Fair decarbonisation of housing in the UK: A sufficiency approach

Ian Gough, Stefan Horn, Charlotte Rogers, Rebecca Tunstall

Contents

CASE/232
March 2024

Centre for Analysis of Social Exclusion
London School of Economics
Houghton Street
London WC2A 2AE
CASE enquiries – tel: 020 7955 6679

Centre for Analysis of Social Exclusion

The Centre for Analysis of Social Exclusion (CASE) is a multi-disciplinary research centre based at the London School of Economics and Political Science (LSE), within the Suntory and Toyota International Centres for Economics and Related Disciplines (STICERD). Our focus is on exploration of different dimensions of social disadvantage, particularly from longitudinal and neighbourhood perspectives, and examination of the impact of public policy.

In addition to our discussion paper series (CASEpapers), we produce occasional summaries of our research in CASEbriefs, and reports from various conferences and activities in CASEreports. All these publications are available to download free from our website.

For further information on the work of the Centre, please contact the Centre Manager, Marta Wasik, on:

Telephone: UK+20 7955 6679
Email: m.m.wasik@lse.ac.uk
Web site: http://sticerd.lse.ac.uk/case

Editorial note

Ian Gough is a CASE Visiting Professor and Associate of the Grantham Institute. He is the author of *Heat, Greed and Human Need* (2017) and several articles advocating eco-social policy.

Stefan Horn is a PhD candidate at the UCL Institute for Innovation and Public Purpose researching land rents and ownership models in a sustainable economy.

Charlotte Rogers is Research Assistant to Prof Gough at CASE.

Becky Tunstall is a CASE Visiting Professor and is Professor Emerita of Housing at the University of York.

Ian Gough is grateful to the Leverhulme Trust for supporting this work as part of his Emeritus Fellowship. Thank you also to Richard Bärnthaler and David Fell for helpful comments on an earlier draft.

Abstract

This paper addresses a neglected aspect of the UK housing crisis: how to rapidly but fairly decarbonise the housing stock to meet tough net zero targets while meeting housing needs of the entire population. To do so the authors adopt a radical approach based on sufficiency. The sufficiency approach is based on determining both a housing floor – a decent minimum standard for all – and a housing ceiling - above which lies unsustainable excess. The authors define these thresholds in terms of bedrooms and floorspace and analyse the distribution of housing in England. They find that excess housing is widespread, concentrated in home ownership, particularly outright ownership, and characterised by above average emissions per square metre. They conclude that current policies based solely on energy efficiency and increasing housing supply cannot achieve agreed decarbonisation goals while securing decent accommodation for those who are housing deprived. To do this will require new policies that distinguish between sufficient and excess housing and more effective use of the housing stock to meet housing needs within planetary boundaries.

Key words: sufficiency, fair decarbonisation, minima-floors, maxima-ceilings, excess housing, housing distribution, sufficiency policy

JEL number: can be found at http://www.aeaweb.org/jel/guide/jel.php

Corresponding author: i.gough@lse.ac.uk

1. Introduction: the sufficiency framework

Housing is a unique consumption good in many ways. It is a capital stock that yields a supply of services over a long period of time. The land on which it sits is inherently limited in supply. Housing is immobile, heterogenous and 'lumpy' with high construction and transaction costs. Housing capital constitutes the most dominant form of personal capital, and the dominant form of personal savings, certainly in the UK. Yet many have no capital and decent housing is increasingly unaffordable for millions of people. Government responses to the housing crisis since the 1980s, especially in the UK, can be broadly characterised as following a 'market-fixing' approach. Treating the housing market as broadly competitive, this seeks to increase the supply of new housing by removing planning and regulatory restrictions and providing subsidies, allowances and benefits to aid purchase and renting (Mazzucato and Farha 2023).

This paper adopts a quite distinct approach, one based on the concept of *sufficiency* that recognises limits to production and consumption. There is a burgeoning literature on the concept of sufficiency (Jungell-Michelsson and Heikkurinen 2022). Using a metaphor from housing itself, Gough defines sufficiency as a conceptual *space* between a *floor*, to ensure a decent minimum standard for all, and a *ceiling* above which lies unsustainable excess – see Figure 1 (Gough 2020, 2023; Raworth 2017).

Figure 1: The Sufficiency Framework

	Wellbeing	Wealth/Income	Consumption
Above ceiling	Excess	Riches	Luxuries
Ceiling			
Sufficiency	Flourishing	Moderate incomes	Comfort goods
	Needs met	Decent minimum	Necessities
Floor			
Below floor	Deprivation	Poverty	Lack of necessities

Sufficiency can also be conceived as a *strategy* to achieve such a state. For example, Lage et al. (2023):

> "We define sufficiency as a strategy for reducing, in absolute terms, the consumption and production of end-use products and services through changes in social practices in order to comply with environmental sustainability while ensuring an adequate social foundation for all people".

This is similar to the idea of a 'consumption corridor' over time leading to a sustainable consumption space (Fuchs et al. 2021). Transitioning to sufficiency is not something to be achieved quickly; it entails a long and difficult process over time.

Within this paper we apply this framework to the sphere of housing in the UK, undertake some empirical work and posit a series of transitional policies to achieve sustainable housing. Throughout, we have regard to the floor as well as the ceiling: a 'fair decarbonisation' strategy cannot be at the expense of eroding the material foundations of social wellbeing (Gough 2017).

Floors

The notion of a *floor* depends ultimately on some notion of human need. In the Doyal-Gough theory (1991) universal human needs are those preconditions for any individual action in any culture: preconditions that must be satisfied to some degree before actors can effectively participate in their form of life to achieve any other valued goals. These are defined as health, autonomy and participation. In turn, they venture to explore eleven domains of life that are universal pre-requisites for these basic needs. 'Shelter' or decent housing is one of these. There are links between the idea of universal needs and the 1948 UN Charter on human rights, and the 2015 Sustainable Development Goals (SDGs).

All need theories incorporate a distinction between needs and need *satisfiers* which are contextual and socially constructed. Satisfiers are the goods, services, activities, and relationships that contribute to need satisfaction in any particular context. The needs for shelter apply to all peoples, but there exist widely different forms of dwelling that can meet any given specification of protection from the elements. Without a sharp distinction between universal needs and specific satisfiers, all need theories could justly be accused of being paternalist, intrusive, and insensitive to context and culture.

Yet, need satisfiers are not simply preferences. Ideally, identifying need satisfiers or *necessities* requires a distinct methodology: *deliberative* procedures that draw on two forms of knowledge: the codified knowledge of experts and the experientially grounded knowledge of ordinary people in everyday lives (Doyal and Gough 1991, Chap.14; Nussbaum 2000). It requires a *dual strategy of policy formation* which values compromise, provided that it does not extend to the general character of basic human needs and rights (Doyal and Gough 1991, 141). In the real world, interests, institutions, and power imbalances will act to thwart this. In

implementing the dual strategy one can only insist, following Habermas (1987), that the debate is as informed, participatory, and free of vested interests as is possible.

Ceilings

A sufficiency approach also entails defining and implementing *ceilings* on many components of high carbon consumption, including housing. Herman Daly (1977) distinguishes two broad arguments for limits to inequality: ethico-social and biophysical. Ethico-social arguments for limits to inequality in the Western canon can be traced back to Plato and Aristotle and have more recently emerged from different disciplines. They include political economists, such as Thorstein Veblen (1899 [2005]), political scientists such as Fred Hirsch (1977), economists such as Robert Frank (2000), eudaimonic psychologists such as Richard Ryan and Edward Deci (2001), sociologists such as Richard Wilkinson and Kate Pickett (2009) and political philosophers such as Ingrid Robeyns (2017, 2019).

These discourses have been augmented and arguably overtaken in recent years by the emergence of the Anthropocene, ecological crisis and the biophysical discourse. The Intergovernmental Panel on Climate Change (IPCC) (Calvin et al. 2023) issues increasingly stark warnings:

> "All global modelled pathways that limit warming to 1.5°C (>50%) with no or limited overshoot, and those that limit warming to 2°C (>67%), involve *rapid* and *deep* and, in most cases, *immediate* greenhouse gas emissions reductions in *all* sectors *this decade*" (emphasis added).

The UK is committed to achieve a 'net zero' economy by 2050, an unprecedented transformation, but this goal entails several worrying assumptions and the route to it is unclear to say the least.

Can a link be forged between these scientific warnings and the idea of a ceiling to income/wealth and consumption in the UK today. Figure 2 summarises the essential steps.

Figure 2: From tipping points to consumption ceilings

Claims: Descriptive/ causal v normative	**Key concepts**	**Application to climate crisis**
Bio-physical science	Physical tipping points	Climatic tipping points, eg. oceanic circulation
Normative	Planetary boundaries	Determination of 'safe' aggregate CO2e levels: eg. 'net zero' by 2050
Biophysical + social science	Secure policy route to a safe climate: supply-side plus demand-side transitions	*Demand-side* climate mitigation an essential supplement to supply-side mitigation, starting in rich countries
Normative	*Fair* demand-side policies require a distinction between necessities and luxuries	*Fair* demand side mitigation requires distinction between necessities and luxuries

Source: Gough 2023, Table 2 and further elaboration.

One crucial step is the recognition that 'supply-side' decarbonisation cannot alone achieve net zero carbon production by 2050. It will not be possible to absolutely 'decouple' production or consumption from emissions. Therefore, 'demand-side' policies are also needed: total and average per capita consumption levels will need to be recomposed and constrained, starting in the global North. This is now recognised in parts of the IPCC (Creutzig et al. 2022) and by the UK Committee on Climate Change (CCC) in its Report to Parliament (2023, 25):

> "There is already a clear case for demand-side policies to reduce emissions. These should be implemented now, as a core part of the decarbonisation strategy, especially on home

> energy use, shifting to healthier and more sustainable diets, and reducing air and car travel."

But the CCC has not yet grasped the distributional nettle that this entails.

Once the necessity for demand-side mitigation is recognised, issues of justice and fairness are raised. Whose consumption should be cut? Professor Shue and others have introduced the normative case that it is profoundly unjust to reduce the consumption of necessities by the poor whilst allowing the consumption of luxuries by the rich (Shue 1993; Schramme forthcoming). Given the close link between personal income/wealth and emissions, this requires compressing economic inequality *starting at the top*. It is here that biophysical limits to inequality interact with ethico-social limits. Inequality, and the capitalist system of 'legitimised greed' that regenerates it, cannot be separated ontologically, empirically or politically from the drivers of planetary overshoot (Gough 2017). Decarbonisation must also be *just* or *fair*, especially in a context already characterised by very high levels of inequality. Decarbonisation thus logically entails reducing inequality, between and within nations.

Since climate change is a global threat, the required global shift is critical, but raises many difficult questions not considered here. As researchers within the UK, we focus on the responsibility of the UK as a whole to decarbonise fast. This involves both territorial emissions from production and demand-related emissions from consumption. Within consumption-based emissions from the UK, the social case to focus on high-emitting households is strong. A wealth of recent research is highlighting the responsibility for emissions of the top 10% of households, the top 1% and the top 0.1% in the UK and the global North as a whole (Gough 2017; Baltruszewicz et al. 2023; Chancel 2022; Oxfam 2023). This provides the evidential foundation for our following research.

The idea of sufficiency as a conceptual space, illustrated in Figure 1, moves beyond the earlier sharp distinction between necessities and luxuries (Gough 2020, 2023). Rather, we order consumption items into three categories: necessities, luxuries and – between these – 'comfort goods'. This is ultimately a deliberative judgement, but it is founded on economic concepts such as the income elasticity of demand. *It is important to note that 'sufficiency' is not restricted to meeting 'minimal' needs.* Sufficiency is a space, not a line. Thus, sufficiency extends beyond this minimum to embrace concepts of flourishing, moderate incomes and comfort goods, provided these do not overstep the ceiling.

An effective sufficiency, or fair decarbonisation, strategy thus requires two things: first, that excess consumption above the ceiling is shrunk or redistributed, and second, that the entire economy is decarbonised whilst ensuring that a minimum floor is guaranteed. Given exorbitant inequality in emission levels the definition of excess is approached by working down from the top emitters. We apply this two-pronged strategy to the housing sector in this paper. Whether or not it enables agreement to be reached on what constitutes 'excess housing' is a central issue discussed in part 2.

A consumption corridor

This then raises a dilemma concerning need satisfiers. The accepted standards of housing, food, mobility, leisure pursuits and so on, of households in the UK have expanded hugely over the past century (at least until the financial crisis of 2007-8). These expectations have been documented in surveys and research forums, including the Minimum Income Standard (MIS) research. Their criteria for deciding what goods, services and activities to include in the minimum is that cited above: the ability of a people to participate in accepted activities in the UK today. Yet this contemporary lifestyle is unsustainable. If the entire UK population

were living on the MIS budget an earlier report calculated that average per capita emissions would still amount to 7.3 tonnes per person (Druckman and Jackson 2010). To move quickly to 1 tonne of CO^2 emissions per person within existing socio-technical structures would deprive citizens of a wide range of goods and services - cars, imported foods, a range of clothing, travel *and* spacious and well-equipped housing – goods that they have agreed (in the MIS groups) are necessary for effective participation in modern British life.

Thus, we must devise in our imaginations and construct in reality a 'consumption corridor' leading quickly to a state of sufficiency but starting from where we are now. Here we apply this methodology to housing in the UK to envisage a 'housing corridor'. The following sections apply this approach to housing in the UK in four stages:

- Part 2 sets the scene on inequality in UK housing and establishes thresholds of necessary housing and excess housing, and proposes measures of each.
- Part 3 then calculates the distribution of the housing stock in England between the resulting spaces of deprivation, sufficiency (both 'meeting needs' and 'comfort') and excess, and their carbon footprints.
- Part 4 then sketches a series of policy proposals that would facilitate a transition or corridor to fair decarbonisation of housing in the UK. Our perspective adds a suite of innovative *sufficiency* policies to more conventional efficiency policies.
- Part 5 concludes by considering further how a democratic consensus might be achieved on such a radical strategy.

Our purpose is to combine the social and ecological dimensions of housing policy: to pursue the goal of an integrated *eco-social* policy. Even so, we do not discuss any aspects of the ecological crisis pertaining to other

planetary boundaries, such as biodiversity loss or land and water availability; our focus is solely on climate change and decarbonisation. The paper builds on much previous work and surveys relevant literature and undertakes some original quantitative research.

2. Applying the sufficiency approach: Defining necessary and excessive housing

2.1. Background: the centrality of floorspace

Tunstall's (2015) analysis for England and Wales derived from the 2011 Census constructs a relative measure of housing space consumption based on rooms per person. In the long view from 1911-2011 the population grew by half, but the number of rooms tripled. The rate of low absolute housing under-consumption (overcrowding) of households with less than one room per person plunged from 49% to 4%. Using the Gini coefficient, inequality in housing space was almost unchanged. However, using inequality definitions more sensitive to the bottom of the distribution, housing space inequality reduced steadily from the 1920s to the 1980s, but then the trend reversed. By 2011, inequality had returned to levels not seen for fifty years or more. This picture of rising inequality in housing is now widely recognised and criticised, but its full implications demand further analysis (Dorling 2014).

A sufficiency framework entails, as in traditional housing policy, discovering and agreeing a lower threshold to identify necessary housing, but also, unlike traditional policy, an upper threshold of excess housing. The housing sector in the UK spans all three of the levels in Figure 1: it is for everyone a necessity, some are comfortable, and others live in luxury. Housing appears to be the site of unending wants and preferences for more quantity and quality, for space, amenities, comforts and fixtures

(Park 2017). Finally, in the UK today and many other countries, it is a critical arena of wealth accumulation, speculation and rent-seeking.

At the same time housing is a major source of carbon emissions and thus a significant contributor to climate change, in construction, in use, and through maintenance and possible eventual demolition. The UK Committee on Climate Change reported that 15% of all greenhouse gas emissions in the UK can be attributed to domestic heating, while a further 4% is generated from the use of electricity in the home for appliances and lighting (CCC 2019, 27). Bringing down home emissions in line with the UK's target for 2050 will require a rapid upscaling of home energy retrofits. Progress towards this goal is inadequate and sporadic and operates alongside a bipartisan policy to build up to 300,000 new homes a year.

In the next section we attempt to construct thresholds of necessary and excessive housing for the UK today, which in turn define what counts as sufficient but not excess housing.

2.2. Defining minimum sufficient housing

<u>The characteristics of housing</u>

Within need theory, 'shelter' is a critical intermediate need, vital for the satisfaction of the universal basic needs for health, autonomy, and participation. While the paramount significance of housing to human wellbeing is consistently recognised, the concept of adequate or sufficient housing has been defined and measured in various ways in housing policy and research. Beyond the use of distinct methodologies, this is due to the fact that adequate housing is a multi-dimensional concept, dependent on particular cultural, social and environmental contexts. Nonetheless, a

close overlap in content can be observed among various descriptions of minimum housing standards.

In *A Theory of Human Need* (1991, 196-8), Doyal and Gough specify that a 'dwelling' should offer reasonable protection from climatic extremes, from exposure and from pests and disease-carrying vectors. It should encompass or provide easy access to clean water and sanitation. And the dwelling should not be so overcrowded that it undermines physical or mental health, or the ability to participate in critical social activities. The International Covenant on Economic, Social and Cultural Rights goes further to include affordability, security, location, and accessibility (Mazzucato and Fahra 2023, 13). A UN-HABITAT (2006, 121) global report likewise stresses the importance of security and accessibility, in addition to adequate privacy, secure tenure, satisfactory services and infrastructure, and suitable environmental quality.

Overall, the most commonly identified dimensions are housing size relative to the number of occupants, housing quality, affordability and security. Housing quality typically refers to the physical condition of a property, its state of repair, and the amenities it offers. Housing security refers to the security of tenure, or the guarantee that housing occupants can reside in their homes without fear or experience of forced eviction, harassment, and other intimidations (Mansour et al. 2022). Housing security can also include the housing environment and considerations of physical security. For example, vandalism or crime in the area may impede on secure housing. The affordability threshold is generally conceived to be met when financial costs associated with housing are at, "such a level that the attainment and satisfaction of other basic needs are not threatened or compromised" (Boyle & Flegg 2022). This is often measured through expenditure-to-income ratios, or residual income after housing costs.

To achieve sufficiency in housing, between deprivation and excess, a household needs to have sufficient housing space, sufficient housing quality, sufficient security and sufficient affordability. However, the remainder of the paper focuses on housing space. We have made this choice in order to demonstrate and measure the extent of sufficiency, and thus to examine the scope of its policy implications. Housing space is a major contributor both to human wellbeing and to carbon emissions, and households could be seen as having insufficient, sufficient or excess space. Quality of housing would have been an alternative focus because it could also be seen as insufficient, sufficient and potentially excess, and may be linked, positively or negatively, to emissions. We do not address it directly, except in terms of energy efficiency as an aspect of quality. In contrast, households may have insufficient security and affordability, but cannot really have excess of these features, and there is no necessary link between these aspects of housing and emissions.

The importance of housing size and a focus on existing housing

Home size per capita is by far the strongest predictor of residential energy consumption per capita (Huebner and Shipworth 2017), at least over the short- or medium-term. Holden (2004, 102-103) similarly asserts that the physical dimensions of a property and its site are central to the household's ecological footprint. Lorek & Spangenberg (2019, 288) find that:

> "Without [policy] instruments limiting average dwelling floor area per person it is hardly imaginable how an absolute reduction in household energy demand could be achieved".

This is why our current focus is drawn to housing space.

Tunstall (2022) found that in England over 2008-2018, efficiency improvements which reduced the production of CO^2 in use (for heating and lighting) outran the addition of extra space through newbuild and

extensions. However, efficiency increases faltered after 2015, and extra space was also produced. The Committee of Climate Change has set the UK a carbon budget, the total amount of CO^2 that can be produced by 2050 to ensure a 50% chance of limiting global heating to 1.5'C. If the UK government halved in-use emissions from housing, existing housing alone would consume 92% of the total budget. If the UK government achieved net zero in construction, but kept its 2019 pledge to build 300,000 homes a year in England by the mid-2020s and extended it to 2050, a further 9% of the budget would be used by the construction of new housing, and 3% by its operation, totalling 104% of the total budget (Zu Ermgassen et al. 2022, 2).

In-use emissions per unit of floorspace can and probably will reduce in the UK, as they did in the 2000s and 2010s, and they could in theory reduce faster than Zu Ermgassen et al. (2022) suggest. However, Serrenho et al. (2019) warn that limits to the capacity for improving efficiency in home construction, and use in England and its high cost, may necessitate complementary limits on construction, and promotion of efficient 'use of existing homes'. Hertwich et al. (2020) and Pauliuk et al. (2021) argue that more intensive use of housing is an important element of a comprehensive strategy to reduce emissions, and that reduced average housing floorspace per person is one of the most promising approaches (see also Huebner and Shipworth 2017). Zu Ermgassen et al. (2022) and others also point out that as homes become more efficient in use, the carbon costs of construction will form a greater proportion of any total.

Minimum space standards

Approaches to identifying adequate housing standards have varied. Some measures ask residents if they feel their housing is sufficient. The ECHP, for example, details households' own evaluations of their housing costs,

quality and size (Till 2005, 155). More commonly, research and policy has relied on objective indicators, comparing housing features and conditions to an external standard, usually determined by expert judgement (for example UN-Habitat ud).

More relevant to a needs approach is the Minimum Income Standard (MIS) focus group research undertaken at Loughborough University over the past fifteen years. This involves deliberative work with members of the public, identifying the minimum sufficient amount of housing space, and minimum acceptable tenure, as part of wider deliberation to determine the goods and services needed for effective minimal participation in UK life (Davis et al. 2015; Padley et al. 2021). Unfortunately, this research has less to say on minimum standards and desirable forms of housing. Padley et al. (2021) do undertake a focus group exercise for a wide variety of household types, distinguishing standards for London and the rest of the UK. However, these mainly use a 'bedroom' approach and mimic the official bedroom standard discussed below.

Considering the lack of applicable 'dual strategy' research, measures and data, we instead utilise government-set minimum standards in this paper. In part 5 we emphasise the importance of conducting future deliberative research on housing standards which combines expert and lay knowledge.

The necessity standard – the floor - for the UK will, in global terms, be very generous compared with a middle-income country such as South Africa, let alone low-income countries (Rao et al. 2019). The United Nations definition of sufficient housing space is at least one third of a room per person (UN-Habitat 2022). This 'sufficiency' threshold would constitute extreme deprivation and overcrowding in the UK. Our aim in this part is to determine what characteristics of housing services facilitate

effective participation in British social life as it exists today within present urban and spatial infrastructures.

However, homelessness, the most blatant and foundational standard of inadequate housing space, does exist in the UK. The legal definition of homelessness is when "a household has no home in the UK or anywhere else in the world available and reasonable to occupy" (DLUHC 2018, updated 2023). Reasonableness refers to legality, and to some extent to safety, quality and affordability This includes rough sleepers and people in temporary accommodation such as hostels or shelters. It has also been argued that those living in very poor-quality homes or extreme overcrowding may be considered homeless (Public Health England 2019). The European Typology on Homelessness and Housing Exclusion (ETHOS) provides a valuable way of thinking about the spectrum of housing deprivation, accounting for physical housing, legal security and feeling at home and/or safe (Amore et al. 2011). When measuring minimum housing thresholds in part 3 we will include estimates of the homeless.

We now consider two lower thresholds, or 'floors', for housing space:

- The bedroom standard
- The floorspace standard

<u>The bedroom standard</u>

The 'bedroom standard' is commonly used in UK housing statistics and by social landlords as the measure of minimum sufficient housing space in relation to the composition of households. Established in 1960, the standard is increasingly criticised as inadequate and outdated. It requires that a separate bedroom should be provided to the following persons: 1) couples of adults, 2) a person aged 21 years or over; 3) pairs of same-sex persons aged between 10 to 20 years; 4) people aged 10 to 20 years

who are paired with a person aged under 10 years of the same sex; 5) pairs of children aged under 10 years, regardless of their sex; and 6) people aged under 21 years who cannot be paired with someone in 3), 4) or 5)[1].

In this research, we define our first sufficiency threshold partly on the bedroom standard and say that a household has insufficient housing space if it fails the bedroom standard.

The floorspace standard

Our second measure of sufficiency is in terms of floorspace per person. In 2015, the UK government for the first time launched a national space standard for new dwellings in all tenures[2]. It sets out requirements for the Gross Internal (floor) Area of new dwellings at a defined level of occupancy as well as floor areas and dimensions for key parts of the home, notably bedrooms, storage and floor to ceiling height (DLUHC 2015, 3). The standard begins at 37m^2 of floor space for a one bed flat with a shower room. Figure 3 below provides an excerpt.

[1] A room is considered available to be used as a bedroom if it is "of a type normally used in the locality as a bedroom" and has a floor area of more than 50 square feet (Housing (Overcrowding) Bill 2003). A similar measure called the rooms standard measures the number of bedrooms, living rooms, and larger kitchens available for households of different sizes and types.

[2] In other jurisdictions in Europe, the quantitative adequacy of housing has long been defined in terms of floorspace (measured in m^2) (Bärnthaler, forthcoming). For example, in Germany, several states have minimum space standards for residential leases. In Berlin, this is 14m^2 for the first person, and 9m^2 for each additional person. Compared with average floorspace use these floorspace requirements are very low. In Germany there is a second, much higher threshold of 50m^2/person (with smaller increments for additional household members), above which households are not eligible for housing benefit. Earlier floorspace standards such as the 1960 Parker Morris standards have existed in the UK, but they have only been required for new social housing and have been advisory for private tenure (Park 2017).

Figure 3: Minimum gross internal floor areas and storage (m^2) as defined by the Space Standard (extract from larger table)

Number of bedrooms (b)	Number of bed spaces (persons)	1 storey dwellings
1b	1p	39(37)*
	2p	50
2b	3p	61
	4p	70
3b	4p	74
	5p	86
	6p	95
4b	5p	90
	6p	99
	7p	108
	8p	117

Source: DLUHC (2015, updated 2016)
Note: Homes with more than one storey have additional circulation space

On this basis, a one-person household in a flat, needs a minimum of roughly 40m^2, but every other household size needs less space per person. Three people sharing a home need just over half the space per person and half the total space compared to three people living as one person households in three different homes. For simplicity, we operationalise this standard as follows: 40m^2 for one person + 10m^2 for each extra person. This standard takes full, perhaps excessive, account of economies of scale in sharing a dwelling, but does not distinguish between households of the same size but different composition. For example, young children count the same as an adult, unlike the bedroom standard above.[3]

[3] Space requirements will also depend on other personal and social factors such as disability. Our macro-analysis cannot delve further into such variation. This relates to the 'conversion' problem discussed in the capability approach literature (Robeyns 2017)

We thus identify two distinct threshold standards for housing sufficiency in the UK: the bedroom standard and the space standard. Estimates of homelessness are then added in.

2.3. Defining excess housing

There is no policy threshold in the UK on housing maxima. However, the bedroom standard does regard more than one bedroom above the standard as 'under occupation'. On this basis we feel confident in defining two or more bedrooms above the standard as 'excess'.

In addition, there are a substantial number of second homes in the UK which can clearly be identified as excess. There are approximately 500,000 long-term vacant and second homes in England. Conversely, 3% of English households - 1.25 million - own a second home, approximately half in England. The majority of these households are outright owner-occupiers. Based on our analysis in part 3 below, we assume there is an overlap between households with second homes and those with excess floorspace in their main home. Thus, the inclusion of vacant homes does not greatly affect the total number of households with excess housing, but it increases the share of excess housing floorspace.

Can we identify a similar threshold of excess in terms of floorspace? There is a literature on maxima or ceilings to the consumption of housing (see Naess and Xue 2016; Bierwirth and Thomas 2019; Lorek and Spangenberg 2019; Cohen 2021). Cohen, for example, estimates biophysical ceilings for housing space as "an initial point of departure for assessing the prospect of sustainable consumption transition" (2021, 180). His resulting sufficient home size is extremely minimal: between 14m^2 and 20m^2 for a single individual - half or less than the new floorspace standard (above). Bierwirth & Thomas (2019) set the European

benchmark for adequate space per person much higher, between 30m^2 and 35m^2, regardless of household type.

The only alternative to expert judgements has been the consensual focus group research undertaken by the LSE and the MIS team at Loughborough (Davis et al. 2020; Hecht et al. 2022). The research organised six focus groups in London, a profoundly and visibly unequal city, to explore public perceptions of the 'wealthy' and the 'rich'. Modelled on the MIS focus group methodology, it was designed to provide some comparability with estimates of necessities and floors. The focus groups create a social setting in which communication and deliberation can take place, between strangers, with the explicit goal of trying to reach consensus.

When asked about living standards above the Minimum Income Standard (level A) discussed above, the groups came up with four further levels which they labelled: 'surviving comfortably' (level B); followed by the '(securely) comfortable' (level C); the 'wealthy' (level D); and the 'super rich' (level E). There was considerable discussion of how this applied to housing, that can be summarised below (Hecht et al. 2022):

E. Super rich: multiple homes (global)
D. Wealthy: Larger home owned outright; a second home
C. (Securely) comfortable: Home owned with mortgage
B. (Surviving) comfortably: Wider choice of rental housing
A. Minimum income standard: Social housing (renting)

Of interest is the distinction between the super-rich and the wealthy, and between the wealthy and the comfortable. It is the latter discontinuity that is of interest to our research. This classification has several dimensions, including floorspace and hierarchy of tenure forms, and their implied security, quality and financial cost. For example, having near-

complete housing security (in the form of outright home ownership) was part of participants' perceptions of what it means to be wealthy. Owning a second home was another. This provides some tempting glimpses of what groups of citizens may regard as excess, but in the absence of a robust deliberative assembly on housing, any notion of 'excess dwelling space' must entail value judgements by the researcher.

We therefore define a generous threshold of excess floorspace as *double* the minimum space standard above. This amounts to 80m^2 for a single person, 100m^2 for a household of two people, 120m^2 for three and so on. The numbers of second or multiple homes in the UK are then added in.

Thus, we have two separate thresholds for excess housing based on bedrooms and floorspace as shown in Figure 3.

2.4. Summary

Figure 4 below summarises the lower and upper thresholds we use to calculate housing deprivation, sufficiency and excess in England.

Figure 4: Upper and lower thresholds for a sufficiency model of housing

<table>
<tr><th></th><th></th><th>Bedroom standard</th><th>Space standard</th></tr>
<tr><td></td><td>Excess housing</td><td>At or above ceiling threshold
+ second/empty homes</td><td>Above ceiling threshold
+ second/empty homes</td></tr>
<tr><td>Ceiling threshold</td><td></td><td>E1. Two bedrooms above the bedroom standard</td><td>E2. Double the space standard. Ie: 80m^2 for the first person, 20m^2 for each additional person</td></tr>
<tr><td rowspan="2">Sufficiency</td><td>Comfort</td><td>Having one more bedroom than required by the standard</td><td rowspan="2">Above the floor threshold and below the ceiling threshold</td></tr>
<tr><td>Needs met</td><td>Having the number of bedrooms required by the standard</td></tr>
<tr><td>Floor threshold</td><td></td><td>N1. Bedroom standard</td><td>N2. Space standard: 40m^2 for the first person, 10m^2 for each additional person</td></tr>
<tr><td></td><td>Deprivation</td><td>Below bedroom standard
+ homeless</td><td>Below the space standard
+ homeless</td></tr>
</table>

3. The distribution of housing and housing emissions in England: Deprivation and Excess

We now turn to analyse the distribution of existing housing space in England between these sufficiency categories. The basic data source is the English Housing Survey 2019-20, so our findings relate to England only. Our analysis is for the whole of England and does not consider the territorial dimension of excess, sufficiency and deprivation. All data below refers just to the one year, 2019-20; it gives no indication of trends over time. Nor do we consider here the potential contributions of new housing.

The full set of tables are available in Annex 3, together with details of the source and the methods used.

This part is in three sections:

- A. The distribution of households and individuals across the housing stock according to deprivation, sufficiency (both meeting needs and comfort) and excess.
- B. The housing stock perspective: dividing up the total floorspace available in England into three categories – floorspace used for meeting needs, comfort, and excess, as well as the floorspace that is lacking.
- C. The carbon footprint of these floorspace categories: meeting needs, comfort and excess.

3.1. The Household perspective

We begin with the distribution of households and individuals across the housing stock - Table A.1. Using the bedroom standard, we can distinguish four categories (deprivation, needs met, comfort, and excess). Floorspace however is a continuous variable so we can only distinguish three categories: excess, sufficiency (comprising both needs met and comfort) and deprivation. Sufficiency is defined as the sum of needs met and comfort. It is measured as space per 'equivalised person' using the formula in Figure 3 - it makes no allowance for the different space needs of small children, teenagers or adults.

Table A.1. Summary distribution of housing sufficiency

Millions and %		**Bedrooms**				**Floorspace**			
		Households				Individuals			
Excess		8.8	36.5%	16.6	30.6%	6.3	26.3%	12.5	22.9%
Sufficiency	**Comfort**	7.9	33.0%	17.6	32.3%	14.6	61.1%	32.9	60.4%
	Needs met	6.3	26.2%	15.8	29.0%				
Deprivation		0.9	3.8%	4.2	7.7%	2.9	12.2%	8.8	16.2%
	Homeless	0.1	0.4%	0.3	0.5%	0.1	0.4%	0.3	0.5%
Total		24.0	100.0%	54.4	100.0%	24.0	100.0%	54.4	100.0%

Housing *deprivation* is lower using the official bedroom standard but quite extensive using our space standard (the official standard for new builds), which is more demanding in terms of what is required to meet needs. Deprivation is higher among individuals than households: 8.8m people, 16% of the English population, are deprived according to the space standard. To these should be added homeless households. Homeless people, who are predominantly housed in temporary accommodation, are not included in the English Housing Survey. Based on the available data of homeless individuals, we estimated the number of individuals in homeless households (following the methodology by Shelter) and then calculated the bedrooms and floorspace required to house these. On this basis, the number of homeless households is approximately 95,000, containing 265,000 persons. While homelessness should not be underestimated, it forms a small proportion (3-5%) of the English population that is bedroom-deprived and space-deprived.

The space standard is more generous than the bedroom standard in defining an *excess* line (double that required to meet needs). Hence, fewer people (23%) enjoy excess space, compared to around one third enjoying two or more spare bedrooms. To these should be added second home owners, but data on household ownership of second homes is not available in every EHS. In the most recent 2021-22 EHS, 3% of English households have a second home (most are second homes, not rented,

and in the UK, not abroad). Most of the households with second homes own their main home outright. We assume that most of the households with second homes are among those 23% of households who already have excess space in their main home. Second homes do not then add to the number of households with excess space, but they do augment the amount of excess space enjoyed by some.

The key, unsurprising finding is that households and individuals enjoying *excess* housing are more numerous and outweigh the numbers of deprived.

A.2. Distribution of sufficiency categories by age of household head

millions		Bedrooms				Floorspace			
		<18	18-60	>60	Total	<18	18-60	>60	Total
Excess		1.5	8.9	6.2	16.6	1.4	6.6	4.5	12.5
Sufficiency	**Comfort**	3.6	10.5	3.4	17.6	7.1	19.8	6.0	32.9
	Needs met	4.7	9.7	1.4	15.8				
Deprivation		2.0	2.1	0.1	4.2	3.3	5.0	0.6	8.8
	Homeless	0.1	0.1	-	0.3	0.1	0.1	-	0.3
Total		11.9	31.4	11.1	54.4	11.9	31.4	11.1	54.4

%		Bedrooms						
		<18		18-60		>60		Total
Excess		2.8	*12.7*	16.4	*28.5*	11.3	*55.7*	30.6
Sufficiency	**Comfort**	6.6	*30.1*	19.4	*33.6*	6.3	*31.0*	32.3
	Needs met	8.6	*39.3*	17.8	*30.9*	2.6	*12.8*	29.0
Deprivation		3.7	*16.8*	3.9	*6.7*	0.1	*0.6*	7.7
	Homeless	0.3	*1.2*	0.2	*0.4*	-	-	0.5
Total		21.9	*100.0*	57.7	*100.0*	20.4	*100.0*	100.0

%		Floorspace						
		<18		18-60		>60		Total
Excess		2.6	*11.7*	12.1	*20.9*	8.3	*40.9*	22.9
Sufficiency	**Comfort**	13.0	*59.5*	36.4	*63.0*	11.0	*54.1*	60.4
Deprivation		6.0	*27.6*	9.1	*15.8*	1.0	*5.0*	16.2
	Homeless	0.3	*1.2*	0.2	*0.4*	-	-	0.5
Total		21.9	*100.0*	57.7	*100.0*	20.4	*100.0*	100.0

Note: The homeless data does not distinguish adults by age. All homeless are included in the 18-60 category here.

Table A.2 shows that the share of children in overcrowded accommodation is high: 17% on the bedroom standard and 28% on the space standard - 3.9-6.2m children. The bedroom standard takes account of the needs of children of different ages, and thus could be more accurate. The data on space make no allowance for the different requirements of children and adults, or of children of different ages.

Households with a head aged over 60 years old account for a plurality of excess space using our space standard (41%) but a majority using the bedroom standard - 56% have 2 or more spare bedrooms.

Table A.3. Distribution of sufficiency categories by tenure

A.3.1.Bedroom standard

millions		Own outright	Own with M	Rent private	Rent HA/LA	Total
Excess		5.1	2.8	0.5	0.3	8.8
Sufficiency	**Comfort**	0.5	5.1	0.1	0.3	6.1
	Needs met	0.1	0.5	0.2	0.2	1.1
Deprivation		0.2	0.1	0.1	0.2	0.6
Total		6.0	8.6	1.0	1.0	16.5

%		Own outright	Own with M	Rent private	Rent HA/LA	Total
Excess		30.9	16.8	3.3	2.0	53.1
		58.3	*31.6*	*6.2*	*3.8*	*100.0*
Sufficiency	**Comfort**	3.3	30.9	0.9	1.7	36.8
		9.0	*84.0*	*2.3*	*4.6*	*100.0*
	Needs met	0.9	3.3	1.2	1.2	6.6
		13.0	*50.4*	*17.9*	*18.6*	*100.0*
Deprivation		1.2	0.9	0.5	1.0	3.6
		33.1	*24.1*	*14.7*	*28.1*	*100.0*
Total		36.3	51.9	5.9	6.0	100.0

A.3.2. Floorspace standard

millions	Own outright	Own with M	Rent private	Rent HA/LA	Total
Excess	3.8	1.9	0.4	0.1	6.3
Sufficiency	4.2	4.7	2.9	2.8	14.6
Deprivation	0.2	0.6	1.1	1.0	2.9
Total	8.2	7.2	4.5	4.0	23.9

%	Own outright	Own with M	Rent private	Rent HA/LA	Total
Excess	16.0	8.1	1.8	0.5	26.4
Sufficiency	17.5	19.6	12.3	11.9	61.4
Deprivation	0.9	2.3	4.6	4.4	12.2
Total	34.4	30.0	18.7	16.8	100.0

Where in the housing system is the excess housing space? The type of tenure and household with excess space affects the potential for addressing deprivation by redistribution as well as, or instead of, through new building. Tables A.3 demonstrates a dramatic contrast. 90% of excess bedrooms and 90% of excess space are in the owner-occupied sector. Within this tenure, the numbers of excess bedrooms and space in the 'owned outright' tenure group are double those in households with a mortgage.

As regards deprivation, our two measures lead to different results. 24% of private renters are overcrowded, though only 7% are lacking on the bedroom standard. One quarter of households in the social sector (1m) are space deprived.

Table A.4. Distribution of sufficiency categories by household type

A.4.1. Bedroom standard

millions		S>60	C>60	S<60	C<60	C+deps	S+deps	Other hh	Total
Excess		2.0	2.8	1.0	2.0	0.8	0.1	0.2	8.8
Sufficiency	**Comfort**	1.3	1.0	1.3	1.5	1.8	0.4	0.6	7.9
	Needs met	0.9	0.3	1.2	0.6	1.6	1.0	0.8	6.3
Deprivation		-	0.0	-	0.0	0.5	0.3	0.1	0.9
Total		4.2	4.1	3.5	4.1	4.7	1.7	1.7	23.9

%		S>60		C>60		S<60		C<60	
Excess		8.2	*47.2*	11.7	*68.5*	4.0	*27.4*	8.2	*47.9*
Sufficiency	**Comfort**	5.6	*32.2*	4.3	*25.3*	5.4	*37.2*	6.3	*36.5*
	Needs met	3.6	*20.6*	1.0	*6.1*	5.1	*35.4*	2.6	*15.2*
Deprivation		-	*-*	0.0	*0.1*	-	*-*	0.1	*0.4*
Total		17.4	*100.0*	17.2	*100.0*	14.5	*100.0*	17.2	*100.0*

%		C+deps		S+deps		Other hhs		Total
Excess		3.6	*18.1*	0.3	*4.0*	0.7	*9.6*	36.7
Sufficiency	**Comfort**	7.6	*38.6*	1.5	*21.3*	2.5	*35.0*	33.2
	Needs met	6.5	*33.3*	4.1	*58.3*	3.3	*47.0*	26.3
Deprivation		2.0	*10.0*	1.2	*16.5*	0.6	*8.4*	3.8
Total		19.7	*100.0*	7.0	*100.0*	7.1	*100.0*	100.0

A.4.2. Floorspace standard

millions	**S>60**	**C>60**	**S<60**	**C<60**	**C+deps**	**S+deps**	**Other hh**	**Total**
Excess	1.6	1.8	0.8	1.0	0.7	0.1	0.3	6.3
Sufficiency	2.3	2.1	2.3	2.6	2.8	1.2	1.2	14.6
Deprivation	0.2	0.2	0.4	0.5	1.2	0.3	0.2	2.9
Total	4.2	4.1	3.5	4.1	4.7	1.7	1.7	23.9

%	**S>60**	**C>60**	**S<60**	**C<60**	**C+deps**	**S+deps**	**Other hh**	**Total**
Excess	6.6	7.7	3.2	4.3	2.9	0.5	1.2	26.4
Sufficiency	9.8	8.6	9.7	10.9	11.9	5.1	5.2	61.4
Deprivation	1.0	0.8	1.6	2.0	4.8	1.4	0.6	12.2
Total	17.4	17.2	14.5	17.2	19.7	7.0	7.1	100.0

The size and composition of households will affect their place in this distribution, as shown in Tables A.4. The proportion of households with 2 or more spare bedrooms is highest among elderly couples (68%); it is roughly one half of all elderly singles. This interesting finding prompts several questions, for example, does widowhood prompt downsizing? A significant share of couples under 60 also enjoy excess bedrooms. Excess *space*, a higher bar, is more concentrated in elderly households – singles and couples. This suggests that older people have larger houses rather than more bedrooms, and/or more non-bedroom rooms.

Space deprivation according to our measure is three times higher than bedroom deprivation. It is found across all household types.

Table A.5. Cross analysis of all households enjoying *excess floorspace* by tenure and household type (percentages)

%	Own outright		Own with M		Rent private		Rent social		Total
S>60	21.7	*35.6*	1.2	*4.1*	1.2	*17.5*	0.9	*45.5*	25.0
C>60	25.9	*42.7*	2.6	*8.6*	0.4	*5.8*	0.2	*7.8*	29.1
S<60	3.6	*5.9*	5.8	*18.9*	2.2	*33.2*	0.5	*26.4*	12.1
C<60	5.2	*8.5*	9.9	*32.3*	1.0	*14.6*	0.1	*6.6*	16.2
C+deps	1.9	*3.1*	8.6	*28.2*	0.5	*7.4*	-	*-*	11.0
S+deps	0.4	*0.6*	1.1	*3.5*	0.6	*8.9*	0.0	*1.8*	2.1
Other	2.2	*3.6*	1.3	*4.3*	0.8	*12.6*	0.2	*11.9*	4.6
Total	60.8	*100.0*	30.5	*100.0*	6.7	*100.0*	2.0	*100.0*	100.0

These findings on tenure and household composition warrant further analysis undertaken in Table A.5 that re-analyses those 6.3m households enjoying excess space. As expected, the vast majority comprise *older owner-occupiers* (3.3m). The next group are singles and couples under 60 (1.5m), and then outright owners with dependents (0.6m).

3.2. The Housing Stock perspective

The housing stock perspective divides up the total floorspace available in England in 2019-20: 2,150 million (or 2.15 billion) square metres. This is then allocated to our three categories – 'meeting needs', 'comfort' and 'excess' – using data on the households occupying each property. For example, in a 120 m^2 house that is occupied by two residents, some of the floorspace is used to meet the housing needs of its residents, another portion is regarded as 'comfort' and another part as 'excess'. Based on the criteria developed in part 2 above, 50 m^2 (40+10 m^2) are used to meet the housing needs of its residents. The excess boundary starts at 100 m^2 (80 m^2 +20 m^2). Thus, another 50 m^2 are regarded as 'comfort' and the remaining 20 m^2 as 'excess'. In this way, the use of the entire housing stock can be allocated between these three categories. It is this

perspective that is used to calculate necessary, sufficient and excess emissions in section 3.

This analysis includes vacant homes. Vacant homes are normally included in the English Housing Survey though are not classified by type of vacancy. This means that they also include temporarily vacant dwellings (i.e. between users due to moves). In addition, the 2019-20 EHS used for our analysis excluded vacant homes due to Covid restrictions. We therefore use vacant homes from the 2018-19 EHS and compare them to Council Tax data (DLUHC 2023), which distinguishes vacant homes by type of vacancy. The Council Tax data is typically used to analyse vacant homes. As the figures broadly line up (approx. 1.1 million vacant homes, including temporarily vacant), we applied the proportions of types of vacancy from the Council Tax data to the vacant homes in the EHS. Temporarily vacant dwellings (approx. 0.6 million) are added back to the main data, assuming that they have the same proportion of excess floorspace as occupied dwellings. Finally, as in the EHS, the bedrooms of vacant dwellings are estimated based on their floorspace. Thus, Table B.1 below includes the estimated bedrooms and floorspace of long-term vacant and second homes in England (approx. 0.5 million).

Table B.1. Distribution of sufficiency categories by share of total housing stock

million m2		**Bedrooms (m)**		**Floorspace (m m2)**	
Excess	**Vacants**	1.2	1.7%	38	1.7%
		11.9	17.4%	300	13.4%
Sufficiency	**Comfort**	17.1	25.2%	661	29.5%
	Meeting needs	38.0	55.7%	1,241	55.4%
Total		68.1	100.0%	2,240	100.0%
Lack*		1.0	1.5%	27	1.2%
	Homeless	0.2	0.3%	6	0.2%

Allocating the English housing stock according to our three categories we find that it is, at an aggregate level, more than adequate for meeting needs and comfort. Excess floorspace amounts to 338 million m^2, 15% of the total housing stock. Of this sum, second homes and vacant homes account for 38m m^2, or 1.7% of the total stock. We calculate that only 1.4% of the total stock would be required to meet the housing needs of overcrowded households and the homeless.

Table B.2. Distribution of housing stock by sufficiency categories and tenure: floorspace standard

million m^2		**Own outright**	**Own with M**	**Rent private**	**Rent HA/LA**	**Total**
Excess		182	94	16	2	293
Sufficiency	**Comfort**	293	234	69	49	646
	Meeting needs	396	401	216	199	1,212
Total		871	729	301	249	2,151
Lack		2	5	11	10	27

Where in the housing system is the excess housing space? The type of tenure and household with excess space affects the potential for addressing deprivation by redistribution as well as, or instead of, through new building, which has high CO^2 and other environmental costs. Table B.2 portrays the tenure distribution according to our sufficiency categories. The vast bulk - 94% - of excess housing space is found in the owner-occupied tenure group, with just over half among those owning outright. This is even higher than the 90% figure in Table A.3 calculated on a household basis. The data suggests there is little scope for reducing deprivation by reallocating space within the tenure. Any reduction in deprivation through reallocation would need to involve transfer between tenures.

Table B.3 shows that 28% of this excess housing space is in single householders but 52% is among couples. When age is distinguished, the

elderly households account for 52.5 % of the total excess stock, while couples under 60 with and without dependents account for 33%.

Table B.3. Distribution of housing stock by sufficiency categories and household type: floorspace standard

million m²		S>60	C>60	S<60	C<60	C+ deps	S + deps	Other hh	Total
Excess		60	94	23	57	39	4	15	293
Sufficiency	**Comfort**	109	149	72	113	125	32	46	646
	Meeting needs	164	208	134	210	310	94	93	1,212
Total		333	451	229	380	474	130	154	2,151
Lack		1	1	3	4	14	3	1	27

%		S>60	C>60	S<60	C<60	C+ deps	S+ deps	Other hh	Total
Excess		2.8	4.4	1.1	2.7	1.8	0.2	0.7	13.6
		20.4	*32.1*	*7.9*	*19.5*	*13.5*	*1.3*	*5.2*	*100.0*
Sufficiency	**Comfort**	5.1	6.9	3.3	5.3	5.8	1.5	2.1	30.0
		16.9	*23.0*	*11.1*	*17.5*	*19.4*	*4.9*	*7.1*	*100.0*
	Meeting needs	7.6	9.7	6.2	9.8	14.4	4.4	4.3	56.3
		13.5	*17.2*	*11.0*	*17.3*	*25.6*	*7.7*	*7.7*	*100.0*
Total		15.5	21.0	10.6	17.7	22.1	6.0	7.2	100.0
Lack		0.1	0.1	0.1	0.2	0.6	0.1	0.1	1.3
		4.5	*5.4*	*10.9*	*14.5*	*49.6*	*9.8*	*5.2*	*100.0*

Cross-tabulating these two variables, Table B.4 shows that 52% of excess housing is accounted for by elderly owner-occupiers (singles and couples). Sometimes labelled the 'empty nest' syndrome, this should clearly be a policy focus in any scenario for fair decarbonisation of housing in the UK. 12% of excess space is in families owning their own homes. But excess space is practically absent in social housing, indicating broad allocation according to needs.

Table B.4. Cross-analysis of all *excess space* in housing stock by tenure and household type

%	Own outright	Own with M	Rent private	Rent HA/LA	Total
S>60	18.4	1.5	0.3	0.2	20.4
C>60	28.1	3.5	0.5	0.1	32.1
S<60	2.4	3.9	1.5	0.1	7.9
C<60	6.8	11.4	1.2	0.1	19.5
C+deps	2.5	10.1	0.8	-	13.5
S+deps	0.4	0.5	0.4	0.0	1.3
Other	3.3	1.2	0.6	0.1	5.2
Total	62.0	32.1	5.3	0.6	100.0

3.3. The carbon footprint of housing in England

Two sources of carbon emissions from housing must be distinguished:

- Emissions from adding to the housing stock: new construction and improvements
- Emissions from operating the housing stock, including space heating, domestic activities and maintenance and repairs

In our analysis, we focus on the emissions from operating the existing housing stock. The operation of the existing housing stock is by far the most important source of total carbon emissions in housing. The UKGBC estimates that embodied carbon from the construction and refurbishment of buildings currently makes up 20% of UK built environment emissions (Benstead & Wilde 2023). Serrenho et al. (2019, 272), who have comprehensively modelled potential decarbonisation pathways of the UK housing stock, equally conclude that "[o]perational emissions are one order of magnitude greater than embodied emissions of new construction". The implication of this is that even if all new construction had net-zero emissions, it would neither resolve the ecological overshoot of the housing sector nor necessarily the meeting of housing needs. This

suggests that better understanding of the use of and the emissions from the existing housing stock should play a more central role. We return to the balance between these two sources of housing emissions in Part 4 of the paper.

Our analysis of the operational emissions from the English housing stock is based on the 2019-20 EHS. We calculate emissions using the UK government standard model, which derives a dwelling's operational emissions as the product of its EIR (Environmental Impact Rating) and its floorspace (DECC 2014). This methodology is used by both Serrenho et al. (2019) and zu Ermgassen et al. (2022). The results indicate carbon emissions from operating the housing stock in *England* in 2019-20 of 58.3 $MtCO^2$. This estimate is broadly consistent with *UK* residential carbon emissions of 67.7 $MtCO^2$ in 2020 (67.7*0.85=57.5) (DBEIS 2022). Using a different methodology, but still based on the EHS, the National Housing Federation arrives at a very similar figure of 58.5 MtCO2 (NHF 2021). This estimate is broadly consistent with *UK* residential carbon emissions of 66.3 $MtCO^2$ in 2020 (66.3*0.85=56.4) (DBEIS 2022).

In what follows, we present current housing emissions, distinguishing between our various indicators of *necessary, sufficient* and *excess* housing using the housing stock perspective above. This means we are showing the excess emissions of households with excess floorspace consumption. Emissions from their floorspace below that level are included in the other categories. Referring back to the introductory example of Part 3, a household of two that occupies 120m^2 has 20m^2 excess floorspace. We are analysing the average modelled emissions arising from this excess floorspace, not the total domestic emissions of households with excess floorspace. Analogous to this, we calculate the share of emissions stemming from the sufficiency space (below the ceiling and above the floor) and the share of emissions stemming from the space devoted to meeting needs. This will include the emissions of that housing

that contributes to but does *not* completely meet the space needs of its members. For example, a household that needs 40m^2 to meet needs but only has 39m^2 has all its 39m^2 classed as 'meeting needs'. In this analysis, there is no 'deprivation' category. We cannot say that we 'lack emissions' whereas we can say that we 'lack floorspace'. We are not incurring emissions for floorspace that does not exist, but we could provide this floorspace with emissions.

Table C.1. Summary Distribution of total in-use housing emissions by sufficiency category

		MtCO2/year	%
Excess	**Vacants***	0.5	0.9
		9.9	16.8
Sufficiency	**Comfort**	16.5	28.0
	Meeting needs	31.9	54.3
Total		58.8	100.0

Note: This assumes that vacants mimic the characteristics of occupied housing stock, but that emissions are 50% of the equivalent occupied housing stock.

53% of total housing in-use emissions are incurred to provide necessary levels of housing, and half that again (28%) to provide 'comfort' levels of housing. But one sixth of the total – c10 million tonnes of CO^2 – is emitted from excess housing space including second homes.

Table C.2. Distribution of emissions sufficiency category and tenure

MtCO2/year		**Own outright**	**Own with M**	**Rent private**	**Rent HA/LA**	**Total**
Excess		6.1	3.2	0.5	0.0	9.9
Sufficiency	**Comfort**	7.6	6.0	1.7	1.1	16.5
	Meeting needs	10.4	10.0	6.1	5.3	31.9
Total		24.2	19.2	8.4	6.5	58.3

%		**Own outright**	**Own with M**	**Rent private**	**Rent HA/LA**	**Total**
Excess		10.5	5.5	0.9	0.1	17.0
Sufficiency	**Comfort**	13.1	10.3	3.0	2.0	28.3
	Meeting needs	17.8	17.2	10.5	9.2	54.7
Total		41.5	32.9	14.4	11.2	100.0

Table C.2 shows the distribution of emissions by tenure. Three quarters come from the owner-occupied sector, two fifths from outright owners alone. The distribution of emissions largely follows the distribution of floorspace, but not entirely. We thus calculate the *emissions intensity* per square metre of floorspace based on the energy rating of the floorspace in question - Table C.3. This is then standardised with 100 corresponding to the average emissions of the entire housing stock in England. For example, a value of 110 means that floorspace in the category in question emits 10% more than the average floorspace.

Table C.3. Emission intensity of floorspace by sufficiency category and tenure

100=average		Own outright	Own with M	Rent private	Rent HA/LA	Total	kgCO2/ m2/year
Excess		125	125	124	105	125	34
Sufficiency	**Comfort**	96	94	91	86	94	26
	Meeting needs	97	92	105	99	97	26
Total		102	97	103	97	100	27

The remarkable finding here is that excess housing has an average emissions intensity 25% greater than the average, and 29% greater than social housing. This is despite the fact that the average emissions intensity of all housing tenures is roughly the same. All housing to meet needs and comfort standards has a lower than average emissions intensity, with the exception of some private renting. The emissions intensity of needs-based and comfort housing is remarkably similar. This supports the validity of separating off excess from comfort housing.

Table C.4. Emission intensity of floorspace by sufficiency category and household type

%		S>60	C>60	S<60	C<60	C+ deps	S+ deps	Other hh	Total
Excess		111	128	99	126	139	130	150	125
Sufficiency	**Comfort**	91	97	88	94	99	87	94	94
	Meeting needs	105	97	110	97	92	90	92	97
Total		101	104	102	101	97	90	98	100

We can also calculate the emissions intensity of different household types (Table C.4). Here, high intensities are concentrated in housing occupied by *couples*: those with and without children and with heads both above and below 60 years of age. Intensity is highest in other multi-person households, and additionally in single parent housing, but the numbers

are very small. Singles have in general a smaller variation in emissions intensity than couples. The drivers of such differences may well be the type of housing that different household groups typically occupy.

To elucidate this, we cross-analyse housing with excess emissions by tenure and household type in the next table.

Table C.5. Cross-analysis of share of housing stock with *excess emissions* by tenure and household type

%	Own outright	Own with M	Rent private	Rent HA/LA	Total
S>60	16.3	1.5	0.2	0.1	18.2
C>60	28.5	4.1	0.5	0.0	33.1
S<60	1.8	3.4	1.0	0.1	6.3
C<60	7.4	10.7	1.6	0.1	19.7
C+deps	3.3	10.8	0.9	-	15.0
S+deps	0.5	0.5	0.4	0.0	1.4
Other	4.2	1.2	0.7	0.2	6.3
Total	62.1	32.2	5.3	0.5	100.0

Elderly outright owners account for 44% of excess emissions, roughly the same as their share of excess space (46%). Most notably, excess emissions are almost entirely *absent* in social housing.

3.4. Summary

We have constructed two measures of housing adequacy in England, based on the number of bedrooms and floorspace. Between deprivation and excess, they measure the extent of 'sufficient' housing - one based on, but going well beyond, 'meeting needs'. This enables us to define a (generous) limit to bedrooms and floorspace above which housing can be regarded as 'excess'. The two measures result in different proportions of households defined as deprived, sufficient and excess. However, they

show similar patterns in terms of the tenure and type of households, so in general agree on which groups are likely to be affected by any policies on excess housing and deprivation (if not necessarily how many of them).

At the most aggregate level, our analysis supports those who argue that there is no gross shortage of housing in England: on both measures, far more households enjoy excess space than those who lack sufficiency. The dominant assumption in much debate that the housing crisis requires a substantial programme of housebuilding to meet needs is not supported at this macro-level of analysis. However, the spare rooms and space may be in the wrong homes, the wrong tenure, the wrong regions and localities. Our further analysis shows that the bulk of spare rooms and excess floorspace is to be found among the elderly and owner-occupiers. Indeed, one half comprise *older owner-occupiers* (3.3m). The next group are singles and couples under 60 (1.5m). This is a new finding for the housing world, where the focus has been on the broader category of 'ownership' in general and on EPC bands.

The standard model to calculate housing emissions is derived from two variables: housing space and a measure of energy efficiency. Thus, the close correlation between our space and emissions measures is not surprising. However, we also find that the emissions *intensity* per square metre of floorspace is *higher* among properties with excess floorspace. This is surprising and requires some explanation. It backs up other findings on the scale of emissions among the top 10% (see Baltruszewicz et al. 2023). Yet, it questions arguments that richer households are more able to invest in energy and emissions saving improvements. We cannot explain this by arguing that excess housing has more features - from more appliances to bigger garages to indoor swimming pools - because these do not figure in EHS surveys. Whatever the explanation, the case that housing space is a major driver of housing emissions is compounded

when the energy efficiency of a square metre of excess housing is found to be higher than average.

The major contributors to excess emissions as well as floorspace are elderly owner occupiers, and especially outright elderly owners. At the same time, excess emissions are entirely absent in the social housing sector, both local authority and housing associations. There is a clear contrast here between wants - backed by income - and needs as criteria of housing allocation. These findings pose interesting and difficult issues for policy makers supporting a redistribution strategy. It also influences policymaking in the two other domains crucial to the fair decarbonisation of housing: retrofitting and newbuild. We turn to these broad policy issues in the next section.

4. Towards a fair decarbonisation of housing

If the two terms of 'fair decarbonisation' are to be simultaneously achieved we will need a paradigm shift in housing policy. In an earlier book, Gough (2017) distinguishes three general strategies for decarbonising the economy:

1. Decoupling: ramp up the eco-efficiency of production by applying low carbon technologies and practices ('supply-side' decarbonisation)
2. 'Recomposing' consumption: reducing consumption emissions by switching from high to low-carbon services and goods, without necessarily cutting overall consumption
3. 'Degrowth': absolute reductions in production and consumption

This is related to the earlier '*Improve-Shift-Avoid'* framework, which originated in Germany in the early 1990s as a way to structure policy measures that limit the ecological impact of transport (Creutzig et al.

2018). The *1.5 Lifestyle Report* (Akenji et al. 2021, 59) also implements this approach, characterising the main strategies to reduce carbon footprints as *"efficiency improvement, modal shift, absolute reduction"*. It then applies this framework to reconsider policies for buildings, including domestic housing.

Based on our findings, we sketch out in this section a strategy and a series of policy proposals that would facilitate housing sufficiency. It is clear that our sufficiency approach can embrace both strategies, (2) 'shift' or 'modal shift', and (3) 'avoid' or 'absolute reduction'.

The first 'Decoupling' ('improve' or 'efficiency') strategy refers to decoupling economic output from emissions (or other ecological goals) through mainly technological improvements. In housing terms this entails mass retrofitting of the current housing stock and ensuring that any new build is of very low or zero carbon homes. But efficiency measures do not, in principle, consider what retrofitted and newly constructed floorspace is used for. Sufficiency outcomes are not guaranteed by more efficiently providing the assets that are required for sufficiency. The assets have to actually be used for sufficiency. Nevertheless, efficiency is a necessary component of any viable sufficiency strategy, so we begin with that.

4.1. Efficiency policies

In policy terms, it is necessary to vastly increase the energy efficiency of the housing stock. The potential for emissions reduction through such retrofits is very substantial. Zu Ermgassen et al. (2022, 7) find that even retrofitting all existing homes to the emissions standards of today's newbuilds by 2035 could avoid 0.8GtCO^2e, equivalent to 32% of the UK's cumulative carbon budget for 1.5°C. Going further and entirely decarbonising the existing stock by 2050 could save 38% of the 1.5°C budget.

The UK government's current Heat and Buildings Strategy seeks to promote a rapid increase of low-carbon heat supply chains through a market-fixing and consumer action approach. It is regarded as quite inadequate by the Committee on Climate Change (2023). It is becoming clear that a more interventionist, 'mission-guided', place-based retrofitting strategy is needed, with new forms of targeting, regulation and substantial subsidies (Farha and Mazzucato 2023). This was recognised by the earlier *Warm Front* and *Decent Homes* programmes, set up by the Labour government in 2008, which targeted social housing and vulnerable households including those in fuel poverty. This programme was abolished in 2010 and since then home energy efficiency installations have collapsed. Lord Deben (2022), former chairman of the Climate Change Committee, writes:

> "A decade ago, 2.3 million energy efficiency measures were installed annually through Government-backed schemes. In 2021, fewer than 100,000 were installed. Reducing energy demand in UK buildings is now the biggest gap in current Government energy policy".

To rebuild this approach would require upfront public capital spending and a proactive industrial policy. The entire provisioning system needs to be built almost from scratch: a huge collective effort, combining information, training, bulk purchase, new industries, standards, regulation, an overall planning agency and much more. There are harbingers of this more focused approach in the social housing sector. Local authorities and housing associations are already taking the lead in decarbonisation; it is the owner-occupied sector that lags, for example in Islington (see Evans et al. 2023).

But full decarbonisation does not answer the question: what will the fully decarbonised housing stock be used for? If newly built housing assets are

not actually used to house deprived households, there will be calls to add yet more housing in the hope that new supply will eventually reduce prices enough for deprived households to meet their demand. However, there is little evidence that this will happen (Mulheirn 2019). Building new homes makes a new net demand on carbon budgets, rather than reducing demand. From a historical perspective, Tunstall (2015, 115) comments:

> "In 1911 only the most generously housed four deciles of the population lived in homes and households that gave them at least a room per person…the least generously housed decile of the population only achieved one room per person as late as 1991. Thus, while the very substantial public and private resources put into housing across the twentieth century had a big impact on average conditions, they translated very inefficiently into better conditions for the worst off".

Going down this route means supplying more insulated floorspace to households that already have sufficient or excess space, in the hope that some space will trickle-down to those who need it. Such a housing system may deliver increasing quantities of *efficient* housing, but the housing system is not *effective* at delivering housing to households who need housing. Furthermore, since all new build requires land, material throughput and some emissions, how is limitless expansion to be limited?

4.2. The Sufficiency strategy

Thus, the provisioning system must shift towards sufficiency outcomes. This involves qualitatively distinguishing and prioritising forms of production and consumption that increase sufficiency. Technological efficiency will need to be married to effective distribution and sufficiency principles. This will also be needed due to the urgent time scale of carbon mitigation. It will take time to build up new supply chains and train the required workforce. Not all efficiency can be delivered immediately and on

time. The physical and political limitations to large-scale decarbonisation suggest that decarbonisation of some housing has to be prioritised. Rather than prioritising based on the ability to pay, we propose that housing needs and sufficiency should be prioritised over other (excess) uses. Part 3 of this article now provides the evidence basis for such a sufficiency strategy.

The task is thus to chart a corridor starting from now to the realisation of housing sufficiency by 2050 at the latest. The most recent and relevant modelling to achieve such a pathway has been undertaken by zu Ermgassen et al. (2022). They consider three pathways up to 2050. Pathway 1 represents the government's current housing strategy. Pathway 2 represents a highly ambitious efficiency strategy: maintaining a high rate of new housebuilding, but accelerating retrofitting the existing housing stock and bringing forward the target date by when all newbuilds deliver zero operational emissions. Pathway 3 adds to this a suite of more demanding efficiency measures - an extremely ambitious retrofitting and decarbonisation of the existing stock - plus new strategies to eliminate vacant homes and thus reduce the need for new housing to zero net additions by 2035.

Only the third pathway stays within the GHG envelope to achieve a net zero housing system by 2050. This is closest to what we advocate below, but it does not go far enough: it models only the elimination of vacant and second homes which, our analysis shows, constitute a small share of excess housing in England (around 10%, see Table B.1 above). Furthermore, since it will be physically and politically challenging to realise this third pathway, there is an urgent need to introduce sufficiency policies right away. A key reason is that flat rate environmental levies, such as a carbon tax resulting in higher petrol and heating prices, affect low-income households more than high-income households. Unless human needs are credibly safeguarded at the same time as

environmental policy is enacted, there will be significant resistance (Stratford 2020).

4.3. Specific sufficiency policies

In policy terms, sufficiency policies entail measures to ensure that the newly efficient housing assets are actually used for housing needs and sufficiency, and that such uses are prioritised and incentivised. The use of housing for other uses would be discouraged. In what follows, we discuss a series of policy options, in the following order:

1. Pricing and taxation
2. Regulation of second homes and excess housing
3. Policies to better match housing stock and households
4. Shift to more effective tenures.

Pricing and taxation

We begin with the potential role of taxation and pricing policies. Taxation - changes to prices to better reflect social costs - is regularly used for efficiency policies. Can such techniques also be designed to incentivise sufficiency? The key element would be to differentiate between needs and wants, as in the analysis performed in section 3 above. For example, a progressive property or land tax would exempt housing needs, while levying surcharges on excess housing. This is already being done, in the form of capital gains tax exemptions for primary residences (housing needs) and stamp duty surcharges on second homes (excess housing). But in many countries, including the UK, this exemption does not exempt primary residences when they contain mostly excess housing. Equally, council taxes do not take into account whether a home is primarily used to meet housing needs. The 'bedroom tax' imposed on council and local

authority tenants in 2013 provides a retrograde example. Not only did it target what are mostly lower income households, but it dealt with a negligible part of under-occupation: only 2.0% of households with excess space are social tenants (Table A3.2), using 0.6% of the overall excess floorspace (Table B.2). Pricing and taxation for sufficiency needs to start from the top, levying significant charges on excess space independent from tenure.

The same principle applies to emerging proposals for needs-based pricing of energy. The UK government capped household energy bills in the face of drastic energy prices in 2022, but the measures were poorly targeted. Echoing the supply of floorspace without regard for ecological cost and human need, energy consumption was subsidised for everyone. A pricing model that takes into account these social goals is a *rising block tariff*, where a first tranche of energy is provided free or at a low cost, with escalating prices for subsequent tranches of energy, discouraging excess use (Chapman and Kumar 2023). This directly engages with the two aspects of sufficiency: depressing overall energy use while ensuring the affordability of necessary energy. Applied to housing, this would benefit households with sufficient floorspace, while households with excess housing would experience high cost for operating excess floorspace. The UK Warm Home Discount gives a subsidy to lower-income households, which covers but is limited to their energy needs. It does not, however, address the problem of excess energy use by higher-income households. There are practical examples of social tariffs in Europe to draw on (see Lausberg & Croon 2023).

However, the scope to apply taxation and pricing policies to sufficiency goals is inherently limited given widening inequality and a high-income elasticity of demand for housing space. The higher the level of inequality, the less effective is the price mechanism as an allocation mechanism (Weitzman 1974; Gough 2017). A practical example of the limitations of

pricing and taxation are second homes in Germany. A number of German towns tried to reduce the number of second homes through taxation. However, affluent households simply paid the tax. In response, local authorities moved to control second homes through regulation and social licensing (Köpf 2022).

Regulation on second homes and excess housing

Thus, when conceiving sufficiency policies, we must also consider regulation, i.e., outright bans of harmful activities. There is much evidence that government regulation is effective in ensuring that minimal standards are met. In the context of housing sufficiency, this includes building standards that ensure both habitability and environmental performance (Grubb et al. 2014, Pillar 1). With respect to floorspace use specifically, there is growing experience in imposing licensing requirements or outright bans on second homes and holiday rentals in Cornwall, Wales and various locales in Europe. However, it is more difficult to apply this approach to excess space within inhabited homes for various reasons, including the value and longevity of the asset and the intimacy of domestic space (Lage et al. 2023). Another question is how the direct regulation of excess floorspace in existing homes could actually be enforced. Could authorities refuse to issue licences or planning permission for under-occupied homes? Implementing sufficiency targets across the entire housing stock could involve a range of regulatory tools, such as licensing or planning.

This is particularly salient in two particular situations: 'empty-nesters' and single households. In both cases, the demand that results in excess housing results from concrete social phenomena, specifically the wish to remain in one's family home (empty-nesters) and the trend towards single households. The following looks at these two phenomena in more detail.

Policies to better match housing stock and households: downsizing

A key dimension of shifting the use of the housing stock towards sufficiency is how to deal with the 'empty nest' phenomenon where children have left and older couples or singles have excess space. Of the 6.3m households with excess space, more than half (3.2m) comprise older owner-occupiers (Table A5 above). These are elderly singles or couples who have often paid off their mortgage and continue to reside in their family homes. Over 65s are currently far less likely to move home than any other age group (Hudson 2022).[4] But more than a quarter have expressed a wish to downsize (Cavendish 2023). Incentivising and enabling some of these households to move to smaller accommodation could play an important part in redistributing the housing stock.

Pricing and taxation can play a role in this, as discussed above. However, empty-nesters are embedded in their communities and exclusively relying on pricing and taxation to free up space for other users would result in widespread discontent, not to mention political opposition given the size and political clout of the affected group. A sensitive policy would combine price incentives with providing alternative appropriate housing in nearby locations alongside information and support. Such alternative housing assets would ideally be supplied by converting existing buildings rather than new construction.

Newly created housing units that are intended to allow empty-nesters to downsize will have to be provided with conditions that ensure that they will actually be used by local households looking to downsize, rather than, say, as second homes or for demand from further afield. The same

[4] The same applies to outright owners. CCC (2023) figures are based on the assumption that homes in outright ownership come up for sale every 24 years, compared to mortgaged homes at 10 years.

applies to the large homes that will be vacated by downsizing households. Policies will need to be in place to avoid large homes being simply transferred from outright ownership of older, wealthy, small households to younger wealthy, small households. An important question in this context is how sufficiency conditionalities can be most effectively implemented and maintained over time, especially when working with existing housing assets, i.e., whether through licensing, planning or tenure.

Immediate relief could be provided by supporting those looking to divide an existing (large) property into two or more separate homes (Kingman 2016). This would allow older occupants to downsize without the hassle and distress which may result from leaving their neighbourhood and home. This process involves a number of obstacles, such as obtaining planning permission and funding necessary building (adding kitchens, bathrooms, separate access etc.). Financial assistance and practical support from local authorities, would incentivise and help owner-occupiers to split larger properties.

Policies to better match housing stock and households: co-living

Another element of housing sufficiency would be to halt and perhaps reverse the relentless shift to smaller, in particular single-person, households. Economies of scale in housing are universally recognised and are incorporated in our floor-space standards. Household members share appliances and equipment, cook together, heat and cool common living spaces and require less individual living space. These acts of sharing reduce per capita energy use, which further translates into lower emissions (Ivanova and Büchs 2020, 2022). Enhancing sharing practices in household and communal contexts would contribute to housing sufficiency and could further support key social foundations, foster cooperation, care and responsibility and, indeed, wellbeing.

How can we encourage co-living and space-sharing? There are many examples and experiments here and abroad to evidence this. In the Hunziker Areal in Zurich, Switzerland, each separate building provides washing rooms and other communal facilities for residents such as a library, party room and repair shop. As a result, "the number of rooms per person are limited which leads to a floor space demand of less than 35m^2 on average" (Bierworth & Thomas 2019, 36). In the UK, there are currently 19 fully established co-housing communities, mostly self-started by groups of people looking to live sustainably together.

The Lancaster co-housing development consists of 35 leasehold homes, communal facilities, a low carbon workspace and a riverside woodland habitat. Residents actively participate in the day to day running of the complex, which involves managing finances, maintenance, gardening, cooking and cleaning. Car use is much lower than average through their community car club and extensive bicycle facilities. The homes are designed to Passivhaus standard and their energy usage for heating and hot water is about 15% that of average UK homes (UK Cohousing 2021). On rare occasions, co-housing community schemes have been instigated by external agents. For instance, the K1 co-housing scheme in Cambridge was initiated by Cambridge City Council, who wanted to test the interest from local people in developing co-housing structures.

It would be important to ensure that incentives to house-share do not encourage the involuntary household sharing common in our current housing system. This includes adults forced to stay many years with parents, or to share a household with other adults in dwellings that are not designed for this purpose. There is a risk that sufficiency policies with excessive focus on reducing demand (e.g., taxing excess floorspace) could exacerbate this problem and force people into resource-efficient but involuntary and potentially abusive sharing arrangements.

Shift to more effective housing tenures

Our analysis in section 3 above showed that there are significant differences between housing tenures in how floorspace is used. Our cross-analysis in Table B.4 above showed that while household type affects floorspace use (older households account for the majority of excess floorspace), the effect is overruled by tenure: older households who are not owner-occupiers do not account for a disproportionate share of excess floorspace. This suggests that ownership of an appreciating asset incentivises excess space. Given the deficiencies of the UK private rental sector in terms of affordability and security (which we do not cover here), it is local authorities and housing associations that most effectively deliver housing sufficiency outcomes. Although not separately shown in our high-level data, this sector includes other non-profit tenures such as cooperative housing and community land trusts (CLTs). This does not mean that other tenures cannot also be closer aligned with housing sufficiency than they are. But ultimately the scope of pricing and regulatory policies conflicts with the private objectives - and property rights - of private owners of housing assets.

This points to the need for expanding forms of tenure that allow for greater democratic control over how space is used. From a sufficiency perspective, the focus of housing policy should be on a more effective use of the existing housing stock. As regards *new* construction, its primary purpose would be to replace deteriorated housing and accommodate net population growth and geographical shifts - not to side-step the misallocation of the existing housing stock. For this reason, there is a strong case that *all* new built housing in the UK should be of tenures that more effectively deliver sufficiency outcomes. In addition, any new construction would ideally use existing infrastructure and limit additional mobility. An example would be gentle densification of already built-up

areas. In other words, new construction would have reduced ecological impact by using the 'existing stock' of infrastructure.

As regards the *existing* housing stock, the key question is how parts of it could be transferred to tenure forms that more effectively deliver sufficiency outcomes. A key element would be the public acquisition of housing assets that notably conflict with sufficiency objectives, such as vacant and non-decent private rental homes (Diner 2023). This can involve acquisitions on the open market, rights of first refusal, and, ultimately, compulsory purchase. Once acquired, these housing assets are retrofitted both physically and institutionally, i.e., energy efficiency and ownership and tenure forms that are less prone to be used for excess housing. Eminent domain is primarily prospective for vacant and abandoned dwellings. But this arguably could be extended to non-decent homes when owners refuse to remedy the condition. In general, these policies would be more impactful if targeted on housing assets that are particularly distant from housing sufficiency, such as non-decent private rental sector properties with low energy ratings, rather than, say, adequate occupied, insulated owner-occupied homes.

4.4. International examples of housing sufficiency policies

We conclude this section with some examples of housing sufficiency policies from jurisdictions outside England.

Figure 5: International housing sufficiency policies

Group	Generic policy	Example
1	Tax excess floorspace	Wales: 300% council tax surcharge on long-term empty and vacant homes Germany: second home tax (*Zweitwohnungssteuer*)
1	Progressive utility tariffs	Barcelona: progressive water rates
1	Sufficiency pricing that distinguishes needs and excess housing	USA: primary residence capital gains tax exemption capped at $250,000 Germany: second home tax exemptions for legitimate needs, such as two small residences due to work requirements
2	Energy use requirements	Require minimum energy certificates to rent out a dwelling (England)
2	Regulate second and vacant homes	Require licence for second home or holiday rental (Barcelona; German cities)
2	Require owner-occupation	Amsterdam: self-occupancy obligation on buyers of the majority of homes
3	Ensure supply of adequte housing for households looking to downsize	OptiWohn project by four cities in Germany
4	Acquisitions on the open market	London (recent and past policy); Diner/NEF
4	Right of first refusal	Paris (DPU)
4	Eminent domain	Catalonia (proposed)
4	Public land leased to non-profits with housing sufficiency conditions	Barcelona ESAL agreements Berlin concept award procedure
4	Planning or lease conditions that require certain uses	New builds only to owner-occupiers (Amsterdam) Unused plots fall back to the city (Ulm, Germany)

5. Conclusions

We focus in this paper on the eco-social aspect of housing in the UK: how to maintain and rebuild the housing stock so as to serve simultaneously urgent social and environmental goals. In our analysis, we restrict our attention to the fair distribution of housing space. It side-lines other

important dimensions of housing wellbeing, such as housing quality, affordability and security, though there exist synergies between these goals[5]. On the environmental side we focus only on climate change and carbon emissions and ignore other ecological constraints such as material throughput and land use.

We apply the floor and ceiling model of sufficiency to provisionally define thresholds of necessity and excess and then to estimate the distribution of the English housing stock between deprivation, sufficiency and excess. Applying these lines to the English Housing Survey of 2019-20 we find that households and individuals enjoying *excess* housing coexist alongside, but are more numerous than, the numbers in housing deprivation. *Our analysis shows that, while vacant homes and homelessness are qualitatively important problems at each end of the spectrum, the vast majority of both excess and deprivation occurs within the existing housing stock.* This inequality and lack of focus on the use of the existing housing stock incurs an ecological cost alongside the social cost: the extra space at the top of the housing distribution adds to emissions *and* has a higher emissions intensity (per square metre of floor space). In addition, it incentivises further housebuilding, extensions and conversions rather than a policy of redistribution.

To achieve the fair decarbonisation of housing in the UK we must therefore envisage a 'housing corridor' from where we are now to where we need to be by 2050: an aggregate stock of housing with zero net emissions that provides sufficient housing for all. To do this, we recognise the need for a crash carbon *efficiency* strategy as discussed elsewhere

[5] It would be interesting to require that all housing space also meet sufficiency standards on quality, affordability and security. These are aspects of housing which cannot be in excess, only in deficit. To do so would likely reduce the numbers in excess and sufficiency and increase the deprived group - people with sufficient or even excess space but who were below sufficiency on the other dimensions.

(see CCC 2022) but contend that this must be situated within a novel housing *sufficiency* strategy. The two are interrelated: without the constraints of a sufficiency framework, a pure efficiency strategy could be self-defeating if it endorses a continual expansion of (more carbon-efficient) housing space. This would be irrational on both environmental and social grounds. The material footprint, land and water burdens and biodiversity damage would be exorbitant (zu Ermgassen et al 2022). Additionally, the continual upsizing of housing at the top would accelerate rising expectations of housing quantity and quality throughout the population.

As Bärnthaler (forthcoming) puts it, sufficiency should not merely complement techno-economic efficiency approaches; it must take precedence over them. Understanding sufficiency as a value standard means that we need to address questions of sufficiency first. Returning to Gough's three strategies for decarbonisation, the second – recomposing production and consumption – will need to frame and guide the application of the first – raising carbon efficiency. With this in mind, we go on to sketch a suite of sufficiency policy programmes for housing. These are radical proposals but without them, however carbon *efficient* the housing stock is made, it will not become more *effective* at delivering sufficient accommodation to households who need it. It will also continuously encourage new house building with associated environmental costs.

Citizen deliberation

The central question this raises is how to achieve political consensus for a radical sufficiency housing strategy. At the end of a long paper, we cannot address this in any detail. The essential requirement is a more robust form of deliberative democracy. This means developing the 'dual strategy' approach which brings expertise into democratic deliberation, as argued

above. It would entail forms of extended dialogue and consensus-building in public forums at different levels of decision-making. A flurry of climate assemblies (CAs) have been established in recent years and there is an emerging appreciation of the contribution these can make to climate policy (Cherry et al. 2021; Elstub et al. 2021; Boswell et al. 2022).

There is growing evidence that climate assemblies are willing to countenance sufficiency programmes. An important recent survey of ten national assemblies, plus one at the European level, conducted a content analysis of their recommendations (Lage et al. 2023). Compared with their national government policies, the CAs proposed a significantly higher share of sufficiency policies and a stronger focus on regulation (compared with fiscal, pricing and education policies). *Housing* accounted for a relatively low share of CA sufficiency policies but the approval rates (the percentage of assembly members of assembly agreeing with the proposals) were highest concerning housing.

There is thus some evidence that a dialogic framework generates calls for a *sufficiency turn* in thinking about housing. But when it comes to determining more generally what constitutes necessity and excess - actual floors and ceilings - there is little to draw on. Our main recommendation is that citizen-expert dialogues be established to consider what constitutes excess consumption in housing - and other key areas such as transport and recreation. These would need to take account of the social as well as environmental burdens of present consumption patterns.

Further research

Our analysis is only a beginning and could be taken forward in many ways. Housing is a geographically fixed resource, so there is a need for a regional and a more fine-grained local analysis of excess and deprivation.

Coupled with this, a better depiction of bedroom and floor space data by types of dwellings is also required, plus more detailed understanding of the housing needs of households with different characteristics.

On the environmental side, other 'planetary boundaries' beyond climate change need to be drawn into the research. Zu Ermgassen et al (2022) do so, drawing on material flow analysis to model land-use change and deteriorating biodiversity in order to critique 'housing proliferation'. It would be interesting to relate their work to the type and nature of luxury and excess housing we have mapped.

We do not discuss in depth here the relationship between decarbonisation and other aspects of human wellbeing, especially housing quality, affordability and security. Some decarbonisation is likely to improve quality and affordability, via warmer homes, but to what extent will people accept lower thermostat settings or shorter showers? This in turn raises broader normative questions concerning the relationship between current wellbeing and intergenerational justice. Finally, we have not been concerned with the drivers of the housing scenario that we map, apart from household income and wealth (and which of these is the more important?). Critical in the background is the role of the capitalist economic system in fostering growing production and consumption: the ongoing escalation of 'need satisfiers' (Brand-Correa et al. 2020; Bärnthaler & Gough 2023). Our focus on households and housing consumption should be integrated with studies of the broad building and allied production sectors, both as they currently exist in the UK and as they must be restructured in order to deliver 'decent homes for all within planetary boundaries'.

Bibliography

Akenji, L. *et al.* (2019) *1.5-Degree Lifestyles: Targets and options for reducing lifestyle carbon footprints*. Institute for Global Environmental Strategies, Aalto University, and D-mat ltd. Available at: https://www.iges.or.jp/en/pub/15-degrees-lifestyles-2019/en (Accessed: 16 June 2021).

Amore, K., Baker, M. and Howden-Chapman, P. (2011) 'The ETHOS Definition and Classification of Homelessness: An Analysis', *European Journal of Homelessness*, 5(2), pp. 19–37.

Baltruszewicz, M. *et al.* (2023) 'Social outcomes of energy use in the United Kingdom: Household energy footprints and their links to well-being', *Ecological Economics*, 205, p. 107686. Available at: https://doi.org/10.1016/j.ecolecon.2022.107686.

Bärnthaler, R. and Gough, I. (2023) 'Provisioning for sufficiency: envisaging production corridors', *Sustainability: Science, Practice and Policy*, 19(1), p. 2218690. Available at: https://doi.org/10.1080/15487733.2023.2218690.

Benstead, A. and Wilde, C. (2023) *Embodied Carbon: Improving your modelling and reporting*. UK Green Building Council, p. 31. Available at: https://ukgbc.org/resources/embodied-carbon-modelling-and-reporting/ (Accessed: 18 February 2024).

Bierwirth, A. and Thomas, S. (2019) *Energy sufficiency in buildings : concept paper*. European Council for an Energy Efficient Economy, p. 48. Available at: https://epub.wupperinst.org/frontdoor/index/index/docId/7326 (Accessed: 20 February 2023).

Boswell, J., Dean, R. and Smith, G. (2023) 'Integrating citizen deliberation into climate governance: Lessons on robust design from six climate assemblies', *Public Administration*, 101(1), pp. 182–200. Available at: https://doi.org/10.1111/padm.12883.

Boyle, K. and Flegg, A. (2022) 'The Right to Adequate Housing in the UK - An Explainer'. Available at: http://dspace.stir.ac.uk/handle/1893/34338 (Accessed: 9 January 2024).

Brand-Correa, L.I. *et al.* (2020) 'Understanding (and tackling) need satisfier escalation', *Sustainability: Science, Practice and*

Policy, 16(1), pp. 309–325. Available at: https://doi.org/10.1080/15487733.2020.1816026.

Calvin, K. *et al.* (2023) *IPCC, 2023: Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland.* First. Intergovernmental Panel on Climate Change (IPCC). Available at: https://doi.org/10.59327/IPCC/AR6-9789291691647.

Cavendish, C. (2023) 'Making downsizing easier could help Britain's housing crisis', *Financial Times*, 24 June. Available at: https://www.ft.com/content/cc78a1c1-1e30-4e11-8d51-a213e303c255 (Accessed: 29 November 2023).

Chapman, A. and Kumar, C. (2023) *THE NATIONAL ENERGY GUARANTEE*. New Economics Foundation, p. 27. Available at: https://neweconomics.org/2023/04/the-national-energy-guarantee.

Cherry, C. *et al.* (2021) *Citizens' climate assemblies: Understanding public deliberation for climate policy*. Cardiff: The Centre for Climate Change and Social Transformations. Available at: https://orca.cardiff.ac.uk/id/eprint/145771/1/CITIZENS-CLIMATE-ASSEMBLIES-CAST-July-2021.pdf.

Cohen, M.J. (2021) 'New Conceptions of Sufficient Home Size in High-Income Countries: Are We Approaching a Sustainable Consumption Transition?', *Housing, Theory and Society*, 38(2), pp. 173–203. Available at: https://doi.org/10.1080/14036096.2020.1722218.

Committee on Climate Change (2019) *UK housing: Fit for the future?* Committee on Climate Change, p. 135. Available at: https://www.theccc.org.uk/publication/uk-housing-fit-for-the-future/ (Accessed: 15 February 2024).

Committee on Climate Change (2022) *2022 Progress Report to Parliament*. Climate Change Committee. Available at: https://www.theccc.org.uk/publication/2022-progress-report-to-parliament/ (Accessed: 18 February 2024).

Committee on Climate Change (2023) *2023 Progress Report to Parliament*. Climate Change Committee. Available at: https://www.theccc.org.uk/publication/2023-progress-report-to-parliament/ (Accessed: 15 February 2024).

Creutzig, F. *et al.* (2018) 'Towards demand-side solutions for mitigating climate change', *Nature Climate Change*, 8(4), pp. 260–263. Available at: https://doi.org/10.1038/s41558-018-0121-1.

Creutzig, F. *et al.* (2022) 'Demand, Services and Social Aspects of Mitigation', in Intergovernmental Panel On Climate Change (Ipcc) (ed.) *Climate Change 2022 - Mitigation of Climate Change*. 1st edn. Cambridge University Press (Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change), pp. 503–612. Available at: https://doi.org/10.1017/9781009157926.007.

Daly, H.E. (1977) *Steady-State Economics : the economics of biophysical equilibrium and moral growth*. San Francisco: W.H. Freeman.

Davis, A. *et al.* (2015) *How much is enough? Reaching social consensus on minimum household needs*. report. Loughborough University. Available at: https://repository.lboro.ac.uk/articles/report/How_much_is_enough_Reaching_social_consensus_on_minimum_household_needs/9470702/1 (Accessed: 6 June 2022).

Davis, A. *et al.* (2020) 'Living on Different Incomes in London: Can public consensus identify a "riches line"?', *CASE Reports* [Preprint]. Available at: https://ideas.repec.org//p/cep/sticar/casereport127.html (Accessed: 18 February 2024).

Davis A, Hirsch D, and Padley M (2014) *A minimum income standard for the UK in 2014*. Joseph Rowntree Foundation, p. 52. Available at: https://www.jrf.org.uk/report/minimum-income-standard-uk-2014 (Accessed: 6 October 2015).

Deben and Climate Change Committee (CCC) (2022) 'Letter: Reducing energy demand in buildings in response to the energy price crisis'. Available at: https://www.theccc.org.uk/publication/letter-reducing-energy-demand-in-buildings-in-response-to-the-energy-price-crisis/ (Accessed: 18 February 2024).

Department for Business, Energy and Industrial Strategy (DBEIS) (2022) *Final UK greenhouse gas emissions national statistics: 1990 to 2020*. Department for Business, Energy & Industrial Strategy. Available at: https://www.gov.uk/government/statistics/final-uk-

greenhouse-gas-emissions-national-statistics-1990-to-2020 (Accessed: 23 September 2023).

Department for Energy and Climate Change (DECC) (2014) *The Government's Standard Assessment Procedure for Energy Rating of Dwellings*. Department for Energy and Climate Change. Available at: https://files.bregroup.com/SAP/SAP-2012_9-92.pdf.

Department for Levelling Up, Housing and Communities (2018) *Homelessness code of guidance for local authorities*, *GOV.UK*. Available at: https://www.gov.uk/guidance/homelessness-code-of-guidance-for-local-authorities (Accessed: 18 February 2024).

Department for Levelling Up, Housing and Communities (2022) *English Housing Survey 2021 to 2022: headline report*. Available at: https://www.gov.uk/government/statistics/english-housing-survey-2021-to-2022-headline-report (Accessed: 18 February 2024).

Department for Levelling Up, Housing and Communities (2023) *Live tables on dwelling stock (including vacants)*. Department for Levelling Up, Housing and Communities. Available at: https://www.gov.uk/government/statistical-data-sets/live-tables-on-dwelling-stock-including-vacants (Accessed: 12 January 2024).

Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities & Local Government (2015) *Technical housing standards – nationally described space standard*. Available at: https://www.gov.uk/government/publications/technical-housing-standards-nationally-described-space-standard (Accessed: 18 February 2024).

Diner, A. (2023) *The community right to buy: how housing acquisitions can regenerate left behind communities, improve standards, and decarbonise homes*. New Economics Foundation, p. 12. Available at: https://neweconomics.org/2023/09/the-community-right-to-buy (Accessed: 20 October 2023).

Doris Fuchs, Marlyne Sahakian, Tobias Gumbert, Antonietta Di Giulio, Michael Maniates, Sylvia Lorek, Antonia Graf (2021) *Consumption Corridors: Living a Good Life within Sustainable*

Limits. London: Routledge. Available at: https://doi.org/10.4324/9780367748746.

Dorling, D. (2014) *All That Is Solid: How the Great Housing Disaster Defines Our Times, and What We Can Do About It*. Penguin UK.

Doyal, L. and Gough, I. (1991) *A Theory of Human Need*. 1st edn. Bloomsbury Publishing Plc. Available at: https://doi.org/10.1007/978-1-349-21500-3.

Druckman, A. and Jackson, T. (2010) 'The bare necessities: How much household carbon do we really need?', *Ecological Economics*, 69(9), pp. 1794–1804. Available at: https://doi.org/10.1016/j.ecolecon.2010.04.018.

Elstub, S., Farrell, D.M. and Mockler, P. (2021) 'The Scope of Climate Assemblies: Lessons from the Climate Assembly UK', *Sustainability*, 13(11272), pp. 101–117. Available at: https://doi.org/10.3390/su132011272.

zu Ermgassen, S.O.S.E. *et al.* (2022) 'A home for all within planetary boundaries: Pathways for meeting England's housing needs without transgressing national climate and biodiversity goals', *Ecological Economics*, 201, p. 107562. Available at: https://doi.org/10.1016/j.ecolecon.2022.107562.

Evans, S. *et al.* (2023) 'Getting to net zero: Islington's social housing stock', *Buildings and Cities*, 4(1), pp. 524–544.

Frank, R.H. (2000) *Luxury Fever: Money and Happiness in an Era of Excess*. Princeton University Press.

Gough, I. (2017) 'Heat, Greed and Human Need: Climate Change, Capitalism and Sustainable Wellbeing', in *Heat, Greed and Human Need*. Edward Elgar Publishing. Available at: https://www.elgaronline.com/monobook/9781785365102/9781785365102.xml (Accessed: 15 February 2024).

Gough, I. (2020) 'Defining floors and ceilings: the contribution of human needs theory', *Sustainability: Science, Practice and Policy*, 16(1), pp. 208–219. Available at: https://doi.org/10.1080/15487733.2020.1814033.

Gough, I. (2023) 'Sufficiency as a Value Standard: From Preferences to Needs', *Ethics, Policy & Environment* [Preprint]. Available at: https://www.tandfonline.com/doi/abs/10.1080/21550085.2023.2269055 (Accessed: 22 January 2024).

Green, F. (2021) 'Ecological limits: Science, justice, policy, and the good life', *Philosophy compass*, 16(6), pp. 1-n/a. Available at: https://doi.org/10.1111/phc3.12740.

Grubb, M., Hourcade, J.C. and Neuhoff, K. (2014) *Planetary Economics: Energy, Climate Change and the Three Domains of Sustainable Development*. Routledge.

Habermas, J. (1987) *Knowledge and Human Interests*. Cambridge, UK and Malden, MA: Polity Press.

Hagbert, P. and Bradley, K. (2017) 'Transitions on the home front: A story of sustainable living beyond eco-efficiency', *Energy Research & Social Science*, 31, pp. 240–248. Available at: https://doi.org/10.1016/j.erss.2017.05.002.

Hecht, K., Burchardt, T. and Davis, A. (2022) 'Richness, Insecurity and the Welfare State', *Journal of Social Policy*, pp. 1–22. Available at: https://doi.org/10.1017/S0047279422000617.

Hertwich, E. *et al.* (2020) *Resource Efficiency and Climate Change: Material Efficiency Strategies for a Low-Carbon Future*. A report of the International Resource Panel. Nairobi, Kenya: United Nations Environment Program. Available at: https://globalabc.org/resources/publications/resource-efficiency-and-climate-change-summary-policymakers.

Hills, J. (2012) *Getting the measure of fuel poverty: Final Report of the Fuel Poverty Review*. CASE Report 72. London: Centre for Analysis of Social Exclusion, The London School of Economics and Political Science. Available at: http://sticerd.lse.ac.uk/dps/case/cr/CASEreport72.pdf.

Hirsch, F. (1977) *Social Limits to Growth*. Routledge & Kegan Paul.

Holden, E. (2004) 'Ecological footprints and sustainable urban form', *Journal of Housing and the Built Environment*, 19(1), pp. 91–109. Available at: https://doi.org/10.1023/B:JOHO.0000017708.98013.cb.

House of Commons (no date) *Housing (Overcrowding) Bill*, *53/2*. Available at: https://publications.parliament.uk/pa/cm200203/cmbills/046/03046.i-5.html (Accessed: 18 February 2024).

Hudson, N. (2022) 'The great British housing wealth divide', *Financial Times*, 9 September. Available at: https://www.ft.com/content/a7c89e3b-7bb4-4227-b6cd-aed168499588 (Accessed: 5 July 2023).

Huebner, G.M. and Shipworth, D. (2017) 'All about size? – The potential of downsizing in reducing energy demand', *Applied Energy*, 186, pp. 226–233. Available at: https://doi.org/10.1016/j.apenergy.2016.02.066.

Ivanova, D. and Büchs, M. (2020) 'Household Sharing for Carbon and Energy Reductions: The Case of EU Countries', *Energies*, 13(8), p. 1909. Available at: https://doi.org/10.3390/en13081909.

Ivanova, D. and Büchs, M. (2022) 'Implications of shrinking household sizes for meeting the 1.5 °C climate targets', *Ecological Economics*, 202, p. 107590. Available at: https://doi.org/10.1016/j.ecolecon.2022.107590.

Jungell-Michelsson, J. and Heikkurinen, P. (2022) 'Sufficiency: A systematic literature review', *Ecological Economics*, 195, p. 107380. Available at: https://doi.org/10.1016/j.ecolecon.2022.107380.

Kingman, D. (2016) *Unlocking England's 'Hidden Homes': How subdividing large homes could solve the climate crisis*. Intergenerational Foundation. Available at: https://www.if.org.uk/research-posts/unlocking-englands-hidden-homes/ (Accessed: 18 February 2024).

Köpf, M. (2022) 'Wie Kommunen neue Zweitwohnsitze verhindern wollen', *Süddeutsche Zeitung*, 16 March. Available at: www.sz.de/1.5548369 (Accessed: 17 January 2024).

Lage, J. *et al.* (2023) 'Citizens call for sufficiency and regulation — A comparison of European citizen assemblies and National Energy and Climate Plans', *Energy Research & Social Science*, 104, p. 103254. Available at: https://doi.org/10.1016/j.erss.2023.103254.

Lausberg, P. and Croon, T. (2023) 'Europe must fight energy poverty more effectively', *European Policy Centre*. Available at: https://www.epc.eu/en/publications/-Europe-must-fight-energy-poverty-more-effectively~4da8dc (Accessed: 25 January 2024).

Lorek, S. and Spangenberg, J.H. (2019) 'Energy sufficiency through social innovation in housing', *Energy Policy*, 126, pp. 287–294. Available at: https://doi.org/10.1016/j.enpol.2018.11.026.

Mansour, A. *et al.* (2022) 'Housing and health: an updated glossary', *J Epidemiol Community Health*, 76(9), pp. 833–838. Available at: https://doi.org/10.1136/jech-2022-219085.

Mazzucato, M. and Farha, L. (2023) *The right to housing: A mission-oriented and human rights-based approach*. Council on Urban Initiatives. (CUI WP 2023-01). Available at: https://www.ucl.ac.uk/bartlett/public-purpose/publications/2023/may/right-housing-mission-oriented-and-human-rights-based-approach.

Ministry of Housing, Communities & Local Government (2019) *English Housing Survey 2018 to 2019: headline report*. Available at: https://www.gov.uk/government/statistics/english-housing-survey-2018-to-2019-headline-report (Accessed: 18 February 2024).

Ministry of Housing, Communities & Local Government (2020) *English Housing Survey 2019 to 2020: headline report*. Available at: https://www.gov.uk/government/statistics/english-housing-survey-2019-to-2020-headline-report (Accessed: 18 February 2024).

Mulheirn, I. (2019) *Tackling the UK housing crisis: is supply the answer?* UK Collaborative Centre for Housing Evidence, p. 47. Available at: https://housingevidence.ac.uk/publications/tackling-the-uk-housing-crisis-is-supply-the-answer/.

Naess, P. and Xue, J. (2016) 'Housing standards, environmental sustainability, and social welfare', in P. Næss and L. Price (eds) *Crisis System: A critical realist and environmental critique of economics and the economy*. Routledge, pp. 130–148.

National Housing Federation (2021) 'England's leaky homes are a greater threat to climate than all of its cars', 25 August. Available at: https://www.housing.org.uk/news-and-blogs/news/englands-leaky-homes-greater-threat-to-climate-than-cars/ (Accessed: 21 September 2023).

Nussbaum, M.C. (2000) *Women and Human Development: the capabilities approach*. Cambridge: Cambridge University Press.

Padley *et al.* (2021) *A minimum income standard for London 2020*. Centre for Research in Social Policy, Loughborough University, p. 55. Available at: https://trustforlondon.org.uk/research/a-minimum-income-standard-for-london-2020/.

Park, J. (2017) *One Hundred Years of Housing Space Standards: What now?* housingspacestandards.co.uk, p. 106. Available at:

http://housingspaceshttp://housingspacestandards.co.uk/assets/space-standards_onscreen_print.pdftandards.co.uk/.

Pauliuk, S. *et al.* (2021) 'Global scenarios of resource and emission savings from material efficiency in residential buildings and cars', *Nature Communications*, 12(1), p. 5097. Available at: https://doi.org/10.1038/s41467-021-25300-4.

Public Health England (2019) *Homelessness: applying All Our Health*, *GOV.UK*. Available at: https://www.gov.uk/government/publications/homelessness-applying-all-our-health/homelessness-applying-all-our-health (Accessed: 9 January 2024).

Rao, N.D., Min, J. and Mastrucci, A. (2019) 'Energy requirements for decent living in India, Brazil and South Africa', *Nature Energy*, 4, pp. 1025–1032. Available at: https://doi.org/10.1038/s41560-019-0497-9.

Raworth, K. (2017) *Doughnut Economics: Seven Ways to Think Like a 21st-Century Economist*. London: Random House.

Robeyns, I. (2017) *Wellbeing, Freedom and Social Justice: The Capability Approach Re-Examined*. Open Book Publishers. Available at: https://doi.org/10.11647/obp.0130.

Robeyns, I. (2019) 'What, if Anything, is Wrong with Extreme Wealth?', *Journal of Human Development and Capabilities*, 20(3), pp. 251–266. Available at: https://doi.org/10.1080/19452829.2019.1633734.

Ryan, R.M. and Deci, E.L. (2001) 'On Happiness and Human Potentials: A Review of Research on Hedonic and Eudaimonic Well-Being', *Annual Review of Psychology*, 52(1), pp. 141–166. Available at: https://doi.org/10.1146/annurev.psych.52.1.141.

Schramme, T. (forthcoming) 'A problem for the distinction between subsistence consumption and luxury consumption', *Ethics, Policy & Environment* [Preprint].

Serrenho Cabrera, A. *et al.* (2019) 'Testing the greenhouse gas emissions reduction potential of alternative strategies for the english housing stock', *Resources, Conservation and Recycling*, 144, pp. 267–275. Available at: https://doi.org/10.1016/j.resconrec.2019.02.001.

Shue, H. (1993) 'Subsistence Emissions and Luxury Emissions', *Law & Policy*, 15(1), pp. 39–60. Available at: https://doi.org/10.1111/j.1467-9930.1993.tb00093.x.

Stratford, B. (2020) 'The Threat of Rent Extraction in a Resource-constrained Future', *Ecological Economics*, 169, p. 106524. Available at: https://doi.org/10.1016/j.ecolecon.2019.106524.

Till, M. (2005) 'ASSESSING THE HOUSING DIMENSION OF SOCIAL INCLUSION IN SIX EUROPEAN COUNTRIES', *Innovation: The European Journal of Social Science Research*, 18(2), pp. 153–181. Available at: https://doi.org/10.1080/13511610500096475.

Tunstall, B. (2015) 'Relative housing space inequality in England and Wales, and its recent rapid resurgence', *International Journal of Housing Policy*, 15(2), pp. 105–126. Available at: https://doi.org/10.1080/14616718.2014.984826.

Tunstall, B. (2022) *Stay Home: Housing and Home in the UK During the COVID-19 Pandemic*. Policy Press.

UK Cohousing (2021) *Cohousing in the UK and worldwide*, *UK Cohousing Network*. Available at: https://cohousing.org.uk/cohousing-in-the-uk-and-worldwide/ (Accessed: 8 April 2023).

UN-HABITAT (2006) *National experiences with shelter delivery for the poorest groups*. Nigeria, Indonesia, Mexico, p. 163. Available at: https://www.humanitarianlibrary.org/resource/national-experiences-shelter-delivery-poorest-groups-1.

UN-HABITAT (2022) *Children, Cities, and Housing: Rights and Priorities*. Discussion paper. UN-Habitat, Habitat for Humanity and UNICEF, p. 71. Available at: https://unhabitat.org/children-cities-and-housing-rights-and-priorities.

Veblen, T. (2005) *The Theory of the Leisure Class: An Economic Study of Institutions*. Aakar Books.

Weitzman, M.L. (1974) *Is the Price System or Rationing More Effective in Getting a Commodity to Those Who Need It Most?* Working paper 140. Massachusetts Institute of Technology (MIT), Department of Economics. Available at: https://ideas.repec.org/p/mit/worpap/140.html (Accessed: 24 June 2016).

Wilkinson, R.G. and Pickett, K. (2009) *The Spirit Level: Why More Equal Societies Almost Always Do Better*. Allen Lane.