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Energy sufficiency, space temperature and public policy

Abstract

Reductions in absolute levels of energy demand in the Global North are increasingly understood to be important for timely net zero transitions. Accordingly, there is growing interest in sufficiency as a basis for policy. This paper explores how indoor air temperatures, as an aspect of heating and cooling demand, might be addressed. Drawing on prior reviews, it argues that sufficiency *as policymaking* can be distinguished from more common interpretations of sufficiency as voluntary individual-level self-moderation or post-growth socio-economic transformation or even the direct imposition of legal consumption limits. Policies could instead be oriented towards the 'framework conditions' that shape social practices. Moreover, common ways of articulating temperature objectives, such as limits or averages, do not reflect the distributional concern that is distinctive of a sufficiency approach. By integrating insights from social practices literature, the paper outlines how a staged thermal energy sufficiency strategy might proceed through a combination of broad guideline temperature ranges and 'shift and improve' objectives for lower-energy practice configurations. Working towards integrated policy packages across health, housing, welfare, energy and climate policies, this strategy would aim to create the conditions for wider debate and, over time, change within thermal norms and standards.

Policy relevance

The prevalent imagination of energy sufficiency policy is dominated, on the one hand, by an idea of imposed legal limits and, on the other, by enabling voluntary consumer reductions in consumption. This is well illustrated in the case of room temperature. But concepts of sufficiency extend beyond this: they call for policies to address the conditions influencing the design and use of heating and cooling systems within buildings. Amongst other things, this requires attention to how existing policies across different sectors of government (e.g. health, welfare, energy) already affect indoor temperatures and how they might be better co-ordinated. Building from this, a thermal energy sufficiency strategy could work collaboratively with other organisations, such as industry bodies, to address under- and over-consumption, promote debate and re-interpretation of narrow thermal 'standards' and improve practical supplementary technologies and techniques for maintaining thermal wellbeing.

Keywords

Energy sufficiency, social practices, thermal comfort, demand reduction, heating, cooling

1. Introduction

Reducing absolute levels of energy demand is increasingly argued to be integral to a timely net zero transition in the Global North (Barrett et al., 2022; Creutzig et al., 2022). Such reduction is understood to entail both efficiency and sufficiency, with the latter referring to a reduction in absolute levels of energy use through changes in demand for the services that energy provides (Darby & Fawcett, 2018). Buildings are an important focus for sufficiency policy. Globally, the operation of buildings account for roughly 30% of final energy consumption, much of which is used for space heating (~30%) and cooling (6%), with the latter growing rapidly and the former predicted to decline (Santamouris & Vasilakopoulou, 2021). A recent special issue in this journal raised debate as to how sufficiency might be operationalised within buildings and urban governance (Sahakian et al., 2024). As elsewhere, including the recent IPCC sixth assessment report chapter on buildings (Cabeza et al., 2022), much of the focus is on volume, use of space and avoiding urban sprawl (e.g. Lehner et al., 2024; Lorek & Spangenberg, 2019; Thomas et al., 2019). The volume of space to be heated or cooled is a foundational aspect of demand for these services, but other components of demand such as internal air temperature have so far received comparatively little attention in the energy sufficiency literature. This is despite, or perhaps because of, a history of actual policies that have sought to change room temperatures across the building stock to reduce energy use.

This paper offers the first dedicated conceptual synthesis on the potential role for sufficiency policy with respect to space temperature, referred to here as thermal energy sufficiency. This is an energy-intensive domain and also a useful case through which to explore energy sufficiency as a public policy strategy. The paper investigates how different conceptualisations of sufficiency enable and preclude certain policy imaginaries. This matters because sufficiency is far from accepted as a legitimate policy aim in most countries. This is, not least, because it involves the inherently contested relationship between governments and the lives of citizens. In this, it does not help that prevalent interpretations of sufficiency include voluntary self-limitation, rationing-like state-imposed prohibition, and post-capitalist transformation of global socio-economic systems. These do not provide an immediately tenable foundation for dedicated and ongoing public policy programmes within contemporary societies. Developing an alternative interpretation of sufficiency *as a policymaking strategy* is therefore important (Grewer et al., 2024; Iten et al., 2024; Lage, 2022).

The emerging literature on sufficiency as a policy approach frequently draws on ideas from practice theoretical framings of consumption (Iten et al., 2024; Lage, 2022). This is somewhat surprising because practice theory accounts have been criticised for not being adequately intelligible or practical for policymakers (Sahakian & Wilhite, 2014). Moreover, social practice framings of energy demand (Rinkinen et al., 2020; Shove & Walker, 2014) differ markedly from ideas of individual choice and moderation, large socio-economic transformation or top-down regulation that are historically associated with sufficiency (Lage, 2022). This may be why offer an understanding of changing consumption that is more apt for sufficiency policymaking.

Practice theoretical accounts argue that energy demand is embedded in normal ways of life, as comprised of social practices (Shove, 2010; Shove & Walker, 2014). These are repeated patterns of doing and saying that pre-exist, and are reproduced through, the (potentially joint) action of individuals (Schatzki, 2002; Shove et al., 2012). Such patterns consist of and depend upon the integration of heterogeneous elements including forms of meaning (such as values, affectivities and rules), practical competencies and tacit know-how and material arrangements (such as buildings, heating and cooling systems, air and infrastructures). Practices change over time as these elements

change and/or their mutual configurations shift (Shove et al., 2012). This applies as much to the activities of heating engineers, architects, industry organisations, company leaders, regulators and policymakers as it does to building occupants. Indeed, the diverse components of 'energy-using' practices that take place within buildings are heavily and multiply shaped over time by other practices, not least construction and heating and cooling design but also interior design trends, lifetime and day-to-day thermal experiences, social expectations and ways of dressing. Through manifold interactions across sectors, public policies may affect this diversity of practices, thereby indirectly shaping 'energy-using' practices within buildings. But such energy outcomes are not always acknowledged or intentional. Thus, so called non-energy or invisible energy policies (Royston et al., 2018) indicate a latent role for public policy that could be harnessed to better shape the conditions in which practices, and thereby energy demand, evolve over time.

Space temperature is explored here, among other reasons, because it is already salient in public, political and academic debates, even if not expressly in relation to 'sufficiency'. For example, in 2024 Net Zero Watch, a UK organisation that campaigns against Net Zero targets, published a commentary entitled 'Cold, hungry, stuck at home: Net Zero's drastic lifestyle changes' (Turver, 2024). It cites how net zero-compatible scenarios produced by the National Grid Electricity System Operator envisage average reductions in home heating setpoints of either 0.5°C or 1°C (National Grid ESO, 2023). Even though such reductions are relatively small and are seen to arise through, and are mitigated by, better levels of insulation, it is suggested that colder homes will not be popular. Along with other measures the argument follows that they will therefore need to be imposed through government coercion. Thus, the ways in which objectives and forecasts for service demand, such as temperature, are articulated can materially matter in public discourse, as do understandings of the role of governments.

The paper deploys a narrative, conceptual literature review to contrast and elaborate key sufficiency concepts and policy approaches to indoor temperature. It synthesises insights from the literatures on sufficiency, adaptive and personal comfort and practice theoretical accounts of consumption. As a scholarly rather than interventionist synthesis (Hart, 2018), the intention is not to review the evidence base for specific policies or temperature thresholds. Instead, it aims to advance policy-relevant research by clarifying the conceptual underpinnings of alternative approaches and the tensions that persist. Nor is it assumed at the outset that indoor temperatures 'need' to change. This depends on context and empirical data. But, as the example above illustrates, indoor temperatures are inextricably relevant to lower-carbon heat transitions. Policymakers could therefore benefit from clearer and expanded concepts and tools for navigating the domain and deciding if and how air temperature should be problematised within policy.

2. Varieties of sufficiency and the role of public policy

Whilst there is some consensus on what sufficiency entails, there persist diverse, and sometimes contradictory, meanings (Jungell-Michelsson & Heikkurinen, 2022; Lage, 2022; Sandberg, 2021). However, prior reviews indicate a general shift from defining sufficiency primarily as a voluntary, individual-led concern to one that requires integration into public policymaking (Iten et al., 2024). But policy responses, which remain sparse, are formulated in markedly different ways reflecting this varied conceptual underpinning. This section takes stock of these differences and emerging directions.

2.1 Consensus

Definitions of sufficiency share a broad reference to avoiding, reducing or constraining the demand for energy, carbon and resource-intensive goods and services in absolute terms whilst respecting, protecting or improving wellbeing and socio-economic equity. This is exemplified in the IPCC sixth

assessment report where sufficiency is defined as 'a set of measures and daily practices that avoid demand for energy, materials, land, and water while delivering human well-being for all within planetary boundaries' (IPCC, 2023: 105). It is also common to define sufficiency in the negative, as a reduction in demand through means *other than efficiency*. In these terms, sufficiency 'differs from efficiency in that the reduction is based on prioritising and rescaling the level of services, while efficiency reduces the level of resources for a defined level of service' (Bourgeois et al., 2023: 9).

2.2 Distinctiveness

As this indicates, two differences set sufficiency apart from longstanding approaches to resource conservation. The first is the integration of a social dimension, variously understood as relating to wellbeing, decent living standards or meeting basic needs (Iten et al., 2024). The second is a concept of upper limits to resource use, not merely relative reductions in consumption but as ultimately commensurate - at individual, population or global levels - with ecological planetary boundaries (Rockström et al., 2009). Yet many authors writing in the Global North emphasise ecological goals, often without expressly engaging with the question of absolute consumption or more than passing acknowledgment of welfare goals. However, recent developments of sufficiency as a distinctive approach, especially for public policymaking, combine two types of 'enough' (Spengler, 2016): a) upper limits to consumption (or ceilings) consistent with ecological limits and b) lower thresholds (or floors) consistent with equitable access to the minimum goods and services for a decent standard of living (Darby & Fawcett, 2018; Gough, 2020; Spengler, 2016). Between these dual thresholds lies a 'space' or consumption corridor (Di Giulio & Fuchs, 2014). Although similar to the idea of doughnut economics (Raworth, 2018) consumption corridors are defined in terms of the use of relatable services and products, and usually on a per capita basis (Darby & Fawcett, 2018; Fuchs et al., 2021).

2.3 Differences

In studying how sufficiency is interpreted in the climate plans of German municipalities, Grewer et al. (2024) differentiate nine dimensions of variation, which had clear implications for the character, priority and even presence of policy measures. One source of variation - and tension - lies between sufficiency as a *state* and/or as a *strategy* to achieve that state (Darby & Fawcett, 2018; Sorrell et al., 2020). In the environmental literature after Sachs (1999) sufficiency is commonly discussed as a *strategy for reducing* consumption through individual, voluntary self-moderation. This envisions change as an ideologically motivated pursuit of 'a good life' (Jungell-Michelsson & Heikkurinen, 2022; Spengler, 2016). In a semi-systematic literature review, Lage (2022) describes this as a *bottom-up approach* that interprets sufficiency as 'conscious and intended reductions in individual consumption and a corresponding cultural change' which is achieved as 'the diffusion of changes in individual behaviour shapes a cultural change toward sufficiency, which forms the basis for possible further political measures' (Lage, 2022: 12). A related but less normative framing views sufficiency as 'changes in individual behaviours' as an expediently 'necessary complement to energy efficiency and renewable energy' (Moser et al., 2015: 2).

Sufficiency alternatively figures as a 'critique of consumer society and our growth-based economic system' (Moser et al., 2015: 2) which calls for socio-economic transformation such as post-growth or doughnut economics. Lage (2022: 12) identifies this as the *social movement approach* which defines sufficiency as 'a critical perspective of the nexus of unsustainability, growth-dependency, externalization, exploitation and discrimination and describes a logic of societal organizations that is oriented toward socio-ecological justice and "enoughness"'. Often overlapping but somewhat distinct from this a notion of sufficiency as a kind of change that requires a 'hard' regulatory role from the state

to impose consumption limits albeit contingent on greater public participation and democratic innovation (Fuchs et al., 2021; Iten et al., 2024).

Lage (2022) identifies a third subset of literature that adopts a *policymaking approach.* Indeed, increasing calls are directed towards policymakers, such as the 2024 campaign with over 100 signatories that called for the EU parliament to address the 'sufficiency policy gap' (Association négaWatt, 2024). Interestingly, Lage characterises the academic literature on sufficiency policy as concerned with 'changes in *framework conditions* that enable, facilitate and shape *social practices* of reduced consumption' through a 'broad and sometimes unconscious change of social practices and a reduction of consumption levels' (Lage, 2022: 12, emphasis added). Iten et al.'s (2024: 1714) review equally observes how the goal of sufficiency policy is frequently understood to involve creating enabling framework conditions and notes that 'scholars of this position often refer to social practice theory'.

2.4 Developing sufficiency as policymaking

The argument in this paper develops from this departure point: that policymaking is a sufficiency strategy in its own right, not merely the means to arrive at or impose a state of sufficiency (be that technocratically or collectively and democratically). Neither is it (only) a means to somehow instigate a bottom-up strategy or a transformative socio-economic paradigm shift. Instead, governments have a role to 'create political, economic, social and infrastructural framework conditions that promote, encourage or enable resource-conserving social practices and avoid or prevent resource-intensive social practices' (Lage, 2022: 09).

This 'policymaking approach' is not yet common in policymaking practice. But, if it were, research indicates the difference it could make. Grewer et al. (2024) analysed the climate policies of leading German municipalities required to incorporate sufficiency as a condition of funding; they found that most interpreted sufficiency as a private action undertaken by individuals (an approach the authors call 'privatisers'). In this, sufficiency was seen as an instrumental necessity to reconcile emissions reduction scenarios. Resulting policy measures were sparse, limited to information and appeals and awarded low(er) priority than renewable and efficiency strategies. The next most common approach ('vision builders') understands sufficiency much like Lage's (2022) bottom-up approach: as individual, voluntary and normative action to moderate consumption and build grassroots cultural change. This keeps sufficiency as an abstract future, largely outside the domain of public policy and positions municipalities as supportive bystanders or, at best, motivators. In a third, much less common 'frameworker' approach, sufficiency was conceptualised as a societal task, steerable through targeted cross-sectoral and integrated policies focused on foundational structures and the conditions of consumption, such as change through providers, physical infrastructures and fiscal instruments; not limited to private lifestyles, abstract visions or information instruments. For example, the City of Rietberg introduced funding to help residents repair (rather than replace) broken appliances (Grewer et al., 2024). Thus, although it is rare, a 'policymaking approach' is both possible in practice and, where established, is associated with a higher priority, more targeted and more structural remit for public policy.

Across Europe, the limited sufficiency and demand reduction policies that do exist (though not always labelled as sufficiency) focus more on transport than other sectors, at both national and municipal levels (Iten et al., 2024; Zell-Ziegler et al., 2021). There is also a greater variety of policy instruments used and proposed for transport than for buildings, where the greatest emphasis is on information (Zell-Ziegler et al., 2021). This again indicates a role for research to critically examine the possibilities for broader, more structural demand-related policymaking. Table 1 summarises and compares the

sufficiency concepts reviewed in this section and their relation to potential policy objectives, approaches and instruments. It adapts Lage's (2022) framework with the additional distinction between subtypes of individual and policymaking approach.

Table 1. A composite overview of sufficiency concepts, adapted from Lage (2022) with additions from Grewer et al. (2024) and the present review

Type	**Individual**		**Policymaking**		**Social movement**
Subtype	**Instrumental**	**Bottom-up change**	**Framework conditions**	**Legal limits**	**Socio-economic transformation**
Approach to change	Individual behaviour change	Conscious voluntary reductions in consumption	Changes in framework conditions to enable and shape social practices	Direct mandates to de/legalise consumption levels	Changes in socio-economic organisation and principles
Goals	Reconcile gaps in climate mitigation models	Pursuit of a good life within limits, individual wellbeing	(Re)distribution, guided but not defined by consumption corridors	Limiting consumption especially upper limits	Post-growth economy, social justice, upper *and* lower consumption thresholds
Role of public policy (example instruments)	Facilitate behaviour change (incentives, information, persuasion, markets)	Motivating and encouraging cultural change (public debates, media, communications)	Central role working with others to shape framework conditions (regulations, guidelines, standards, industry initiatives, advocacy, funding)	Legislation and enforcement (speed limits, setpoint limits)	Transforming governmental structures, whenever possible (doughnut economics)

3. Room temperature and sufficiency: a brief review

This section turns attention to space temperature. It outlines how sufficiency has so far been discussed in relation to temperature and reviews past and proposed policy measures. Whilst the inter-connections between fuel poverty, heat vulnerability and demand reduction are vital for a full, dual threshold definition of sufficiency, these are large literatures; the focus here is with the more contentious policy objective of demand reduction. Equally, whilst *energy* demand reduction can also be achieved through improvements in insulation and appliance efficiency, the aim is to explore how *service* demand, in this case temperature, has figured in policies and research so far. Nevertheless, there are important interactions between building fabric, temperature and comfort and hence housing, labour and energy policies, which are returned to later. The discussion also aims to cover both space heating and air conditioning, as both are relevant to thermal energy sufficiency. However, it is somewhat unevenly occupied with heating reflecting the largely northern European sufficiency literature and position of the author.

3.1 Limitation and information

Given the large share of national energy committed to space heating and cooling, these services are often targeted during an energy crisis, including the introduction of legal limits for building setpoint temperatures. Indeed, setpoints offer something of a rare opportunity to impose quantifiable limits on consumption in order to save energy. For instance, in 1979 the US brought in the Emergency

Building Act to restrict heating setpoints in government buildings to no more than 68°F (19°C). The Japanese CoolBiz policy, initiated in 2005, limited air conditioning temperatures in government offices to no less than 28°C. In 2022, European Union countries mandated legal limits to temperatures in public, and in some cases commercial, buildings of 19°C for heating and 25°C (Italy) or 27°C (Spain) for cooling. This was part of the RePowerEU programme which successfully reduced gas use by 18% between August 2022 and March 2023 (European Commission, 2024).

In view of this history, it is not surprising that a 'rationing' imaginary continues to inform suggestions for sufficiency policy. For example, the CLEVER scenario, which sketches out 'convergence corridors' across EU nations towards a carbon neutral 2050, includes 'a target to obtain a limit of space heating to 19°C' (Taillard et al., 2022: 43). To reach this, the authors propose limits of 19°C in public buildings and 'awareness raising campaigns for consumers', citing the crisis measures taken in 2022 as an example of good practice. Guilbert (2024) similarly describes the measures taken in Geneva in 2022 as 'sufficiency' but offers a more critical appraisal. During this time, 'obligatory sufficiency' disproportionately and negatively affected tenants in large apartment blocks with centralised heating systems where setpoint temperatures were lowered by building managers to 19°C or 20°C. This reduced tenants' sense of control and introduced new problems with damp and discomfort, whilst high-income homeowners often reported low awareness of the voluntary information appeals issued around the same time.

Nevertheless, in France, there has been a long debate concerning the 'standardisation' of 19°C heating setpoint limits. In 2020, the French Citizens' Convention on Climate recommended measures to impose limits on the use of heating to a maximum average of 19°C and for no cooling below 25°C applicable for all buildings (Gough, 2020). The Energy Sobriety plan of 2022 embeds the ambition of moving towards a target temperature of 19°C in winter and 26°C in summer as applied across all buildings, focusing initially on public buildings and those owned by larger stakeholders. A survey of French households indicates ongoing public acceptance for 'rationing' measures that would see winter heating temperatures in homes reduced by 2-3°C, with only 11-24% of respondents (depending on social cluster) outright rejecting the idea (Bouillet & Grandclément, 2024).

Advice, information and appeals - to turn the thermostat down or up - are more typical for public-facing measures (Bertoldi, 2022; Strengers & Maller, 2011). Mandated setpoint limits are usually only applied or suggested for public buildings. But mandates and information are limited, and reflect a widespread but narrow view of consumption as arising, and changing, through choices, incentives and better information (Shove, 2010). The success of the CoolBiz campaign, in contrast, showed the importance of wider measures to address the 'context' for indoor temperatures, in this case, by enabling cultural changes in the formal business dress code.

3.2 Sufficiency practices

In this vein, a considerable body of work investigates consumption as a complex socio-historic phenomenon embedded in inter-related social practices. This includes research into voluntary changes to indoor temperatures made by households through so-called 'sufficiency practices' (Sahakian et al., 2021; Van Loy et al., 2021; van Moeseke et al., 2024). For instance, Sahakian et al. (2021) conducted a 'living lab' study with households in several European countries who were set the challenge of reducing winter indoor temperatures to 18°C over a four-week period. Through use of alternative means to keep people (and pets) warm, such as clothing, blankets, heating mats and creating more bounded spaces within the home, living room temperatures reduced from an average of 21.2°C to 20.1°C, and from 20°C to 18.5°C in bedrooms. Similarly, 23 Belgian households participated in a co-created 'living lab' study over 3 years (van Moeseke et al., 2024). A 'sufficient heating practice' (which participants called

'slowheating') evolved through a mixture of personal comfort systems (small heaters and heated throws), clothing and physiological adaptation. The authors suggest that changes in heating demand through lower indoor temperatures offer significant, and more than commonly assumed, potential for energy demand reduction. Modelling confirms that 'sufficiency practices' of lowering setpoints or heating only main living spaces could reduce domestic energy consumption substantially, equivalent to a deep retrofit (Loche et al., 2025).

This work joins other investigations into the possible configurations of practice for lower-energy warmth (Bordass et al., 2025; Jaeger-Erben et al., 2025) and cooling (Strengers & Maller, 2011) as well as the physiological and design paradigms of adaptive and personal comfort, including theories of thermal pleasure (Parkinson & de Dear, 2015). The key point is that air temperature is not the only objective for sufficiency policies to work with. As Darby and Fawcett (2018: 10) suggest, thermal energy sufficiency objectives 'would allow policy to accept more flexible, adaptive definitions of thermal comfort' including 'prioritising the use of ambient, untraded energy services (e.g. passive house design, natural cooling and ventilation)', 'valuing and enabling adaptive and non-expert ways of achieving comfort in buildings' and 'developing skills and practical know-how' (2018: 17).

From this perspective, sufficiency is achieved when thermal wellbeing is realised without using 'too much' energy, judged comparatively. The two senses of enough are thereby incorporated *within* practice as a provisional, ongoing achievement. This concept of sufficiency differs markedly from state-based, absolute definitions of temperature thresholds. Having earlier suggested that sufficiency is best, and most characteristically, defined as a distributional approach to policymaking that addresses both upper and lower thresholds, rather than generalised reductions, this contrast is significant. The next section compares these different kinds of sufficiency objectives and considers their potential combination within policy strategies.

4. Policy frameworks for thermal energy sufficiency

This section begins the work of outlining a policy approach for thermal energy sufficiency, working through potential stages of development. It does not recommend specific policies or temperature thresholds nor address how lower-energy heating and cooling might be organised in detail. Neither does it assume that policy measures to change space temperatures are urgently needed. Rather, what is lacking, and what this section aims to address, are the strategies to define thermal policy problems, objectives and instruments.

4.1 Objectives

Changes in indoor temperatures or setpoints are just one of several possible objectives for thermal energy sufficiency, albeit the most familiar to date. Prior literature proposes ample typologies of sufficiency actions such as 'avoid, shift improve', 'reduce, substitute' or 'less, lighter, slower, closer, more personal modes of consumption and production' (see Iten et al., 2024). Applied to heating and cooling, the former helps to distinguish energy reductions through *avoiding* use of heating, cooling and ventilation (HVAC) systems (including duration of operation, the volume of spaces/rooms conditioned as well as the temperatures achieved) from *improved* ways of using HVAC systems (e.g. optimisation) and *shifting* to alternative strategies and tactics for cooling and warming oneself and home. In other words, shift and improve type changes signify broader reconfigurations in the elements of practices beyond thermostat settings and air temperature. This may include changes in system and building design, specification and operating standards, availability of technologies, skills in using them, thermal cultural understandings and improved scientific knowledge and so on.

Importantly, avoid and shift-improve sufficiency objectives are not mutually exclusive and a combination is ideal. Focusing only on avoidance measures, such as space temperature changes and time of use, overlooks measures to support emerging 'sufficiency practices' in which wellbeing is forefront and achieved in alternative ways. Yet focusing only on the practice organisation through shift-improve measures prioritises more generalised change rather than the distinctly distributive strategy that, as argued above, is core to sufficiency. For this, some reference to external consumption benchmarks, such as temperature, are needed to operationalise and share definitions of over- and under- consumption.

This calls for temperature objectives that can capture this distributional concern. In the examples above, temperatures typically specify goals either for an upper limit, an absolute *average* or an *average* change. Clearly, changes on *average* can be achieved in many ways: only among the already highest-consuming, or among the lowest-consuming, or by those who do so voluntarily, or where it is imposed in multi-dwelling buildings, or by roughly equal reductions across a population and so on. Equally, whilst upper limits address 'excess', they say little about the distributional changes below the threshold.

An alternative is to define consumption corridors for internal temperature: one for winter heating, one for summer cooling, each bounded by upper and lower thresholds. This similar in some ways to a large degree of control tolerance or differential around heating and cooling setpoints (as well as a wide deadband between them). Indeed, as Gough (2020) argues, sufficiency does not so much imply a limit or single value but rather *a space* between floors and ceilings that allows for a 'comfortable' and variable range of consumption. Floor and ceiling thresholds themselves could be treated more like margins than tightly defined lines, allowing for further variation dependent on context. This is important because any dividing lines need to be cognisant of different heating and cooling needs amongst the population: from person to person, home to home, and variations with age, illness and even time of day. A broad, banded and flexible approach would be crucial. Moreover, as there is little chance of enforcing or regulating even broadly specified thresholds among diverse private households and privately-owned buildings, thresholds are best conceptualised as guidelines for policymaking rather than legal limits or regulations. A summary of different types of thermal energy sufficiency objectives is given in Table 2.

Table 2. Comparing thermal energy sufficiency objectives

Objective type	Space temperature objective	Example	Avoid/shift/improve
Reduce	By average degree of change; Or changes in average setpoints	Changing setpoints by 1°C; Or heating: average of 19°C Cooling: average of 26°C	Avoid
Single upper limit	Setpoint limits	Heating: ≤19°C Cooling: ≥26°C	Avoid
Dual thresholds	Guiding range between upper and lower thresholds as bands	Heating: [16-18]-[21-22]°C Cooling: [30-28]-[26-23]°C	Avoid *excesses*, enable minimums
Practice organisation	Healthy comfort through variety of means	Adaptive design of personal comfort, textiles, buildings	Shift, improve

4.2 Strategies for framework conditions

As noted earlier, the literature on sufficiency makes frequent reference to 'framework conditions' as the overall 'target' for sufficiency policy (Iten et al., 2024; Lage, 2022). The English term is a translation of the German concept of '*rahmenbedingungen'* which refers to the economic, business, regulatory and the wider political and social context in which companies and economic actors operate and make decisions (Sewell, 2017). It is often used in reference to the conditions for innovation. It can also be applied to the context for individual and consumer activity. For instance, in their study of municipal sufficiency policies in Germany, Grewer et al. (2024) cite from a District of Lippe policy document that states 'individual decisions… are… always in the context of *social framework conditions* and can be influenced – among others by… political and economic… instruments, the design of products and services, technical and social infrastructures and by changing societal priorities' (Grewer et al., 2024: 8, emphasis added).

Yet the concept of framework conditions is not widely used in combination with social practice theories beyond the sufficiency literature. This sub-section draws on insights from social practices literature to explore how a policy approach to framework conditions for social practices could be developed. This identifies several stages as part of an evolving and reflexive strategy. In contrast with a policy imaginary of acting directly on bounded consumer behaviours or choices, the aim is to draw attention to the multiple yet indirect relationships through which governments can and do (unintentionally) shape consumption over time. In recognising the role of diverse actors in achieving policy objectives, it is also broadly in line with a polycentric governance approach (Ostrom, 2010).

a) Acknowledge existing policy impacts

A sufficiency strategy to address framework conditions should start by understanding the government's current influences upon and interactions with patterns of consumption. Royston et al. (2018) argue that practices which are significant for energy demand are shaped over time, usually in unacknowledged or invisible ways by *non-energy policies*. For instance, national public health policies and guidelines often specify minimum and maximum space temperatures for workplaces and homes, especially for more vulnerable occupants (Strengers & Maller, 2011). Heat load calculations ensure that new heat pumps must be able to attain certain 'peak' temperatures in order to receive government subsidies (UK's Microgeneration Certification Scheme). National and local governments may also subsidise energy bills, fund initiatives to improve thermal insulation or develop extreme heat

action plans, all with the intention of changing indoor temperatures. These policies depend on implicit understandings of 'minimum' acceptable temperatures.

Government policies also indirectly influence and interact with the policies of other organisations, with further implications for thermal conditions. For instance, international standards for commercial building design and operation specify narrow ideal operative temperature ranges helping to 'standardise' energy intensive arrangements (Shove, 2003). Guidelines for office buildings help to escalate the 'market standards' and lock-in air conditioning for speculative developments just in case the 'highest' standards are required by future owners (Cass, 2018).

To trace the impacts of government policies (e.g. health, housing, welfare, energy and climate and industry) on thermal practices and indoor temperatures some 'epistemological innovation' (Royston et al., 2018: 132) may be required. A consistent evidence base of space temperatures across national building stocks would be a start. Alternative epistemologies that integrate qualitative and experiential knowledge could also be explored, not least to better reflect the divergence between outcomes and intersectional vulnerabilities and reductive temperature-based indicators of health risk (Hamstead, 2023).

b) Co-ordinate, evaluate, debate

In identifying the national and local policies that impact indoor conditions and thermal wellbeing, conflicts may be revealed. For instance, Strengers and Maller (2011) describe how policy objectives during extreme heat events in Australia often directly oppose one another: energy networks urge households to restrain their air-conditioning use to reduce blackout risk, while public health authorities encourage more use to prevent death and illness. Instead of focusing on these as separate problems, the authors argue for repositioning policy responses around the common root issue of how people moderate the effects of heat. This indicates a need for greater integration of health, housing and energy policies. Among other things, this could include encouraging building designs that facilitate and strengthen the adaptive capacities of inhabitants, supporting practices that indirectly keep people cool (shopping, swimming, seeing a film) and more targeted public health communications, including sharing a range of practical strategies for keeping cool. Similar principles could translate to winter coldness.

Bringing 'thermal' policies from across departments, sectors and layers of governance into contention should also help inform policy evaluation and prioritisation. Co-ordination between climate, energy, housing, health and welfare policy objectives is a sufficiency strategy in its own right; and could be assigned to a cross-departmental government working group. By making explicit tacit assumptions about what is and is not 'acceptable' for indoor conditions, they are opened to contestation and refinement. Agreeing a guiding dual threshold temperature framework would be integral to such co-ordination work, not least by clarifying the conditions under which *increases* in service demand, for instance from welfare or energy efficiency policies, are desirable and when they are not.

c) New policies and packages

To further develop a sufficiency strategy, a top-level government directive to prioritise thermal energy sufficiency would not go amiss (Royston et al., 2018). But even without this, putting in place thermal guidelines, a better supporting evidence-base and a working group would also establish a platform for more active policy measures. Policy packages might encompass measures from different departments to address over- and under- consumption, supplemented by a range of 'soft' (Iten et al., 2024) and 'indirect' 'push' and 'pull' instruments to shape broader aspects of thermal organisation. This might include: convening and co-ordinating industry groups to encourage adjustments to building standards; technological development and assessment of radiant and personal comfort technologies; research

priorities to better understand the performance and health implications of alternative heating and cooling systems; leading reform in construction practice and building standards through regulation and benchmarking; working with the clothing industry to inspire improved design and retail promotion of more 'thermal' styles and garments; funding for training programmes in fitting alternative and low energy heating and cooling systems. Several are discussed further below.

Over time, and in combination, these efforts would shape the diverse practices and elements that in turn shape the 'energy-using' practices within buildings. This largely entails a facilitating role for central government. Local authorities and housing associations are also important as their work often engages with householders directly.

4.3 Addressing 'excess'

The formulation of provisional guidelines for temperatures ranges would by default define 'excess'. This may help to legitimate a policy goal of addressing so-called 'over-consumption'. Building on suggestions above, there follows a brief outline of some policy ideas in this direction.

Organisational space temperature policies

Commercial buildings are often operated to intentionally produce extreme thermal contrasts to the outdoor climate as a social signifier of modernity, power and progress (Sahakian, 2014). In the case of air conditioning, the result is often uncomfortably cold. Even organisations that are not intentionally producing extreme thermal contrasts, overheating and overcooling may still arise through lack of control, complexity and convention. Facilitated by governments, industry groups and consortia could be encouraged to develop sector-specific best practice guidelines to collectively debate and moderate such extremes, and to implement organisational space temperature policies (New et al., 2023).

Service-based pricing

There is growing interest in alternatives to flat-rate energy pricing, including innovations in energy social tariffs, dynamic pricing and heat-as-a-service business models. Incremental or rising block tariffs are widely used for utility pricing, especially for water in the US and Australia, and are increasingly discussed in relation to energy, often critically (Belsham-Harris, 2025). In district heating and communal heating systems, heat demand is often metered or otherwise allocated as the basis for charging by measuring heat differentials through pipework serving radiators. In addition to this and to electricity smart meters, it may be increasingly possible to integrate room temperature data into alternative pricing models. Although requiring careful design, especially to avoid 'gaming' the thermal sensors, this could allow for variable or tiered tariffs to account for the service actually achieved rather than just the volumes energy used, thereby better protecting those in hard-to-heat homes. Equally, as it could be linked to consistent patterns of heating or cooling, it could provide a more reliable basis for heavy-use charges where no medical or health exemption applies.

Wider temperature standards

Another policy aim might be to facilitate more flexible, adaptive and less energy-intensive standards for HVAC systems. International standards such as ASHRAE 55 and EN15251 have already incorporated adaptive comfort models which, for non-airconditioned buildings, vary according to outside temperature trends throughout the year. Recent analysis suggests that such standards are equally applicable to mixed mode buildings and that air conditioning setpoints should be varied dynamically along similar lines (Parkinson et al., 2020). National standards and guidelines may be able to respond to such advice more readily, and in ways that fit regionally appropriate adaptive models. For instance, the Dutch standard, ISSO 74 specifies minimum and maximum thresholds which vary depending on running mean outdoor temperatures and performance expectations (Boerstra et al., 2015).

Thermal 'service design'

A sufficiency temperature framework might inform promotion of demand-side flexibility and smart home optimisation, for example, by helping to prevent periodic overheating and overcooling. Policies to promote improved design and use of sustainable warmth and cooling technologies (as alternatives and supplements to conventional central heating and air conditioning) could also help tackle 'excessive' space temperature. For instance, in 2014 the US ARPA-E Delta research programme invested millions of dollars into research and development of high-tech thermal textiles because of their potential to reduce energy demand quickly and flexibly (ARPA-E, 2014). Programmes like CoolBiz also offer inspiration where, in addition to setpoint limits in government buildings, the Japanese government brought together actors from the fashion industry and leading corporations as part of a wider conversation about air conditioning and dress codes.

Although not usually labelled as sufficiency, the research into sustainable cooling extends across the whole socio-technical organisation of practices of responding to heat, including low-energy alternative technologies to conventional vapour-compression air conditioning, building design and the development and strengthening of people's adaptive capacities (Khosla et al., 2021). These attempts to design cooling solutions in an energy-constrained world integrate questions of health, affordability, energy and ecology in a way that was largely absent in the emergence of space heating, but remains equally relevant.

Integrating sufficiency goals

Large government investments are being made into heat and cooling decarbonisation. This is a key nexus for policy integration. For instance, shifting from a gas boiler to a heat pump represents a change in the salient qualities of thermal service provision including longer heating up times. This suggests both a need and an opportunity for shifting away from an exclusive dependence on central heating and improving supplemental products and strategies. Heated throws, for instance, could provide local warmth at short notice or during demand-response events. Equally, higher insulation values following retrofit should increase radiant temperatures so that similar levels of comfort can be achieved at lower temperatures. Installations also offer an interaction with providers and advisers, presenting an opportunity to help extend and refine understandings and skills.

5. Discussion

A thermal energy sufficiency strategy may seem radical, but it is not. Policies already exist in many countries to bring heated or cooled indoor spaces within acceptable minimum thresholds, even if the temperatures are not explicitly stipulated. In moving towards policy packages that *also* address excess, it helps to recognise that sufficiency would be practiced as a policymaking strategy by, in the first instance, seeking balanced 'thermal' outcomes across health, welfare, climate, energy and housing policies. Merely recognising these connections and raising debate about thermal guidelines forms the basis of a strategy. Research has an important role to play in this by providing better understanding of the impacts of existing policies as well as the scope for 'happy mediums' between thermal wellbeing and ecological goals. The interactions between indoor conditions, personal comfort devices, clothing and physical and mental health outcomes are currently understood at coarse, large population levels that often do not account for factors beyond air temperature, such as the role of radiant heat.

Nevertheless, there appears to be a significant drawback to the kind of thermal energy sufficiency strategy proposed here: it may not be effective at reducing energy use. If excesses are defined by broad thresholds rather than generalised reductions or ambitious limits, and if minima are also included, the scale of overall service and energy demand reduction may not amount to much, even if measures are successful. This of course depends on existing levels of over- and under- consumption. But in the UK,

for instance, where winter living room temperatures average around 19-20°C during evening heating hours with large variations either side (Pullinger et al., 2022), a thermal energy sufficiency strategy based on broad temperature ranges alone would likely not shift this average. Successes in curbing over-consumption would be counter-acted by successes in tackling under-consumption. Indeed, to bring all households in the UK to the minimum standard of living as defined by the national Minium Income Standard and still meet climate obligations would require significant reductions in overconsumption, not least because so many homes are already underheated (Betts-Davies et al., 2025). Sufficiency is a vital strategy for just net zero transitions because it brings such distributional trade-offs to the forefront of policy evaluation, design and monitoring. This builds a stronger case for addressing excesses.

However, by designing sufficiency strategies that also include shift and improve measures to shape the structural, framework conditions in which heating and cooling-related practices evolve over time, broader and sustained changes in energy intensity could still be achieved. Such a policy strategy would entail reflexively monitoring trends, aiming amplify or moderate them and working interactively across a range of partners: it is undoubtedly a complex governance challenge. But complexity, moving goals and shifting contexts are not unfamiliar to policymaking in other domains such as economic and industrial policy.

6. Conclusion

This paper contributes, as far as the author is aware, the first dedicated discussion of energy *sufficiency policy* in relation to *space temperature* within buildings. It argues for wider policy measures than the information campaigns and legal mandates that have been typical to date. It also suggests that since sufficiency is distinctively concerned with distributional equity, space temperature objectives should reflect this and move away from average reductions, average changes or even single limits. Instead, a broad, banded guideline range for temperatures is proposed not so much to describe an ideal state, or as a policy tool to directly achieve that outcome by mandate or regulation, but rather as a way to co-ordinate and evaluate policy instruments across government departments, such as health, housing, industry and energy. A sufficiency policy strategy, thus, begins by acknowledging, then co-ordinating and balancing the thermal outcomes of existing policies and priorities across departments and sectors.

Taken further, a sufficiency strategy could identify shift and improve objectives to shape, over time, the organisation of thermal wellbeing across society. Such objectives would focus on thermally relevant practices and their elements, including formal rules for organisations and building operation, integration with insulation and heat pump policies, service-based pricing, development of low-energy heating and cooling technologies and skills, cultures of dress and the design of clothing. Thus, rather than aiming to change heating or cooling behaviours directly this approach is orientated towards the ‘framework conditions’ in which practices and the demand for conditioned indoor climates evolve over time. This view emerges from a synthesis between sufficiency and social practice literatures, which are not hitherto naturally aligned. But because of this, practice theories offer a fruitful departure from the more common interpretations of sufficiency that do not serve well as a basis for policymaking. In return, the growing interest in sufficiency as a policy approach presents an opportunity to further develop practice theoretical research and its contribution to policymaking.

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The author has no competing interests to declare.

Data accessibility

This article is not based on original data.

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