# A new definition of fuel poverty in Scotland

## A review of recent evidence

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## The 2017 Scottish Fuel Poverty Definition Review Panel

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## The Review Panel

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# List of Acronyms

| | |
|---|---|
| AHC | After housing costs |
| ADRD | Alzheimer's Disease and related dementias |
| AHFC | After housing and fuel costs |
| ASHRAE | American Society of Heating, Refrigerating and Air-Conditioning Engineers |
| BHC | Before housing costs |
| BRE | Building Research Establishment |
| BREDEM | Building Research Establishment Domestic Energy Model |
| CC | Conventional control |
| CFU | Consumer Futures Unit |
| DEFACTO | Digital Energy Feedback and Control Technology Optimisation |
| DUKES | Digest of UK Energy Statistics |
| EFUS | Energy Follow-Up Survey |
| EHS | English House Condition Survey |
| EU | European Union |
| EU-SILC | European Union Statistics on Income and Living Conditions |
| FC | Fuel costs |
| FP | Fuel poverty |
| FPSWG | Fuel Poverty Strategic Working Group |
| HBAI | Households below average income |
| HH | Household |
| HIDB | Highlands and Islands Development Board |
| LIHC indicator | Low Income High Cost indicator |
| LILC | Low Income Low Cost |
| MD | Multiple deprivation |
| MIS | Minimum Income Standard |
| NGO | Non-governmental organisation |
| NICE | National Institute for Health and Care Excellence |
| NTR | New temperature regime |
| OECD | Organisation for Economic Cooperation and Development |
| Ofgem | Office of Gas and Electricity Markets |

| | |
|---|---|
| PHE | Public Health England |
| PSE | Poverty and Social Exclusion |
| SAP | Standard Assessment Procedure |
| ScotPHN | Scottish Public Health Network |
| SEEP | Scotland's Energy Efficiency Programme |
| SG | Scottish Government |
| SHCS | Scottish House Condition Survey |
| SHS | Scottish Household Survey |
| WEMWBS | Warwick and Edinburgh Mental Wellbeing Scale |
| WW1 | World War 1 |
| WHO | World Health Organisation |
| ZC | Zonal control |

**A note on terminology**

Boardman's original definition of fuel poverty is different from the Boardman-*based* definition which later featured in the first UK Fuel Poverty Strategy. Her definition focused on *actual* energy spend:

*"[A Fuel poor household is] are unable to obtain an adequate level of energy services, particularly warmth, for 10 per cent of its income*" (Boardman, 1991).

The first UK Fuel Poverty Strategy used a definition based on *required* energy spend i.e. the energy needed to provide an acceptable standard of warmth, lighting and appliance use in the home, even if this level of energy use was not actually attained by the household:

"*A fuel poor household is one which needs to spend more than 10% of its income on all fuel use and to heat its home to an adequate standard of warmth*" (DEFRA, 2001).

In this Review, we refer to the *Boardman definition* on many occasions. It is a term familiar to most stakeholders. But we use it to refer to the form of her definition which was adopted in the 2001 UK Fuel Poverty Strategy; at the time of this Review's publication, this is still the accepted definition of fuel poverty in Scotland, Wales and Northern Ireland.

# Executive Summary

On 24 October 2016, the Scottish Fuel Poverty Strategic Working Group (FPSWG) published a report entitled *A Scotland Without Fuel Poverty is a Fairer Scotland*. This included the recommendation that a review of the current definition of fuel poverty in Scotland should be commissioned, in light of concerns that the current definition is too broad and impedes targeting assistance towards those in most need.

The Scottish Government accepted this recommendation and, in early 2017, established a Panel of four independent academics

- to conduct a review of the current definition of fuel poverty in use in Scotland;
- to make evidence-based recommendations for whether the definition should be retained;
- and if not, to indicate any changes that should be made.

This report comprises the result of the Panel's deliberations.

The Panel had five months in which to complete a Review, and we hope that it is read in that context. By contrast, Boardman's 1991 definition of fuel poverty took more than three years to develop. The LIHC indicator developed by John Hills in 2012 had a 12 month timeline, as did the 2016 report by the FPSWG.

**Chapter 1** lays out the scope and remit of the task which the Scottish Government asked the Panel to address. It begins with a near-verbatim description of the remit we were given. Drawing on the FPSWG's work in 2016, as well as that of the Scottish Rural Fuel Poverty Task Force (which also delivered a report in 2016), we explored whether a rebalance of focus in the definition was required; for example whether the definition might need shifting towards a greater emphasis on its interrelationship with poverty and deprivation. We concluded that some of the adverse outcomes associated with fuel poverty were at risk of being de-emphasised in the increasing policy focus on energy efficiency and building fabric. While still recognising the multifaceted nature of the issue, and the range of relevant policy concerns, we also concluded that these adverse outcomes belonged at the heart of

how fuel poverty should be defined in Scotland. We were aware too that a great deal of high-quality evidence had been published in recent months, and that this was not part of the evidence which FPSWG or the Scottish Rural Fuel Poverty Task Force had been able to take into account. The Panel felt that this evidence merited detailed scrutiny, and also full representation. For that reason, and as a consequence of the broad scope of our remit, the Review is lengthy.

**Chapters 2 to 8** contain our analysis of the evidence which underpins the development of our thinking. In selecting evidence to include, the Panel were in agreement that the debate about fuel poverty has been particularly fast-moving in the past 3 years. For that reason, the Review is dominated by data and evidence published between 2015 and June 2017, and the Panel has relied heavily on this when reaching its conclusions.

That being said, on occasion the Panel also examined historical evidence, particularly in the context of indoor temperatures. As the Review indicates, and contrary to what many have surmised, there was a great deal of early thinking and discussion around indoor temperature regimes, dating back to 1936. A strong inter-disciplinary consensus can be seen in this early work. We viewed the long timeline of evidence as very important when reaching decisions about what should constitute an affordable heating regime.

**Chapter 2** considers the content and role of definitions, and gives an account of the different ways in which fuel poverty has been defined in Europe, with particular emphasis on the UK. It illustrates the broad range of definitions which have been in play since the millennium:

- some of these have focused on calculating the *how many and who* domains of fuel poverty (the technical definitions);

- whilst others have tried to interpret the *meaning and significance* of living in fuel poverty (the consensual definitions).

The latter are definitions largely based on how ordinary people respond when asked if they are experiencing fuel poverty, and if so what the lived experience of being fuel poor is like. The Panel has given equal weight to the contributions made

by both, but saw consensual definitions as increasingly vital complements to the more longstanding technical definitions which focus on energy costs, income, and thresholds.

In this context, the Panel felt that the consistency with which studies have reported mental wellbeing benefits associated with alleviating fuel poverty lent strong support to the argument that being fuel poor leads to discomfort, stress and anxiety. Encompassing hardship and burden, we recognised, would draw the issue of fuel poverty more squarely into a socio-political arena in which energy justice and equality would have a greater presence. This, we also recognised, would have the potential to reframe the concept in quite profound ways.

**Chapter 3** explores the additional and sometimes confusing issue of Vulnerability. Part of the confusion which surrounds this term stems from the different ways it is used:

- '*households that are vulnerable to fuel poverty*' can mean households likely to be in it;

- *'vulnerable households*' sometimes refer to households that have been unable to develop the capacities for avoiding fuel poverty, and are therefore less likely to be in a position to avoid being fuel poor;

- at other times, '*vulnerable households*' refers to the collective of households where someone has a health condition or disability that makes them especially prone to suffering the adverse effects of being fuel poor – these include people with limited mobility, cardiovascular and respiratory conditions, as well as people with dementia.

The Panel concluded that this last-mentioned definition, namely *vulnerable to the adverse health outcomes of fuel poverty*, should ideally prevail in the Scottish context. In this way, the focus on fuel poverty as a condition of hardship and burden could be sustained, and the protection of human health and wellbeing could remain central to how fuel poverty was addressed in policy and practice.

There was, however, also merit in retaining the idea that energy-related skills and capabilities could help protect households from falling into fuel poverty, although perhaps through the use of a term other than '*vulnerable*'. In this way, the broader toolkit for alleviating fuel poverty (encompassing energy advice, support in tariff-switching, debt management, etc.) could become more central to how fuel poverty programmes were designed and delivered.

As a consequence of the lack of scientific consensus about health conditions and age groups most vulnerable to adverse impacts of fuel poverty, the Panel recommended that a short piece of further work on vulnerability criteria should be undertaken, as an integral, focused, component of planned Government consultation. The work should be done by a specialist group representing public health practitioners, local health and social care partnerships, and the social security team. The terms of reference should be narrow, so that the group confines its deliberations to the issues related to vulnerability *as these affect a definition of fuel poverty*.

Also in Chapter 3, the Review Panel sets out the working assumptions made in relation to age groups, long term ill health and disabilities, and the resulting adjustments made to recommended indoor temperatures and Minimum Income Standards. The additional work of the practitioner group should test the validity and robustness of these assumptions, consider their connectivity with vulnerability criteria used in other domains of Scotland's social security strategy, and recommend a set of vulnerability criteria, and consequent adjustments to income standards and/or energy needs, to be used in the context of fuel poverty.

Given the dominance of the Boardman-based and Hills definitions, **Chapter 4** provides a more in-depth analysis of the common ground which they share, as well as their respective strengths and weaknesses. For the first time, it focuses specifically on how each of these definitions performs in the context of *Scottish* fuel poverty data. Neither definition emerges as ideal.

- A major drawback of the Boardman-based definition is that households which have quite high incomes can be classified as fuel poor – in Scotland especially, this group represents more than half of all those in fuel poverty, making this a very substantive problem.

- When considering the Low Income High Cost (LIHC) indicator devised by Hills, almost the opposite problem emerges: people living on very low incomes may be excluded from fuel poverty if their energy costs are lower than the national median cost. Their energy bills may be just as burdensome, probably more so, when compared with households who have higher energy costs but can afford them. In light of Chapter 2's conclusion that any definition of fuel poverty should capture issues of hardship and energy burden, this drawback made the LIHC equally problematic when compared with Boardman's definition.

- A further difficulty with the LIHC lies in its insensitivity to fuel prices; estimates of the impact of changes in fuel price on fuel poverty are only accessible through a second-tier analysis of the fuel poverty gap, since these impacts are not reflected in the headline data concerned with prevalence.

Taking these issues into consideration, we concluded that neither of the two definitions currently operational in the UK were suitable for Scotland in a future fuel poverty context.

**Chapter 5** focuses on optimal indoor temperatures, which have been a recurring issue for many years; precisely where temperature thresholds are set has implications for the prevalence of fuel poverty in Scotland (higher recommended temperatures will increase prevalence). But much more importantly it has implications for people's health, wellbeing, and thermal comfort. At present, Scotland recommends that able-bodied and healthy households have their living rooms set at $21^0$C, and all other rooms set at $18^0$C. These recommended temperatures are based on longstanding World Health Organisation (WHO) guidelines, and in the absence of evidence to the contrary, the Panel took the view that these guidelines should continue to be adhered to.

For households where someone's poor health or disability makes them vulnerable to the adverse effects of cold and damp, WHO guidelines simply recommend that both temperature thresholds (living room and all other rooms) are increased by $2^0$C. At present only half of this recommendation is adhered to in Scotland, with

living room temperatures of 23 $^0$C stipulated for vulnerable households. But bedroom temperatures have been left the same as for all other households at 18$^0$C. The Panel thought the gap between 23 $^0$C (living room) and 18 $^0$C (all other rooms in the house) might demand too great a physiological adjustment for people who were suffering from ill health or disabilities. Consequently, we recommended 23 $^0$C for living rooms and 20 $^0$C for all other rooms in the homes of vulnerable people. This brings the *overall* recommended temperature regime more fully in line with longstanding WHO recommendations.

Given our proposed reorientation of the fuel poverty definition to more adequately relate to wider poverty and deprivation concerns, **Chapter 6** deals specifically with our approach to developing and justifying our preferred concepts of poverty and energy affordability, and how we believe these might best be measured in future. We draw on insights from mainstream poverty research, and make the case for a more sophisticated understanding of relevant deprivations and hardships that moves beyond crude and 'arbitrary' income poverty thresholds. We take up some suggestions in the FPSWG (2016) report, particularly on the case for moving to an 'after housing costs' (AHC) measure of income. We also develop the argument for using 'Minimum Income Standards' (MIS) (Hirsch et al., 2016) in our revised definition of fuel poverty; this reflects the Panel's commitment to consensual and more participatory approaches that command majority public support in this field.

In **Chapter 7** we focus on the association between

- six alternative ways of defining fuel poverty;
  and
- some of the adverse outcomes of being fuel poor.

We consider a strong association between definition and adverse outcomes to be a key test of a good definition. We take the two established official definitions, Boardman and LIHC, and compare their performance with that of modified versions of each of these, and then also with two new definitions based on the Minimum Income Standards concept (MIS). We use four distinct datasets to interrogate the performance of these different definitions in terms of their ability to predict, or discriminate between, households who report a range of adverse outcomes and

those who do not. This leads to consistent findings which further support a move away from the status quo. We offer a revised definition, which emerges from these analyses, for scrutiny and comment. It is as follows:

Households in Scotland are in fuel poverty if:

- they need to spend more than 10% of their AHC income on heating and electricity in order to attain a healthy indoor environment that is commensurate with their vulnerability status;

- and if these housing and fuel costs were deducted, they would have less than 90% of Scotland's Minimum Income Standard as their residual income from which to pay for all the other core necessities commensurate with a decent standard of living.

**Chapter 8** outlines the demography and geography of fuel poverty under different options for a revised definition. Which types of households are most likely to be in fuel poverty alters when using these different options, as does the energy efficiency profile of dwellings. Under our preferred option, the prevalence rate of fuel poverty in Scotland (2015) is broadly similar to the rate under the current Boardman definition (31% under Boardman and 32% under our preferred option). However, older age groups are *less often* deemed to be in fuel poverty, as are owner occupiers; a larger proportion of fuel poor households live in relatively energy efficient dwellings, highlighting the extent to which almost any level of energy cost is a significant economic burden for households on lowest incomes. Groups which are *more often* in fuel poverty under the preferred definition include those in rented accommodation, both social and private. Households where someone is living with a long-term illness or disability remain at relatively greater risk of fuel poverty than other households. Whilst not all rural households have a greater likelihood of being fuel poor, those in remote rural areas are at greater risk.

Under the preferred option, we also examined the fuel poverty gap – a means by which the severity of fuel poverty can be better understood. Groups with the largest gap (and likely to be experiencing more severe fuel poverty as a consequence) include elderly couples, private renters, and households located in remote rural

areas. The Panel concluded that the combination of data on prevalence *and* severity was essential for a fuller understanding of how alleviation measures could be most effectively targeted.

**Chapter 9** contains a summary list of the Panel's 37 Key Conclusions, as these appeared in the previous Chapters.

In the time available to us, we have proposed a new definition of fuel poverty which is rooted in an objective and impartial scrutiny of the current evidence base. We believe that this evidence base should serve as a foundation on which some core decisions about how fuel poverty should be defined in Scotland can rest.

The proposed revision retains the classic focus on issues of income and required energy cost, but it takes additional cognisance of the meaning and significance of being fuel poor in two key ways:

- in the manner in which income is measured, with the MIS being a democratic and participatory metric; and

- in testing our proposed definition (and 5 of its rivals) against core adverse outcomes that people say they experience as a consequence of being fuel poor.

During Panel discussions, we frequently considered how a new definition might affect professionals and practitioners working on doorsteps and communities in Scotland. We were unanimous in thinking that any revised definition should have the highest regard for the challenges they would experience in working with it. We are mindful of their importance in the months to come, as consultation and exchanges of views are worked through. At the very least, we hope that a revised definition will show a greater synergy between definition, Strategy, policy and practice than has hitherto been possible.

The Review concludes with a list of Sources and an Annex.

# Chapter 1

# The Review: The Panel's scope and remit[1]

## 1.1. Introduction

On 24 October 2016, the Scottish Fuel Poverty Strategic Working Group (FPSWG) published its report *A Scotland Without Fuel Poverty is a Fairer Scotland.* This included the recommendation that a review of the current definition of fuel poverty in Scotland should be commissioned in light of concerns that the current definition is too broad and impedes targeting assistance towards those in most need.

The Scottish Government accepted this recommendation and established a Panel of independent experts to conduct a review of the current definition of fuel poverty in use in Scotland, and to make evidence-based recommendations for whether the definition should be retained and, if not, any changes that should be made.

The FPSWG report identified a range of issues which it felt should be considered within the independent review; these were summarised in a Background Brief given to the Panel by the Scottish Government (see Annex A).

## 1.2. Background

Following the *Housing (Scotland) Act 2001 (section 88), the Scottish Fuel Poverty Statement (2002)* set out how fuel poverty should be defined: a household is in fuel poverty if, in order to maintain a satisfactory heating regime, it would be required to spend more than 10% of its income on all household fuel use. While section 95 of the Act indicated that '*a person lives in fuel poverty if that person is a member of a household with a* ***low income*** *living in a home which cannot be kept warm at a reasonable cost'*, the subsequent Statement made no reference to income levels in setting the definition.

The *required* energy spend is determined on the basis of a theoretical model (BREDEM) which estimates energy requirements from the physical characteristics of the dwelling, the heating system, fuel used and certain assumptions about

[1] Sections 1.1 to 1.4 are taken largely verbatim from the background briefing which the Review Panel were provided with at the start of this process.

household behaviour. No information on actual energy consumption is used in the definition of fuel poverty. Household income is measured before housing cost and net of tax, Council tax, and national insurance contributions.

To estimate household needs for space heating, two types of heating regimes are used, standard and enhanced. Households where someone is aged 60 or older or suffers from long term illness or disability are considered vulnerable and are assumed to require an enhanced heating regime; maintaining 23°C in their living rooms and 18°C in their bedrooms for 16 hours every day of the week, during the heating season. The energy needs of all other households are assessed under a standard heating regime; where living rooms are heated to 21°C, and bedrooms to 18° for 9 hours during week days and 16 hours during weekends.

Heating regime assumptions and the type of households considered vulnerable differ in some aspects from those adopted in other parts of the UK. There are additional differences, for example in the way the number of residents relative to the size of the dwelling are taken into account, or not, in determining the amount of energy required.

Fuel poverty in Scotland is monitored using data from the Scottish House Condition Survey which does not always contain the full set of information required to implement the definition of fuel poverty. This leads to some simplification in the way fuel poverty is measured in practice. For example, information on income is collected for the highest income earner and their partner only and no additional income recipients in the households are covered. This means that where other household members have earnings or other forms of income, household income is underestimated and the likelihood of fuel poverty is correspondingly overstated[2].

The current definition of fuel poverty has been in use in Scotland for over a decade, during which fuel prices have risen considerably, the thermal efficiency of the housing stock has improved, and lifestyles have undergone change. The high sensitivity of the current definition to changes in price levels has meant that trends in measured fuel poverty have primarily tracked the price of fuel. It has been more difficult to understand the contribution that many types of help can

[2] Full details on the definition of fuel poverty and how it is implemented in the SHCS are available in the following publication: *SHCS 2015 Methodology Notes*.

make in reducing the adverse effects of living in cold and damp homes, such as advice and support around energy use or accessing benefits to maximise income. This limits the usefulness of the definition in designing effective policies to tackle the problem of fuel poverty, and in monitoring their impact.

### 1.3. Defining Fuel Poverty: Current Issues

There are a range of aspects of the current definition of fuel poverty that have been contested and the definition of fuel poverty has been subject to considerable examination and interrogation across the UK. For example, in 2012 an independent review commissioned by the UK Government concluded that the traditional approach to measuring fuel poverty was not fit for purpose and proposed an alternative framework for measuring the extent of the problem[3]. In Scotland, the Fuel Poverty Forum commissioned a review of the assumptions underpinning the definition of fuel poverty, but concluded that there was insufficient evidence to make any changes.

The Scottish Government established two short-life expert groups in 2015 to develop a vision and inform action for the eradication of fuel poverty in Scotland, the Scottish Fuel Poverty Strategic Working Group and the Scottish Rural Fuel Poverty Task Force. Both groups published their final reports on 24 October 2016 and highlighted a number of issues with the current definition of fuel poverty. The groups highlighted concerns that the definition is too broad and impedes efforts to target resources on those that need them most. The groups therefore recommended that the definition should be reviewed.

The Strategic Working Group felt that the definition should offer a more transparent link to the desired social outcome(s) and the actual experience of energy use in Scottish homes and reflect current social norms in terms of minimum requirements for an acceptable living standard. In their view, fuel poverty should be seen as a 'manifestation of wider poverty and inequalities in society' and defined within that context. The Group was also very conscious of the policy implications of the definition, highlighting the importance of quantifying the extent of the problem and

[3]The Final Report of the Fuel Poverty Review by John Hills.

measuring progress, as well as the ability to target resources towards those in most need.

At the same time the Group also pointed to a number of benefits of the current definition and the risks associated with changing it.

The Group highlighted the importance of understanding fuel poverty in the context of its causes and consequences, and argued for a definition which helps achieve this. Its report concluded that energy use should be seen as a driver of fuel poverty, in addition to those currently recognised, and recommended that this should be reflected in the way fuel poverty is defined.

It also recommended that the review considers international examples of how fuel poverty is defined (including the Hills definition), and argued that potential unintended consequences of any changes to the definition are also considered.

A summary of the SWG's findings and recommendations around the definition of fuel poverty is attached at Annex A.

In that context the Scottish Government has identified the following aims and objectives for the review.

### 1.4. Aims and Objectives of the Review, as specified by Scottish Government

The overarching aim of the review is to assess whether the current definition of fuel poverty is fit for purpose and adequately reflects the social problem which needs to be tackled. This was expressed in the Housing Act 2001 (Scotland) as that of a 'household with a low income living in a home that cannot be kept warm at reasonable cost' and identified by the Scottish Fuel Poverty Strategic Working Group as inability to achieve 'affordable and attainable warmth and energy use that supports health and wellbeing'.

The review will examine the extent to which the existing definition represents an effective way to: a) measure fuel poverty; and b) guide policy action. The review

will recommend changes to the way fuel poverty is defined or measured where the current definition is found to fall short of these requirements.

The SWG report made a number of recommendations for issues the review should address. Based on these, members of the review panel will want to consider the following areas in making recommendations:

- **Affordability and reasonable cost of energy use**: how can these concepts be best defined and expressed as measurable indicators?
- **Outcomes**: the SWG report was particularly concerned with the negative impacts of fuel poverty on individual health and wellbeing, there may be a broader range of outcomes that deserve consideration as part of the review.
- **Vulnerability**: does the current approach continue to be useful and identify the right kind of negative outcomes and the social groups that are most at risk?
- **Behaviour**: as well as the energy efficiency of the home, the price of domestic fuels and household income, the SWG recommended that the definition should also reflect how people actually use energy at home because, in their view, this should also be seen as a determinant of fuel poverty.
- **Income and deprivation**: how should the economic resources of households be taken into account when determining the affordability of warmth and energy use?
- **Standard of warmth and energy use**: under the current 'required spend' approach, fuel poverty is defined and measured against a strictly specified pattern of energy use, should this pattern be revised?
- **Monitoring of progress**: a key requirement for an effective definition in the policy context is to enable the effective monitoring of progress in tackling fuel poverty as well as to provide a guide to effective and efficient use of resources.

- **Relationship between definition and programme delivery**: how can the definition of fuel poverty be better aligned with identifying those in most need and provide a better guide for action on the ground?

The review would also consider the consequences of any changes to the definition. It will be for the review panel to determine the contents of any reports it produces and the list of issues should not be viewed as an outline structure for a final report or set of recommendations.

### 1.5. The Panel's interpretation of the Review's scope and remit

The FPSWG report recommended that 'a new definition [of fuel poverty] should focus on the desired outcome – affordable and attainable warmth and energy use that supports health and wellbeing', and should also 'acknowledge fuel poverty as a manifestation of wider poverty and inequalities in society', while still being 'easy to understand and measure'[4]. A further recommendation, if accepted, would commit the Scottish Government to accepting 'a new definition and target with a statutory basis', albeit subject to transitional arrangement[5]. The Panel has drawn from the above that the most important criterion in developing a revised definition of fuel poverty should be the identification and avoidance of *relevant adverse outcomes*. Consequently, we interpreted our primary task as being to:

- select the most important potential adverse outcomes;
- seek robust measures of these outcomes; and
- examine how fuel poverty, defined in different ways, relates to, and impacts upon, them.

Insofar as we have examined new evidence, or have brought existing evidence together in different ways, it is in this spirit of seeking the best way forward in terms of targeting situations where the most important adverse outcomes may be avoided altogether or minimised as much as possible.

These adverse outcomes may be in different arenas, and the multifaceted nature of fuel poverty is partly why it has become a distinct focus for policy attention. We

[4] Recommendation 42
[5] Recommendation 44

believe it is also why arguments from contrasting perspectives and interest groups can be legitimately considered, even though these would frequently pull any revised definition in different directions.

Clearly fuel poverty relates to energy policy, supply and pricing, as well as to the drive for improved energy efficiency, lower emissions and less pollution. Equally clearly, it relates to poverty, because energy costs currently constitute a significant burden for those on lower income. Fuel costs are difficult to avoid yet, in sharp contrast to housing rents or Council Tax, they are not subject to specific subsidy as is the case with Housing Benefit and the Council Tax Reduction Scheme. This may lead to indirect knock-on effects in areas of financial indebtedness and financial exclusion.

At the same time fuel poverty has an important health and wellbeing dimension, which may particularly affect specific vulnerable groups, but can also affect any individual or household, depending on the level of severity. There are consequences, then, for NHS costs and other areas of public expenditure, as well as for the people and communities directly affected.

The energy efficiency of the housing stock has also been a significant element in housing policies and strategies for minimum standards across different tenures, albeit the mechanisms, opportunities and incentives for improvement vary greatly across these sectors. Among other recognised benefits of alleviating fuel poverty are the significant opportunities alleviation programmes offer for economic development and job creation; the Panel was mindful of the multiple co-benefits of alleviating fuel poverty which are now internationally acknowledged (IEA, 2014).

The Panel took the view that the fuel poverty definition and associated targets should continue to reflect this diverse set of considerations, while being balanced by a desire for simplicity and comprehensibility. In the FPSWG report (2016) it was argued that '*the [existing] definition is more a measure of fuel efficient homes rather than a measure of fuel poverty as it affects health, [leading to] a predominant focus on energy efficiency measures'.* It was also highlighted that [only] *'42% of the fuel poor are income poor, while 58% of the fuel poor are not income poor'*.

This in turn was linked to the call by the First Minister's Independent Advisor on Poverty and Inequality, Naomi Eisenstadt, in her *Shifting the Curve* report, for *'future programmes [to] focus more specifically on helping those in fuel poverty who are also in income poverty'* (Eisenstadt, 2016).

In discussing the 'vision' for future fuel poverty strategy, the FPSWG report (2016) points out that:

*'Fuel poverty, while not exactly a subset of income poverty, is strongly associated with low incomes and will ultimately only be eradicated if Scotland is able to make sustained progress at reducing poverty and inequality in our society*'.

This is supported by the FPSWG's very first recommendation that:

'The Scottish Government should place the new fuel poverty strategy firmly within the government's plans to tackle poverty and inequality.'

The Panel took cognisance of the encouragement given in these key passages, which supported our move to rebalance the focus of how fuel poverty is defined. We have tried to give greater emphasis to its interrelationship with poverty and deprivation more generally, while still recognising the multifaceted nature of the issue and the range of relevant policy concerns.

# Chapter 2

# Ways of defining fuel poverty

## 2.1. Purposes of a definition

There are several commonalities in the phrases which are customarily used to describe what a definition should ideally accomplish; words which appear regularly in dictionaries and similar accounts include:

- describe the *nature* of a phenomenon or state;
- encompass its *scope i.e. what is contained within it, and what is not;*
- give an account of its *meaning;*
- explain its *significance*.

In the specific context of fuel poverty, it is commonly agreed (e.g. DuBois, 2012) that a formal definition of fuel poverty should enable information to be collected in 3 different areas:

- *extent* – a definition should provide a means by which the prevalence of fuel poverty can be quantified, and hence monitored over time;
- *demography* – it should provide a means of determining who the fuel poor are, according to criteria such as age, tenure, and household type;
- *geography* – it should help identify where the fuel poor are most likely to be located.

Having enabled collection of data in these core areas, a definition of fuel poverty can then be used to:

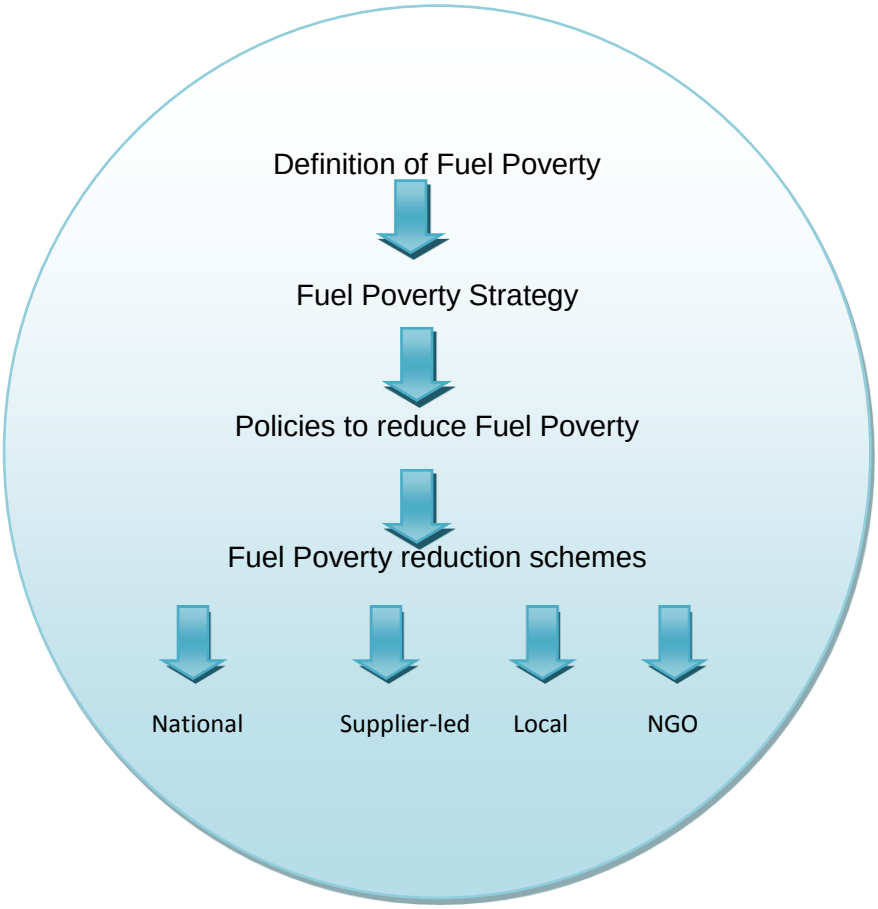
- formulate a *Strategy* for tackling fuel poverty;
- shape *Policies* that achieve the Strategy's objectives;
- guide *programmes* that address the Strategy's objectives.

Hence the relationship between definition, strategy, policy and implementation is ideally one in which they form an integrated system as illustrated in Figure 2.1 (Liddell, Morris, McKenzie & Rae, 2011).

In outlining the main ways in which fuel poverty has been defined, this Chapter considers the extent to which the different definitions have been able to:

- capture the nature, scope, meaning and significance of the concept;
- contribute directly to the formulation of strategy, policy and programmes in Scotland.

Figure 2.1.: An integrated system: Definition, strategy, policies, and implementation




## 2.2. Origins of the term fuel poverty

One of the first definitions of fuel poverty was published in 1983. This definition was adapted from Townsend's (1979) classic definition of relative poverty, and is an early exemplar of Europe's longstanding endorsement of poverty as a relative rather than an absolute concept: people are deemed poor if they do not have access to the same income and resources which most of their neighbours enjoy.

**First formal definition of fuel poverty**

'*Individuals, families and groups in the population can be said to be in fuel poverty when they lack the resources to obtain the reasonably warm and well-lit homes which are customary, or at least widely encouraged or approved in the societies to which they belong*'. (Bradshaw & Hutton, 1983).

Eight years later, Boardman (1991) published the following definition in her book entitled *Fuel Poverty*:

**Boardman's 1991 definition**

*'[A fuel poor household is] unable to obtain an adequate level of energy services, particularly warmth, for 10 per cent of its income'.*

### 2.3. The first technical definitions of fuel poverty used in UK jurisdictions

The first technical definitions of fuel poverty were based on '*a theoretical calculation of how much it would cost to heat a dwelling according to a specified heating regime and assumptions about use of lighting, hot water, cooking and appliances'* (Scottish Government, 2012). These drew heavily on Boardman. The precision and explicitness of these definitions enabled – for the first time – the collection of detailed and accurate information on fuel poverty prevalence, including:

- how many households were fuel poor (*extent*);
- what types of households are likely to experience fuel poverty (*demography*);
- where they were most likely to be found (*geography*).

These calculations of energy cost led directly to the development of a UK-wide strategy to lessen the prevalence of fuel poverty, which was launched in 2001. This strategy adopted a definition of fuel poverty which then remained in place for over a decade in England, Wales and Northern Ireland.

**UK Fuel Poverty Strategy definition (DEFRA, 2001)**

*'A fuel poor household is one that cannot afford to keep adequately warm at reasonable cost. The most widely accepted definition of a fuel poor household is one which needs to spend more than 10% of its income on all fuel use and to heat its home to an adequate standard of warmth. This is generally defined as $21^0$C in the living room and $18^0$C in the other occupied rooms – the temperatures recommended by the World Health Organisation*'.

Scotland adopted a similar definition in 2002:

**Scotland's definition (Scottish Executive, 2002)**

'*A household is in fuel poverty if, in order to maintain a satisfactory heating regime, it would be required to spend more than 10% of its income (including Housing Benefit or Income Support for Mortgage Interest) on all household fuel use. The definition of a 'satisfactory heating regime' would use the levels recommended by the World Health Organisation. For elderly and infirm households, this is 23° C in the living room and 18° C in other rooms, to be achieved for 16 hours in every 24. For other households, this is 21° C in the living room and 18° C in other rooms for a period of 9 hours in every 24 (or 16 in 24 over the weekend); with two hours being in the morning and seven hours in the evening. 'Household income' would be defined as income before housing costs, to mirror the definition used in the UK Households Below Average Income (HBAI) Statistics*'.

Within these strategies, targets were set for the eradication of fuel poverty within a defined timeline. But as the prevalence of fuel poverty in the UK escalated, both the 2010 and 2016 targets were missed. The Boardman-based definition became increasingly scrutinised and contested. A search for new ways of defining fuel poverty had gotten underway.

### 2.4. England's LIHC Indicator of Fuel Poverty

In 2010, the then UK Department for Energy and Climate Change commissioned a review of how fuel poverty might be defined. This was carried out by John Hills (2011/2012). England adopted the alternative which Hills recommended in 2012. This was the Low Income High Cost Indicator (LIHC).

**England's LIHC Indicator of Fuel Poverty (Hills, 2012)**

'*Under the LIHC indicator, a household is considered to be fuel poor if they have required fuel costs that are above average (the national median level), and were they to spend that amount, they would be left with a residual income below the official poverty line*'.

However, Wales, Northern Ireland and Scotland have – thus far – retained the Boardman definition.

### 2.5. Energy Precariousness

At the same time, mainland European researchers were exploring other options for a definition of fuel poverty. The search was mainly led by France, which adopted the term *précarité energétique* (*energy precariousness)* in 2010. It loses much in translation, but in English it is described as follows:

**Energy Precariousness**

'*A person in energy precariousness is anyone who meets, in its home, particular difficulties to have the necessary energy needs because of the inadequacy of its resources or of its housing conditions'*. (DuBois, 2012).

The term is supplemented by a so-called '*practical definition…inspired by the UK definition, with a threshold of actual energy expenses of 10% of income to define who is actually in fuel poverty*' (DuBois, 2012). More recently, France has begun to explore the possibility of replacing this practical definition with the LIHC indicator. However, their databases are not yet capable of providing estimates of required fuel costs, and so France still relies on actual energy expenditure or very broad models of required fuel costs, in order to calculate *précarité energétique* and estimate the LIHC indicator (Imbert, Nogues & Sevenet, 2016).

## 2.6. Consensual or subjective metrics

The European Union pioneered the implementation of 'consensual' indicators of fuel poverty embodied in the EU-SILC metric (Thomson, Snell & Liddell, 2106). This paved the way for a broader investigation of the adverse outcomes commonly associated with fuel poverty. In that sense, it laid the foundation for a more rights-based approach to defining fuel poverty, which has re-positioned fuel poverty into a wider socio-political agenda.

### 2.6.1. Consensual Fuel Poverty – EU-SILC

The term EU-SILC stands for European Union Statistics on Income and Living Conditions. The EU-SILC asks households to make subjective assessments about indicators of fuel poverty and whether these apply to them or not. Three questions in the EU-SILC are concerned with fuel poverty, and these are added together to produce a single score (0-3) denoting both the prevalence of fuel poverty in a particular Member State (a score of 1 or above), as well as the depth of fuel poverty (with a score of 3 being the most severe).

**The EU-SILC metric**

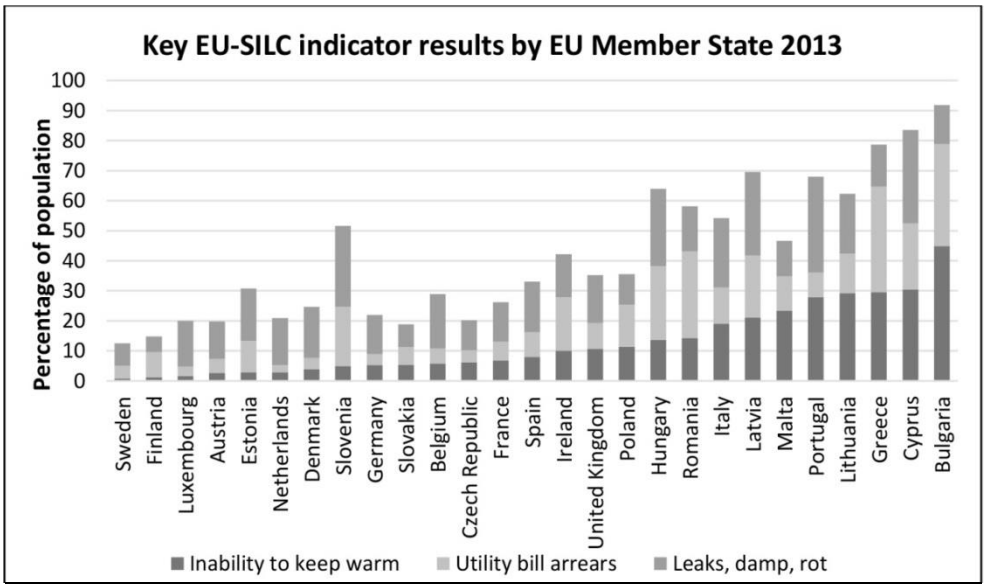
'*Have you been unable to keep your home adequately warm in the past year through lack of money?*

*Have you been in arrears with utility bills in the last 12 months?*[6]

*Does your home have a leaking roof, or damp walls, or rotten windows*?'

The EU-SILC definition approximates a technical definition, in that it yields prevalence data using a consistent metric (*extent*), and can identify who is most likely to be fuel poor (*demography*) and where they might be living (*geography*). On occasion, scores are compared across the Member States (see Figure 2.1).

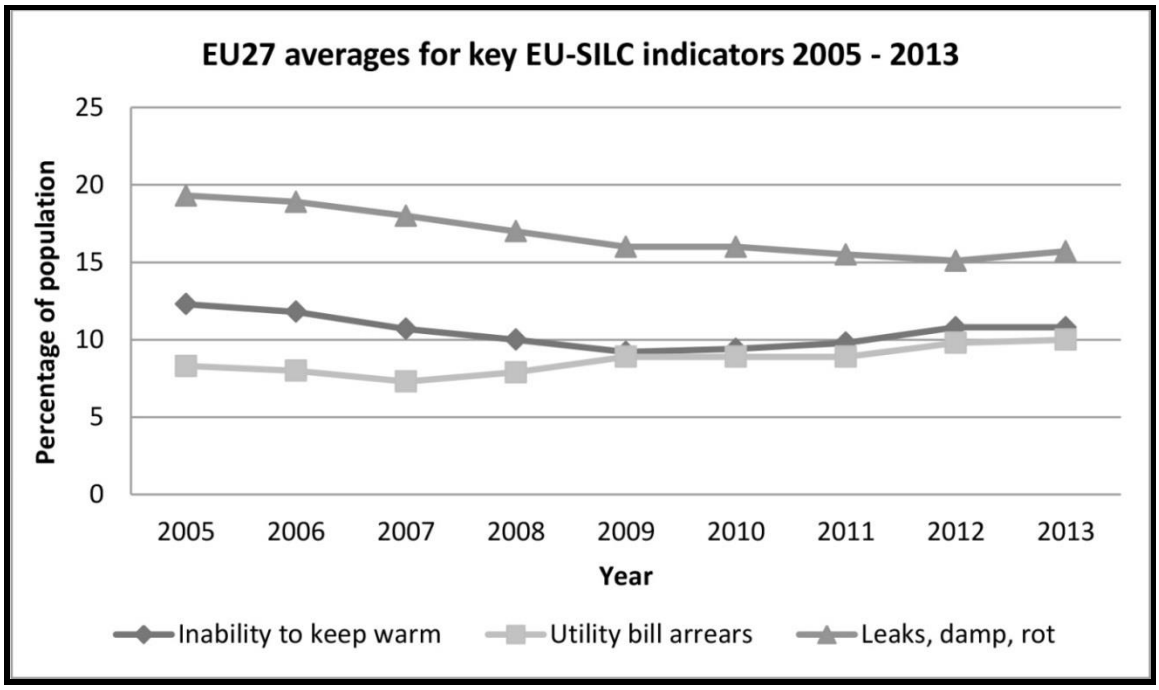
Figure 2.1.1.: Fuel poverty in Europe: consensual indicator




[6] Utilities include heating, electricity, gas, and refuse collection.

The timeline from previous European surveys (2005-2013) can be seen in Figure 2.2.

Figure 2.2.: Fuel poverty in Europe: consensual indicator




Very recently, supplementary approaches to the EU-SILC have been explored as a means of gauging subjective perceptions of fuel poverty in Europe. These are showing promise, especially in terms of their predictive validity[7] (e.g. Thomson, Snell & Bouzarovski, 2017).

### 2.6.2. Energy Poverty, energy vulnerability and energy justice

The EU-SILC indicator rested on the idea that fuel poverty could be defined in terms of people's perceptions of energy burden, rather than in terms of energy costs relative to income. Over time, this indicator spurred the development of a completely new fuel poverty discourse – around concepts such as energy poverty, energy vulnerability and energy justice.

The term *energy poverty* was introduced by Stefan Bouzarovski in the mid-2000's.

[7] Predictive validity refers the extent to which scores on a particular metric or test predict scores on something known to be highly correlated with it. For example, to assess the predictive validity of a new test for educational achievement, it would be expected that the results would show a strong correlation with school examination scores as well as with teacher ratings of a student's educational ability. We return to the issue of predictive validity in Chapter 7, more specifically in the context of Scottish data and definitions of fuel poverty.

**Energy Poverty (Bouzarovski et al., 2017)**

'*A condition characterized by the inability of a household to secure materially and socially necessitated levels of energy services in the home. The meaning of the term 'necessitated' in this context is normally derived from relative and capabilities approaches, and normally refers to the level of energy services that enables full participation in the customs and practices that define membership in society, while maintaining a healthy indoor environment*'.

Energy poverty is used synonymously with the term *fuel poverty* in the European Union, and has since also become a term frequently used to describe the global context of domestic energy insecurity.

Some years after energy poverty entered the lexicon, the term 'energy vulnerability' was coined to capture '*the likelihood of a household being able to identify and respond to any significant and/or long term changes in energy prices*' (CFU, 2016).

**Energy Vulnerability**

'*To be neither in, nor at risk of, fuel poverty householders must be able to maintain a comfortable indoor environment; know how to identify and respond to challenges to maintaining that environment; be capable of responding to those challenges; and to perceive themselves as having the capacity and agency to do so*'. (CFU, 2016).

As noted by Thomson, Bouzarovski & Snell (2017):

'*Studying energy vulnerability means examining risk factors that contribute to the precariousness of particular spaces and groups of people. One novelty of the vulnerability framework is its emphasis on the spatial and temporal dynamics of energy poverty, which recognizes that households described as energy poor may*

*exit the condition in the future by a change in some of their circumstances, and vice versa*.'

This approach views energy as a basic human right, and a matter of social justice (Gillard, Snell & Bevan, 2017). The logic of this position is that most requirements for a minimum quality of life in contemporary societies rely on heating and electricity. The debate includes questions about the global dimensions of energy justice (Sovacool et al, 2017), since a narrower national perspective ignores the way that energy consumption in more affluent economies often harms populations in other parts of the world.

Scottish publications in this domain include those of Keith Baker and Ron Mould, who point out that, while a key strength of Boardman's definition is its rootedness in robust evidence from building science, an unintended consequence is that the definition is insensitive to the human realities of being fuel poor, which are diverse in both origin and solution (Mould & Baker, 2017a). Consequently, Scottish discourse related to energy vulnerability focuses on alternative concepts such as exposure to fuel poverty, sensitivity to its impacts, and a household's adaptive capacities for coping with it (e.g. Mould and Baker, 2017b).

Treating the alleviation of fuel poverty as a matter of social justice means tackling the structural causes of inequality, rather than focusing mainly on technical and economic metrics of housing standards and energy efficiency. Whilst it does not offer a simple guide to how fuel poverty should be defined, it does offer insight into the wider societal impacts of such definitions, and can assist in aligning policy across the multiple areas of economy, poverty, energy, housing, climate change, and fairness.

There are 3 types of energy justice, which together provide a tool for policy-making, mainly through the investigation of weaknesses and failings of current practice:

- distributional justice concerns the familiar inter-relations of income, energy prices and quality of housing; resolving distributional injustices (such as inability to pay for energy) requires fair *procedures* and *recognition* of different needs of social groups who experience disadvantage;

- procedural justice concerns the means by which people can gain access to energy, including the contesting of injustices, such as through political representation or legal redress;

- recognition justice draws attention to the different amounts of energy likely to be needed to produce the same quality of service for those with limited mobility, or long term ill health, or for families with young children: an energy justice framework would mean that this was recognised and addressed, rather than treated primarily as a matter of ability to pay (Gillard, Snell & Bevan, 2017).

In this way, proponents of this approach argue for recognition of the *heterogeneity* of those defined as fuel poor, and for participative procedures to decide the means to fairer outcomes. The principle of recognition means that policy makers have to consider how to devise services which are responsive to groups with different needs. By empowering those defined as vulnerable, ensuring greater voice and influence, policy could become more effective in overcoming stigma, challenging preconceptions and prejudices, understanding different needs and making policy fit for purpose.

The energy justice approach thus reframes fuel poverty into broader contexts than public health or energy efficiency, because it distances itself from the quantitative techno-science of traditional approaches. Instead, fuel poverty is interpreted as '*a condition in which a household lacks a socially-and materially-necessitated level of energy services in the home*' (Bouzarovski, 2007). It focuses on the human consequences of energy poverty, interpreting these in the language of inequality, justice, and fairness.

### 2.7. Non-technical definitions

These are lay definitions written in plain English. Over time phrases that have appeared more often in these definitions are '*affordable energy*' and '*reasonable*

*cost*', which highlight that energy costs need to be understood within the broader context of people's incomes and other essential expenditures.

Lay definitions are concerned with enhancing public understanding of, and engagement with, fuel poverty as a housing and public health issue. They are not customarily concerned with quantifying prevalence, severity or demography, and only occasionally with what thresholds should be used to define '*affordable energy*' and '*reasonable cost*'.

**Energy Action Scotland**

'*Fuel poverty is the inability to afford adequate warmth in the home, defined as needing to pay more than 10 per cent of income on energy costs'.*

**The Housing (Scotland) Act of 2001 section 95**

*'A person lives in fuel poverty if that person is a member of a household with a low income living in a home which cannot be kept warm at a reasonable cost*'.

### 2.8. Summary

The plethora of definitions used to capture what fuel poverty is can be organised into 3 broad categories:

- Detailed *technical* definitions, such as the LIHC Indicator and the Boardman definition. These are almost epidemiological in nature, aiming to quantify how many households are in fuel poverty, how serious a problem it is, who is most likely to be at risk of it, and where they might live.

- *Subjective or consensual* definitions. These have become increasingly concerned with justice, equality, and the lived experience of being fuel poor. They have the (often explicit) aim of reframing fuel poverty so that it moves beyond the technical confines of improved building fabrics and energy retrofits. Many qualitative accounts of fuel poverty have been published in this domain (e.g. Middlemiss & Gillard, 2015). However, apart from a few items which feature in the EU-SILC and EQLS, these approaches have not, as yet, yielded new metrics by which the prevalence of fuel poverty could be measured.

- Simple *lay descriptions* written in plain English, of which a wide variety are in common use. These have no explicit interest in measurement or monitoring, but are wholly concerned with translating what is a complex and multi-faceted concept into language that the public can access and engage with. For that reason, they have an important place in the lexicon, but should ideally match as closely as possible the multi-faceted nature of the concept being described.

Viewed historically, the concept of fuel poverty has had a long heritage. Under Boardman's original 1991 conceptualisation, it was defined and measured in terms of the balance between required energy costs and income; more than 20 years later, much of this focus was retained in the LIHC metric, where residual income and energy cost thresholds became different means for quantifying the same two thresholds of income and energy cost. But newer developments have begun to reform the framework within which fuel poverty is understood, introducing ideas of consequence, not just cause, as well as much more socio-political concerns about energy justice, rights, and fairness. Ironically perhaps, these newer approaches resonate much more with the very earliest ethos surrounding fuel poverty – as a condition which adversely affected human wellbeing (Liddell, 2012).

Returning to how this Chapter started, it can be argued that the Boardman/Hills definitions capture some of the nature and scope of fuel poverty, and are more than able to guide estimates of its extent, demography, and geography. However, in requiring very precise information on household income and required energy costs,

these two definitions rest on metrics which in fact cannot be measured precisely on the doorstep. Hence the link between definition, policy and practice has become somewhat tenuous. Deciding who is and who is not fuel poor for the purposes of implementing alleviation programmes has long rested on some rather weak proxies of the core metrics, such as benefit dependency and age. This becomes clearer in Chapter 4, where Scottish data are used to assess the links between income, required fuel costs, and who is classified as fuel poor.

Furthermore, it is only the consensual approaches to defining the term which grapple with the meaning and significance of what it is to be fuel poor, capturing issues of hardship, inequality and justice. These issues too should have a role in guiding Strategy, policies, and programmes. In that sense, a definition which is able to combine both technical and consensual approaches offers the prospect of a more rounded alternative.

**Key Conclusions on ways of defining fuel poverty**

There is a growing need to reframe how fuel poverty is defined in Scotland, with greater prominence being accorded to issues of energy injustice and inequality. Over and above the classic metrics of income and required energy cost, a new definition should capture the lived experiences of people affected by fuel poverty, especially those for whom energy costs incur enduring hardship and adversity.

In that context, a new definition should reflect a balanced combination of objective and consensus-based metrics. This combination is likely to point towards a greater diversity of causes and consequences, and hence a wider range of potential tools for alleviating fuel poverty than has hitherto been acknowledged.

# Chapter 3

# Fuel poverty and vulnerability

In Chapter 2 we introduced the term 'energy vulnerability', which has become part of recent discussions about the experiences of people affected by fuel poverty. In this Chapter we examine the sometimes confusing ways this term has been used, and make recommendations about how it might be most accurately used as part of a revision to the Scottish definition of fuel poverty.

## 3.1. Vulnerability in energy policy contexts

In EU policies related to fuel poverty, there is no common definition of vulnerability. Each Member State is required to define what they mean by the term 'vulnerable'. The EU gave guidance on how Member States should capture the concept as follows:

> *'In this context, each Member State shall define the concept of vulnerable customers which may refer to energy poverty and, inter alia, to the prohibition of disconnection of electricity (gas) to such customers in critical times' (EU, 2009).*

The guidance treats vulnerability as a by-product of European energy markets, and defines those unable to pay as 'vulnerable customers' who need additional protections. Each EU Member State can then use its own particular definition of the vulnerable customer, with more than a dozen different definitions currently in play. The British energy markets regulator, Ofgem (2013), submitted the following definition to the EU:

> '*Ofgem have defined vulnerability as when a consumer's personal circumstances and characteristics combine with aspects of the market to create situations where he or she is:*
>
> - *significantly less able than a typical consumer to protect or represent his or her interests in the energy market; and/or*

- *significantly more likely than a typical consumer to suffer detriment, or that detriment is likely to be more substantial.'*

In an energy market, consumer protection is a necessary part of fuel poverty remediation, but it is not a sufficient means to end fuel poverty (Pye and Dobbins, 2015), particularly when the intention is to treat this as a matter of social justice, rather than market access alone.

### 3.2. Understandings of vulnerability in fuel poverty strategies

In the more specific sphere of fuel poverty strategies and practices, the term vulnerability is also used in several different ways.

#### 3.2.1. Who is vulnerable to being fuel poor?

Here, the term refers to the types of people or households who are most likely to be in fuel poverty – people or households that are vulnerable to it, in other words. Hence, for example:

*'Deprivation is high also among young people and students who regularly live in houses of multiple occupation, but are rarely recognised as a group vulnerable to fuel poverty (Bouzarovski et al., 2013). The same could be said of migrants, homeless people, and asylum seekers*.' (Cauvain & Bouzarovski, 2013).

In this context, objections have been raised against this use of the term, since it assigns a label or status to people and may imply that this state of risk is immutable, rather than remediable. On the contrary, it is argued, people should be seen as being 'in vulnerable positions', often through no fault of their own:

'*We must recognise that the policies and practices of service and product suppliers in different markets can heavily influence the choices available, the decisions people make and the extent to which people are in vulnerable positions. People, for example, may 'choose' more expensive energy tariffs, loan or purchase deals because it is the only real option available for them. Similarly people may be put into vulnerable positions because they do not have the confidence – or power – to negotiate affordable deals if they get into deb*t.' (Stearn, 2012).

3.2.2. Energy vulnerability in a capabilities framework

Here 'vulnerability' is broadly defined as a lack of the skills and capacities required by households in order to avoid the risks and adverse effects of fuel poverty. This approach draws heavily on the capabilities framework of Sen & Nussbaum (1993). A seminal paper published in 2016 by Day, Walker and Simcock states that:

'*Promoting capabilities maximises opportunities, but leaves the individual free to decide what kind of life they value…development programmes should be aiming to increase the capabilities of individuals, and should be evaluated in these terms*.'

The *capabilities* framework is translated in the work of Thomson, Bouzarovski & Snell (2017) into 6 contributors to household energy vulnerability, which encompass both market access and wider health and welfare. Each contributor has a subset of metrics that could be used in assessing the severity of national fuel poverty and who is most in need:

- *access* i.e. a household's access to energy markets, including choice and competition amongst suppliers;
- *affordability*, encompassing not only modelled energy costs for particular types of house, but also self-perceived affordability and energy debt;
- *flexibility* i.e. a household's capacity to manage complex local/national energy infrastructures, smart metering and supply contracts and to engage in switching suppliers, tariffs, etc;
- *energy efficiency*, encompassing not only the customary House Condition Survey data, but also the energy efficiency status of appliances, and self-assessments of the extent to which the building fabric and design supports a household's daily routines;
- *needs*, particularly as these relate to health, other forms of personal vulnerability and thermal comfort;
- *practices*, encompassing energy rationing, self-disconnection, and experienced control over energy use.

Hence, a household which has a required energy cost three times the median, but which is experienced in tariff-switching, finding the best supplier on an annual basis, and has adopted a range of energy-saving routines already has some of the necessary capabilities to reduce the impacts of their high energy costs. By contrast, a household with little or no experience of engaging with suppliers, and only limited knowledge of how energy can be saved in their home is more vulnerable to the impacts of fuel poverty. The latter could, it is argued, be deemed in greater need of assistance. Under the current UK definitions (Boardman and LIHC), none of these factors are taken into consideration when estimating severity of fuel poverty and who is most in need.

This emphasis on vulnerability as lack of capabilities strengthens the rationale for widening the types of measures which government schemes deploy in their efforts to alleviate fuel poverty. These go well beyond household heating and insulation measures, and include:

- energy efficiency advice and support;
- installation of innovative energy efficiency devices;
- support for using these;
- support in managing energy debts, understanding bills and switching suppliers/tariffs;
- ongoing help in monitoring energy deals;
- advice on appliance purchasing.

In Scotland particularly, where such services have been provided within local communities (supported by local authorities, community organisations and/or national energy agencies), they have been found to maximise both a household's sense of agency and control over their bills, and neighbourhood empowerment (Darby, 2017).

On a more pragmatic note, it is doubtful whether current data in Scotland have the capacity to produce adequate metrics for these 6 contributors to fuel poverty. At least in the medium term, they serve as an important reminder of the value which can be derived from enhancing a household's capabilities and confidence in

managing their energy bills, particularly when this begins as part of an integral package of remedial measures, and then continues with support for the household long after measures have been installed.

3.2.3. Health vulnerabilities – fuel poverty's adverse effects on health and wellbeing

Here, vulnerability refers to those individuals who are most susceptible to adverse health effects associated with living in fuel poverty – usually the aged, very young, infirm and disabled. Cold homes are a potential determinant of *future* ill health as well as being an exacerbating factor in current illness and disease. In 2015, NICE published guidance concerned with preventing excess winter deaths and illnesses associated with cold homes in England. This has perhaps the most explicit definition of health-related vulnerability:

'*A wide range of people are vulnerable to the cold. This is either because of: a medical condition, such as heart disease; a disability that, for instance, stops people moving around to keep warm, or makes them more likely to develop chest infections; or personal circumstances, such as being unable to afford to keep warm enough. In this pathway, the term vulnerable refers to a number of different groups including:*

- *people with cardiovascular conditions*
- *people with respiratory conditions (in particular, chronic obstructive pulmonary disease and childhood asthma)*
- *people with mental health conditions*
- *people with disabilities*
- *older people (65 and older)*
- *households with young children (from new-born to school age)*
- *pregnant women*
- *people on a low income*.'

The Scottish Public Health Network (ScotPHN 2016) also identifies those vulnerable to health damage from poor housing. The key groups are pre-school children, older people, those with long term illness, pregnant women and disabled

people, many of whom spend more time at home. Risk of winter – or cold-related mortality and morbidity increases with age, particularly for cardio-respiratory illnesses, and particularly among those aged 85 and over (Milner et al, 2014). Among children, the percentage with respiratory problems increases with number of years in poorly heated homes. People living with one or more of the major diseases – cardiovascular and respiratory, mental ill health and conditions such as cancer – are also more likely to be vulnerable to the effects of cold homes regardless of age.

It is important to note that reliable results concerning impacts of fuel poverty on illness and disability are derived from major national studies, each with samples of at least 2,000 homes and carried out using rigorous scientific trial methodologies (Liddell & Morris, 2010). For any local authority or charitable group aiming to evaluate smaller scale retrofit programmes in their area, impacts on chronic illnesses such as COPD or asthma are unlikely to be readily found – these sorts of impacts tend to be small but significant impacts, detectable only when large samples are drawn.

But other impacts are more readily detectable with smaller samples. Here, recent consensus has emerged around the likelihood that the *primary* health benefits of alleviating fuel poverty are on mental rather than physical health (at least in the first 12 months post-retrofit). Such findings may support the idea that – at the very least – fuel poverty imposes burdens of hardship, discomfort and stress, since these burdens all show robust causal pathways to poor mental health and wellbeing (e.g. Liddell & Guiney, 2015). Evaluations using outcomes such as wellbeing, perceived control over energy bills, attitudes to the home, and thermal comfort have provided a strong evidence base from which smaller scale interventions can be assessed. The most recently published example of this approach can be found in the health and wellbeing outcomes associated with Arbed, a major fuel poverty programme in Wales (Grey et al., 2017). We use similar types of outcomes in Chapter 7, where we compare some alternative definitions of fuel poverty in terms of how they correlate with adverse outcomes.

Relevant health conditions where additional data may eventually be needed to ensure that a fuel poverty definition is not wrongly excluding individuals whose

energy costs are higher because of long term illness and disability may be as follows (Hodges et al., 2016):

- Cardiovascular and respiratory conditions;
- Neurological conditions (including dementia, Parkinson's disease, multiple sclerosis, epilepsy etc.);
- Musculoskeletal conditions (incl. Osteoarthritis, Rheumatoid Arthritis etc.);
- Blood disorders (incl. Sickle Cell Disease, Thalassemia etc.);
- Cancer;
- Diabetes;
- Psychiatric and mental health;
- Disabilities (consequences of physical, cognitive, mental, sensory, emotional, or developmental impairment, or some combination of these).

It is noteworthy that the list produced by Hodges and colleagues *includes* conditions that are not encompassed in the NICE Guidelines, and also *excludes* some conditions in the Guidelines. In particular, age is not seen as a proxy for vulnerability in the list published by Hodges and colleagues, whereas the NICE Guidelines stipulate an age threshold of 65 years above which people are automatically considered to be vulnerable to the health impacts of cold and damp homes. As will be seen in Chapter 5, the World Health Organisation concurs with NICE's view.

However, in the context of an increasingly healthy and active older population, it could be argued that age per se is not a particularly useful criterion for classifying people as vulnerable to cold-related health impacts. *In the absence of any long-term ill health or disability*, the Panel took the view that age should not become a proxy for vulnerability, until a much older age than is presently used as a threshold in Scotland (which is 60 years). A threshold nearer 75 to 80 years might be more appropriate; however the setting of an age threshold was considered a matter for public health experts in Scotland, rather than for the Panel, a point to which we return later in this Chapter.

### 3.3 Using health vulnerabilities in how fuel poverty is defined

Any revised definition of fuel poverty may unintentionally exclude some individuals who, by virtue of age, health or disability are particularly vulnerable to effects of cold homes. This may happen if for example their income is marginally above the level at which they would be defined as fuel poor, in relation to required energy costs. Such individuals may lack the capabilities, interest and financial means to manage energy efficiency, heating and appliance upgrades. Problems would be exacerbated when poor health or disability limit the person's ability to decide what work is needed in order to achieve the intended benefits, to manage potentially complex and disruptive projects, to monitor the quality and price of the work, and to make best use of improved heating and electric appliances afterwards. The challenge is to represent those vulnerable individuals accurately, not only in practice, but in the definition itself. Here too, the Panel thought that expert adjudication was needed.

### 3.4. Incorporating adequate vulnerability criteria into a definition of fuel poverty: Recommendations for further development

In Chapter 2 we noted that a revised fuel poverty definition and subsequent strategy should include a combination of objective and consensus-based metrics. This is likely to point to greater diversity of causes and consequences of fuel poverty, and to suggest a wider range of potential tools and services for alleviation than previously acknowledged.

We recommend that an important dimension of such a definition is inclusion of appropriate vulnerability criteria for Scotland, relating particularly to age (both with respect to young children and older people), long term illness (whether physical or mental) and/or disability. When the concept of vulnerability is brought into the context of health, highlighting the extent to which living in fuel poverty can be a factor in causing or worsening disease and ill health, it can be a useful tool for prioritising scarce resources.

In our consultations with stakeholders, the value of an underpinning principle of vulnerability in a revised definition was supported, but viewed as potentially complex to implement. At present there is no consensual set of criteria for assessing health-related vulnerability in relation to fuel poverty, although we have

noted in this Chapter that a range of public health evidence identifies broad disease, disability and age groups. We recommend therefore a further stage of work on vulnerability criteria, which should be done by a specialist group with representatives from public health, local health and social care partnerships and the social security team.

The terms of reference should be narrow, so that the group confines its deliberations to the issues related to vulnerability *as these affect a definition of fuel poverty*. The work should be undertaken as an integral, focused, component of the planned Government consultation. In Chapters 7 and 8 the Review Panel has set out the working assumptions made in relation to age groups, long term ill health and disabilities, and the resulting adjustments made to recommended indoor temperatures and Minimum Income Standards. The additional work of the practitioner group should test the validity and robustness of these assumptions, consider their connectivity with vulnerability criteria used in other domains of Scotland's social security strategy, and recommend a set of vulnerability criteria, and consequent adjustments to income standards and/or energy needs, to be used in the context of fuel poverty.

A range of definitions of vulnerability already exist, including in development of Scotland's Social Security strategy, and these strands of work need to be aligned. Fuel poverty will then retain its significance as a problem in which its health impacts are understood, and tackled, in relation to low income, energy prices, and household energy use.

Health vulnerabilities need to be incorporated into a fuel poverty definition in relation to increased need for energy at home, leading to *higher required energy costs*, and likely need for a higher *minimum income standard*.

These costs may stem from a range of additional energy needs, for example:

- necessity for a warmer home for longer periods;
- additional hot water;
- use of electrical equipment as part of health care support for independent living.

At the same time, some vulnerable groups may also incur additional unavoidable expenditure on non-fuel items, such as transport costs (e.g. need for taxis to attend hospital appointments as a result of limited mobility) or food (e.g. if require a special diabetic diet) (Fitzpatrick *et al*, 2016). This means that the minimum residual income that they require after housing and fuel expenditure is deducted may have to be higher than for non-vulnerable households.

The relevant cost factors need to be defined and tested to produce suitable metrics for a range of required energy costs and/or minimum income standards. Which factors should be incorporated into a minimum income standard, and which into required energy costs for which groups, needs to be agreed. As part of this, a consensus is also needed on the *recommended indoor temperatures and periods of heating* for different long term illnesses and disabilities, and age groups (particularly young children and frail elderly).

Inclusion of these factors in the definition makes it less likely that vulnerable people will be falsely excluded from an eligibility group; conversely, they make it more likely that fuel poverty prevalence will include a large proportion of people whose status is deemed vulnerable.

Once the issues related to the definition are dealt with, scope will be needed for development of an effective strategy, which can be implemented at local scale, for example by local authorities, community groups, and health and social care partners. As part of strategy development, it is necessary to consider not just the energy efficiency of housing, but the constrained capabilities[8] of vulnerable groups to manage energy use, energy appliances and bills, or improvements to thermal comfort. While those living on low incomes with long term poor health or disability are frequently highly resourceful and resilient, services and resources responsive to their needs can considerably improve their circumstances, sense of autonomy and control, as well as their participation in social and community networks.

In strategy development, consideration also needs to be given to the risk that a revised fuel poverty definition may exclude some people at the margins of eligibility, by virtue of their income in relation to required energy costs. Poor health,

[8] The capabilities framework is discussed in Chapters 2,3 and 6 of the Report.

disabilities, age or other life circumstances may mean, however, that they lack capacity and capabilities to manage energy efficiency, heating and appliance upgrades for their home, rendering them susceptible to future experience of fuel poverty and further adverse outcomes. Local services are critical to identifying people in this situation and to prevent them from falling into fuel poverty. Telephone advice, or even a home visit and report of recommended action are insufficient in many cases, because home energy efficiency projects are often complex to manage, disruptive of home routines and there may be no easy access to trusted local suppliers and quality guarantees. The affordability of the work relative to its subsequent value for quality of life can be hard to assess, and people may also lack understanding of how to use improved heating and electric appliances afterwards. Health records and knowledge from community health and social care partnerships could be used to identify those who are not, technically, fuel poor. Appropriate local services then need to be created. Such services are likely to be similar to those services for people in fuel poverty,[9] which are designed to provide direct support to people to improve the comfort and use of their home, and to meet the standards set by the forthcoming Scotland's Energy Efficiency Programme (SEEP).

### 3.5. Conclusions

The term vulnerability has been used in many different contexts, and has different meanings in each of them. The EU's directive to Member States, advising them to each construct their own definition of vulnerability in energy markets has focused on advocacy of additional protections for vulnerable consumers, but has not addressed the wider structural causes of low incomes and relative poverty and resulting needs. Nor has the use of the term as another word denoting the likelihood of people being in fuel poverty proved productive, since this is arguably just an unnecessary synonym for *prevalence*.

However, where the concept of vulnerability is brought into the context of health, highlighting the extent to which living in fuel poverty can be a factor in causing or

[9] This type of Homecare service is being piloted by Home Energy Scotland in around 220 rural households. The project will be evaluated by HES and University of Edinburgh (ClimateXChange: SEEP Pilots' Evaluation, https://goo.gl/kNhkj7) and findings will contribute to future strategy.

worsening disease and ill health, it can be a useful tool for targeting and prioritising scarce resources. It also helps ensure that tackling fuel poverty is not subsumed into a programme for energy efficiency in housing, but retains its significance as a problem in which health impacts stem directly from low income, energy prices, and household energy use. This means that policies to address poverty, social justice and health, as well as housing, are all implicated in solutions.

Furthermore, where vulnerability is captured within a capabilities framework, it legitimises a range of additional solutions and tools for alleviating fuel poverty, all of which have to do with providing people with the capacities and skills they need to build energy resilience.

**Key Conclusions on vulnerability**

The Panel did not consider it appropriate that the term 'vulnerability' should be used as a synonym for prevalence.

However, it saw an important role for the convention of vulnerability being conceptualised in a capabilities framework. This gave special status to people who had, for example, only limited opportunities to develop problem-solving skills around tariff-switching, or who were not confident in making application for support, etc. However the term 'vulnerable' was not considered to be especially apt in describing this group, not least of all because the assistance this group might require was rather more specific than the term 'vulnerable' implied.

The most appropriate use of the term 'vulnerability' was thought to be related to health risks, such that people most likely to experience the adverse health and mental wellbeing outcomes associated with fuel poverty were deemed to be vulnerable.

The Panel thought that, in the context of an increasingly healthy and active older population, age per se is not a particularly useful criterion for classifying people as vulnerable to cold-related health impacts. *In the absence of any long-term ill health or disability*, the Panel took the view that age should not become a proxy for vulnerability, until a much older age than is presently used as a threshold in Scotland (which is 60 years). A threshold nearer 75 to 80 years might be more appropriate.

Precisely whose health was most likely to be vulnerable, and how vulnerabilities might be prioritised in terms of Scotland's future fuel poverty strategies remained a matter for debate, and the Panel recommended further expert assessment of this issue. The recent (2015) NICE Guidelines for England (which deal with health risks associated with living in cold homes), and the Scottish Public Health Network's 2016 Guidance on this matter, were thought to be useful potential starting points for further refinement of the term.

Given multiple uncertainties in this regard, the Panel recommended that a small independent group of Scottish public health experts be invited to develop a specific list of health and disability categories, as well as age bands, which would satisfactorily encompass the term "*vulnerable to the adverse health and wellbeing impacts of living in fuel poverty*". This matter was beyond the scope of the present Panel's expertise.

# Chapter 4

# The UK's technical definitions: Boardman and the LIHC indicator

## 4.1. Common ground

At present, the two technical definitions used in the UK are those developed from Brenda Boardman's definition (used in Wales, Northern Ireland and Scotland) and by John Hills (used in England). Both agree that fuel poverty should be considered a unique form of poverty, distinct from other types of poverty, and requiring tailored solutions. Both also specify a range of parameters that must be objectively measured and monitored – always in the same way over time – to yield a consistent estimate of fuel poverty prevalence and its broad demography. For both, prevalence is estimated by the Building Research Establishment (BRE) using:

- a set of indoor temperatures that homes should be able to maintain; this is known as the *satisfactory heating regime*;
- the costs that are associated with maintaining those temperatures;
- additional costs associated with non-heating energy needs, such as for lighting and appliance use.

Both Boardman and Hills set these energy costs alongside the income of a household. Through this they are able to estimate whether the energy cost of attaining a satisfactory heating regime places an undue burden on people's income. If so, the household is deemed to be in fuel poverty.

Both definitions focus on *required fuel costs (*referred to in past times as *needs to spend),* rather than *actual energy expenditure*. This concept was first introduced in 1991 in the English House Condition Survey's Energy Report. Among households that can be effectively captured through required fuel costs are those who *should* (for example) be spending more than 10% of their income on heating, light and other energy needs around the home, but are not doing so because of concerns about affordability. That cohort is likely to include many of those most likely to need assistance in coping with cold and damp homes. In England, for example, 80% of

households in fuel poverty were found to be underspending on energy, when their actual spend was compared to the cost associated with achieving an acceptable heating regime. This fell to 65% of households who are not fuel poor (BRE, 2013).

However, the LIHC indicator equivalises energy costs, so that household occupancy is taken into account when estimating how much energy a household requires, whereas the Boardman approach does not. The two definitions also assess income differently. Boardman's definition uses income before housing and other costs have been taken into account, and does not equivalise it; the LIHC indicator uses an after housing cost measure which is then equivalised.

Under the LIHC indicator, information on required fuel cost is sufficient to exclude a household from being fuel poor, as long as the required fuel cost falls below the national median required fuel cost. If a household's required fuel cost is above that median, then a further test is carried out, to assess whether their residual income falls below 60% of the national median income; if so, then it can be classified as fuel poor.

For Boardman on the other hand, it is the ratio of the *energy cost: household income* which determines whether a household is fuel poor or not. Hence, before eligibility for fuel poverty schemes can be determined, both energy cost and income must be assessed in every case.

### 4.2. The ratio of income to expenditure versus a floating median

The Boardman-based definition currently in use stipulates that a household is in fuel poverty if its required fuel cost is more than 10% of household income. 10% of income is a fixed proportion, which does not change over time. It has been integral to her definition since 1991. At the time, it approximated twice-median actual spend on energy in the UK relative to gross income. It was also the proportion of income the poorest income deciles were already spending on energy.

As a threshold for what could be considered high energy expenditure, twice-median had been a common construct before Boardman. In 1977, for example, Isherwood and Hancock defined '*households with high fuel expenditure as those spending more than twice the median (i.e. 12%) on fuel, light and power*'. The median quoted by Isherwood and Hancock was based on the 1977 Family Expenditure Survey.

The choice of twice median expenditure (rather than average expenditure) reflected endorsement of the concept of relative poverty. Medians are more helpful in representing relative concepts than are averages because they are able to smooth out the effects which extreme scores have on averages.

The UK Fuel Poverty Strategy (DEFRA, 2001), adopted a '*10% cut off point*', following directly from Boardman:

'*The 10% cut off point has been used for many years now. The 1988 Family Expenditure Survey (FES) showed that households in the lower three income deciles spent, on average, 10% of their income (not including Housing Benefit or ISMI as part of their income) on fuel for all household uses. It was assumed by researchers in the fuel poverty field that this could be taken as representing the amount that low-income households could reasonably be expected to spend on fuel*'.

It is unclear why a threshold based on the 1988 Family Expenditure Survey was adopted for the UK's 2001 Strategy, since more recent data on energy expenditure was available at the time. However, the 10% cut-off did approximate twice-median *actual* spend in England at the time the Strategy was formulated.

This is no longer the case. Twice-median actual expenditure is now lower than this in England, and also in Scotland and Wales (the exception being Northern Ireland), as can be seen on Table 4.1. In Scotland, twice-median (2010 – 2012) was 7.4% of gross income.

Table 4.1.: Actual fuel spend as a proportion of income (2010-2012) (Scottish Office data)

| Actual fuel spend | | England | Wales | Scotland | Northern Ireland | UK |
|---|---|---|---|---|---|---|
| **% of gross income** | Mean | 6.9 | 6.2 | 5.9 | 9.9 | 6.8 |
| | Median | 3.3 | 4.0 | 3.7 | 5.4 | 3.5 |
| | | | | | | |
| **% disposable income** | Mean | 6.6 | 6.5 | 6.4 | 11.1 | 6.7 |
| | Median | 3.9 | 4.5 | 4.3 | 6.3 | 4.0 |

Moving to *needs to spend* – rather than actual spend – Table 4.2. provides information on the median ratio of required energy costs: income (the fuel poverty ratio) for Scotland, before- and after-housing costs (BHC and AHC respectively). The three-year average median (BHC) is 7.5%, making twice-median required energy cost 15% rather than 10%. However, among households who are neither income poor[10] nor fuel poor (the most ideal category), twice median is 11% rather than 10% BHC (or 12% AHC); it is, perhaps, that subgroup whose energy: income ratio could be considered the better reference point for determining who is defined as fuel poor.

[10] In this Chapter, the term *income poor* derives from the Scottish definition of poverty: households with less than 60% of the median income.

Table 4.2.: Required spend: median fuel poverty ratio (2013 to 2015) (SHCS)[11]

| **Fuel and Income Poverty Combined Groups** | **BHC** | **AHC** |
|---|---|---|
| Fuel poor and income poor | 18.1% | 22.5% |
| Fuel poor, not income poor | 13.3% | 13.7% |
| Income poor, not fuel poor | 8.4% | 8.6% |
| Neither income nor fuel poor | 5.5% | 5.9% |
| **All Households** | **7.5%** | **8.7%** |
| *Sample* | *7998* | *8024* |

The LIHC indicator also uses median energy costs to assess whether households are in fuel poverty. By contrast, this is a floating rather than a fixed median, based on national energy costs prevailing in the year that fuel poverty prevalence is being assessed. Households whose required fuel costs are above the *current* median (which will change each year) are, potentially, in fuel poverty – though only if these costs mean that their residual income leaves them in income poverty

Whether a floating median is any more or any less problematic than a fixed median has been much debated, for example:

'*By defining 'reasonable' as 'less than the median', the energy costs threshold produced by Professor Hills becomes relative and arguably arbitrary in nature: half of households would always fall beneath it and be facing 'reasonable' fuel costs (whilst half of households would always be facing 'unreasonable' fuel costs). The shifting nature of the median means that it is difficult to reduce the fuel poor*

11

There are some discontinuities in the underlying method for Annual Running Costs as follows: figures for 2011 and 2012 allow for Warm Home Discount (WHD) adjustment only; 2013 includes WHD and price source adjustments; 2014 and 2015 include WHD and price source adjustment and an updated BREDEM model.

*headcount through efficiency improvements; as energy costs reduce, so will the median.' (Moore, 2012b).*

The extent to which a floating median evens out annual estimates of fuel poverty prevalence can be seen in Table 4.3 which compares estimates of fuel poverty in Scotland using:

- Boardman, where a fixed median is applied, and where *>10% of income for energy = fuel poor;*
- the LIHC indicator, where a floating median is applied, and where *above current median energy costs = fuel poor provided residual income is below the poverty threshold*.

Table 4.3.: Percentage of fuel poor households in Scotland 2007 to 2015 – Boardman and LIHC indicator estimates (SHCS)

| | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** |
|---|---|---|---|---|---|---|---|---|---|
| **Boardman (B)** | 25% | 27% | 33% | 28% | 39% | 35% | 36% | 35% | 31% |
| **LIHC** | 13% | 12% | 13% | 13% | | 12% | 11% | 12% | 12% |
| ***B – LIHC*** | *+12%* | *+15%* | *+20%* | *+15%* | | *+23%* | *+25%* | *+23%* | *+19%* |

If fuel prices had risen in line with inflation in Scotland between 2002 and 2015, the rate of fuel poverty in Scotland (2015) would have been 8% rather than 31% (Hansard, 2017), illustrating the extent to which the LIHC's floating median obscures one of the principal drivers of fuel poverty, namely fuel prices.

As is well known, national fuel poverty strategies in Scotland and elsewhere in the UK have been predicated on alleviating, if not eradicating fuel poverty. The LIHC Indicator also makes achieving *one* of these extremely difficult (alleviation), and the other almost impossible (eradication), since prevalence will always calibrate around the floating median. To address this problem, Hills introduced the concept of a 'fuel poverty gap', which is discussed in the next section.

### 4.3. Severity of fuel poverty: Boardman and the fuel poverty gap.

In the current era of austerity, there has been growing interest in targeting scarce resources towards those in deepest fuel poverty (Walker, Liddell, McKenzie & Morris, 2014). This makes a metric which can reflect different severity levels of fuel poverty especially important.

Based on the Boardman definition, the Scottish House Condition Survey (SHCS) can be used to generate a '*5-fold indicator*' of fuel poverty. This is provided in Table 4.4.

The five categories represented on the table are defined as follows:

- *Extreme fuel poverty* encompasses households whose required fuel costs are **more than 20%** of their income;
- *Severe fuel poverty* encompasses households whose required fuel costs are **over 13% but no more than 20%** of their income;
- *In fuel poverty* encompasses households whose required fuel costs are over **10% but no more than 13%** of their income;
- *Not in fuel poverty* encompasses households whose required fuel costs would consume **10% or less** of their income. Some of these will be in so-called 'marginal fuel poverty;
- In marginal fuel poverty encompasses households whose required fuel costs are more than **8% but no more than 10%** of their income.

Table 4.4.: Prevalence of fuel poverty: five-fold severity indicator (SHCS)

| 5-fold indicator | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | Mean 2013-2015 |
|---|---|---|---|---|---|---|---|
| **Extreme** | 10% | 9% | 9% | 10% | 9% | 8% | 9% |
| **Severe** | 13% | 13% | 13% | 14% | 14% | 11% | 13% |
| **Fuel poor** | 12% | 12% | 13% | 12% | 12% | 12% | 12% |
| **Marginal** | 12% | 12% | 14% | 13% | 13% | 12% | 13% |
| **Not fuel poor** | 53% | 55% | 52% | 52% | 52% | 57% | 54% |

Between 1990 and 2012, when all 4 nations used the Boardman definition, a more common distinction in annual reports was between *fuel poverty* (energy costs require more than 10% of income) and a subset of households in *extreme fuel poverty* (more than 20% of income). Table 4.5 contains details. Two features are noteworthy from the Table:

- the proportion of fuel poor households who are in extreme fuel poverty has been consistently just above a quarter of all the fuel poor in Scotland since 2010 (27% – 28%);

- more than 200,000 households were estimated to be in extreme fuel poverty in 2015.

Table 4.5.: Fuel Poverty and Extreme Fuel Poverty in Scotland (N in '000s (%) (SHCS)

| Year | Fuel poverty | Extreme fuel poverty | Extreme as % of all fuel poor |
|---|---|---|---|
| **2010** | 818 (35%) | 225 (10%) | 28% |
| **2011** | 779 (39%) | 209 (9%) | 27% |
| **2012** | 824 (35%) | 222 (9%) | 27% |
| **2013** | 860 (36%) | 236 (10%) | 27% |
| **2014** | 845 (35%) | 229 (9%) | 27% |
| **2015** | 748 (31%) | 203 (8%) | 27% |
| **3 year mean** | **818 (34%)** | **223 (9%)** | **27%** |

The LIHC definition generates a more precise estimate of severity through a measure called the *fuel poverty gap* (see Table 4.6). Instead of the broad bands of severity the LIHC indicator calculates severity to the nearest £1.

Table 4.6.: Fuel poverty gaps in Scotland (SHCS data)

| Year | Median fuel poverty gap in Scotland via LIHC | Change in gap |
|---|---|---|
| **2010** | £511 | |
| **2011** | £505 | -£6 |
| **2012** | £520 | +£15 |
| **2013** | £545 | +£25 |
| **2014** | £591 | +£46 |
| **2015** | £532 | -£59 |

Given that the use of a floating median, adjusted each year, greatly constrains annual variations in LIHC fuel poverty prevalence, it is the fuel poverty gap which gives the primary estimate of severity in the LIHC indicator.

For that reason, it is a crucial element of the LIHC metric for:

- monitoring change in national estimates of how serious or otherwise fuel poverty is;

- identifying people most in need;

- assessing whether intervention programmes are making inroads.

### 4.4. The demography of fuel poverty – Boardman & LIHC compared

The lack of any read across from one definition to the other is further evidenced by differences in the types of households each definition finds to be most vulnerable to fuel poverty (Preston et al., 2014). This means that the overlap in terms of which types of households are most likely to be fuel poor is small.

The same has been found in France, where only one-third (35%) of fuel poor households were common to both approaches. As with studies in the UK, the LIHC indicator detected more low-income households, more families, more tenants and more homeowners with a mortgage.

Most of these differences can be explained by the differences between the two indicators in:

- use of fixed versus floating thresholds;

- the deduction of housing costs under the LIHC indicator;

- the equivalisation of income and energy costs under the LIHC indicator (Imbert, Nogues & Sevenet, 2016).

Under Boardman, a drawback of perhaps greatest magnitude is that the definition does not preclude wealthy people from being classified as fuel poor. Households on a net income of £60,000 would be fuel poor under the Boardman definition if they lived in a large, draughty and uninsulated old home with a *required* fuel spend greater than £6,000 (even though they may not actually spend that amount).

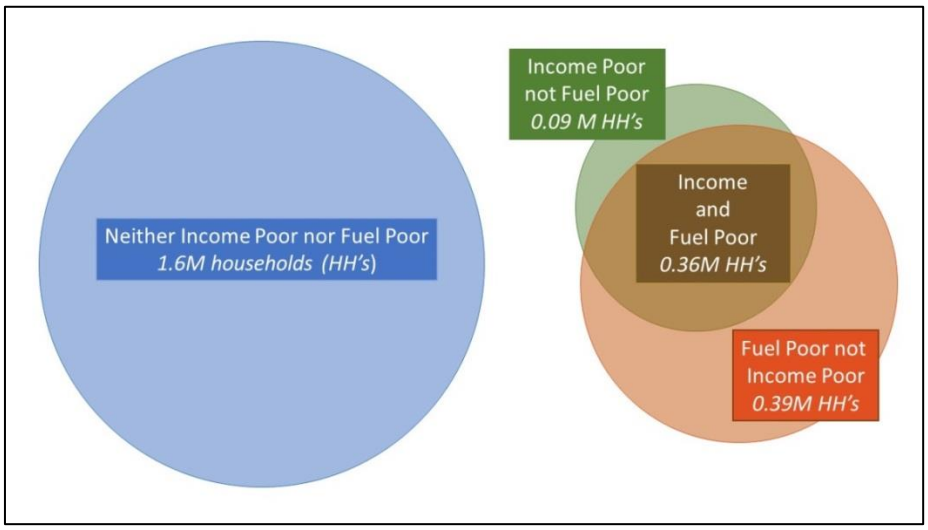
The same household could not be classed as fuel poor by the LIHC indicator. Although their required fuel costs would be patently higher than the median, these costs would still leave them with a residual income above the poverty threshold (60% of median income).

To most Scottish practitioners, it is the classification of wealthier households as fuel poor which creates the greatest unease with the Boardman definition. It has major impacts on prevalence. In fact, the Boardman definition, as used in Scotland, does not align successfully with section 95 of the Housing (Scotland) Act 2001 which indicated that:

*'a person lives in fuel poverty if that person is a member of a household* ***with a low income*** *living in a home which cannot be kept warm at a reasonable cost'.* (bold font added)

Between 2013 and 2015 less than half of all fuel poor households in Scotland were also income poor (46%). As can be seen in Figure 4.1. the confluence of households that are *both income and fuel poor* under Boardman is a relatively small one (estimated at 360,000 households) when taken in the context of the Scottish population of households (15% of all Scottish households).

Figure 4.1.: The population of households (N = 2.43M) by income and fuel poverty status (SHCS, 2015)



According to the Scottish Fuel Poverty Evidence Review of 2012, and the SHCS 2015, households who are *fuel poor but not income poor* can be characterised as follows:

- they tend to live in rural areas;
- in detached and energy inefficient homes which are under-occupied;
- their homes are heated for a significantly longer period (8 hours more per week);
- the majority of them are in work;
- they have the highest self-reported spend on energy (almost £1,500 per annum) but also the greatest shortfall from what they should be spending in order to achieve a satisfactory heating regime (a *needs to spend* estimated as £2,400 per annum);
- more than three-quarters of them (82%) would be classified as vulnerable under Scotland's definition of the term, mainly as a result of the current age threshold is set at pensionable age;
- they are marginally less likely than others to feel fuel poor (5% rate themselves as subjectively fuel poor, compared with 7% of the population as a whole).

Under the LIHC indicator, concern is of the opposite kind, centred on who fails the fuel poverty test, rather than who passes it erroneously. Here, a group who are frequently not considered fuel poor are relatively low income households who live in small[12], reasonably energy efficient homes. These households are likely to fail the first test under LIHC, namely whether they fall below the national median energy cost.

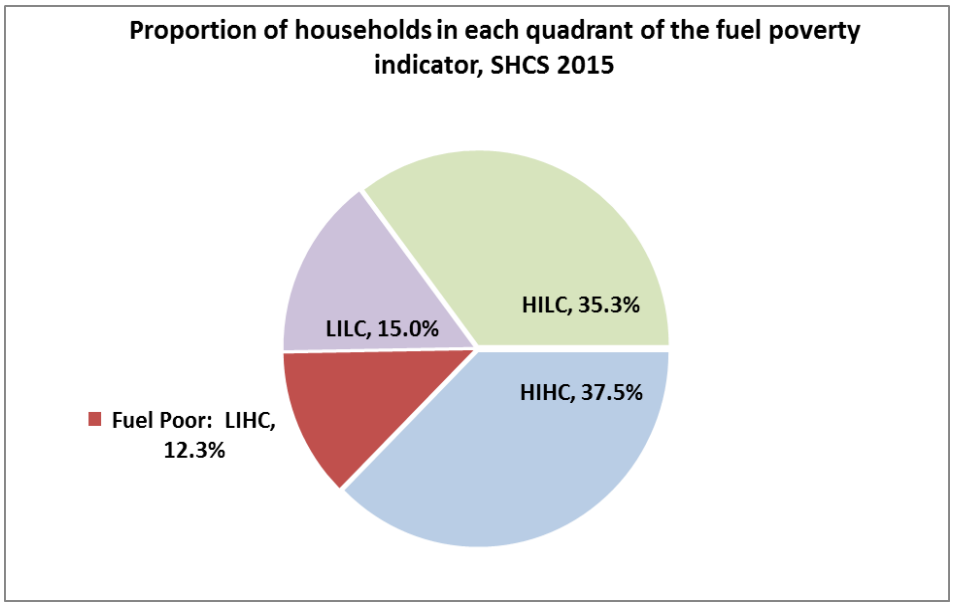
[12] LIHC's bias towards including large homes as fuel poor is evident in the fact that average dwelling size for English households in LIHC fuel poverty is 99.4 $m^2$ compared to an average dwelling size of 90.9 $m^2$ and 65.6 $m^2$ for all other low income homes (Moore, pers. comm.).

As Moore et al. (2012b) point out:

'*The majority of low income households with energy costs below the median have the potential for low cost energy efficiency improvements that would save at least £50 per year – in practice likely to be much higher. Can a low income household's energy costs be considered 'reasonable' if their homes can be made cheaper to run at low expense*?'

For England, Moore and colleagues estimate that this omission excludes 12% of what would be construed as fuel poor households under Boardman. For Scotland, Figure 4.2 indicates that the exclusion may involve a greater proportion of households: 15.0% of Scottish households were classified as low income/low cost (LI**LC**), which was almost 3% more than households classified in fuel poverty (LI**HC**) (12.3%).

Figure 4.2.: Households in each quadrant of the fuel poverty indicator (SHCS 2015).




The LILC group merits careful consideration for at least 2 reasons. First, they may be among the most cost-effective households to fuel poverty proof. Second, they could be among the more needy households, in terms of the strain which energy bills place on their meagre disposable income. This possibility has been confirmed using English House Condition Survey data, where LILC households are found to

be unable to afford required household energy costs once other essentials (such as rent, food and clothing) are costed against their income (Moore, pers. comm.). As energy prices rise, and the floating median rises along with them, the burden of energy bills on these particular households is likely to escalate, but without any improved prospect of them passing the *energy cost above median* test.

### 4.5. Affordable heat or affordable domestic energy?

Both Boardman and LIHC estimate fuel poverty based on all domestic energy needs. This is in line with the original intention of Boardman's work on fuel poverty (1991) which was to include all energy needs (i.e. heat, light, and appliances).[13] If the rationale for tackling fuel poverty centres on public health, then some have argued that fuel poverty should be calculated solely from what is needed to achieve a satisfactory heating regime, omitting the energy required for cooking, lighting, etc. In that vein, an alternative concept, 'heat poverty' has been mooted (Scottish Government, 2012).

The latest available data (from the Scottish House Condition Survey) indicate that the modelled cost of space heating makes up just under half of the average domestic energy bill, so a measure solely based on heat poverty would have a substantial impact on the prevalence of fuel poverty. Based on the 2008-2010 SHCS data, for example, it would have reduced fuel poverty from 28% of households to 11%.

It would require only a simple amendment to either the Boardman or the Hills definition to achieve this modification. However, almost one-third (31%) of the average domestic energy bill derives from cooking, hot water, lights and appliances. It is difficult to imply that these basic energy requirements are of less importance to people's wellbeing and quality of life than are warm rooms.

The work which has been completed in Scotland on Minimum Income Standards (e.g. Hirsch et al., 2016) is relevant here, since 3 of the 7 elements making up these

[13] Although she frequently emphasises that her concerns are with 'mainly heat'.

Standards require significant expenditure on energy, and 2 of these implicate electricity:

- 'housing and domestic fuel' – costs associated with heating a home and hot water are derived from BREDEM 12, and so reflect the 'needs to spend' methodology which both Boardman and Hills have endorsed;

- 'household goods and services' – these include a range of small electrical goods (lamps, hairdryer, hair straighteners, kettle, toaster, iron, hand blender);

- 'Social and cultural participation' – TV, laptop and internet access.

Hence, there are reasonable grounds for estimating a combination of heating and all other domestic energy needs when calculating *required fuel costs*.

### 4.6. Affordable domestic energy or a healthy indoor environment?

Whilst the issue of safe indoor temperatures is examined in detail later on (see Chapter 5), stakeholders that we consulted on heat-only or heat-plus-electricity options also reminded us of the extent to which a healthy living environment should encompass more than safe temperatures – condensation, ventilation, damp and mould contribute to indoor climate too. As a consequence, the revised definition was one which we thought should be concerned less specifically with "an affordable heating regime" and more broadly with the attainment of a healthy indoor climate[14].

### 4.7. Under-occupancy

Under the Scottish definition of fuel poverty, under-occupancy occurs when a house exceeds the bedroom standard of its occupants by 2 or more rooms. Estimates of fuel poverty are made on the assumption that all under-occupied rooms require

[14] We acknowledge that this will require an increasing emphasis on cooling homes, particularly in urban areas of Scotland. However, recent modelling of climate change to 2080 indicates that the need to cool homes in the UK will not alter the current requirements for heating them – the burden of cold is greater than the burden of increasing temperatures throughout the modelled period (Hajat et al., 2014).

heating to the same standards as the main bedroom[15] (18 $^{0}$C), which increases estimates of *required fuel costs*.

The original rationale for heating all rooms of the house was contained in the Parker Morris Report of 1961:

'*Better heating…provides an extra degree of freedom in meeting individual needs in the areas of the home which at present are too cold to be suitable for daytime and evening use except in the summer*'.

The Scottish method for estimating fuel poverty prevalence is in keeping with these remarks, although not for the reasons that Parker Morris proposed. Instead, Scotland supports higher temperatures in rooms that are unoccupied '*because it is considered that creating cold-spots is detrimental to the physical structure of the dwelling*' (Scottish Government, 2012). In most cases, under-heating of rooms which are not used on a daily basis can lead to the development of damp, mildew and mould in the building fabric, on walls, wooden beams, floorboards, and most other surfaces. There is much more evidence supporting this likelihood now than there was at the time Scotland opted to include all under-occupied rooms in estimates of required fuel costs.

Given that damp, mildew and mould are also significantly associated with poorer respiratory health, it could be argued that under-heating practices can be equally detrimental to the health of a dwelling's *inhabitants* and not just the dwelling per se (Thomson, Sellstrom & Petticrew, 2013). Under-heating rooms can also mean householders close off parts of their home during the colder seasons, experiencing spatial shrink and reduced mobility. These adaptations can have adverse effects on both their physical health and their mental wellbeing.

Hence, as with the original fixing of indoor temperature regimes in Scotland, there was sound reason at the time to accept the need for all areas of the home to be heated in a relatively even manner. Since there is no new evidence to challenge this decision, but rather a significant accumulation of evidence in favour of it, it seems reasonable to suggest that rooms which may not be occupied very often in

[15] In England, fuel poverty is estimated on the basis that only 50% of under-occupied rooms need heat.

the colder seasons are nevertheless retained at temperatures recommended for bedrooms in frequent use. In this way, there is a dual opportunity to protect the house as well as the household.

There is however a tension between this perspective and current practice in advice to households about energy (and cost) saving which typically includes recommendations about 'zonal' heating. This means turning heating off or down in unoccupied rooms and only heating these rooms half an hour before they are going to be used. The UK's DEFACTO programme is trialling zonal systems, and reports that they are *least* beneficial for households who are at home most of the time. By contrast, they are *most* beneficial for families who are at work or school during the day (Beizaee et al., 2015). As illustrated on Table 4.7, there are substantial savings to be derived from using zonal controls in appropriate conditions.

Table 4.7.: Estimated gas use for heating by region.

| **Region (Weather station)** | **Annual heating energy use CC[a] (kWh)** | **Annual heating energy use ZC[b] (kWh)** | **Reduction in heating energy use (%)** | **NPV after 15 years: Basic system[b] (£)** |
|---|---|---|---|---|
| London (Gatwick) | 15685 | 13839 | 11.8% | £971 |
| East of England (Hemsby) | 15696 | 13848 | 11.8% | £972 |
| Northwest (Aughton) | 15805 | 13936 | 11.8% | £985 |
| West Midlands (Birmingham) | 16354 | 14379 | 12.0% | £1,047 |
| Northern Ireland (Belfast) | 16374 | 14395 | 12.1% | £1,050 |
| Yorkshire (Finningley) | 16507 | 14503 | 12.1% | £1,065 |
| Scotland (Aberdeen) | 17346 | 15180 | 12.5% | £1,160 |

[a] Calculated based on HDD base temperature of 17.8°C. For a typical weather year with heating months being October to April.
[b] Based on Department Of Energy and Climate Change (DECC) energy & emissions projections central scenario for residential gas prices and discount rate of 5%.

This is an area where further discussion is needed across the policy domains of domestic energy efficiency and public health, and we return to the issue in Chapter 5.

Analysis of the Scottish House Condition Survey data in previous years (2008-2010) indicated '*a modest but significant correlation between under-occupancy and fuel poverty*' (Scottish Government, 2012). However, when the analysis is updated (2013-2015) and further disaggregated, a rather different pattern emerges (see Table 4.8).

Table 4.8.: Under-occupancy by income poverty and fuel poverty 2013-2015 (SHCS)

| **Underocc. Level** | **Fuel + Income Poor**<br><br>**N 000s**<br>**%** | **Fuel Poor only**<br><br>**N 000s**<br>**%** | **Income Poor only**<br><br>**N 000s**<br>**%** | **Neither**<br><br>**N 000**<br>**%** |
|---|---|---|---|---|
| **2 or more bedrooms underocc.** | 89<br><br>24% | 204<br><br>46% | 2<br><br>2% | 414<br><br>27% |
| **1 bedroom underocc.** | 136<br><br>37% | 140<br><br>31% | 20<br><br>28% | 598<br><br>39% |
| **Compliance with standard** | 129<br><br>35% | 97<br><br>22% | 40<br><br>56% | 477<br><br>31% |
| **Crowded** | 16<br><br>4% | 6<br><br>1% | 10<br><br>14% | 41<br><br>3% |

These data suggest that:

- A quarter (24%) of those who are in fuel poverty and on low incomes reside in homes with 2 bedrooms or more under-occupied; this almost doubles (46%) for households who are fuel – but not income-poor;

- 4% of those who are in fuel poverty and on low incomes are in homes which are overcrowded rather than under-occupied; this equates to 1% for households who are fuel – but not income-poor.

In other words under-occupancy among fuel and income poor households is relatively uncommon. The '*modest but significant correlation*' between fuel poverty and under-occupancy is largely located in households on higher incomes. Hence, under-occupancy does not seem to be a dominant feature of households in both income *and* fuel poverty. Given that there are health concerns related to under-heating any rooms that may only be used occasionally, there seems little justification for altering how under-occupancy is treated when estimating fuel poverty prevalence.

### 4.8. Definition and practice – tenuous links

Whether jurisdictions use a Boardman-based definition (Scotland, Wales and Northern Ireland) or the LIHC indicator (England), recent reviews of how alleviation programmes deliver in practice suggest that these are at best loosely guided by how the concept is officially defined. A review of health-related fuel poverty alleviation programmes suggest that neither definition was used to target resources: *"it is as if different languages are being spoken at national and local level when it comes to how objectives are expressed and measured*" (Fletcher et al., 2017). This perhaps reflects the extent to which how fuel poverty is defined *in principle* has become dislocated from how it is being addressed *in practice*.

In this context, the 2012 Evidence Review for Scotland noted that:

"*The debates about fuel poverty have traditionally been maintained at quite a theoretical level whilst fuel poverty programmes on the ground attempt to operationalise fuel poverty into a practical concept using proxy variables to identify target households*".

#### 4.8.1. <u>The trouble with proxies</u>

In the past, determining eligibility for assistance from Scottish fuel poverty programmes has relied on proxies. These have most commonly been:

- age of occupants;
- location in an area of deprivation;
- type/age of building;

- rural location;
- receipt of passport state benefits;
- type of heating system;
- modelled energy costs needed to attain a satisfactory heating regime.

Whilst these are all significant correlates of fuel poverty in Scotland, the strength of correlation seldom exceeds low-to-moderate (Mould, Baker & Emmanuel, 2014). For example, there is no statistically significant relationship between income as measured for the Scottish Index of Multiple Deprivation (SIMD) and the distribution of fuel poverty at small area level based on Scottish House Condition data (Mould and Baker, 2017b). Furthermore, data for 2015 suggest that, of all households in receipt of those passport benefits which can trigger eligibility for state-funded fuel poverty assistance, only 20% are both fuel poor and income poor. By contrast, more than half of these households (54%) are neither fuel nor income poor.

Increasingly, proxies seem less than fit for the purpose of deciding who is eligible for state assistance via subsidised fuel poverty schemes:

"*The groups prone to fuel poverty, as defined by [a needs to spend value] and income can only be reliably diagnosed by those vectors. Other risk factors [such as age, house condition, etc.] appear to be so diverse within the fuel poor population that they can equally apply to the population as a whole*". (Scottish Government, 2012).

4.8.2. Replacing proxies with data

4.8.2.1. Income

There are difficulties in obtaining accurate data on income, and these are substantial, but in many cases not insurmountable. At present many households being assessed for eligibility on fuel poverty programmes are referred for income maximisation checks. These are carried out by teams in the civil service who have access to HMRC and other income data. Could such checks be expanded to

include all consenting households being assessed for eligibility and if so what resources would be required to achieve that? Initial feedback to delivery teams need only be in the form of a binary result on Income Poor/Not Income Poor and would disclose little of substantive sensitivity. For those who are Income Poor, actual income would then need to be set against required fuel costs, for which further consent could be sought.

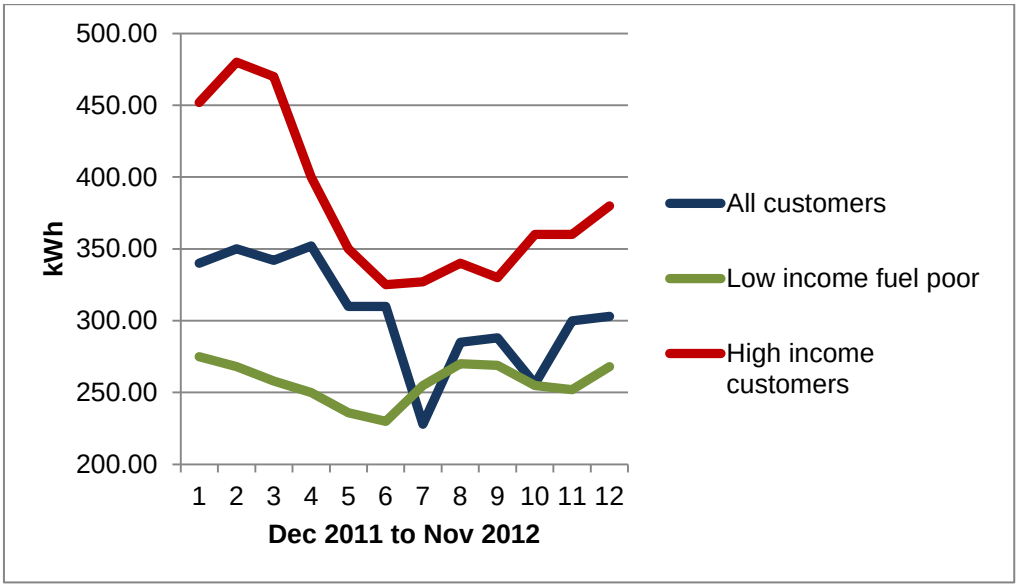
4.8.2.2. Modelled energy costs

Similarly, whilst most stakeholders would agree that required fuel costs are the metric of choice when estimating fuel poverty, since they capture *needs to*, rather than *actual* spend, a number of new databases on actual spend have recently become available in the public domain. These may be useful for identifying those most in need of state assistance.

The first derives from the National Energy Efficiency Data-Framework (NEED), which has been established by BEIS to provide data on energy use and energy efficiency in Great Britain. It contains matched data on energy consumption and the energy efficiency measures installed in homes, as well as information on household characteristics and property attributes.

The second derives from the growing database available from smart meters in Great Britain. These meters provide detailed data on both electricity and gas consumption, available on a baseline of half-hourly intervals. Smart meter data can help identify customers likely to be in fuel poverty, particularly those who may be in deepest fuel poverty. For example, Figure 4.3. compares electricity consumption data from Northern Ireland's main retailer (PowerNI) and illustrates a year's consumption for the population of all PowerNI customers as well as for a subset of their "high income" customers; the third group ("low income fuel poor" customers) are a subset in fuel poverty. Fuel poor customers show much less evidence of seasonal variation in electricity consumption, which suggests a finite expenditure capacity with little elasticity (Darby, Liddell & Hills, 2015).

Figure 4.3.: Monthly electricity consumption in Northern Ireland – consumption profile for all, high-income, and low-income/fuel poor customers




Smart meter data are also valuable for locating vulnerable customers who have a regular pattern of self-disconnection or unusual diurnal patterns of under- or over-use:

"*Smart meters could provide a useful additional means of identifying vulnerable customers and, in particular, patterns of heating use and bill payments suggestive of fuel poverty. Reducing the invisibility of the most vulnerable may need to be more prominent in models, as a potential public service benefit over and above energy savings, demand response, and ability to switch between tariffs and suppliers. Identifying and protecting vulnerable customers could, in the broader framework of consumer engagement, contribute significantly to acceptance of this technology*." (Darby, Liddell & Hills, 2015).

In brief, the combination of three features in smart meter data:

- low consumption;
- low seasonal elasticity in consumption; and
- frequent self-disconnection

can provide a valuable means for identifying households likely to be in greatest need of assistance. Energy retailers are already using smart meter data for this purpose, and anonymised data on consumption via smart meters in Scotland may have considerable value for identifying those most in need.

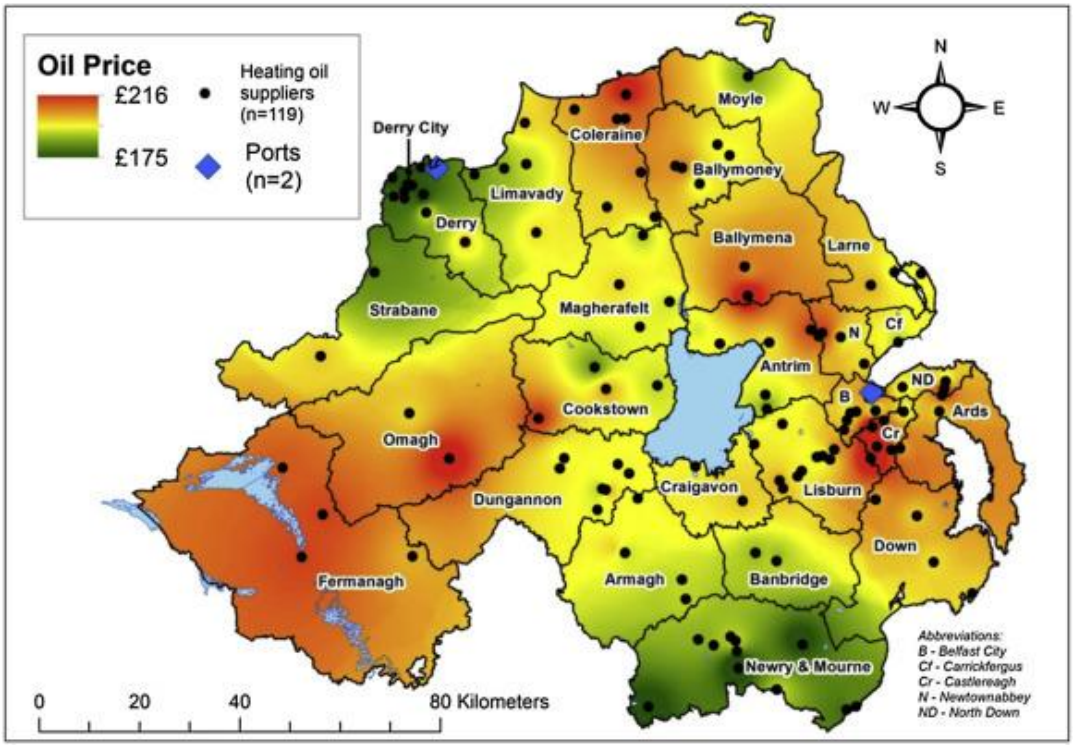
A final use of smart meter data is in the provision of more tailored and evidence-based energy efficiency advice to customers. Meta-analyses of smart meter data in this context indicate potential savings of 2% on a household's electricity bills through the direct feedback on consumption that in-house displays attached to smart meters can facilitate; with additional expert energy efficiency advice and support, meta-analysis indicates that this can more than double (to 5%) (Darby, Liddell & Hills, 2015). The CharIoT project is an EPSRC-funded research programme in this area which uses specially designed sensors, alongside smart meters to collect data on internal temperature, external temperature, light levels, relative humidity and energy consumption. The data are sent via broadband and the mobile phone network to a server for capture and analysis, and are being used by energy agencies to develop household-specific energy advice packages (Fischer et al., 2017).

For these reasons, the potential of data being gathered by the National Energy Efficiency Data-Framework (NEED) and smart meters in Scotland should be more fully explored, with a view to both finding more households who are in deepest fuel poverty, and identifying ways of assisting them and a much wider variety of households in reducing their energy costs.

Real data may also enable more extensive validity-testing of some key assumptions made in estimations of fuel poverty prevalence which derive from the UK's application of the BREDEM model. As noted by Herrero (2017) actual spending is well below modelled energy expenditure – most crucially in the higher income deciles, where there is less need for rationing or cutting costs; the ratio of actual to required energy spend tends to stabilise at 80% from income decile 7 upwards, which may suggest an over-estimation of household energy requirements in the BREDEM model at national level.

Conversely, many have argued that the BREDEM 2012 model (which is used in Scotland at present) underestimates how much energy costs in certain geographical areas, particularly in remote rural and island communities.
Data are not collected on the actual price households need to pay for fuel, this being sourced from standard publications such as the Sutherland Tables and BEIS Quarterly Energy Prices. This is particularly problematic in the case of non-regulated fuels, such as heating oil, the cost of which can vary substantially from one geographical area to another. Whilst this problem is partially alleviated by assigning different price indices to the North and South of Scotland (prices for the former being higher), it is debateable as to whether this geographical differentiation is sufficient. As has been shown in Northern Ireland, the cost of purchasing 300 litres of oil varied across much smaller areas – from £175 to £216 based on concurrent survey data from retailers. This is a difference of almost 25% (see Figure 4.4.).

Figure 4.4.: Continuous price surface generated by spatial interpolation of heating oil prices in Northern Ireland. Data collected from suppliers (n = 119) in July 2011, January 2012 and July 2012.



Whilst prices were among the cheapest around one of the ports into which oil is imported (Derry), it was among the most expensive around the other port (Belfast). Multivariate analyses suggested that prices were based on a complex set of interacting factors related to local market structures, supply costs, market competitiveness and socio-economic factors which affect demand (Walker et al., 2015). The same is likely to occur in Scotland, and could significantly underestimate the extent to which fuel poverty prevails in remoter off-grid areas. However, the extent of price variations, how readily these could be attenuated in Scotland, and how these variations might alter estimates of both prevalence and severity, remain unknown. The Panel thought that this was an area which could be relatively easily researched (and updated over time) by a trusted independent research agency.

#### 4.8.3. Targeting those most in need: impacts on fuel poverty prevalence

If households in the extremes of fuel poverty are targeted for state assistance, many may not be taken out of fuel poverty altogether, even after the deepest possible retrofits. Such households would most likely still contribute to the prevalence of fuel poverty in Scotland. Of those that are removed from fuel poverty, the move could be ephemeral, in that a large proportion are likely to move from *extreme* to *marginal* fuel poverty[16], which locates them in the so-called churn area; any increase in energy costs could readily move them back across the 10% required energy cost threshold and into fuel poverty again.

It has been argued that the headline *"in fuel poverty*" prevalence rates which regions of the UK publish could be construed as encouraging targeting on those just beyond the 10% threshold; for schemes to demonstrate maximal effectiveness, an optimal strategy would be to locate households with energy costs around 10.1% to 12% where modest retrofits will move them out of fuel poverty (Walker et al., 2014). Under such a scenario, there is potential for the proportion of households in extreme need to grow in prevalence.

[16] Scotland defines households in marginal fuel poverty as having required energy costs of over 8 to 10% of income.

If a strategy for targeting those most in need is to be pursued in the future, then that strategy may wish to focus on the *prevalence of extreme fuel poverty, however fuel poverty is ultimately defined.* Targets could then be set related to reducing that particular subset of fuel poor households. This will not only monitor outcomes on the basis of impacts on the target group, but will also ensure that positive impacts are not obscured by the very challenging target of removing *all* households assisted out of fuel poverty.

Targets are also likely to be more useful and informative if they are set (and outcomes published) annually. The original fuel poverty targets which all nations in the UK signed up to (eradicate fuel poverty where practicable by 2016) were set in 2001 – a 15 year target which afforded too much elasticity in the timeframe of failure, affording many years of negative publicity in which failure could be amply anticipated. It will be easier to avoid such a long tail of negative publicity with more short-term targets, and these will also afford more immediate opportunities to seek solutions and redress[17].

### 4.9. Summary

The Boardman versus LIHC choice is not a simple matter of choosing between two definitions which differ from one another in nuanced and subtle ways. They are fundamentally different in how they measure the same construct. Weighing up their respective strengths and weaknesses, there is little to favour LIHC over Boardman or vice versa. Each definition has advantages and shortcomings when applied to data from Scotland, corroborating results from England and France.

Whilst adopting the LIHC indicator would more than halve fuel poverty prevalence, it should be noted that the exclusion of wealthier households from a Boardman definition would have a similar effect on prevalence, since the 2015 SHCS highlighted that more than half those in fuel poverty were not income poor. Using SHCS data averaged for the last three years (2013-2015), and Boardman's definition modified to exclude those who are not income poor, the proportion of

[17] The Panel is grateful to Alan Ferguson, Chairperson of the Scottish Fuel Poverty Forum, for this point.

Scottish households in fuel poverty would be 15%, compared with 34% using the Boardman definition as it currently stands (and 12% using the LIHC indicator).

But neither of these technical definitions can satisfy growing concerns about the place of fuel poverty in discourses concerned with energy justice and a fairer society in Scotland. At the time they coined their definitions, Boardman's specialism was largely in understanding heating in the housing stock, whilst Hills was an economist. Their definitions are technical, and in that sense they have been relatively immune to the vagaries of socioeconomic change or newly elected governments. This can be seen when comparing England's 2001 and 2015 Fuel Poverty Strategies. The first was published under Boardman during a Labour Government, the second under Hills and a Conservative/Liberal Democrat Coalition. As has been made clear in this report, the two definitions are radically different metrics with little cross-over. Yet the Strategies themselves show little evidence of footprint deriving from the different definitions in play. With the exception of the 2001 Strategy's focus on the goal to eradicate fuel poverty, the Strategies are remarkably similar: both emphasise partnership-working, both prioritise helping those most in need first, and in looking ahead, both identify the same impediments to achieving their goals.

Over time, both definitions have become increasingly remote from what teams delivering fuel poverty alleviation programmes have deemed most effective. The main concern with such a dislocation is that it becomes difficult to assess the extent to which funds invested in alleviating fuel poverty on the ground can be expected to alleviate fuel poverty prevalence as it is officially measured. For Boardman and Hills, the reasons behind such dislocation may have been different, since their definitions dominated in very different political and economic contexts. The UK Fuel Poverty Strategy of 2001 used a modified version of Boardman's definition to outline a Strategy that was positive, expansive and ambitious. It set out plans to "eradicate" fuel poverty by target dates, representing this issue as one which could be systematically whittled away.

The 2011/12 review took place against a much gloomier backdrop:

- failing targets for eradicating fuel poverty;

- a 2008 judicial review in which Friends of the Earth and Help the Aged challenged the view that Government had done everything reasonably practicable to eliminate fuel poverty in England; the challenge was unsuccessful, and significantly dented the morale of local authority teams and other stakeholders;

- a shrinking Government budget for tackling fuel poverty in England: between 2009 and 2012, this was cut by almost one-third (31%) (Jansz & Guertler, 2012);

- the progressive dismantling of England's flagship fuel poverty alleviation programme (Warm Front), which was completed in 2013.

The Hills LIHC indicator had relatively little potential to make a substantial impact on government fuel poverty programmes in England, in part because these were being so systematically scaled down and deprioritised.

In this context, it is perhaps worth noting that the current review of a definition for Scotland is taking place against the backdrop of a fuel poverty budget which has increased significantly between 2008/9 £66.9M to £114M[18], and in which energy efficiency was recently classed as part of a national infrastructure priority.[19] There is now, perhaps, greater potential for a renewed synergy between definition, Strategy, policy and programmes than had hitherto been possible.

[18] http://www.parliament.scot/ResearchBriefingsAndFactsheets/S4/SB_15-13_Fuel_Poverty_in_Scotland.pdf

[19] http://www.gov.scot/Publications/2017/01/2195/1

If a new definition is sought in Scotland, and the intention is to encompass many of the broader aspects of the fuel poverty agenda, then the search for a new definition will have to encompass changes to:

- whose voices are heard;
- how fuel poverty is measured;
- who is prioritised for assistance;
- what steps should be taken to alleviate it;
- what outcomes are monitored.

In other words, the search for a new definition could require root and branch reform.

### 4.10 Last word – lay definition

Finally, sight should not be lost of the value of having a simple lay definition of fuel poverty running alongside whichever technical option is chosen. In line with the increasing discourse on fuel poverty and inequalities, most of which derives from UK scientists (e.g. Gillard et al., 2017), it seems increasingly likely that this will encompass concepts such: as affordability, justice, equity, community empowerment, public health and human wellbeing. It need not be laconic, since it should do justice to the complexity of the causes and consequences of fuel poverty, but it should ideally be written in a manner which makes this complex construct more accessible and easy for people to understand.

**Key Conclusions on the Boardman (1991) definition and the LIHC indicator**

There are strengths to be found in both the current Scottish definition (based on Boardman) and the current English definition (based on Hills).

However, Boardman's definition does not confine fuel poverty to households on lower incomes and as such it does not align with Section 95 of the Housing Act which indicated that *'a person lives in fuel poverty if that person is a member of a household* ***with a low income*** *living in a home which cannot be kept warm at a reasonable cost'.* (bold font added)

In a similar fashion, the Hills LIHC indicator excludes many households from being considered fuel poor, despite the fact that they may be on very low incomes indeed. There are likely to be practical forms of assistance which could significantly reduce the burdens arising from their energy bills. Where the meaning and significance of being fuel poor are a consideration, the burdens associated with their energy costs support the view that this group should remain an integral part of those deemed to be in fuel poverty.

Furthermore, the headline prevalence estimates of fuel poverty in Scotland under an LIHC indicator are insensitive to changes in fuel prices, which means that second-tier data (on the fuel poverty gap) needs to be accessed before any understanding can be gained of what such changes imply for prevalence.

These core drawbacks alone point to the need for a different definition in Scotland.

However an additional and salient drawback with both of the conventional options lay in the fact that neither of these definitions currently bears a substantive relationship to how fuel poverty programmes are delivered on the ground.

The Panel accepted emerging consensus around the idea that "an affordable heating regime" is only one aspect of a healthy indoor climate; optimal indoor conditions should, we thought, also encompass aspects of ventilation, condensation, mould growth, and damp.

The Panel had concerns about the use of inaccurate proxies for estimating fuel poverty – whether for national prevalence data or on the doorstep. Wherever possible in the medium-term, efforts to replace these with more accurate data (particularly regarding income and energy costs) were strongly supported.

# Chapter 5

# Indoor temperatures

'*Standards are too often treated as if they possessed some kind of separate and independent status or viability. They seem to exist more or less indefinitely – long after their origins and rationale have been lost in the mists of time and the words of countless reports and debates. They are compared, averaged, raised or lowered in this or that respect. The Committee suggests that housing standards are not of this order; they are means to the ends of public health – the physical, mental and social well-being of man. They should be examined and periodically re-examined to determine whether or not they are fulfilling their objective.' (WHO, 1961).*

## 5.1. 'Satisfactory heating regimes' in Europe – timeline

### 5.1.1. Housing Commission of the League of Nations 1936

The earliest technical reports on optimal indoor temperatures were published by the Housing Commission of the League of Nations. Starting in 1936, their reports on public health and housing covered a wide remit:

*'These reports deal with the thermal environment of housing, noise, natural and artificial lighting, town planning, air pollution, water supply, sewage treatment and the collection and treatment of domestic refuse*'. (WHO, 1961).

### 5.1.2. Parker Morris and World Health Organization Reports 1961

The Parker Morris standards for public housing in the UK were published in 1961 and noted:

'*We therefore think it is time to recognise that a home without good heating is a home built to the standards of a bygone age*'.

When the temperature was −1 °C outside, the Parker Morris Standards recommended that heating systems installed in homes be capable of maintaining **13 °C** in most rooms and halls, with living and dining spaces able to be kept at

**18 °C**. However, the need for topping rooms up with secondary heating sources was noted, on occasions when they were being used for anything other than passing through or sleeping in. Where these occasions became routine, more extensive primary heating systems would be required:

'…*they can easily be topped up for use as studies or bed-sitting rooms. But where family requirements are clearly going to demand such use as a matter of course – and this may become widespread within the life of the building – a more expensive installation capable of heating the bedroom to 65 °F [18* °C] *as well will represent greater value for money*'.

Whilst these temperature thresholds were modest, they were not considered ideal, but rather practicable during an era of mass public housing investment:

'*The aim here, as with all the other minimum standards which we are recommending, should be a progressive raising of standards through the years*'.

However, by 1978, when the Building Research Establishment monitored indoor temperatures in 1,000 homes, average living room temperatures were still at the Parker Morris minimum standard from 1961 (18.3 °C); bedrooms were slightly warmer (14.6 °C) (Hunt & Gidman, 1982).

5.1.3. The 1968 WHO report

The pioneering role of the League of Nations was taken over in 1961 by the World Health Organization (WHO), with the publication of *Public Health Aspects of Housing* in 1961. Thereafter, WHO alone became the main protagonist in setting temperature thresholds for satisfactory heating regimes in Europe. It has remained so for almost 50 years, (Ormandy & Ezratty, 2012).

The WHO's initial recommendation was that homes in Europe be kept between **15 ºC and 25 ºC**, on the basis that this range protected people from illness and disease.

5.1.4. The 1984 WHO report

The 1984 Working Group recommended that this range be altered to between **18 ºC and 24 ºC**, a range that should apply to all non-vulnerable households. No explicit reasons were given for this change (Ormandy & Ezratty, 2012). However, reports

from other Working Groups (working on related topics) had started to recommend a minimum indoor temperature of 20 ºC for at-risk groups (e.g. WHO, 1979), which is likely to have influenced their deliberations, although they did not ultimately adopt a different regime for vulnerable groups. Instead, they felt there was insufficient evidence on the matter.

The Group concluded by recommending a series of studies across Europe, with a view to revisiting the issue once these were complete. Many of these studies were subsequently commissioned.

5.1.5. The 1987 WHO report

A Working Group convened again in 1985, and updated their evidence review. They did so, at least in part, on the basis of reactions to the energy crises of the late 1970's, which had led to some European Governments introducing policies that constrained indoor heating regimes to a range between 15 ºC and 19 ºC :

'*WHO has therefore to reconsider its former recommendations regarding indoor climate in order to discourage excessively low temperatures which may have detrimental effects on the health of at-risk groups*'.

The Group published its report in 1987, and focused particularly on vulnerable people living in cold homes:

*'[A]… main objective was to consider whether sufficient evidence from scientific studies and epidemiological investigations was available to demonstrate an adverse effect on health of low indoor temperatures, especially in high-risk groups*.'(WHO, 1987).

Vulnerable groups were defined as '*the elderly, the sick, disabled, and preschool children*' (WHO, 1987).

The 1987 publication is the WHO's seminal report on indoor temperature guidelines. It is a concise 20-page summary of relevant studies, citing 56 different sources. Almost all the evidence base cited remains valid now, despite 30 more years of further experimental research and field study.

Among other recommendations:

- it retained the **18 ºC – 24 ºC** range, but only **for non-vulnerable groups**;

- **for vulnerable groups**, they recommended 20 °C as a minimum temperature, hence narrowing the range still further to **20 °C – 24 ºC.**

5.1.6. The latest WHO report – 2007

This retained these recommendations.

5.1.7. Post-1987

Since that time, the only notable adaptation to these recommendations concerns rooms where infants sleep. Here there is a general consensus in the UK that "*an ambient room temperature of 16-20°C, combined with light bedding or a lightweight well-fitting sleeping bag, offers a comfortable and safe environment for sleeping babies",* although it is also noted that further research is necessary to establish this with confidence (Lullaby Trust, 2017). This consensus currently applies to infants in the first 12 months of life. The NHS currently recommends a sleeping temperature for infants of 18 ºC (e.g. NHS Sheffield, 2017).

### 5.2. 'Satisfactory heating regimes' and UK Fuel Poverty Strategies

The earliest Fuel Poverty policies deployed in Scotland, Wales, England and Northern Ireland were all predicated on the belief that a link existed between cold homes and poor health. These early policies were, first and foremost, public health policies. In the UK Fuel Poverty Strategy of 2001, for example, the word '*health*' features 238 times in a document of 158 pages. The rationale for focusing on health derived from the WHO series of reports outlined earlier in this Chapter, as well as from a (then) very small body of research evidence linking, for example, cardiovascular illnesses and exposure to cold (e.g. Donaldson & Keatinge, 1997; Eurowinter Group, 1997). In the same year as the UK Fuel Poverty Strategy was published, the first study linking cold temperatures to energy inefficient homes was also published (Wilkinson et al., 2001).

5.2.1. England and Northern Ireland

Fuel Poverty Strategies were published in 2001 and 2015 for England, and in 2004 and 2011 for Northern Ireland. In specifying a satisfactory heating regime, they did not fully rely on the range of temperatures which WHO recommended. Rather, they used:

- the WHO lower temperature threshold (**18 ºC**) to set a temperature that should be maintained in most[20] rooms;

- with the exception of living rooms, where a temperature of **21 ºC** was set (the midpoint of WHO's 18 ºC -24 ºC range).

As early as 1983, the Royal Society of British Architects were recommending that future homes be built in a manner that permitted temperatures of 18 ºC for bedrooms and 21 ºC for living rooms, providing some degree of precedent (RIBA, 1983). Although the temperature for 'other rooms'[21] complied with the WHO lower limit, there may have been relatively little scientific evidence supporting 21 ºC as the ideal for living rooms. According to Healy and Clinch (2002), for example:

'*The Building Research Establishment **has generally considered** 18–21 ºC as a comfortable temperature for a living room during wintertime, and Boardman **has generally advocated** this temperature range as 'comfortable*'. (bold font added)

The BRE Domestic Energy Factfile (2003) states:

'*It **would be expected** that the average temperature would stabilise as more households move towards their desired comfort levels. For most people, a living room temperature during occupied periods of 21ºC **would be regarded** as comfortable. A temperature **perhaps** 2ºC below this would **generally be considered** adequate elsewhere in the dwelling so that the overall comfort level **might be around** 19-20ºC*.' (BRE, 2003). (bold font added)

[20] England, Wales and Northern Ireland define '*most rooms*' as 'all occupied rooms other than the living room', whilst Scotland defines 'most rooms' as 'all rooms other than the living room'. This issue of so-called '*under-occupancy*' is dealt with in Chapter 4.
[21] For example, dining rooms, kitchens and bathrooms.

The fixing of 2 temperature set points, broadly within the WHO recommended range, may have been deemed a prerequisite for estimating domestic energy needs, including fuel poverty prevalence. In both original Fuel Poverty Strategies, England and Northern Ireland set targets which required monitoring of domestic energy need over time. It would have been more feasible to estimate need on the basis of *specified* temperatures in *specified* types of room, rather than relying on a temperature range which could vary by as much as 6 ºC.

Another factor contributing to the decision to set 21 ºC as the temperature for living rooms may have been a series of *modelled* indoor temperature data which were available from BRE at the time. For the 4 years preceding England's 2001 Strategy, centrally heated homes were estimated to maintain average indoor temperatures around 19 ºC (Uttley & Shorrock, 2008). It could be argued that selecting the narrower band of 18 ºC in most rooms and 21 ºC in living rooms meant that the temperatures recommended were within the realms of what might be deemed '*reasonably practicable*'. However, these *modelled* internal temperatures were the result of energy balance calculations using building physics data and DUKES energy consumption figures. They were not drawn from the monitored performance of homes. More recently, independent studies monitoring *actual* temperatures suggest that these modelled estimates were optimistic i.e. homes were in fact maintaining significantly lower temperatures at that time.

5.2.2. Scotland and Wales

Scotland and Wales opted for a more nuanced temperature regime which was more closely aligned to the WHO's 18 ºC to 24 ºC range. According to the Scottish Fuel Poverty Statement (Scottish Executive, 2002):

'…*a 'satisfactory heating regime' would use the levels recommended by the World Health Organisation. For elderly and infirm households, this is 23° C in the living room and 18° C in other rooms, to be achieved for 16 hours in every 24. For other households, this is 21° C in the living room and 18° C in other rooms for a period of 9 hours in every 24 (or 16 in 24 over the weekend); with two hours being in the morning and seven hours in the evening*'.

*Elderly* is defined as people over 60 years old. In short:

- **elderly and infirm people** should be able to maintain their living room temperature at **23° C**, and all other rooms in their home at **18° C** – for most of every day;

- **all other households** should be able to maintain their living room temperature at **21° C**, and all other rooms a temperature of **18°** C – for most of weekend days, and shorter periods of time during the week.

Wales adopted a similar definition of *satisfactory heating regimes* in their more recently published Fuel Poverty Strategy (WAG, 2010).

A concern with these recommendations is that they do not permit provision of 24-hour levels of safe temperatures, assuming perhaps that homes will retain sufficient heat to be safe, even in the 8-15 hour unheated intervals when indoor temperatures are likely to fall. For fuel poor households living in energy inefficient homes, levels of heat loss from the building fabric could mean that temperatures fall well below these safe levels during these unheated intervals, some of which could occur when people are at home.

5.2.3. Satisfactory heating regimes for UK homes: summary of timeline

The temperatures required to maintain satisfactory heating regimes in the UK are broadly based on the WHO recommendations of 1987, thirty years ago. Contrary to the assertion that many have made, WHO did not stipulate either 21 ºC or 23 ºC as set points for different rooms. Rather, they specified a range of indoor temperatures within which human health was likely to be protected, with this range being narrower for at-risk groups.

The adoption of set points may have been based on the need to have specific temperatures from which to calculate domestic energy need and fuel poverty prevalence, without which BRE could not have generated statistics that could be easily understood and tracked over time. The set points chosen had due regard for the WHO's decision on a minimum safe temperature, with an upper set point positioned mid-way between the 18 ºC and 24 ºC range.

The narrower range of 18 ºC and 21 ºC may have reflected modelled data on room temperatures thought by BRE and others to be prevailing in UK homes at the time (19ºC), although it is now recognised that these estimates were probably inflated.

In the context of fuel poverty prevalence, the issue of whether a recommended temperature regime could reasonably be altered has important consequences. For example, the current recommendation yields a prevalence rate of 31%, but 26% if vulnerable groups are expected to maintain the same temperatures as standard occupants (see Table 7.1).

Table 7.1.: Variants of temperature regime and effects on fuel poverty prevalence

| Occupant Types | Temps. | Heating Pattern | Fuel Poverty Rates | | | |
|---|---|---|---|---|---|---|
| | | | Older | Families | Other | All |
| **Standard occupants** | 21°C/18°C | 9 hrs weekdays, 16 else | 45% | 16% | 29% | 31% |
| **Any occupant aged 60+ or LTSD**[22] | 23°C/18°C | 16 hours per day | | | | |
| **Standard occupants** | 21°C/18°C | 9 hrs weekdays, 16 else | 36% | 14% | 26% | 26% |
| **Any occupant aged 60+ or LTSD** | 21°C/18°C | 9 hrs weekdays, 16 else | | | | |
| **Standard occupants** | 21°C/18°C | 9 hrs weekdays, 16 else | 39% | 14% | 26% | 27% |
| **Any occupant aged 65-79 or LTSD** | 21°C/18°C | 9 hrs weekdays, 16 else | | | | |
| **Any occupant aged 80+** | 23°C/18°C | 16 hours per day | | | | |

[22] Long-term sickness or disability.

### 5.3. New studies on temperatures in UK homes (2014 – 2017)

This section contains a brief review of studies which have been published since the Scottish Fuel Poverty Strategic Working Group (2016) examined evidence related to '*satisfactory heating regimes'*. The studies described are all published in established peer-reviewed journals, have acceptable sample sizes, use conventional scientific methodologies, and interpret results using advanced analytic tools.

#### 5.3.1. Public Health England's 2014 Cold Weather Plan

In 2011, the Department of Health and Health Protection Agency, in association with the Meteorological Office, published a Cold Weather Plan (DOH, 2011) aimed at protecting the health of those most vulnerable to the impacts of cold temperatures (DHHPA, 2011). It recommended that:

- **21 °C** should be the *minimum* recommended daytime temperature for rooms occupied during the day;

- **18 °C** should be the *minimum* recommended night-time temperature for bedrooms.

In 2014, three years later, Public Health England (PHE) published a review of evidence on indoor temperatures supporting a change; it recommended:

- a **single minimum temperature threshold of 18 ºC**.

PHE and other stakeholders concluded that:

'*The review suggests that 18ºC is a reasonable minimum threshold to adopt for future guidance in the Cold Weather Plan for England based on the limited evidence available and discussion with experts. The evidence did not support a threshold of 21* °C *in living rooms, and there was additional concern that if widely implemented by the whole population it could potentially result in excessive use of household energy and lead to higher carbon emissions. Neither of these are desirable outcomes from a broad health and wellbeing perspective….A single*

*minimum threshold of at least 18ºC for all rooms was considered the most appropriate advice*'. (Jevons, Carmichael, Crossley & Bone, 2016).

The Jevons et al. meta-analysis acknowledged that more still needed to be learned about the health impacts of temperatures on specific at-risk groups, such as people with long term conditions and frail older people. For these people, '*temperatures slightly above this threshold may be beneficial to health*'. This somewhat undermines a previous assertion in their paper, namely that a one-size fits all recommendation is most appropriate since it '*means that messages are kept as simple as possible whilst protecting the health of all'*.

While aiming for a single generic message, PHE downplayed a wealth of existing evidence regarding significant differences in both preferred and actual ambient temperatures by age and vulnerability. Since the 2014 Cold Weather Plan was published, that evidence base has grown, and some of it is reviewed below.

5.3.2. <u>The Energy Follow-Up Survey (Hamilton et al., 2017)</u>

This study used temperature data from 823 English homes, all of which were part of the English Survey's Energy Follow-Up sample (2010-2011). The research comprises a large cross-sectional survey of indoor temperatures and dwelling/household characteristics. Among key results:

- during daytime heating periods (standardised to an outdoor temperature of 5 ºC), **living room** temperatures ranged **between 18.4 ºC** in homes located in NW England, **and 19.2 ºC** in the East and East Midlands;

- **bedroom** temperatures ranged between **17.8 ºC** in SW England and Yorkshire/Humber, and **18.6 ºC** in the East and the South East;

- households categorised as vulnerable (low income or in receipt of specified benefits) maintained warmer living rooms than did non-vulnerable households (19.3 ºC and 18.7 ºC respectively); there was no significant difference in bedroom temperatures for the two groups (18.3 ºC and 18.2 ºC respectively);

- using the Boardman definition of fuel poverty, households that were fuel poor had colder living rooms than households not in fuel poverty (18.2 ºC and 18.9 ºC respectively); their bedrooms were colder (17.2 ºC and 18.4 ºC respectively);

- by contrast, comparisons using the LIHC definition of fuel poverty found no difference between the living- and bed-room temperatures of fuel poor households and those not in fuel poverty.

The authors conclude that:

'*Policies in England that focus on households in lower socio-economic conditions will likely find an unmet need for improved indoor temperature conditions*'.

5.3.3. The 2015 Leicester Study (Kane et al., 2015)

Another comprehensive study of winter temperatures (December to February) in UK homes is based on monitoring 249 homes in Leicester. There was a strong positive association between outdoor and indoor temperatures, indicating that households ran their heating systems in a manner largely responsive to the weather outside: in living rooms the correlation between outdoor and indoor temperature changes was high (r = 0.87), and broadly the same in bedrooms (r = 0.91).
The sample included a range of housing types and income brackets, but had a higher than representative group of retired households. Among the key results:

- **living rooms** were maintained at an average of **18.5ºC**;

- **bedrooms** were maintained at **17.4ºC;**

- both rooms had **a standard deviation of 3ºC**, which indicates a substantial variation in maintained temperatures between households; as noted below, vulnerability status was significantly implicated in these variations.

The authors note that these temperatures are:

- lower than what is generally assumed in the current BRE energy models used to estimate fuel poverty prevalence;

- lower than fuel poverty recommended temperatures of 21 ºC in living rooms (a 2.5 ºC shortfall) and 18 ºC in bedrooms (a 0.6 ºC shortfall).

Shortfalls of the same order of magnitude have been reported in many other recent (2014-2017) UK studies, some using more geographically dispersed samples than Leicester. In summarising these, Kane and colleagues (2015) conclude:

'*Overall, the high level of agreement between the findings of these different studies, both with regard to the heating patterns and the temperatures achieved, is rather remarkable; especially given the different samples, monitoring equipment used, periods of measurement, parameter definitions and methods of calculation*'.

In the Leicester study:

- living rooms of the **over 60's were maintained at 19.3 ºC, almost 3 ºC higher than those of people in their 20's (16.4 ºC**);

- living rooms of **people unable to work were maintained at 20.6 ºC, almost 2 ºC higher than living rooms of working people (18.9 ºC)**;

- **bedrooms, on the other hand, were maintained at significantly cooler temperatures among those who might be vulnerable to the impacts of cold**.

Here, the two vulnerable groups averaged a mean difference between living room and bedroom of 2 ºC, whereas non-vulnerable households maintained living- and bed-rooms at broadly similar temperatures.

The two potentially vulnerable groups (older and unable to work) also used their heating in a different way from non-vulnerable people, with heating:

- starting earlier in the year;
- coming on earlier in the afternoon;
- running for longer each day;
- with secondary heating sources used more often;
- and fewer under-heated days.

Data on central heating timings indicate too that some of the significant disparity between living- and bed-room temperatures among those more vulnerable arose because of secondary heating systems being used in living rooms through the day. Many of these (e.g. electric fan heaters, log burners, and open coal fires) are known to be particularly expensive ways of generating extra heat (Sutherland Tables, 2017). This was also found in households located in small areas of Northern Ireland which had a high prevalence of fuel poverty (78% of homes in fuel poverty, with 19% of these in extreme fuel poverty). Among the 2,145 homes surveyed in these areas, more than two-thirds relied on secondary heating systems almost throughout the year (Liddell & McKenzie, 2013). In a second in-depth survey of 40 fuel poor households who were using wood pellet boilers, two thirds were also using open coal fires (Liddell & Guiney, 2017).

The tendency for people on lower incomes to maintain warmer than average temperatures in living rooms but lower temperatures in bedrooms was also noted in the Energy Follow-Up Survey (see 5.3.2.). It is possible that those more vulnerable to the impacts of cold elect to invest in a warmer than average room to spend their day in, often using more expensive forms of secondary heating, and perhaps trading this extra expense off by running their bedrooms at colder than average temperatures.

Kane and colleagues conclude:

'*Based on the evidence generated here, those over 60 and those unable to work, are likely to use more energy and have the highest heating bills, and so energy efficiency measures could benefit them most. They are also a sector of the population which might experience most difficulty in paying fuel bills, yet benefit most from maintaining a relatively high indoor temperature over the whole day*'.

Broadly speaking, almost all post-2000 field studies indicate that temperatures in English homes average around 18 ºC to 19 ºC in living rooms, with bedrooms running at around 1.5ºC cooler than that. There is, however, a large inter-household variation, even in homes of similar design, age, and energy efficiency, with vulnerability status being a significant mediating variable (Rupp, Vásquez & Lamberts, 2015).

5.3.4. <u>The Portsmouth Study (Teli, Dimitriou & James, 2016).</u>

This was a relatively small but carefully monitored study of 18 flats in Portsmouth, which gathered data in a month straddling March and April. Unlike the Leicester study, which was based on a wide variety of homes and demographics, this focused on low income tenants in a social housing tower block. Temperature shortfalls were greater than those reported in Leicester:

- more than half of the tenants failed to achieve bedroom temperatures of 18 ºC;

- a third of occupants used no bedroom heating at all during this time, though outdoor temperatures ranged between 2 ºC and 12 ºC;

- over 80% failed to attain 21ºC in their living rooms, and those that did only attained these temperatures during the night through availing of cheaper night-time tariffs;

- more than two-thirds of occupants relied on portable electric heaters, and for half of these electric heaters were their sole source of heating.

Whilst it is known that many households fail to meet the 18ºC – 21ºC range of temperatures in their homes, the Portsmouth study highlights the fact that – on average – households more likely to be in fuel poverty maintain temperatures further below that range than do households who are not in fuel poverty. As evidence cited in this Chapter indicates, this is almost certainly more often for reasons to do with affordability than idiosyncratic perceptions of thermal comfort. The study added to a growing accumulation of evidence documenting lower ambient temperatures in the homes of people experiencing fuel poverty.

An important consequence, as Teli and colleagues point out, is that the potential of fuel poor households to contribute to carbon reduction targets, even after deep retrofits, will sometimes be minimal. For households in fuel poverty, there is an increasing expectation that many will need to produce more rather than less carbon post-retrofit, since they are currently unable to heat their homes to temperatures that even approximate 18 ºC and 21 ºC. The extent of shortfall from these thresholds may mean that even the deepest retrofits may not allow them to achieve safe temperatures without using more energy and expending more carbon.

This finding lends weight to the argument that fuel poverty is a social justice, rather than a carbon-reduction issue. It also points to the need for caution in setting up measurable outcomes for fuel poverty policies and programmes; whilst these are often conceptualised in terms of people in fuel poverty having 'lower fuel' bills and homes that 'emit less carbon' (Scottish Government, 2012) such goals may be neither realistic nor ideal.

5.3.5. Scottish solid-walled homes (Herrera & Bennadji, 2015)

This small study of 24 solid granite walled buildings located in the North-East of Scotland compared homes which had been upgraded with improved energy efficiency measures with homes which had not. The study found that:

- average summer temperatures indoors were moderately low: **19.8 ºC** (non-retrofitted) and **18.8 ºC** (retrofitted); and

- in winter, non-retrofitted homes averaged **14.4 ºC**, and the retrofitted homes **15.4** ºC. These temperatures are well below the levels that the WHO considers safe.

Notably, though, in terms of *'thermal comfort*', the occupants of these homes did not report dissatisfaction with indoor temperatures. Even in winter, most of the occupants described the temperature as '*comfortable'.*

5.3.6. Spatial shrink and temperatures (Tweed, Humes & Zapata-Lancaster, 2015)

A qualitative study, interviewing older people in England, Scotland & Wales, illustrates the extent to which ambient temperatures in different rooms shape older people's everyday use of space. Respondents may:

- avoid certain rooms because they are not kept at a comfortable temperature;
- move furniture into rooms which are kept more comfortably warm so that core activities can still be pursued;
- divide rooms into smaller spaces with curtains or more structural room dividers;
- remain close to a radiator when carrying out more sedentary activities.

All of these common practices represent forms of spatial shrinkage which are likely to reduce mobility, as well as the everyday options people have for variety and stimulation in their home. Both of these effects have implications for health and wellbeing (Liddell & Guiney, 2015).

5.3.7. Cold homes and older people's health (Shiue, 2016)

Nurses gathering data for the English Longitudinal Study of Ageing visited the private homes of 7,997 participants – all over 50 years old – in order to collect a wide range of physiological data. In each home, they recorded the temperature of the room they worked in whilst they were visiting, a crude measure of ambient

temperature in people's homes, but compensated for by the very large random sample.

Using the WHO minimum threshold of 18ºC, the study found:

- among **50-64 year olds, 19% were in rooms with temperatures of less than 18 ºC**;
- among **65-79 year olds, 16% were below the 18 ºC threshold**;
- among those **80 years and over, 9% were below the 18 ºC threshold**.

Where rooms were below the 18ºC threshold, residents showed a wide range of adverse health markers including:

- higher blood pressure readings;
- higher cholesterol levels;
- lower white blood cell counts;
- poorer lung function.

Although the study did not evaluate potential confounding variables or covariates (such as income, smoking, etc.) the results showed a significant linear association between room temperature and adverse outcomes. In other words, there was a dose-response effect, such that the further below 18ºC a room temperature was, the more adverse the biomarker results were.

Summarising the range of studies discussed here, 5 conclusions are reached.

1. Relatively few UK households attain temperatures which WHO consider safe.

2. This is especially so in the more northerly regions of the UK.

3. Households in fuel poverty live in colder homes than households which are not.

4. Older households and households where people are at home all day opt for warmer temperatures.

5. At least among over 50's, colder temperatures are significantly correlated with poorer health, and in a dose-response fashion.

### 5.4. '*Satisfactory heating regimes*' and thermal comfort

5.4.1. Defining thermal comfort

Thermal comfort is a key focus of energy efficiency programmes, largely because *perception* of thermal comfort (or the lack of it) is the primary driver of how residents choose to use their heating systems. After the energy efficiency status of a home has been improved, studies suggest that as much as 50% of potential energy savings can be lost as a result of people experiencing poor thermal comfort post-retrofit, and seeking their own solutions to remedy this (Teli et a., 2016). Thermal comfort is also of interest when exploring the range of temperatures which could be considered '*satisfactory*' because, as previously noted, the range of indoor temperatures which people maintain in their homes is considerable. This suggests that thermal comfort might have an important part to play in agreeing what can be considered a '*satisfactory heating regime*'.

There are 3 international standards of assessment for measuring thermal comfort, the most common of which is ASHRAE 55-2013. This defines thermal comfort as:

'*that condition of mind that expresses satisfaction with the thermal environment and is assessed by subjective evaluation*'. (in Rupp, et al., 2015).

The critical elements of this definition are that thermal comfort is:

- a condition of mind…
- …assessed by subjective evaluation.

This makes thermal comfort a complex yardstick by which to assess what a safe set of indoor temperatures is likely to be, since at least part of thermal comfort derives from to a person's subjective preferences. The potential for adverse health impacts from living in conditions that are too cold (or too warm) may not feature in decisions people make about thermal comfort. As with some other aspects of health and wellbeing, what people prefer is not always what best protects them from harm.

In this context, the WHO (2010) recommended that the concept be replaced with an evidence-based definition of '*thermal health*' in the coming years. Little progress on this new concept has been made, and none in the field of fuel poverty.

Thermal comfort preferences are generally assessed in experimental conditions rather than field studies, which afford participants the opportunity to vote for their optimal room temperature under a variety of conditions (see Rupp et al.'s review, 2015). Two aspects of these studies are relevant here, namely thermal comfort and gender, and thermal comfort and age.

### 5.4.2. Thermal comfort and gender

The Rupp et al. review of preferred indoor temperatures (2015) notes that studies largely support the commonly held perception that women:

- are more sensitive to ambient temperature than men;
- prefer higher room temperatures than men do.

This is unlikely to be entirely because of gender differences in '*conditions of mind*' or '*subjective evaluation*'. Physiological differences between men and women also underpin these preferences. Women, on average:

- have a lower skin temperature than men;
- are more sensitive to skin temperature, particularly in their hands and feet.

### 5.4.3. Thermal comfort and age

The Rupp review also notes evidence of age differences in temperature preferences, though these differences are not quite as consistent as the evidence for gender differences. People aged 67 to 73 years show more distinct physiological reactions to cooler temperatures (e.g. peripheral vasoconstriction) than do younger people (20-25 years). Distal vasoconstriction is implicated in many of the adverse health impacts of indoor cold (particularly raised blood pressure), which makes this physiological sensitivity in older people an important consideration when assessing the range of indoor temperatures to recommend for older people (Liddell & Morris, 2010).

van Hoof et al. (2017) also note that one of the more common medications prescribed to older people are beta-blockers (mainly for the treatment of heart disease and high blood pressure). These are known to alter thermoregulatory responses, with common symptoms including cold hands and feet. Thermal discomfort arising from this is frequently reduced when people experience warmer temperatures.

Among older people living at home with Alzheimer's Disease and related dementias (ADRD), thermal comfort levels show wide variability. Until recently, the two most common causes of excess winter deaths in the UK were *respiratory* events and *cardiovascular* events. Over the past few years, however, the two most common causes have become *respiratory* events and *events related to ADRD* (Liddell, Morris, Gray, et al., 2016). Here too, a blend of adverse physiological reactions and a change in subjective sensations regarding thermal comfort is implicated.

### 5.4.4. Thermal comfort in England

Using DECC's 2013 Energy Follow Up Survey data (n = 2,616 households), there was no correlation between levels of thermal comfort and energy consumption, or between thermal comfort and indoor temperatures (Huebner et al, 2016).

5.4.5. Thermal comfort in Scotland

The most recent Scottish House Condition Survey (2015) indicates that 27% of fuel poor households say their home is never or only sometimes warm in winter. For people not in fuel poverty, the figure is only slightly less at 21%. This means that more than 1 in 5 households in Scotland are presently living in homes they say are too cold in winter.

5.4.6. Summary

'*Thermal comfort is a complex topic and we are far from understanding all its related aspects. It has become evident that there is a gap in thermal comfort studies in relation to interdisciplinary research. The association with other professionals like psychologists, physiologists, sociologists, philosophers and even with other building related ones (architects and engineers) could be of great value for the development of an integral (systemic/holistic) research approach that may help to a better comprehension about sensation, perception and thermal comfort…We certainly need a better understanding of thermal comfort to face climate change and the demands for more energy efficient buildings.'* (Rupp et al., 2015).

The Panel recognised the importance of people being able to achieve thermal comfort at home, even if comfort was reached at temperatures outside those recommended by WHO. There is a wealth of evidence, for example, that many vulnerable people prefer bedrooms to be cooler than 20 ºC finding this conducive to better rest and wellbeing. However, in calculating the prevalence of fuel poverty, the Panel thought that estimates of prevalence should be based on temperature regimes thought to be protective of human health. Where thermal comfort levels deviated substantially from those regimes (and these would need to be at the extremes of heat or cold), the issue e could be a matter for targeted public health messaging rather than a review of safe temperature thresholds.

### 5.5. Unintended consequences: Overheating

Adverse physiological reactions to heat in England are thought to become evident when ambient temperatures exceed 26 ºC in bedrooms and 28 ºC in living rooms (Gupta & Kapsali, 2016). There is growing concern in the UK about the prospect of high-grade energy efficiency measures leading to homes being overheated in summer, particularly houses built to passivhaus or similarly high energy efficiency standards.

Overheating in Scotland

Climatic variations in the UK mean there is more potential for overheating in some parts of the UK than others, although colder regions are not exempt from risk. A recent study carried out in Scotland demonstrated that:

'…*low energy buildings, through a combination of effective heat retention and recovery, occupant behaviour and poor design or installation essentially override the northerly location*'. (Morgan, Foster, Sharpe & Poston, 2015).

The authors concluded that 54% of 26 new homes built to high standards of energy efficiency were overheating for more than 6 months of the year. Whilst relatively few fuel poor households in Scotland are likely to be living in homes of passivhaus or similar highly efficient standards, the issue is likely to becoming of increasing importance over time. However, the authors also note that actual overheating (as measured by sophisticated temperature loggers) and people's self-report of overheating bore little correlation with one another, leading them to conclude that '*what is being defined as overheating is simply the desired comfort range of some occupants*'. This adds to the considerable body of evidence highlighting the variable nature of what people consider to be ideal indoor temperatures.

### 5.6. Options for change

The temperatures required to maintain satisfactory heating regimes in Scotland are broadly based on the WHO recommendations of 1987, published 30 years ago. These recommendations were primarily aimed at protecting human health from the adverse effects of cold and damp homes. A review of their present-day

appropriateness seemed timely, especially since a large number of well conducted studies have been published in the last 3 years.

In recommending an 18º C – 23º C temperature range for estimating fuel poverty prevalence, Scotland has remained closer to longstanding WHO recommendations than England or Northern Ireland. It has set higher standards and more demanding targets, especially in a time of the UK's increasingly ageing population.

That having been said, there are still several options for changing how a satisfactory heating regime is defined in the Scottish fuel poverty context. These include:

(i) weighing up the advantages and disadvantages of using actual temperatures versus thermal comfort as the most valid yardstick;

(ii) raising the temperature set points currently in use;

(iii) lowering the set points;

(iv) changing the wording used to define a '*satisfactory heating regime*'.

These options are considered in this section.

5.6.1. <u>The metric: Temperatures or thermal comfort?</u>

When examining evidence on *actual ambient temperatures* in people's home, and comparing this with evidence related to people's *estimation of thermal comfort*, it seems evident that any future recommendations regarding safe temperatures at home should be based on actual temperatures. Thermal comfort is a state of mind, is subjective, and though bound up with physiological reactions to cold, there are many other influences on how people rate ambient temperature, not all of which are fully understood. Furthermore, temperatures which people think (or say) are comfortable are not necessarily temperatures which the WHO would consider safe. For all of the above reasons, thermal comfort assessments are not recommended as a primary tool for identifying households in fuel poverty.

Based on the most recent Scottish House Condition Survey (2015), a thermal comfort metric would do little to reduce the prevalence of fuel poverty in the region, since more than 1 in 5 households not in fuel poverty under the current measure say their homes are too cold in winter, with this figure rising to more than 1 in 4 among the fuel poor.

Thermal comfort is, however, an appropriate metric by which to measure the outcomes associated with energy efficiency retrofits, so that we can be assured of householder satisfaction with measures taken, and so that we can better understand the relationship between thermal comfort and different types and depths of retrofits. The concept is probably valid as an *outcome metric*, but not as part of how fuel poverty is defined – it is used as an outcome metric in Chapter 7.

5.6.2. Non-vulnerable households: lower the 21 ºC threshold in living rooms?

It is widely recognised that this would save considerable money for households and governments, would lower fuel poverty prevalence estimates, and reduce carbon emissions. Of all the options for changing Scotland's temperature recommendations it is both the easiest option and carries the greatest positive impact at policy level. There is also nothing in the WHO recommendations which would challenge this, and since UK living rooms tend to be run at around 18 ºC to 19 ºC, the status quo is (on average) still within the WHO's 18 ºC – 24 ºC range.

On the other hand, it is also where the greatest temperature shortfall occurs. Bedrooms are generally maintained much nearer the current 18 ºC threshold, with living rooms falling much shorter of the 21 ºC threshold. Reducing living room recommendations still further could be a controversial matter. There is no hard evidence to support the change, and we do not yet fully understand why living rooms are run with such a large temperature shortfall. In some cases, it will be a matter of thermal comfort (i.e. choice), in others of inaffordability and hardship. The ratio of one to the other is – though unknown – worth consideration. Among the majority of people in fuel poverty, it is more likely that the shortfall results primarily from issues of affordability, rationalised by an '*I'm not complaining*' attitude which people frequently invoke to account for living in a cold home (Boardman, 2010). This is supported by the fact that, after an energy efficiency upgrade, most

people elect to raise their room temperatures rather than spending less on energy.[23] (Teli et al., 2016).

For these reasons, and because the question of what constitutes a '*satisfactory heating regime'* is concerned mostly with protecting the fuel poor, there seems little justification for lowering the living room temperature threshold from 21 ºC.

5.6.3. Vulnerable households: raise or lower the 23ºC temperature in living rooms?

To stay within the WHO's 18 ºC to 24 ºC range, living room temperatures could be raised to 24 ºC among vulnerable households. However, there could be risks associated with overheating in the event of the threshold for vulnerable people being raised from 23 ºC to 24 ºC, particularly bearing in mind that adverse physiological reactions become evident at 26 ºC (Gupta & Kipsali, 2016). The margin between 24 ºC and 26 ºC leaves little room for real-world error in managing home temperatures.

On the other hand, lowering the living room temperature recommended for vulnerable people to that for non-vulnerable groups (as done in England and Northern Ireland) would be counter to the consistently expressed view of WHO panels since 1982, namely that vulnerable people should be able to live in temperatures around 2 ºC warmer than able-bodied people.

In the absence of evidence to the contrary, there seems little to support lowering living room temperatures recommended for vulnerable people.

[23] In fuel poverty discourse, this is known as the rebound effect (e.g. Herring & Roy (2007): 'Many consumers, realising that the [energy now costs less to use], are less concerned about switching it off…Thus they 'take back' some of the energy savings in the form of higher levels of energy service… This is particularly the case in households that suffer from 'fuel poverty' where the past level of energy services, such as space heating, are, or were considered, inadequate. Some or all of the energy savings from efficiency improvements, such as increased levels of insulation or a more efficient heating system, may then be spent on higher heating standards – the consumer benefits by getting a warmer home for the same or lower cost than previously. Such rebound effects are not theoretical; they have been observed or measured in empirical studies (e.g. Hong et al., 2006). Recent reviews suggest that more than a third of potential energy saving after retrofit is not realised because it is 'taken back' in the form of raising indoor temperatures (e.g. CFU for Scotland, 2016; Galvin, 2015)'.

5.6.4. Non-vulnerable households: lower than 18 ºC in other occupied rooms?

The 18 ºC seems difficult to lower, in view of these considerations:

(i) this represents the lowest safe temperature set out by the WHO;

(ii) it is the minimum threshold of room temperatures recommended by Public Health England;

(iii) it broadly approximates the temperatures which the average British household already maintains in rooms other than their living room.

In many respects it represents the commonly accepted status quo for a minimum threshold, and there is no substantive evidence to support lowering it.

5.6.5. Vulnerable households: lower than 18 ºC in other occupied rooms?

On the basis of the 1987 WHO recommendations, a minimum threshold of 18 ºC could be viewed as insufficient for vulnerable households, since WHO set a minimum threshold of 20 ºC for this group, which WHO define as '*the sick, the handicapped, the very old and the very young'* (WHO, 1987).

Minimum temperatures for the '*the sick, the handicapped, the very old'*[24] should perhaps be raised from 18 ºC to the WHO recommendation of 20 ºC, since there is sound evidence to support that change. Under the *current* guidelines, if these at-risk groups were to comply with Scottish temperature recommendations, they would be moving from a living room at 23 ºC, to a bathroom or kitchen at 18 ºC, which is a drop of 5 ºC. Medical evidence has consistently demonstrated the level of physiological effort required to regulate temperature when people move rapidly from warm to cool conditions (and vice versa). Core body temperature in humans seldom changes by more than 0.3 ºC, despite even radical changes in ambient

[24] WHO consider '*old*' as aged 65 years or more; they do not define what age people become '*very old*'. A threshold could be set based on other Scottish policies designed to assist the oldest citizens.

temperature. This stability is achieved through physiological effort, which involves most of the cardiovascular system.

Older people are less effective than younger ones at maintaining core body temperature when exposed to thermal stress, since they usually have a lower metabolic rate from which to generate heat or cool down; they also have less effective vasoconstriction responses because of hardening of the blood vessels (DeGroot and Kenney, 2007). Other factors that impede rapid heating up or cooling down include low or high body fat levels, sedentary lifestyle, medication use, and chronic conditions (heart conditions, circulatory disease & diabetes) (Marmot Review Team, 2011).

In that context, an observational study of 17,000 participants from England, Scotland and Wales showed that a 2 ºC drop in outdoor temperature had a threefold greater impact on systolic blood pressure in those aged 65 or older than in those aged 35 or younger (Brennan, et al., 1982).

Among vulnerable groups, therefore, a temperature regime which means that recommended temperatures in different parts of the home vary by 5 ºC could represent a significant risk to their health, particularly if shifts between thermal zones happen several times each day, for example as older people rise in the morning, wash and get dressed, prepare meals, and undress for bed. It should be noted that the WHO 1987 Report on indoor temperatures also remarked on the adverse health impacts of at-risk groups having to '*move repeatedly between warm and cold indoor environments*'.

For vulnerable groups there seems to be sufficient evidence to raise the 18 ºC minimum threshold for all occupied rooms other than the living room, to a higher threshold of 20 ºC:

(i) since it is the WHO recommendation for vulnerable groups;
(ii) because of medical evidence on the physiological stressors caused by rapid warming and cooling, which increase with age and infirmity.

### 5.6.6. Age thresholds

The evidence cited here supports the decision to acknowledge that older people, people with disabilities, and those unable to work often require higher temperatures at home in order to protect their health and wellbeing. However, there is no clear and safe indication of whether vulnerable groups could be differentiated in terms of heating needs. For example, there is as yet no convincing evidence that people over 70 need more heating than people over 60, or that people with physical disabilities need higher temperatures than people living with mental illness.

In the context of fuel poverty, the current temperature threshold change (from 21 ºC to 23 ºC) is recommended for people over 60 years old in Scotland. On the one hand, it could be rational to raise the age limit denoting a need for warmer homes to 65 years, based on the fact that this is what WHO originally used as the threshold for defining people as 'elderly' (Ormandy & Ezratty, 2015). This is especially so in cases where people between 60 and 65 are still in good health and in full-time work.

But several other alternatives for segmenting older age groups have also been explored, one of which is a needs-based segmentation (e.g. Shekarriz & Spinelli, 2012). This focuses on *transition points* in people's lives, which are the points in a lifespan when support is most needed. These could include retirement, at whatever age that occurs, since it generally leads to a change in income and how much time people are at home (both of which will affect the proportion of income needed to heat a home adequately).

Another point of view on the matter, as outlined in Chapter 3, is that in the absence of any long term illness or disability, temperature recommendations should not be automatically raised on an age threshold, since age alone is not always a satisfactory proxy for vulnerability, except in the much later years.

### 5.6.7. Secondary heating systems and their implications for how a '*satisfactory heating regime*' is defined

Some of the studies cited in this report indicate that, in fuel poor households particularly, extra heat is often generated from inefficient and expensive secondary

heating sources, such as paraffin heaters and open coal fires. This greatly increases the cost of keeping a home warm, and hence the risk (and severity) of fuel poverty. In this context, perhaps more consideration could be given to not only *what* temperatures people are able to maintain in their homes, but also *how* they achieve those temperatures. '*Being able to maintain a satisfactory heating regime through the sole use of a home's primary heating system'* is, perhaps, worth considering as an amendment to the current definition of what constitutes a '*satisfactory heating regime*'.

### 5.7. Summary

It seems prudent to retain existing temperature recommendations except in instances where evidence strongly supports change. This seems particularly apposite when current recommendations for temperatures in Scotland so closely resemble those originally set out by the World Health Organization. Although the Working Groups who set the WHO temperature range could not have known their future impact, they met regularly to review previous decisions, commissioned work they knew would guide them, and have retained their 1985 recommendations ever since. In the course of 30 years there have been almost no substantive challenges to these recommendations.

When viewed historically, the WHO's 18 ºC – 24 ºC temperature range has been considered the gold standard for European homes since the 1980's, because of its concern with minimising adverse health impacts. Yet for most of that time, and for the vast majority of UK households, these levels of warmth have been aspirational rather than normative. The narrower band of 18º C (most rooms) and 21ºC (living room) temperatures still exceed what the average UK household is achieving at present. Since most UK experts who were involved in fixing the 18 ºC and 21 ºC set points relied on a weak evidence base (including modelled temperature data that overestimated ambient temperatures) it has been difficult to attain what looked, at the time, like a reasonable thermal increase.

To use the terminology of fuel poverty, 18 ºC – 23 ºC (for vulnerable) and 18 ºC – 21 ºC (for non-vulnerable households) remain '*needs to achieve*' temperatures, rather than temperatures which approximate those in the average home. A

decision to lower any of the recommended ambient temperatures in Scotland will distance fuel poverty strategies even further from the gold standard that WHO set out.

There may, however, be substantive justification for raising one of the temperatures in the '*satisfactory heating regime*', namely the temperature set point for all rooms other than the living room in the homes of vulnerable people. In line with WHO's recommendation, it is argued that this should increase from 18 ºC to 20º.

In sum, any decision about whether to alter the existing definition of what constitutes a '*satisfactory heating regime*' in Scotland hinges on:

- whether to remain close to a 30-year old set of WHO recommendations; or

- whether to move towards a set of temperatures that may more accurately reflect what energy efficiency improvements can be practically made in Scottish homes, given the status quo of a cold climate and high fuel prices.

According to previous WHO Panels, they faced a similar dilemma – recommend what an evidence base suggests is ideal, or limit recommendations to what is pragmatic? (WHO 1961; WHO 2010). Since addressing fuel poverty in Scotland remains, principally, a matter of concern for the nation's health and wellbeing, then applying the principle of '*first do no harm*' could reasonably be invoked. In that context, with one exception (which required an upward adjustment of temperature), recent evidence broadly supports the existing temperature recommendations which Scotland uses in defining fuel poverty.

**Key Conclusions on indoor temperatures**

Temperature should remain the metric used to define what constitutes 'a '*satisfactory heating regime*'. Thermal comfort lacks objectivity and is not associated with a concern for protecting human health.

Among non-vulnerable households, the 21 ºC threshold for living rooms should be retained, and also the 18 ºC threshold for all other occupied rooms.

Among vulnerable households, the 23 ºC threshold for living rooms should be retained too, but the 18 ºC threshold for all other occupied rooms should be raised to 20 ºC in order to more *fully* meet WHO recommendations associated with vulnerability.

# Chapter 6

# Poverty, affordability and fuel poverty

## 6.1. Overview of poverty

The definition and measurement of poverty have long been controversial topics, (Mack, 2017), with major debates about:

- relative versus absolute poverty;
- how important is (current) income (as against other resources);
- whether one should root the definition of poverty in an objective/scientific frame;
- what role consensus should play in terms of definitions of material necessities and/or minimum standards.

There are also more technical issues about how to measure poverty and set thresholds, for example the treatment of housing costs or other committed expenditures, or the use of equivalence scales for household composition. Although apparently technical these questions raise issues of principle, for example about *choice* in the first instance or about *need* in the second (e.g. needs associated with age or disability).

We review these issues because this could help a new definition to encompass more fully emerging issues of hardship, inequality, and deprivation.

## 6.2. Should poverty be seen as relative or absolute?

Historically, poverty tended to be defined in absolute terms, usually referring to the basic essentials necessary for subsistence; this approach informed the classic early studies of poverty, such as the work of the Rowntrees, and also the foundations of the post-war welfare system established along the lines of the Beveridge report. But since the 1970s, a more relative concept of poverty has become predominant in the.  This reflects in particular the work of Townsend (1979), who argued that the essence of poverty was being unable to participate in the normal life of the

community to which you belonged. Townsend sought to show that this state could be measured through identifying specific indicators of deprivation, and that there was a clear threshold between having enough income to avoid this state, and falling into it.

The argument that poverty is therefore relative, and has to be defined in the context of a particular society in a particular period, has gained widespread acceptance. This can be seen directly in the poverty targets which UK and Scottish governments have followed since the late 1990s, which are expressed in terms of incomes below a certain threshold (60% of the median).

### 6.3. Is poverty the same as low income?

To be concerned about poverty is to be concerned about the resources which households have to meet their needs. Income is one of these resources, but not the only one. Savings, financial investments, and housing can significantly affect a household's ability to ride out temporary or even extended income shortfalls. In addition to these kinds of *capital*, households may have *human capital* i.e. skills that can make them self-reliant, or which can be sold/exchanged. Another form of capital is *social capital* – the networks of relationships where people (relatives, friends, neighbours) provide informal help in kind, loans and gifts. Access to services provided by local government and other public or voluntary bodies are also part of the resources which people may draw upon, and as with all these resources, people differ in terms of how successful their efforts might be.

A key part of the contribution Townsend and colleagues made was to identify a range of material (and social) deprivations which could act as indicators of real hardship. These, they claimed, better reflected poverty than income alone.

Subsequent research including the Poverty and Social Exclusion (PSE) Surveys generally confirm that poverty measured using material deprivations tends to be more strongly related to a range of adverse outcomes, as well as to people's personal experience of living in poverty, than does income alone.

An even broader approach to poverty is the 'human capabilities' approach, first developed by Sen (1992). The central focus is on functional capabilities, not just on

what people consume but on a wider vision of *what they can do and be over a lifetime.* Clearly, some of the ideas and insights of the approach are relevant. If somebody's home is hard to heat then that reduces the scope of what they can do within it, or reduces their household budget available for other things, or potentially undermines their health and wellbeing, affecting their wider life possibilities and choices.

### 6.4 What does poverty mean when ordinary people define it? The PSE metric

The idea of consensus has become important in thinking about poverty, in this case *consensus about what constitute the basic necessities of life*. Consensus does not mean unanimity, but it does mean clear, stable majority support for certain value judgements in a society. In the context of poverty, a set of goods, services, and social activities can become indicators of acceptable living standards provided a clear majority of people agree these are necessities.

In the UK, the Poverty and Social Exclusion (PSE) study of 2012 is a good example of this approach (Bailey & Bramley, 2017). Large samples were asked to rate potential indicators in terms of how essential they thought they were. Over repeated scoping, a 23-item list eventually emerged as the consensual view of what material deprivation consisted of. Notably, people of all ages, cultural backgrounds and genders showed a strong consensus in rating whether items were essential to a decent life or not, and this applied whether groups were surveyed in England, Wales, Scotland or Northern Ireland.

The two items deemed most essential (with 94-95% of participants agreeing that they are essential), were:

- *heating to keep the home adequately warm;* and
- being able to live in *a damp-free home.*

The fact that 2 of 23 material deprivation items directly reflect some of the consequences of fuel poverty highlights fuel poverty's rightful place in debates about poverty, hardship and material deprivation.

### 6.5 What is the threshold of poverty? The Minimum Income Standard metric.

While the PSE represents one key approach to poverty, the other is the Minimum Income Standard (MIS). This attempts to define a minimum acceptable household budget for different types of household. The MIS also draws on the experience and opinions of ordinary people. A final list of essentials for decent living are gathered and this 'basket of goods' is then costed at any one point in time, to yield a threshold or 'tipping point' below which people can be considered poor.

That threshold tends to be higher than the income levels applied to assess people's eligibility for welfare benefits in the UK, particularly for working age households and single adults. Partly for that reason, many recommend that the threshold is lowered somewhat when using MIS. For example, if MIS generates a minimum income of £500 a month, below which a single adult would experience deprivation, then a more conservative approach would conventionally set the threshold at 90% of that (£450 per month), or perhaps at 80% (£400). In this way, if one wishes to be reasonably confident when stating that 'anyone below *this* income line is likely to have a much greater risk of deprivation than anyone above it', then it is advisable to select a figure which is below 100%, of the full MIS (see Hirsch et al., 2016).

### 6.6. Responses to housing and energy affordability problems

Consideration of the way that households may respond to energy affordability problems suggests that the analogy with housing affordability is quite strong.

Table 6.1 summarises possible responses to problems of housing affordability and fuel affordability (derived from Bramley, 2012). The significance of these responses is that they provide a list of potential 'adverse outcomes' which are of concern and may result from fuel poverty. As such they may provide measures for assessing the extent to which different definitions of fuel poverty capture the adverse outcomes of living in fuel poverty. This is discussed further in the next Chapter.

Table 6.1.: Responses to affordability problems in relation to housing and fuel.

| **Housing Affordability (or Housing-Induced Poverty) Problem** | **Fuel Poverty Problem** |
|---|---|
| Move/ trade down | Move to more fuel-efficient home |
| Housing costs 'committed' so little scope for reducing without moving which can be impractical and/or costly both financially and personally | Reduce fuel use with possible adverse impacts on health, wellbeing and condition of home |
| Material hardship – risks to social outcomes | Reduce spending on food/other essentials |
| Move into or tolerate a housing need e.g. crowding | Move to smaller home or share with others |
| Spend savings, increase debt (risk default, financial exclusion) | Get into debt on utility or other bills |
| Rent/mortgage arrears risking loss of home | Fall behind on housing payments, risking loss of home |
| Apply for social housing or subsidy (e.g. Housing Benefit) | Apply for social housing or subsidy (for energy efficiency improvement) |
| Household dissolves | Less likely solely as consequence of fuel poverty |

### 6.7. The definition of income in the context of fuel poverty

There are different ways to calculate income when analysing fuel poverty. The traditional Boardman measure uses net household income 'before housing costs' (BHC) as the denominator for its ratio. By contrast, Hills' LIHC measure uses net household income 'after housing costs' (AHC) and 'equivalised' for different household composition. We would argue, in line with the predominant view from the poverty research field, that it is better to use income after housing costs (AHC). This is because housing costs are a fixed commitment, given where a household is living, and are very variable between different individuals, groups, regions and stages in the life cycle.

This supports the argument that it is the residual income after housing costs against which the affordability of fuel costs should be assessed.

This conclusion is further reinforced by a good deal of evidence from the analysis of surveys like the PSE, such as the finding that income poverty AHC is more strongly related to a range of adverse outcomes (e.g. poor health, subjective poverty, financial difficulties, material deprivations) than the equivalent BHC measure. One of the key factors here is that some households have negligible housing costs because they are outright home owners. Use of AHC income gives a fairer picture of this situation than the traditional BHC measure. Scottish Government is changing the emphasis in its poverty targets to the AHC measure (e.g. the 2017 Child Poverty (Scotland) Bill).

It is also desirable when comparing incomes of different household groups to apply some equivalisation factors to adjust for different size and composition of households. The standard factors used in most government analyses are derived from the 'modified OECD' scale, which is relatively simplistic. Using MIS instead introduces a different equivalisation scale, in which families with children and households where someone is disabled are deemed to need more income to meet their non-housing living costs. This is relevant to the issue of fuel poverty because current methods for estimating household income in Scotland classify benefits paid to people on the basis of a disability as income, rather than as a supplementary payment needed to cover the additional costs associated with their disability. Studies have shown the extent to which this excludes many people living with a disability from being considered fuel poor, simply on the basis of their having an income boosted to cover their extra needs (Snell, Bevan & Thomson, 2015).

### 6.8. Summary

This Chapter has outlined the Panel's thinking on how poverty should be defined when estimating fuel poverty prevalence in Scotland. We supported using residual income after housing costs, equivalised according to household type, and in a manner which takes account of additional needs (for example needs related to the presence of children or living with a disability). These are all considered important components. Furthermore, a poverty threshold based on a Minimum Income Standard is deemed to be most suitable, with a conservative approach reflected in a threshold lower than 100% MIS.

**Key Conclusions on poverty and affordability**

While low income (relative to that of others in the same society) provides a starting point, the whole evolution of conceptual thinking about poverty leads towards a definition of poverty based more on consensual deprivation approaches which focus on societal norms about what people need and should not have to do without. Good candidates for measuring poverty are, therefore: the consensual material deprivation index approach exemplified by PSE and the Minimum Income Standards (MIS) approach to setting household budgets.

However, for practical reasons to do with the availability of suitable survey data, the second of these (MIS) is likely to be the front runner for implementation.

We believe that there may be merit in combining measures based on residual income with ratio measures, and that in general income should be measured after housing costs.

Consideration of the ways in which households may respond to situations of fuel poverty, some of which are similar to responses to problems of housing unaffordability, suggest a number of possible adverse outcomes. These might be a basis for investigating the relative effectiveness of particular fuel poverty measures in highlighting the pressing 'hardship' problems that policy and practice ought to be most concerned with.

# Chapter 7

# Fuel poverty and adverse outcomes

## 7.1 The role of outcomes evidence

Based on the discussion in Chapter 6, the Panel had reasons to believe that certain ways of measuring poverty, and fuel poverty within that context, are 'better' than others. By that we mean that they are based on arguments of principle from premises which most people would accept. If these measures are 'better', it should be possible to bolster that claim by showing that they are more strongly associated with core outcomes associated with living in fuel poverty. Table 6.1 identified potential outcomes in which people in fuel poverty may:

- be suffering a poor level of thermal comfort, or related physical house condition problems like condensation;
- report adverse effects on health, happiness or social life;
- be obliged to move into or remain in situations of housing need;
- incur debts or report problems maintaining payments (not just fuel debts/payments);
- suffer other material deprivations as they cut expenditure on other budget items.

Hence, a key test is to see whether different definitions of fuel poverty perform better or worse when predicting the incidence of these problems, or discriminating between the populations experiencing them or not. This is the primary focus of this Chapter, reflecting the Panel's general wish to focus on outcomes. Having considered this key aspect, we go on in the next Chapter to report on overall prevalence and the demographic, socio-economic and geographic profile of fuel poverty under these different definitions. While it is important to know what these numbers and patterns will look like, as part of the overall assessment and decision-making process, we regard the adverse outcomes evidence as the most important consideration.

### 7.2 Datasets from which outcomes were selected[25]

- The main dataset used to generate national fuel poverty statistics in Scotland is the Scottish House Condition Survey (SHCS) which contains items related to outcomes;
- the Scottish Household Survey (SHS) also contains some variables of interest;
- the English House Condition Survey (EHS) two outcome measures of interest;
- the UK Poverty and Social Exclusion (PSE) Survey of 2012 has a further six items.

In the time available to us, we have been able to carry out a number of partial analyses based on these different datasets, from which a reasonably consistent picture can be built.

### 7.3 Modelling fuel costs

The official definitions of fuel poverty, and the alternatives which we are testing, use required fuel costs estimated for a given dwelling and household subject to a standard heating/temperature regime. These numbers are derived from models which are developed from detailed building models (BREDEM), utilising data available from within the House Condition Surveys. Two of the four analyses reported here use these data directly, one set for England (EHS) and the other for Scotland (SHCS). The current heating/temperature regime for Scotland is used.

One of the analyses reported here, using the PSE survey, is based on a 'model of a model'. In other words, we fit quite a detailed predictive model to the EHS 'required fuel costs', using a range of variables, available in both surveys, and describing both the dwelling and the household. This model uses 21 variables and explains 50% of the variation in required fuel costs across households in the EHS data for England. We believe this is a good model which provides a fair representation of

[25] Items were selected a priori. A priori means that a test is carried out solely because there is prior knowledge or deductive reasoning to support their inclusion in analysis.

required fuel costs for most households in the PSE survey (although possibly not for some more extreme and unusual cases).

The remaining analysis, based on the Scottish Household Survey (SHS, 2012-14), uses recent data on actual fuel costs, but then uses modelled relationships to 'adjust' these actual numbers to a hybrid figure, which we term 'adjusted/standardised'. Actual fuel costs tend to vary more widely and are obviously influenced by individual household 'behavioural' factors as well as unmeasured individual dwelling factors. Thus although we do fit a statistical model to predict these fuel costs this has less variables in it (less detail on the dwelling) and only explains 25% of the total variation. We particularly want to strip out the socio-economic influences on fuel spending – better off households are able to spend more – but we are slightly hedging our bets on the 'unexplained variation', which may be a mixture of behavioural and distinct dwelling factors. We therefore construct two measures:

A. 'standardised' cost, which is the predicted values from the statistical model, but setting all the socio-economic variables to average values (i.e. neutralising them);

B. 'adjusted actual' cost, which is the actual value minus the predicted effects of (variations in) the socio-economic factors.

We then take the average of these two estimates as our 'adjusted/standardised' estimate. This is a measure of fuel costs which reflects the characteristics of the house and the household, but not the household's income/socio-economic status; but it does include some element of variation in actual expenditure which may be a reflection of a combination of individual household behaviour and unique /unmeasured characteristics of the dwelling. We think it is justifiable to use this measure (a) because the background commentary in the briefing for this project suggested that some actors believed that there was a case for looking at analysis of actual spend as well as the required spend; (b) because we can compare results fairly closely with those based on SHCS for a number of the same outcome measures.

In the final testing and exemplification of options, modifications were made to the assumed vulnerability definitions and heating/temperature regimes, to reflect the thinking emerging on these issues as discussed in Chapters 3 (on vulnerability) and 5 (on temperature regimes). While seeking further guidance and evidence on some aspects of these issues, we took the view that the more likely scenario would involve changes to these (e.g. vulnerability age thresholds under 5 and over 75, if not with LT illness/disability, higher temperatures in other rooms if vulnerable). We also sought to ensure modelled fuel costs in PSE and SHS analyses reflected the level of higher costs generally exhibited in remote and sparse rural Scotland, while also allowing for an enhancement to MIS for other costs of living based on Hirsch et al (2013) in these areas across the different datasets.

### 7.4 The adverse outcomes considered

Based on Table 5.1, outcomes range from direct indicators of fuel affordability problems, to indicators of more indirect or displaced effects:

- failure to achieve thermal comfort – 'not being warm in winter' in the SHCS and SHS;
- failure to achieve thermal comfort – 'having been much colder than would have liked last winter' in the PSE;
- indicators which link failure to achieve thermal comfort to affordability – 'can't afford to heat the house or replace the heating system' (SHCS/SHS); 'can't keep the living room warm in part or wholly because of the cost (EHS); and 'very difficult to meet fuel costs' (EHS);
- an indicator of impacts on the physical condition of the dwelling (with possible health implications) – 'condensation problems (affecting more than just windows)' (SHS/SHCS);
- indicators linking experience of cold with significant cutting back behaviour (on heating, hot water or cooking) and this affecting health or social life – PSE survey items (combining answers to several questions);
- indicators of financial/debt problems directly related to fuel – PSE;
- broader indicators of financial difficulties including falling behind with bills, or specifically affecting payment of rent or mortgage – SHS/SHCS;

- indicator of poor wellbeing (using the standard WEMWBS[26] scale) – SHCS and a similar indicator in PSE).

### 7.5. The different definitions of fuel poverty we tested

We tested 6 different fuel poverty definitions which we selected *a priori* from 13 possibilities, across all datasets:

1. **Boardman1 =** where a household's non-equivalised required fuel costs are more than 10% of their non-equivalised income before housing costs. (The classic Boardman 1991 definition).
2. **Boardman2 =** where a household's non-equivalised required fuel costs are more than 10% of their non-equivalised income after housing cost ***AND*** their equivalised income after housing costs is less than 60% of median equivalised AHC income. (Broadly speaking, they are both income poor and fuel poor).
3. **LIHC1** [27] **=** where a household's equivalised required fuel costs are above the national median, ***AND*** their residual income (equivalised AHC income *minus* equivalised required fuel costs) means that they fall below the official poverty line i.e. below 60% of the median equivalised AHC income (the classic LIHC indicator).
4. **LIHC2 =** where a household's residual income falls below the official poverty line as in LIHC1 *AND where their n*on-equivalised required fuel costs are greater than 10% of their non-equivalised income after housing costs (broadly speaking they are relatively poor and have relatively high energy bills).
5. **MIS1** = having a residual income after housing and fuel costs below 90% of the MIS level for that household composition, excluding MIS elements for housing and fuel.
6. **MIS2** = having a residual income after housing and fuel costs below 90% of the MIS level for that household composition, *and* having fuel costs in excess of 10% of AHC income.

[26] Warwick and Edinburgh Mental Wellbeing Scale – one of the most highly regarded short scales of mental wellbeing, and one used frequently to assess the impacts of improving the energy efficiency of people's homes.

[27] For BEIS methodology on income equivalisation (using OECD scale) and fuel costs equivalisation, see https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/623154/Fuel_Poverty_Methodology_Handbook.pdf (p. 56 and p. 58).

In addition, after further consideration of impending developments in survey data collection, we also tested definitions based on material deprivation, but solely within the PSE-UK dataset, as reported in section 7.7 below.

### 7.6 The relationship with outcomes

The key question the Panel wished to answer was: which measure(s) of fuel poverty show the strongest relationship with adverse outcomes? The simplest way to approach this is to tabulate the rates of incidence of each outcome against the binary variables fuel poor/not fuel poor under each definition. We report the relative 'risk ratios' based on this on Table 6.1.

Whilst the differences between risk ratios are sometimes small, consistent conclusions emerge from this analysis:

- the two existing official fuel poverty measures, Boardman1 and LIHC1, are consistently poorer performers than the other four options;
- significant modifications to these existing indicators (Boardman2 and LIHC2) improve their performance;
- moving to an 'after housing costs' basis for income is clearly a necessary first step;
- in the case of Boardman, there is also a further improvement from excluding households who are not 'at risk of poverty' through introducing this as a secondary criterion;
- in the case of LIHC1, a significant improvement is attained by replacing the second criterion (fuel costs above the national median) with the ratio of fuel costs to AHC income (LIHC2); this second criterion is probably the main root of criticism of the Hills measure (see Chapter 4);
- a further significant improvement can be gained by moving to an MIS model. The alternatives (like Boardman2, and LIHC2) rely on an essentially arbitrary 60% of median income using a simplistic OECD equivalisation scale;
- two MIS options are presented, both using the 90% of full MIS level but with the MIS2 having a secondary criterion based on fuel cost to net AHC income

ratio. They both perform well, with the simpler MIS1 option showing very slight but consistently better risk ratios;

- however, we believe there are several arguments for going with MIS2. Firstly, the fuel poverty issue is multifaceted and it seems likely that a dual criteria definition will better capture this. Secondly, there is strong support for the view that fuel costs should feature centrally in any definition of fuel poverty, particularly where these are relatively high (whether because of energy inefficiency or higher household need).

Table 7.1 applied the analysis of a wide range of outcomes across four datasets. Further analysis was then conducted to enable incorporation of refinements relating to the definition of vulnerability, the proposed temperature regime and the treatment of remote rural areas in MIS. This analysis was also aimed at fine tuning the precise parameters to use in an MIS-based standard. Table 7.2 presents the risk ratios resulting from this revised analysis. As can be seen, this still broadly supports the conclusions summarised above.

Table 7.1.: Relationships of 6 fuel poverty indicators with adverse outcomes (risk ratios); *columns highlighted in pink indicate highest risk ratios; columns highlighted in brown indicate lowest risk ratios.*

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **Outcomes** | **Boardman1** | **Boardman 2** | **LIHC1** | **LIHC2** | **MIS1** | **MIS2** |
| | **10% net income BHC** | **10% AHC and <60% med AHC** | **<60% med AHFC & FC > med FC** | **<60% med AHFC & FC> 10% AHC inc** | **< 90% MIS AHFC** | **<90% MIS AHFC & FC>10% AHC inc** |
| *Outcomes, EHS, England* | | | | | | |
| Can't keep LR warm – cost | 2.3 | 2.8 | 2.6 | 2.9 | 3.0 | 2.9 |
| Very difficult to meet fuel costs | 2.1 | 3.0 | 2.2 | 3.0 | 4.5 | 3.0 |
| Average risk ratio | 2.2 | 2.9 | 2.4 | 3.0 | 3.8 | 3.0 |
| *Outcomes, PSE, GB* | | | | | | |
| Much colder than liked | 1.9 | 3.2 | 2.2 | 3.3 | 4.1 | 3.7 |
| Cold, cut back, affected health | 2.4 | 4.6 | 2.6 | 4.9 | 6.5 | 5.7 |
| Cold, cut back, affected social | 2.0 | 4.6 | 2.5 | 5.0 | 6.0 | 5.5 |
| Cold, cut back, affected either | 2.1 | 4.2 | 2.3 | 4.5 | 5.8 | 5.1 |
| As above, or fuel debt | 1.7 | 3.1 | 2.3 | 3.3 | 4.4 | 3.6 |
| As above, or any debt/skimping | 1.5 | 2.6 | 2.2 | 2.6 | 3.6 | 2.8 |
| Average Ratio | 1.9 | 3.7 | 2.3 | 3.9 | 5.1 | 4.4 |
| *Outcomes, SHS, Scotland** | | | | | | |
| Not warm in winter, serious | 2.1 | 2.2 | 2.0 | 2.1 | 3.2 | 3.1 |
| Can't afford heating system or replacement of system | 2.1 | 2.3 | 1.9 | 2.2 | 3.2 | 3.1 |
| Condensation problems (>windows) | 1.2 | 1.6 | 1.5 | 1.5 | 2.6 | 2.2 |
| Some/deep financial difficulties | 2.3 | 3.3 | 2.2 | 3.3 | 3.4 | 3.2 |
| Diff paying rent/mort, behind, etc. | 2.0 | 2.2 | 2.4 | 2.7 | 4.0 | 2.8 |
| Informal loans | 2.0 | 2.1 | 2.1 | 2.6 | 3.5 | 2.5 |
| Average Risk Ratio | 2.0 | 2.3 | 2.0 | 2.4 | 3.3 | 2.8 |
| *Outcomes, SHCS, Scotland* | | | | | | |
| Not warm in winter, serious | 2.1 | 1.9 | 1.9 | 2.0 | 2.8 | 2.7 |
| Can't afford heat system or replacement of system | 2.0 | 2.0 | 2.0 | 2.1 | 2.2 | 2.4 |
| Condensation problems (>windows) | 1.2 | 1.1 | 1.1 | 1.2 | 1.3 | 1.2 |
| Some/deep financial difficulties | 1.9 | 3.5 | 1.6 | 3.2 | 4.3 | 3.5 |
| Diff paying rent/mort, behind, etc. | 1.7 | 3.4 | 1.8 | 3.2 | 5.0 | 4.1 |
| Sub-optimal wellbeing | 1.5 | 1.8 | 1.4 | 1.8 | 2.1 | 2.0 |
| Average Risk Ratio | 1.7 | 2.3 | 1.6 | 2.2 | 2.9 | 2.7 |

*SHS Scotland based on adjusted/standardised actual fuel expenditure**;** see preceding text for derivation of this and basis of required fuel cost estimates in EHS and PSE analyses, and for definition of fuel poverty thresholds and outcome indicators. SHCS uses 2-year averages, 2014-2015 or 2013-2014 based on available data for the underlying SHS questions (SHCS risk ratios are based on the current heating regime. MIS thresholds incorporate disability adjustment only).
**BHC** = Before Housing Costs; **AHC** = After Housing Costs; **med** = median; **FC** = Fuel Costs; **AHFC** = After Housing and Fuel Costs; **MIS** = Minimum Income Standard.

Table 7.2.: Risk ratios for the alternative indicators. Average 2013-2014 ("Difficulty paying rent/mortgage") or average 2014-2015 (all other outcomes), reflecting modified vulnerability, heating regime and rural MIS (Scotland, SHCS).

| Alternative Indicators | Not warm & Serious problem | Can't afford to heat house or replace system | Any level of conden-sation | Some or deep financial difficul-ties | Difficulty paying rent/ mort-gage | Poor Well-being | Average Risk Ratios |
|---|---|---|---|---|---|---|---|
| Current Boardman | 2.1 | 2.0 | 1.2 | 1.9 | 1.7 | 1.5 | **1.7** |
| Modified Boardman | 1.9 | 2.0 | 1.1 | 3.5 | 3.4 | 1.8 | **2.3** |
| LIHC | 1.9 | 2.0 | 1.1 | 1.6 | 1.8 | 1.4 | **1.6** |
| Modified LIHC | 2.0 | 2.1 | 1.2 | 3.2 | 3.2 | 1.8 | **2.2** |
| MIS 1 | 2.8 | 2.2 | 1.3 | 4.3 | 5.0 | 2.1 | **2.9** |
| MIS 2 (90/10) | 2.7 | 2.4 | 1.2 | 3.5 | 4.1 | 2.0 | **2.7** |
| MIS 2 (90/10) * | 3.0 | 2.4 | 1.3 | 3.7 | 4.2 | 2.0 | **2.8** |
| MIS 2 (95/10) * | 2.9 | 2.4 | 1.3 | 3.7 | 4.2 | 2.0 | **2.7** |
| MIS 2 (90/12) * | 2.7 | 2.4 | 1.2 | 3.5 | 3.9 | 1.9 | **2.6** |
| MIS 2 (85/12) * | 2.7 | 2.4 | 1.2 | 3.6 | 4.0 | 2.0 | **2.6** |
| MIS 2 (85/15) * | 2.5 | 2.3 | 1.3 | 3.1 | 3.5 | 1.8 | **2.4** |

* Based on modified heating regime, and MIS thresholds incorporating remote rural enhancement as well as the disability adjustment.

[1] The combined wellbeing score is based on households' responses to Scottish Household Survey (SHS) questions about: feeling optimistic about the future; feeling useful; feeling relaxed; dealing with problems well; thinking clearly; feeling close to other people; and being able to make up own mind about things.

Data on combined wellbeing scores exist for years 2014 and 2015.

Combined wellbeing scores range from a minimum of 7 to a maximum of 35. The cut-off relating to the worst 15% cases is a score of 22.

### 7.7 Additional consideration of material deprivation

In Chapter 6 we discussed the general merits of 'consensual' approaches to poverty definition, highlighting the poverty and Social Exclusion (PSE) Survey as a particular exemplar, where poverty is defined primarily with reference to material deprivations. It is possible in principle to conceive of a fuel poverty definition based on this approach, and thereby overcome the limitations of current income alluded to in that Chapter. Proponents of this approach would argue that this comes closer to identifying households who are really experiencing hardships from their poverty.

At the outset of the project it did not appear that this approach would be practically feasible, but it has since transpired that developments in data collection might render this approach possible, at least at national level. It is proposed to collect data on a subset of the PSE material deprivation items for households with children in forthcoming waves of the SHS linked to the SHCS. The Scottish Government would consider extending this to all households if it were the intention to use this information for the fuel poverty definition. There remain significant doubts about whether this approach could be made operational down to the doorstep level of practical programmes, but it was judged worthwhile to report on what it might look like, utilising the PSE dataset already being utilised in the analysis of other options.

Using the exact MD items which are to be included in the SHS (10 household/adult and 10 child related)[28], we were able to test various options, utilising up to six adverse outcome indicators. Three variant MD-based definitions were tested:

- 3 plus deprivations, Income less than £304 pw[29], and fuel costs over 10% of AHC income;
- 2-plus deprivations, income under £304, fuel costs over 12% of AHC income;
- 2-plus deprivations, income under £304, fuel costs over 10% of AHC income.

[28] Omitting two items, relating to damp and heating/warmth, which are treated as adverse outcomes of fuel poverty rather than as indicators of poverty in the definition.
[29] Income after housing cost, equivalised using PSE equivalisation scale, which is based on MIS; £304pw is the estimated critical income level at which deprivations tend to exceed 3, and as such forms part of the definition of 'PSE Poor'.

The rationale for 3 deprivations is that this is the standard threshold for PSE poverty. However, there is a case for 2+ deprivations in this instance because the total number of deprivation items is less than in full PSE and has had two common deprivations (the ones related to fuel poverty) removed because they are treated as adverse outcomes. The overall prevalence of FP under these definitions would be 17%, 17% and 20% respectively, based on UK-wide data, and slightly less in Scotland[30]. Based on these considerations and the performance in terms of the relationships with adverse outcome we would recommend the third of these options. These tests were performed using the suggested new vulnerability and temperature regimes.

The MD-based approach appears to achieve a markedly stronger relationship with adverse outcomes even than MIS, with a risk ratio of 5.6 for the recommended option (2/10), which compares with 4.2 using the recommended MIS option (90/10) within the PSE data, although the performance in terms of 'adverse outcomes excluded' (see below) is not quite so good (but this is affected by the overall lower prevalence). It should be noted that this MD-based indicator does not use in its definition the two MD items which directly flag fuel poverty-related adverse outcomes – 'damp home' and 'can't afford to heat home'. This is partly to present a 'fair test' without spurious correlation, and partly reflecting some doubt about whether such 'subjective' indicators should feed directly into the definition. But clearly it could be an option to use these as part of the definition, in which case the indicator would undoubtedly show an even stronger relationship with adverse outcomes.

However, this leads into the main area of doubt about the using MD as a basis for the FP definition. While there is a strong case for it in the context of national monitoring using survey data, it raises problems if it were to be applied in local programme implementation, particularly on the doorstep with individual households. Firstly, the battery of questions to be asked, on top of income, would be too onerous for this context. Secondly, the questions are partially subjective and, once issues of eligibility for significant grants/subsidies come into play, the incentives become

[30] While the prevalence in Scotland would appear to be 1-2% lower than in UK, the PSE analysis may underestimate required fuel costs in some cases.

strong for households to give the answer which attracts the grant. Income, by contrast, is essentially factual and subject to verification.

A further area of doubt about the use of MD as a basis for the FP definition concerns the demographic and geographic profile of such a definition, as discussed further in Chapter 8.

### 7.8 Choice of thresholds

In this report we have argued for an approach to defining fuel poverty based both general principles and on evidence that it appears to be better at discriminating between households who do experience adverse outcomes associated with fuel poverty, and those who do not. While we had some reasons for suggesting the particular combination of thresholds proposed – 90% of the MIS standard, with a fuel cost to net income ratio of 10% – it is fair to ask: why exactly these percentages?

We have conducted some sensitivity testing, to see whether the suggested parameters are optimal. While our primary criterion has been the association of adverse outcomes with fuel poverty, as measured by average risk ratios, at this stage we have added additional measures, based on the proportion of all households reporting adverse outcomes who would be excluded by any particular fuel poverty measure. In addition, we naturally report the overall incidence under each set of parameter values. The Scottish Government will want to take a view about the overall incidence of fuel poverty, having regard to prospective programmes and resources. It is helpful, however, at least from the viewpoint of making comparisons, that our recommended preferred set of parameters (MIS 90/10) happens to have a similar incidence to the classic Boardman measure.

We have looked at these measures across a range of different thresholds (MIS 95/10, 90/10, 90/12, 85/12 and 85/15, using the suggested modified temperature regime, vulnerability thresholds, and also including a suggested deep rural enhancement to MIS). This has been repeated across two alternative datasets (PSE and SHS) as well as the official Scottish House Condition Survey dataset, with the latter results shown in Table 7.3 below. Broadly speaking, this analysis

supports the choice of thresholds recommended (i.e. MIS 90/10), in that this tends to be associated with the highest risk ratios and the lowest percent of adverse outcomes excluded. One PSE MD-based indicator is also reported here, and although this shows a high risk ratio it is somewhat less impressive in terms of adverse outcomes excluded, while raising broader concerns about implementation as mentioned above.

Table 7.3.: Summary of key performance indicators for variant fuel poverty definitions

| Fuel poverty definition | Fuel poverty rate | Average risk ratio Adv Outcm | 1+ Adv Outcm excluded | 2+ Adv Outcm excluded |
|---|---|---|---|---|
| Current Boardman | 30.7% | 1.7 | 58% | 48% |
| Modified Boardman | 19.3% | 2.3 | 72% | 60% |
| LIHC | 12.3% | 1.6 | 84% | 79% |
| Modified LIHC | 24.2% | 2.2 | 65% | 53% |
| MIS 1 | 38.1% | 2.9 | 48% | 31% |
| MIS 2 (90/10) | 30.3% | 2.7 | 57% | 39% |
| MIS 2 (90/10) * | 31.9% | 2.8 | 54% | 36% |
| MIS 2 (95/10) * | 33.0% | 2.7 | 53% | 35% |
| MIS 2 (90/12) * | 27.6% | 2.6 | 60% | 43% |
| MIS 2 (85/12) * | 26.2% | 2.6 | 61% | 45% |
| MIS 2 (85/15) * | 20.2% | 2.4 | 69% | 54% |
| PSE (2 deps/10)* | 17.5% | 5.6 | 53% | 47% |

* Based on modified heating regime, and MIS thresholds incorporating remote rural enhancement as well as the disability adjustment.

Note: Fuel poverty rates are based on SHCS (2015). Average risk ratios are also based on SHCS (2-year averages, 2014-2015 or 2013-2014 based on available data for the underlying SHS questions). The last two columns are based on the PSE UK Survey 2012.

### 7.9 Justifying a distinct approach

The Scottish Government is moving to adopt a new suite of poverty targets associated with the Child Poverty Act (Scotland), and these are generally built

around the established Households Below Average Income (HBAI) methodology, but with a significant shift within that to emphasise relative low income After Housing Costs (AHC), rather than the previous focus on Before Housing Costs (BHC) income. The panel have followed a similar path in this respect, but have gone rather further to arrive at a distinct approach to fuel poverty.

The panel's view is that Fuel Poverty is a distinct entity which merits a specific definition, and that this may legitimately lead to it deviating in some respects from mainstream poverty. We have sought to build on consensual foundations, and noted that the Scottish Government itself is moving to give more emphasis to consensual poverty, by using PSE-based material deprivation indicators for some of its targets. We were strongly of the view that the best criterion for judging how good any definition of fuel poverty is would be based on how well it is related to the adverse outcomes which households report relating to inadequate thermal comfort and problems paying for fuel.

Therefore we came to the view that the best approach would probably be based on a combination of a residual income measure linked to MIS levels for different households, combined with a ratio of fuel costs to AHC income, the latter element representing both continuity from the earlier Boardman approaches and a shared recognition that AHC income is a better basis. The MIS represents a different equivalence scale from that used in the standard measure, giving more weighting to families, and a lot more to households with long term sick and disabled residents; these differences are arguably justified by the evidence within the PSE-UK survey of relationships with material deprivations experienced by different groups. It seems particularly appropriate to be sensitive to the needs of these groups in the context of fuel poverty. It also provides a natural framework to accommodate arguments and evidence about differential cost of living factors in particular contexts, notably remote rural Scotland.

### 7.10 MIS on the doorstep

In the context of MIS, stakeholders were concerned about how a MIS-based assessment could be completed in people's homes when their eligibility for fuel poverty services was being assessed. There is a range of software programmes

which assess eligibility, but so far only one offers the option of calculating household income and comparing it with what a Minimum Income Standard would require. This is the Fuel Poverty Assessment Tool developed by Richard Moore in association with the Energy Audit Company. It determines:

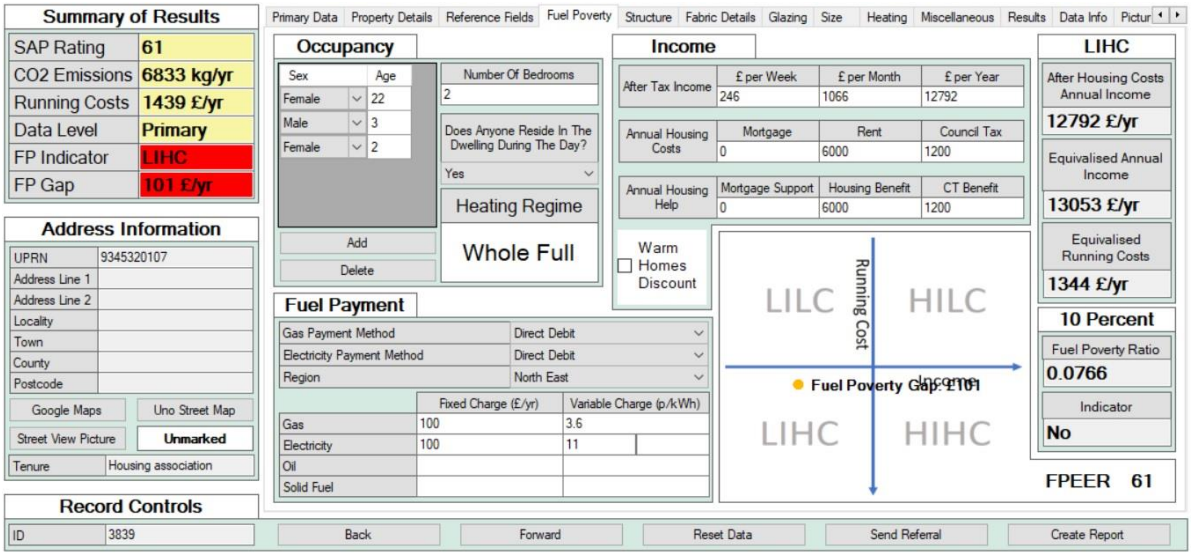
- the required fuel costs of a particular home;
- actual housing costs;
- other required costs for food, clothing etc. via a link to the MIS calculator.

It then establishes whether the household's income is sufficient to cover all of these or not. It will also calculate the extent of shortfall (or excess) to the nearest £, in much the same manner as the LIHC indicator's gap metric does, but in this case based on the shortfall from the MIS standard that applies to that particular household. If required, it can also calculate the impact of different interventions on the level of fuel poverty to help assessors understand which could be the most cost-effective measures. The software is usually set up with databases specific to local authorities intending to use it, and area-based options are available where these are more appropriate for intervention programmes.

To date, the Assessment Tool has been used in England for doorstep assessments by several local authorities; the software can be integrated for use with both LIHC and Boardman options. It is possible to over-ride the English temperature regimes, in order to use the current Scottish or any other temperature regime, and local fuel tariffs can also replace standardised ones. This, Moore notes is "*fully in keeping with one of the central aims of the tool, namely that it should be sufficiently flexible to meet local housing conditions, policies and priorities*".

The Tool has recently been updated so that it can be used in its own right as a means of deciding whether or not households are fuel poor or not, and at what level of severity. It is in this newer format that it may be of use in Scotland, although it would clearly need further adaptation in moving away from the LIHC towards the recommended MIS-based approach. Figure 7.1 shows a screen shot of it being used with the LIHC.

Figure 7.1. Screenshot of the Assessment Tool's fuel poverty tab




## 7.11 Summary

In this Chapter we have tried to apply the principle enunciated in the opening Chapter, namely that the key criterion for judging fuel poverty indicators is how well they relate to relevant adverse outcomes. In developing options we have followed the principles and lessons emerging from mainstream poverty research and policy, as set out in the previous Chapter. This process has led to clear and consistent conclusions and a definite direction for going forward, while also paying attention to practical application of the definition.

Both the classic Boardman definition, and the LIHC indicator, are shown to be relatively weakly related to adverse outcomes associated with fuel poverty. Although ways of improving these have been demonstrated through modified versions, which make fuller use of after housing cost income, the best achievable fuel poverty measures at this time would appear to be those based on MIS. Our central recommendation, favouring a 90% threshold on residual income with a secondary ratio of fuel costs to AHC income criterion set at 10%, emerges from this analysis, including a fuller sensitivity testing to variations in these key parameters which also considers the extent to which households with adverse outcomes might be excluded by under different settings.

We have deliberately not focussed on the demographic or geographic profile of the different competing indicators in reaching this view, although these profiles are reported in detail in Chapter 8.

Hence, in terms of a revised definition of fuel poverty in Scotland, the Panel proposes that the following is put forward for scrutiny and comment:

Households in Scotland are in fuel poverty if:

- they need to spend more than 10% of their AHC income on heating and electricity in order to attain a healthy indoor environment that is commensurate with their vulnerability status;

- and, if these housing and fuel costs were deducted, they would have less than 90% of Scotland's Minimum Income Standard as their residual income from which to pay for all the other core necessities commensurate with a decent standard of living.

Translating this into a lay definition, we propose the following:

Households should be able to afford the heating and electricity needed for a decent quality of life. Once a household has paid for its housing, it is in fuel poverty if it needs more than 10% of its remaining income to pay for its energy needs, and if this then leaves the household in poverty.

**Key Conclusions on fuel poverty and adverse outcomes**

The ways in which households may respond to situations of fuel poverty, some of which are similar to responses to problems of housing unaffordability, suggest a number of possible adverse outcomes which might be a basis for investigating the relative effectiveness of particular fuel poverty measures in highlighting the pressing 'hardship' problems that policy and practice ought to be most concerned with.

Both the classic Boardman definition, and the LIHC indicator, are relatively weakly related to these adverse outcomes associated with fuel poverty.

Ways of improving these two definitions are identified; using after housing cost income seems particularly useful.

However, a better measure of income for this purpose would appear to be based on the Minimum Income Standards approach (MIS). While a good case can be made for using Material Deprivation as a basis for monitoring Fuel Poverty, at national level, we do not see it as appropriate for use 'on the doorstep'.

The Panel's central recommendation favours a 90% of MIS threshold on residual income, with a secondary criterion being the ratio of fuel costs to income after housing costs set at 10% (AHC). It also recommends the inclusion within MIS of significant markups for disability/long term illness and for remote rural cost of living factors.

Hence, in terms of a revised definition of fuel poverty in Scotland, the Panel proposes the following for scrutiny and comment:

Households in Scotland are in fuel poverty if:

- they need to spend more than 10% of their AHC income on heating and electricity in order to attain a healthy indoor environment that is commensurate with their vulnerability status; and
- if these housing and fuel costs were deducted, they would have less than 90% of Scotland's Minimum Income Standard as their residual income from which to pay for all the other core necessities commensurate with a decent standard of living.

Translating this into a lay definition, we propose the following:

Households should be able to afford the heating and electricity needed for a decent quality of life. Once a household has paid for its housing, it is in fuel poverty if it needs more than 10% of its remaining income to pay for its energy needs, and if this then leaves the household in poverty.

# Chapter 8

# Demographic and Geographic Profiles

## 8.1 Introduction

This Chapter provides a concise review of the patterns of incidence of fuel poverty under different proposed definitions, in comparison with the existing definition. It looks at the pattern across different population age and household composition groups, housing tenure, type, age and occupancy categories, as well as the pattern in terms of features particularly associated with fuel poverty, namely general poverty and the energy efficiency rating of homes. The Chapter also looks at the potential impact of changed definition on the incidence across urban and rural areas, in particular the more remote rural areas.

It is important to be aware of these patterns, and that any new definition of fuel poverty may affect different groups in different ways, in terms of inclusion or exclusion. The panel did not think that it was appropriate to choose a fuel poverty definition primarily on the basis of some predetermined demographic or geographic profile. Rather, our approach has been to focus primarily on outcomes, in terms of the association of fuel poverty under different definitions with a range of adverse outcomes. Nevertheless, any recommendation and decision should be informed by a full set of information including evidence concerning potential impacts on different groups of concern to different stakeholders. This may have a bearing on policy programme design issues going beyond the definition of fuel poverty itself.

The profile comparisons are mainly compared using bar charts showing the proportion of households in each group who would be deemed ‘fuel poor’ under each definition. This overcomes the issue that different groups represent very different shares of the overall population, although sometimes when salient we also mention the share of fuel poor within particular categories.

## 8.2 Demographic profile

8.2.1. Prevalence of fuel poverty

Table 8.1. shows prevalence rates using different options, (preferred option highlighted).

- the (traditional) 'Boardman' definition estimates a 2015 prevalence rate for Scotland of 30.7%;

- the Panel's recommended option (is MIS2 i.e. 'residual income after housing and fuel costs below 90% of MIS level, with fuel costs over 10% of AHC income, using the new preferred temperature regime associated with the modified vulnerability definition';

- the estimated prevalence rate for Scotland under MIS2 is 31.9%;.

- this increase of 1.2% over the current Boardman definition equates to approximately 30,000 more households.

The modified Boardman approach, the Hills LIHC definition and the modified version of LIHC all have lower overall prevalence, and in that sense may be seen as more restrictive definitions. Three variant sets of parameters are tested around the recommended MIS 90/10 NTR definition. One of these (95/10 NTR) is more generous, by setting a higher percentage of the full MIS, and this has a similar incidence to the Boardman + NTR at 33.0%. The other variants are slight more restrictive, with MIS 90/12 NTR entailing a higher fuel cost as percentage of AHC income and bringing the incidence down to 27.6%. The further option of 85/12 NTR brings it down a little further, to 26.2%.

Table 8.1.: Fuel Poverty rates (2015). (SHCS and SHS data) using current* (CTR) and modified temperature regimes (NTR)**

| Definition | Description | Fuel Poverty CTR | Fuel Poverty NTR |
|---|---|---|---|
| Current Boardman | 10% net income BHC | 30.7% | 33.0% |
| Modified Boardman | 10% AHC and <60% med AHC | 19.3% | |
| LIHC | <60% med AHFC & FC > med FC | 12.3% | |
| Modified LIHC | <60% med AHFC & FC>10% AHC | 24.2% | |
| MIS 1 + | <90% MIS AHFC | 38.1% | |
| MIS 2 (90/10) + | <90% MIS AHFC & FC>10% AHC | 30.3% | |
| MIS 2 (90/10) * | <90% MIS AHFC & FC>10% AHC | 30.7% | 31.9% |
| MIS 2 (95/10) * | <95% MIS AHFC & FC>10% AHC | 31.9% | 33.0% |
| MIS 2 (90/12) * | <90% MIS AHFC & FC>12% AHC | 25.7% | 27.6% |
| MIS 2 (85/12) * | <85% MIS AHFC & FC>12% AHC | 24.5% | 26.2% |
| MIS 2 (85/15) * | <85% MIS AHFC & FC>15% AHC | 18.8% | 20.2% |

+ Incorporates disability adjustment of +83 £/week to MIS thresholds (no remote rural enhancement). ***** REMOTE RURAL ADJUSTMENT TO MIS (AS WELL AS THE DISABILITY ADJUSTMENT). These MIS measures include an adjustment to MIS thresholds for households HHs) in remote rural areas (working age singles and couples +15% of MIS, pensioner singles and couples +19%, and HHs with children +27.5%).

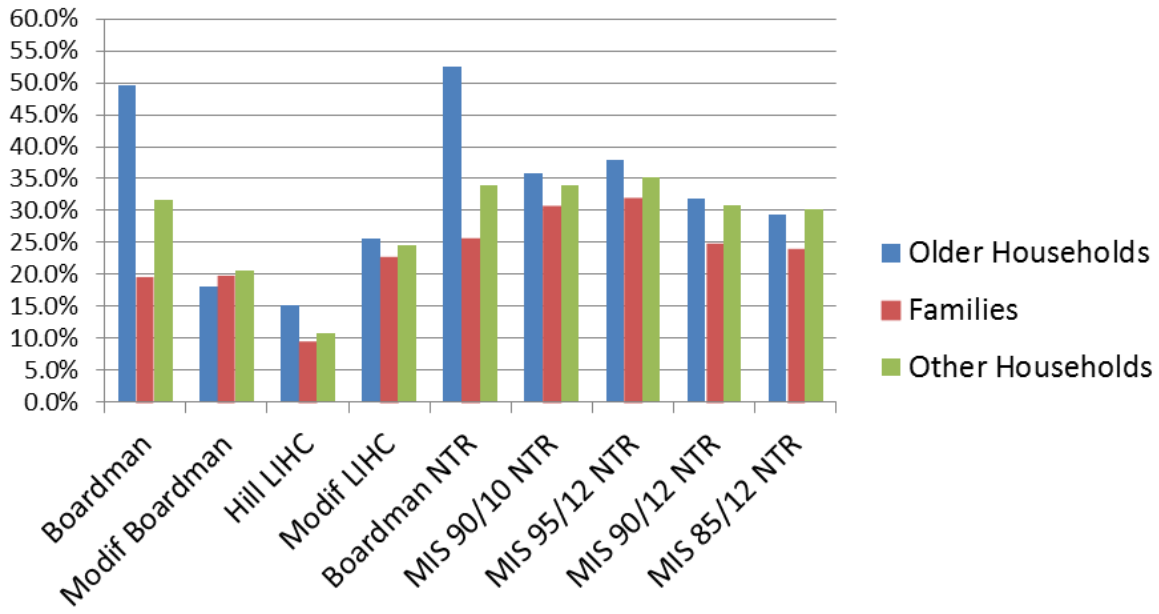
****** NEW HEATING REGIME (NTR)**.** Fuel poverty rates in this column are based on the modified heating regime. This consists of 3 degree difference – i.e. 23 degrees in the living rooms and 20 instead of 18 degrees in other rooms – for vulnerable HHs, where these are defined as those with any member who is LTSD, or any member aged 75 or above, or any children aged 4 or under. In the case of the latter (HHs with pre-school children), for which the necessary BREDEM energy consumption variable is not currently available, a 20% increase was applied to energy consumption, on the basis that vulnerable households are modelled as requiring on average 20% more energy than other households, under the 20/23 heating regime (this is around 10% under the 18/23 regime).

Source: Scottish House Condition Survey (2013-2015).

8.2.2. Fuel poverty by definition and household composition

Figure 8.1 presents a summary picture using the different options for definition.

Figure 8.1.: Fuel poverty rates by definition and broad household types




Source: Scottish House Condition Survey (2013-2015)

The classic Boardman definition is distinguished by giving a much higher FP incidence to older households, particularly compared with families but also with other household types. No other approach tested gives anything like such a high incidence to older households, although it should be noted that the MIS based approaches still give slightly higher incidence to older households. Modified Boardman actually gives older households the lowest rate, a finding confirmed in the PSE dataset, while modified LIHC only gives a slight premium to older households. The PSE data also indicate that a material deprivation based indicator would also give a very low incidence to older households.

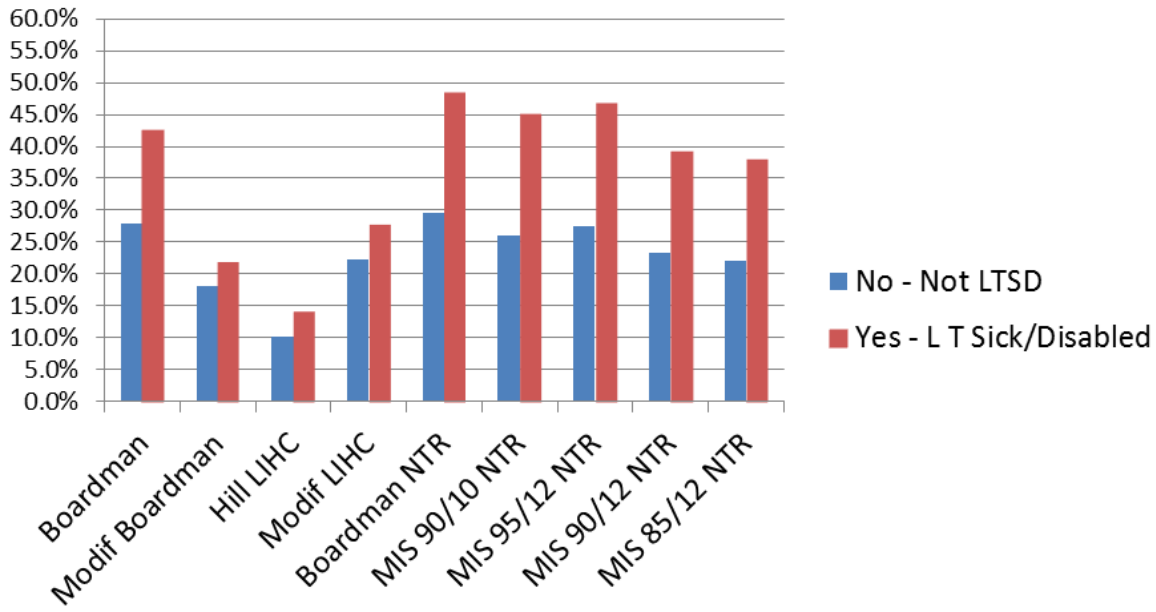
All approaches give families the lowest incidence, with MIS 90/10 and 95/12 giving them a relatively higher score, but it should be noted that under all approaches lone parent families have much higher incidence, while under a number of approaches

(especially MIS) larger families (3+ children) would have a higher incidence. It should also be underlined that single person households of working age tend to have a higher incidence under most approaches than multi-adult and family households.

8.2.3. Fuel poverty and long term illness or disability (LLTID)

This is illustrated in Figure 8.2. Here we find a convergence between traditional Boardman and the MIS-based approaches, where both give a much higher incidence for households with LLTID. This is partly because of the enhanced temperature regime but also because of the substantial disability enhancement to the MIS allowances for other living costs. The other alternatives (modified Boardman, LIHC and modified LIHC) do not have this characteristic, giving relatively little greater chance of being classified as fuel poor to households with LLTID.

Figure 8.2.: Fuel poverty by definition and long term illness/disability status

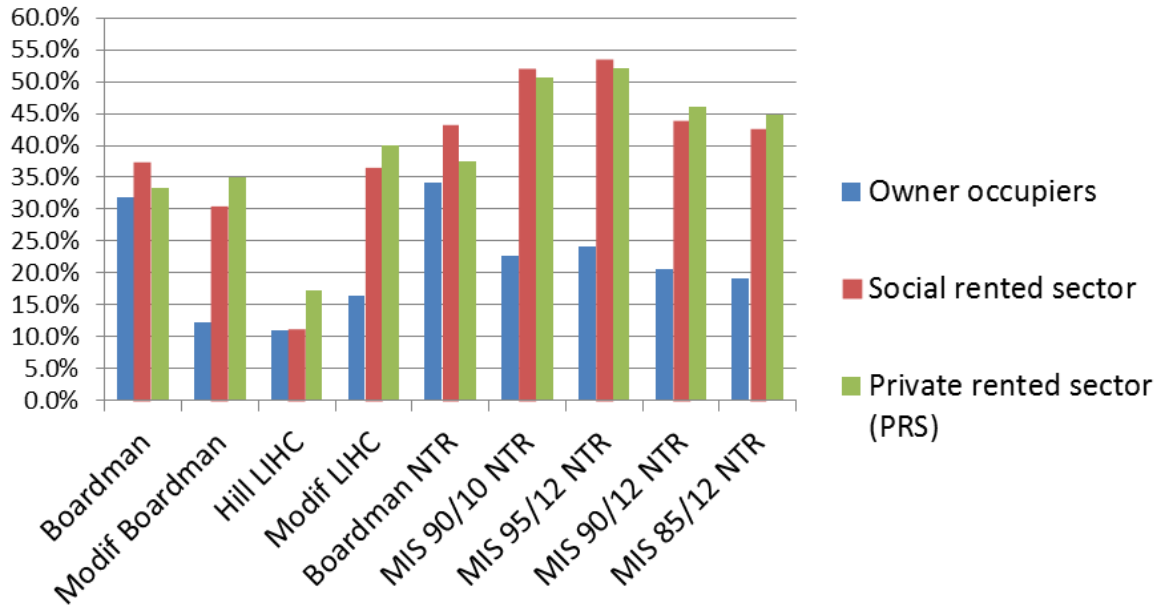



Source: Scottish House Condition Survey (2013-2015)

8.2.4. Housing tenure

Housing tenure shows a marked difference between the approaches to defining fuel poverty (see Figure 8.3). Under classic Boardman, owner occupiers have almost as high an incidence of FP as the rental tenures. This changes under virtually all of the alternatives (except Hills), which show renters having FP rates double or more that of owner occupiers. This reflects the general societal trend whereby older households have seen their poverty rates fall and relative living standards rise strongly since the 1990s, and is particularly influenced by the shift of focus in poverty from Before to After Housing Cost measurement.

Figure 8.3.: Fuel poverty by definition and by housing tenure



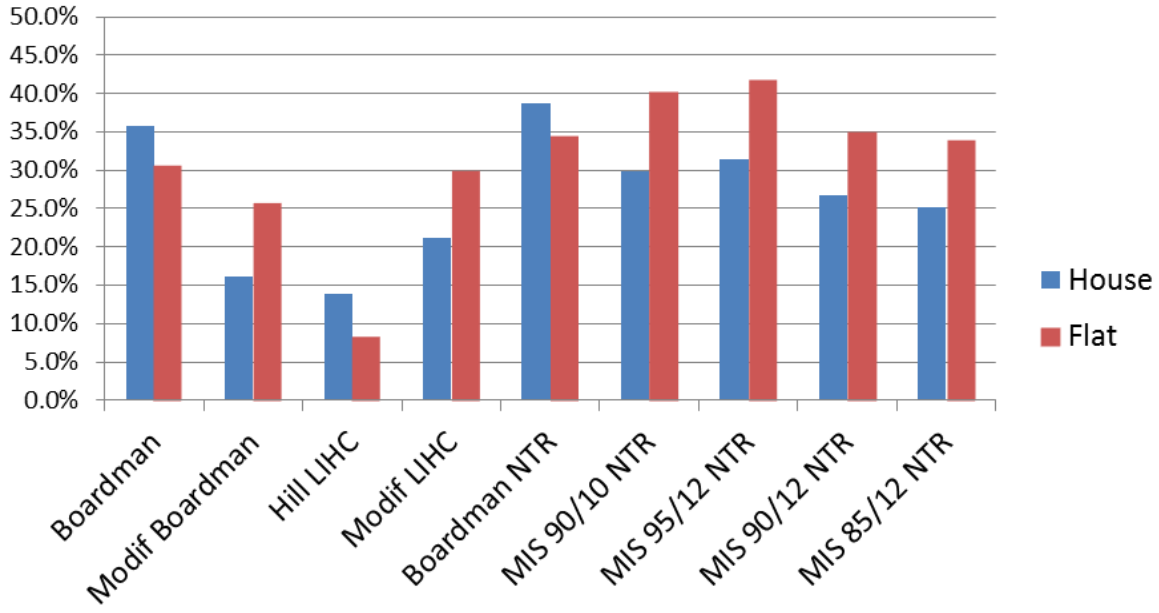

Source: Scottish House Condition Survey (2013-2015)

Among the variant MIS based approaches, as well as modified Hills or Boardman, there is less difference, but not complete agreement as to whether social renters or private renters have higher rates of FP. In our preferred recommended definition, the two rates are very similar.

8.2.5. Housing type

Figure 8.4 looks at broad house type. Here we see a shift from a higher rate in houses under traditional Boardman to a higher rate in flats under most of the alternatives, except Hills LIHC. While flats have some intrinsic advantages in terms of energy efficiency, people living in flats are much more likely to be poor.

Figure 8.4.: Fuel poverty by definition and housing type

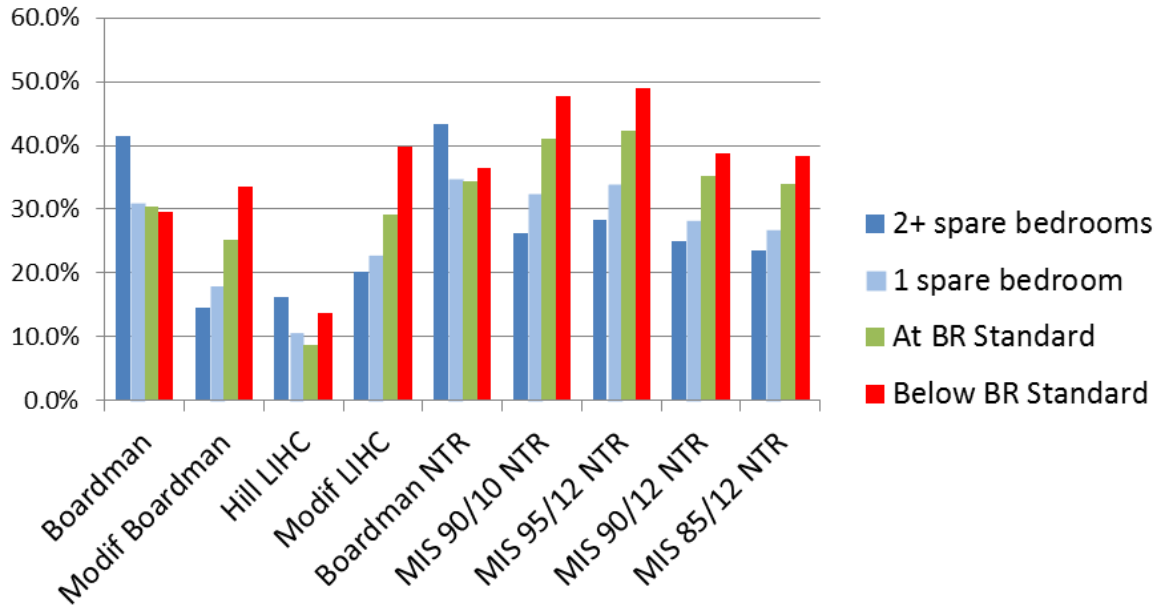



Source: Scottish House Condition Survey (2013-2015)

*8.2.6. Underoccupancy*

The next figure shows a similar picture, this time focused on bedroom occupancy.

Figure 8.5.: Fuel poverty by definition and bedroom occupancy




Source: Scottish House Condition Survey (2013-2015)

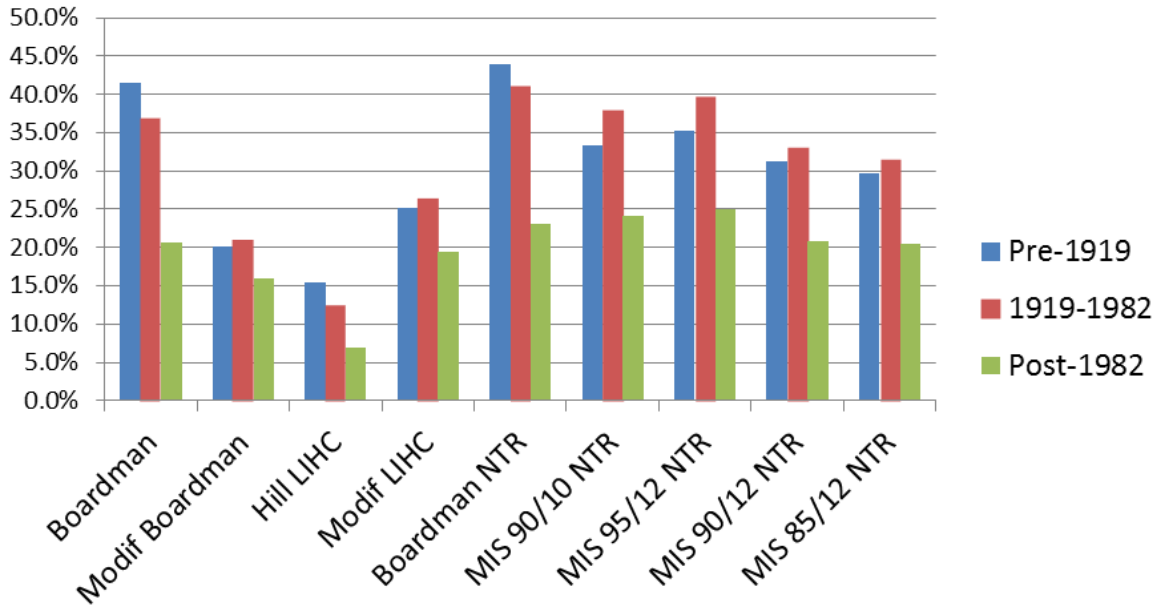
The Boardman based indicators show relatively high scores for households with two or more spare bedrooms – one may infer that many of these will be older households in owner occupation. Most of the alternatives, certainly those based on MIS or the modified versions of LIHC and Boardman, show a pattern where overcrowded households are most likely to be fuel poor and underoccupying households least likely. While we have not recommended imposing an occupancy limit on fuel poverty, it is reassuring to see that there is an inverse relationship with underoccupancy.

8.2.7. Age of dwellings

While clearly there is some relationship between type and size of housing and required fuel costs, particular features of dwellings are known to have a strong relationship. One of these is age of dwelling, with greater problems associated with pre-WW1 stock and energy insulation standards generally higher on post-1980

housing.  Figure 8.6 shows that fuel poverty is more associated with older housing, with the critical cutoff being 1980 rather than 1919.

Figure 8.6.: Fuel poverty by definition and age of housing



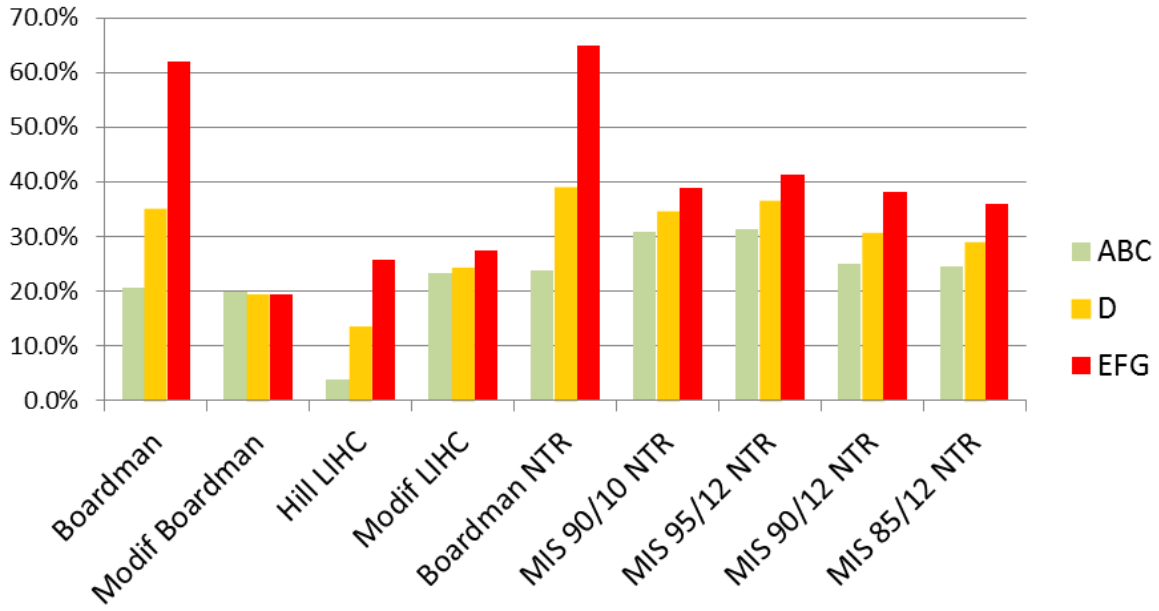

Source: Scottish House Condition Survey (2013-2015)

All FP definitions show this pattern, but it is more strongly marked in the Classic Boardman and MIS-based measures, and less so in modified Boardman or LIHC. This is one case where the difference between Boardman and MIS (90/10) is not that marked.

8.2.8. Energy efficiency of dwellings

This is the focus of Figure 8.7, where the stock is divided into three groupings – ABC, the relatively efficient grouping, D which is intermediate, and EFG which are the least energy efficient.  As expected, fuel poverty is generally worse in EFG rated homes than in ABC rated, although curiously this does not appear to be the case with Modified Boardman, and the relationship is weak with Modified LIHC.  Classic Boardman shows the strongest difference, with the MIS –based measures all showing a more moderate pattern in the expected direction.

Figure 8.7.: Fuel poverty by definition and energy rating of home




Source: Scottish House Condition Survey (2013-2015)

The fact that between 25% and 31% of households living in ABC rated homes are still in fuel poverty (or that as many as 36% of fuel poor live in such homes) is indicative of the fact that there are many poor households, particularly in social renting, who struggle to maintain or pay for adequate thermal comfort, primarily because of their poverty. Although social landlords have improved the average quality of their stock, this is not generally to the point of eliminating fuel bills as an issue. While further efforts in this direction may be part of the solution to fuel poverty problems on the ground, this finding underlines that part of the response should perhaps be directed more towards increasing these households' income. In other words, these analyses support the view that, for some low income households, any energy bill, even one consisting of only standing charges, will present them with a substantial financial burden.

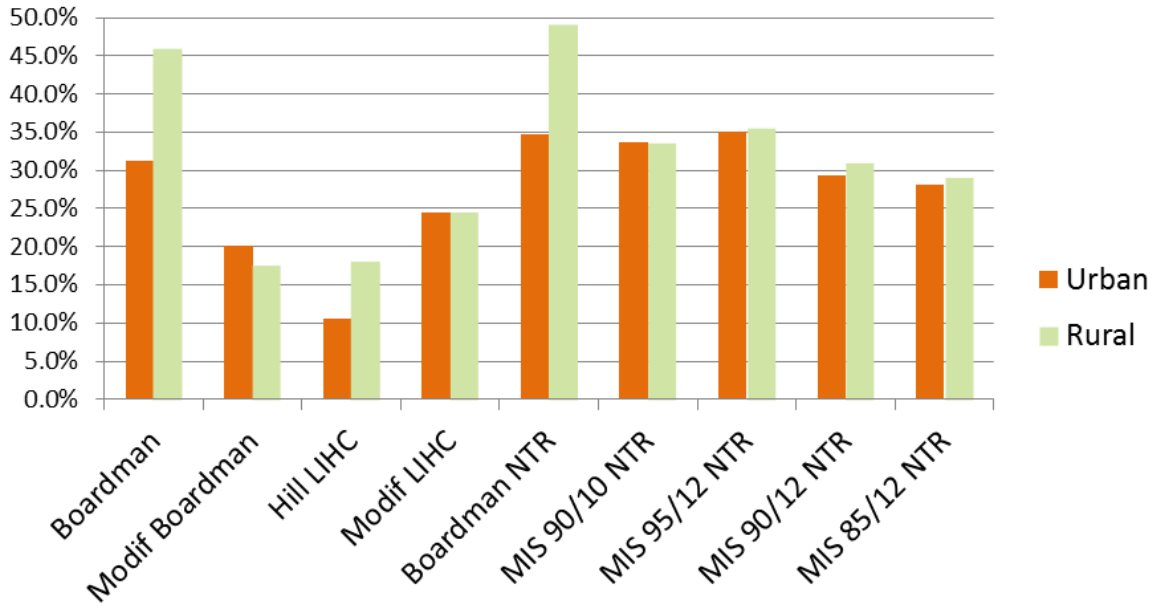
### 8.2.9. Urban-Rural differences

It is clear from the literature and debate about fuel poverty, particularly in Scotland, that this is perceived to be an issue with a particular salience in rural areas, and perhaps especially in the more remote and sparse rural environments which are a particular feature in Scotland. Fuel costs can be markedly higher due to such

factors as not being connected to the gas grid and reliance upon oil, bottled gas or solid fuels; this may be compounded by characteristics of the housing stock and by features of rural poverty (e.g. prevalence of low, seasonal or insecure work incomes). As discussed in Chapter 4, it can also be argued that the way fuel costs are measured in the Scottish Government (SG) modelling may understate the actual price paid by some rural residents, although in the exemplifications here we are reliant upon the standard SG model. There may be scope to look further at 'actual' fuel spend data and at material deprivations associated with FP across the urban-rural spectrum, particularly in the near future when SG are intending to collect some metered consumption data for the SHCS sample.

With these qualifications in mind, we look in Figures 8.8 and 8.9 at the pattern of fuel poverty under different definitions across the urban-rural classifications, a simple 2-way division and a more detailed 6-category division. Figure 8.8 suggests that fuel poverty is substantially higher in rural Scotland if you use the classic Boardman definition, but that the differences become much smaller if you use any of the alternative definitions. Mostly, these still show slightly higher or similar levels of fuel poverty in rural Scotland to the urban levels, although one exception is the 'modified Boardman' measure which shows lower rates in rural compared with urban areas. The sharpness of this switch suggests that both the shift to after housing costs and the cutting off of fuel poverty eligibility from households who are not poor, or close to the poverty line, have a big effect on the outcome. In other words, classic Boardman highlights households who are not poor, perhaps because they are older outright owners, but who have expensive to heat houses. With the MIS-based measures, we recognise not just the higher fuel costs (as modelled) but also some other higher living costs (e.g. motoring), in more remote/deep rural locations, based on the 2013 HIDB Cost of Living study. These are offsetting other factors which make for less poverty in rural areas, for example lower rates of worklessness and lower housing costs.

Figure 8.8.: Fuel poverty by definition and by 2-way urban-rural division

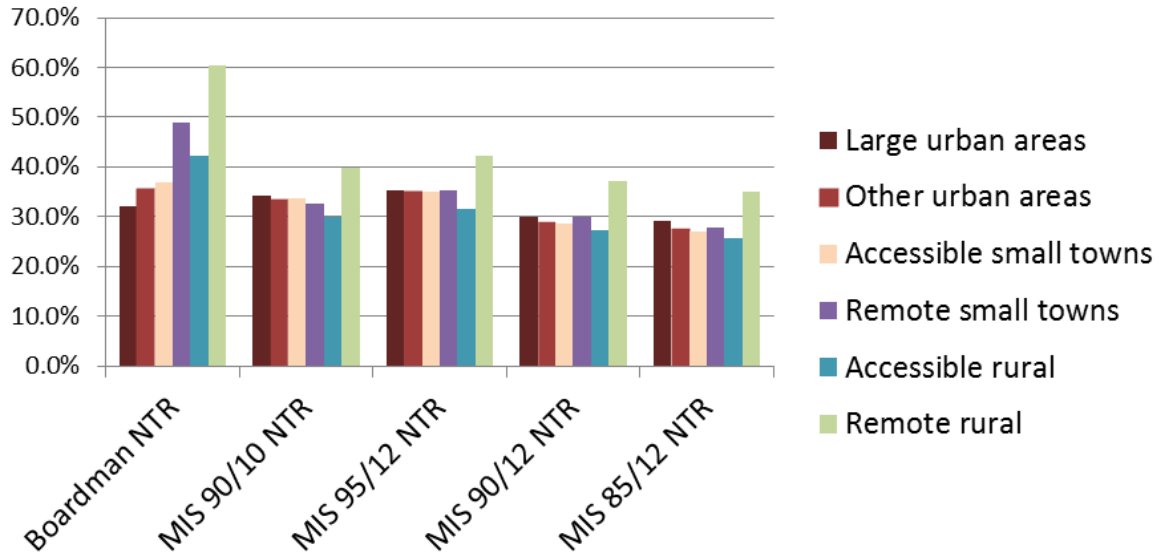



Source: Scottish House Condition Survey (2013-2015)

Figure 8.9 provides a comparison of a more limited set of fuel poverty measures across a more detailed classification of the urban-rural continuum. All measures illustrated seem to show that remote rural areas do have markedly more fuel poverty than all other area types, to that extent confirming the a priori arguments and the case made by rural stakeholders. While the difference is greater under 'classic Boardman', it is still marked in all the MIS-based measures, although somewhat more in some than in others.

It is slightly less clear what the pecking order is between the other types of area. Boardman suggests remote small towns, and to a lesser extent accessible rural, also have higher incidence. The MIS measures suggest that accessible rural generally has a low incidence, below the urban categories. Two of the MIS measures give slight support to the notion that remote small towns also have a slightly higher incidence.

Figure 8.9.: Fuel Poverty by definition and more detailed urban-rural classification




Source: Scottish House Condition Survey (2013-2015)

Using a different dataset (the Poverty and Social Exclusion Survey) we also found that our preferred measure (MIS 90/10 NTR) showed markedly higher incidence in remote and sparse rural areas, but that accessible rural, small town and urban fringe areas tended to show lower fuel poverty than larger urban areas. This dataset also enables testing of a material deprivation (MD) based fuel poverty definition. However, this shows a markedly lower level of incidence in the deep rural areas.

### 8.3 Poverty Overlap

An important part of the critique of the existing fuel poverty measure, as voiced for example through the SWG report, is that it is insufficiently related to poverty. It is therefore appropriate to report on the degree of overlap between fuel poverty and general poverty. There are of course different ways of measuring poverty, and some of our fuel poverty indicators are more closely related to one rather than another measure, so that we may expect close relationships in particular cases, but not in others.

Table 8.2 provides a summary of these relationships. Classic Boardman is less closely related to poverty than modified Boardman, which is particularly closely related to AHC poverty. Both variants of LIHC are quite closely related to AHC poverty. The recommended MIS 2 (90/10) is quite closely related to poverty based on MIS, although rather more of the non-fuel poor are income poor here.

Table 8.2.: Fuel poverty (FP) and relative income poverty (IP) under different definitions of fuel poverty and general poverty (SHCS, 2015).

| Definition | **% FP and IP** | **% IP NOT FP** | **% FP and IP** | **% IP NOT FP** | **% FP and IP** | **% IP NOT FP** |
|---|---|---|---|---|---|---|
| **Poverty Basis** | **BHC** | **BHC** | **AHC** | **AHC** | **MIS** | **MIS** |
| Current Boardman | 47% | 5% | 50% | 10% | 74% | 26% |
| Modified Boardman | 76% | 4% | 100% | 4% | 99% | 27% |
| LIHC | 61% | 12% | 77% | 15% | 96% | 34% |
| Modified LIHC | 66% | 3% | 84% | 3% | 98% | 23% |
| MIS 1 | 47% | 1% | 58% | 1% | 99% | 6% |
| MIS 2 (90/10) | 55% | 2% | 66% | 4% | 99% | 16% |
| MIS 2 (90/10) | 52% | 2% | 64% | 3% | 98% | 15% |

Using a different dataset and expressing it slightly differently, the PSE survey analysis suggests that 68% of the general poor (AHC[31]) would be fuel poor under classic Boardman, but this would rise to 83% under modified Boardman, 92% under modified LIHC, and 95% under MIS 90/10. Using a different poverty definition, based on material deprivation as well as income, these figures would all be lower, 46%, 55%, 64% and 70% respectively – this perhaps underlines the limitations of poverty measures based solely on current income.

[31] This version of AHC low income uses a different equivalisation, based on MIS rather than OECD.

### 8.4 Additional Severity Measures

The analysis so far has concentrated on seeking a single, binary fuel poverty indicator, as a key national target and by implication as a basis for targeting programmes and actions. We are conscious that existing indicators actually include more than one measure, such as the severity bands within Boardman or the 'gap' measure within LIHC. We have given only limited consideration to this issue. A measure of the size of the gap between the household's actual fuel bill and the fuel bill which it could just afford, on our preferred FP definition (MIS 90/10), based on PSE analysis for UK in 2012, is illustrated in Table 8.3. The figures are based only on those in fuel poverty. The median value of this gap is £585 per year. Larger values are shown for bigger family households, for owners and private renters, for houses rather than flats, and for rural areas, especially the remote and sparse rural locations.

Clearly, this kind of measure could be turned into a banded or categorical measure e.g. households with a Gap > £650 etc. In this way, bands of severity could be introduced. For household types, a median Gap > £65 is present among households of 2 adults, multiple adults, and elderly couples. The last-mentioned have a particularly high Gap (£964), suggesting that – whilst this group is less prominent in prevalence figures under the preferred MIS9010 definition than under Boardman – some of them may nevertheless be experiencing among the most severe levels of fuel poverty. These patterns by household type arise partly because larger households tend to require larger absolute fuel costs – while in theory there is a case for 'equivalising' fuel costs in this context, this is a complication which we have tried to avoid up to this point.

The same pattern emerges among owner-occupiers, where the gap is high (£751) even though this group features less prominently in terms of overall fuel poverty prevalence under the MIS9010 option. However, private renters are both more prominent under MIS9010 than Boardman *and* have the largest Gap by tenure group (£793).

The extent to which fuel poverty in remote rural areas of Scotland is more severe than any other area is made plain by the fact that the median Gap in these remoter regions is almost double that in accessible areas.

Table 8.3.: MIS9010 ‘Gap’ measure for fuel poor households by demographic/geographic categories (SHCS, 2015).

| | Mean gap | Median gap | No. of Fuel Poor HH’s | Sample size (Fuel Poor HH’s) |
|---|---|---|---|---|
| Single non elderly | £784 | £617 | 172,000 | 182 |
| Lone parent | £749 | £545 | 53,000 | 69 |
| Couple /2 adults | £858 | £669 | 126,000 | 126 |
| Cpl + 1 child | £960 | £554 | 48,000 | 48 |
| Cpl + 2+ children | £1,097 | £631 | 49,000 | 56 |
| Multi Adult | £1,093 | £740 | 109,000 | 116 |
| Single elderly | £845 | £622 | 148,000 | 177 |
| Couple elderly | £1,064 | £964 | 71,000 | 82 |
| | | | | |
| Owner Occupier | £1,093 | £751 | 327,000 | 375 |
| Social Rented | £662 | £502 | 290,000 | 317 |
| Private Rented | £982 | £793 | 150,000 | 155 |
| | | | | |
| House | £1,093 | £776 | 449,000 | 551 |
| Flat | £648 | £513 | 328,000 | 305 |
| | | | | |
| Large urban areas | £768 | £631 | 255,000 | 212 |
| Other urban areas | £768 | £562 | 306,000 | 325 |
| Accessible small towns | £971 | £702 | 72,000 | 84 |
| Remote small towns | £1,546 | £1,188 | 28,000 | 61 |
| Accessible rural | £1,121 | £651 | 62,000 | 76 |
| Remote rural | £1,672 | £1,314 | 53,000 | 98 |
| | | | | |
| **Scotland** | **£905** | **£646** | **777,000** | **856** |

Note: Tenure groups do not include Rent free households (9 survey cases).

Estimates based on modified heating regime (20 degrees in Zone 2 for vulnerable households, and vulnerable households including those with children under 5, members aged 75+, or members who are long-term sick or disabled) as well as based on MIS thresholds incorporating disability adjustment and remote rural enhancement.

It is clear that the inclusion of data on the geography and demography of the Gap provides a valuable supplement to prevalence data.

## 8.5 Conclusions

We underlined at the outset that the key evidence to use in deciding on the best definition of fuel poverty should be evidence about adverse outcomes. The picture in terms of how different definitions impact on different demographic and geographic groupings is a useful part of the overall picture, and necessary to inform future policy design, but should arguably not dictate the fuel poverty definition. Another consideration will inevitably be the overall percentage rate of fuel poverty, and here it is helpful to be able to compare the existing and recommended definitions. They have a broadly similar overall incidence: 30.7% under the current Boardman definition, and 31.9% under the Panel's preferred MIS2 definition (which encompasses a modified heating regime and markups associated with disability and rural location).

Following our recommended definition would lead to a significant shift in some aspects of the demographic profile, including a reduced emphasis on older households (relative to families), a reduced emphasis on home owners (relative to tenants), on houses (as against flats) and on larger underoccupied houses. In all these cases, however, the same pattern of change would follow whichever of the alternative fuel poverty measures were chosen. At the same time, certain important features of the profile would be maintained: long term sick and disabled would still be much more likely to feature, as would older (pre-1980) housing, and housing with a lower energy efficiency rating would still have a higher chance of being identified, although this relationship would be less strong. Our analysis suggests that once different types of rural areas are distinguished, our recommended approach would still show markedly higher levels of fuel poverty in the most remote/sparse rural areas. And of course, by design, fuel poverty would show a stronger relationship with poverty more generally.

**Key Conclusions on demographic and geographic profiles**

Any decision on who is included or excluded from being classified as in fuel poverty may need to be informed by additional evidence concerning potential impacts on different groups of concern to different stakeholders. This may have a bearing on policy programme design issues going beyond the definition of fuel poverty itself.

Adopting a Minimum Income Standard approach to how fuel poverty is defined has consequences for the demographic and geographic profile of where fuel poverty is most likely to be found.

However, adopting a Minimum Income Standard approach does not alter the prevalence rate of fuel poverty when this is compared with the rate derived from a classic Boardman definition. Under both Boardman and our preferred MIS2 option, approximately one-third of all Scottish households are experiencing fuel poverty.

As with most conventional definitions of fuel poverty which rely on after housing cost calculations, prevalence shifts away from older owner occupiers, and towards younger people, particularly lone parents, and private renters.

Both the preferred approach and the Boardman option yield a high prevalence among households where someone is living with a long term illness or disability.

Under a definition guided by Minimum Income Standards, people living in very energy efficient homes (SAPs of A to C) can often be classified as fuel poor, given the extent to which even the most basic energy bill (based on standing charges) constitutes a significant financial burden.

Fuel poverty is substantially higher in rural Scotland under Boardman, but differences are smaller using any of the alternative definitions. Higher fuel costs and higher living costs in rural areas are offset by lower housing costs and lower rates of worklessness. However, all options suggest that remote rural areas have markedly higher rates of fuel poverty than other areas.

The preferred option can be used to generate a severity metric, akin to that of the LIHC's gap. This, in turn, could be used to generate severity bands, akin to those used in Boardman. Publication of data on the demography and geography of the gap is likely to be an essential supplement to prevalence data, indicating where and for whom fuel poverty is at its most extreme.

# Chapter 9

# Summary of key conclusions

## Ways of defining fuel poverty

9.1. There is a growing need to reframe how fuel poverty is defined in Scotland, with greater prominence being accorded to issues of energy injustice and inequality. Over and above the classic metrics of income and required energy cost, therefore, a new definition should capture the lived experiences of people affected by fuel poverty, especially those for whom energy costs incur enduring hardship and adversity.

9.2. In that context, a new definition should reflect a balanced combination of objective and consensus-based metrics. These are likely to point towards a greater diversity of causes and consequences, and hence a wider range of potential tools for alleviating fuel poverty than has hitherto been acknowledged.

## Vulnerability and fuel poverty

9.3. The Panel did not consider it appropriate that the term ‘vulnerability’ should be used as a synonym for prevalence, in the manner it has routinely been used in the European Union.

9.4. However, it saw an important role for the convention of vulnerability being conceptualised in a capabilities framework. This gave special status to people who, for example, had only limited opportunities to develop problem-solving skills around tariff-switching, or who were not confident in making application for support, or who were not able to manage (often very complex) control panels and heating systems. However the term ‘vulnerable’ was not considered to be especially apt in describing this group, and an alternative term was thought advisable in future, not least of all because the assistance this group might require was rather more specific than the term ‘vulnerable’ implied.

9.5. The most appropriate use of the term ‘vulnerability’ was thought to be related to health risks, such that people most likely to experience the adverse health and mental wellbeing outcomes associated with fuel poverty were deemed to be vulnerable.

9.6. The Panel thought that, in the context of an increasingly healthy and active older population, age per se is not a particularly useful criterion for classifying people as vulnerable to cold-related health impacts. *In the absence of any long-term ill health or disability*, the Panel took the view that age should not become a proxy for vulnerability, until a much older age than is presently used as a threshold in Scotland (which is 60 years). A threshold nearer 75 to 80 years might be more appropriate.

9.7. Precisely whose health was most likely to be vulnerable, and how vulnerabilities might be prioritised in terms of Scotland’s future fuel poverty strategies remained a matter for debate. The recent (2015) NICE Guidelines for England (which deal with health risks associated with living in cold homes), and the Scottish Public Health Network’s 2016 Guidance on this matter, were thought to be useful potential starting points for further refinement of the term.

9.8. Given multiple uncertainties in this regard, the Panel recommended that a small independent group of Scottish public health experts be invited to develop a specific list of health and disability categories, as well as age bands, which would satisfactorily encompass the term “*vulnerable to the adverse health and wellbeing impacts of living in fuel poverty*”. This matter was beyond the scope of the present Panel’s expertise.

**The current UK definitions of fuel poverty**

9.9. Regarding the two most commonly used definitions of fuel poverty, there are strengths to be found in both the current Scottish definition (based on Boardman) and the current English definition (based on Hills).

9.10. However, Boardman's definition does not confine fuel poverty to households on lower incomes and as such it does not align with Section 95 of the Housing (Scotland) Act which indicated that: *'a person lives in fuel poverty if that person is a member of a household with a low income living in a home which cannot be kept warm at a reasonable cost'.* At present, more than half of people deemed to be in fuel poverty have incomes above the poverty threshold (60% of median Scottish income).

9.11. In a similar fashion, the Hills LIHC indicator excludes many households from being considered fuel poor, despite the fact that they may be on very low incomes indeed. There are likely to be practical forms of assistance which could significantly reduce the burdens arising from their energy bills. Where the meaning and significance of being fuel poor are a consideration, the burdens associated with their energy costs support the view that this group should remain an integral part of those deemed to be in fuel poverty.

9.12. Further to the last point, the LIHC's use of a floating median renders it largely insensitive to changes in fuel price, except through second-tier scrutiny of changes in the fuel poverty gap. This makes the measure somewhat more challenging in terms of public engagement and understanding.

9.13. These core drawbacks alone point to the need for a different definition in Scotland.

9.14. However, an additional and salient drawback with both of the conventional options lay in the fact that neither of these definitions currently bears a substantive relationship to how fuel poverty programmes are delivered on the ground.

9.15. The Panel accepted emerging consensus around the idea that "an affordable heating regime" is only one aspect of a healthy indoor climate; aspects of ventilation, condensation, mould growth and damp were also essential components.

9.16. The Panel had concerns about the use of inaccurate proxies for estimating fuel poverty – whether for national prevalence data or on the doorstep. Wherever possible in the medium-term, efforts to replace these with more accurate data (particularly regarding income and energy costs) were strongly supported.

**Indoor temperatures**

9.17. Temperature should remain the metric used to define what constitutes ‘a ‘*satisfactory heating regime*’. Thermal comfort lacks objectivity and is not associated with a concern for protecting human health.

9.18. Among non-vulnerable households, the 21 ºC threshold for living rooms should be retained, and also the 18 ºC threshold for all other occupied rooms.

9.19. Among vulnerable households, the 23 ºC threshold for living rooms should be retained too, but the 18 ºC threshold for all other occupied rooms should be raised to 20 ºC in order to more *fully* meet WHO recommendations associated with vulnerability.

**Poverty, affordability and fuel poverty**

9.20. While low income (relative to that of others in the same society) provides a starting point for identifying those most in need, the whole evolution of conceptual thinking about poverty leads towards a definition based more on consensual deprivation approaches which focus on societal norms about what people need and should not have to do without. Good candidates for measuring poverty are, therefore: the consensual material deprivation index approach exemplified by PSE; the Minimum Income Standards (MIS) approach to setting household budgets.

9.21. For practical reasons to do with the availability of suitable survey data as well as potential application ‘on the doorstep’, the second of these (MIS) is likely to be the front runner for implementation.

9.22. We believe that there may be merit in combining measures based on residual income with ratio measures, and that in general income should be measured after housing costs.

**Fuel poverty and adverse outcomes**

9.23. The ways in which households may respond to situations of fuel poverty, some of which are similar to responses to problems of housing unaffordability, suggest a number of possible adverse outcomes which might be a basis for investigating the relative effectiveness of particular fuel poverty measures in highlighting the pressing 'hardship' problems that policy and practice ought to be most concerned with.

9.24. Both the classic Boardman definition, and the LIHC indicator, are relatively weakly related to these adverse outcomes associated with fuel poverty.

9.25. Ways of improving these two definitions are identified; using after housing cost income seems particularly useful.

9.26. However, a better measure of income for this purpose would appear to be based on the Minimum Income Standards approach (MIS). While a good case can be made for using Material Deprivation as a basis for monitoring Fuel Poverty, at national level, we do not see it as appropriate for use ‘on the doorstep’.

9.27. The Panel’s central recommendation favours a 90% of MIS threshold on residual income, with a secondary criterion being the ratio of fuel costs to income after housing costs set at 10% (AHC). It also recommends the inclusion within MIS of significant markups for disability/long term illness and for remote rural cost of living factors.

9.28. Hence, in terms of a revised definition of fuel poverty in Scotland, the Panel proposes the following for scrutiny and comment:

Households in Scotland are in fuel poverty if:

- they need to spend more than 10% of their AHC income on heating and electricity in order to attain a healthy indoor environment that is commensurate with their vulnerability status; and

- if these housing and fuel costs were deducted, they would have less than 90% of Scotland's Minimum Income Standard as their residual income from which to pay for all the other core necessities commensurate with a decent standard of living.

9.29. Translating this into a lay definition, we propose the following:

Households should be able to afford the heating and electricity needed for a decent quality of life. Once a household has paid for its housing, it is in fuel poverty if it needs more than 10% of its remaining income to pay for its energy needs, and if this then leaves the household in poverty.

**Demographic and geographic profiles**

9.30. Broadly speaking, any decision on who is included or excluded from being classified as in fuel poverty may need to be informed by additional evidence concerning potential impacts on different groups of concern to different stakeholders. This may have a bearing on policy programme design issues going beyond the definition of fuel poverty itself.

9.31. Adopting a Minimum Income Standard approach to how fuel poverty is defined has consequences for the demographic and geographic profile of where fuel poverty is most likely to be found.

9.32. However, adopting a Minimum Income Standard approach does not alter the prevalence rate of fuel poverty when this is compared with the rate derived from a classic Boardman definition. Under both the current Boardman definition and the Panel's preferred MIS2 option, approximately one-third of all Scottish households are experiencing fuel poverty.

9.33. As with most conventional definitions of fuel poverty which rely on after housing cost calculations, prevalence shifts away from older owner occupiers, and towards younger people, particularly lone parents, and private renters.

9.34. Both the preferred approach and the Boardman option yield a high prevalence among households where someone is living with a long term illness or disability.

9.35. Under a definition guided by Minimum Income Standards, people living in very energy efficient homes (SAPs of A to C) can often be classified as fuel poor, given the extent to which even the most basic energy bill (based on standing charges) constitutes a significant financial burden.

9.36. Fuel poverty is substantially higher in rural Scotland under Boardman, but differences are smaller using any of the alternative definitions. Higher fuel costs and higher living costs in rural areas are offset by lower housing costs and lower rates of worklessness. However, all options suggest that remote rural areas have markedly higher rates of fuel poverty than other areas.

9.37. The preferred option can be used to generate a severity metric, akin to that of the LIHC's gap. This, in turn, could be used to generate severity bands, akin to those used in Boardman. Publication of data on the demography and geography of the gap is likely to be an essential supplement to prevalence data, indicating where and for whom fuel poverty is at its most extreme.

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## ANNEX A

## Scottish Government

## Review of the definition of fuel poverty in Scotland

## (edited segment)

### 1. Introduction

1.1. On 24 October, the Scottish Fuel Poverty Strategic Working Group published its report 'A Scotland without fuel poverty is a fairer Scotland'. This included the recommendation that a review of the current definition of fuel poverty in Scotland should be commissioned in light of concerns that the current definition is too broad and impedes targeting assistance on those in most need.

1.2. The Scottish Government has accepted this recommendation and is establishing a panel of independent experts in relevant fields to conduct a review of the current definition of fuel poverty in use in Scotland, and make evidence-based recommendations for whether the definition should be retained and, if not, any changes that should be made.

### 2. Background

2.1. Following the Housing (Scotland) Act 2001 (section 88), the Scottish Fuel Poverty Statement (2002) set out how fuel poverty should be defined: a household is in fuel poverty if, in order to maintain a satisfactory heating regime, it would be required to spend more than 10% of its income on all household fuel use. While section 95 of the Act indicated that 'a person lives in fuel poverty if that person is a member of a household **with a low income** living in a home which cannot be kept warm at a reasonable cost', the subsequent statement made no reference to income levels in setting the definition. The required energy spend is determined on the basis of a theoretical model (BRE-DEM) which estimates energy requirements from the physical characteristics of the dwelling, the heating system and fuel used and certain assumptions about household behaviour. No information on actual energy consumption is used in the definition of fuel poverty. Household income is measured before housing cost and net of tax and national insurance contributions.

2.2. To estimate household needs for space heating, two types of heating regimes are used, standard and enhanced. Households where someone is aged 60 or older or suffers from long term illness or disability are considered vulnerable and are assumed to require an enhanced heating regime; maintaining 23°C in their living rooms and 18°C in their bedrooms for 16 hours every day of the week, during the heating season. The energy needs of all other households are assessed under a standard heating regime; where living rooms are heated to 21°C, and bedrooms to 18° for 9 hours during week days and 16 hours during weekends.

2.3. Heating regime assumptions and the type of households considered vulnerable differ in some aspects from those adopted in other parts of the UK. There are additional differences, for example in the way the number of residents relative to the size of the dwelling are taken into account, or not, in determining the amount of energy required.

2.4. Fuel poverty in Scotland is monitored using data from the Scottish House Condition Survey which does not always contain the full set of information required to implement the definition of fuel poverty. This leads to some simplification in the way fuel poverty is measured in practice. For example, information on income is collected for the highest income earner and their partner only and no additional income recipients in the households are covered. This means that where other household members have earnings or other forms of income, household income is underestimated and the likelihood of fuel poverty is correspondingly overstated[32].

2.5. This definition of fuel poverty has been in use for over a decade, during which fuel prices have considerably risen, the thermal efficiency of the housing stock has improved and lifestyles have undergone change. The high sensitivity of the definition to changes in price levels has meant that trends in measured fuel poverty have primarily tracked the price of fuel. It has been more difficult to understand the contribution that better energy efficiency and other types of help, such as advice and support about energy use or to maximise income, can make in reducing the risk of living in cold and damp homes. This limits the usefulness of the definition in designing effective policies to tackle the problem of fuel poverty and in monitoring their impact.

## 3. Defining Fuel Poverty: Current Issues

3.1. There are a range of aspects of the current definition of fuel poverty that have been contested and the definition of fuel poverty has been subject to considerable examination and interrogation across the UK. For example, in 2012 an independent review commissioned by the UK Government concluded that the traditional approach to measuring fuel poverty was not fit for purpose and proposed an alternative framework for measuring the extent of the problem[33]. In Scotland, the Fuel Poverty Forum commissioned a review of the assumptions underpinning the definition of fuel poverty, but concluded that there was insufficient evidence to make any changes.

3.2. The Scottish Government established two short-life expert groups in 2015 to develop a vision and inform action for the eradication of fuel poverty in Scotland, the Scottish Fuel Poverty Strategic Working Group and the Scottish Rural Fuel Poverty Task Force. Both groups published their final reports on 24 October 2016 and highlighted a number of issues with the

[32] Full details on the definition of fuel poverty and how it is implemented in the SHCS are available in the following publication: *SHCS 2015 Methodology Notes.*
[33] The Final Report of the Fuel Poverty Review by John Hills.

current definition of fuel poverty. The groups highlighted concerns that the definition is too broad and impedes efforts to target resources on those that need them most. The groups therefore recommended that the definition should be reviewed.

3.3. The Strategic Working Group felt that the definition should offer a more transparent link to the desired social outcome(s) and the actual experience of energy use in Scottish homes and reflect current social norms in terms of minimum requirements for an acceptable living standard. In their view, fuel poverty should be seen as a 'manifestation of wider poverty and inequalities in society' and defined within that context. The Group was also very conscious of the policy implications of the definition, highlighting the importance of quantifying the extent of the problem and measuring progress, as well as the ability to target resources towards those in most need.

3.4. At the same time the Group also pointed to a number of benefits of the current definition and the risks associated with changing it.

3.5. The Group highlighted the importance of understanding fuel poverty in the context of its causes and consequences, and argued for a definition which helps achieve this. Its report concluded that energy use should be seen as a driver of fuel poverty, in addition to those currently recognised, and recommended that this should be reflected in the way fuel poverty is defined.

3.6. It also recommended that the review considers international examples of how fuel poverty is defined (including the Hills definition) and argued that potential unintended consequences of any changes to the definition are also considered.

3.7. A summary of the SWG's findings and recommendations around the definition of fuel poverty is attached at Annex A.

3.8. In that context the Scottish Government has identified the following aims and objectives for the review.

## 4. Aims and Objectives

4.1. The overarching aim of the review is to assess whether the current definition of fuel poverty is fit for purpose and adequately reflects the social problem which needs to be tackled. This was expressed in the Housing Act 2001 (Scotland) as that of a 'household with a low income living in a home that cannot be kept warm at reasonable cost' and identified by the Scottish Fuel Poverty Strategic Working Group as inability to achieve 'affordable and attainable warmth and energy use that supports health and wellbeing'.

4.2. The review will examine the extent to which the existing definition represents an effective way to: a) measure fuel poverty; and b) guide policy action. The review will recommend changes to the way fuel poverty is defined or measured where the current definition is found to fall short of these requirements.

4.3. The SWG report made a number of recommendations for issues the review should address. Based on these, members of the review panel will want to consider the following areas in making recommendations:

- **Affordability and reasonable cost of energy use**: how can these concepts be best defined and expressed as measurable indicators?
- **Outcomes**: the SWG report was particularly concerned with the negative impacts of fuel poverty on individual health and wellbeing, there may be a broader range of outcomes that deserve consideration as part of the review.
- **Vulnerability**: does the current approach continue to be useful and identify the right kind of negative outcomes and the social groups that are most at risk?
- **Behaviour**: as well as the energy efficiency of the home, the price of domestic fuels and household income, the SWG recommended that the definition should also reflect how people actually use energy at home because, in their view, this should also be seen as a determinant of fuel poverty.
- **Income and deprivation**: how should the economic resources of households be taken into account when determining the affordability of warmth and energy use?
- **Standard of warmth and energy use**: under the current 'required spend' approach, fuel poverty is defined and measured against a strictly specified pattern of energy use, should this pattern be revised?
- **Monitoring of progress**: a key requirement for an effective definition in the policy context is to enable the effective monitoring of progress in tackling fuel poverty as well as to provide a guide to effective and efficient use of resources.
- **Relationship between definition and programme delivery**: how can the definition of fuel poverty be better aligned with identifying those in most need and provide a better guide for action on the ground?

4.4. The review should also consider the consequences of any changes to the definition. It will be for the review panel to determine the contents of any reports it produces and the list of issues should not be viewed as an outline structure for a final report or set of recommendations.

## 5. Methods

5.1. It is anticipated that the review process would involve examining existing evidence, undertaking new analysis where necessary and considering key stakeholder views on how the official definition of fuel poverty can best contribute to improved outcomes.

## 6. Outputs

6.1. The final report should provide clear, evidence-based recommendations on what changes, if any, should be made to the current definition of fuel poverty in Scotland and why. If no changes are recommended, an evidence-based explanation should be provided of why the current definition – and its component parts – is still valid. The final report should also provide recommendations on how the definition is applied in practice.






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