around a third said they scavenged pallets (32%) and/or other salvaged wood, including discarded items from building sites or skips (28%) (see Figure 4.11 which also includes the incidence among the whole indoor burning population).

Figure 4.11: Types of material that indoor burners salvage or are given (% of indoor burners, multi-response allowed)



Note: Only responses equal or higher than 11% included in chart.

The qualitative interviews revealed that free wood was obtained from a range of sources, including tree surgeons and as offcuts from joinery work.

> *My husband's a carpenter by trade, so whenever he's doing a job we burn whatever wood he's got left over, skirtings, architraves, bits of furniture* (Wales, Rural – Off grid, SEG – C2)
>
> *I get pallet wood from a neighbour for free, have been getting it from him for 9 years…Occasionally I might go to a local industrial estate and get pallet wood if it's there or when I see some pallets out for free I'll collect them* (Midlands, Urban, SEG - D)

[58] The question on the sourcing of wood, which was not asked of those who only burned *waste* wood, suggests some respondents who classified what they burned in the last week as wood were burning what this report is defining as waste wood.

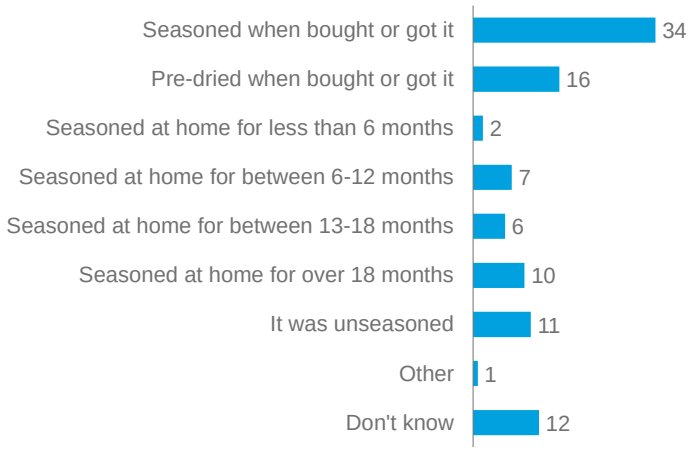
[59] Defined as fallen/cut wood from trees as well as treated and wood salvaged from skips, etc.

4.4.3 Wood seasoning

There were questions on seasoning of wood in both the CAS and PiT surveys. However, there were differences between their focus, how they were phrased and explained, and who was asked. The PiT asked whether, in general, burners who burned wood or waste wood obtained that wood seasoned, seasoned it themselves or burned it unseasoned[60]. The CAS asked how seasoned most of the wood (but not waste wood) that respondents had burned indoors and/or outdoors *in the last week* had been. The CAS explained seasoning as 'leaving the wood to dry for a period after the tree has been felled or cut' and also had the option of buying wood pre-dried, whereas the PiT used the term 'ready to burn' and prompted the interviewer to explain this included 'kiln-dried' wood.

Not surprisingly, given these differences in phrasing and focus, the results are a little different. Whilst the percentages who said they seasoned at home were similar between the CAS (25%) and the PiT (27%), the proportion who said they bought or got pre-seasoned or pre-dried wood was much lower in the CAS (51% compared with PiT 68%). Meanwhile, the percentage of those who said they burned wood in the last week that had not been seasoned at all (11%) was significantly higher than the 1% who said they burned wet or unseasoned wood in the PiT. The fact that the PiT asked the question about what respondents usually did whereas the CAS focused on what actually had been done in a specified week is the most likely explanation for the differences in the results. The focus of the question (on a recent specific period), the size of the base sample and the survey methodology makes the CAS results more robust and is therefore what is presented in Figure 4.12 below.

Figure 4.12: Level of seasoning of most wood burned indoors in last seven days (% of indoor burners who burned wood, but not waste wood exclusively)



Source: (CAS) How would you describe the seasoning of most of the wood you burned in the last 7 days? Base: All burners who burn wood and burned indoors in last 7 days (n=892)

This report defines wet wood as wood that is unseasoned or has been seasoned for less than a year[61]. Wood that has been seasoned for over a year or is pre-dried is defined as

[60] The question was 'In general, do you get wood that is ready-to-burn or seasoned (this can include kiln dried wood) or get wood that you dry or season yourself or burn wet/unseasoned wood'. Options also included 'other' (please specify) and 'don't know'.

[61] This is different to the definition of wet wood in the PiT survey where it was equated to unseasoned wood.

dry wood and therefore ready to burn for the purposes of this report[62]. Figure 4.12 also represents the extent of seasoning that CAS respondents claimed to have done in relation to the wood they burned in the week prior to being interviewed. Overall, it suggests that 20%[63] of respondents who burned wood indoors in the previous week burned wet wood (11% burned unseasoned wood, 2% burned wood that was seasoned from 0-6 months, and 7% burned wood that was seasoned for 6-12 months). When only looking at those who seasoned wood themselves, 39% said they had seasoned wood for over 18 months, a further 24% for between 13 and 18 months, another 29% between 6 and 12 months, and 7% for less than 6 months.

The qualitative research participants suggested they had high awareness of the need to season wood, but more variable knowledge of good practice. Approaches to seasoning were based on what they saw as 'common sense', and experience of wet wood not burning properly. Yet there was low awareness of recommended seasoning periods, apart from some notable exceptions among participants who were off the gas grid.

> *My husband…he's got a humidity measure for taking the humidity…you stick it in the wood before you take it out and it gives you a percentage on the water moisture….I think it's got to be below 20 [%]* (Surrey, Rural – Off gas grid, SEG – B)

The qualitative data also suggested that for this sample burning wood that is not seasoned properly may be skewed towards wood that is sourced informally, with interviewees who were salvaging wood aware of the need to season it but admitting to burning it early if there was no seasoned wood available.

> *We normally stack [salvaged wood] for… about 8, 9, 10 months… because by that time I'm too bloody cold.* (North East, Rural, SEG – D)

There were also a few interviewees who deliberately burned wood they classified as wet in order to make their solid fuel or fire last longer.

The data above indicates that wood, possibly including waste wood, burned by those who season their own wood (approximately a quarter of those who burn wood indoors) is sometimes not as dry as it should be. In particular the CAS would suggest a fifth of indoor burners who burn wood may burn on occasion wet wood (wood that is seasoned for less than a year or not at all). This may be due, the qualitative data suggests, to lack of awareness of how much seasoning dry wood needs and/or not having enough wood that

[62] These definitions reflect existing Defra guidance (https://uk-air.defra.gov.uk/assets/documents/reports/cat09/1903131256_Seasoning_Wood_Web_Feb_2019_V5.pdf), but it is important to note that the new solid fuels legislation requires wood to be dried for two years in line with advice from industry and definitions used in the consultation. Defra guidance is being updated to reflect this.

[63] Excluding those who did not know, this percentage rises to 23%.

has been dried for long enough and /or lack of storage space, or alternatively a belief that burning wet wood prolongs a fire and the supply of solid fuel.

4.5 Coal burning

4.5.1 Incidence/patterns of coal burning

Table 4.13 shows data from the CAS on the spatial distribution of the population by location who said that they had burned some form of coal indoors. Overall, 3% of the UK population said they had burned coal in the last year (translating to 41% of indoor burners). Indoor coal burning was higher in Northern Ireland (22% of the Northern Irish adult population, or 80% of indoor burners in Northern Ireland). There is some indication of burning of coal of different forms in London, including by those who burn only coal indoors.

Table 4.13: Spatial distribution of proportions of UK adult population that burn coal indoors in the last year by nation, region and population density (incidence, % of adult population -- UK)

	All UK	Country			
All respondents		**England**	**Scotland**	**Wales**	**Northern Ireland**
Unwtd base	*46729*	*38930*	*4241*	*2201*	*1357*
Coal burned indoors	3.3%	2.7%	2.4%	5.6%	21.7%

	All UK	English region								
All respondents		**N. East**	**N. West**	**Yorks & Humber**	**East Mids**	**West Mids**	**East of Eng-land**	**Lon-don**	**S. East**	**S. West**
Unwtd base	*46729*	*2128*	*5292*	*3938*	*3313*	*3996*	*4359*	*5610*	*6362*	*3932*
Coal burned indoors	3.3%	2.9%	4.0 %	3.2%	3.7%	2.3%	2.5%	0.9%	2.6%	2.5%

	All UK	Population density			
All respondents		**Urban**	**Rural**	**Urban SCA**	**Urban non-SCA**
Unwtd base	*46729*	*37909*	*8820*	*21764*	*15936*
Coal burned indoors	3.3%	2.6%	6.1%	1.4%	4.3%

As already mentioned, 48% of all indoor burners in the PiT said they burned coal in their appliance at least on occasion. However, 92% burned coal together with some form of wood and/or waste wood and/or garden waste. Only 7% of coal burners used coal exclusively, which equates to 4% of all indoor burner respondents in the PiT. The question on burning in the last week in the CAS presents a slightly different picture: in total 28% reported burning coal the previous week, with 13 % of all those who burned indoors in the last week saying they only burned some form of coal, and 25% saying they burned coal and wood (including those who burned waste wood).

Although it is not clear from the quantitative surveys whether those who burned coal and wood did so together on the same fire, this was relatively common amongst the qualitative respondents. They gave a number of reasons for burning coal and wood together, with some of those just using a little coal to supplement a largely wood-based fire, and a few using a little wood on top of largely a coal-based fire. A number of participants described using coal to extend the time between needing to top up with wood so making it less work or allowing them to use less of their wood supply.

> *We do burn coal as well [as wood]. We've put some coal on as well because that just makes us need less wood. I mean we've got the wood. We are lucky enough we've got a supply of wood, a good supply of wood but by using some coal as well…It lasts longer basically. It makes it last longer. (London, Urban, SEG- C1)*

Others talked about adding the other fuel to alter the look or heat output of the fire.

As shown earlier in Figure 4.6, indoor burners with an open fire were more likely than those with a stove to have burned coal (71%), whether the coal was used in conjunction with wood (26% of open fire users), a mix of woods (38% of open fire users) or burned on its own (7% of open fire users).

Quality of the fuel was less commonly mentioned as a factor in fuel purchasing decisions by those who burned coal (40%) in comparison with indoor burners generally (51%). Cost on the other hand was more often mentioned by indoor burners who burned coal (55% compared with 48% of all indoor burners).

4.5.2 Sourcing coal

The qualitative interviewees' purchases of coal tended to be a little more ad hoc than that of wood, and often seemingly in smaller amounts from sources, including large homewares stores, local garages, or from local merchants (for those in rural or ex-coal mining areas). In line with these findings, four out of five (82%) coal burners in the PiT got their coal in bags they could carry themselves, whilst 19% got their coal delivered[64]. This could suggest that these 19% are the ones who use more coal, though it may also be that they have greater ability to store coal.

4.5.3 What types of coal are used indoors

Based on CAS data, around a third (35%) of those who used coal said they had only burned house coal in the last seven days, whilst 38% of coal burners said they had only used smokeless coal. The qualitative data suggested coal users had fairly fixed preferences for one or the other, based on perceptions of relative costs, heat capacity and/or ease of use. However, a further quarter (26%) of CAS coal users said they had

[64] During the survey if required, respondents were told that a 'bag' is something that people could carry themselves rather than requiring delivery. Deliveries require delivery to the house due to the volume of solid fuel bought.

used both house coal and smokeless coal in the past seven days. The qualitative research suggested that using both was primarily an issue of availability.

There were significant differences between rural and urban areas in the types of coal respondents burned. In urban areas, 41% of coal burners only burned smokeless coal, whilst 27% only burned house coal, and 31% burned both. However, in rural areas, 34% burned only smokeless coal, 48% burned house coal, and 19% burned both. Among those burning coal, three-quarters (77%) of indoor burners with a stove used smokeless coal, compared with around three in five (49%) of those with an open fire.

Multi-variate analysis was performed to measure the strength of the links between certain respondent circumstances and burning house coal. It found that burning house coal was most strongly associated with use of an open fire, not being connected to the gas grid and paying more than £50 for fuel annually. Moderately associated with the burning of house coal were the variables: burning solid fuels for all or most of their heating (meaning, being a primary burner) and living in a rural area (see Appendix D for more detail).

In the PiT survey coal burners who said they did not use smokeless coal gave a wide range of reasons for why this was, including the higher cost of smokeless coal (22%), lack of convenience in sourcing smokeless coal (17%), a lack of motivation to change (17%), the tradition of having always burned the same way [habit] (12%), and a perceived lack of efficiency of smokeless coal (12%). Some of these reasons were also mentioned in the qualitative research:

> *There was a lady who we used to do some landscaping for and I asked her if I could try some so I tried a bit of smokeless fuel, but it's actually quite hard to get it lit, and once it's lit you have to run it quite hot so you need those vents going otherwise it doesn't burn hot enough.* (Wales, Rural – Off grid, SEG – C1)

A few other house coal burners also believed that smokeless coal was not as efficient or easy to use as house coal, so dismissed using it. Those with low awareness of smokeless coal also seemed to expect it to be expensive.

4.6 Other types of solid fuels burned

4.6.1 Household waste

In the CAS, the (weighted) proportion of the UK adult population who said they had burned household waste in the last year was 0.3% indoors (see Table 4.14), which is equivalent to 2% of indoor burners. This translates to 4% of all indoor burners. However, in the PiT four in ten (37%) indoor burners admitted to at least occasionally burning household waste. Indoor burners with an open fire were more likely than those with stoves to have burned household waste (44% compared with 35% of stove users).

It is not clear why there is a discrepancy in the findings between the CAS and the PiT, but the difference may be that the PiT included the phrase 'occasionally' and so captures respondents who burned household waste very rarely. But the difference may also be to do with what is called a 'mode effect' as the CAS data was collected in a face-to-face survey, whilst the PiT was conducted over the phone. Question positioning (at the start of CAS and after many PiT questions) and additional prompting in the PiT may also help explain the difference.

What is not known directly is what the household waste that these respondents burned was made up of. Asked why they burned household waste, 58% said that they used it to start the fire. Convenience was the motivation cited next most often, with 26% saying it was convenient for disposing of confidential waste; 18% said that it was a convenient way to dispose of things more generally. When probed directly in the PiT, 2% of indoor burners, said they did occasionally or rarely burn plastics indoors. Some of these responses may suggest that for some at least, the household waste being burned was largely paper-based. Certainly this tended to be the case for interviewees in the qualitative research, a number who talked about using paper, letters, newspapers and/or cardboard as part of lighting a fire.

Table 4.14: Spatial distribution of proportions of UK adult population that burn household waste indoors in the last year by nation, region and population density (incidence, % of adult population -- CAS)

	All UK	Country			
All respondents		**England**	**Scotland**	**Wales**	**Northern Ireland**
Unwtd base	*46729*	*38930*	*4241*	*2201*	*1357*
Household waste burned indoors	0.3%	0.3%	0.3%	0.5%	0.8%

	All UK	English region								
All respondents		**North East**	**North West**	**Yorks & Humber**	**East Mids**	**West Mids**	**East of Eng-land**	**Lon-don**	**S. East**	**S. West**
Unwtd base	*46729*	*2128*	*5292*	*3938*	*3313*	*3996*	*4359*	*5610*	*6362*	*3932*
Household waste burned indoors	0.3%	0.3%	0.6%	0.4%	0.2%	0.2%	0.2%	0.2%	0.4%	0.4%

	All UK	Population density			
All respondents		**Urban**	**Rural**	**Urban SCA**	**Urban non-SCA**
Unwtd base	*46729*	*37909*	*8820*	*21764*	*15936*
Household waste burned indoors	0.3%	0.3%	0.6%	0.2%	0.5%

4.6.2 Other fuels

Table 4.15 shows the proportions of the UK adult population (by region) that burned garden waste, peat and other (unspecified) fuels indoors, according to the CAS. All three types were burned at very low levels overall. The proportion of the UK adult population who said they burned garden waste (0.1%) and/or peat (0.2%) indoors was very small, although the proportion burning peat was higher in Northern Ireland (2.1%). It is not clear what garden waste meant for those who said they burned this, in particular whether this included wood (and if so whether this was seasoned) or was largely green material.

Table 4.15: Spatial distribution of proportions of UK adult population that burned other fuels indoors in the year prior to being interviewed by nation, region and population density (incidence, % of population -- CAS)

	All UK	Country			
All respondents		**England**	**Scotland**	**Wales**	**Northern Ireland**
Unwtd base	*46729*	*38930*	*4241*	*2201*	*1357*
Garden waste burned indoors	0.1%	0.1%	0.1%	0.1%	0.1%
Peat burned indoors	0.2%	0.0%	0.7%	0.1%	2.1%
Other fuel burned indoors	0.2%	0.2%	0.2%	0.0%	0.0%

	All UK	English region								
All respondents		**N, East**	**N, West**	**Yorks & Humber**	**East Mids**	**West Mids**	**East of Eng-land**	**Lon-don**	**South East**	**S. West**
Unwtd base	*46729*	*2128*	*5292*	*3938*	*3313*	*3996*	*4359*	*5610*	*6362*	*3932*
Garden waste burned indoors	0.1%	0.1%	0.1%	0.0%	0.0%	0.2%	0.1%	0.0%	0.1%	0.2%
Peat burned indoors	0.2%	0.0%	0.0%	0.1%	0.1%	0.0%	0.1%	0.0%	0.0%	0.1%
Other fuel burned indoors	0.2%	0.0%	0.1%	0.2%	0.2%	0.1%	0.3%	0.2%	0.1%	0.2%

	All UK	Population density			
All respondents		**Urban**	**Rural**	**Urban SCA**	**Urban non-SCA**
Unwtd base	*46729*	*37909*	*8820*	*21764*	*15936*
Garden waste burned indoors	0.1%	0.1%	0.2%	0.0%	0.1%
Peat burned indoors	0.2%	0.1%	0.4%	0.0%	0.2%
Other fuel burned indoors	0.2%	0.2%	0.1%	0.2%	0.2%

5. Burning practices: the prevalence of good practice

5.1 Reported burning behaviours and recommended practice

In the qualitative interviews, indoor burners who took responsibility for setting and maintaining fires typically described a high level of confidence regarding their knowledge of, and skill in, operating their appliance, often based initially on upfront guidance from the fitter, but then honed through trial and error over the period they had been burning.

However, there was evident variation in the levels of engagement with appliance specifics. Some burners actually seemed to know very little about how their appliance worked, whereas others demonstrated great enthusiasm in understanding how to use the vents and additional gadgets such as fans, etc. Others suggested that operating an appliance is very straightforward and that there is little to learn and get right:

> *What's to know? They're pretty simple. You put things in them and set light to them. If they stay alight then you're probably using your stove all right. You know? There are no gadgets to it.* (Surrey, Rural SEG – AB)

Those who inherited their appliance with a house purchase often seemed less engaged in the specifics of how the appliance worked in comparison with those who had bought their appliance and often researched it before buying. A few women who were interviewed said they left the operation, management and cleaning of the appliance to their male partner, suggesting that in some households the practice of indoor burning may be gendered. Burners also tended to believe that they were burning "the right stuff", and that they were making an environmentally friendly and sustainable choice, whatever fuel types they used. Where they recognised that they might occasionally not be following best practice, they dismissed this as a minor infraction because of the infrequency with which they claimed to do it or the circumstances which had made it necessary for them to do so.

They did not seem to question how they burned; their methods were picked up from others and practiced so often in the same way that they no longer consciously thought about it. This suggests that burning behaviours are developed based on a 'common sense' approach and maintained through habit and rules of thumb.

> *I think it's all common sense, really...But I think, you know, if you do, if you are sensible and burn the right things and stuff like that, you don't have any of that* [negative impact on health]*, really* (North East, Urban, SEG – D)

However, the qualitative research also suggested that ensuring fire safety is important to many burners. A number of the interviewees spontaneously cited a need to ensure the fire is out or a guard is put in place (if they are using an open fire) - unless they were primary burners who reported actively banking their fire to facilitate easy lighting the next day. A number of burners reported installing carbon monoxide monitors.

Building on these findings, the CAS and PiT asked a range of questions to better understand the extent to which burners are engaged in recommended burning-related practice. The recommended practice outlined in this chapter is taken largely from current Defra guidance[65] (in collaboration with industry and Forestry Commission experts).

[65] Three guides: Open fires and wood burning stoves – a practical guide - https://uk-air.defra.gov.uk/assets/documents/reports/cat09/1901291307_Ready_to_Burn_Web.pdf; Smoke Control Areas: Do you know the rules? -- https://uk-air.defra.gov.uk/assets/documents/reports/cat07/1901291328_Smoke_Control_Web.pdf; How to get the most from your

Additional advice from HETAS[66] or the Burnright[67] campaign is also cited, as are building regulations where relevant.

5.1.1 Use of pre-dried or appropriately seasoned wood if burning wood

Defra guidance[68] recommends either using bought wood that has been seasoned or dried by the supplier and is labelled 'ready-to-burn' or to season freshly felled (and therefore unseasoned) wood for at least a year. Partly seasoned wood should be seasoned until it is at a moisture content of 20% or below. This is because wood that is not seasoned properly has a higher moisture content and therefore emits more particulate matter that is harmful to health than dry wood[69].

As noted in Chapter 4 on fuel use, the CAS data suggests that 16% of indoor burners who burned in the last week had bought/got pre-dried wood, and a further 34% had got it seasoned (though it is not clear for how long). Half of wood burners therefore sought wood that was already appropriately dried; the rest bought/got freshly felled wood that they seasoned themselves. However, 20% of wood burning respondents who had burned in the last seven days had seasoned their wood for less than a year (9%) or not at all (11%). According to Defra advice therefore 20% of respondents had burned wood that had not been seasoned for long enough to ensure a moisture content of 20% or less (which Defra classifies as dry wood[70]). A further 12% did not know how long their wood had been seasoned for (see Figure 4.11 for details).

As outlined in Chapter 4, the qualitative interviews suggested that whilst these burner respondents' appreciation of the need to season wood was high, their depth of knowledge about what was required --particularly the length of time needed so that their wood was seasoned properly -- varied greatly. Those in rural locations appeared to be more knowledgeable. Whilst interviewees saw it as obvious that "wet wood won't burn properly", a few still reported burning it on occasion if there was no seasoned wood available. A few also said they deliberately burned unseasoned wood in order to prolong the fire and/or their wood supply.

Experienced burners tended to pick up their knowledge from family and other burners. A few respondents who knew less about different wood types and seasoning requirements reported looking for specific phrases when they bought wood, for example "kiln-dried logs", in order to ensure it was "good quality and seasoned". A few also tended to assume that what they bought must be seasoned properly: a number said that their supplier would "only sell seasoned wood" or "they tell me it's seasoned and I've been going to them for years", although one or two had had bad experiences (from their perspective), getting wood that they thought would be dry but that was not. Some of the interviewees also deliberately bought or collected freshly cut wood to season themselves.

stove or open fire: A guide to buying, storing and seasoning wood -- https://uk-air.defra.gov.uk/assets/documents/reports/cat09/1903131256_Seasoning_Wood_Web_Feb_2019_V5.pdf

[66] HETAS is the national organisation working for consumer safety and the wider public interest in safe, efficient and environmentally responsible use of biomass and other solid fuels: https://www.hetas.co.uk/wp-content/mediauploads/AFTERconsumer220118DIGITAL.pdf and https://www.hetas.co.uk/wp-content/mediauploads/BEFOREconsumer220118DIGITAL.pdf.

[67] www.Burnright.co.uk

[68] https://uk-air.defra.gov.uk/assets/documents/reports/cat09/1903131256_Seasoning_Wood_Web_Feb_2019_V5.pdf

[69] Wood with a moisture content of 20% of less.

[70] https://uk-air.defra.gov.uk/assets/documents/reports/cat09/1901291307_Ready_to_Burn_Web.pdf

5.1.2 Use of smokeless coal if burning coal

If burning coal, Defra recommends burning an approved solid fuel rather than house -- or bituminous – coal[71]. This is because approved fuels emit less smoke (which contains particulate matter [$PM_{2.5}$]) and can be more efficient. Smokeless coal is a generic name for a wide variety of approved fuels, and it is the term that was used within the two surveys.

As outlined in Chapter 4, 65% of coal using CAS respondents said they used smokeless coal, but only 38% used smokeless coal exclusively; 35% only used house coal. This means that over half of coal users are not always using the cleaner option. The reasons, as previously highlighted, were varied, but the most common were to do with price and availability.

5.1.3 Burning of treated waste wood and/or household rubbish

Defra strongly recommends not to burn treated waste wood or household rubbish[72] because the emissions can be particularly harmful to health (for example, emitting arsenic). As the previous chapter discussed, only 4% of indoor burners in the CAS said they had burned household rubbish in the last year, though 37% of PiT indoor burner respondents said they occasionally burned household rubbish indoors. However, only 2% of these PiT respondents said they burned plastic indoors. This suggests that there is a broad understanding that burning household rubbish indoors is not sensible, though a number of respondents in the qualitative interviews mentioned using paper-based waste to help light fires.

Only small percentages of indoor burners within the PiT said they burned types of wood that are likely to be treated: pallets (6%), other salvaged wood (6%), old furniture (4%), fence posts (3%) and window frames/doors (2%) (multiple responses were permitted). The qualitative interviews suggested that many of the respondents were aware that burning treated wood was problematic from an air quality perspective. However, a few seemed unclear as to what waste wood might be treated and a few admitted to burning wood they knew was treated occasionally. They seemed unconcerned whether the wood had been treated, justifying their behaviour because they did it infrequently and therefore saw it as not very harmful. One suggested that he thought his Defra-exempt stove would filter out any toxins.

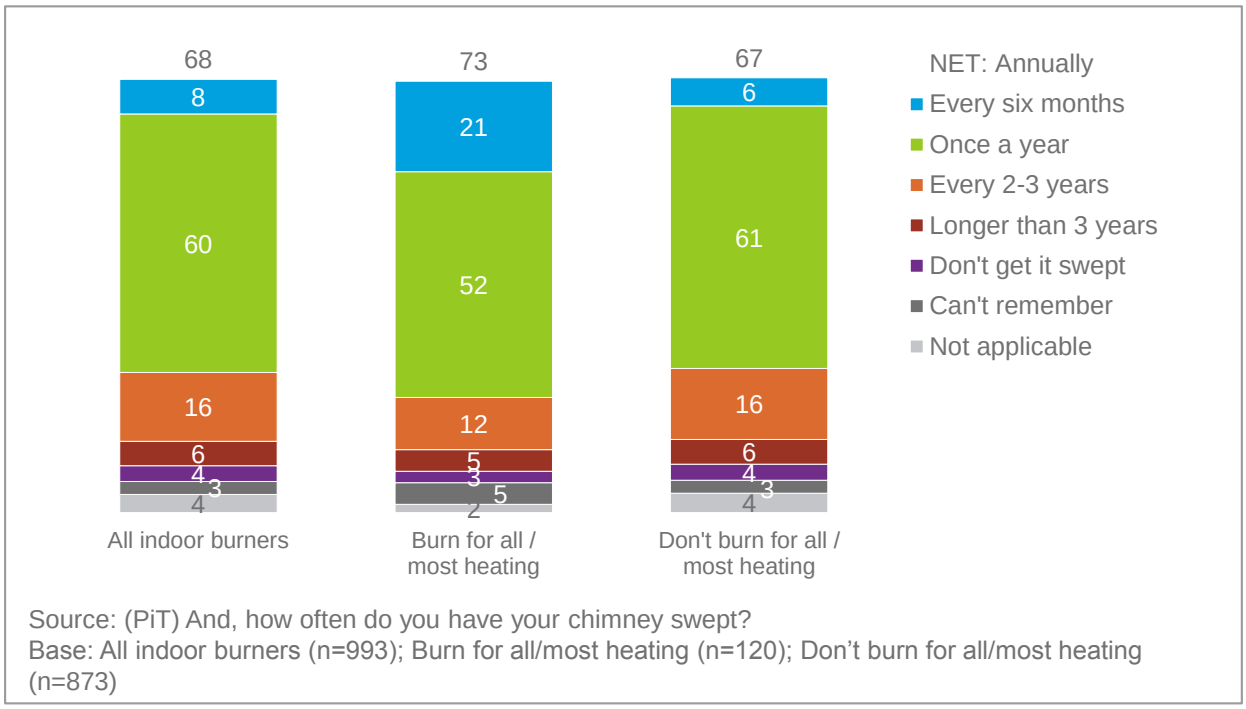
[71] https://uk-air.defra.gov.uk/assets/documents/reports/cat09/1901291307_Ready_to_Burn_Web.pdf

[72] https://uk-air.defra.gov.uk/assets/documents/reports/cat09/1901291307_Ready_to_Burn_Web.pdf

5.1.4 Frequency of having chimney swept

Defra recommends having the chimney swept up to twice a year because soot and tar build-up during use reduces efficiency and increases the risk of chimney fires[73]. Two-thirds (68%) of indoor burners in the point-in-time survey said that they had their chimney swept at least once a year (60% annually, 8% every six months). However, altogether 25% said they only had it swept every two to three years (16%) or longer (6%) or not at all (4%), whilst a further 3% could not remember when they last had it swept. This said, a higher proportion of those who burned for all or most of their heating had their chimney swept at least annually (73% compared with 67% who did not burn for all/most of their heating, see Figure 5.1).

Figure 5.1: Frequency of having chimney swept by purpose (% of indoor burners)

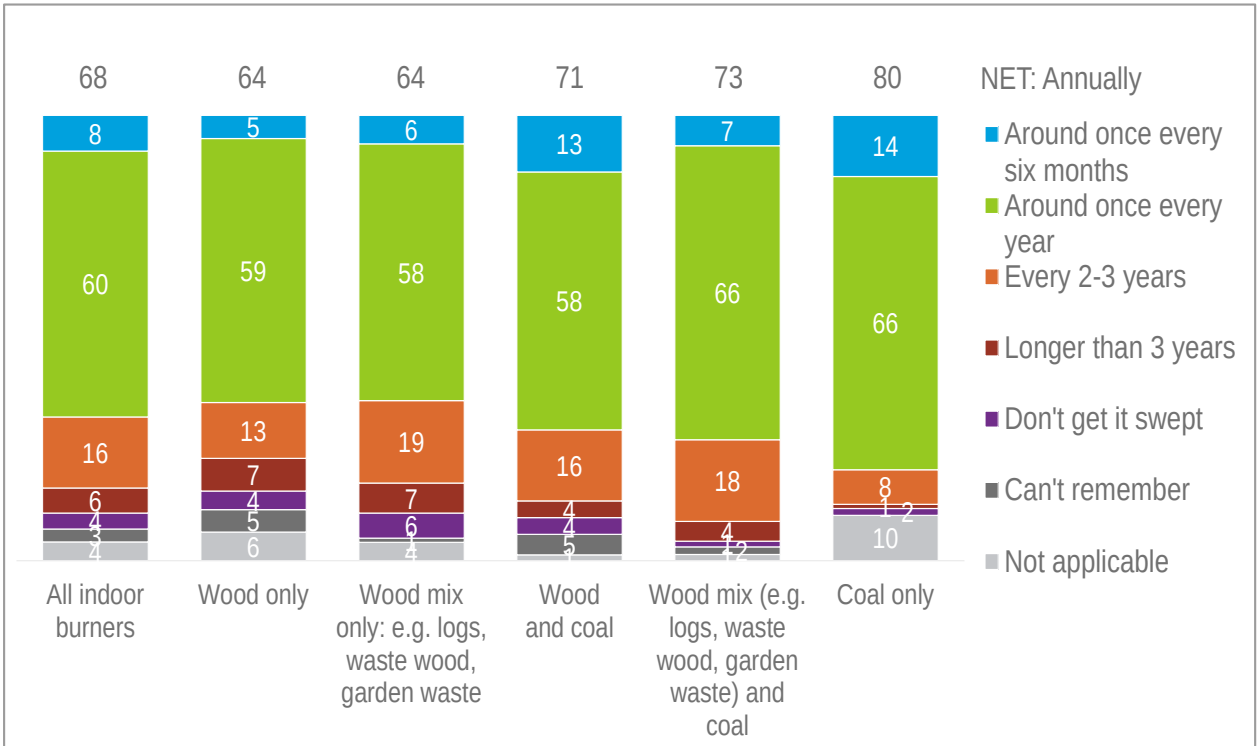


Source: (PiT) And, how often do you have your chimney swept?
Base: All indoor burners (n=993); Burn for all/most heating (n=120); Don't burn for all/most heating (n=873)

As Figure 5.2 illustrates that those who burned wood together with coal were more likely to sweep their chimney every six months (13%) compared with those who burned wood only (5%) or a wood mix (6%).

[73] https://uk-air.defra.gov.uk/assets/documents/reports/cat09/1901291307_Ready_to_Burn_Web.pdf

Figure 5.2: Chimney sweeping frequency by type of fuel burned (% of indoor burners)



Source: (PiT) And, how often do you have your chimney swept?
Base: All indoor burners (n=993); Wood only (n=223), Wood mix only (n=252), Wood and coal (n=195), Wood mix and coal (n=256), Coal only (n=39)

The qualitative research suggested a similar pattern: the majority had their chimneys (or flues) swept regularly, although frequency varied from every one to four years; very few had it done more than once a year. A small number had never had their chimneys swept and were unconcerned by this. A few rural-dwellers reported being unable to engage a sweep because of the location of their property. One interviewee also said they swept the chimney themselves, although Defra recommends using a chimney sweep who can advise on good burning practices[74]:

> *I do the sweeping myself. I've got all the parts… Depends how much we use it, twice a year or once a year. It gets [done] at least once a year definitely* (Wales, Urban, SEG – C2)

Many of the qualitative interviewees believed sweeping should be based on appliance usage and disputed the need to do it more than once a year. This also seemed to reflect the advice those who used a chimney sweep received:

> *We get it swept every year…we don't use it for a whole year. We use it for the 4 months, maybe 5 months if it's really cold.* (Midlands, Urban, SEG – C2)

> *Well our chimney sweep always says once a year's alright and I think if it was bunged up he'd say, oh you need to do this a bit more often.* (Surrey, Rural, SEG – C1; burning as a primary source of heat)

[74] https://uk-air.defra.gov.uk/assets/documents/reports/cat09/1901291307_Ready_to_Burn_Web.pdf

5.1.5 Replacing less efficient burning appliances with more efficient appliances or heating

Modern stoves are up to four times more efficient than open fires in producing heat, when appropriately sized and used correctly, meaning that for the same heat output they should use much less fuel. They should also produce less smoke and PM2.5. Older stoves are not as efficient as newer stoves. Defra recommends if someone is thinking of buying a stove to consider purchasing one that has a Defra exemption, permitting its use in smoke control areas, or an Eco-design Ready stove as these have been rigorously tested and demonstrate low smoke emissions.

What this study has found, as already detailed in Chapter 3, is that 31% of indoor burners in the CAS used an open fire as their main appliance in the week prior to being surveyed, and 26% used stoves that were installed prior to 2010. 9% of respondents did not know how old their stove was (possibly because it was with the house when they moved in). This suggests that many indoor burners are not using the most efficient appliances they could. However, as the multi-variate analysis in 3.3.5 suggests, for some this may be driven partly by financial considerations.

In the PiT, respondents with an appliance installed before 2000 were asked if they had any intention[75] of replacing their main open fire or stove in the next five years. Two in three (66%) said replacement was not at all likely (73% of those with an open fire and 50% of those with a stove) and 21% that it was fairly unlikely; 12% said it was very (3%) or fairly likely (9%) that they would.

As mentioned in Chapter 3, on average respondents who used stoves burned for longer in the week in their peak burning season than those who used open fires (though less in the summer season). This could suggest that investing in a stove encourages a household to burn for longer in the winter. However, it may be that this data suggests heavy (particularly primary) burners have tended to switch to stoves earlier than those who burn less frequently because of the greater efficiency of stoves. It is not possible to verify the reason(s) from this research.

5.1.6 Installation of appliance by professional

HETAS advises that burning appliances are installed by a registered professional to ensure building regulations are met[76]. Overall, among PiT indoor burners who installed their appliance after they moved in, 82% said that it was installed by a HETAS registered installer. This figure was slightly higher among stove owners (85%), and higher still among those who installed their stove after 2009 (88%). It is not known what those who did not use a HETAS registered installer did: whether they all used someone else who was qualified to install stoves, or whether some self-installed their stove.

5.1.7 Appliance maintenance

Defra advises that appliances are serviced regularly[77]. There were no questions in the survey on appliance maintenance, but a few qualitative interviewees did mention either maintaining the appliance themselves or having their chimney sweep do it as part of their visit. Many talked about how they cleaned out the appliance regularly, though the

[75] Of course, this question can only ask what respondents think they might do, and therefore is only indicative of current intentions within this sample, not actual behaviour.

[76] https://www.hetas.co.uk/consumer/faqs/

[77] https://uk-air.defra.gov.uk/assets/documents/reports/cat09/1901291307_Ready_to_Burn_Web.pdf

frequency varied seemingly in line with how often they cleaned their house. However, one older couple reported never cleaning their burner due to a perception that "a build-up of ash helps it burn better".

5.1.8 Using the correct fuels and appliances in a smoke control area

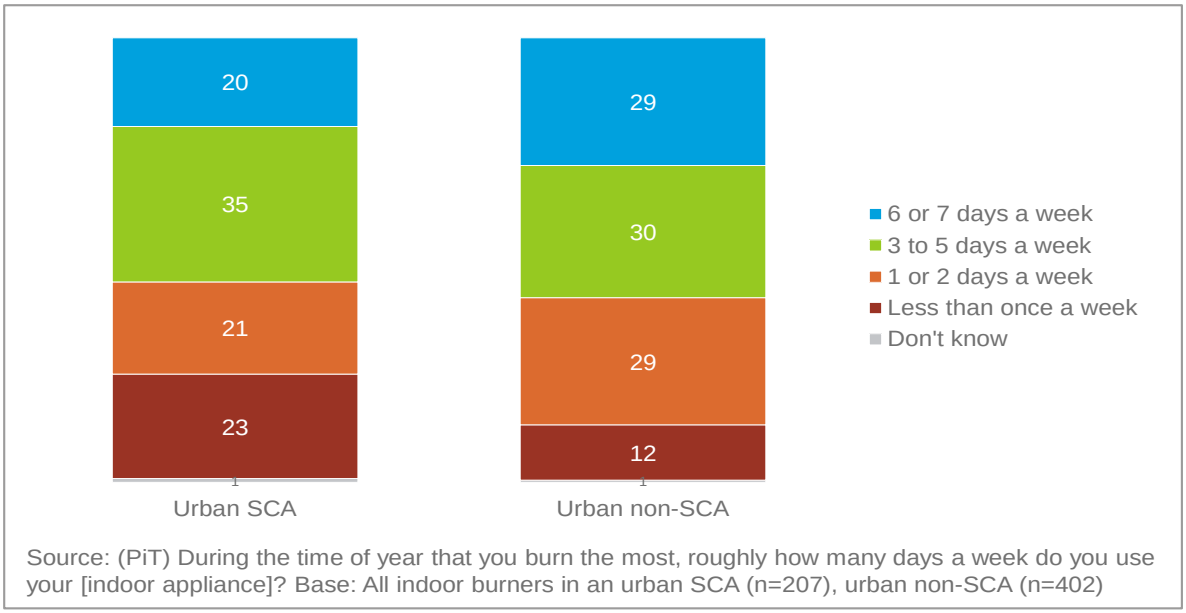
Defra guidance defines a smoke control area (SCA) as 'a legally defined area where only approved solid fuels or exempt appliances can be used within buildings'[78]. The list of authorised fuels and exempt appliances vary slightly by nation depending on when products are approved by them.

As mentioned earlier, the CAS findings suggest living in an SCA did seem to be correlated with some differences in terms of burning incidence. In addition, the PiT data suggest a greater prevalence of certain behaviours amongst those living in SCAs that are consistent with SCA regulations and/or are indicators of good burning practices:

- The proportion of indoor burners who said that they bought dried or seasoned wood was higher in urban smoke control areas (75% compared with 66% in urban non-SCAs).
- A greater proportion of those in urban smoke control areas tended to use smokeless coal, with some (though not all) knowing that they lived in a smoke control area; almost all (95%) indoor burners who thought they lived in an SCA regularly used smokeless coal.
- More indoor burners who lived in urban SCAs said that whether their fuel was smokeless and/or how environmentally friendly it was, was factor in fuel-purchasing decisions (19% compared with 9%, and 19% compared with 11% respectively).
- Burning frequency was lower among indoor burners in urban smoke control areas, as can be seen in Figure 5.3. However, slightly more than half still used their appliance at least three days a week during the periods of the year when they burned the most (55% compared with 58% of indoor burners in urban non-SCAs).

[78] https://uk-air.defra.gov.uk/assets/documents/reports/cat07/1901291328_Smoke_Control_Web.pdf

Figure 5.3: Number of days a week urban indoor burners burned inside during the period they burn the most by smoke control area (% of indoor burners in urban areas)



Source: (PiT) During the time of year that you burn the most, roughly how many days a week do you use your [indoor appliance]? Base: All indoor burners in an urban SCA (n=207), urban non-SCA (n=402)

However, whether such differences are due to respondent knowledge of living in an SCA or to other factors that can be associated with urban SCAs (such as gas grid connectivity or housing types, tenure or space for fuel storage) is unclear. The fact that the findings also show that awareness of SCAs amongst indoor burners was relatively low suggests knowledge of living in an SCA can only have been an influence on some: a third (32%) of indoor burners in urban areas did not know whether they lived in an SCA or had not heard of one; among those indoor burners who thought they did live in an urban SCA, 70% actually did so and 29% did not, whilst 13% of those who thought they did not, actually did (see Table 5.4).

Table 5.4: Levels of awareness of whether live in an SCA (% of indoor burners in urban areas -- PiT)

Actually live in SCA (based on postcode)	**All indoor burners in urban areas**	**Awareness of SCA**			
		Never heard of SCAs	**Think they live in an SCA**	**Think they don't live in an SCA**	**Don't know whether they live in SCA**
Unwtd base	637	*24**	*193*	*264*	*156*
Live in SCA	35%	41%	70%	13%	34%
Don't live in SCA	65%	59%	29%	87%	66%
Unknown	*	*	1%	*	*

* Caution: low base size

5.1.9 Slumbering of fires overnight

Defra recommends against the slumbering of fires overnight[79]. This is because it can contribute to carbon monoxide build-up as well as continued emissions of $PM_{2.5}$ overnight unless the stove is specifically designed to operate that way. Banking the fire is often done to facilitate slumbering, where ash is 'banked' around hot (not fully burning) coals or wood embers so that they remain hot all night. This can make it easier to light the following day, which may explain why this appeared to be more common among indoor burners who used solid fuels to provide the majority of their heating. More than one in three (36%) of those who burned for all or most of their heating followed this practice, compared to fewer than one in six (14%) indoor burners who used it for some of their heating or for another purpose such as heating their water. Overall, 16% of PiT burners said they banked their fires overnight, whilst 83% did not.

In the qualitative interviews, safety was forefront in some participants' descriptions of their burning behaviour, with many spontaneously citing the need to ensure the fire is out (and guarded) before they go to bed. However, a small number of participants who burned as a primary source of heat readily acknowledged banking the fire to facilitate easy lighting the next day.

5.1.10 Use of carbon monoxide monitors

Defra recommends installing a carbon monoxide monitor in order to alert household occupants to the build-up of dangerous fumes that can lead to carbon monoxide poisoning[80]. There was no question on carbon monoxide monitors in the surveys, but some of the interviewees in the qualitative research did mention they had them for reasons of safety. One interviewee described how theirs had gone off as a result of banking their fire at night.

> *We did have a little experience recently where we think we banked it up too much and it caused one of our carbon monoxide alarms to go off so we're a bit worried about that so we got a chimney sweep in and he's declared it safe* (Gloucestershire, Urban, SEG – C1)

5.1.11 Ventilation

Depending on a number of factors, including the size of the stove, building regulations[81] often require that a permanent open air vent is installed if a solid fuel appliance is to be used, although older, less well-insulated homes with smaller appliances or room-sealed appliances may not be required to have one.

The qualitative research found some people chose a smaller appliance to avoid installing an air vent. Interviewee reasons for this tended to focus on the desire to avoid the disruption and costs associated with air vent installation, but also reflected perceptions about the loss of warmth through ventilation.

> *It was the largest [appliance] we could get… without [having to install] an air vent… It kind of seemed wrong to have them pulling in cold air when you're trying to heat the room up.* (Surrey, rural, SEG – A)

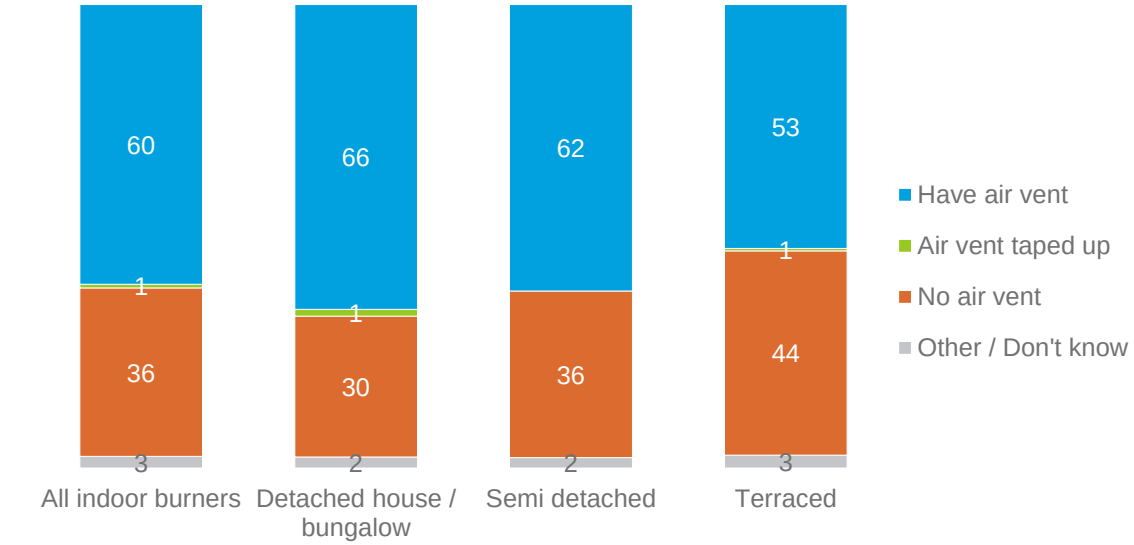
[79] https://uk-air.defra.gov.uk/assets/documents/reports/cat09/1901291307_Ready_to_Burn_Web.pdf

[80] https://uk-air.defra.gov.uk/assets/documents/reports/cat09/1901291307_Ready_to_Burn_Web.pdf

[81] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/468872/ADJ_LOCKED.pdf

The PiT survey found that 60% of indoor burners said they had an air vent that was left permanently open, but 36% said they did not have one and 1% said they kept it taped up (see Figure 5.5). The figure for those not having an air vent was higher amongst those living in terraced housing (44%).

Figure 5.5: Presence of ventilation by house type (% of indoor burners)



Source: (PiT) Do you have an air vent in the room with your [indoor appliance] that is permanently open? Base: All indoor burners (n=993); Detached house / bungalow (n=395), semi-detached house (n=332), Terraced house (n=250)

5.1.12 Use of air controls on stoves

The Burnright[82] campaign highlights the importance of appropriate use of air controls on stoves to ensure the solid fuel is burning at the right temperature: 'If the air controls are shut down too much, the burning temperature drops and lots of pollution is produced.'

Throughout the year in the CAS, stove users were asked how they set the air controls on their appliance in the last seven days. Most commonly, they had their air controls partially open (44%). However, around a third (35%) said they had them on the minimum setting. The remainder had them fully open (9%) or altered them frequently (6%).

The Burnright campaign also notes that one sign that a stove is not burning hot enough may be having blackened glass (although there are other potential reasons for this, including the moisture content of wood). 38% of stove users admitted the glass on their stoves sometimes blackened, and 6% said that it always did. Burners with older appliances (2009 or earlier) were more likely to have blackened glass than those with more recent appliances (51% compared with 39%).

5.1.13 Lining of the chimney flue

Although Building Regulations do not require all existing chimneys to be lined, it tends to be recommended, at least for stoves. HETAS suggests that the existing chimney should be inspected to check the integrity and appropriateness of the lining for safety-related reasons prior to installation of a new appliance. Indoor burners with a stove were thus

[82] https://www.burnright.co.uk/using-your-fire/using-the-controls/

asked in the PiT whether their chimney was lined. More than three-quarters (79%) of those with such an appliance said their flue was lined, but 12% said their chimney was not lined and 8% said that they did not know.

5.2 Seeking advice on good practice

Many of the burners who participated in the qualitative research did not actively seek advice on burning. This seemed to because many thought that they were already engaging in good burning practice (even if they described particular instances of poor practice, such as burning wood that was not seasoned properly). This appeared to be rooted in the perceived legitimacy of what they were doing (such as the view that a participant burning the 'right things' and/or viewing burning as an environmentally sustainable choice) and also their reliance on a 'common sense' approach to their burning behaviour. However, a few also said they thought there was little to learn in using a stove. The result is that these interviewees had rarely questioned their burning practices or sought to explore alternative approaches.

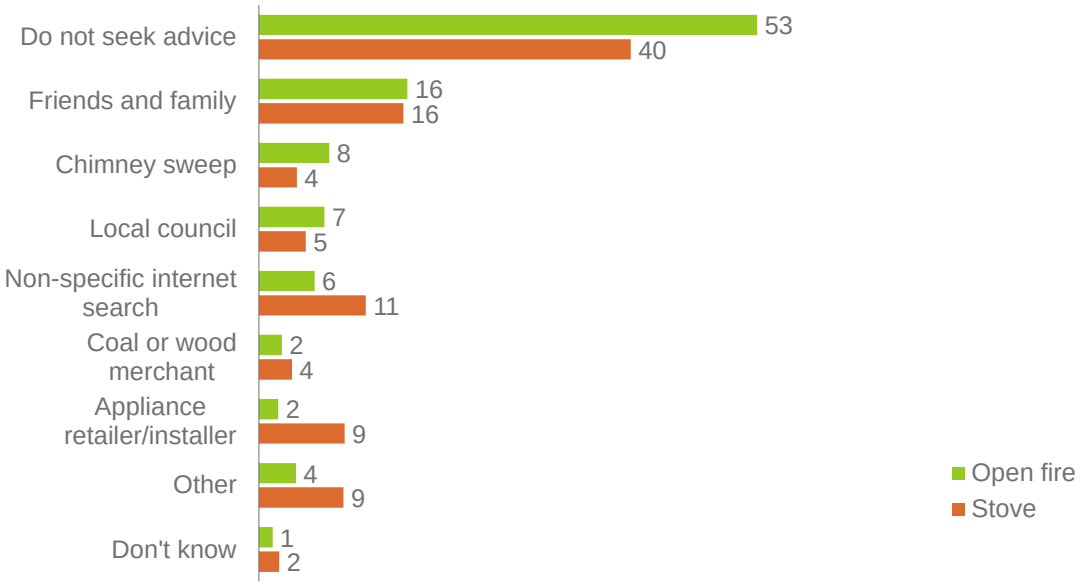
> *I think we are* [engaging in good practice]*. I think maybe it was just by- it just happened rather than we went for that way, but we kind of understand it now we're there. Do you know what I mean? (Surrey, Rural, SEG – A)*

Therefore perhaps it is not surprising that the PiT survey found that 44% of indoor burners said they did not seek advice, and that this was higher for those with an open fire (53%). This was particularly the case for burners with appliances installed before 2010 (50% who said they did not seek advice compared with 37% of those with newer appliances). This may be linked to the finding that indoor burners who had been burning at home for more than a decade were more likely than less experienced burners to seek no advice on burning practices (54% compared with 35%).

Those who did seek advice mentioned friends and family as their most common source of guidance (16%), followed by a range of other options in particular the internet and appliance installer for those using stoves, and chimney sweep and local council for those using open fires. Figure 5.6 shows the most common sources who burners with a stove or open fire said they turned to for advice.

Those with appliances installed more recently were more than twice as likely to mention they had sought advice from an appliance retailer or installer than those with older appliances (11% compared with 4%). One in twenty of those with more recent appliances (5%) mentioned that they turned to their coal or wood merchant for guidance (compared with 1% of those with older appliances). Types of individuals or organisations in the 'other' category from where advice was sought included the media (radio, news), HETAS, heating engineers and woodland organisations.

Figure 5.6: Sources of burning information by type of appliance (% of indoor burners, multi-response allowed)



Source: (PiT) Who or what is your main source for guidance and advice on burning practices, if any?
Base: All who use an open fire (n=282), All who use a stove (n=680)

Both the survey and the qualitative interviews revealed that those with more recent appliances, or who had installed them after moving in, were more prepared to seek out information or had done more research when installing their appliance. The survey also found that more than three-quarters (77%) of indoor burners who had had their appliance installed received advice or information on burning practices when they bought it.

The qualitative interviews also suggested that perceived 'experts', such as chimney sweeps and fuel suppliers, were usually seen as a credible source of advice on burning practices, including on fuel decisions and frequency of cleaning appliances, although the surveys suggested they were not often asked to provide such guidance. This may mean there is a potential role for such intermediaries in informing burners of good practice.

6. Why burn indoors: respondent rationale

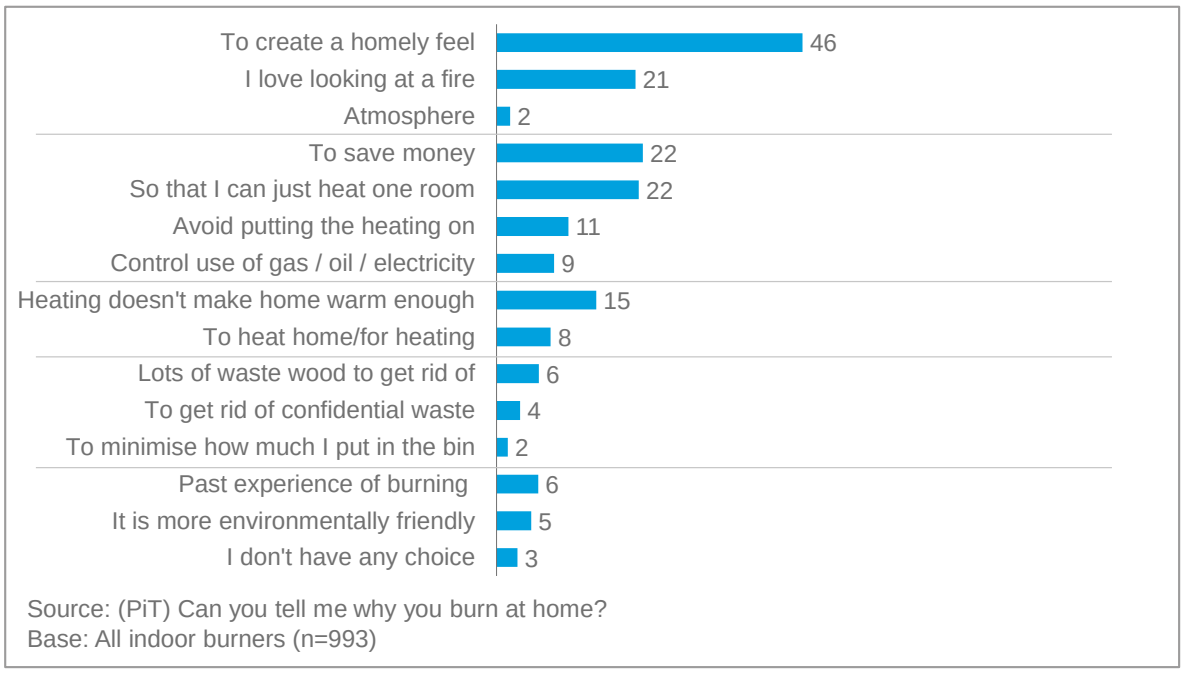
This chapter explores the reasons respondents gave for burning indoors, as well as their response to questions about the impact of burning on health and the environment.

6.1 The perceived benefits of burning indoors

As discussed in Chapter 4, 87% of indoor burners reported using solid fuels to provide at least some of their home heating. The remainder burned for cooking (3%), to heat water (7%) and/or to dispose of waste (4%), though a few of those who burned for heating also did one or more of these. Among those who used solid fuel for most or all of their heating, 25% said it was also a source of hot water.

To explore in greater depth why people who burned indoors chose to use *solid fuel* systems as a form of heating (or to heat water or cook) - given most had access to an alternative heating source (gas, electricity or oil) as detailed in Chapter 3 - PiT respondents were asked about the reasons for using their appliance (see Figure 6.1): they could choose more than one option. The most popular response (46%) was 'to create a homely feel'. This reason was given more often by less frequent burners (54% of those who burn at most two days a week). It was also reported more often than average by social grades AB (50%) and those who find it very easy to meet their fuel costs (57%).

Figure 6.1: Further reasons for using solid fuel systems (% of indoor burners, multi-response allowed)



Note: Only responses equal or higher than 2% included in chart.

The next most cited reasons were related to saving money and to heat just one room (both at 22%), followed closely by the enjoyment of looking at a fire (21%) and their other heating not making the home warm enough (15%). Other less common reasons given for burning related to the disposal of waste, with 6% mentioning a good supply of waste wood,

4% the need to get rid of confidential waste and 2% the desire to reduce what goes into the bin. Family tradition (or what might be seen as habit) was mentioned by 6%, and seeing it as a more environmentally friendly way of heating the home was chosen by 5%. A small proportion (3%) said they had no choice but to burn.

The qualitative research revealed that the participants who took part in that aspect of the research demonstrated strong emotional attachment to fires. These revolved around comfort, cosiness and/or nostalgia.

> *It's just homely; it's just everything. Because I love heat… I think it takes me back to my childhood, actually, because when I was young, obviously, as I said, it was an open coal fire. But seeing the winter nights and you were washed and your pyjamas on and sitting in front of the fire with your hot chocolate. And it just feels like home with a coal fire.* (Scotland, Rural, SEG – DE)

> *I've always loved fire. I think they're very homely…And I think it's like with everything. It's like water. People are drawn to water; people are drawn to fires…Hmm…Beauty of nature, really* (Surrey, Rural, SEG – A)

> *It creates a cosy atmosphere, there's something nice about coming together as a family around the fire* (Wales, Rural, SEG – C1)

> *It just reminds me of being warm, comfy and warm cos it's the colour I think. If the flames were blue you wouldn't have that feeling but because they're orangey it just reminds…* (Gloucestershire, Rural, SEG – B)

> *I do I like the nostalgia of a fireplace. I like, it's very soothing, it's very relaxing (London, Urban, SEG C1)*

Some described a strong sense of empowerment delivered from heating their own homes. There were some who saw it as a matter of 'survival' as one respondent put it, a necessity for those without other means of heating. Even for a couple of interviewees who used burning as a secondary means of heating it was seen as essential back-up in case they could no longer run their main heating system because of their context:

> *When the heating doesn't work or we've run out of kerosene because we can't get it delivered…if we didn't have the stove, then we'd be freezing and there'd be no hot water.* (North East, Rural – Off grid, SEG – C2)

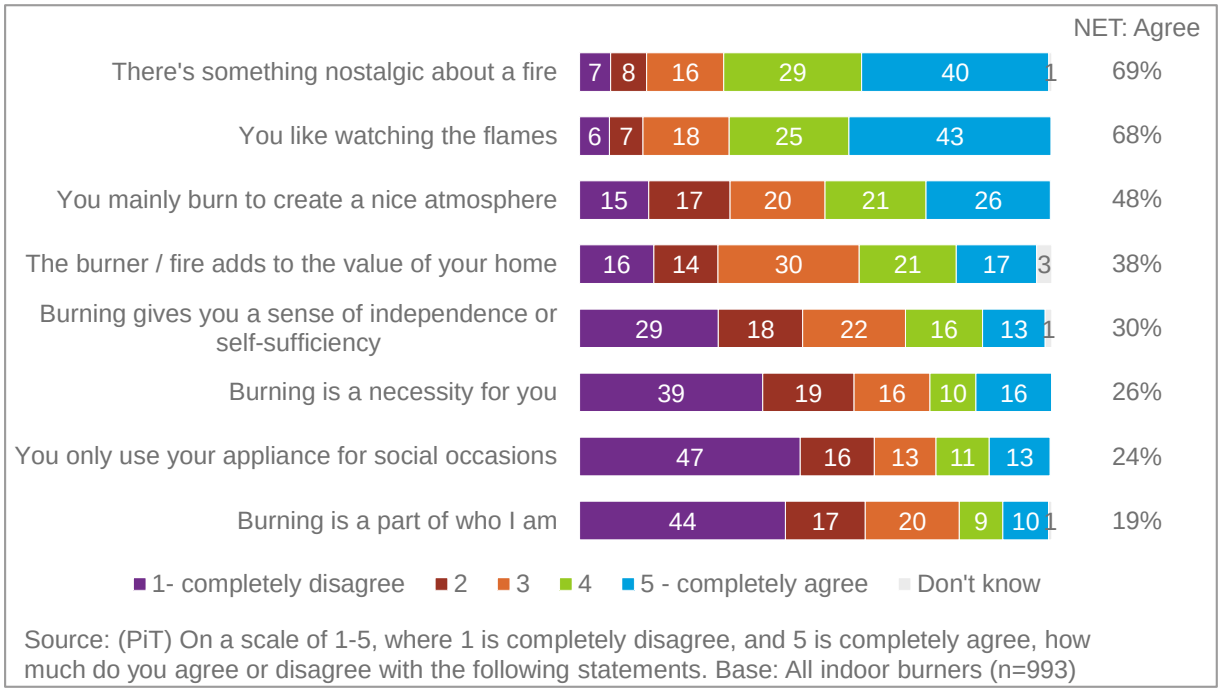
For others, having a fire indoors was for enjoying with other people:

> *I don't use it often, it's more of a social type thing, cos as I say it looks nice so it's not my main source of heating by any means.* (Gloucestershire, Urban, SEG – B)

Building on this, respondents were asked the extent to which they agreed or disagreed with a series of statements (see Figure 6.2). The statements were derived from the qualitative findings and aimed to quantify the prevailing feelings, attachments and views in relation to burning, which could also be used to develop a segmentation of indoor burners.

Two-thirds of indoor burners in the PiT agreed that they liked watching the flames (68%) and/or that there's something nostalgic about a fire (69%), rating their agreement as four or five on a five-point scale. Almost a third (30%) reported that burning gave them a sense of independence or self-sufficiency. Around a quarter (24%) agreed either completely (13%) or to a certain extent (11%) that they only used their appliance for social occasions, whilst a similar proportion agreed that burning was a necessity for them (26%). A fifth (19%) identified with burning, agreeing that it is a part of who they are. Among those owning their property, around two-fifths (38%) thought their indoor appliance would add value to their home.

Figure 6.2: Degree of agreement/disagreement with statements on burning (% of indoor burners)



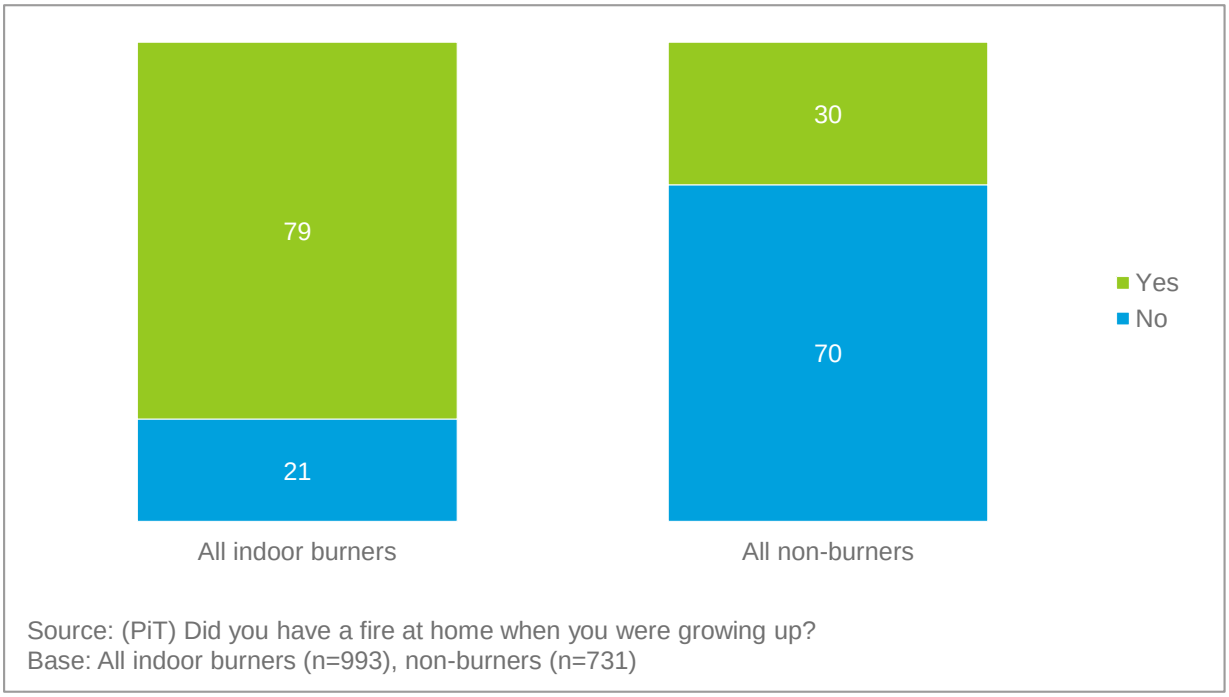
Source: (PiT) On a scale of 1-5, where 1 is completely disagree, and 5 is completely agree, how much do you agree or disagree with the following statements. Base: All indoor burners (n=993)

6.2 The role of childhood experience of indoor burning

As noted above, family tradition of burning was one reason for indoor burning identified by the qualitative research. Where participants described burning as a habit or 'way of life', this either reflected burners passively continuing established family routines or taking a more active decision to reconnect with nostalgic experiences.

The potential influence of childhood experience of burning appears to be supported by the PiT finding that 79% of indoor burners reported having had a fire at home when growing up, which is much higher than it is among non-burners (23%, see Figure 6.3). This may suggest that growing up with indoor burning is important to understanding who burns. Experience of growing up with a fire was higher amongst retired households who burned (94%), probably reflecting the greater prevalence of solid fuel systems as primary heating systems prior to the spread of central heating systems.

Figure 6.3: Previous experience of indoor burning at home when growing up (% of indoor burners, non-burners)

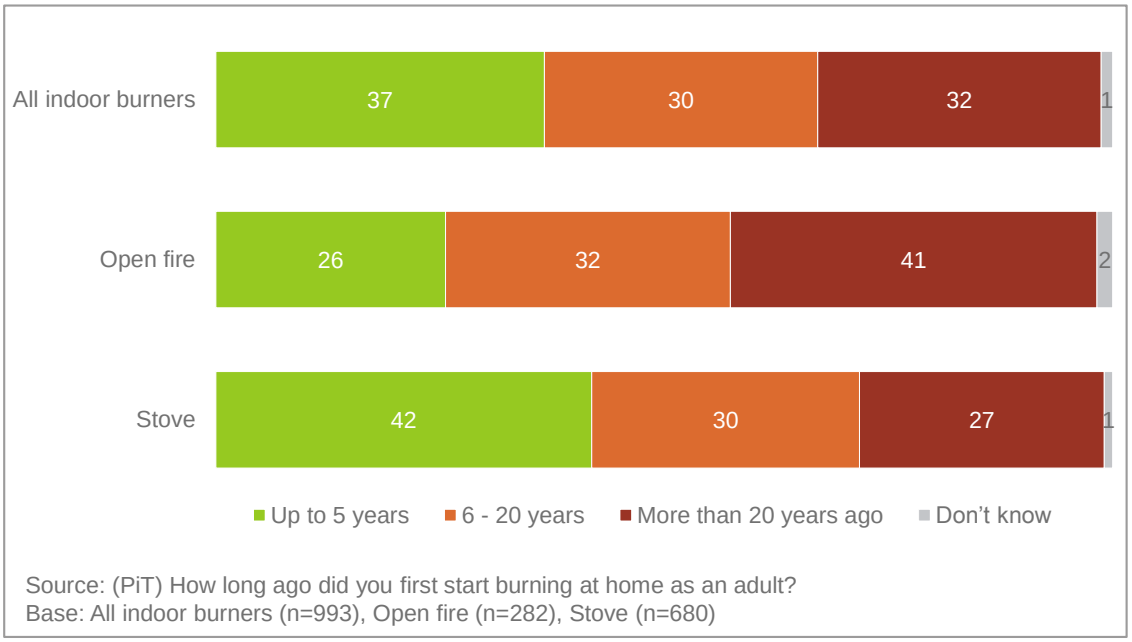


Source: (PiT) Did you have a fire at home when you were growing up?
Base: All indoor burners (n=993), non-burners (n=731)

Burners can be split roughly into thirds in terms of the length of their experience of indoor burning: 37% had been burning for at most five years, 30% for between six and 20 years, and 32% for over 20 years (see Figure 6.4). Stove owners tended to be less experienced, with 42% having started burning in the last five years (compared with 26% of open fire users). Indoor burners in Northern Ireland reported burning for longer, with 49% having over 20 years' experience, while those in England had less (40% had burned for at most five years, suggesting a more rapid uptake of burning in recent years). Recent burners were also more prevalent in urban SCAs (46%) and in homes with mains gas (41%).

The most experienced burners were twice as likely to view burning as a necessity (33% of those with 20 or more years of experience compared with 18% of those who had burned for five years or less). More than a third of the most experienced burners also agreed that having a fire gave them a sense of self-sufficiency (35% compared with 24% of recent burners), and 28% saw burning as part of their identity (compared with 10% of recent burners).

Figure 6.4: Experience of indoor burning by appliance type (% of indoor burners)



Source: (PiT) How long ago did you first start burning at home as an adult?
Base: All indoor burners (n=993), Open fire (n=282), Stove (n=680)

6.3 Indoor burner attitudes towards health and the environment

6.3.1 Impact on the environment

Most of the interviewees in the qualitative research considered solid fuel burning to be "environmentally friendly" because they saw it as carbon neutral, with burning wood viewed as part of a natural cycle of absorption and release of carbon dioxide by trees from and into the atmosphere. Those burning smokeless coal also thought it had no negative environmental impact. Overall, they tended to portray themselves as *"responsible burners"* and *"burning the right stuff"*. In addition, those living in a rural (or coastal) area, argued that any smoke that they might emit easily dispersed, causing no negative effects.

However, most of those burning house coal did accept that it was a "dirty" way to burn, but believed that the small amounts they were using would not have a huge impact. Some who were more environmentally concerned were more worried about other forms and sources of pollution, such as industry and vehicles, and toxins in the food chain.

Most of the interviewees also reported never having thought about the impacts of burning on health, apart from those with family members who either suffered with asthma or chronic obstructive pulmonary disease (COPD); this latter group expressed worry about the negative effects of smoke. However, there was also a perception expressed by a couple of interviewees that central heating can be worse for these conditions as the heat is "too dry" and that "burning wood is better for you".

> *They've* [the council] *pressured me twice trying to get me to change to electric heating, but it's not good for my chest, so I've refused it…I've got COPD and I know that electric heating's not good for me and gas heating's not good for me* (Scotland, Rural, SEG – DE)

Some were aware that burning unseasoned wood can produce a lot of smoke, which is not good for health, and many burners did understand that if people burn "the wrong things" (for example, waste) this can produce harmful chemicals; however, many did not consider that waste wood potentially fell under this category (when treated). They tended to be shocked or surprised by an infographic on the health harms of fine particulate matter and its links to burning that they were shown during interviews because of the scale of the

contribution to particulate emissions from domestic combustion that it illustrated. They tended to question the credibility of the information and/or its sources.

The point-in-time survey (almost a year later and with many more respondents) suggested a greater acknowledgement of domestic burning as a possible source of pollution, with few indoor burners overall agreeing that their burning had a positive impact on the local environment (15%), and substantially more disagreeing (57%). Nearly half (46%) agreed that burning in people's homes and gardens is a significant source of air pollution. However, only three in ten expressed concern about the impact their burning might have on their health and those around them (27%) and interestingly, indoor burners who had someone in their household who suffered from a respiratory or cardiac condition did not show greater concern about the impact of burning on health and air pollution.

Indoor burners mainly using an open fire were more likely to disagree that their burning has a positive impact on the local environment (62%) than those who mainly used a stove (55%). In line with this, they were also more likely to view domestic burning as a significant source of air pollution (52% compared with 44% of stove-users). Therefore there does seem to be recognition by some of the negative impacts of indoor burning, particularly by those with open fires which are less efficient and likely to produce more particulate matter for the amount burned.

However, those who used solid fuel for all or most of their heating tended to be less concerned about negative impacts, with only 37% agreeing that burning is a source of air pollution compared with 48% of those who do not burn for all or most of their heating. They were also less likely to disagree that their burning has a positive impact on the local environment (44% vs 58% of those not burning for all/most heating).

In summary, whilst the survey suggests that some indoor burner respondents did recognise that indoor burning causes air pollution and that this can be linked to damage to health and the environment (although there may be confusion as to how), it also indicates that some did not. The qualitative research indicates that those for whom this is new information may find it difficult to accept and may question its credibility.

7. Who burns: A segmentation of indoor burners

This chapter provides a brief summary of the key characteristics of indoor burners as a whole group, followed by a description of the segmentation that was conducted to identify particular groupings of indoor burners based on their reasons for burning.

7.1 Key socio-demographic characteristics of indoor burners

A full set of tables describing burner and non-burner characteristics is in Appendix A. According to the CAS, almost half of all indoor burners (46%) were from the highest AB social grades (particularly those who burned both indoors and outdoors: 57%). Indoor burners were considerably more likely to own their home outright (42%) and less likely to be renting (8%) than non-burners (24% from AB social grades, 33% owning their home outright and 35% renting). Based on CAS data, of those who burned indoors, 21% reported household incomes of over £50,000 per year[83]. However, one in ten (10%) indoor burners reported a household income of below £20,000 per year. Almost all indoor burners in the CAS classified themselves as 'white' (97%), while among non-burners this figure was 85%.

Indoor burners were more likely to have children in the household (33% compared with 25% of non-burners), but indoor *only* burners were no more or less likely (26%) to have children. Almost all indoor burners in the PiT lived in a house (98%) rather than a flat or maisonette, and they were more likely to live in a detached house (28%) than non-burners (15%). More indoor burners lived in older properties (these are more likely to have been built with chimneys): 46% lived in buildings constructed before 1929, compared with non-burners (16%)[84]. This suggests that propensity to burn indoors may be, at least in part, associated with certain property characteristics.

Although a greater proportion of indoor burners appear to be relatively affluent in comparison with non-burners, 19% of indoor burners said they found it difficult to meet their energy costs[85], 3% of whom found it very difficult. Those who found it difficult to keep up with the cost of energy were more likely to have an open fire as their main appliance (38%) than indoor burners in general (28%), and consequently less likely to have a stove (59% compared with 70% across all indoor burners). The quality of the fuel was less commonly mentioned as a concern by indoor burners who found it difficult to meet the cost of fuel and energy (42%), though a high heat output was more of a concern for those in this category, who burned coal and wood, than for other coal and wood burners (16% compared with 10%). A greater proportion of those in social grades DE (30%) said it was difficult to meet fuel costs, though 11% of ABs also said it was difficult.

[83] As is often the case with questions about income, many respondents refused to answer the question (26%) or answered 'don't know' (15%). Excluding these respondents, 36% of indoor burners reported household incomes over £50,000. This question was not asked of non-burners.

[84] The Energy Follow-Up Survey data from 2011 also shows that secondary solid fuel heating systems were overwhelmingly found in owner-occupied homes: most often detached, semi-detached or large terraced houses, and typically outside of a city centre, and indicate that households who use these systems were most likely to be owner-occupiers, in the highest income band and aged 45 and over.

[85] This compares with 13% of non-burners, which is significantly lower. However, so is the 78% who found it easy to pay their bills, partly because the percentage who did not know whether they found it easy or difficult to pay energy bills was significantly higher amongst non-burners.

Figure 7.1 shows that the proportion of primary burners in the DE category (15%) was double the proportion who were in the AB category (8%) which, as mentioned earlier, makes up almost half of all indoor burners. They also made up a greater percentage of indoor burners in rural areas (16%) in comparison with urban areas (8%) and made up almost a quarter of indoor burners in Scotland (22%).

Table 7.1: Primary and secondary burners[86] by social grade, nation and population density (% of indoor burners -- PiT)

	All indoor burners	Social grade			Nation				Pop density	
		AB	C1 C2	DE	Eng-land	Scot - land	Wales	NI	Ur-ban	Rural
Unwtd base	*993*	*447*	*408*	*137*	*733*	*85*	*86*	*88*	*637*	*352*
All or most of your home heating	11%	8%	13%	15%	9%	22%	9%	17%	8%	16%
Some of your home heating	75%	76%	76%	68%	76%	69%	85%	64%	75%	76%
Use solid fuels for another purpose	13%	16%	10%	14%	14%	8%	6%	18%	16%	7%
Don't know	1%	0%	1%	2%	1%	0%	0%	1%	1%	0%

Key: Orange: significantly higher than all indoor burners; blue: significantly lower

7.2 Indoor burner segmentation

A segmentation of indoor burners was conducted using the process outlined briefly in the Introduction and more fully in the Appendix C. Used initially in marketing, segmentation involves dividing a population into different groups or typologies based on their motivations and characteristics. This can help in targeting communications or other interventions better through improving understanding of the variation within the audience. In this case, the segmentation is of indoor burners, and the main purpose is to provide an easy way of understanding some of the main differences in the indoor burner population in order to assist with the design of appropriate communications to reach different types of indoor burners and the consideration of policy in light of differences within the indoor burning population.

[86] Those who said they burned indoors for most or all of their heating are termed in this report as 'primary burners'; those who burned indoors for some of their heat are termed 'secondary burners'.

7.2.1 Key characteristics and attitudes that segment the indoor burning population

Overview of the segments

The qualitative research proposed segmenting indoor burners according to frequency of burning and differences in the reasons people burn (on a continuum of burning as a primary source of heating where options seem limited and therefore seen as a necessity through to burning for pleasure and/or as an additional source of warmth).

The survey data was used to produce a more robust statistical segmentation of the UK indoor burning population. This took into account the following data for indoor burners:

- Primary purpose of indoor burning (for example, heating, hot water, etc.)
- Additional drivers for indoor burning (for example, saving money, tradition, homely feel, etc.)
- Attitudes towards money, health and the environment in relation to indoor burning

The purpose of segmentation analysis in general is to identify sub-groups of objects that are as homogeneous as possible within each segment, and as heterogeneous as possible between segments. This is done by identifying key dimensions that differentiate between respondents and then clustering these into segments using multivariate analysis. This produced the five segments of indoor burners shown in Figure 7.2 Further detail is included in the Appendix C.

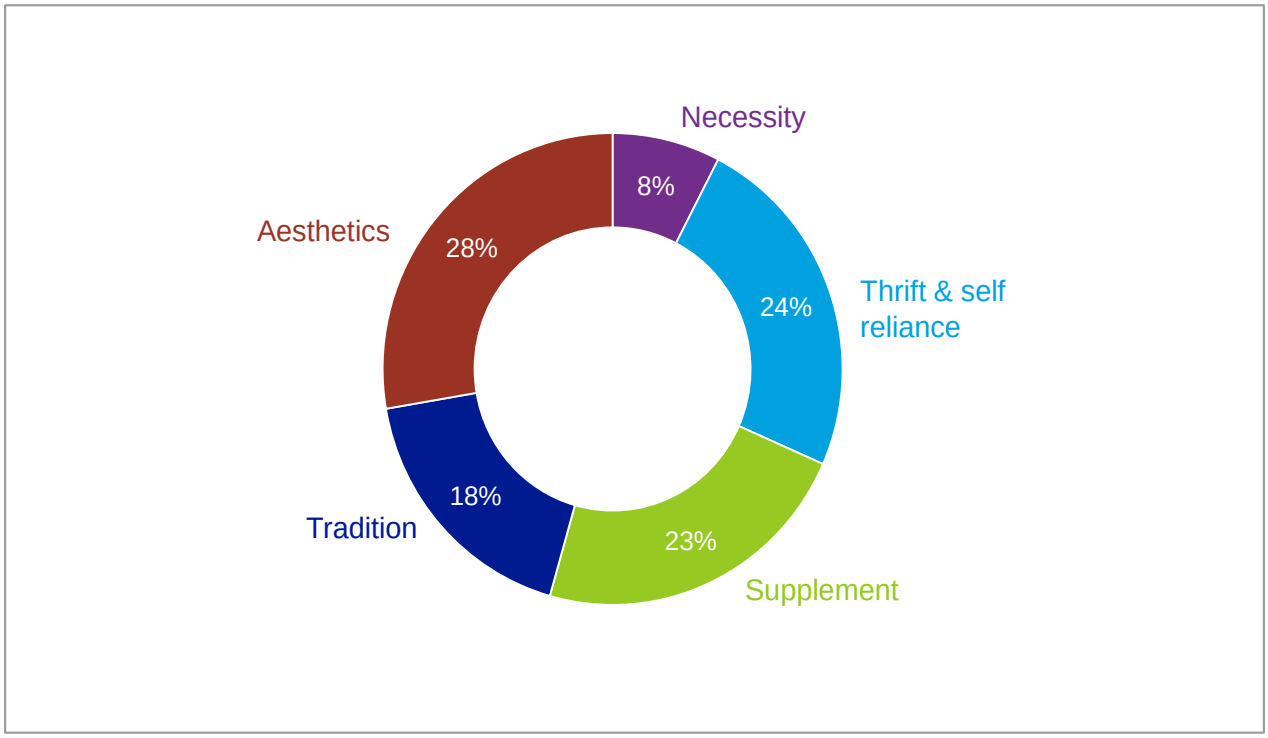
The key characteristics of a segment are derived from the variables for which there is a statistically significant difference in response percentages between respondents in that segment and indoor burners overall. This creates a typology which generalises particular characteristics to the whole segment when in reality there is almost always some degree of diversity within each segment, and there is some overlap of characteristics and attitudes with other segments. It is worth bearing in mind therefore that individuals will not necessarily fit neatly into one of the five segments.

The names that have been given to each segment represent the underlying 'driver' that marks that segment out when compared with the average for all indoor burners, although – as suggested above – this does not mean that a proportion of those in other segments did not mention this driver, just that the percentage was less. The segments therefore are:

- **Necessity (8% of the indoor burning sample)**: burning is the main source of heating (often, though not always, through lack of choice) for this less affluent, more rural segment of very experienced burners, who burn considerably more than average.
- **Thrift & Self-reliance (24% of the weighted indoor burning sample)**: burning to save money and for a sense of self-sufficiency, this segment is a little less affluent than the 'average' burner but also more experienced and burns more than average.
- **Supplement (23% of the weighted indoor burning sample)**: burning to supplement their main source of heating and largely burning for this functional purpose, this segment is relatively inexperienced, and may well have installed their appliance recently.
- **Tradition (18% of the weighted indoor burning sample)**: burning is about family experience, nostalgia, identity and creating a homely atmosphere, usually with an open fire; it is very much a lifestyle choice for this relatively affluent, largely English segment.

- **Aesthetics (28% of the weighted indoor burning sample)**: burning is about socialising and creating a homely atmosphere; it is a lifestyle choice for this affluent and largely English segment who burn least and could be persuaded to burn less or differently.

Figure 7.2: Indoor burner segmentation (% of indoor burners)



Section 7.2.2 provides a more detailed description of the significant differences between each segment and the 'average' burner, while section 7.2.3 provides a pen portrait of each of the five segments in terms of key demographics, household characteristics, property characteristics and burning experiences and behaviours. These are drawn from tables in Appendix B where similarities and differences between the segments in relation to each variable can be seen.

7.2.2 How attitudes and drivers differ between the segments

As mentioned, indoor burners were segmented into five groups in terms of attitudes to, and drivers for, burning, albeit with a degree of overlap, and with some segments more clearly defined by their attitudes than others.

While the majority of all segments reported using indoor burning to heat at least some of their home, the Thrift and Self-reliance segment were most likely to report using it for at least some of their household heating (96%), while the Necessity segment were most likely to use it for most or all of their heating (40%) and/or to heat their hot water (usually in addition to providing at least some heating) (70%), and/or for cooking (17%) (Table 7.3).

Table 7.3: Primary purpose of indoor burning by segment (% of indoor burners, multi-response allowed - PiT)

	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
Unweighted base	*89*	*231*	*218*	*160*	*242*
Heat ANY of home	91%	96%	92%	86%	81%
All or most of home heating	40%	18%	11%	4%	2%
To heat your hot water	70%	4%	1%	1%	1%
For cooking	17%	0%	2%	0%	7%

Key: Orange: significantly higher than all indoor burners; blue: significantly lower

Since heating was the primary purpose of indoor burning for all segments, more insight into their differences is provided by the reasons these indoor burners gave for choosing indoor burning as a source of heating, although findings also illustrate where there is a particular overlap between the segments (see Table 7.4).

Table 7.4: Reasons for indoor burning by segment (% of indoor burners, multi-response allowed - PiT)

	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
Unweighted base	*89*	*231*	*218*	*160*	*242*
Don't have any choice	39%	0%	1%	0%	1%
Save money	9%	63%	23%	5%	3%
Avoid putting heating on	2%	18%	17%	10%	5%
Lot of waste wood to get rid of	6%	13%	3%	8%	1%
Control use of gas/oil/electricity	1%	15%	18%	3%	1%
To just heat one room	4%	12%	37%	41%	11%
Heating sometimes not enough	12%	6%	32%	7%	16%
Tradition / past experience	4%	4%	2%	26%	0%
Atmosphere	0%	1%	0%	7%	1%
To create a homely feel	14%	43%	13%	64%	78%
I love looking at a fire	10%	22%	12%	23%	29%

Key: Orange: significantly higher than all indoor burners; blue: significantly lower

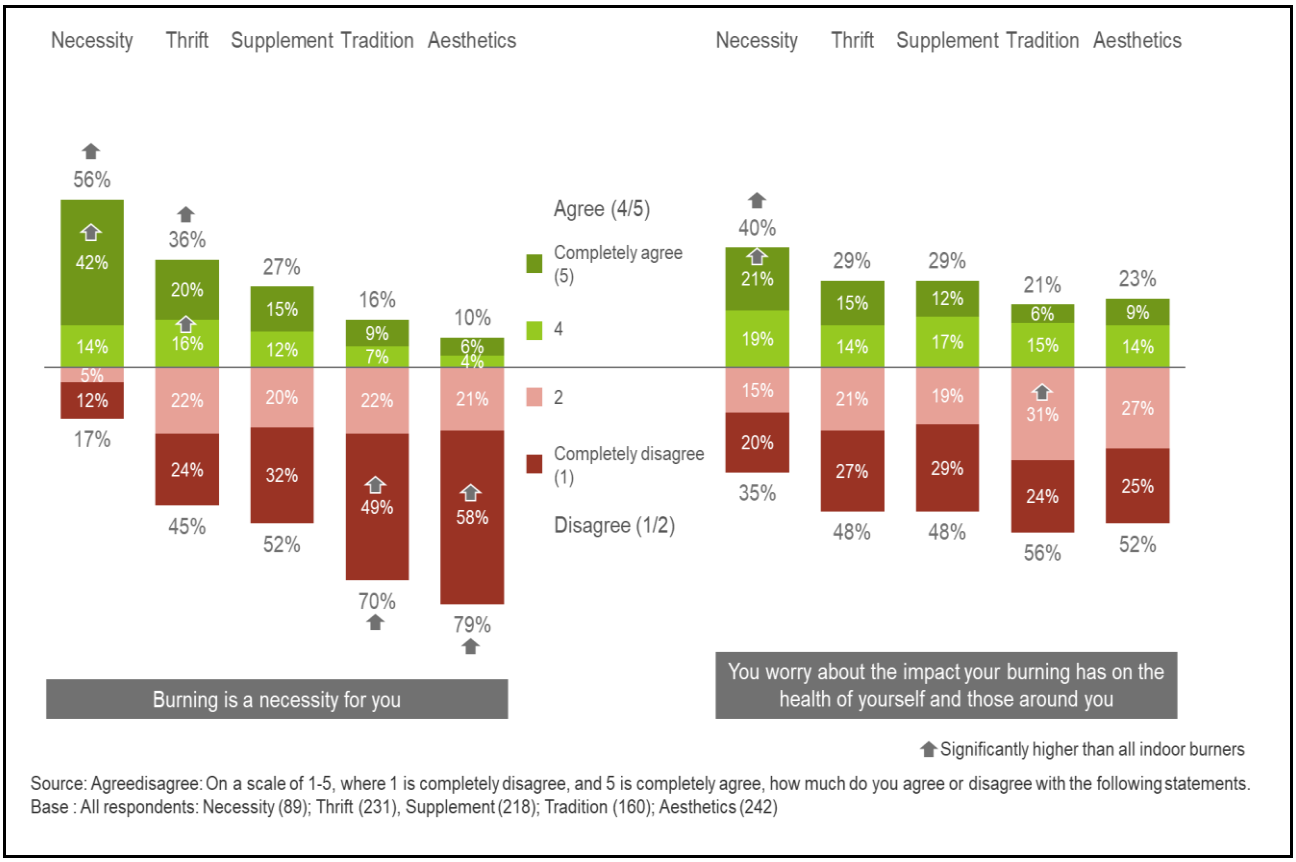
The Necessity segment was most likely to report having no choice but to burn (39%), reflecting many were not on the gas grid (71%). 43% were based in rural areas and only half were based in England, with 28% based in Northern Ireland.

The Thrift and Self-reliance segment seemed often driven by saving money: 63% said they burned to save money, and they were more likely to burn to avoid putting the heating on (18%) and/or because they had a lot of waste wood to use (fallen wood from trees or other salvaged wood) (13%). The Supplement segment also seemed to some extent to be trying to control their use of other fuels, but this segment in particular, reported using indoor burning to supplement other heating because other heating was not enough (32%) or because they wanted to heat just one room (37%). Those in the Supplement segment had little interest in creating a homely atmosphere.

While the Tradition segment also used indoor burning to heat one room (41%), they were sometimes additionally driven by tradition or familial experience (26%). A high proportion (86%) of the Tradition group had a fire in the home when growing up. This group also said they burned to create a homely feel (64%). In this respect they overlap with the Aesthetics segment which was largely motivated to create a homely feel (78%), along with the pleasure of looking at a fire (29%). Those in this segment were less likely to be concerned with financial considerations.

The level of agreement with a series of specific attitudes towards indoor burning also sheds some light on the nature of each segment and the degree of overlap between segments. Two attitudes in particular help to define the Necessity segment: unsurprisingly they were most likely to agree that burning is a necessity for them (56%) (although agreement was also higher than average for the Thrift and Self-reliance segment at 36%), and also more likely to worry about the impact of burning on health (40% - see Figure 7.5). This segment also tended to be older (see full pen portrait in section 7.2.2). Those in the Necessity segment were most likely to burn coal (63% compared with 48% of all indoor burners), and in particular coal in combination with a wood mix (for example, logs, waste wood or garden waste) (39% compared with 25% of all indoor burners).

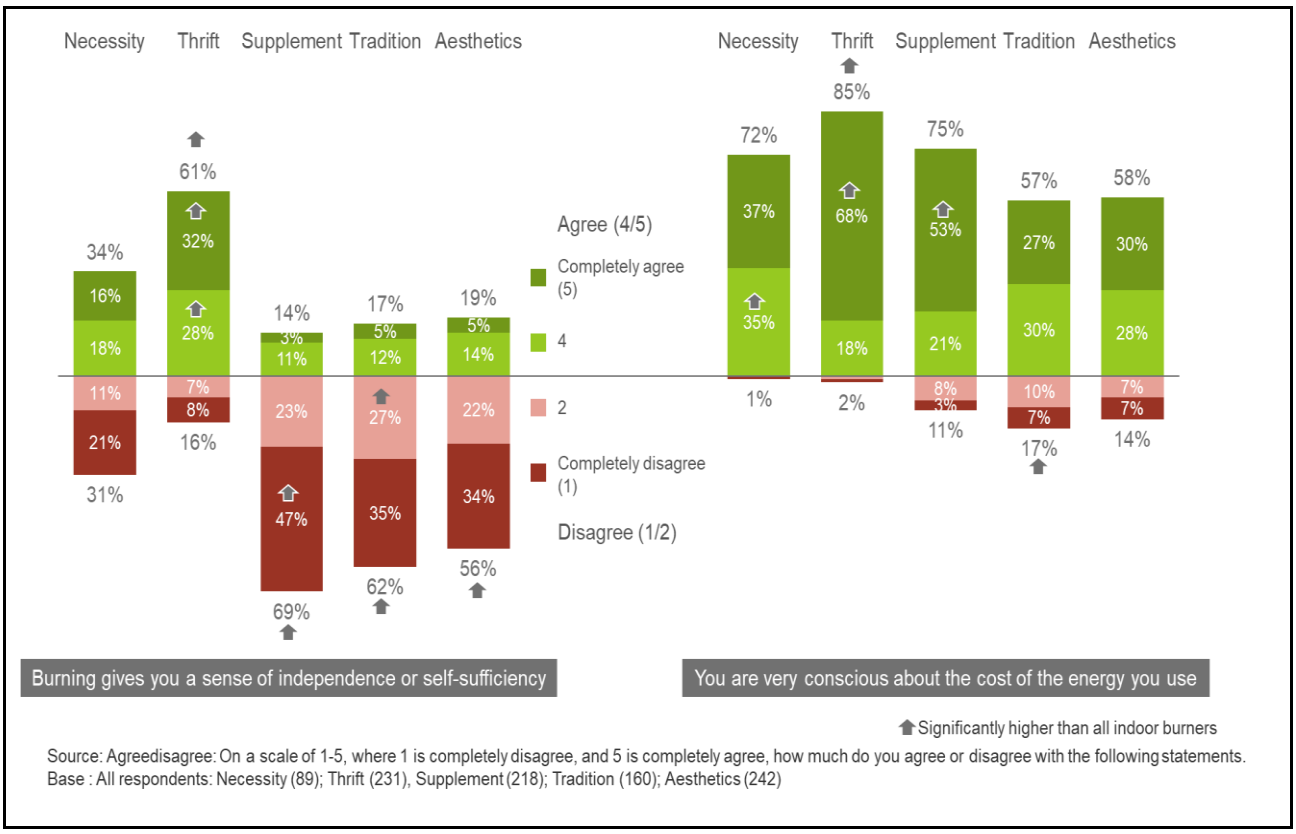
Figure 7.5: Segment attitudes - views on burning as a necessity & its impact on health (% of indoor burners -- PiT)



Source: Agreedisagree: On a scale of 1-5, where 1 is completely disagree, and 5 is completely agree, how much do you agree or disagree with the following statements.
Base : All respondents: Necessity (89); Thrift (231), Supplement (218); Tradition (160); Aesthetics (242)

The next two attitudes help to define the Thrift and Self-reliance segment: those in this segment were most likely to agree they are very conscious about the cost of energy (85%), which differentiates them most from the Tradition and Aesthetics segments. Providing greater differentiation from all other segments, 61% of the Thrift and Self-reliance segment agreed that burning gives them a sense of independence or self-sufficiency, suggesting a subtle motivation for burning other than pure cost-savings (see Figure 7.6). In particular, those in the more functional Supplement segment were more likely to disagree with this statement (69%), particularly to strongly disagree (47%).

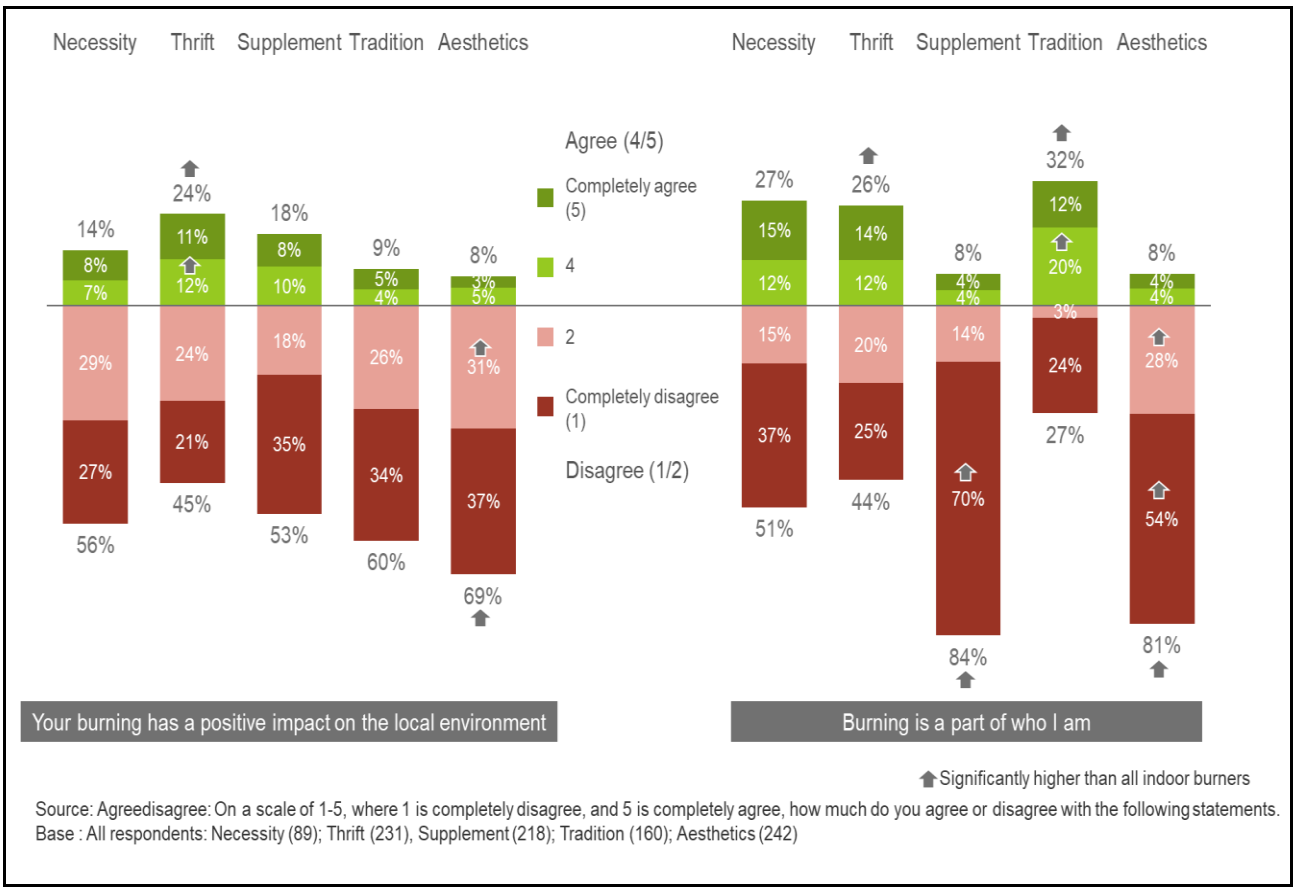
Figure 7.6: Segment attitudes - burning as self-sufficiency & consciousness of cost of energy (% of indoor burners -- PiT)



Source: Agreedisagree: On a scale of 1-5, where 1 is completely disagree, and 5 is completely agree, how much do you agree or disagree with the following statements.
Base : All respondents: Necessity (89); Thrift (231), Supplement (218); Tradition (160); Aesthetics (242)

Furthermore, although only a minority of each segment agreed that burning has a positive impact on the local environment, this was higher than average for the Thrift and Self-reliance segment (24%), with disagreement highest among the Aesthetics segment at 69%. The more functional Supplement segment was not strongly defined by positive attitudes but was highly likely to *disagree* that burning is a part of who they are (84%). In this, they were similar to the Aesthetics segment (81%) and strongly differentiated from all other segments (Figure 7.7).

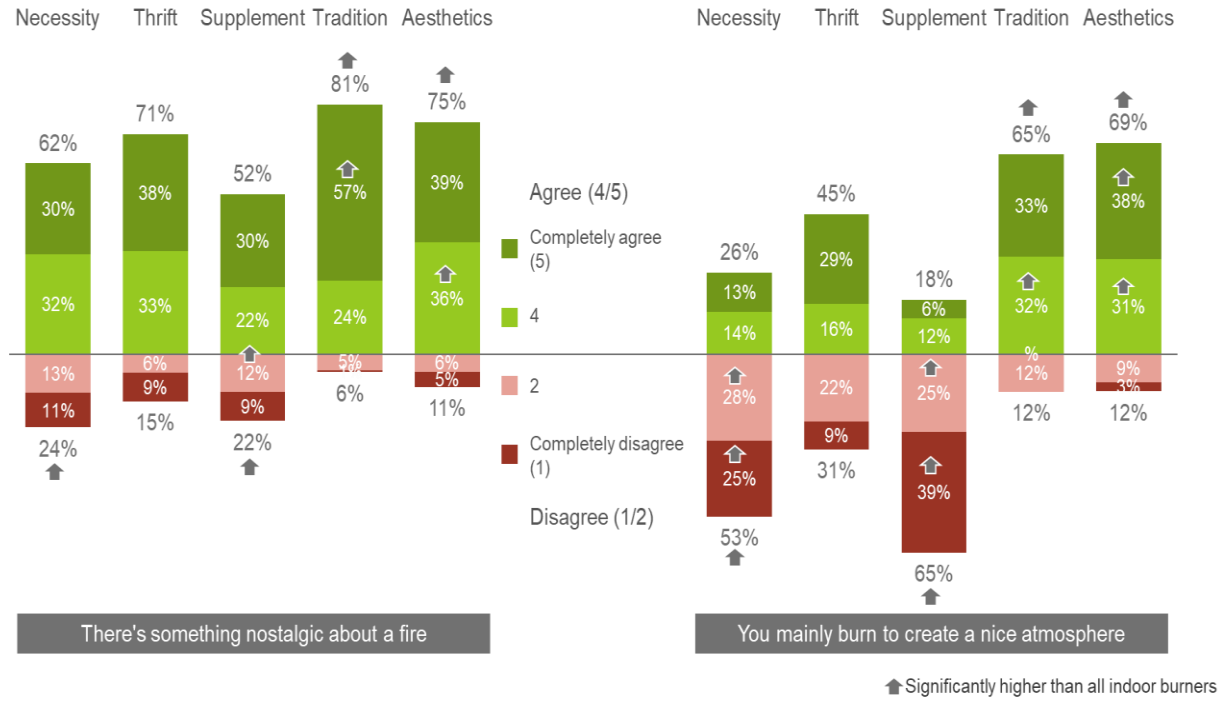
Figure 7.7: Segment attitudes - impact on environment & burning as part of identity (% of indoor burners -- PiT)



Source: Agreedisagree: On a scale of 1-5, where 1 is completely disagree, and 5 is completely agree, how much do you agree or disagree with the following statements.
Base : All respondents: Necessity (89); Thrift (231), Supplement (218); Tradition (160); Aesthetics (242)

The remaining attitudes serve largely to differentiate the Tradition and Aesthetics segments from other segments, and to some extent from each other, although there were strong similarities between these two groups. Around two in three of both of these segments agreed they burned mainly to create a nice atmosphere (65% of the Tradition segment and 69% of the Aesthetics segment), and this was much higher than for all other segments, particularly the Supplement segment (Figure 7.8). These two segments were also more likely than average to agree that there is something nostalgic about a fire, with this a little higher among the Tradition segment (81%) than the Aesthetics segments (75%), but with majority agreement among all segments.

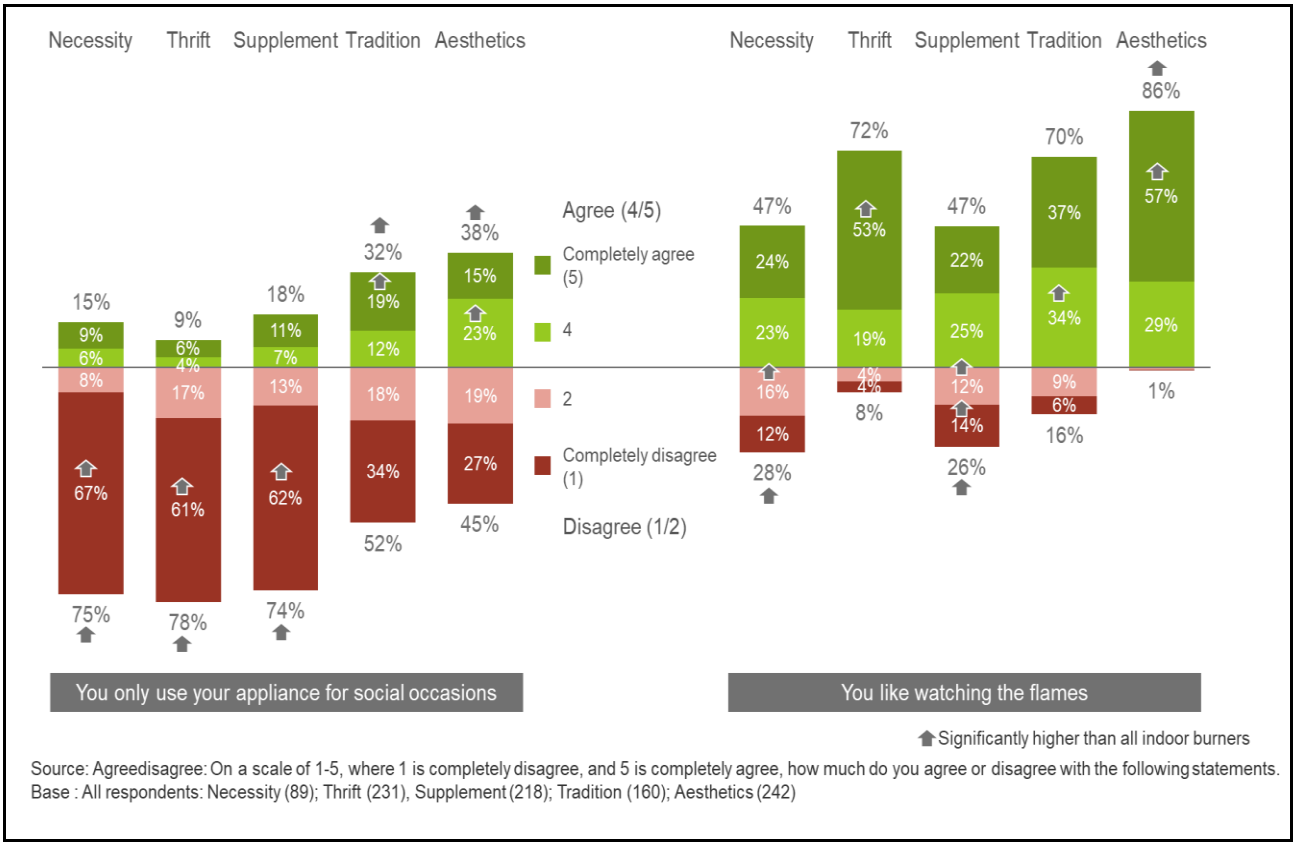
Figure 7.8: Segment attitudes - nostalgia and atmosphere (% of indoor burners-- PiT)



Source: Agreedisagree: On a scale of 1-5, where 1 is completely disagree, and 5 is completely agree, how much do you agree or disagree with the following statements.
Base : All respondents: Necessity (89); Thrift (231), Supplement (218); Tradition (160); Aesthetics (242)

These two segments were also similar in their degree of agreement that they use their appliance only for social occasions, and that they like watching the flames, but for these two attitudes, agreement was a little higher among the Aesthetics segment than the Tradition segment (Figure 7.9). Even among these segments, just one in three agreed that they burned indoors *only* for socialising (38% of the Aesthetics segment, 32% of the Tradition segment) but few disagreed strongly, suggesting that socialising is a driver, but not necessarily the sole driver, for these segments. Almost nine in ten of the Aesthetics segment (86%) agreed that they like watching the flames, compared with 70% among the Tradition segment and 72% for the Thrift and Self-reliance segment.

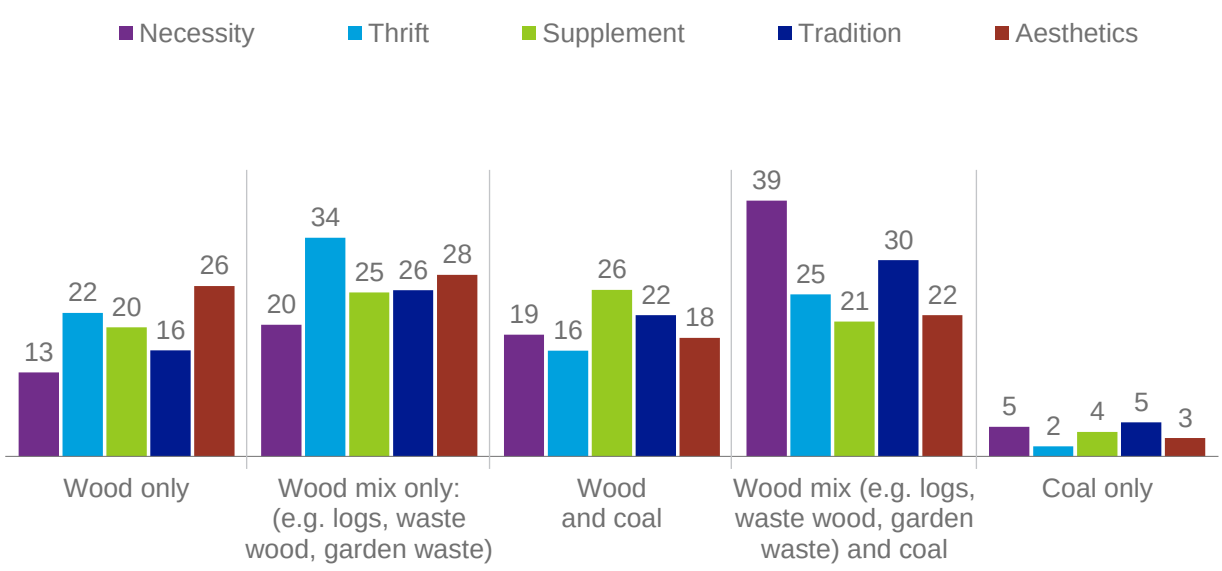
Figure 7.9: Segment attitudes: Burning for socialising or watching the flames (% of indoor burners -- PiT)



Source: Agreedisagree: On a scale of 1-5, where 1 is completely disagree, and 5 is completely agree, how much do you agree or disagree with the following statements.
Base : All respondents: Necessity (89); Thrift (231), Supplement (218); Tradition (160); Aesthetics (242)

Figure 7.10 shows the proportion of each segment that use each type of fuel combination. The Aesthetics segment was more likely to use wood only (26%) when compared with the average burner. The Thrift and Self-reliance segment was more likely to use a wood mix, including either waste wood or garden waste (34%). The Supplement segment was more likely to use wood and coal (26%), while the Necessity segment was more likely to burn a wood mix and coal (39%).

Figure 7.10: Fuel use by segment (% of indoor burners)



Source: (PiT) What types of fuel do you burn in your [indoor appliance]?
Base: Necessity (n=89); Thrift (n=231); Supplement (n=218); Tradition (n=160); Aesthetics (n=212)

7.3 Who is a typical member in each segment?

While the differences in attitudes were explored in section 7.2, this section contains a 'pen portrait' description of a typical member of each segment. It is important to remember that there is some overlap between the segments and that these portraits set out the significant characteristics that differentiate the segments from each other and from the average indoor burner. In essence, they deliberately provide a stereotype of a person within the segment, rather than an accurate description of every member because they do not reflect the variation within each segment.

Real life case studies are included from the qualitative interviews that help illustrate some of the variation as well as how the segments can be equated to actual experience, although not all the interviewees were easily classifiable. What this suggests is that these segments are most useful in thinking about the key fault-lines within the burning population, rather than a definitive categorisation tool, and therefore should be useful in creating communications that appeal to different people within the burner population. As mentioned, the full set of tables on which this analysis is based is available in Appendix B, which break down each survey measure by segment.

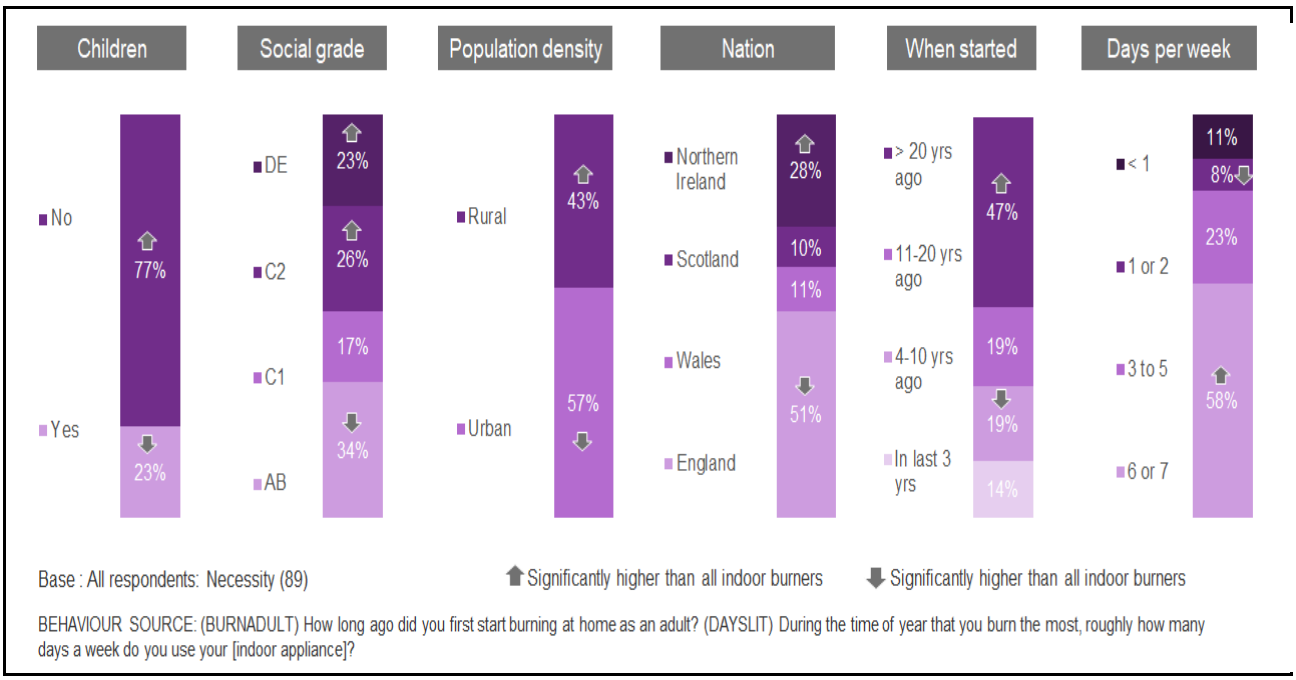
7.3.1 The Necessity segment

The Necessity segment is small at 8% of indoor burners and is strongly defined by the use of indoor burning as a primary source of heating and/or for hot water. While more than half feel they burn out of necessity, other drivers are also at play for a majority, such as nostalgia and energy costs. They are most likely to be concerned about the impact of burning on health. As indicated earlier, half (49%) of the Necessity segment reside outside of England, 71% are off the gas grid, and half (49%) are in the C2DE social status categories, with over a quarter (27%) saying it is fairly or very difficult to meet energy costs. This suggests that for some the necessity categorisation is associated with their

socio-economic situation, for some it is largely related to a lack of appropriate infrastructure for other heating options, and for some it is a mix of the two.

A typical member of the Necessity segment is likely to be over 55, not in full-time employment and has no children at home. They are likely to be less affluent than the average indoor burner (typically from socio-economic groups C2DE). Reflecting their lack of affluence, they are more likely than average to have difficulty meeting their energy costs. They are more likely to live in an area with no mains gas, somewhere rural, and in one of the devolved nations, especially Northern Ireland, with few in the South of England. They tend to have grown up with indoor burning and are more likely to have burned as an adult for over 20 years. They are unlikely to seek advice from others on burning practices, perhaps reflecting their substantial experience.

Figure 7.11: Necessity segment: demographic, geographic and behavioural profile (% of segment -- PiT)



Reflecting their use of indoor burning for heating and hot water, they are likely to spend more than average on solid fuel. They often burn for much of the year, for six or seven days a week, and at least five hours a day (quite possibly all day) when they are burning. They usually burn both wood and coal, including house coal. Their appliance was likely to be installed before 2000, and those who have had an appliance installed since they moved into their home may not have used a HETAS approved installer.

While their chimney is often lined and they are more likely to have it cleaned at least once a year (more than average), they are not willing to have their appliance serviced annually, and a substantial minority say they are likely to ignore any identified need to upgrade their appliance. If they could no longer burn solid fuel their choices are limited – particularly given many lack access to mains gas. Some of this segment therefore feel they have absolutely no alternative to burning.

Necessity case study from qualitative research

Karen (social grade DE, rural Scotland)

Karen lives in a council-owned property with her partner in a rural area of Scotland that is off the gas grid. She does not work and both she and her partner have had significant health problems.

They have a multi-fuel enclosed burner that provides hot water and heating through radiators for the household. It was put in by the council a decade ago to replace a previous version. The first one had replaced an open fire. The council currently service the burner and have the chimney swept once a year by a contractor, but she has been told that they may be phasing out this service.

The council have tried to persuade her to have an electric system installed but she has refused this on the grounds of health and money. She believes that electric and gas central heating is not good for her respiratory health, as she has found that both make her cough. She is therefore sceptical of information that suggests domestic burning may be harmful to health, and - unlike some others in this segment - is therefore not concerned about this aspect.

The burner is on all the time in the winter. On rare occasions she lets it go out for a couple of days at a time during the summer as she has an electric immersion heater she can use.

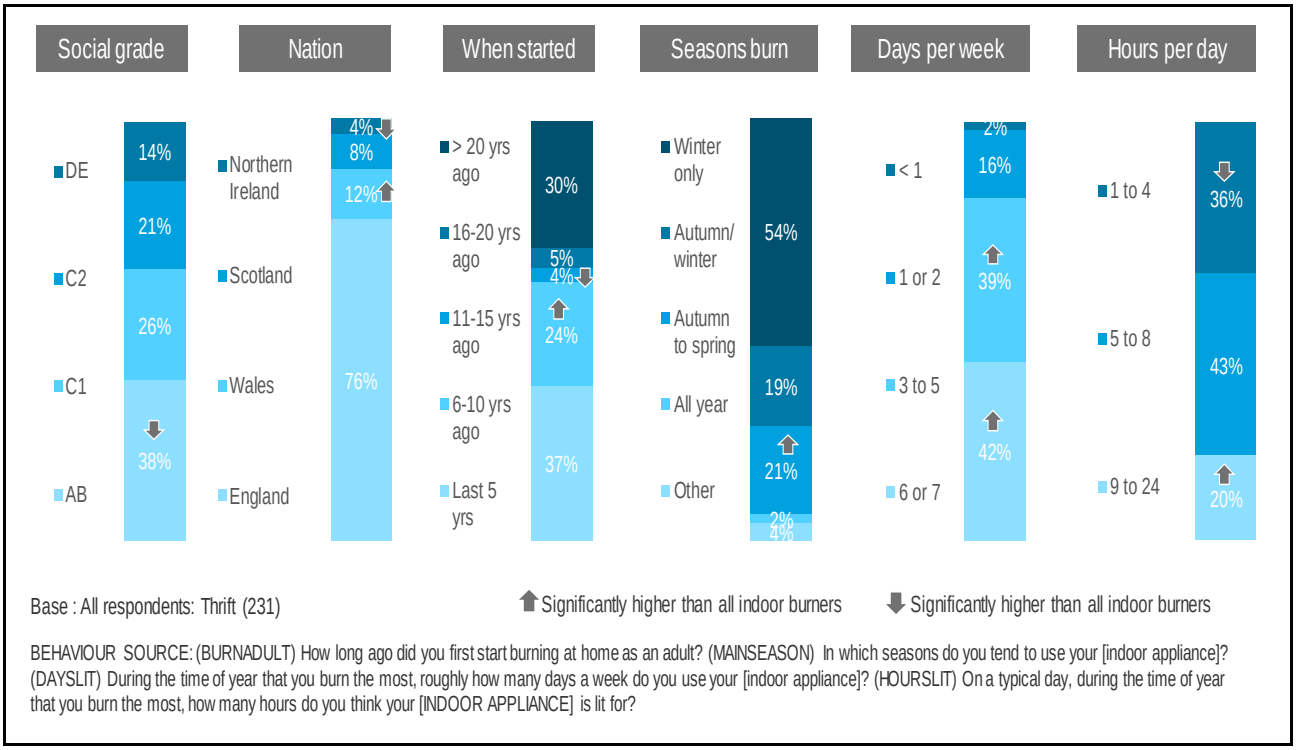
Anthracite (a smokeless, naturally-occurring coal) is the solid fuel she tends to use which she banks up overnight, turning the stove down low. She prefers anthracite over 'ordinary coal' as it is 'longer lasting and you don't have to put as much coal on… Ordinary coal doesn't burn in it as good… and it burnt it quicker so the anthracite's better value for money.' She pays £18 for each bag.

The previous year, she had used some wood she had been given, but it only lasted a couple of days. The household does not burn solid fuels outside.

7.3.2 The Thrift and Self-reliance segment

The Thrift and Self-reliance segment is large at 24% of indoor burners and strongly driven to burn to save money or deal with waste, with around a third feeling that burning is a necessity. Beyond cost, those in the thrift and self-reliance segment are most strongly differentiated from other segments in deriving a sense of independence and self-sufficiency from burning. There is also greater belief (albeit still only for a minority) that burning is positive for the environment.

Figure 7.12: Thrift and Self-reliance segment: demographic, geographic and behavioural profile (% of segment -- PiT)



A typical member of the Thrift and Self-reliance segment is fairly similar demographically to the average indoor burner, but likely to be a little less affluent (fewer are ABs), and while they are *more* affluent than those in the Necessity segment, they are just as likely to report some difficulty meeting their energy costs. A greater proportion than average are likely to live in Wales and in the North of England. They are more likely to have started burning indoors in the last 10 years, so are less experienced than the Necessity segment.

In contrast to the Necessity segment, they are unlikely to burn all year round, but when they do burn, they tend to do so for at least three days a week and for at least five hours a day (and quite often more than this). They also tend to buy their wood in larger quantities (full or half loads) and supplement this with wood given to them for free, or salvaged. They are more likely than average to season their wood at home for burning.

They are relatively likely to get smoke in the room occasionally from burning wood, even though few have an open fire, possibly reflecting their thrifty fuel choices and the use of burning to deal with waste. They generally have had their burner installed since 2000, with some considering getting a new one in the next five years. While most have access to mains gas, one in ten still sees no alternative but to burn. If the price of fuel should increase substantially, they are unlikely to spend more, and more likely to seek alternatives, particularly free fuel.

Thrift and Self-reliance case study from qualitative interviews

Megan (social grade C2, rural Wales)

Megan shares a house with her partner and adult children in rural Wales, where she has no access to the gas grid. She and her partner both work. They have an 8 or 9 kW log burner that is over 10 years old and an open fire, but also have oil-fired central heating as their 'main

source' of heat. The cost of oil has increased a lot since they first moved there from 'like 12 pence a litre and now I think it's about 51'.

They tend to burn wood that they gather from their own land and season for two to three years. She estimates they have 10 years of wood stored, much of it against the house. They also burn off-cuts from a workshop. They burn on average 3 nights a week for about 4 hours each time from about September to February, sometimes with the central heating on, sometimes instead of the central heating. They tend to burn 3 large baskets of wood per night when they burn. They have tried coal to make the fire last longer, as recommended by friends, but did not notice much difference.

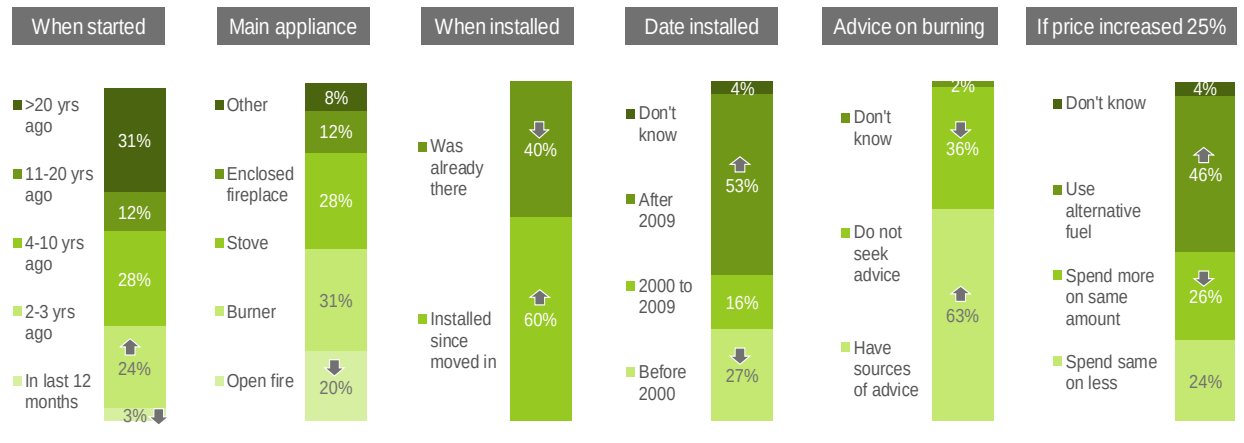
When asked the reason they burn at home, she says: 'obviously the cost is the main issue, as it is for everybody, because, like I say, you've got heating and it's not costing any money and we had wood to burn -- so it was a natural thing to do.' She also mentions that it is useful to have a stove in case of an 'emergency' such as a power cut.

They also enjoy burning outdoors, using a ceramic firepit for social occasions. They may have a BBQ with it, and then keep it burning into the night.

7.3.3 The Supplement segment

The Supplement segment is large at 23% of indoor burners, and fairly simply defined by their main drive to burn to supplement other sources of heating. Only a small proportion of this segment feels burning is intrinsic to their identity, and attitudes suggest motivations to burn are purely functional (heat) for many among this segment, with few doing so for socialising or atmospheric reasons.

Figure 7.13: Supplement segment behavioural profile (% of segment - PiT)



A typical member of the Supplement segment is very similar to the average indoor burner in terms of demographics (so most likely to be under 55, in work, and relatively affluent). They can be relatively inexperienced, being more likely than average only to have started burning in the last few years (although most have been burning for longer than this). They are unlikely to have an open fire and less likely than average to use their appliance to burn

household waste or rubbish. They have generally installed their appliance since 2009 and are not thinking of replacing it in the next five years. They are likely to seek advice on burning practices, reflecting their relative lack of experience. If the price of fuel should increase substantially, they are unlikely to spend more, and more likely to seek alternatives (both free fuel and mains heating options).

Supplement case study from qualitative research

Dan (Social grade C2, urban/suburban Midlands)

Dan rents a 4-bedroom house with his partner and children. They have been in the house for over a decade. His partner works in healthcare and he is not in paid employment.

The house is Victorian and not well-insulated. They asked the landlord if they could open up an old fireplace which the landlord agreed to on condition that they had the chimney swept annually for which a certificate is then issued. 'So the house doesn't hold heat very well, so even though we upgraded the central heating ourselves, we have upgraded some of the radiators… And put some extra ones in, but they don't always heat the house fully, so what we tend to do in winter is congregate in here where the open fire is.' He would like a log burner, but they cannot afford one, so unusually for a Supplementary burner, they use an open fire.

They largely burn waste wood because he can access it for free, largely from a friend who works on a building site. He does not burn anything that has been painted or creosoted because of potential toxins: 'we keep it clean for the simple fact that sometimes you do get a little bit of smoke blow back, don't you, and I don't want anybody breathing that in'. He also sometimes uses compressed recycled wood briquettes that he buys from a garage when running low of waste wood. He sometimes buys house coal from there too which he uses to keep the fire going so that he does not have to keep tending the fire - but rarely uses it because it is expensive, perhaps a couple of bags a winter. (He said he was willing to switch to smokeless when he found out house coal was more polluting).

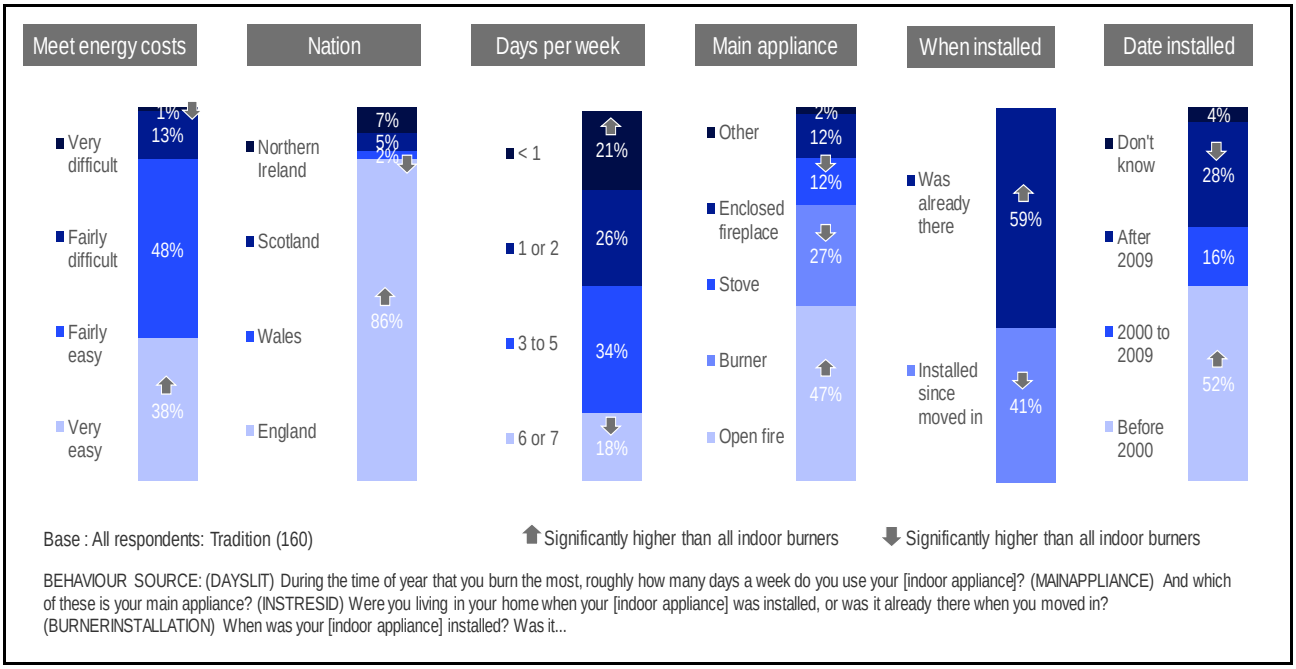
He tends to put the fire on in the evenings, once the children get home from school, for four or five hours approximately five evenings a week on average during the four months of winter. 'If we are all in here over an evening watching TV and playing board games or whatever we will have the fire on and the central heating will be down just to you know, keep the air… Because again its bills as well. There's no point pumping all that heat into the house if nobody's using it because you know you are just throwing money away aren't you?' However, he also sees having a fire as being a 'romantic idea… it's character'.

In the summer from June to August they tend to have a charcoal barbeque outdoors about once a week.

7.3.4 The Tradition segment

The Tradition and Aesthetics segments are similar in terms of drivers, burning primarily to produce a homely atmosphere. The Tradition segment is smaller at 18% of indoor burners, and more driven by family tradition and nostalgia, and this segment feels most strongly that burning is part of who they are.

Figure 7.14: Tradition segment: demographic, geographic and behavioural profile (% of segment -- PiT)



A typical member of the Tradition segment is very similar to the average indoor burner in terms of demographics although there are indications of greater affluence: almost all pay for their utilities by direct debit, most find it easy to meet their energy costs and few rent their home. Most live in England (and very few in Scotland), but they have low awareness of whether they live in a smoke control area. They tend to have access to mains gas, so they are not burning from a lack of alternative heating options. They are more likely to have grown up in a home with a fire, but if they could no longer burn they would use central heating instead, offering more evidence that burning is a lifestyle choice and not an essential for them.

They tend to burn less often than the other segments (with few burning all year round, or on most days of the week) but more than just occasionally, and they usually do not bank their fire overnight. They are the segment most likely to have an open fire, which was likely to have been in the house when they moved in, and installed before 2000; they tend not to be thinking about getting a new appliance. They often burn a mix of wood and coal, including wood/fuel given to them by friends and family, but they tend to say they would pay more for fuel with less environmental impact. They are likely to rely on people they know for advice.

Tradition case study from qualitative research

Elizabeth (Social grade C1, London)

Elizabeth is retired and lives with her husband. They bought their house 30 years ago. It has a fireplace that they have used since they moved in, though they have gas central heating. 'Well I like to look at a fire. I do I like the nostalgia of a fireplace. I like, it's very soothing, it's very relaxing'. She also sees it as a 'talking point' when people come around because she feels it is unusual to have a fire in London. However, it does have a practical purpose too: it supplements the heating in the north-facing room the fireplace is in which can get quite cold because of a lack of cavity wall insulation in the house.

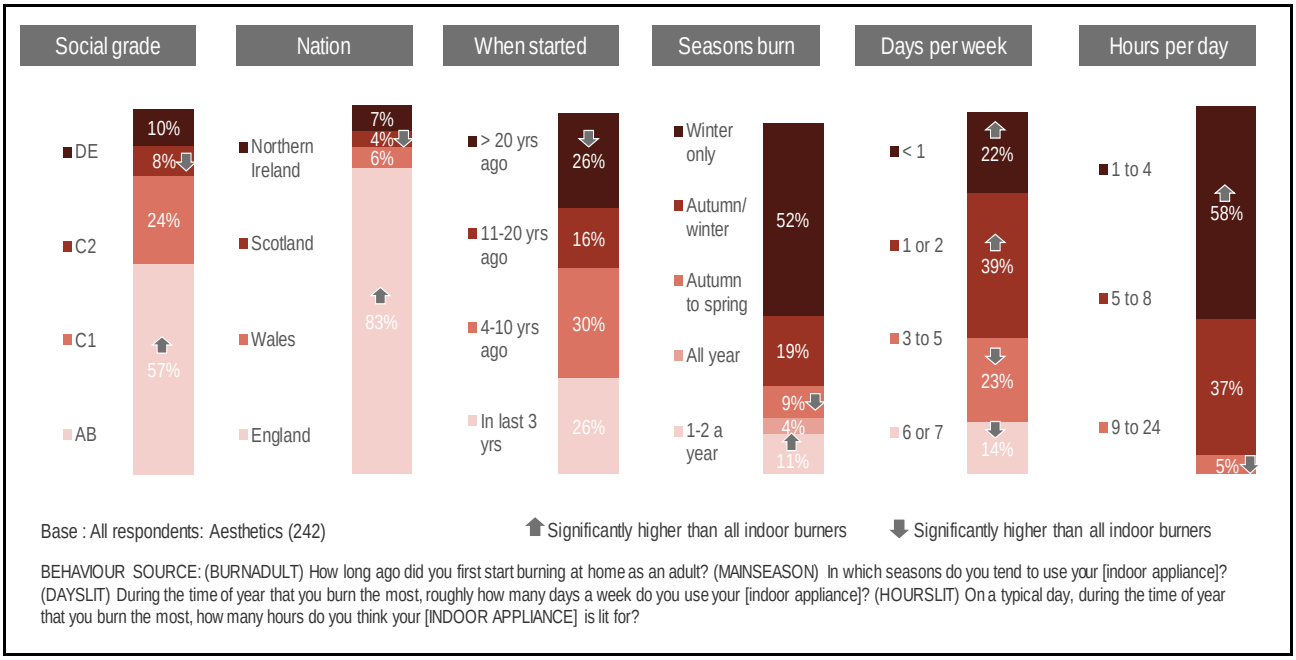
The household may use the fire a couple of times in November and then a couple of times a week in December, perhaps using it through March, more often in cold spells. She tends to light it in the early afternoon if she is at home, and possibly keep it lit until 10pm. They burn wood from their large garden, from neighbours and given free to them by tree surgeons. Her husband also collects waste wood from skips using a wheelbarrow: 'I don't know we just seem to accumulate wood.' He rotates the wood so that it is seasoned at least a year before they burn it. They also use coal too to prolong their wood supply that they buy through a friend because it is much cheaper (she did not know what kind it was). Her husband is the 'expert', she says, and has taught her how to light the fire, and uses a chainsaw to chop up the wood.

They tend to have 3 or 4 bonfires a year to get rid of garden waste: 'we burnt a lot of, well I say we, that's his department. He burns a lot of stuff out there, wood, garden waste and all those kind of things.' She does worry, however, about the potential health impacts of burning wood and coal, though her husband has reassured her it is not something to worry about. They do not bank the fire, and let it die down before they go to bed, for safety reasons. They use a screen guard to contain any remaining embers.

7.3.5 The Aesthetics segment

This segment is larger at 28% of the indoor burning population, but like the Tradition segment, the Aesthetics segment burns primarily to produce a homely atmosphere. However, aesthetic burners are relatively more likely to say they get pleasure from watching a fire and the social nature of burning, with very few feeling burning is essential to their identity.

Figure 7.15: Aesthetics segment: demographic, geographic and behavioural profile (% of segment -- PiT)



A typical member of the Aesthetics segment tends to be considerably more affluent than average, typically in the AB social grade, and owns their home. Most live in England, and they are more likely than average to be based in London. They have access to mains gas, and if they could no longer burn, they are likely to say they would use central heating instead. Burning seems to be very much a lifestyle choice, not a necessity. A substantial minority did not grow up with a fire at home, and relatively few have burned for more than ten years as an adult.

This segment covers a range of burning frequencies, albeit less frequent than other segments, with most burning in autumn and winter, but one in ten burning only a couple of times a year. They tend to burn only a couple of days a week, and for just a few hours at a time, and they usually do not bank their fire overnight. Reflecting this, they often spend less on solid fuel than other segments. They are likely to buy their wood in smaller quantities, including some in nets, and they don't rely on being given wood/fuel by friends and family. Around half inherited their burner with their property, with the rest having installed a new burner, and they do not intend to replace their appliance in the next five years. They are more likely to have their chimney swept less than once a year.

This segment seems most receptive to incentives to change their behaviour. If someone in the household were to develop a respiratory problem, they might well reduce their burning, and if their appliance failed a test, they are fairly likely to stop using it. They also tend to be willing to pay more for fuel that burns hotter. Generally, cost is not a disincentive, however: a 25% increase in price for solid fuels would not necessarily reduce their burning.

Aesthetic case study from qualitative research

John (social grade A, South East England)

John is a professional who lives with his family in a rural area of the south-east of England. His wife is also a professional. They have a mixed fuel 4 kW stove that is 4 years old, which replaced an old fireplace that was in the house when they moved in and which they used for many years. Their reason for replacing the open fire was that a stove is 'more efficient heat-wise'. They burn wood and smokeless coal on it, using a 20kg bag a week in peak burning season. 'I tend to use coal if I'm going to burn something all day as a background heat source. Or, if we're entertaining, then I'll often put the wood on.' John prefers coal because it is simpler to light and he can leave it, but feels wood burns hotter for warmth and looks 'nicer'.

He attempts to 'scavenge' 'castaway' wood as much as he can, such as old fencing panels or trees that have been cut down and wood offered on the website Freecycle, though he does buy some wood if needs it. He calculates he may spend £70-£80 on a builder's sac of wood per year that is delivered to the house.

They have gas central heating and electric underfloor heating in the conservatory. They only use the stove when it is 'freezing outside' because 'obviously... there isn't really a huge need for it', about 3 days a week at the peak season over Christmas, when they are home for the holiday, but this is short-lived. Otherwise it is the occasional day in November, say. 'We also have it sometimes if we've got guests. It's to, you know, it's quite nice to look at.' "I suppose, the principle reason for getting it. It wasn't the heat; it was the look of it. It's just a nice thing to have as a sort of concentrated heat source. It's just nice'. 'It's pretty cosy and homely.'

They have an occasional bonfire outside, no more than twice a year, to burn garden waste. They also have a firepit around three times a year when they want to stay out longer, but it is chilly, usually when having a BBQ.

8. Exploring possible levers and potential barriers in changing burning behaviour

There are two main forms of behaviour change that reducing emissions from domestic combustion is likely to require: burning better and burning less. As the section on 'temporality' in Chapter 3 indicated, there is a lot of variation in how much indoor burners burn, and as Chapter 5 identified, whilst many indoor burning respondents gave answers that suggested they are following good practice in terms of indoor burning, a proportion were not.

The research therefore also briefly explored with burners a number of scenarios that might lead to or encourage less burning and/or greater take-up of better burning practice. However, these responses need to be treated with caution as they are reactions to hypothetical scenarios and there can be a gap between stated intentions and what people would actually do if the situation then happened. Moreover, sometimes the sample sizes for particular questions are small and therefore unreliable. Where this is the case, it is highlighted.

8.1 Stated responses to possible changes in fuel prices

A number of questions in the PiT aimed to understand how burners might respond to changes in fuel prices in order to gauge how price sensitive they might be, and whether increases or decreases in fuel prices might lead to desirable changes in burning behaviour. This built on questions asked during the qualitative interviews.

As indicated in Chapter 6 on why people burn, financial considerations do appear to be important for some indoor burners. Around two-thirds of indoor burners said that, in general, they looked for ways to save money (62%) and that they were very conscious about the cost of the energy they used (69%). However, this is not unusual for energy consumers generally. For comparison, Ofgem's Retail Market Review from 2016 found 72% of those responsible, or jointly responsible, for paying their household's gas and/or electricity bills agreed they were conscious about the cost of energy they used[87]. It was also high among non-burners in the PiT (71%).

The proportions of those who used solid fuels for most or all of their heating who said they looked for ways to save money and were conscious about the cost of energy was higher (77% and 76% respectively) than for those who used solid fuels for some heating or another purpose (60% and 68% respectively).

However, indoor burner respondent estimates of how much they thought they had spent on solid fuel varied greatly. Though responses should be treated with caution because they depend on recall and estimation skills that can vary from respondent to respondent, these figures provide an indication of the scale of spend. Four in ten indoor burners in the PiT (40%) estimated that they had spent under £50 over the past year on solid fuel, including 17% who said they had spent nothing. A further 14% had spent between £50 and £99.

87 https://www.ofgem.gov.uk/system/files/docs/2016/08/consumer_engagement_in_the_energy_market_since_the_retail_market_review_-_2016_survey_findings.pdf

There are indications that there was a greater average spend among those who used solid fuel for most or all of their heating (though sample size is small and should be treated cautiously) as well as those who burned more frequently and/or those who had no access to mains gas. Those on mains gas reported spending less, on average.

8.1.1 Potential responses to increases in solid fuel costs

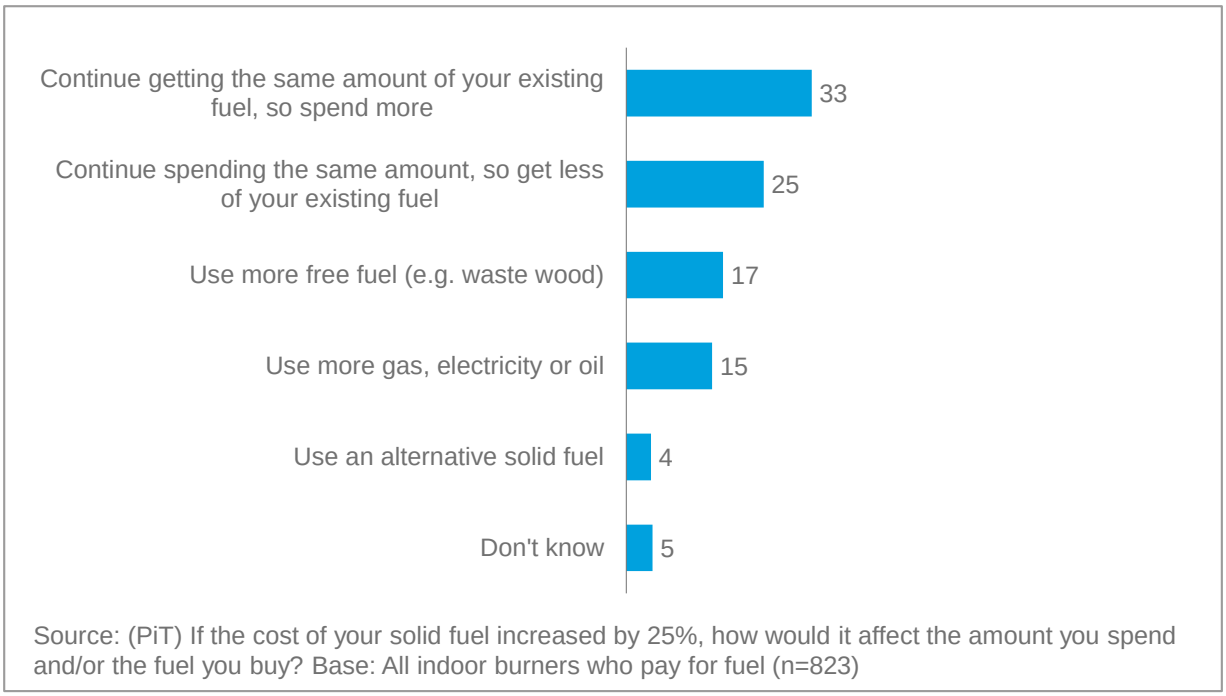
Participants in the qualitative research queried the likely impact of increased fuel prices, particularly those who accessed most of their solid fuel for free. Solid fuels were currently viewed as the 'cheaper option' compared to gas central heating, and rising gas bills were seen as a more realistic future scenario, meaning that solid fuel prices would need to rise considerably to make alternatives appealing.

The PiT survey explored this question using the hypothetical scenario that fuel prices had increased by 25%[88], asking respondents how they thought their spending patterns might change if faced with such an increase. Most indoor burners indicated that they would continue to burn indoors, although not necessarily in the same form or the same amount (Figure 8.1):

- one third of indoor burners (33%) said they would continue buying the same amount of their existing fuel, though it would cost them more;
- one in four (25%) said they would spend the same amount and cut down on the amount of the existing fuel they bought;

Unsurprisingly, there was some correlation between responses and levels of affluence, with a greater proportion of those in social grades AB saying they would continue to use the same amount (35%) than those in grades DE (25%), and a greater proportion of home owners saying this (35%) than tenants (22%).

Figure 8.1: Likely impact of increase of 25% in solid fuel costs (% of indoor burners)



Source: (PiT) If the cost of your solid fuel increased by 25%, how would it affect the amount you spend and/or the fuel you buy? Base: All indoor burners who pay for fuel (n=823)

[88] An increase of 25% was chosen for the question to measure the impact of a *noticeable* increase in solid fuel prices, given that many of those in the qualitative interviews had suggested solid fuel prices would need to increase a lot to potentially start impacting on their behaviour.

However, the findings indicate that increases in solid fuel costs might lead some to change what they burned or how they heated their home:

- Around one in seven said they would use more gas, electricity or oil for heating (15%).
- 17% said they would use more free fuels such as waste wood if costs increased by 25% (which was higher in Wales at 30%), and 4% said they would seek alternative solid fuels.

Whilst some interviewees in the qualitative research argued that, even if solid fuel prices changed, they would find another way to continue burning regardless in order to protect their way of life, overall the research suggests there may be some price sensitivity for some burners if prices rose significantly.

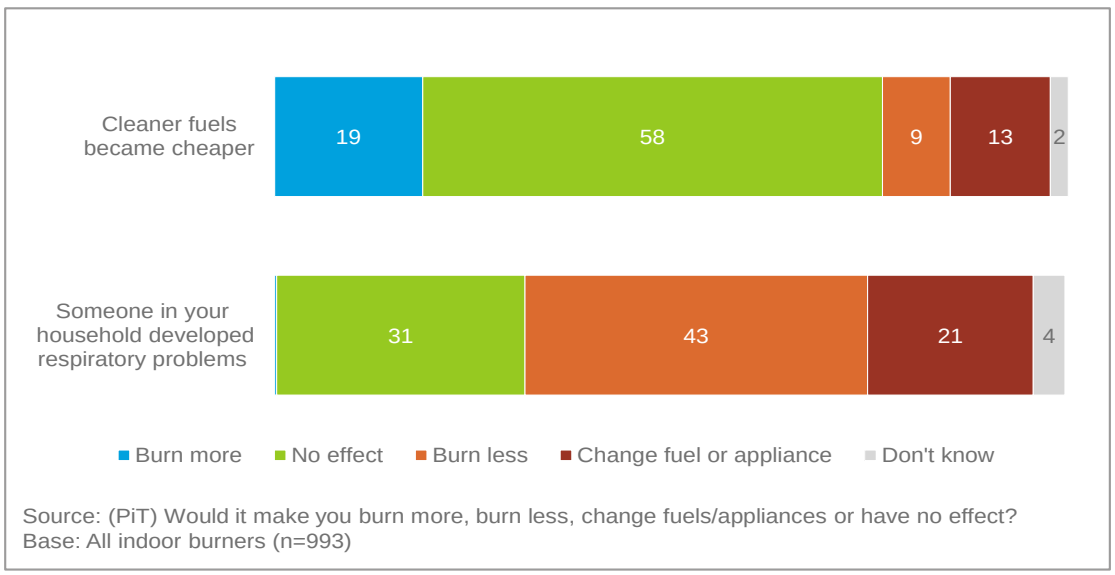
8.1.2 Stated willingness to pay for cleaner fuels

Despite this price sensitivity amongst some indoor burners, 73% of PiT indoor burners said that they would be willing to pay more per kilogram for a solid fuel that has less environmental impact. Primary burners – those who burned for most or all of their heating -- were less willing to pay more (36% were less willing to pay more as opposed to 21% of all burners who were less willing).

Burners were also asked whether cleaner fuels becoming cheaper might lead them to change how much they burn or what they burn and with what appliance (see Figure 8.2). The majority (58%) said it would have no effect, but 13% said this would lead them to change fuel (or appliance).

Those who burned coal seemed particularly open to changing their burning behaviour. Four in five (80%) of those who burned coal said they were prepared to pay more per kilo for a fuel with less environmental impact, compared with 68% of wood only burners. They were also more likely to say that they would burn more if cleaner fuels were cheaper (21% compared with 16% of wood only burners) and to say they would change fuel or appliance in such circumstances (16% compared with 9%).

Figure 8.2: Whether cheaper cleaner fuels or household member developing respiratory problems would lead indoor burners change how they burn (% of indoor burners)



Source: (PiT) Would it make you burn more, burn less, change fuels/appliances or have no effect?
Base: All indoor burners (n=993)

Respiratory problems seemed to be a greater (potential) driver of change to burning behaviour than fuel price, though only for some. 43% of indoor burner respondents said someone in their household developing respiratory problems would cause them to burn less, one in five (21%) indicated it would lead them to change fuel or appliance, but 31% said it would not affect what they would do. Those with children in the household were more likely to say they would burn less (54%), whereas those more dependent on solid fuels were less likely to say they would burn less if someone developed respiratory problems in their home (for example, 28% of those who were primary burners).

These findings suggest that, for almost three quarters of indoor burner respondents, cleaner fuels seem to be an attractive proposition, and that for some (probably the more affluent) this might trump price in prompting them to change their burning practices. However, the qualitative findings also provide some insight into the perspectives of people who felt negatively about the suggestion of limiting access to solid fuels that are potentially more polluting. To some extent, their resistance tended to reflect an emotional attachment to the way they burned and a reaction against perceived 'nanny state' intervention in established household behaviours that were often seen as unproblematic. However, for some, it also reflected practical concerns and difficulty envisaging alternative options.

> *It would just irritate me* [if the most polluting solid fuels were phased out]*, it would really irritate me but I wouldn't burn any more and I wouldn't burn any less. What else am I supposed to do, burn oil, that's the alternative and I've got to get heat from somewhere. (Gloucestershire, Rural, SEG – B)*

8.2 Response to other possible levers

Many of those interviewed in the qualitative interviews were supportive generally of efforts to encourage good burning practice, despite some being concerned about the possible implications for them of a few of the scenarios discussed. The PiT asked about a number of other possible options to encourage such behaviour.

8.2.1 Response to idea of introducing annual chimney sweeping requirements

As discussed in Chapter 5, 68% of PiT indoor burners had their chimneys swept at least annually. The remainder were asked how willing they would be to comply if the government introduced proposals that chimneys should be swept every year. Of those not currently sweeping their chimney annually, 86% said they would be willing to comply, of whom 45% said they would be very willing. However, 9% said they were not willing to start doing this, which equates to 3% of all indoor burner respondents. There was no question in the PiT asking these respondents why they were unwilling.

The qualitative interviews also reflected these differences of opinion, with those already maintaining their chimneys annually viewing the requirement as common sense: one equated it to the annual maintenance of their gas boiler, and a few mentioned that it was required by their buildings insurance company or by their landlord. There were also those who were potentially more resistant, with a few who viewed it as an unnecessary imposition. There did appear to be some link between the frequency that the chimney was swept and the degree of burning that a household did, though not always. Reference was made once or twice by infrequent burners to there being less of a need to have their chimneys swept on a frequent basis.

8.2.2 Response to idea of annual appliance testing

Among indoor burners responding to the PiT survey who had appliances other than open fires, 85% said they would be willing to have their appliance tested annually to ensure it was working efficiently, with half (51%) saying they were very willing to do so. However, 13% said they were not very or not at all willing to do this.

PiT stove users were then asked what they would do if their appliance were to fail such a test: 66% said they would upgrade it to meet the minimum standard, while 18% would stop using or reduce use of it. 12% said they would continue to use it as usual.

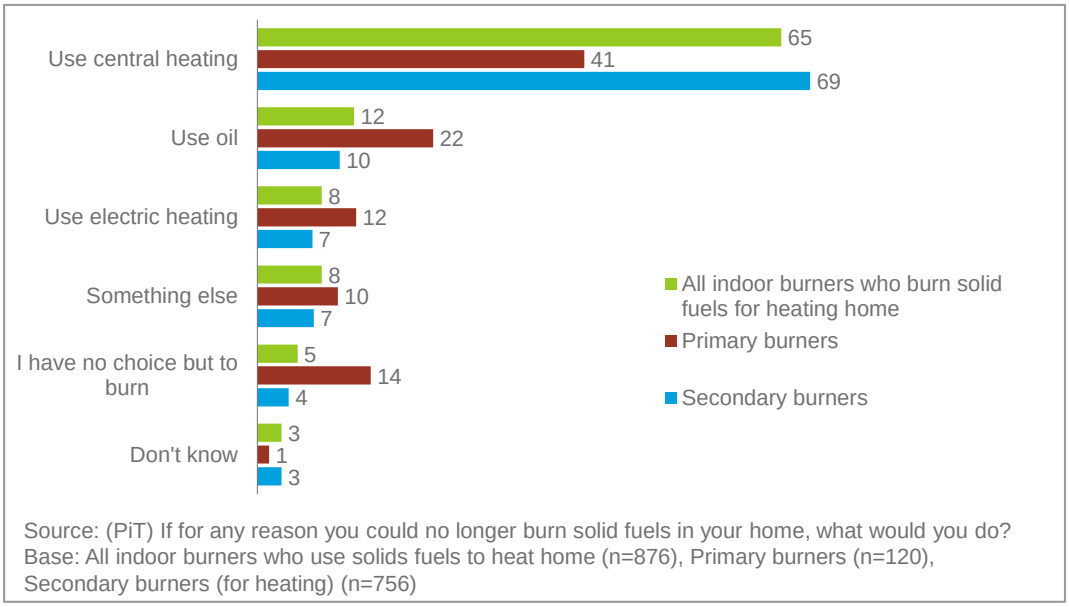
The qualitative interviews revealed mixed views based, like with chimney-sweeping, on current practices and expectations. There was resistance to government or local authority intervention where this might affect participants' current behaviour, but also widespread acceptance that appliances need to be safe. For many, annual maintenance certification aligned with the need to certify the appliance for insurance purposes, as well as compliance certification for boilers, and therefore made sense.

> *We do kind of get a certificate anyway. Though it's not a law, I don't know how law-abiding it is, but it certainly helps. Like, for instance, if you're selling a house (Wales, Rural- Off-grid, SEG- B)*

8.2.3 Potential responses to changes in solid fuel availability, particularly house coal

Those who use solid fuels for heating indoors were asked what they would do if they could no longer heat their home with solid fuels. While most said they would move to some other form of heating, 5% felt they had no choice but to use solid fuels (see Figure 8.3). This figure was higher for those who used solid fuels for all or most of their heating (primary burners - 14%) and for those who said they find it difficult to meet their energy costs (12%). However, two in three (65%) said they would use an existing central heating system (or install one), 12% would use oil, and 8% would use or install electric heating. There were differences in response by geography, largely reflecting the level of usage of solid fuel for heating and access (or not) to mains gas.

Figure 8.3: What would do if could not use solid fuel for heating (% of indoor burners)



Source: (PiT) If for any reason you could no longer burn solid fuels in your home, what would you do?
Base: All indoor burners who use solids fuels to heat home (n=876), Primary burners (n=120), Secondary burners (for heating) (n=756)

For most of those with access to mains gas, moving to or using existing central heating was seen as the solution (80%), but for those without a gas connection, two in five (41%) said they would switch to oil and 16% electric heating. However, one in ten of those with no access to mains gas saw no alternative to burning solid fuel.

House coal burners

In the PiT survey, indoor coal burners who did not regularly use smokeless coal were asked what they thought they would do if house coal were no longer available. The sample size of house coal users is small, and therefore these results have relatively large confidence intervals (see Table 8.4). Moreover, as is the case with other questions that relate to hypothetical scenarios, the question required quick responses about future intentions, which do not necessarily reflect how an individual will actually behave should the situation arise. The findings should therefore be treated with caution.

In this sample of house coal users, 48% said they would switch their coal use to mainly burning wood (96% of whom were already burning some form of wood as well as house coal), 35% said they would move to mainly burning smokeless coal or anthracite, and 21% that they would switch to gas, electricity or oil based heating (multiple responses were permitted). This suggests that the issue deserves greater attention: more focused research would be needed before robust conclusions can be drawn.

Table 8.4: What house coal burners would switch to if house coal was no longer available (% of indoor coal burners questioned as part of the the PiT survey who do not regularly use smokeless coal. Multi-response allowed)

	All indoor coal burners who do not regularly use smokeless coal	**Confidence interval**
Unweighted base	*131*	
Switch to mainly burning wood	48%	±10.5%
Switch to mainly burning smokeless coal or anthracite	35%	±10.0%
Switch to gas, electricity or oil-based heating	21%	±8.5%
Switch to mainly burning something else	4%	±4.0%
Other	4%	
Don't know	2%	

8.3 Identification of drivers of burning behaviour

Analysis of the qualitative data identified a number of potential drivers for indoor burning as well as related challenges to changing behaviour, based on the Kantar Behavioural Framework which is outlined in Chapter 1, Figure 1.1. It is important to note, that the extent to which the behaviour of burners is driven by the factors identified is likely to differ from individual to individual, and also over their time as a burner.

In summary, burning as a behaviour seems to be deeply influenced by System 1 drivers that are automatic and unconscious, with habit and rules of thumb becoming key to how

burners burn (see Appendix E). In essence, this means that practised burners tended not to think about how they burned; their burning behaviour had become entrenched based on initial trial and error and how others they knew had burned. Another important System 1 driver for burning for some was the current heating, hot water and cooking system they had in their house, which was sometimes influenced by whether they were on the gas grid.

Informal cost/benefit analysis was identified as the key driver in System 2, the reflective and deliberative side of behaviour that the Framework draws attention to, and this underpins the rational & emotional reasoning for why these burners burned. The benefits of burning that analysis of the interviews identified in relation to at least some of these burners were both financial (energy cost savings through accessing free or cheap fuel options) and emotional (for example, pleasure from looking at a fire or the cosy atmosphere that many perceived; the sense of empowerment, control and/or self-sufficiency inspired by being more directly involved in providing heat for the household).

The potential costs (such as the time and effort involved in making and maintaining fires) tended not to be considered because they had been integrated into the daily rhythm of household life. These interviewees also demonstrated little acknowledgment of the potential health and environmental costs through lack of awareness of the potential extent of these (where emissions of pollutants were recognised they tended to be dismissed as minimal and/or having little or no impact because of their dispersal).

Other System 2 drivers of burning included a belief, that many interviewees expressed, that they were competent burners who knew how to burn properly (efficacy) and did the 'right thing' (legitimacy). Indeed, a number saw burning as a pro-environmental behaviour because wood is a natural renewable resource and burning wood is often said to be carbon neutral. Fossil fuel-based energy alternatives were perceived as more polluting.

Linked to this, were the cross-cutting issues of socio-cultural norms and morality which helped to support these System 1 and System 2 drivers: being brought up with fires at home, the seeming aspirational nature of having a fire, the general lack of knowledge of the harms of burning, the relative absence of its positioning as a moral issue (unlike recycling or more recently use of single plastics), and perceptions of burning as being better than many other heating options.

In combination, these contributed to a solid and largely unquestioned set of beliefs and attitudes about burning amongst this set of burners, although it is important to point out that their burning practices varied greatly. It is not known how much this is reflected in the wider population of burners, but if it is, it may present a challenge for designing policy and communications to try and encourage changes in burning practice as it will require burners to reappraise their burning behaviour, and in some cases financial investment to facilitate this, which may be a struggle for some.

Providing credible and therefore persuasive information on the costs of burning (health and environmental) is therefore likely to be an important strategy in helping burners consciously reappraise their burning choices. Changes in policy, such as the new solid fuels legislation, may also offer other opportunities to encourage burners to consciously reappraise their current burning practices though disrupting routines that have become second nature, potentially through encouraging System 2 aspects of burning behaviour.

8.4 Potential barriers to changing indoor burning behaviour

These drivers of burning can also be seen as barriers to changing burning behaviour, in particular the fact that system 1 drivers appear to be particularly dominant. As indicated, these might need consideration when thinking about policy and interventions. The potential

barriers identified through the qualitative research, and further explored through the quantitative research, are listed below. The number and scale of the barriers will vary, depending on the burner and their circumstances, and so the analysis points to the burner segments identified in the previous chapter to help understand the burners for whom each barrier is most relevant:

- a lack of availability of a cheap alternative heating infrastructure, in particular for those living in an area without gas grid connectivity (more of an issue outside of England and in rural areas as Chapter 3 indicated) – mostly a barrier for the Necessity segment;
- a household's financial situation (whilst many indoor burners appear to be relatively affluent, some are not, see Chapter 7) – more relevant for the Necessity and Thrift & Self-reliance segments
- the degree of integration of burning practices within the everyday life of the household (see Chapter 5) – relevant for the Necessity segment;
- burning being part of family heritage and tradition (as suggested in Chapter 6) – most relevant for the Tradition segment;
- self-confidence in knowledge and skills around household burning (some do not actively seek advice on good practice - as discussed in Chapter 5) – particularly relevant for the Necessity segment and to a lesser extent the Tradition and Aesthetic segments;
- the emotional appeal of burning indoors (lighting and having a fire contributes to positive feelings - as highlighted in Chapter 6) – particularly pertinent for the Aesthetics segment and to a lesser extent the Tradition segment and then the Thrift & Self-reliance segment;
- the extent to which burning becomes an aspect of the person's/household's identity (as indicated for a small minority in Chapter 6) – most relevant for the Tradition segment;
- the sense of self-reliance or independence that being responsible and able to heat one's own home provides for some burners (see Chapter 6) – more commonly a feature in the Thrift & Self-reliance segment;
- the financial and/or practical benefits of using a fire (expenditure on solid fuels was perceived by some qualitative interviewees to be less than how much they would spend on other heating systems, particularly if collecting or salvaging free wood - see Chapter 4 for details. Burning can also be used as a waste disposal method - for example, for confidential waste or green waste, which people might otherwise be charged to dispose of - see Chapter 6) – most relevant for those in the Necessity segment.

What this suggests is that the barriers are more numerous for the Necessity segment, and for some within this group, and also likely to be greater for primary burners who are both off the gas grid and less affluent. Primary burners (those who used solid fuel appliances for all or most of their heating) made up 11% of the PiT sample overall and were more often located in rural areas. Consequently they were less likely to be connected to the gas grid (55% did not have access to gas) compared with secondary burners (those who burned for some of their heat or for another purpose). They were also older and tended to be less affluent, with a greater proportion (35%) saying they found it difficult to meet their fuel and energy costs. It is this small sub-group of primary burners who lack the infrastructure and financial means to adapt, who are likely therefore to struggle in the face

of efforts to change or improve burning practice, especially if these involve additional costs they cannot afford. This group fits the Necessity pen portrait particularly well.

8.4.1 Potential barriers to changing specific indoor burning behaviours

Additionally, Chapters 4 and 5 point to some specific barriers to adopting the behaviours discussed, that the regulatory and financial levers explored might struggle to address:

- switching from house coal to smokeless coal - the cost, availability and/or perceived efficacy of smokeless coal in comparison to house coal (see section on coal in Chapter 4);
- seasoning wood – lack of space for seasoning wood or storing sufficient dry wood;
- chimney sweeping – perceptions that this requires a 'common-sense approach' based on usage levels which may challenge advice that does not take this into account;
- other practices – that banking of fires can be seen as an easy way to light a fire the next day, and that room ventilation may be seen as counterproductive when attempting to heat a room with a fire.

Again, the qualitative research finding that the personal safety of those in the household was a concern for many of the burners interviewed may provide a means to engage burners in thinking about why changes in the above behaviours would be of benefit to them.

9. Outdoor burning

Respondents who burned at home were also asked about their outdoor burning practices in order to understand the reasons they burned outdoors, the fuels typically used, the frequency of use of these fuels, the types of outdoor appliances used, and respondents' attitudes to burning and to the potential impact on neighbours. This chapter presents the findings of this aspect of the research, highlighting the variation and differences within outdoor burners.

9.1 Where and when do people burn outdoors

A greater proportion of the UK population engaged at least occasionally in outdoor burning than indoors, with 14% of CAS respondents saying they had burned outdoors at some point over the year prior to being surveyed (see Table 9.1), though the proportions burning outdoors in Northern Ireland, Scotland and Wales were lower. Only 2% of the population had burned both outdoors and indoors.

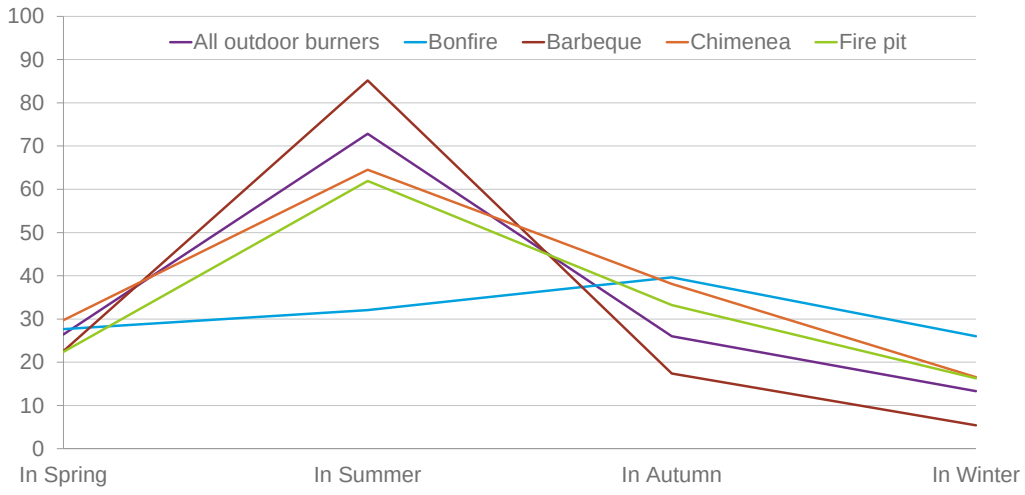
Table 9.1: Spatial distribution of proportions of UK population who burn indoors and outdoors (incidence, % of population)

		Nation			
All respondents	**All UK**	**England**	**Wales**	**Scotland**	**N. Ireland**
Unwtd base	*46729*	*38930*	*2201*	*4241*	*1357*
All burners (total)	19.4%	19.3%	20.9%	14.9%	34.2%
Indoors (total)	8.0%	7.3%	12.0%	6.8%	27.1%
Indoors only	5.8%	5.1%	10.7%	5.1%	23.1%
Both indoors and outdoors	2.2%	2.2%	1.3%	1.7%	4.1%
Outdoors (total)	13.6%	14.3%	10.2%	9.8%	11.2%
Outdoors only	11.4%	12.1%	8.9%	8.0%	7.1%
Non-burners	80.6%	80.7%	79.1%	85.1%	65.8%

Key: Orange: significantly higher than all UK; blue: significantly lower than all UK

Outdoor burners tended to burn less frequently than indoor burners and, whilst the seasonal pattern for outdoor burning was less pronounced, it was largely inverse to indoor burning. Three-quarters (73%) burned in the summer months, with a small proportion (10%) burning throughout the year. As shown in Figure 9.2, the use of barbeques was particularly seasonal, with 85% of barbeque users lighting barbeques in summer. Bonfires were less of a seasonal occurrence but peaked in autumn when 40% of bonfire burners lit a bonfire, possibly related to garden clearance at the end of the growing season or festivities such as bonfire night. They were, however, also more infrequent with 44% saying these only happened once or twice a year.

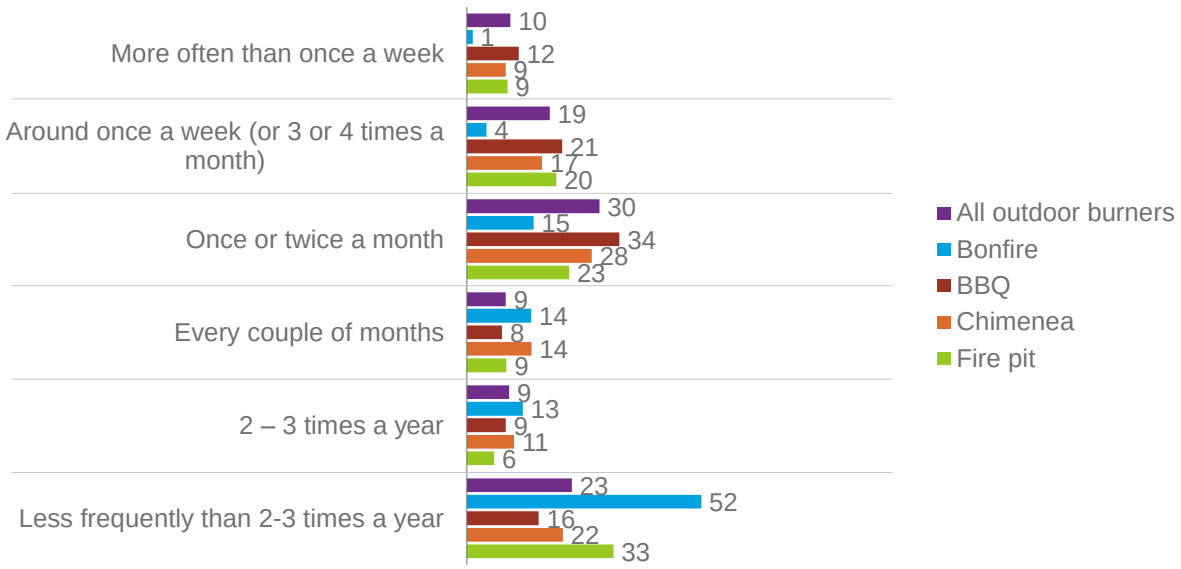
Figure 9.2: When outdoor burners tend to burn outdoors by type of fire (% of outdoor burners, multi-response allowed)



Source: (PiT) When do you tend to use your [outdoor appliance]?:
Base: All outdoor burners (n=1289), Bonfire (n=129), BBQ (n=723), Chimenea (n=90), Fire pit (n=153)

Similar to indoor burners, outdoor burners were asked how often they burned during the time of year they burned the most. Three in ten (28%) burned around once a week or more, and a similar proportion (30%) burned once or twice a month (Figure 9.3). A third (33%) of barbeque users used them at least once a week in the season they used them the most, while the majority of bonfire burners lit a bonfire no more than three times a year (65%).

Figure 9.3: Frequency of outdoor burning (% of outdoor burners)



Source: (PiT) Roughly how frequently do you use your [outdoor appliance], during the time of year you use it most? All outdoor burners (n=1289), Bonfire (n=129), BBQ (n=723), Chimenea (n=90), Fire pit (n=153)

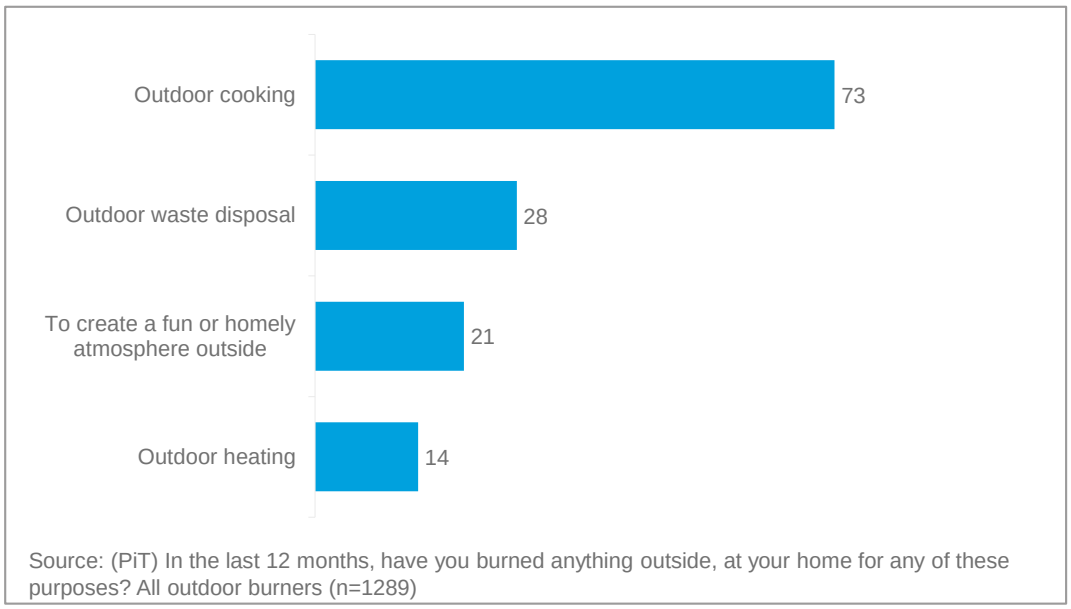
9.2 Who burns outdoors

Outdoor burners were more likely than indoor burners to live in urban areas (82%) and to rent their property (22%). They were less likely to live in detached houses (25%) and own their home outright (26%). When compared with indoor burners, a higher proportion of outdoor burners lived in London (15%) and the South East (21%) and in England as a whole (88%). They were predominantly white (90%), but to a lesser extent than indoor burners, more likely to have children at home (40%), and only 12% were retired or semi-retired. A higher proportion of outdoor burners, compared with indoor burners, reported a gross income of above £50,000 per year (23%), something that was particularly the case for those who burned both indoors and outdoors (34%).

9.3 Why people burn outdoors

Cooking and barbequing were the purposes respondents most frequently gave for outdoor burning (73%, see Figure 9.4). This was higher in London (83% of outdoor burners living in London). Outdoor burners with children were also more likely than average to report outdoor cooking as the main purpose of outdoor burning (79%), as were households with someone in employment (75%).

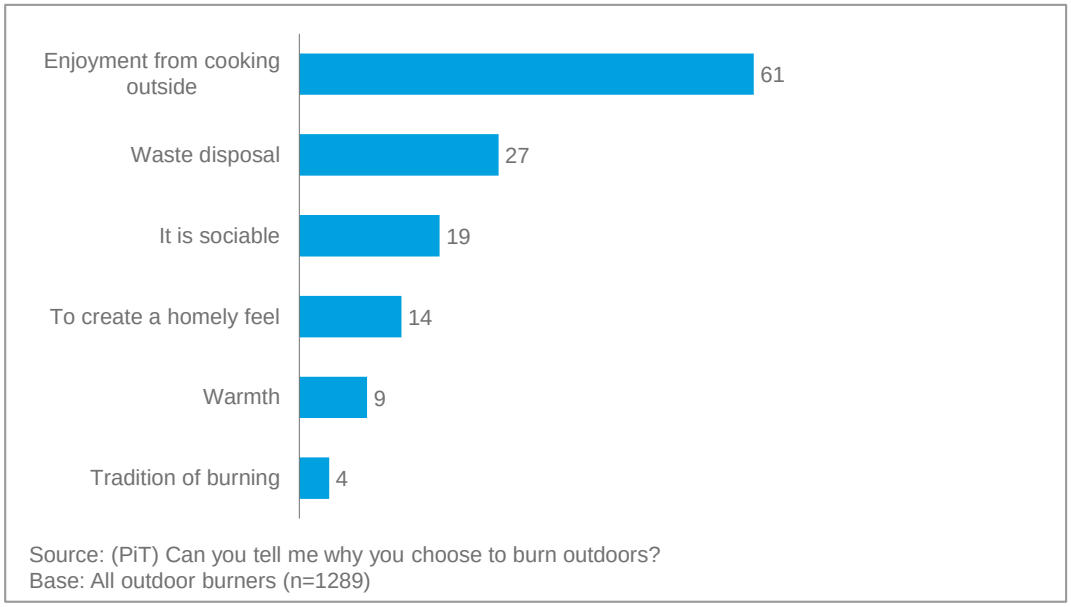
Figure 9.4: Purpose of burning outdoors (% of outdoor burners, multi-response allowed)



Note: Only responses equal or higher than 10% included in chart.

Further to questions around the purpose of their outdoor burning (cooking, waste disposal, etc.), outdoor burners were also asked about why they chose to burn outdoors. The responses are shown in Figure 9.5. Not surprisingly given the number who burned outdoors for cooking, enjoyment from cooking outside was the most frequently mentioned motivation (61%). This was higher among those whose main outdoor appliance was a barbeque (87%). While the proportions listing enjoyment from cooking as motivations for using a chimenea (22%) or fire pit (32%) were lower, some of the PiT respondents did use these appliances for cooking purposes.

Figure 9.5: Main reasons for choosing to burn outdoors (% of outdoor burners, multi-response allowed)



Note: Only responses equal or higher than 4% included in chart.

Waste disposal was the second most reported reason for choosing to burn outdoors (27% of outdoor burners said one of the reasons they burned outdoors was to dispose of waste). Six in seven (84%) of those who mainly burned on a bonfire chose to burn outdoors for this reason. Burning for waste disposal was higher in the East Midlands (42%) and the South East (34%), but was less common in London (13%), and urban areas generally (25%). It was more commonly reported in rural areas (34%) and by those in retired households (42%). A few outdoor burners in the focus groups conducted as part of the qualitative research mentioned sporadically burning garden waste, reportedly because of the lack of council garden waste collections, or being an avid gardener and creating lots of garden waste.

One in five (19%) reported burning outdoors because it was sociable and 14% to create a homely feel (creating a homely feel was more widely mentioned among users of chimeneas (36%) and fire pits (30%)). One in ten (9%) reported using outdoor burning for warmth (also higher among users of chimeneas (38%) and fire pits (22%)). Other minor motivations for outdoor burning included tradition (4%) and saving money (2%).

The major reason therefore for outdoor burning for PiT respondents was cooking, though this was more common among more affluent younger families, particularly in more densely populated areas, whilst burning waste (the second most common reason for outdoor burning) was more common in relatively rural areas and amongst retired households.

9.4 Outdoor burning appliances

Reflecting the predominance of outdoor cooking as the key reason for outdoor burning, two thirds (68%) of outdoor burners used non-gas fuelled barbeques as their outdoor burning 'appliance'[89], while the least used were bonfires and chimeneas (12% each). One in five (19%) outdoor burners used a firepit. In summary, barbeques dominated the appliances used for outdoor burning and around half of those who used other outdoor

[89] The study did not cover gas BBQs as they do not meet the definition of a solid fuel burning appliance.

appliances also used barbeques (46% of bonfire users, 50% of chimenea users and 44% of fire pit users).

Barbeques were used by a greater percentage of *urban* outdoor burners (70% compared to 57% of outdoor burners in rural areas). Reflecting this, a greater proportion of outdoor burners in London used barbeques than was the case in the UK as whole (86% compared with 68%).

In the PiT, outdoor burning questions were asked in relation to respondents' main outdoor appliance (if they used more than one). Barbeques were most frequently listed as the main appliance overall (60%), especially for ethnic minority adults (80%). A third of those who burned outdoors using barbeques did so once a week or more in the season they used them the most (33%).

Bonfires were listed as the main outdoor appliance[90] by 7% of outdoor burners, and more often by those residing in the South East (11% of outdoor burners in the South East compared to 2% in London). Bonfires were more commonly listed as the main appliance for outdoor burners in rural areas (listed by 13% of outdoor burners in rural areas compared with 6% of those in urban areas). During the time of the year they burned bonfires the most, the majority of bonfire users (94%) lit one once or twice a month or less.

Fire pits were the main appliance for 12% of outdoor burners and chimeneas for 7%. Outdoor burners who mainly used chimeneas and fire pits were burning outdoors for warmth (38% and 22% respectively) and homeliness (36% and 30%), but also waste disposal (38% and 35%) and cooking (22% and 32%).

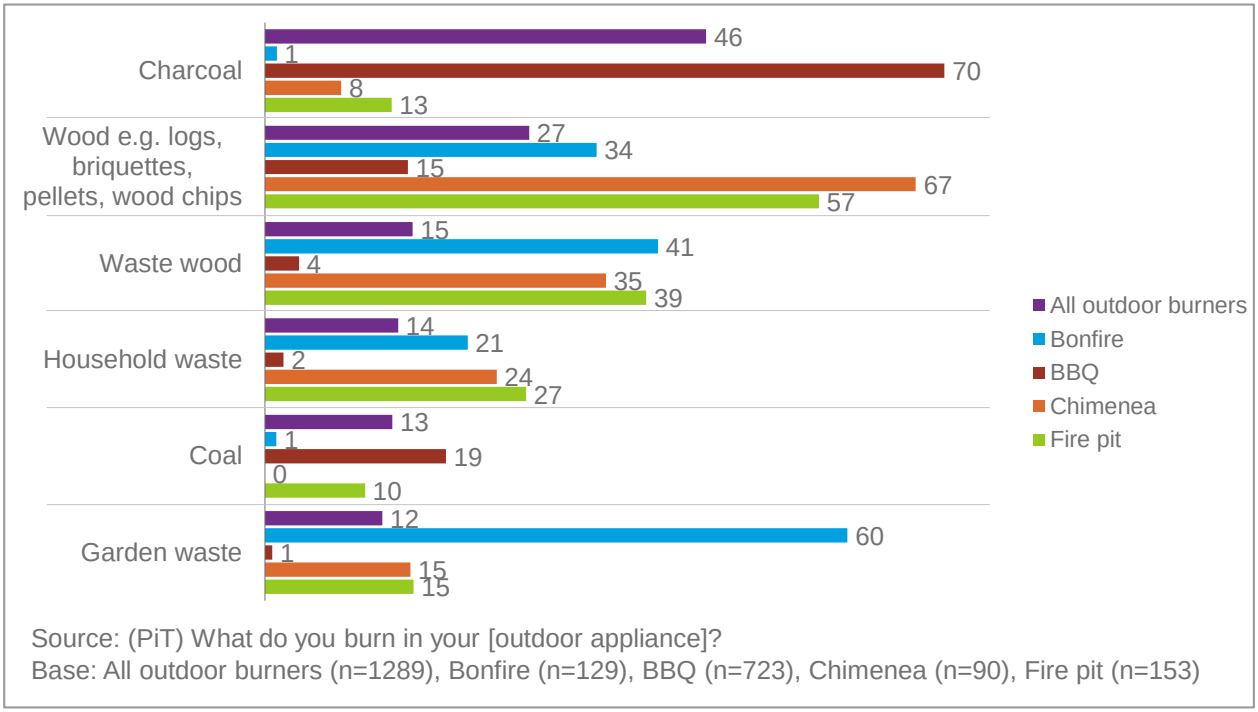
There was no clear difference in the equipment used (for example, BBQ, bonfire, chimenea, fire pit)/ form of burning undertaken by respondents of different social grades, but there was in relation to burning frequency. Over half of ABs (62%) who burned outside did so at least once or twice a month in the period of the year they burned the most, compared with 43% of DEs.

9.5 Fuels used for outdoor burning

Consistent with the high proportion of barbeques in use, nearly half (46%) of burners burning outdoors used charcoal (Figure 9.6). This varied by type of appliance. Seven in ten burners (70%) with a barbeque used charcoal. In addition to charcoal, 19% of barbeque users said they burned coal and 15% burned wood, for example, logs, briquettes, pellets or wood chips.

[90] It is understood that bonfires are not really an 'appliance' but a form of burning.

Figure 9.6: Fuels used for outdoor burning (% of outdoor burners, multi-response allowed)



Note: Only responses equal or higher than 10% overall included in chart.

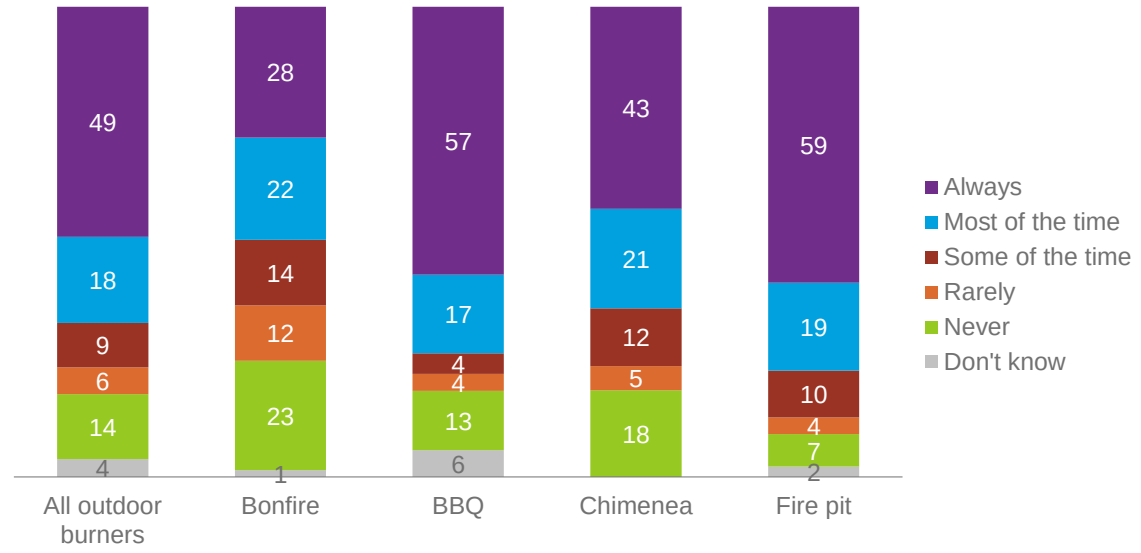
Just under a third (27%) of outdoor burners burned wood. Those with chimeneas or fire pits were most likely to burn wood (67% and 57% respectively). In addition, 15% of outdoor burners burned waste wood (wood that is either fallen from trees or discarded or no longer needed, such as old fence posts); the burning of which was higher among bonfire users (41%).

Three-fifths (60%) of those with a bonfire burned garden waste (as distinct from waste wood). Burners in urban smoke control areas were around half as likely as other urban burners to burn garden waste (8% compared with 13%).

Around half (49%) of PiT outdoor burners burning wood, waste wood, or garden waste outdoors said they always made sure the wood was dry or seasoned, and a further 18% said they made sure most of the time (see Figure 9.7). Again, this varied by type of appliance. While most burners with a fire pit always ensured the wood was dry or seasoned, burners with a bonfire were half as likely to always ensure this (59% compared with 28%). Nearly a quarter (23%) of burners with a bonfire never ensured the wood or garden waste they burned was dry.

In the CAS, 39% of outdoor only burners said they had sourced the wood they had burned in the previous week from a general supplier and 18% said it had come from their own garden.

Figure 9.7: How often wood burned outdoors is dry or seasoned (% of outdoor wood, waste wood and garden waste burners)

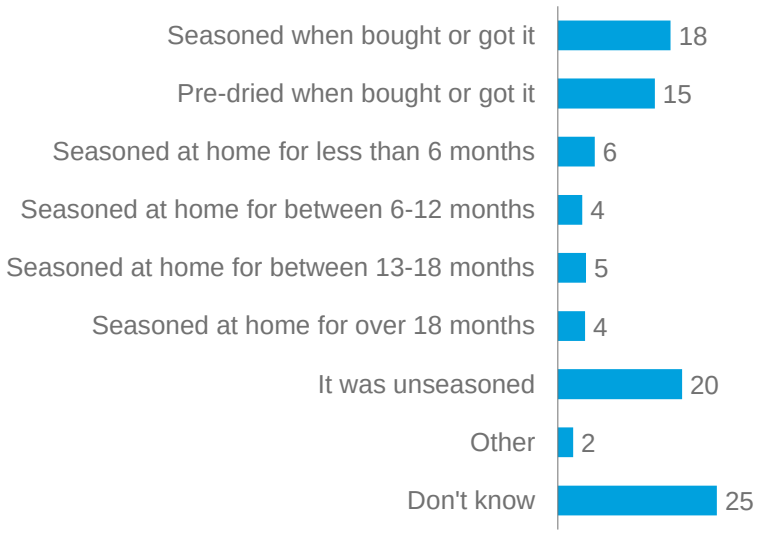


Source: (PiT) Can you tell me how often you made sure all the wood you burned was dry or seasoned?
Base: All outdoor burners who burned wood, waste wood or garden waste (n=566), Bonfire (n=120), BBQ (n=115), Chimenea (n=80), Fire pit (n=133)

According to CAS data on outdoor-only burners who had burned wood in the previous week *which they they seasoned themselves*, 4% had seasoned it for between six months and a year, 6% for less than 6 months and a further 20% burned unseasoned wood (see Figure 9.8). This means that 30% of outdoor burners from the CAS used 'wet wood' (as defined in this report, meaning seasoned for less than a year[91]), whilst a further 25% did not know whether the wood was pre-dried or unseasoned or if seasoned how long it had been seasoned for. On the other end of the scale, third said they bought or got the wood they burned outdoors seasoned (18%) or pre-dried (15%). Most outdoor-only burners (87%) spent under £50, if anything at all, on the fuel they burned (36% did not spend anything).

[91] It is important to note that the new solid fuels legislation requires wood to be dried for two years in line with advice from industry and definitions used in the consultation. Defra guidance is being updated to reflect this.

Figure 9.8: Reported level of seasoning of most wood burned outdoors in last seven days (% of outdoor only burners who burned wood)



Source: (CAS) How would you describe the seasoning of most of the wood you burned in the last 7 days? Base: All burners who burn wood and burned outdoors in last 7 days (n=130)

9.6 Attitudes to outdoor burning and potential impact on neighbours

Overall, a third (32%) of outdoor burners were concerned about the impact of burning on their health or health of those around them. Outdoor-only burners were more likely to be concerned (35%) than those who burned indoors (including indoors and outdoors) (27%).

62% of outdoor burners disagreed that their burning had a *positive* impact on the local environment. Outdoor-only burners were more likely to disagree (64% compared with 57% of indoor-only or indoor and outdoor burners).

For most burners (whether or not they burned outdoors themselves), smelling burning outside in their local area in winter was fairly commonplace, with half reporting this occurring at least once a month (49%) and around a third (35%) saying it happened at least once a week. Indoor burners were more likely to smell smoke on a weekly basis (45%) than outdoor burners (32%). It was most common for those living in a bungalow and those in rural areas (50% and 44% at least once a week respectively), and least common in urban areas and for those living in a flat or maisonette (32% and 20% at least once a week respectively).

It was relatively uncommon for outdoor burners to notify neighbours before burning, with only around a fifth (22%) saying they did most of the time or always. A further 7% did so some of the time and 11% did it rarely. Proximity to neighbours appeared to be a factor: people in terraced housing were more likely to inform neighbours (30% always or most of the time) than those in a detached house (16%) or bungalow (12%). People in DE social grades were also more likely to inform neighbours (34% always to most of the time).

From outdoor burners' perspectives at least, burning was rarely the cause of tension among neighbours. It was unusual for burners to report receiving complaints from neighbours about smoke (95% said this had never happened and 4% said it happened rarely). The qualitative research suggested that there was a concern among many of those who burned outdoors to burn in a way that is respectful to neighbours, especially when neighbours hung their washing out (burning at an alternative time). Virtually none had had

experience of complaints around nuisance burning – either reporting or being reported themselves – as the common understanding was that it was “not the done thing to complain about neighbours”. However, one indoor burner mentioned complaining anonymously to the council about someone who regularly burned rubbish he collected (seemingly as part of his work) in a field he owned nearby because of what he burned and the smoke that was given off.

Eight in ten outdoor burners in the PiT (79%) said that they would burn less often outdoors if they thought they were being a nuisance to their neighbours, higher at 86% in the North West. It was also higher for those in households where someone had a respiratory or cardiac condition who may need reciprocal consideration from their neighbours (84%). Those in social grades DE were less likely than average to say they would burn less often if they thought they were being a nuisance (69%) as were those who burned outdoors once a week or more (75%), compared with less frequent outdoor burners (82%). This may suggest highlighting the negative impacts of outdoor burning on other people could dissuade some from burning, but that more frequent burners may be harder to persuade.

9.7 Key characteristics that differentiate the outdoor burning population

9.7.1 Overview of the derived groups

Survey data was used to produce a breakdown of the UK outdoor burning population. This took into account the following data for outdoor burners:

- Appliance or place where the main fire was lit (bonfire, barbeque, fire pit or chimenea)
- Frequency of outdoor burning
- Season(s) in which the burning mainly took place

This produced the five groups of outdoor burners. These are:

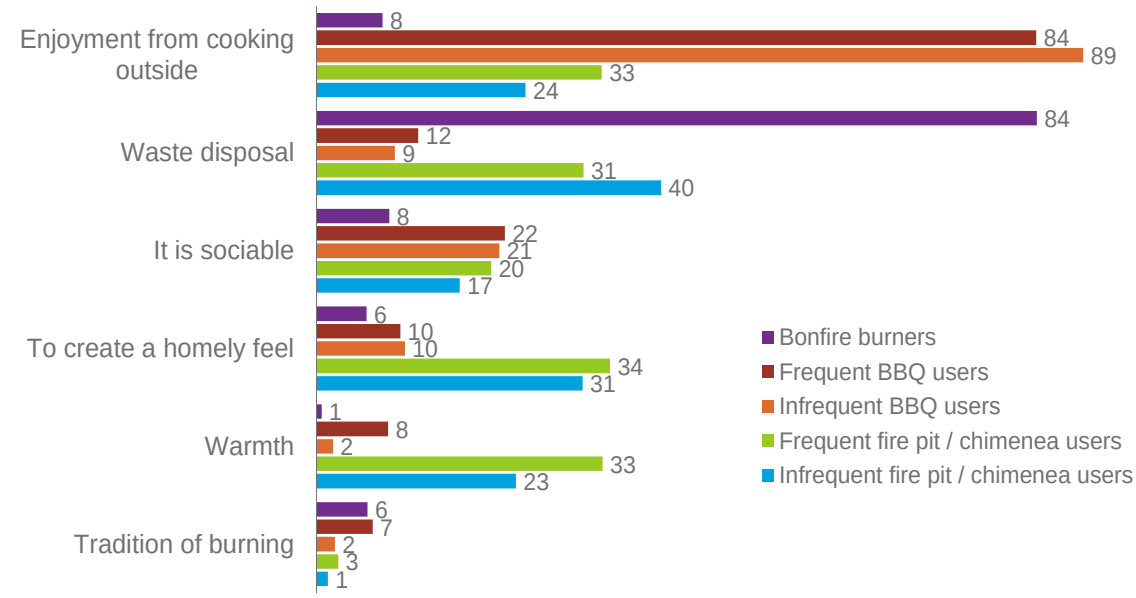
- **Bonfire burners**: bonfire burners were grouped together as the overall sample was too small to differentiate between frequency of burning or main burning season.
- **Frequent barbeque burners**: this group used a barbeque at least every couple of months year-round, once or twice a month in at least two seasons or at least once a week in the season(s) they had one the most.
- **Infrequent barbeque burners**: this group used a barbeque at most up to around six times a year.
- **Frequent fire pit or chimenea burners**: this group used a fire pit or chimenea at least every couple of months year-round, once or twice a month in at least two seasons or at least once a week in the season(s) they had one the most.
- **Infrequent fire pit or chimenea burners**: this group used a fire pit or chimenea at most up to around six times a year.

Section 9.7.2 sets out the main demographic, behavioural and attitudinal differences between these groups.

9.7.2 How the outdoor burners groups differ from outdoor burners overall

There were some demographic, motivational and attitudinal differences between the groups outlined above when compared with outdoor burners overall. Figure 9.9 shows how the reasons for choosing to burn outdoors differs by group.

Figure 9.9: Main reasons for choosing to burn outdoors by outdoor burning group (% of outdoor burners, multi-response allowed)



Source: (PiT) Can you tell me why you choose to burn outdoors?
Base: All outdoor burners; bonfire burners (n=129), frequent BBQ (n=314), infrequent BBQ (n=409), frequent fire pit/chimenea (n=114), infrequent fire pit/chimenea (n=129)

Bonfire burners

Bonfire burners tended to be older. A higher proportion lived in a household of retired adults (35% compared with 13% of outdoor burners overall), and 52% were aged 55 or older (compared with 26% of outdoor burners overall). They also tended to be more affluent. A higher proportion were in the AB social grade (53% compared with 41% of outdoor burners overall). In terms of geographical spread, they were more likely to live in the South East of England (33% compared with 21% of outdoor burners overall) and in rural areas (35% compared to 20% of outdoor burners overall). Lastly, they were more likely to burn both indoors and outdoors (41% compared with 32% of outdoor burners overall).

As can be seen in Figure 9.9 above, waste disposal was the most frequently mentioned reason for outdoor burning by bonfire users (84% compared to 27% overall). Bonfire users were more likely to agree that burning was a necessity (32% compared with 15% of outdoor burners overall).

Barbeque users

Overall, the characteristics of BBQ users were relatively similar to outside burners overall because they are the most common type of outdoor burner. A higher proportion of barbeque users lived in a household with at least one working adult (88% compared with 83% overall). Infrequent barbeque burners were more common in urban areas (85% compared with 80% of outdoor burners overall) and in the North West (14% compared with

6% of frequent barbeque users and 10% of outdoor burners overall). Both groups of barbeque users were more common in London (19% each compared with 14% of outdoor burners overall).

Barbeque users were primarily motivated by their enjoyment of cooking outside (84% of frequent and 89% of infrequent users compared with 61% overall). Infrequent barbeque users more commonly said they had barbequed because of the weather (4% compared with 0% of frequent users) suggesting that their behaviour was more often opportunistic.

Among barbeque users, infrequent users were more likely to agree that they only used their appliance for social occasions (66% compared with 60% of frequent barbeque users), while more frequent users agreed they liked watching the flames (55% compared with 47% of infrequent barbeque users).

Firepit and chimenea users

As with bonfire burners, frequent firepit and chimenea users were more likely to live in rural areas (30% compared with 20% of outdoor burners overall). Frequent users were also more common in Wales (9% compared with 4% of outdoor burners overall).

Firepit and chimenea users were more often motivated to burn for warmth (33% of frequent and 23% of infrequent users compared with 9% of outdoor burners overall, although the difference between frequent and infrequent users here is statistically significant). They were also more likely to say they burned to create a homely feel (34% of frequent and 31% of infrequent users compared with 14% overall). Three quarters of frequent fire pit and chimenea users (74%) agreed they liked watching the flames (compared with 62% of infrequent users). Mirroring this, seven in ten (71%) agreed there was something nostalgic about a fire (compared with 52% of infrequent users).

10. Non-burners

10.1 Profile of non-burners

The research also included a survey of 731 non-burners' experiences of, and attitudes towards, burning at home. A sample of this size provides estimates for non-burners with maximum 95% confidence intervals of ±4.5 percentage points. This chapter presents the main findings from this aspect of the research, with a particular focus on what their perspectives were in relation to how likely it would be that they would take up burning at home in the future and whether burning at home should be more controlled.

Based on the CAS data, 81% of the UK population were non-burners in 2018/19 (people who lived at a property where solid fuels have not been burned inside or out in the last 12 months). Non-burners were more likely to live in urban areas (82%) and/or in an urban SCA (59%) in comparison with indoor burners. They were more likely to have mains gas supply (91%), live in a flat or maisonette (12%), and in a property built since 1966 (38%). Smaller proportions lived with children (25%) and they were more likely to rent (35%) and to be less affluent. A full set of non-burner and burner profiling tables is in Appendix A.

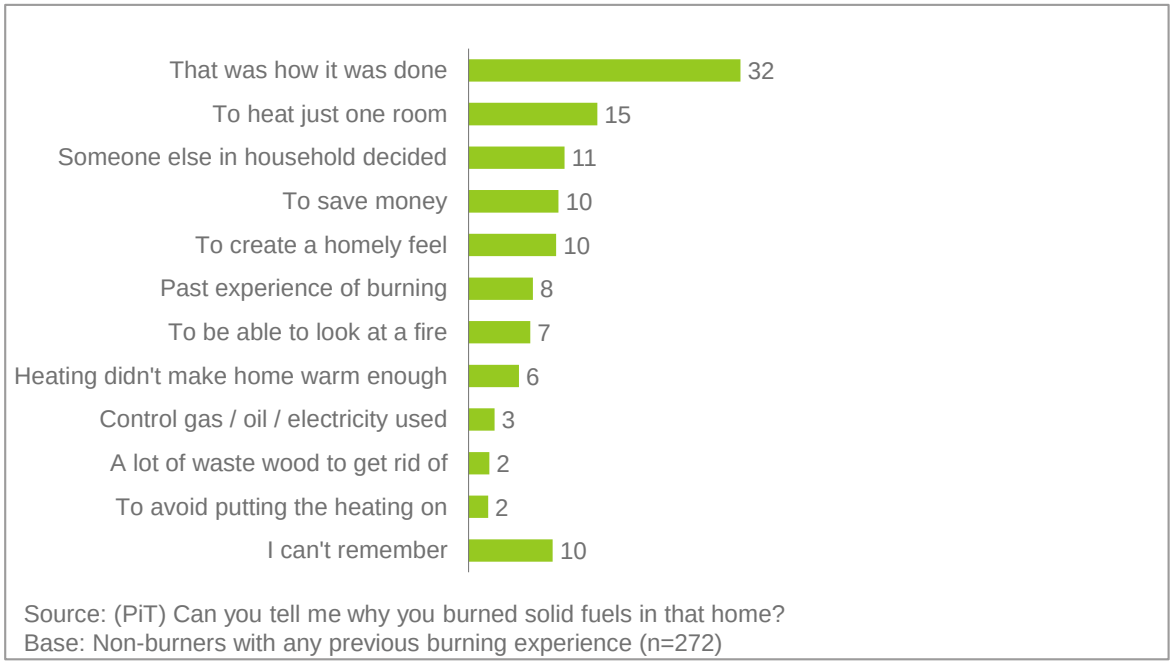
Non-burners were more likely to be DEs (28%) than both outdoor-only burners (15%) and indoor burners (12%). Among non-burners, those living in London were less likely to say meeting their fuel costs was very easy (19% compared with 31% among non-burners overall).

10.2 Prior experiences of burning among non-burners

The findings from this research support the results of previous research that the majority of the UK population do not burn at home. However, our survey of non-burners suggested that in total 30% of non-burners had some experience of solid fuel appliances in the home, either when growing up (23%), and/or since they left home (13%). Prior experience of burning follows general patterns of burning incidence across the UK. For example, the percentage of non-burners who had prior experience of burning in the home was much higher in Northern Ireland than in England.

Non-burners who reported having a fire in the past were asked about the reason(s) solid fuels were used in a previous home. For most who had some prior experience of a fire (either in childhood or more recently), three in ten said that was just how it was done in that home (32%) while one in ten said someone else decided to burn (11%, Figure 10.1). Both of these responses suggest their experiences of burning occurred when they were children.

Figure 10.1: Reason for previous indoor burning (% of non-burners, multi-response allowed[92])



Note: Only responses equal to or higher than 2% included in chart.

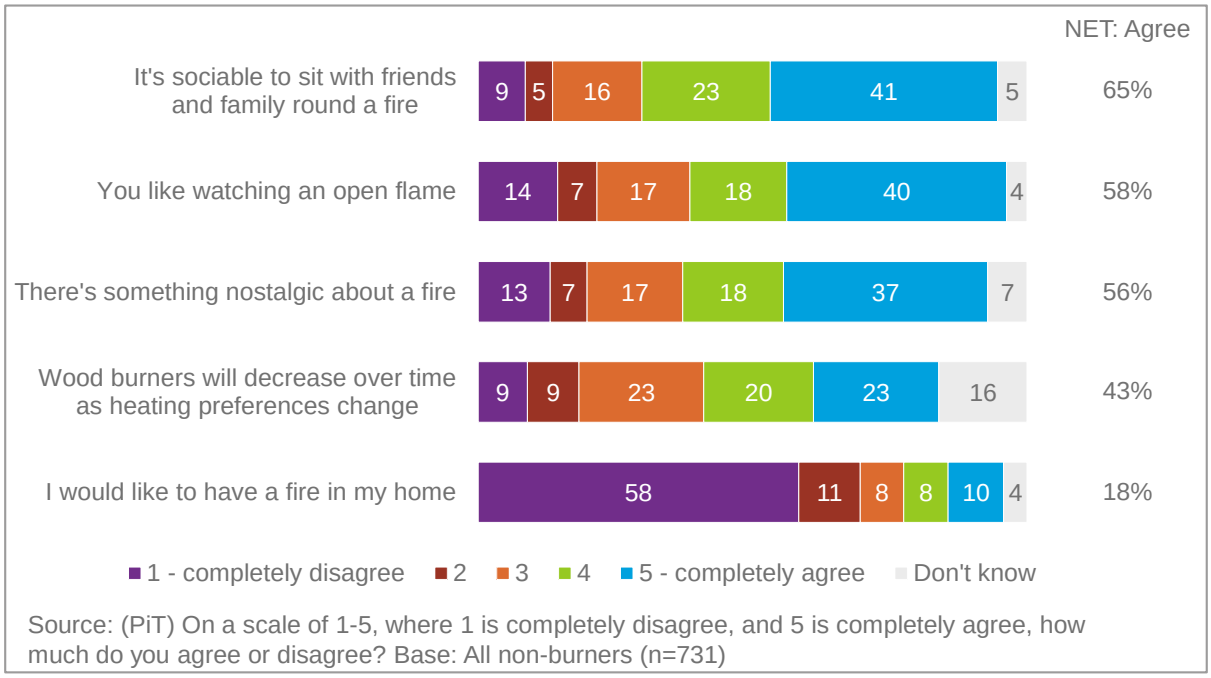
10.3 Non-burner perceptions of burning and burners

In four focus groups held with people who did not burn indoors (two in London and two in the North-East), most non-burners demonstrated a limited personal knowledge of indoor burning. Only a small number spontaneously referenced wood-burning stoves when asked about indoor burning, or mentioned friends who had fires in their homes. Most had come across indoor burning through the media, for example in home improvement programmes or magazines. Indoor burning was generally perceived to be aspirational, or a "fad". This does not mean it was perceived negatively – indeed many saw fires as cosy – just that it was removed from their own heating context.

Non-burners in the PiT were asked about their feelings towards burning. Most felt that it was sociable to sit with friends and family round a fire (65%) and three in five (58%) said they liked watching an open flame. Just over half agreed that there was something nostalgic about a fire (56%). Hence, non-burners were similar to burners in terms of their feelings about sitting round a fire (see Figure 10.2).

[92] The response categories were, for the most part, consistent with the equivalent question in the burners PiT to allow for comparison.

Figure 10.2: Agreement with statements on burning by non-burners (% of non-burners)



Non-burners' views on the impact of burning were more mixed. Like burners, they were more likely to disagree (43%) than agree (23%) that domestic burning had a positive impact on the local environment, although they were less critical of this aspect of burning than all burners (only 14% of whom thought it had a positive impact). Otherwise, they were more negative about burning than burners were. Over half agreed that burning in people's homes and gardens was a significant source of air pollution (53% compared with 44% of burners), while two in five (42%) said they worried about the impact domestic burning has on their health and on those around them (31% for burners).

Views on the social acceptability of burning varied. Over half (55%) thought that people have the right to burn in their own home if they want to, with 35% completely agreeing with this statement. Only 18% disagreed, 10% of whom strongly disagreed. However, two in five (41%) non-burners thought that people who burn do not think about the impact of their burning on people around them.

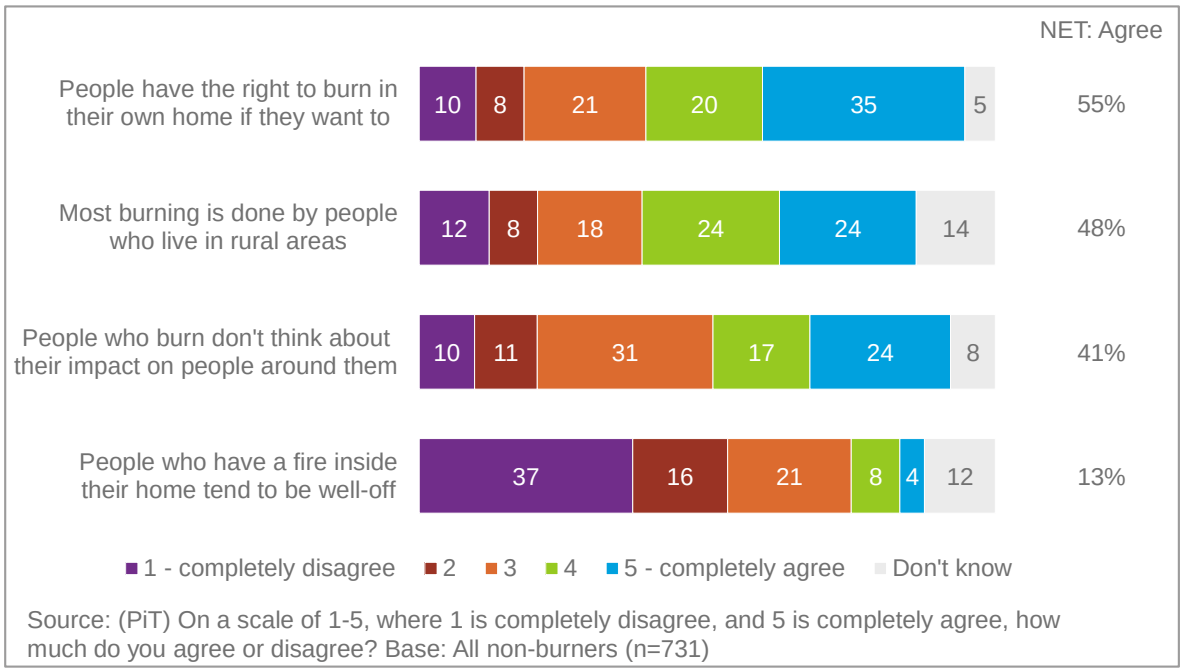
Non-burners were considerably less likely than burners to smell burning outside in winter (22% said they did so at least once a month). However, non-burners who smelt burning were more likely to say it bothered them (15%) than burners (9%), although in both cases, it was not a concern for the majority. For both the burner and non-burner samples, women who had smelled smoke were more likely to say it had bothered them than men (12% burner; 20% non-burner). Additionally, for the non-burner sample only, those in DE social grades (24%) who had smelled smoke were more likely to have been bothered by it.

Non-burners were also asked if they had taken any action on the last occasion they were bothered by smoke. The most common response was that they did nothing (4% of all non-burners). When action was taken it was most often to close their windows and doors (2%), while 1% said they did not go out in their garden and the same proportion said they dried their washing indoors. Less than 0.5% reported it to the burning neighbour or to the council. Non-burners were also asked if they had made a complaint on previous occasions; again, less than 0.5% had complained to the neighbour and no one had complained to the council.

In the qualitative focus groups with members of the public who did not burn indoors, participants were asked for their views on a typical burner. These non-burners imagined them to be “trendy”, “well-off” and imagined people who “live in rural places with no central heating”, or “older people whose kids have left home” and potentially “living in an older house with chimneys”.

Perceptions of burners were also explored through the non-burner PiT (Figure 10.3). Nearly half (48%) thought that most burning was done by people who live in rural areas, (35% completely agreed with this statement), as those in the focus groups also thought. (As we have seen, this is a misconception: though the proportion of those in rural areas who burn is higher, nearly three-quarters of people who burn in the UK, be it indoors or outdoors, live in urban areas. This is simply because more people live in urban areas so a smaller proportion nevertheless equates to a greater number). Unlike the focus group participants, relatively few non-burners in the PiT associated burning with affluence: only 13% thought that people who have a fire inside their home tend to be well-off. However, those who were classified as being in DE social grades were more likely to associate home burning with affluence (21%).

Figure 10.3: Agreement with statements on burners by non-burners (% of non-burners)



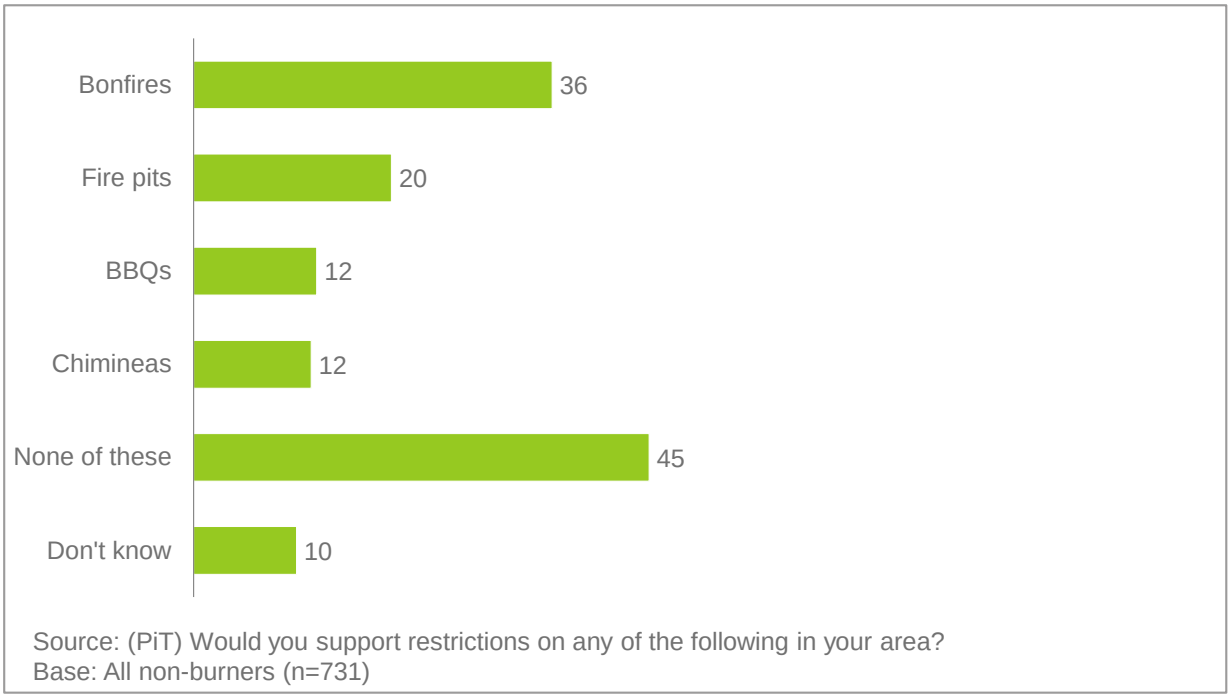
10.4 Non-burner responses to restricting outdoor burning

Among non-burners, two in five thought some form of restriction on outdoor burning was necessary in their local area (42%). Those living in urban SCAs (55%) were more likely to think this than those living in urban non-SCA and rural areas (31% and 33% respectively), though a third of non-burners living in an urban SCA (34%) did not think restrictions were needed. Participants whose households included someone with a respiratory or cardiac condition were more likely to think restrictions were necessary in their area (51%) than those without (40%).

Whilst 45% of non-burners did not support any restrictions on burning on any of the types/appliances mentioned in Figure 10.4, 44% of non-burners said they would support restrictions on at least one type of outdoor burning appliance/type. Those who supported some form of restriction were most likely to think there should be restrictions on bonfires

(36% of all non-burners), followed by fire pits (20%) and barbecues and chimeneas (both at 12%). Retired people were the least supportive of restrictions (54% would not support a restriction on any type of outdoor burning).

Figure 10.4: Restrictions on outdoor burning non-burners support (% of non-burners, multi-response allowed)



10.5 Indoor burning aspirations of non-burners

In the focus groups with people who did not burn inside, participants were asked what would encourage them to start burning. As mentioned, they suggested that what potentially attracted them to the idea of burning was an association of fire with cosiness, and that a fire is an attractive and aspirational feature in the home. However, they identified a number of barriers to serious consideration of installing burning appliances in their homes. These are outlined in 10.5.2.

In the PiT, very few non-burners reported having an unused solid fuel burning stove or open fire (3%): the numbers are too small for reliable analysis of their reasons for not using it.

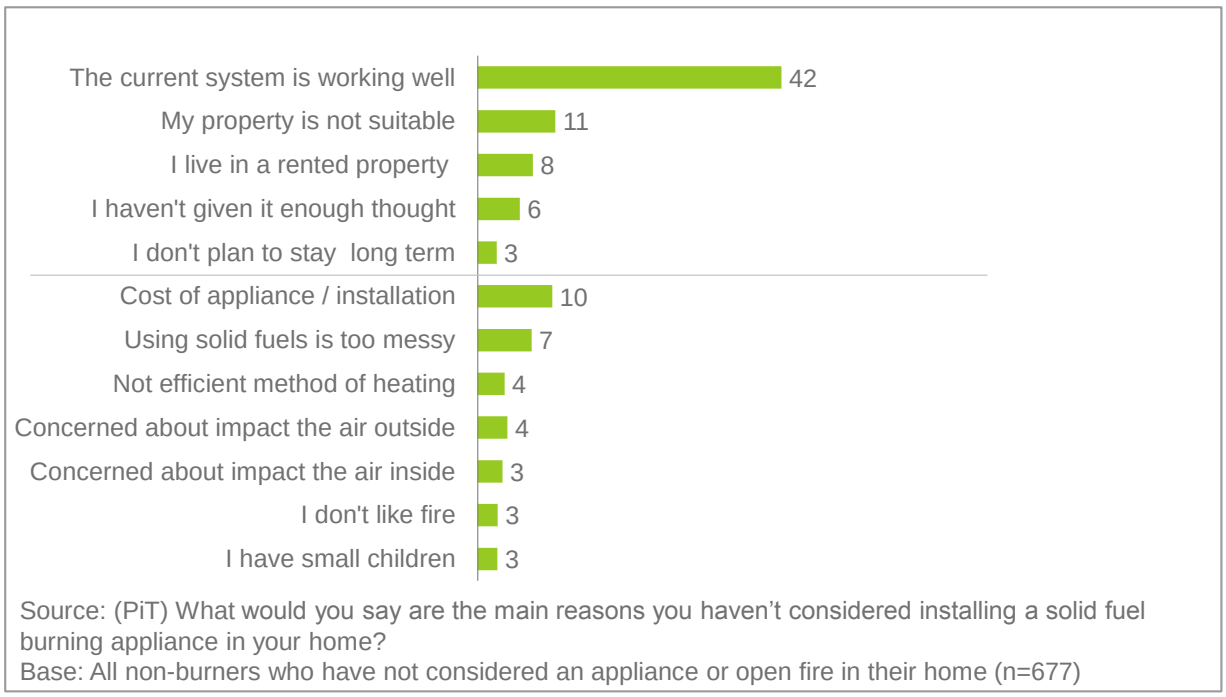
10.5.1 Non-burners who have not considered installing a burning appliance

Non-burners who took part in the non-burner PiT were asked whether they had considered installing a burning appliance in their home. The vast majority of non-burners had not (91%). When asked why (see Figure 10.5), the main reason given most often was that their current heating arrangement worked well (42%). This view was more prevalent in retired households (53%).

The next most common reason at 11% was that their property was not suitable (which was higher for those living in a block of flats, at 50%), then the cost of the appliance and/or installation (10%, though more prevalent in the North West and West Midlands - each 22%), and living in a rented property (8% overall, and higher in the South East at 16% and Wales at 18%). This set of reasons, given by over a quarter of non-burners overall,

suggest that the obstacles to burning indoors (for this group of non-burners at least) may be to do with lack of opportunity to burn, rather than a feeling that it is not necessary or desirable.

Figure 10.5: Main reasons for not considering burning indoors (% of non-burners, multi-response allowed)



Note: Only responses equal or higher than 3% included in chart.

However, 13% gave reasons which suggested a dislike of burning as a method of heating: 7% felt it was too much trouble or too messy; 4% thought it was an inefficient means of heating; and 3% said they did not like a fire. A further 5% expressed concern about the impact of burning on air quality, both inside the home (3%) and outside (4%) and another 3% said they had small children (which accounted for 10% of those with children in the household), possibly implying concern about their safety. This suggests that approximately 19% of non-burners had some form of dislike or concern about burning as a method of heating. In addition, 6% said they had just not given it any thought.

Offering further evidence that circumstance was not the main or only reason which stopped people burning indoors, only 16% of non-burners said that they would burn solid fuels in the home *if they were able to*, and just 5% saying that they were likely to start burning indoors in the next five years. However, whilst these are relatively small percentages, if such numbers of people were to take up indoor burning in the UK, this would increase the incidence of indoor burning considerably, and depending on how much they burned, could have a big impact on resulting emissions.

Reflecting differences seen among indoor burners, non-burners from social grades AB (17%), and C1C2 (20%) were more likely to want to burn indoors than those from the DE grades (8%). Non-burners in retired households were less likely than average to want to burn indoors in future (8%).

10.5.2 Non-burners who have considered installing an indoor burning appliance

One in twenty non-burners (5%) who did not have a working burning solid fuel appliance in their home said they had considered installing or restoring one. The main deterrents to going ahead with the installation were said to be the costs of doing so, along with a lack of need to change how they heat their home[93]. These findings were reflected in the focus groups, where participants who did not burn indoors cited a range of reasons for not seriously pursuing the option of indoor burning:

- Physical barriers to appliance installation, such as difficulty adapting their current home to allow indoor burning, or negative perceptions of the costs associated with changing their current heating configuration;
- Lack of knowledge about solid fuels – including what they could use, how much it costs, how much they would need, where they would store it – which made indoor burning less appealing;
- Safety concerns, for example not knowing how to safely start, manage and put out a fire, and worries about fire risks to their home and family members (particularly children);
- A perceived lack of warmth and temperature control, with limited awareness about whole home systems or ways to control the heat produced, which added to uncertainty about heating costs.

10.6 Outdoor burning aspirations and intentions of non-burners

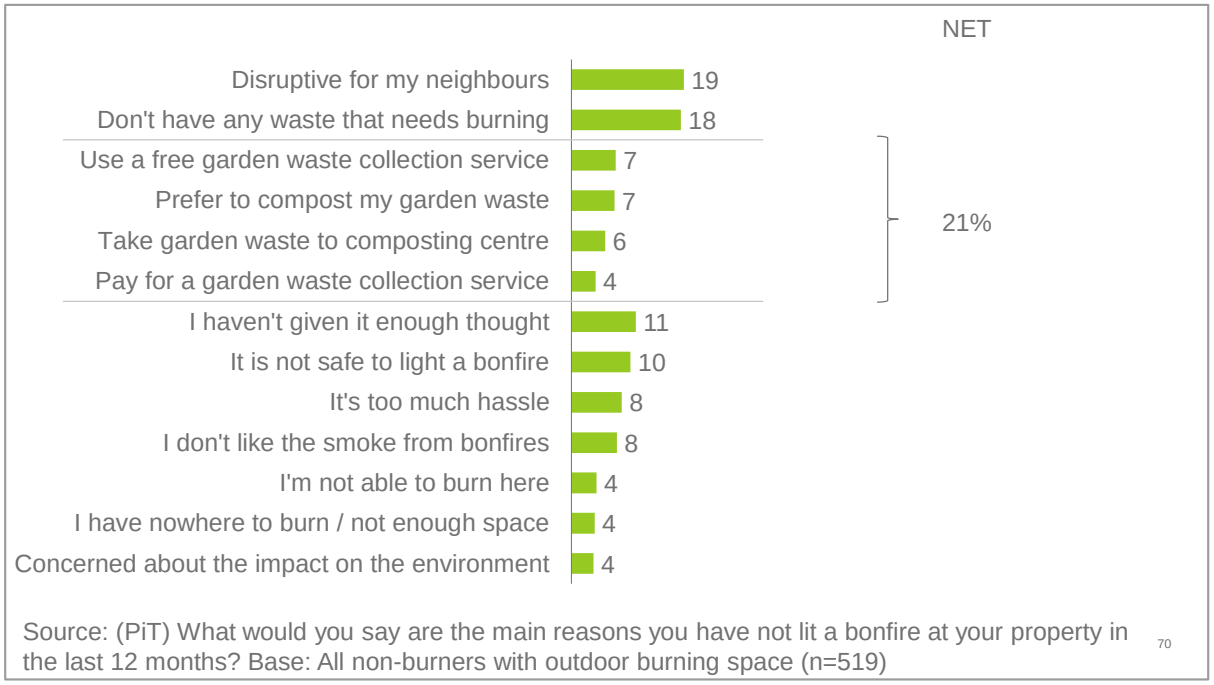
Since 75% of non-burners reported having a garden or an outside space at their property where they could light a barbecue, outdoor burner or bonfire, the decision not to burn outdoors was *not* purely circumstantial for the majority of those who did not burn. The lack of space to burn outdoors was more often reported by social grades DE (39%), those who rent (44%) and flat dwellers (67%).

10.6.1 Reasons non-burners have not made a bonfire the past year

Among those with a suitable space, the main reasons given for not making a bonfire outdoors were related to not wanting to disrupt neighbours (19%), not having waste to dispose of (18%) or using other means for disposing of waste (overall, 21% said they used other means - see Figure 10.6). The alternative waste disposal methods mentioned included garden waste collection (7% free, 4% paid for), and composting (7% generally, 6% mentioning a composting centre). One in ten said they had never given any thought to lighting a bonfire (11% of non-burners with outdoor space). Very few said they did not burn one because of concerns about the impact on the environment (4%).

[93] The small sample size means further analysis is only of potentially indicative value.

Figure 10.6 Main reasons for not burning a bonfire (% of non-burners, multi-response allowed)



Note: Only responses equal or higher than 3% included in chart.

10.6.2 Plans to burn outdoors over the next year

Three in ten (28%) non-burners said that they thought they would burn outdoors in some way in the next 12 months, a far larger percentage than those who thought they might burn indoors in the future. This reinforces the findings from the qualitative research that non-burners are less likely to consider starting burning indoors than burning outdoors. Practical and financial barriers, such as appliance installation costs and disruption, were seen as much larger deterrents in relation to indoor burning than outdoor.

Not surprisingly, the possibility offered by opportunity appeared to play a role in who said they might burn outdoors in the next 12 months, with plans to burn outdoors more common among non-burners living in detached houses (44%) than flats (10%). A greater proportion of non-burners were planning to burn outdoors in the next year in urban areas (32%) than in rural areas (16%), as was the case for those in social grades AB (36%) and C1C2 (34%) compared with DE (12%). Those in retired households were less likely to have plans (15%) than those with children (33%). Plans for burning most often involved using a barbecue: either gas[94] (13%) or solid fuel (12%). Very few were planning a bonfire (3%). Given that outdoor cooking was the main reason given for outdoor burning by those currently burning outdoors, it is unsurprising that future intention to burn outdoors reflects this.

10.6.3 Non-burner awareness of smoke control areas

Non-burner awareness of whether or not they live in an SCA was very low with only 28% of those living in an SCA aware that they did, and 10% of those not living in an SCA erroneously thinking that they did. Non-burners were more likely to be unsure of whether

[94] Gas BBQs were included in this section of the questionnaire to distinguish between them and solid fuel burning BBQs, but they were otherwise not included in the rest of the study as they do not meet the definition of solid fuel burning.

they lived in an SCA or not (66%) than indoor burners (34%). This suggests that living in an SCA has very little influence on non-burner decisions not to burn.

There was no difference between respondents who did and did not live in an SCA in whether or not they had considered installing an appliance or open fire, or in the reasons given for *not* considering burning indoors. Given the lack of awareness about SCAs among non-burners, it is perhaps not surprising that SCAs did not seem to be a potential factor in the decision to burn (although they were not directly asked this).

11. Conclusions

The aim of this chapter is to address the eleven research questions that informed the research, discuss what this might mean in terms of areas for action, and outline remaining research gaps. In doing so, it highlights the key findings of this important new study of domestic burning in the UK. It involved conducting: a core activity survey (CAS); a point-in-time survey of burners (PiT) and separately of non-burners; qualitative interviews and focus groups; and secondary analysis of the English Housing Survey findings from 2003 to 2016, and the 2011 Energy Follow-up Survey that throw light on appliance ownership and usage. The research provides not only an update on the data from the 2016 BEIS study on wood burning, but extends coverage to look at the use of other fuels. For the first time, it also presents evidence on the nature and extent of outdoor burning in the UK.

Throughout the conclusions, it is important to keep in mind the distinction between how many people perform a particular burning activity, how often they do it and the quantity of fuel they burn when they do it. These conclusions principally focus on the first two of these, giving us important insights into the incidence of burning and into burning practices in the round but not the quantity of material burned. Defra's work to estimate burning quantities based on the data gathered in this research is included as Annexe A.

11.1 Indoor and outdoor burner profiles

Survey data from this research (referred to as 'the Kantar research' in this chapter to distinguish it from other sources of evidence on domestic burning discussed) and secondary analysis of older surveys[95], conducted by BRE as part of this wider project, corroborated the average profile of indoor burners. Solid fuel heating systems were overwhelmingly found in owner occupied homes; most often in detached, semi-detached or large terraced houses, and typically outside of city centres. Households that used these systems were most likely to be owner-occupiers, in the highest income band, aged 45 and over and white. These burners tended to use their solid fuel appliance alongside other forms of heating, usually gas or electric.

However, those who used solid fuel systems for all or most of their heating (11%) – termed primary burners in this report – had a different profile. They were more commonly located in rural areas and consequently were less likely to be connected to the gas grid (55% did not have access to gas). They were also older and tended to be less affluent, with a greater proportion (35%) saying they found it difficult to meet their fuel and energy costs.

Outdoor burners (who included many barbeque users) were more likely than indoor burners to live in urban areas (82% compared with 68% of indoor burners), in flats (5% compared with 1%) and to rent their property (22% compared with 8%). Outdoor burners were more likely than indoor burners to have children at home (40% compared with 33% of indoor burners), and only 12% were retired or semi-retired (compared with 20% of indoor burners). Those who burned both indoor *and* outdoor were most likely to report a gross income of above £50,000 per year (34%, compared to 23% and 21% of outdoor and indoor burners respectively).

[95] The EHS and the 2011 Energy Follow-Up Survey (EFUS).

11.2 Addressing the research questions

11.2.1 What proportion of the population burn in their home and garden respectively?

The Kantar research found that, overall, 19.4% of the UK adult population had burned solid fuels in their home and/or garden in the year prior to being surveyed. 8.0% of the population had burned solid fuels indoors, and although the percentage burning in their garden was larger at 13.6%, the frequency of burning, on average, was smaller (see next section). These statistics include the 2.2% of the UK population who had burned both indoors and outdoors in the year prior to being surveyed, demonstrating that most of those who burn outdoors do not burn indoors and vice versa.

The incidence of indoor burning found in the Kantar research (8% for solid fuel usage generally, and c.7% for wood fuel users, including waste wood) is similar to the 7.5% figure provided by the BEIS residential wood use study conducted in 2014 and 2015. It is also relatively similar to -- but lower than -- the 2011 Energy Follow-Up Survey which found that c. 9.5% of respondents used a solid fuel burning system for primary or secondary heating in England. (That study did not cover the rest of the UK and is focused on heating systems alone). Kantar's England-only indoor incidence rate is 7.3%, of whom 13% burned for cooking and/or heating water only, and not heating[96].

Together these results suggest that the incidence of indoor burning, in terms of the percentage of households that burn indoors, has probably not risen since at least 2011, and may have even declined. However, the impact of the incidence rate on the quantities of solid fuel burned and on the emissions that are emitted from burning these fuels depends on a number of other factors: the type and number of burning appliances in a household, how extensively each is used, how they have been maintained, what fuels are used in these appliances, how they are burned, etc. Annexe A provides a summary of Defra's analysis of what the data collected by the Kantar research suggests in terms of quantities of solid fuels used in domestic settings[97].

The Kantar research found significant regional variations in terms of where indoor burning occurred: in particular, prevalence of indoor burning was far higher in Northern Ireland (27%), and also higher in Wales (12%) and in rural areas (13%). Notwithstanding the higher prevalence of burning in rural areas, these findings corroborate BEIS's earlier work showing that most of the UK's indoor burners live in *urban* areas. This reflects the fact that the majority of the UK population lives in urban settings. The research also suggest spatial variations in how dependent people are on solid fuels. Though the incidence of indoor burning was higher in Northern Ireland and in Wales, the PiT survey found that the highest proportion of those who burned for most or all of their heating lived in Scotland (22% of indoor burner respondents in Scotland).

The research also highlighted spatial variations in outdoor burning practices, which differed from indoor practices. A higher percentage of UK outdoor burners lived in London (15%), the South East (21%) and in England as a whole (88%) compared with the percentage of UK indoor burners living there (London - 5% of indoor burners, the South East - 16% of indoor burners, and in England as a whole - 76% of indoor burners).

[96] The questions asked to establish what we are calling here 'incidence rates' were different, with the Kantar research defining burners as those who said they had burned in the last year, whereas the other studies drew on data that asked about burning more generally.

[97] It also mentions what further information is needed in order to be able to estimate the emissions resulting from this burning.

11.2.2 What do people burn when and on what[98]?

This section starts with a brief description of the seasonality, frequency, and types of solid fuels and appliances used, both indoors and outdoors. Specific data on quantities of fuel used is not presented in this report but, as highlighted above, the findings from the Kantar research have been drawn on by Defra to produce a quantification estimate of different solid fuels burned in the UK over 2018-19, the findings of which are being published as a separate annexe (Annexe A).

As might be expected, there were large variations between indoor and outdoor burners in terms of the frequency with which they burned, the season(s) in which they burned, what they burned and where they burned (i.e. the type of appliance they used). There were also large variations within these two groups of burners (indoors and outdoors).

Indoor burning

Analysis of the English Housing Survey (EHS) between 2003 and 2016 conducted as part of this project showed that existence of primary solid fuel heating systems had fallen below 1% in England, whilst there had been a rise in the ownership of secondary solid fuel appliances, driven largely by stove installation. It indicated that by 2016, around 7% of English dwellings had open fires and that a similar proportion had stoves, with the latter increasing from around 2% in 2003[99]. However, the EHS does not tell us which are in use (or provide data on what is happening elsewhere in the UK) and additional analysis of the associated 2011 Energy Follow-Up Survey (EFUS) showed that having a burning appliance in the home does not necessarily equate to usage.

The BEIS study on domestic wood use, which explored domestic burning over the period from autumn 2013 through the following year, suggested open fires accounted for 43% of all appliances used indoors, and closed stoves 52%[100]. Whilst the overall incidence of indoor burning is similar, the Kantar research presented in this report (conducted in 2018-19) points to an increase in use of stoves in all areas of the UK, apart from Northern Ireland – with six in ten respondents overall (58%) stating that stoves were the main appliance they used in the previous week, and only 31% burning on open fires as their main appliance in the seven days prior to being surveyed.

Reflecting this, 96% of main appliances installed by respondents since 2009 had been stoves. Although the nature of the questions on appliances in the two studies mean that the findings are not directly comparable, this difference does suggest there continues to be a shift in type of solid fuel systems being used in the UK towards stoves and away from open fires[101].

The Kantar core activity survey (CAS) found that during the 2018-19 period 19% of indoor burners burned in spring (for an average of 15.1 hours)[102], 7% in summer (for an average of 8.7 hours), 33% in autumn (for an average of 20.8 hours) and 61% in winter (for an average of 27.9 hours). This indicates that indoor burners do not necessarily burn every week even in the winter, but also that some burning does occur in the summer. (Some of those interviewed as part of the qualitative research mentioned occasionally lighting fires

[98] The actual research question asked: 'What do people burn when and in what quantities?' Specific data on quantities of fuel used is not presented in this report but, as highlighted above, the findings from the Kantar research have been drawn on by Defra to produce a quantification estimate of different solid fuels burned in the UK over 2018-19, the findings of which are being published as a separate annexe (Annexe A).

[99] One significant difference between indoor burning in the UK traditionally and that which takes place in other European countries and further afield is the appliance mix (and in particular the use of open fires which emit many times more particulate matter than more efficient, closed stoves).

[100] The DWUS asked about all appliances that were used in the home in the last year.

[101] https://www.gov.uk/government/publications/summary-results-of-the-domestic-wood-use-survey

[102] The figures for spring are based on less data than the other seasons and is also an aggregation of data from the last month of spring of 2018 and the last month of spring 2019: it is therefore less robust than the percentages for the other seasons.

in the summer if the temperature dropped and solid fuels may also be used for cooking or heating water in summer if respondents do not use alternatives).

Concurring with the Kantar findings, additional analysis of the 2011 Energy Follow-Up Survey, conducted as part of this project, indicated that secondary heating systems, including solid fuel systems, are mainly used in the coldest months of the year to supplement the main heating system, rather than being used as an alternative to the main heating system in the 'shoulder' months (the months immediately preceding and following the main heating season) as some have suggested. However, households with a secondary heating system which uses solid fuel tended to use it for more of the year than those with other types of secondary heating systems (for example, electric or gas fires).

Another of the notable findings from the Kantar research is the extent to which those burning solid fuels indoors mixed the types of fuel that they used. The findings from the qualitative work pointed to householders making deliberate choices of what solid fuels to burn when during the burning process, such as using coal to prolong a wood fire. Therefore, whilst the brief summary of solid fuels used in indoor burning is organised in three major fuel categories, it is important to note that 45% of indoor burners in the Kantar PiT survey reported burning some form of coal as well as wood and/or waste wood, at least on occasion. Concurring with this, a quarter of CAS respondents said they had burned both coal and wood in the previous week (although it is not clear whether these fuels were burned together on the same fire).

Wood

Approximately 86% of Kantar's core activity survey respondents who burned in the previous week used some form of wood fuel (wood logs, wood briquettes, wood pellets, wood chips and/or waste wood), either on their own or in combination with other solid fuels: 58% burned wood fuel on its own[103], whilst 25% burned wood and coal (house coal, smokeless coal, and/or coal briquettes), rarely with other solid fuels. 73% had burned wood logs, 16% wood briquettes, 14% wood pellets and 13% wood chips, and 12% burned what they classified as waste wood, although it is possible that some of those who burned wood they had gathered and chopped themselves classified this as wood logs.

Although 22% of indoor burning respondents in the PiT said they *only* burned wood generally (logs, wood chips, pellets or briquettes) and not waste wood or other solid fuels, around half said they burned some form of *waste* wood[104] at least on occasion, providing further confirmation of the extent to which wood fuel is sourced informally.

Coal

Kantar's core activity survey found that 38% of those burning indoors had burned coal in the week prior to being surveyed[105], with 13% of respondents only burning coal and 25% burning a combination of coal and wood. In terms of the types of coal burned, 22% of all indoor burners who had burned anything in the week prior to being surveyed had burned smokeless coal, 21% house coal, and 9% coal briquettes (with some burning more than one type). Of those who burned coal the previous week, over a third had only used smokeless coal (38%) and a similar proportion said they had only used house coal (35%). 26% had used both.

[103] 22% of PiT respondents suggested that in general they only burned wood (not including waste wood).

[104] Includes pallets, salvaged wood (i.e. wood that has been discarded e.g. from building sites or skips and old furniture/fence posts/other items from the home) and fallen wood from trees.

[105] Kantar's PiT survey found that around half (48%) of indoor burning respondents had burned coal (house coal, smokeless coal and/or coal briquettes) on occasion, though just 4% used it exclusively.

The PiT suggests that coal usage was more common amongst burners with open fires and those who used solid fuel to provide all or most of their heating.

Other fuels

While Kantar's PiT survey found that around four in ten indoor burners (37%) said they burned household waste indoors[106] at least occasionally, figures from Kantar's CAS suggested that only 2% of those who had burned indoors in the last 7 days had burned waste. This suggests the burning of household waste is infrequent, although in the PiT, those using solid fuels for all or most of their heating were more likely to say they burned household rubbish at least on occasion.

It is not clear what types of rubbish were being burned (many of those interviewed as part of the qualitative work burned paper or cardboard, often to help start a fire and/or to get rid of confidential letters). When asked directly, only 2% said they burned *plastics* indoors (either sometimes or rarely).

Outdoor burning

As a result of the Kantar research, we now know that outdoor burning is more prevalent on a population basis than indoor burning, although on average the frequency of burning outdoors appears to be lower. There was again a seasonal dimension to outdoor burning, but largely inverse to that of indoor burning. Those using barbeques (60% of outdoor burner respondents), firepits (12%) and chimeneas (7%) largely used these in the summer, while burning on bonfires (which 7% of outdoor burners did) was more of a year-round activity that peaked in the autumn.

The PiT suggests that a third (33%) of those who used barbeques did so once a week or more in the season they used them the most, while bonfires were much less frequently used, with only 1% of those who had bonfires having one once a week or more in the 'peak' period. The majority (65%) of bonfire burners lit bonfires no more than three times a year.

Barbeques were used by a greater percentage of outdoor burners in urban areas (70% compared with 57% of outdoor burners in rural areas), whilst a greater percentage of outdoor burners living in the South East had bonfires than was usual across the UK (11% as opposed to the average of 7%).

The two main reasons respondents gave for burning outdoors were cooking (the reason given by approximately two-thirds of outdoor burners in Kantar's PiT survey) and burning to dispose of waste (cited by almost a third of outdoor burners). This helps to explain the nature of fuels burned: 46% of outdoor burners said they burned charcoal; 15% said they burned waste wood, which includes both fallen wood from trees and treated wood; 14% burned household waste, and 12% said they burned garden waste. In addition, 27% of outdoor burners said they burned wood (logs, chips, pellets and/or briquettes) and 13% that they burned coal. Most outdoor only burners (87%) estimated they spent less than £50 a year on fuel, of whom over 40% did not spend anything at all.

What the above findings suggest is that there are two very different main practices involving outdoor burning: barbequing and having bonfires. They are different in terms of their purpose, the season they are done, their frequency, the numbers of adults engaged in them, where they are done and the solid fuel used. Moreover, whilst there are those who both barbeque and have bonfires, Kantar's PiT survey suggests that often they are done by different people. In addition, the data also point to a group of people who burn

[106] This may include newspaper and/or tissue paper as well as other forms of waste.

outdoors for warmth and/or to create a homely feel, particularly among those who used firepits and chimeneas.

11.2.3 How do burners obtain the materials that they burn?

Kantar's PiT survey found the most common ways that respondents sourced their solid fuels was by purchasing them through a specialist supplier (for example, from a wood or coal merchant - 43%) or general supplier such as a supermarket or petrol station (38%). Just over half, 57% of indoor burners said they *only* used one of these two avenues to source their solid fuel and did not get their fuel any other way.

In line with this finding and the results of BEIS' earlier domestic wood use survey[107], the Kantar CAS research showed that the majority of indoor burners who burned *wood* in the previous week (59%) had also acquired it from a general or specialist supplier. However, the CAS results also corroborate BEIS' previous findings on the significance of the 'grey market'[108] for wood and of collecting or salvaging of wood from free sources. A third of CAS respondents (32%) who had burned wood[109] in the previous week they had accessed for free. Respondents reported sourcing wood from friends and/or family members, farmers and landowners, by salvaging it from skips and elsewhere, gathering it in public places and/or obtaining it from their garden (each being named as a source by between 6 and 11% of those who had burned indoors in the week prior to being interviewed).

Kantar's CAS study found that half (51%) of those who had burned wood the previous 7 days had got it pre-dried or seasoned. In addition, a quarter said they dried or seasoned their own wood. Among those that did, 16% said they had seasoned it for at least 12 months, but 9% said they had seasoned it for less than 12 months. In addition, 11% admitted they burned unseasoned wood. Based on the definition of wet wood used in this report, this means that 20% of all those who had burned wood in the week leading up to being interviewed had burned wet wood[110]. (Note, this is the percentage of respondents, not of wood being burnt). Additionally, 12% were not aware of the level of seasoning of the wood they burned.

Among those who burned outdoors (only), the CAS study found that 39% sourced the wood they had burned in the last week from a general supplier and 18% from their own garden.

11.2.4 What are the reasons why people do and do not burn at home?

Indoors

Though most burners had access to alternative heating sources, such as gas and electric, the Kantar research found that the main use of indoor solid fuel appliances was to provide heating (although a small proportion burned in order to heat water, cook and/or to dispose of waste). The research suggests a range of circumstantial factors that may influence the decision to use solid fuels to heat with, such as the nature of housing stock and tenure, which can provide an opportunity or an impediment to burn. For example, older houses are more likely to have chimneys that allow burning, and tenants have less say over decisions affecting their property.

[107] https://www.gov.uk/government/publications/summary-results-of-the-domestic-wood-use-survey

[108] Informal but paid for e.g. wood bought from a local landowner

[109] The question was not asked of those who exclusively burned what they classified as waste wood.

[110] If those who did not know the seasoning of the wood are removed from the totals, this translates into c. 23% of respondents who burned wet wood.

Location can also play a role in terms of the alternatives available (such as access to mains gas and/or a grey market for obtaining wood), and regulation (for instance, the presence of smoke control areas) might also be a factor for some. Lastly, affluence affords more choice as to whether or not to burn (linked both to property ownership and to being in a position to install modern appliances).

Given few burners had no alternative heating system, the findings highlight a range of reasons why people choose to burn indoors if circumstances allow: these include the emotional appeal of fires, wanting to save money or avoid putting on the central heating, and the desire for supplementary warmth. Previous experience of burning, particularly in childhood, also was a factor for some.

As a result, the Kantar research provided the basis for a segmentation of indoor burners into five groups based on the reasons they gave for burning. The name of each segment aims to highlight what are seen as its key differentiators: Necessity, Thrift & Self-reliance, Supplement, Tradition and Aesthetics (though the analysis done can only point to correlations, not causation). These segments are potentially useful when considering policy levers and impacts, and for thinking about tailoring communications to different indoor burner audiences.

- The **Necessity** segment is strongly defined by their use of solid fuel burning for most or all their heating.
- The **Thrift and Self-reliance** segment is strongly driven by the desire to save money and not to have to rely on others.
- The **Supplement** segment is defined by burning to supplement other sources of heating.
- The **Tradition** segment is motivated by the desire to produce a homely atmosphere and by family tradition and nostalgia, with most belonging to this segment having grown up with burning in the home.
- The **Aesthetics** segment is also motivated by wanting to produce a homely atmosphere, and often also by the pleasure of watching a fire, but members tend to be less experienced burners.

Outdoors

As discussed above, the Kantar research found that the major driver for outdoor burning was cooking, though this was more common among more affluent younger families, particularly in more densely populated areas. Burning waste (the second most common driver for outdoor burning) was more common among burners in rural areas and amongst retired households.

Reasons given for burning outdoor were in line with the type of burning done and appliance used. Waste disposal was the most frequently mentioned reason for outdoor burning by bonfire burners (84%) for example. Barbeque users meanwhile were primarily motivated by their enjoyment of cooking outside (87%). Fire pit and chimeneas users were more often motivated to burn for warmth and to create a homely feel.

Non-burners (see Chapter 12 for details)

The Kantar research found that the most common reasons non-burners gave for not burning indoors were that their current (heating) system worked well (42%), their property was not suitable (11%), the cost of the appliance/installation was prohibitive (10%), and/or that they lived in rented property (8%). In essence, this suggests practical and circumstantial reasons were dominant in people's decision not to burn indoors, though a minority did give reasons that suggested a dislike of burning.

In terms of outdoor burning, the main reasons given for not having a bonfire were concern it would be disruptive to neighbours and not having any waste to dispose of, although a range of other reasons were also provided.

11.2.5 What are the drivers of purchasing decisions for materials and appliances?

The PiT found that for half of indoor burners who had bought an appliance (usually a stove), its efficiency or how much heat it gave off was a key factor in their purchasing decision. However, the look or design of it was (also) important for over a third (37%). 21% took account of size (see Chapter 4 for more details). Cost and quality of fuel were the most important reasons given for purchasing decisions in relation to solid fuel for indoor burning.

11.2.6 To what extent do people use efficient burning methods when they burn?

Chapter 5 outlined the Kantar research findings on a range of practices that are likely to impact on how efficient burning methods are from an emissions and safety perspective. It illustrated that whilst what many respondents said they were doing was in line were with recommended advice, some was not:

- About a third of main indoor burning appliances used in a given week were open fires which tend to be much less efficient than stoves; and about a third of stoves being used were installed before 2009, which tend not to be as efficient as more modern stoves. Furthermore, nearly half of stove owners did not know if they had Defra exempt or an Eco-design appliance (46% overall and 34% in urban SCAs) which tend to produce lower emissions. However, 85% of those who installed a stove since they moved in, had had it installed by a HETAS registered installer.
- As outlined earlier, approximately two-thirds of indoor burners who used wood (which was the majority of indoor burners) either had burned pre-dried/seasoned wood they bought or wood they seasoned for a year or more in the week prior to being surveyed. They were therefore using dry wood. However, 20% burned wet wood (as defined in this report), which would have resulted in higher emissions, and 12% did not know how seasoned the wood they burned was.
- 68% of indoor burners (and 73% of those burning for most or all of their heating) had their chimney swept at least once a year, but the remainder (26%) did not or could not remember the last time it was swept (a further 7%) potentially resulting in a greater risk of chimney fires.
- A third of those who burned for most or all of their heating banked their fires at night, which can be dangerous in terms of releasing carbon monoxide and result in higher PM emissions due to a lower burning temperature.
- 79% of stove owners said their chimney was lined (as tends to be advised), but 12% said it was not and 8% said they did not know.
- 60% of indoor burners said they had an air vent that was left permanently open (recommended, but not always necessary depending on the nature of properties and appliances). 35% said they did not have a vent (perhaps for the exemptions outlined) and 1% said the air vent they did have was kept taped up.

Shedding additional light on these practices, through the qualitative interviews the Kantar research found that burners tended to believe they were engaging in good burning practices (whether they were or not), which were developed through trial and error, and 'common sense', and then became habitual. Many knew that burning wet or treated wood was not a good idea, and that wood needed to be seasoned before burning, but there were mixed views on what such terms meant, and some did not always put this knowledge into practice.

11.2.7 Are people aware of whether they are in a smoke control area (SCA)?

The findings of the Kantar research also show that indoor burning was relatively prevalent in smoke control areas: indeed, around a third of urban respondents who burned indoors lived in an urban SCA (35%). This does not indicate that SCA rules are ineffective: people living in SCAs are currently allowed to burn indoors if they use an authorised fuel or exempted appliance[111]. However, a third (32%) of indoor burners in urban areas did not know whether they were living in an SCA or had not heard of SCAs; and among indoor burners who thought they did live in an urban SCA (26% of indoor burners in urban areas) 29% did not.

11.2.8 To what extent are people aware of the environmental and health impacts of burning?

Indoor burners (see Chapter 6 for details)

Kantar's PiT survey found that almost half of indoor burners (46%) agreed that burning in people's homes and gardens is a significant source of air pollution. However, only 27% expressed concern about the impact their burning might have on their health and those around them.

Outdoor burners (see Chapter 9 for details)

The pattern was similar for outdoor burners. 42% agreed that burning in people's homes and gardens is a significant source of air pollution. However, only 32% were concerned about the impact their burning might have on their health and those around them.

Non-burners (see Chapter 10 for details)

Views of non-burners were also similar. Kantar's research found that just over half of non-burners (53%) agreed that burning in people's homes and gardens was a significant source of air pollution. 42% were concerned about the impact burning might have on their health and those around them.

Together, the figures above suggest that there is some awareness of the environmental impacts of burning but potentially less so (or less concern) about the impacts of burning on health[112]. However, the data also suggests that about half of burners and non-burners alike[113] were not aware or did not believe that burning was a significant source of air pollution. In addition, over half were unconcerned about the impacts burning might have on their own health or the health of those around them.

[111] https://www.gov.uk/smoke-control-area-rules

[112] Evidence of the impacts on health is based on the contribution of burning to $PM_{2.5}$ in the atmosphere and the negative effects $PM_{2.5}$ is known to have on health, rather than direct inhalation of smoke within UK indoor environments where research and evidence is relatively scarce.

[113] Based on an unweighted PiT survey sample of about 2,500 people.

11.2.9 What is the likely future uptake of domestic combustion behaviours amongst those who do not burn?

Although it is not possible to predict future uptake of solid fuel burning, the Kantar research findings did provide a few signs that there may be further expansion of the market, most likely in relation to secondary heating[114].

The first sign is that the percentage of burners who said (in the PiT survey) that they had started burning recently was quite high: 36% of indoor burners had begun to burn in the last five years. This could suggest that though the incidence of burning does not appear to have risen in the last few years, it may now do so, particularly if those who are now starting are in younger age groups. However, this is not clear and a rise partly depends on how many stop burning. (The research also found that 12% of those with appliances installed pre-2000 were considering upgrading, indicating a degree of commitment to continuing the practice).

The second is that although many non-burners had little interest in burning, burning was seen as aspirational for some: 16% of non-burners agreed that they would consider burning at home in the future and 5% had considered installing a solid fuel burning appliance or restoring an open fire in their residence. Interestingly, the profile of this 5% was not dissimilar to that of existing burners. Moreover, although they only made up a small proportion of non-burners, it would nevertheless represent a significant increase in the size of the UK population burning solid fuels indoors (which currently stands at 8%) were such a percentage to take up burning in the future, with potential knock-on impacts on emissions. However, again this would depend on how much burning any new burners did, what solid fuel and appliances they used and how they used them.

11.2.10 What are the barriers to stopping burning, reducing the amount of fuel being burnt and adopting burning behaviours with lower environmental impacts?

Although, the Kantar research found that the majority of indoor burners used open fires and stoves as a form of secondary heating alongside other heating systems (see Chapter 3), the exploration of why people burn in Chapter 6 revealed additional perceived benefits from burning (despite some recognising the potential environmental and health impacts too). These ranged from financial benefits (such as reduced energy costs) to practical benefits (for example, burning of confidential waste), and/or emotional benefits (such as positive feelings of self-sufficiency and/or positive associations with comfort or energy security). These benefits can also be seen, to varying degrees, as potential barriers to changing burning behaviour.

Moreover, the qualitative interviews suggested that many burners seemed highly confident in and protective of their burning practice and that non-burners also often acknowledged the attraction of having a fire. Indeed the non-burner PiT survey found that approximately half of non-burning respondents supported burners' rights to burn in their own home (55% agreed), and 45% did not support any restrictions on outdoor burning. This suggests that social norms, even among the non-burning majority, currently do not discourage burning.

Chapter 8 also highlighted a number of circumstantial barriers that are outlined below.

[114] Based on analysis of English Housing Survey that shows downward trends in burning appliance ownership of primary burning systems and upwards trends in appliance (particularly stove) ownership for secondary heating between 2003 and 2016 in England, where the majority of burners are situated.

Barriers to stopping burning and reducing amount of fuel burnt

In the discussions of burning being a secondary form of heating for many, it is important not to forget that 3% of indoor burners said they had no choice but to burn, whilst a much more significant minority (26%) felt that burning was a necessity (see Chapter 6). Whilst some of those who burned to provide most or all of their heating did so as an active choice, 55% were not on the gas grid, resulting in more limited options for other sources of heating (and the potential for greater expense).

Kantar's qualitative interviews with burners found that living in a remote location could not only mean difficulty in getting onto the gas grid, but challenges in either collecting or getting deliveries of alternative fuels (such as oil, LPG and sometimes coal), particularly in poor weather conditions. This led a couple of interviewees to suggest that having a working fire was an important back-up.

Beyond these practical and circumstantial barriers, the emotional appeal of burning, which both burners and non-burners pointed to throughout Kantar's research (for example, liking to watch the flames of a fire) is likely to be a large barrier to stopping burning.

Barriers to adopting burning behaviours with lower environmental impacts

Barriers relating to specific burning behaviours (as highlighted by the Kantar research findings) include:

- **Burning dry wood, not wet wood** – the qualitative research suggested that there may not be enough understanding of what dry wood means or that seasoning is important if buying or collecting wood that is not pre-dried; lack of space for storing wood was also mentioned, and could be a barrier to seasoning; for those who burned to save money; the price of pre-dried wood may also be a barrier as these research participants often took cost into account when deciding what fuel to buy.
- **Burning smokeless coal instead of house coal** – cost and availability were identified as barriers to burning smokeless coal; a few interviewees also perceived smokeless coal to be less efficient than house coal; there did not seem to be an understanding amongst these respondents that there were a variety of smokeless coals available.
- **Not burning treated wood** – the gathering and salvaging of wood meant burner respondents knowingly (or perhaps unknowingly) sometimes burned contaminated wood; burners who justified this (in the qualitative interviews) said that it was only in small amounts, or that their stove would filter out the toxins.
- **Regular chimney sweeping -** typically, burners associated frequency of chimney sweeping with frequency of appliance use, rather than with the type of fuel they burned.

11.2.11 What wider changes might lead to changes in behaviour?

The nature of the Kantar research means that it is not possible to be definitive about what would lead to changes in behaviour, particularly as the segmentation (Chapter 7) and the chapter on levers and barriers (Chapter 8) suggest that the drivers for burning are likely to differ for different types of burners. However, some suggestions can be made based on the evidence gathered:

- Raising greater awareness of the impact of burning is likely to be needed as the research suggests that many respondents (both burners and non-burners) did not

understand the negative effects of burning on health and/or the environment. The qualitative research indicated burners and non-burners alike tended to see other pollution sources as more significant. It also suggested that messaging and advice needed to be seen as credible and that this partly depends on quality of the evidence and the sources used. Potential trusted advisers included chimney sweeps, appliance providers and fitters, and fuel suppliers.

- Since indoor burners seemed to see themselves as already doing 'the right thing' steering them towards better practice may be more effective than punishing poor practice – for instance, 73% of indoor burners claimed to be willing to pay more per kilogram for a solid fuel that had less environmental impact.
- In the qualitative interviews, burners' responses to the idea of greater powers for local authorities suggested some resistance to greater regulation and enforcement of burner practice, with burners tending to see this as interference in the private sphere. However, both burners and non-burners discussed the importance of safety, which may suggest that this might be a way of framing discussions to encourage adoption of better practices.
- Very few outdoor burners reported receiving complaints about outdoors burning, though 79% said they would burn less outdoors if they thought they were being a nuisance to their neighbours. The qualitative interviews indicated a concern to burn responsibly outdoors. This suggests that highlighting the negative impacts of outdoor burning on other people could dissuade some from burning or burning as much, but that more frequent outdoor burners may be harder to persuade.

11.3 Links between socio-economics and burning

Whilst the Kantar research suggests that burning tends to be associated with greater affluence, it also highlights the diversity of burners, notably showing that some struggle with their energy bills (15% of all indoor burners said they found it fairly difficult to meet their energy bills and 3% said they found it very difficult). The segmentation analysis also highlighted some of the groups that might find it more challenging to adapt to any changes in burning requirements which result in increased costs. Approximately a quarter of the Necessity segment (8% of indoor burners), a quarter of the Thrift & Self-Reliance segment (24% of indoor burners), and a quarter of the Supplement segment (23% of indoor burners) reported difficulty in currently meeting their energy costs. They may also face other barriers, such as a lack of access to the gas grid in the case of the Necessity group (55%).

11.4 Encouraging better burning

The Kantar research suggested that a large proportion of burners did not seek advice or guidance when it came to burning practices, which may present a challenge when communicating best practices. The qualitative research indicates that interviewees tended to rely on 'common sense', with prior experience of burning and a sense of 'tradition' contributing to burners' confidence. However it also indicated that in the purchasing and installation phase, experts sometimes played a significant role in influencing decision-making. Four in five (82%) indoor burners who had installed their appliance since moving into their home had had it installed by a HETAS registered installer. The qualitative research suggests, moreover, that engagement with advice on good burning practice was higher among interviewees with a newer appliance. This may indicate that for many this initial stage is important for establishing good habits.

This said, some of these burners inherited their appliance and others had installed theirs long ago. There is some risk in these cases that knowledge was not sufficiently established or had fallen away over time. A regular touchpoint for ongoing review and instruction may therefore be beneficial. Chimney sweeps (or related professionals) could be used in this capacity. Again, the qualitative research suggests that those respondents who used them tended to see them as a credible source on maintaining their appliance and chimney and general burning practices. A high proportion of indoor burners (85%) expressed willingness to have their appliance tested annually to ensure it is working efficiently. Another credible source of information that was mentioned was solid fuel providers.

The Kantar research certainly highlighted a number of areas in which better burning practices should be encouraged; the list below also highlights which burners are more likely to be receptive to such encouragement based on the findings of this research:

- Burning less – particularly relevant to the Traditional and Aesthetic segments for whom burning tends to be a secondary source of heat;
- Encouraging people to use more efficient appliances – likely to be more appealing to those for whom saving money is a major motivator and who burn for most or all of their heating, if they can afford the upfront costs of a Defra exempt or Eco-design ready stove;
- Ensuring proper installation and maintenance of appliances (e.g. chimney lining, ventilation, sweeping and maintenance) – those for whom safety is a particular concern and/or who have financial means are probably more likely to adopt such behaviours; Aesthetic burners who tend to be less experienced may be more willing to adopt them as well;
- Developing a shared understanding of good wood seasoning practices and encouraging burners who burn wood to burn dry wood – a focus on those who gather and salvage wood or buy unseasoned wood in large quantities may be particularly effective, as these practices are not regulated by the recently introduced domestic fuels legislation;
- Discouraging the burning of household waste (particularly plastics) and treated wood – the segmentation and surveys do not provide much insight into who the burners are who do this, but it is clear that it is done by a few; the qualitative interviews suggest that this is perhaps because there is mixed understanding of what type of materials are problematic; a focus on raising awareness of what wood is treated (for example, that this can include pallets, depending on origin), the toxins that burning these products emit and the resulting health impacts may be worth exploring;
- Encouraging the use of smokeless coal -- helping house coal users to understand the varieties of smokeless coal available and their cost-effectiveness is likely to be the best way forward, regardless of segment.
- Discouraging practices such as banking and slumbering fires (by restricting the ventilation in stoves) – probably easiest among less frequent burners, particularly the Aesthetic group, although they are also less likely to do this; focusing on safety concerns may be the best way to reach other burners in other segments;
- Raising awareness of good practice regarding outdoor burning – outdoor burners in the qualitative interviews were keen to have more information so that they could burn responsibly outdoors (for example, a number aimed to avoid burning when neighbours had their laundry out); ensuring materials include a separate

focus on those who cook outdoors, those who burn garden and/or other waste outdoors and those who burn for warmth outdoors may potentially facilitate engaging with the range of outdoor burners.

11.5 Identifying needs for further analysis and research

It will be important to further investigate the extent of the issue around burning household waste once information on the quantities of materials being burned becomes clear. There is a marked difference between, for instance, the use of newspapers to start fires and the systematic use of indoor (or outdoor) burning for disposing of waste. The analysis of quantities will help clarify this and provide a better evidence base for gauging emission impacts.

There are also a number of policy-relevant research needs highlighted by this study. The first is a continuing need to monitor (a) whether there are any changes in the incidence of domestic burning over the next few years, particularly given the percentage of burners who started burning relatively recently, (b) whether there continues to be a shift towards use of stoves, and if so, what age, size and type of stoves, and (c) whether this leads to any changes in the intensity of burning (how much people burn in terms of time and fuel quantity).

Linked to this is the need to continue monitoring what people burn and how it is sourced. Not only is this important to help understand the impact of the solid fuels policy, it will also assist in monitoring the market penetration of new fuels, and if appropriately designed help to disentangle the waste wood and household rubbish categories. There is a particular need to understand the effects of solid fuel policy on less affluent primary burners, in particular those in the Necessity segment, and how they respond.

More specific questions associated with some of the above that qualitative work might provide some more insight into include:

- Do those who burn wood have a better understanding of what seasoned wood is and of the seasoning process? What difference has this made to what they do, and with what outcome?
- Do those who burn house coal have a better understanding of the range of smokeless coal available? What difference has this made to what they do, and with what outcome?
- What household waste do indoor burners burn, and what household waste do outside burners burn, how, and for what purpose?
- What new solid fuels are indoor burners trying, why, and how do they assess them?
- Do stoves encourage burners to burn for longer? If so, why and when?
- Are burners aware of the advice provided in relation to the solid fuels policy and what do they think of it? Has it impacted what they do?

Appendices

A. Differences in burning behaviour

Table A.1: Proportion of burners and non-burners within the general population (CAS)

	ALL UK	Social grade			Housing tenure				Ethnicity	
All respondents		AB	C1C2	DE	Own/ buying	Own	Buy-ing	Rent	White	Min ethnic
Unwtd base	*46729*	*8348*	*21750*	*16631*	*26708*	*16924*	*9784*	*19457*	*40908*	*5539*
Burners	19%	29%	19%	11%	23%	18%	28%	11%	21%	12%
Indoors	8%	13%	7%	4%	11%	10%	11%	2%	9%	2%
Indoors only	6%	9%	5%	3%	8%	8%	8%	2%	7%	1%
Both	2%	5%	2%	1%	3%	2%	4%	0%	2%	1%
Outdoors only	11%	15%	12%	7%	13%	8%	17%	9%	12%	10%
Outdoors	14%	20%	13%	7%	16%	11%	20%	9%	14%	11%
Non-burner	81%	71%	81%	89%	77%	82%	72%	89%	79%	88%

Key: Orange: significantly higher than all UK; blue: significantly lower than all UK

Table A.2: Region and nation profile of burner/non-burner typology (CAS, from postcode)

	ALL UK	Burners						Non-burners
All respondents		All Burners	In-doors	Indoors only	Indoors & out	Outdoors only	Out-doors	
Unwtd base	*46729*	*7531*	*2996*	*2279*	*717*	*4535*	*5252*	*39198*
Nation								
England	84%	84%	76%	73%	85%	89%	88%	84%
Wales	5%	5%	7%	9%	3%	4%	4%	5%
Scotland	8%	6%	7%	7%	7%	6%	6%	9%
Northern Ireland	3%	5%	9%	11%	5%	2%	2%	2%
English Region								
North East	4%	3%	3%	3%	2%	4%	3%	4%
North West	11%	11%	12%	12%	11%	10%	11%	11%
Yorkshire & Humber	8%	7%	7%	7%	7%	6%	6%	9%
East Midlands	7%	7%	8%	8%	9%	6%	6%	7%
West Midlands	9%	8%	7%	7%	7%	9%	9%	9%
East of England	9%	9%	8%	8%	10%	10%	10%	9%
London	13%	12%	5%	4%	7%	17%	15%	13%
South East	14%	19%	16%	13%	23%	20%	21%	13%
South West	9%	8%	10%	10%	8%	7%	7%	9%

Key: Orange: significantly higher than all UK; blue: significantly lower than all UK

Table A.3: Whether correctly know live in SCA or not (PiT)

	Burners					Non- Burners		
All respondents	**All Burners**	**Indoors**	**Outdoors only**	**Live in SCA**	**Not in SCA**	**All Non-burners**	**Live in SCA**	**Not in SCA**
Unwtd base	*1832*	*993*	*839*	*647*	*1179*	*731*	*292*	*436*
Live in SCA	17%	22%	12%	29%	8%	33%	28%	10%
Don't live in SCA	33%	45%	21%	13%	45%	18%	10%	20%
Don’t know if live in SCA	40%	27%	50%	46%	36%	15%	39%	50%
Never heard of SCA	11%	6%	16%	12%	11%	21%	23%	19%
NET: Unaware of whether living in SCA	51%	34%	67%	58%	47%	66%	62%	70%

Key: Orange: significantly higher than all Burners; blue: significantly lower than all Burners

Table A.4: On-grid profile of burner/non-burner typology (PiT)

	Burners						
All respondents	**All Burners**	**Indoors**	**Indoors only**	**Indoors & outdoors**	**Outdoors only**	**Out-doors**	**Non-burners**
Unwtd base	*1832*	*993*	*543*	*450*	*839*	*1289*	*731*
NET: Mains gas	82%	72%	68%	76%	92%	87%	91%
Mains gas only	2%	2%	2%	1%	2%	1%	3%
Mains gas & electricity	80%	70%	66%	75%	90%	85%	88%
Mains electricity only	17%	27%	31%	24%	7%	12%	8%
Neither	0%	0%	0%	0%	0%	0%	0%
Don't know	1%	0%	1%	0%	2%	1%	1%

Key: Orange: significantly higher than all Burners; blue: significantly lower than all Burners

Table A.5 Housing type profile of burner/non-burner typology (PiT)

	Burners						
All respondents	**All Burners**	**Indoors**	**Indoors only**	**Indoors & outdoors**	**Outdoors only**	**Outdoors**	**Non-burners**
Unwtd base	*1832*	*993*	*543*	*450*	*839*	*1289*	*731*
Detached house	25%	28%	25%	32%	21%	25%	15%
Semi-detached house	38%	36%	34%	38%	40%	39%	37%
Terraced house	27%	27%	30%	25%	27%	26%	30%
Bungalow	5%	6%	9%	3%	4%	4%	4%
Flat (in a block of flats)	2%	1%	1%	1%	3%	2%	7%
Flat (in a house)	2%	0%	0%	1%	3%	3%	4%
Maisonette	1%	0%	0%	0%	1%	1%	1%
Other	0%	0%	0%	0%	0%	0%	0%
Refused	0%	0%	0%	0%	0%	0%	1%
Don't know	0%	0%	0%	0%	0%	0%	0%
NET: House	95%	98%	98%	98%	92%	94%	86%
NET: Not house	5%	2%	1%	2%	8%	6%	12%

Key: Orange: significantly higher than all Burners; blue: significantly lower than all Burners

Table A.6: Housing age profile of burner/non-burner typology (PiT)

	Burners						
All respondents	**All Burners**	**Indoors**	**Indoors only**	**Indoors & outdoors**	**Outdoors only**	**Outdoors**	**Non-burners**
Unwtd base	*1832*	*993*	*543*	*450*	*839*	*1289*	*731*
1929 or earlier	31%	46%	43%	49%	17%	28%	16%
1930-1965	30%	26%	27%	26%	33%	31%	26%
1966-1994	18%	15%	17%	14%	22%	19%	26%
1995 or later	11%	8%	8%	8%	13%	12%	12%
Refused	0%	0%	0%	0%	0%	0%	20%
Don't know	10%	5%	6%	4%	14%	11%	1%
NET: 1966 or later	29%	23%	25%	22%	35%	31%	38%

Key: Orange: significantly higher than all Burners; blue: significantly lower than all Burners

Table A.7: Gender profile of burner/non-burner typology (CAS)

	ALL UK	Burners						
All respondents		**All Burners**	**In-doors**	**Indoors only**	**Indoors & out**	**Outdoors only**	**Outdoors**	**Non-burners**
Unwtd base	*46729*	*7531*	*2996*	*2279*	*717*	*4535*	*5252*	*39198*
Male	49%	50%	48%	49%	46%	51%	50%	49%
Female	51%	50%	52%	51%	54%	49%	50%	51%

Key: Orange: significantly higher than all UK; blue: significantly lower than all UK

Table A.8: Ethnicity profile of burner/non-burner typology (CAS)

	ALL UK	Burners						Non-burners
All respondents		All Burners	In-doors	Indoors only	Indoors & out	Outdoors only	Outdoors	
Unwtd base	*46729*	*7531*	*2996*	*2279*	*717*	*4535*	*5252*	*39198*
White	87%	92%	97%	97%	97%	89%	90%	85%
Minority Ethnic	13%	8%	3%	3%	3%	11%	10%	14%
Refused	1%	0%	0%	0%	0%	0%	0%	1%

Key: Orange: significantly higher than all UK; blue: significantly lower than all UK

Table A.9: Household composition profile of burner/non-burner typology (PiT)

	Burners						Non-burners
All respondents	All Burners	Indoors	Indoors only	Indoors & out	Outdoors only	Outdoors	
Unwtd base	*1615*	*913*	*503*	*410*	*702*	*1112*	*731*
Children in household	36%	33%	26%	40%	39%	40%	25%
No children/at least 1 adult employed	46%	45%	46%	43%	48%	46%	43%
No children/all adults retired or semi-retired	16%	20%	25%	15%	10%	12%	23%
No children/all adults unemployed, students, other	2%	2%	3%	1%	2%	2%	10%

Key: Orange: significantly higher than all Burners; blue: significantly lower than all Burners

Table A.10: Social grade profile of burner/non-burner typology (CAS)

	ALL UK	Burners						Non-burners
All respondents		All Burners	Indoors	Indoors only	Indoors & out	Outdoors only	Outdoors	
Unwtd base	*46729*	*7531*	*2996*	*2279*	*717*	*4535*	*5252*	*39198*
AB	27%	40%	46%	41%	57%	36%	39%	24%
C1C2	48%	46%	43%	45%	36%	49%	47%	48%
DE	25%	14%	12%	14%	7%	15%	14%	28%

Key: Orange: significantly higher than all UK; blue: significantly lower than all UK

Table A.11: Housing tenure profile of burner/non-burner typology (CAS)

		Burners						
All respondents	**ALL UK**	**All Burners**	**Indoors**	**Indoors only**	**Indoors & out**	**Outdoors only**	**Outdoors**	**Non-burners**
Unwtd base	*46729*	*7531*	*2996*	*2279*	*717*	*4535*	*5252*	*39198*
Own outright	33%	31%	42%	44%	36%	24%	26%	33%
Buying with mortgage/ shared ownership	34%	50%	49%	46%	57%	50%	51%	31%
Rent	32%	18%	8%	9%	6%	25%	22%	35%
Other	1%	1%	1%	1%	1%	1%	1%	1%
NET: Own/buying	67%	81%	91%	90%	93%	74%	77%	64%

Key: Orange: significantly higher than all UK; blue: significantly lower than all UK

Table A.12: Income profile (household income) of burner/non-burner typology (CAS)

	Burners						
All respondents	**All Burners**	**Indoors**	**Indoors only**	**Indoors & out**	**Outdoors only**	**Outdoors**	**Non-burners**
Unwtd base	*2117*	*1294*	*990*	*304*	*823*	*1127*	*NA*
Under £15,000	7%	6%	6%	4%	8%	7%	*NA*
£15,000 - £19,999	5%	4%	4%	4%	6%	6%	*NA*
£20,000 - £29,999	12%	12%	12%	11%	11%	11%	*NA*
£30,000 - £39,999	9%	8%	7%	10%	10%	10%	*NA*
£40,000 - £49,999	8%	8%	8%	10%	9%	9%	*NA*
£50,000 - £59,999	6%	6%	5%	11%	5%	7%	*NA*
£60,000 - £69,999	3%	3%	3%	4%	3%	4%	*NA*
£70,000 - £79,999	4%	4%	3%	8%	2%	4%	*NA*
£80,000 or more	7%	7%	5%	11%	8%	9%	*NA*
Don't know	16%	15%	18%	9%	17%	14%	*NA*
Refused	24%	26%	28%	19%	20%	20%	*NA*
NET: £50,000 or more	20%	21%	16%	34%	18%	23%	*NA*

Key: Orange: significantly higher than all Burners; blue: significantly lower than all Burners

Table A.13: Ease of meeting energy costs profile of burner/non-burner typology (PiT)

	Burners						
All respondents	**All Burners**	**Indoors**	**Indoors only**	**Indoors & outdoors**	**Outdoors only**	**Outdoors**	**Non-burners**
Unwtd base	*1832*	*993*	*543*	*450*	*839*	*1289*	*731*
Very easy	33%	30%	28%	33%	35%	34%	31%
Fairly easy	49%	50%	51%	50%	48%	49%	47%
Fairly difficult	14%	15%	15%	15%	13%	14%	11%
Very difficult	3%	3%	5%	2%	3%	2%	2%
Don't know	1%	1%	1%	0%	1%	1%	9%
NET: Easy	82%	81%	79%	82%	84%	83%	78%
NET: Difficult	17%	19%	20%	17%	15%	16%	13%

Key: Orange: significantly higher than all Burners; blue: significantly lower than all Burners

Table A.14: Person with respiratory or cardiac condition in household profile of burner/non-burner typology (PiT)

	Burners						
All respondents	**All Burners**	**Indoors**	**Indoors only**	**Indoors & outdoors**	**Outdoors only**	**Outdoors**	**Non-burners**
Unwtd base	*1832*	*993*	*543*	*450*	*839*	*1289*	*731*
Yes	23%	22%	22%	21%	24%	23%	17%
No	77%	78%	78%	78%	75%	76%	82%
Prefer not to say	0%	0%	0%	0%	0%	0%	0%
Don't know	0%	0%	0%	0%	0%	0%	1%

Key: Orange: significantly higher than all Burners; blue: significantly lower than all Burners

Table A.15: Methods of heating the home profile of burner/non-burner typology (PiT)

	Burners						
All respondents	**All Burners**	**Indoors**	**Indoors only**	**Indoors & outdoors**	**Outdoors only**	**Outdoors**	**Non-burners**
Unwtd base	*1832*	*993*	*543*	*450*	*839*	*1289*	*731*
Do not use solid fuels for heating	58%	13%	12%	15%	100%	73%	98%
Only use solid fuels for heating	4%	7%	10%	4%	0%	1%	0%
Use solid fuels and another source for heating	39%	79%	77%	81%	0%	26%	0%
Don't know	0%	0%	0%	0%	0%	0%	2%

Key: Orange: significantly higher than all Burners; blue: significantly lower than all Burners

B. Differences by indoor burners segments (Chapter 7)

KEY: Orange: significantly higher than all indoor burners; blue: significantly lower than all indoor burners

	Indoor burners	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
All respondents – unweighted base size unless otherwise stated	993	89	230	218	160	242

B.1 Indoor burners: Demographics

AGE	Indoor burners	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
16-34	15%	12%	16%	17%	14%	16%
35-54	46%	39%	44%	42%	52%	51%
55-64	19%	25%	19%	25%	14%	16%
65+	19%	25%	21%	16%	20%	17%

SOCIAL GRADE	Indoor burners	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
ABC1	71%	51%	64%	73%	76%	82%
AB	46%	34%	38%	47%	48%	57%
C1	25%	17%	26%	26%	28%	24%
C2	16%	26%	21%	15%	14%	8%
DE	13%	23%	14%	11%	11%	10%
C2DE	29%	49%	35%	27%	24%	18%

WORKING STATUS	Indoor burners	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
Unweighted Base	*913*	*84*	*210*	*205*	*142*	*221*
Not FT	55%	66%	60%	50%	54%	52%
Full time	45%	34%	40%	50%	46%	48%
Part time	19%	19%	20%	19%	17%	21%
Retired	24%	30%	26%	19%	25%	20%
In Education	2%	0%	0%	2%	3%	3%
Not working	11%	17%	13%	10%	9%	9%

Children in household	Indoor burners	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
Unweighted Base	*913*	*84*	*210*	*205*	*142*	*221*
Child	33%	23%	34%	33%	33%	37%
No child	67%	77%	66%	67%	67%	63%

Annual spend on solid fuel	Indoor burners	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
£0	17%	6%	22%	15%	18%	13%
£1-£49	23%	14%	17%	21%	21%	35%
£50-99	14%	9%	10%	18%	14%	16%
£100-£199	19%	18%	24%	16%	25%	17%
£200-£299	9%	5%	11%	13%	8%	5%
£300-£499	8%	19%	8%	9%	6%	5%
£500-£749	4%	15%	1%	4%	2%	3%
£750-£999	1%	8%	0%	1%	1%	0%
£1000-£1500	2%	3%	4%	1%	1%	1%
More than £1500	0%	1%	0%	0%	0%	0%

How pay for gas/ electricity	Indoor burners	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
Unweighted Base	*989*	*88*	*230*	*217*	*159*	*242*
Monthly direct debit	82%	68%	78%	83%	90%	85%
On receipt of monthly or quarterly bill	9%	15%	11%	8%	5%	7%
Pre-payment (key card or token)	7%	16%	8%	8%	5%	4%
Included in rent	0%	0%	0%	0%	0%	1%
Other	1%	0%	0%	1%	0%	1%
Don't know	1%	2%	3%	0%	0%	1%

Ease of meeting energy costs	Indoor burners	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
Very easy	30%	20%	22%	25%	38%	38%
Fairly easy	50%	53%	51%	51%	48%	54%
Fairly difficult	15%	24%	23%	18%	13%	7%
Very difficult	3%	3%	3%	5%	1%	1%
Don't know	1%	0%	0%	1%	0%	1%

B.2 Indoor burners: Geography and property

Population density	Indoor burners	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
Unweighted Base	*989*	*89*	*230*	*217*	*160*	*240*
Urban	70%	57%	69%	72%	68%	72%
Rural	30%	43%	31%	28%	32%	28%

Region/nation	Indoor burners	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
North East	3%	3%	4%	3%	3%	2%
North West	11%	12%	12%	13%	13%	8%
Yorkshire and The Humber	8%	4%	13%	9%	7%	4%
East Midlands	7%	11%	6%	4%	10%	8%
West Midlands	7%	4%	6%	6%	9%	9%
East of England	8%	2%	6%	7%	5%	11%
London	5%	2%	2%	3%	5%	9%
South East	17%	6%	16%	20%	20%	18%
South West	11%	7%	9%	9%	11%	15%
England	77%	51%	76%	74%	86%	83%
Scotland	7%	11%	8%	10%	2%	6%
Wales	7%	10%	12%	7%	5%	4%
Northern Ireland	8%	28%	4%	8%	7%	7%

Smoke control area	Indoor burners	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
Yes	26%	15%	27%	21%	30%	30%
No	73%	85%	72%	77%	70%	70%
Not known	0%	0%	1%	2%	0%	0%

Whether believe live in SCA	Indoor burners	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
I've never heard of smoke control areas	6%	3%	5%	6%	5%	7%
I live in a smoke control area or zone	22%	12%	24%	21%	19%	24%
I don't live in a smoke control area or zone	45%	58%	46%	49%	38%	42%
I don't know whether or not I live in a smoke control area	27%	26%	25%	24%	38%	27%
Don't know	0%	0%	0%	1%	0%	1%

Tenure	Indoor burners	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
Yes - Own	89%	87%	86%	84%	93%	93%
Yes - Rent	10%	12%	14%	11%	6%	7%
No	1%	1%	0%	4%	2%	0%
Don't know	0%	0%	0%	1%	0%	0%

Mains fuel	Indoor burners	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
No mains gas	27%	71%	27%	29%	17%	21%
Mains gas	72%	28%	73%	71%	81%	79%

B.3 Indoor burners: Experience

Fire at home growing up	Indoor burners	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
Yes	79%	87%	76%	78%	86%	72%
No	21%	13%	24%	22%	14%	28%
Don't know	0%	0%	0%	0%	0%	0%

When started burning as adult	Indoor burners	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
In the last 12 months	6%	6%	7%	3%	7%	8%
2-3 years ago	17%	8%	18%	24%	12%	18%
4-5 years ago	13%	9%	12%	14%	11%	16%
6-10 years ago	17%	10%	24%	14%	18%	14%
11-15 years ago	7%	11%	4%	8%	9%	7%
16-20 years ago	7%	8%	5%	4%	10%	9%
More than 20 years ago	32%	47%	30%	31%	33%	26%
Don't know	1%	1%	1%	2%	0%	2%

B.4 Indoor burners: Burning frequency

Seasons burn	Indoor burners	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
Year round	4%	13%	2%	4%	1%	4%
Autumn to Spring	13%	15%	21%	13%	12%	9%
Autumn/Winter	18%	23%	19%	16%	19%	19%
Winter only	56%	42%	54%	61%	61%	52%
Once or twice a year	5%	2%	1%	3%	3%	11%
Other mix	4%	5%	3%	4%	4%	5%
Don't know	0%	0%	0%	0%	0%	0%

Days burn per week	Indoor burners	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
Unweighted Base	*955*	*87*	*229*	*213*	*155*	*220*
Less than once a week	14%	11%	2%	13%	21%	22%
1 or 2 days a week	25%	8%	16%	24%	26%	39%
3 to 5 days a week	31%	23%	39%	35%	34%	23%
6 or 7 days a week	29%	58%	42%	28%	18%	14%
Don't know	1%	0%	0%	0%	1%	1%

Hours burn per day	Indoor burners	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
Unweighted Base	*953*	*87*	*229*	*212*	*154*	*220*
1 to 4	46%	42%	36%	45%	48%	58%
5 to 8	41%	31%	43%	45%	40%	37%
9 to 24	13%	27%	20%	10%	12%	5%
Don't know	0%	0%	1%	0%	0%	0%

B.5 Indoor burners: Fuel use

Fuels burned	Indoor burners	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
Wood	89%	78%	93%	89%	91%	92%
Waste wood	51%	59%	56%	46%	55%	47%
Coal	48%	63%	43%	50%	57%	43%
House coal	*13%*	*25%*	*10%*	*15%*	*16%*	*8%*
Smokeless coal	*33%*	*36%*	*32%*	*32%*	*39%*	*30%*
Household waste or rubbish	37%	33%	41%	30%	39%	40%

Fuel mix	Indoor burners	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
Wood logs only	22%	13%	22%	20%	16%	26%
Wood mix only: logs, waste wood, garden waste	28%	20%	34%	25%	26%	28%
Wood logs and coal	20%	19%	16%	26%	22%	18%
Wood mix (logs, waste wood, garden waste) and coal	25%	39%	25%	21%	30%	22%
Coal only	4%	5%	2%	4%	5%	3%
Other	3%	4%	1%	4%	1%	3%

Motivation for fuel choice	Indoor burners	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
Unweighted Base	*955*	*84*	*223*	*208*	*157*	*232*
Quality - for example, seasoning	51%	42%	54%	51%	49%	54%
Cost	48%	46%	48%	52%	51%	43%
Availability / convenience	21%	23%	20%	22%	21%	23%
That it burns easily	16%	18%	14%	11%	23%	16%
How environmentally friendly	14%	11%	14%	10%	20%	14%
Smokeless / approved for use in SCA	12%	12%	11%	9%	17%	11%
From my local/trusted supplier	10%	8%	8%	11%	16%	10%
Gives high heat output	10%	12%	10%	10%	18%	6%
Whether or not it is free	5%	1%	9%	2%	9%	4%

How buy wood	Indoor burners	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
Unweighted Base	*921*	*79*	*220*	*200*	*148*	*227*
A full load	27%	27%	34%	25%	23%	23%
A carry net or nets	22%	20%	13%	23%	24%	28%
A half load	19%	17%	21%	18%	19%	19%
A carry bag or bags	19%	20%	18%	20%	17%	20%
In bulk (unspecified)	9%	8%	10%	10%	8%	7%
Don't know	12%	13%	12%	10%	14%	12%

Where buy fuel	Indoor burners	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
Specialist supplier	43%	47%	43%	44%	45%	39%
General supplier	38%	40%	29%	39%	42%	43%
Given by friends / family etc	15%	10%	21%	11%	24%	9%
From my own garden	14%	10%	14%	10%	17%	15%
Bought from landowner/farmer	12%	16%	17%	16%	5%	10%
Salvaged wood	9%	6%	15%	6%	13%	6%
Fallen wood from trees in public places	5%	3%	8%	3%	4%	3%
Online	1%	0%	0%	1%	0%	1%
Don't know	1%	0%	3%	0%	0%	0%

General wood seasoning	Indoor burners	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
Unweighted Base	*921*	*79*	*220*	*200*	*148*	*227*
Wood that is ready to burn or seasoned (incl. kiln dried wood)	68%	66%	60%	71%	68%	73%
Wood that you dry or season yourself	27%	25%	37%	22%	29%	23%
Burn wet / unseasoned wood	1%	4%	0%	4%	1%	0%
Other	1%	0%	2%	1%	2%	0%
Don't know	2%	5%	0%	2%	1%	3%

Whether get smoke in room burning wood	Indoor burners	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
Unweighted Base	*258*	*28*	*39*	*38*	*64*	*74*
Ever	34%	31%	51%	36%	33%	31%
Not at all	65%	69%	49%	59%	67%	69%

B.6 Indoor burners: Burning behaviours and appliance use

Main appliance	Indoor burners	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
An open fire	27%	35%	14%	20%	47%	30%
Burner/Stove/Enclosed fireplace	67%	54%	83%	71%	51%	64%
Or something else	5%	9%	2%	8%	2%	5%
Don't know	0%	1%	0%	0%	0%	1%

Whether installed appliance	Indoor burners	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
Installed while I was living in my home	52%	42%	61%	60%	41%	46%
Already there when I/we moved in	48%	57%	39%	40%	59%	54%
Don't know	0%	1%	0%	0%	0%	0%

When appliance installed	Indoor burners	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
Before 2000	33%	49%	20%	27%	52%	33%
Between 2000 and 2009	17%	15%	23%	16%	16%	15%
Or installed after 2009	43%	25%	50%	53%	28%	43%
Unsure of installation date	6%	11%	7%	4%	4%	8%

Whether chimney is lined	Indoor burners	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
Unweighted base	*648*	*48*	*184*	*155*	*84*	*147*
Yes	79%	89%	80%	74%	86%	78%
No	12%	7%	13%	17%	9%	11%
Don't know	8%	4%	6%	9%	5%	11%

Likelihood of replacing appliance in next 5 years	Indoor burners	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
Unweighted base	*357*	*48*	*52*	*61*	*82*	*91*
LIKELY (NET)	12%	21%	26%	7%	6%	12%
Very likely	3%	7%	3%	6%	1%	3%
Fairly likely	9%	14%	23%	1%	5%	9%
Not very likely	21%	39%	17%	31%	21%	12%
Not at all likely	66%	37%	56%	61%	72%	77%
Don't know	1%	3%	1%	2%	1%	0%
NOT LIKELY (NET)	87%	76%	73%	92%	93%	88%

How often chimney swept	Indoor burners	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
ANNUALLY (NET)	68%	82%	73%	72%	62%	58%
Around once every six months	8%	20%	10%	11%	4%	2%
Around once every year	60%	62%	64%	60%	59%	56%
Every 2-3 years	16%	6%	14%	14%	21%	19%
Longer than 3 years	6%	3%	4%	5%	7%	8%
Don't get it swept	4%	0%	4%	3%	5%	4%
Can't remember the last time it was swept	1%	3%	1%	1%	1%	2%
Not applicable	4%	4%	1%	6%	3%	6%
Don't know	2%	1%	2%	1%	0%	3%

Main source of advice	Indoor burners	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
Friends and family	16%	7%	13%	18%	26%	13%
Non-specific internet search	10%	16%	11%	12%	6%	10%
Appliance retailer/installer	7%	4%	9%	8%	4%	8%
Local council	6%	3%	6%	7%	5%	6%
Chimney sweep	5%	7%	2%	6%	5%	7%
Coal or wood merchant	3%	4%	5%	3%	2%	2%
Defra	2%	1%	4%	3%	1%	0%
Books/newspapers	1%	0%	3%	0%	1%	1%
Manufacturers' literature	1%	1%	0%	2%	1%	1%
Fire or safety professionals	1%	0%	0%	1%	0%	2%
Industry associations	1%	0%	2%	0%	0%	1%
You do not seek advice	44%	55%	40%	36%	47%	45%
Don't know	2%	1%	2%	2%	0%	3%

B.7 Indoor burners: Policy/context change

What would do if could not burn solid fuel	Indoor burners	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
Unweighted base	*876*	*81*	*217*	*185*	*140*	*207*
Install/use central heating	65%	27%	62%	61%	75%	78%
Install/use electric heating	8%	19%	6%	10%	4%	7%
Use oil	12%	31%	10%	13%	9%	9%
I have no choice but to burn	5%	14%	9%	5%	1%	1%
Something else	4%	4%	6%	4%	4%	1%
Use/install gas	3%	4%	4%	2%	4%	1%
Extra layers/clothing	1%	0%	0%	3%	1%	1%
Don't know	3%	1%	3%	3%	3%	3%

What would do if fuel price increased by 25%	Indoor burners	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
Unweighted base	*823*	*83*	*179*	*190*	*133*	*201*
Continue spending the same amount, so get less of your existing fuel	25%	27%	17%	24%	29%	30%
Continue getting the same amount of your existing fuel, so spend more	33%	27%	32%	26%	34%	42%
Use more gas, electricity or oil	15%	19%	16%	21%	15%	10%
Use an alternative solid fuel	4%	2%	7%	5%	4%	1%
Use more free fuel (for example, waste wood)	17%	20%	24%	20%	12%	14%
USE ALTERNATIVE (NET)	37%	41%	46%	46%	31%	25%
Don't know	5%	6%	5%	4%	7%	2%
Unweighted Base	823	83	179	190	133	201

If someone in house developed respiratory problems would …	Indoor burners	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
Burn more	0%	0%	1%	0%	0%	0%
No effect	31%	32%	33%	36%	25%	29%
Burn less	43%	36%	38%	41%	51%	50%
Change fuel or appliance	21%	28%	22%	20%	20%	18%
Refused	0%	0%	0%	1%	0%	1%
Don't know	4%	5%	6%	2%	4%	2%

Have your chimney swept at least once a year [including those who already do]	Indoor burners	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
Very willing / already do	82%	86%	79%	84%	44%	77%
Fairly willing	13%	10%	18%	10%	42%	18%
Not very willing	2%	2%	1%	1%	8%	3%
Not at all willing	1%	0%	2%	1%	5%	0%
Don't know	2%	3%	1%	3%	1%	2%

Willingness to test appliance annually for efficiency	Indoor burners	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
Unweighted Base	*712*	*59*	*191*	*174*	*88*	*164*
Very willing	51%	50%	51%	53%	44%	52%
Fairly willing	34%	27%	32%	32%	42%	37%
Not very willing	7%	6%	9%	7%	8%	4%
Not at all willing	6%	16%	6%	4%	5%	5%
Don't know	2%	1%	2%	4%	1%	0%

What would do if appliance failed test	Indoor burners	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
Unweighted Base	*712*	*59*	*191*	*174*	*88*	*164*
Upgrade appliance	66%	56%	69%	66%	73%	61%
Continue to use it as now	12%	22%	15%	6%	11%	12%
Stop or reduce using it	18%	13%	11%	23%	13%	26%
Don't know	4%	8%	5%	6%	3%	0%

Would pay more for fuel with less environmental impact	Indoor burners	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
Yes	73%	66%	69%	74%	84%	74%
No	21%	27%	25%	19%	14%	21%
Don't know	5%	7%	6%	7%	2%	5%

Would pay more for fuel that burns hotter	Indoor burners	Necessity	Thrift and Self-reliance	Supplement	Tradition	Aesthetics
Yes	70%	48%	72%	72%	70%	85%
No	28%	49%	28%	25%	28%	15%
Don't know	1%	3%	0%	2%	2%	0%

C. Technical appendix: Segmentation

Data from the PiT was analysed using multivariate analysis to identify key sub-groups within the population of indoor burners. The following section sets out the technical detail of how this was done.

C.1 Methodology

The purpose of segmentation analysis in general is to identify sub-groups of objects that are as homogeneous as possible within each segment, and as heterogeneous as possible between segments. The general process involves splitting the data based on a specific set of variables (inputs) and then profiling the resulting segments on the input variables, as well as any other variables of interest.

C.1.1 Selecting Segmentation Inputs

The first step was identifying which variables to include as inputs to the segmentation. Good input variables should be answered by all respondents, relevant to the themes of the study & show good variation with the data to allow differentiation between respondents. Some variables which are of interest or relevance to the purpose of the segmentation but are not ideal for inclusion in the segmentation process itself, can be used for profiling the segments once they have been created.

C.1.2 Dimension Reduction

The total set of variables that could potentially be included in the analysis is relatively lengthy. Understanding the key themes in the data is therefore of value in suggesting ways in which the inputs to the segmentation might be simplified.

Factor analysis was undertaken to simplify the set of input variables and understand essential dimensions & themes that emerge in the data. This creates a number of independent dimensions (factors) from a larger number of input variables.

C.1.3 Clustering

Clustering is the umbrella term for a technique used to split data into segments. There are many different clustering algorithms but the ones that are most typically used on survey data are either K-means or hierarchical clustering. The general idea is that objects (respondents/ customers/ occasions etc.) are grouped in such a way that objects in the same group are more similar to each other than to those in other groups. Similarity is defined based on the input variables used for the clustering. The aim of this technique is to partition the respondents into clusters (segments) of respondents, while trying to maximize the heterogeneity between segments and maximize the homogeneity within segments, in terms of the input variables.

A k-means clustering algorithm was used in this segmentation. This identifies discrete clusters over a range of numbers of clusters. Segmentation, being an iterative process, means multiple runs were trialled to obtain a different number of clusters on various combinations of the inputs, and clustering algorithms. A number of alternative segmentation solutions were created, profiled, and shared for feedback.

A division of the data objects into non-overlapping clusters such that each data object is in exactly one cluster. The clusters are represented by their centroids and the objects are assigned to the closest centroid (centre-based/ prototype-based clustering). There are a number of proximity/distance measures available. The Euclidean distance was used in this case. As K-means can be sensitive to the initial conditions this is taken into account when the segments are created to ensure they are stable and replicable.

C. 1.4 Decision on Segmentation Solution

The segments need to capture the key variations present in the total population of burners. Too few can lead to an uninformative solution and overlook important differences. Too many can result in an overly complicated solution and exaggerate small differences between different types of burners. The final decision is therefore a balance between usefulness and usability.

C. 1.5 Evaluation & Profiling of Segments

Once segments were defined, other variables of interest were used to evaluate the segmentation. The profiling tables were then used to analyse the segments conceptually and quantitatively, to ensure that the differences were large enough. Key criteria typically considered in this process are:

- Identifiability – Can I find/recognise the targeted persons in the marketplace?
- Substantiality – Is the segment large enough to have a critical volume of business?
- Accessibility – Can I reach the target via promotion and distribution?
- Stability – Are the segments reasonably stable over time?
- Responsiveness – Does a segment respond homogeneously to marketing efforts?
- Actionability – Does the segmentation provide guidance for decision making?

C.1.6 End solution

The input variables were:

- Agreement (on a scale of 1 to 5 where 1 is completely disagree and 5 is completely agree) with the statements:

- Burning is a necessity for you
- You mainly burn to create a nice atmosphere
- Burning gives you a sense of independence or self-sufficiency
- You only use your appliance for social occasions
- You like watching the flames
- There's something nostalgic about a fire
- The burner / fire adds to the value of your home
- Burning is a part of who I am
- In general, you always look for ways to save money, even if it's only a little

- You are very conscious about the cost of the energy you use
- Your burning has a positive impact on the local environment
- You worry about the impact your burning has on the health of yourself and those around you
- Burning in people's homes and gardens is a significant source of air pollution
  - Question: In the last 12 months, have you burned anything - such as wood, coal or rubbish - inside your home? If so, for what purpose?
  - Question: Can you tell me why you burn at home?

A three-segment, four-segment and five-segment solution was derived. The five-segment solution was chosen after discussion with the Defra research team. This solution was considered the best at capturing nuance in burner characteristics, so would be most useful in informing policy and/or messaging. Table C.1 shows the maximum confidence for each segment.

Table C.1: Segment confidence intervals

Segment	**Sample size**	**Confidence interval (max)**
Supplement	218	±8.4%
Tradition	160	±9.8%
Necessity	89	±13.1%
Thrift & self-reliance	231	±8.2%
Aesthetics	242	±8.0%

D. Technical appendix: Multi-variate analysis

Multivariate analysis was conducted in order to attempt to better understand the drivers of three particular burning behaviours (see list below). Regression analysis is a statistical technique used to examine the relationships between a dependent variable (i.e. 'outcome variable') and one or more independent variables (i.e. 'predictor variables'). In linear regression, a model is derived that most closely fits the data according to the dependent and independent variables. This analysis was conducted to detect the relative strength of the links between respondent circumstances and certain behaviours. The three behaviours explored were all based on PiT data:

- Use of house coal
- Use of an open fire
- Use of a stove installed before 2009

For each model an initial set of independent variables were included:

- Whether or not connected to the gas grid
- Whether find it very easy, fairly easy or fairly/very difficult to meet fuel and energy costs
- Whether live in a detached house/bungalow, semi-detached/terraced house or other type of house
- Whether home was built pre or post 1966
- Whether live in an urban or rural area
- Household composition: with children, at least one adult employed, all adults retired, all adults unemployed/in education
- Whether own home outright, with a mortgage or other (i.e. renting)
- Whether primary or secondary burner
- Whether AB, C1C2, DE social grade
- Whether pay more or less than £50 a year for fuel
- Whether use open fire (house coal model only)
- Whether use stove (house coal model only)
- Whether burn waste wood or garden waste at all (house coal model only)
- Whether buy all fuel from general/specialist supplier or not (house coal model only)

Each model was refined in an iterative process by reducing the number of predictor variables. The variables omitted at each iteration were based on analytical value to the model, taking into account their correlation. The final models are shown below. The independent variables highlighted in yellow were judged to be strongly linked with the dependent variable and the variables highlighted in orange were judged to be moderately linked to the dependent variable.

Table D.1: Regression model for use of house coal

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.043	.028		1.510	.131
	Use an open fire	.216	.022	.303	9.760	.000
	Not on the gas grid	.075	.015	.119	4.870	.000
	Pay less than £50 annually (i.e. negative effect towards paying more than £50 annually)	-.054	.014	-.100	-3.775	.000
	Primary burner	.054	.024	.052	2.297	.022
	Urban (i.e. negative effect towards rural)	-.027	.013	-.047	-2.038	.042
	Household of unemployed adults (e.g. students)	.041	.040	.025	1.036	.300
	Own home outright	.018	.018	.035	1.027	.304
	DE social grade	.016	.018	.022	.912	.362
	Household of employed adults	.013	.019	.025	.722	.470
	Only buy fuel from general/specialist supplier	.011	.016	.021	.713	.476
	House built pre 1966	.008	.012	.016	.701	.483
	Own home with mortgage	.011	.018	.021	.642	.521
	Household with children	.010	.020	.017	.497	.619
	Burn waste wood or garden waste	.006	.015	.011	.415	.678
	AB social grade	-.005	.012	-.009	-.407	.684
	Find it very/fairly difficult to meet fuel/energy costs	-.004	.016	-.005	-.238	.812
	Use a stove	-.003	.019	-.006	-.180	.857
	Find it very easy to meet fuel/energy costs	.002	.013	.004	.175	.861
	Household of retired adults	-.003	.020	-.005	-.132	.895

Table D.2: Regression model for use of an open fire

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.026	.038		.676	.499
	House built pre 1966	.088	.018	.116	4.933	.000
	Not on the gas grid	.104	.023	.118	4.623	.000
	Own home outright	.076	.026	.105	2.938	.003
	Find it very/fairly difficult to meet fuel/energy costs	.062	.024	.066	2.644	.008
	Household of unemployed adults (e.g. students)	.086	.060	.037	1.431	.153
	Household with children	.028	.030	.033	.928	.353
	Own home with mortgage	.023	.026	.031	.896	.371
	Urban (i.e. negative effect towards rural)	-.017	.020	-.020	-.835	.404
	Find it very easy to meet fuel/energy costs (i.e. negative effect towards not very easy)	-.016	.019	-.020	-.824	.410
	Household of employed adults	.007	.028	.009	.234	.815
	DE social grade (i.e. negative effect towards not DE)	-.004	.026	-.004	-.153	.878
	Primary burner	.002	.035	.002	.063	.950
	Household of retired adults	.002	.031	.002	.062	.951
	AB social grade	.001	.018	.001	.027	.978

Table D.3: Regression model for use of a stove installed before 2009

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-.027	.050		-.546	.585
	Not on the gas grid	.127	.021	.150	6.000	.000
	Primary burner	.151	.033	.108	4.601	.000
	Household of retired adults	.100	.028	.124	3.495	.000
	House built pre 1966	.059	.017	.082	3.450	.001
	Own home outright	.070	.025	.101	2.863	.004
	Urban (i.e. negative effect towards rural)	-.044	.019	-.057	-2.383	.017
	Own home with mortgage	.044	.025	.059	1.771	.077
	AB social grade	.024	.017	.033	1.369	.171
	Household of employed adults	.035	.026	.049	1.349	.178
	Detached house or bungalow	.051	.043	.070	1.205	.228
	Household of unemployed adults (e.g. students)	.034	.056	.015	.603	.547
	Household with children	.013	.028	.016	.476	.634
	Semi-detached or terraced house	.012	.041	.016	.286	.775
	DE social grade	-.003	.025	-.004	-.141	.888

E. Technical appendix: Analysis of the potential drivers of burning identified through the qualitative interviews

The Kantar Behavioural Framework (Figure 1.1) was used as a basis to identify potential drivers of burning attitudes and behaviours based on the qualitative interviews in order to inform policy and communications designed to change burning behaviour. Given the small size of the sample and the fact that, though varied, it is not fully representative of the wider burning population, these findings should be treated particularly as representative in of this group of burners amongst whom there are more heavier, primary and/or rural burners, and more who burn on older appliances, than in the wider burner population. However, it is likely that many of the drivers here are applicable to other burners too.

In the analytical process, the Kantar team worked with a member of the Defra team to map the qualitative analysis on to the framework, decoding the ways in which each driver presented itself in terms of actual behaviour and attitudes reported. The importance of each driver was assessed from qualitative understanding of its influence on burning behaviour and attitudes, analysed across the sample of qualitative interviews.

Table C 5: System 1 drivers

Driver	Importance	Description	Challenge presented to changing behaviour
Habit	**High**	• Some burners have a long, entrenched history with burning, influenced by ways of doing things which have been passed down within the family. • For many, burning is a part of daily home life managed in a habitual way like other daily tasks. • It can be a deeply ritualistic behaviour which, for some, is connected to personal identity. • Burners may have thought about how to light fire or their fuel choice sometime in the past, but have forgotten this thought process, now adopting a default approach	All aspects of burning tend to become underpinned by this unconscious driver, meaning that it may be hard to get burners to re-appraise their behaviour. For some, burning has become ingrained and part of who they are, rather than a considered behaviour.

Heuristics (learning by trial and error; basing behaviour on assumptions)	**High**	• Trial and error and rules of thumb often influence behaviour and choices. More experienced burners often assume they know the best way to burn in their home • Regarding solid fuel, some burners believe that wood is a natural, sustainable source, so can't be that bad when burnt; a few saw burning wet wood as prolonging the fire; a couple saw solid fuel as better for their breathing-related health issues than gas or electric heating • Some burners do seek the knowledge and advice of perceived experts, such as fuel suppliers, chimney sweeps, appliance fitters for advice, on occasion (particularly those who are less experienced)	There are a range of shortcuts and rules of thumb which may unconsciously influence behaviour, again, potentially posing a challenge in re-appraisal of the ingrained assumptions influencing behaviour Intermediaries such as fuel suppliers, chimney sweeps and fitters may provide a trusted way to disseminate guidance on burning, at least to some burners
Context/ Environment	**Medium-high**	• Relevant in particular to those in rural or remote locations, especially in off gas-grid areas, as often they seem to feel a greater need to burn because of the expense/lack of reliability of alternative heating sources; they potentially also have better access to wood they can gather for free • The established heating configuration and related infrastructure (e.g. insulation levels) affects fuel and appliance choices and usage, for example effectiveness of the central heating • Types of solid fuel available locally and therefore lack of experience with cleaner alternatives (for example, smokeless coal)	For the minority of burners who don't have access to the gas grid or some form of central heating, creating and/or running a new heating configuration could prove too costly.

Table C.6 System 2 drivers

Driver	Importance	Description	Challenge presented to changing behaviour
Cost / benefit	**High**	• A powerful driver – for some, burning wood offers a low or no cost way to provide primary or seconary heat in the home – responses suggested that the cost of solid fuel would need to increase a lot to impact this (where cost was actually relevant as many accessed at least some of their wood for free) • For many, burning seems to provide a direct, personalised way to control the needs of daily life and meet the rational need for heat • For most, it also seems to provide a deep emotional benefit realised in the pleasure of creating/watching a fire and the associations and atmosphere experienced • The cost to others' health or the environment is not well-understood and for some is a new narrative that is not credible and goes against current beliefs	Burning has a strong rational and emotional grounding that offers tangible benefits to the burner – this suggests the need for clear, credible and persuasive messaging to re-calibrate what they believe about the potential costs of burning
Efficacy	**Medium-high**	• As a domain of control and empowerment, many burners are confident in their ability to burn to provide for their heating/hot water/cooking needs, and that they do so in a responsible and effective way.	Behaviour is governed by a sense of confidence in how they are burning, which has hitherto gone unchallenged. Given this, a strong set of rational arguments would be required to support why a change to that behaviour might deliver a better outcome

Legitimacy	**Medium**	• Many burners have a strong, sense that they are "doing the right thing". Most believe themselves to be responsible burners, even when engaging in behaviour that they know is advised against (for example, burning treated wood) • Burning wood believed to be sustainable and part of a natural cycle by at least a few burners • Some burners do not believe the impact of burning is comparable to that of other sources of air pollutants that are part of the public narrative or to other forms of energy • Indoor burners tended to believe that their burning only affected their own personal environment, not that of others, particularly those in rural areas.	To date, burners' sense of legitimacy has not been challenged, so any new information that does needs to be absorbed and embedded as a credible narrative before encouraging them to reconsider their behaviour and attitudes

Table C.7 Focus on the influence of "morality" and "social/cultural norms" (system 1 & 2)

Driver	Importance	Description	Challenge presented to changing behaviour
Morality	**Low-medium**	• A subordinate justification to the driver of "Legitimacy". Many burners feel legitimised in the actions that they take (they are responsible and potentially making a better environmental choice to heat their homes) and rarely think about their behaviour in "moral" terms. • Many perceive themselves as responsible citizens and some post-rationalise a moral position based on engaging in a "carbon neutral" activity of burning wood • Some burners exhibit a tendency to make moral trade-offs between burning and other activities for example, not as harmful as burning fossil fuels etc.	This driver seems to be of less importance vs. others - legitimacy as a driver plays more of a role in how they burn and their associated attitudes towards burning
Social / cultural norms	**Medium**	• For some, may drive choices around installation for example, following aspirational trends, what neighbours have installed • Where there is a history of family burning heritage and a community of practice this can deeply influence burning behaviour as this is the unofficial source of education and information • Narratives around impact on health and the environment do seem to have the potential to challenge norms, surprising many of these burners which led some to being defensive about their behaviour	It is hard to influence norms without changing the current narrative around burning and its potential impacts. The narrative needs to then flow through the networks and channels of information in families and communities of burners