Energy sufficiency: how can research better help and inform policy-making?

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Abstract

The concept of sufficiency – reducing energy uses beyond technical efficiency – is far-reaching and requires a reflection on human needs, energy services, urban structures, social norms, and the role of policies to support the shift towards lower-energy societies. In recent years, a growing body of literature has been published on energy sufficiency in various disciplines. However, there has been limited exchanges and cooperation among researchers so far, hindering the visibility and impact of this research.

This paper presents an assessment of where sufficiency research stands, especially in the perspective of policy-making. It is the first overview paper issued in the context of the newly-founded ENOUGH network – International network for sufficiency research & policy, established in 2017.

In the first part, we provide a condensed literature review on energy sufficiency, based on dozens of recent references collected through the network. Through four main themes (the nature of sufficiency, the challenges of modelling it, the barriers to its diffusion, and the approaches to foster it), we summarise the key issues and approaches.

We then present what the scholars themselves see as the priorities for future research, promising sufficiency policy options, and key barriers that research should help overcome. We collected their views through a questionnaire completed by more than 40 knowledgeable authors and experts from various disciplines.

We finally build on the previous parts to draw some recommendations on how sufficiency research could increase its impact, notably in relation to policy-making.

Introduction

Energy sufficiency is receiving increasing attention as an approach towards sustainability. This concept questions the root causes of what makes us consume energy services, and how we could do so differently before and beyond looking into technical efficiency solutions. It reflects notably on human needs, energy services, urban structures, social norms, and consumption habits.

Interpreted as an ideal, sufficiency refers to a state in which humanity would only consume energy services equitably and in quantities compatible with sustainability and ecological limits (Darby et al 2018). The concept is also often understood as a strategy or process to move towards this ideal, beyond efficiency and consistency (Bierwirth et al 2015). Energy sufficiency as a strategy consists in "favouring behaviours and activities that are intrinsically low on energy use" (Toulouse et al 2017), notably through "changes in quantity or quality" of energy services (Thomas et al 2015). It supposes changes at individual but also collective levels.

The role that policies can play to foster sufficiency is a particularly important issue. Projects such as the multi-year eceee project on energy sufficiency[1] are an illustration of the interest shown for the topic. It appears that for sufficiency to deliver, innovative state interventions and regulations of non-typical and

1. https://www.energysufficiency.org

cross-sectoral forms and scopes are probably necessary. There is a need for research to inform such policy-making.

Yet, until recently, research on sufficiency was relatively scattered and remained off the radar of decision-makers. Exchanges and cooperation among researchers have been limited, and knowledge neither systematised nor promoted. ENOUGH – *the international network for sufficiency research & policy*[2] – was established in 2017 precisely to overcome these barriers and increase the impact and visibility of this research. The present paper, co-authored by some of its founders, is the first written contribution of the network.

The purpose of the paper is to offer an overview of energy sufficiency research and a discussion on how its impact on policy can be strengthened. In the first part, we provide a literature analysis, focusing on themes of particular relevance. In the second part, we investigate what pressing priorities and policy options research can contribute to, according to scholars active in this field. This leads us, in the third part, to formulate some recommendations with respect to furthering, diffusing, and exploiting sufficiency research.

Research on energy sufficiency: an overview

The ENOUGH network has started compiling references on (energy) sufficiency. More than a hundred publications have been identified, originating mostly from Germany, France, Switzerland and other European countries, and covering various disciplines. The term 'sufficiency' is not universally used though. For instance, some of the ample literature on energy 'behavioural change' touch on sufficiency aspects. The term is also not translated in exactly equivalent ways in all languages. This makes it difficult to be exhaustive. Besides, sufficiency is a far-reaching concept with potential connections with other broad topics: research on human needs and wants, degrowth, criticisms of the dominant social paradigm, social and environmental justice, among others.

The condensed literature overview presented in this section does not seek to be comprehensive, but rather focuses on themes that are particularly relevant for policy-making, and preferably covering recent publications to provide a state-of-the-art picture.

THEME 1 – ON THE NATURE OF SUFFICIENCY

A preliminary question relates to the definition(s) of sufficiency, and the way it may be approached and interact with the fabric of our societies. The concept of sufficiency appears to be far-reaching and multifaceted. The various conceptions position sufficiency at different levels with respect to policy.

Fischer et al (2013) coined the term 'Eco-sufficiency' (*Öko-suffizienz*) to characterise something that respects the carrying capacity of the Earth. In this state, legitimate efforts should be made to ensure that the needs of all people are met, but all their wants cannot be. Where and how to draw the line between needs and wants, and how to define what is 'enough' are essential and researched issues (e.g. Darby et al 2018, Spengler 2016, Di Giulio et al 2014). Practical attempts have also been made at picturing and quantifying what such a sufficient society could look like (e.g. Druckman et al 2010). There is a shared view that reaching this state requires more than technical efficiency and greener technologies.

When seen as a strategy or process, energy sufficiency means favouring the use of services that are as low energy as possible. Subcategories have been proposed to make the strategy more operational (e.g. in Brischke et al 2016 and others), often articulated around the concepts of:

- Reducing (decreasing ownership and use of energy-intensive goods/services)
- Substituting (replacing highly consuming services by less energy-based ones)
- Better sizing (avoiding energy waste due to oversized services/equipment)
- Sharing (optimising the use of each energy-based service)
- Lifestyle changes (making more profound changes towards low-energy practices and frugality).

A seemingly elegant approach would be to consider sufficiency as a simple extension of efficiency to behaviours. This notion is widespread in the literature on efficiency, yet it runs the risk of falling into the same symptoms as efficiency, which stops short of questioning the root causes that drive our endless thirst for energy services (Shove 2018; Princen 2005). Authors have also investigated what profound societal changes this strategy requires, for instance Schneidewind et al (2014) pointing to the four principles of "less speed", "less distance", "less clutter", and "less market".

Although sufficiency may be stimulated indirectly, many authors consider that the sufficiency strategy necessarily involves some intentionality (Linz 2017; Vivanco et al 2016; Stengel 2013). It can go as far as 'voluntary simplicity' or downshifting, with a strong engagement and a profound reassessment of personal or collective priorities. Whatever the degree, it assumes a sufficiency-driven mindset or orientation (Fischer et al 2013). Muller at al (2016) argue that this can only happen if sufficiency is not just seen as a policy goal (as efficiency), but promoted as a core value of our liberal societies, as paramount as freedom and social justice (thus above policy-making). It remains to be seen how far these values can coexist (Heindl et al 2016). Some authors go even further by attaching a moral dimension to the concept, equating sufficiency to a new definition of the 'Good life' (Schneidewind et al 2014). In this case however, the role of policy in shaping such a cardinal value is open to debate (Ekardt 2016).

THEME 2 – THE CHALLENGE OF MODELLING SUFFICIENCY AND ITS POTENTIALS

In order to be acknowledged by policy-makers, sufficiency (as any other topic) needs to be formally visible in usual decision-making tools, such as policy scenarios and potential assessments.

It appears that so far the contribution of sufficiency to sustainability goals has been largely overlooked and remains a blindspot in most mainstream energy scenarios (Samadi et al 2016). Nevertheless, things are changing with an increasing number of authors proposing that sufficiency strategies (or more prosaically a greater focus on energy services) are accounted for,

2. https://www.researchgate.net/project/ENOUGH-International-network-for-sufficiency-research-policy

garnering more assessments and research (Creutzig et al 2016; Grubler et al 2018).

Existing scenarios, models and studies that have quantified sufficiency potentials one way or another generally concur on the significance of the sufficiency wedge, with cuts on final energy demand ranging from 20 to 40 % by 2050 and commensurate with those achievable through efficiency (négaWatt 2018; Virage Energie 2016; Fischer et al 2016; Lehmann et al 2015; Pfäffli 2012; etc.).

Weaknesses in such potential assessments have been spotted though:

- Due to insufficient backing, they often remain quite normative in that they fail to display and quantify the causal chains needed to concretise them (Zell-Ziegler et al 2018).
- There are biases in terms of sectors covered: households and personal mobility are preponderant (Samadi et al 2018), whereas very scarce research is available on other sectors (e.g. only Bocken et al 2016 was identified on sufficiency in business strategies).
- Last, sufficiency-based scenarios are still quite divergent in terms of methodology and assumptions.

Discussions emerge on how to overcome these issues, as well as recommendations to increase the quality and credibility of sufficiency potential quantifications (Toulouse et al 2019; Zell-Ziegler et al 2018).

THEME 3 – UNDERSTANDING THE BARRIERS TO SUFFICIENCY DIFFUSION

It is plain for authors that sufficiency often goes against the mainstream worldview and dominant social paradigm based on consumerism and materialism, pushing for increased uses of energy-intensive services (Lorek et al 2013, Jackson 2009, Princen et al 2002, etc.).

There is also a recognition of the responsibility of the current economic system, and how its economic growth is defined and achieved, as a barrier to sufficiency. As an illustration among others, containing the increase of average dwelling space per capita is an exemplary sufficiency goal. However, the financial advantage of many key actors in the sector is to do the opposite: from architects, municipalities, banks and real estate agents (Brown 2018), to consumers, and tenants who remain in old dwellings that are larger than they really need (Ropke et al 2018).

Beyond the current structures of economic and financial gains, there are other barriers to consider:

- A relative invisibility and intangibility of energy use in daily practices and routines, making it difficult to realise the savings opportunities (Zélem 2010).
- Even when the potentials are acknowledged, a possibly negative perception of sufficiency as encompassing some loss (in comfort, welfare, utility) (Figge et al 2014).
- Some resistance to change in daily practices (Aro 2017), leading to gaps between knowledge and action (Kollmuss et al 2010).
- Even when people or organisations engage in sufficiency, there are difficulties in reaching advanced levels of implementation due to socio-technical lock-in effects, and the weight of social norms and social imaginaries (Cherrier et al 2012). Social norms and wants poorly compatible with sufficiency are often supported by mainstream media and marketing, in the way they promote certain lifestyles as desirable or even normal (e.g. large luxury flats, immoderate use of digital technologies, globe-trotting, etc.).

As a result of these barriers, the social acceptance of sufficiency is problematic. However, it varies according to the aspects and degrees, as a survey in Switzerland about preferences for sufficient lifestyles has revealed (Moser et al 2015). Acceptance issues appear exacerbated among policy-makers, as reflected by the limited number of occurrences and decisions. Arguments about perceived threats for the economy, and reluctance to interfere in consumer freedom and demand are frequent (Akenji 2014). As an illustration, a survey in Finland among decision-makers showed an overly negative view on a policy option to reduce the size of apartments (Ahvenharju, 2018).

THEME 4 – APPROACHES TO STIMULATE ENERGY SUFFICIENCY

Social innovation theories suggest that for a value such as sufficiency to shift from niche to dominant in the social paradigm, it requires to be acknowledged and promoted by decision-makers and cultural leaders (Virage Energie 2016).

Other interventions supporting sufficiency can aim at influencing the factors that affect the consumption of energy services (in terms of quantity and quality). The literature on energy use behaviour is ample, and two main framings from the perspective of policy-making can be distinguished (Spurling et al 2013). The first one, centred on choices, draws from social psychology, behavioural economics, and energy studies. It sees people as individual decision-makers but also part of social groups. Authors usually analyse how attitudes, behavioural costs, and financial costs can be influenced to induce change. They study the relevance of e.g. financial schemes, social competition, environmental education, gamification, etc. Nudge theory is a part of these approaches (Thaler et al 2008).

The second framing, considering the limits of the previous one (Shove 2010), insists on the habitual and routinised aspects of daily energy using practices (e.g. Shove et al 2014). In these theories, the complex intertwining of what shapes practices suggest that more than one element must be addressed to foster change (skills, social norms, material arrangements, etc.) (Sahakian et al 2014). A shift to sufficiency therefore requires a modification of framework conditions (Schneidewind et al 2014), in order to recraft and substitute practices, and change how they interlock (Spurling et al 2013). Cycling is a good example: it requires skills, infrastructures, and the normalisation of a bike culture.

Whatever the approach, policy interventions are usually seen as relevant instruments to influence behaviours and change practice conditions. Research investigates the conditions for success in shifting e.g. social norms (Nyborg et al 2016) or expanding the too narrow traditional scope of policies on energy demand (Royston et al 2018). However, the stage of concrete and consensual policy formulations is rather in its infancy. Some authors have proposed sufficiency policy packages (Thomas et al 2018) and policy options at various levels (FoEE 2018; Toulouse et al 2017; Bertoldi 2017; etc.), building on existing regulatory frameworks or social innovations (Lorek et al 2017).

Priority topics and areas for research according to the scholars

The literature overview in the previous part gives a first sense of the topics, issues, and research areas that have been investigated so far, and that can usefully inform policy-making activities. In order to dig deeper into the question of how research could do better, we have asked the most active experts in the field to give us their views and opinions. An online questionnaire was developed in December 2018 by the authors of the paper, and over a hundred scholars were invited to participate. They were identified as scientifically productive or knowledgeable persons on sufficiency, based on their work (publications and research projects) and/or interest in being part of the ENOUGH network.

Four questions were asked:

1. What are the priority topics / research questions that you think should be addressed on energy sufficiency?
2. What are in your opinion (or based on your research) promising policy options to stimulate sufficiency?
3. What barriers could research help overcome in the design or implementation of such policies?
4. What are your top recommendations to make sufficiency research more visible and impactful?

OVERVIEW OF THE RESPONDENTS

42 answers have been received to our questionnaire, and are analysed below. The respondents include members of universities (43 %), research institutes (36 %), NGOs/IGOs (7 %), and independent experts (14 %). Disciplines are varied, as shown in Figure 1.

There is a clear bias towards the European scene: respondents are mostly located in Germany, France, Switzerland and neighbouring countries. Only 7 % are outside the continent. This can be explained by the quite Eurocentric initial set up of the ENOUGH network, and the fact that the term 'sufficiency' is seldom used elsewhere as of yet.

It is interesting to note that more than half of the respondents (52 %) are currently preparing publications in relation to sufficiency.

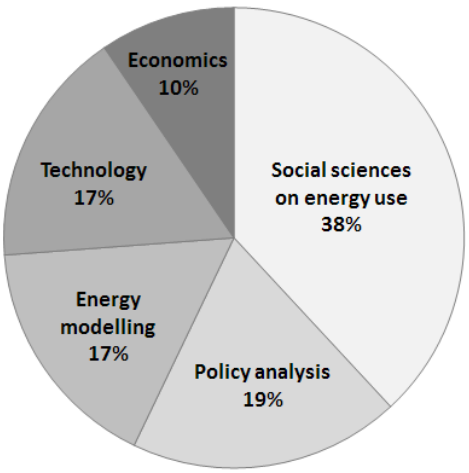

Figure 1.Fields of research/expertise of the respondents

As it was not possible within the space of this paper to reproduce in full detail all the questionnaires received, we are providing a synthesis that we have tried to make as representative as possible of the 42 answers. A few precise illustrations or quotes are sometimes added in italics; we chose them because we considered them particularly interesting, innovative or thought-provoking, however they display only a fraction of the full material gathered.

PRESSING PRIORITIES FOR FUTURE RESEARCH

On a conceptual level, a need was expressed by some respondents to further sufficiency definitions in relation to worldviews, dominant ontologies and epistemologies, and go beyond definitions restricted to material and energy terms. Systemic approaches accounting for infrastructures, institutions, social organization, and social norms should be further investigated, as well as the ways in which sufficiency might be related to human wellbeing and the 'good life'.

> For example, one respondent suggested a stronger focus not only on consumption domains, but more broadly on what the IPCC's 1.5 °C report mentions as "societal transformation" involving systems of production, distribution, and consumption.

In relation to this, theories of change could be further developed to uncover opportunities for promoting sufficiency, and notably characterise the differences and specificities of individual versus collective interactions.

Another strong emphasis was on grasping the barriers to sufficiency diffusion and the way to overcome them. The priority topics mentioned are:

- Understanding cultural, social and psychological factors
- Accounting for power dynamics and better identifying who might benefit or lose from sufficiency (the role of the economy, industries, companies, etc.)
- Defining quantitative and qualitative indicators of sufficiency (policies), including macroeconomic impacts
- Integrating energy sufficiency systematically into energy modelling and policy scenarios
- Understanding how acceptance could be further promoted towards the normalisation of sufficiency (in relation to life stages and settings; and through narratives and other tools)
- Analysing examples of sufficiency policies which have worked, and why.

When it comes to practical areas, the most often cited ones for future research are listed in Table 1.

PROMISING POLICY OPTIONS FOR ENERGY SUFFICIENCY

To the question on how best to stimulate sufficiency, respondents listed several policy options, that can be classified in five categories.

Macroeconomic policies

Overarching approaches were mentioned, such as the internalisation of externalities via taxes on energy and resources. Caps on carbon or energy consumption could also be considered,

Table 1. Priority areas for research according to the questionnaire respondents.

Area	Examples of topics mentioned
Mobility	Reduced car dependency, road traffic avoidance, short-distance city planning, pedestrian and cycling promotion, lowered air traffic, etc.
Heating and cooling spaces	Both the issue of upper limits of energy usage, but also the option of reducing per capita living space
Work and income	Uncovering the links between unequal income distribution and sufficiency potential, opportunity for a reduction in working time to support energy sufficiency, conceivability of a maximum income level, etc.
Food	Although this area was given less priority, it has been mentioned nonetheless in relation to shifts to vegetarian, regional, seasonal and organic diets

either economy wide or through personally tradable permits. Another approach at the individual level would be progressive energy tariffs.

> One respondent framed this approach more generally as a basic 'physical income' combined with a progressive system for the demand above this basic income.

Policy ideas in non-energy areas were also proposed, such as reducing working time and incomes.

Communication and information policies

Communication and advertising can be used to underline the benefits of sufficiency practices. Case studies of pioneers can also inspire a broader public. Such tools may also be used to discourage energy-intensive practices.

> A respondent highlighted the Swedish Flygskam ('Fly shame') campaign, led by a celebrity athlete, to reduce air travel[3] as an example of such public communication approaches.

Nevertheless, the majority of communication and advertising today remains in support of consumerist lifestyles, thus some form of limitation or ban on commercial advertising was also highlighted.

Housing policies

The reduction of the average living space per person was often referred to as a sufficiency goal which can be stimulated by various instruments. Subsidy schemes could be introduced. Several types of building regulations at regional and local levels were also proposed. The example of the Geneva Canton (Switzerland) was mentioned where upper limits to housing area per person for new residential developments are in place, raising important questions about how much space is needed per person, and how such decisions are made. Financial support for housing innovations (that enable living in less space per person and the adaptation of living space) was also brought up, as well as tax adjustments to encourage the voluntary reduction of housing space.

3. https://en.reset.org/blog/flygskam-flying-shame-movement-thats-taking-over-sweden-12112018

Product policies

Policy frameworks covering products (such as the EU energy labelling and ecodesign regulations) provide opportunities to encourage more energy sufficient behaviours. Suggestions included:

- Absolute caps on energy use (e.g. vacuum cleaners)
- More progressive efficiency standards
- Provisions on product settings to ensure that products are set by default in ways that avoid unnecessary services/functionalities and thus energy use
- Standards on material efficiency (increased repairability, reusability…)

On the latter, other policies could be relevant such as supporting repair-cafés, sharing systems, as well as sales taxes to make repairing more attractive than buying whenever relevant.

Local planning policies

Some respondents emphasised the need for changes in urban development. These changes should aim at making it easier to favour sufficient practices over more energy and resource intensive ones. Examples focus mainly on mobility, through investments and improvements in public transport, cycling and walking.

On the other hand, a limitation of parking spaces would be a way of reducing the attractiveness of individual cars. Urban development and planning should generally refocus on shortening distances in cities.

ON KEY BARRIERS THAT RESEARCH NEEDS TO HELP OVERCOME

First, some respondents highlighted the need for research to help uncover how social wellbeing and justice can be achieved under ecological constraints and with limited resources, or characterising the ideal sufficiency state and describing what it means in terms of societies and lifestyles.

It was also suggested by some respondents that research could help to produce evidence to challenge some usual objections to sufficiency:

- Building on the advances in macro ecological economics (notably Peter Victors and Tim Jackson's work on prosperity, Kate Raworth's work on doughnut economics, and the associated calculations made by colleagues at the University of Leeds[4]), more research could be carried out to assess some of the arguments about the supposed risks that sufficiency would pose for the current economic system. This could involve e.g. credible impact assessments, economic modelling, and clearer orientation on upper and lower limits.
- In order to contest dominant energy-intensive social norms, research contributions could showcase how reasonable levels of comfort may be reached with less resource use, thus questioning collective conventions around e.g. heating and cooling.
- Accounting for power dynamics is another barrier to be overcome, which involves understanding 'weak' stakeholder perspectives, and how to address them. Collaboration with political economy and political ecology scientists was suggested as a way forward.

Research was also called by respondents for widening the scope and avoiding a too narrow focus on individual change, as collective and social factors appear very relevant. Providing evidence of such changes, showcasing best practices, and communicating around positive trends could also contribute to lowering some barriers. It was mentioned that scholars could focus more on the amplification of such research results and findings.

How can research be more impactful on policy-making?

In this last part, we build both on the questionnaire answers and our experience as an expert network to offer some recommendations on how research could be more visible and influential on policy-making. Sufficiency policy is in its infancy on several aspects, and it is therefore important for research to play a role in informing policy-making.

COORDINATING AND INCREASING EXPERTISE

In order to reach a 'critical mass', sufficiency research first requires a wider coordination. This can be achieved through:

- Increasing interdisciplinarity, involving researchers working in the fields of climate change mitigation, sustainable consumption, human development, ecological economics, energy modelling, industrial ecology, social change, behaviour change, social and global justice, marketing, and adjacent fields
- Setting up networks and shared platforms
- Developing highly-visible international projects and expert databases
- Building up strong citation networks to raise academic ranking
- Developing a shared agenda for sufficiency research to inspire colleagues, post-grad students, etc.
- Building links and alliances with other expert communities (engineers, architects, frontrunner companies, consumer groups, NGOs, policy advocates, etc.)

The ENOUGH network, established in 2017, aims to contribute to the above-mentioned tasks, although it is a community in the making and would need further outreach to engage a wide range of scholars and practitioners in sufficiency research and policy-making.

Funding is also an essential aspect if sufficiency research is to be enhanced and consolidated. Dedicated support programmes on sufficiency are needed, as well more room for sufficiency approaches in mainstream research programmes on energy and sustainability (beyond pure behavioural change for efficiency).

> One respondent also suggested the creation of a prestigious 'Sufficiency Grant' (providing funding for a team of researchers for some time).

DIFFUSING RESEARCH

Research on sufficiency generally lacks visibility. Possible ways of amplifying and diffusing research on the sufficiency topic involves:

- Increasing publications, conferences and special issues (both in terms of quantity and quality)
- Inviting a broader community to sufficiency conferences and workshops, to increase interdisciplinary exchanges
- Maintaining an up-to-date bibliography on sufficiency (which ENOUGH plans to contribute to)
- Integrating the scope and vocabulary of sufficiency in the institutions working on efficiency and the broader movements on sustainability
- Possibly setting up a journal for (energy) sufficiency

The sufficiency concept also needs to reach out to a broader non-academic audience. Articles in newspapers, influent blogs, social media, lifestyle magazines, etc. could emphasize the relevance of sufficiency-oriented behaviour. Scholars can also participate in public debates. Civil society organisations active on sustainability, social justice, degrowth, and development could also be interesting promoters of sufficiency research findings.

The way to communicate on sufficiency should be carefully looked at. Positive formulations – placing sufficiency in the broader context of better living, and pitching it as an emerging lifestyle trend – may help counteract discourses that merely depict it as renunciation or asceticism. Highlighting co-benefits (at individual and societal level) and promoting notions of justice and wellbeing as essential to sufficiency were also recommended by some respondents.

> One respondent encapsulated it as: 'show images of happy people living with few things vs unhappy people in affluent societies'.

4. https://goodlife.leeds.ac.uk/countries/

TARGETING DECISION-MAKERS

Policy-makers are a specific audience, often with a reluctance or disregard towards sufficiency discourses. They focus on the needs of the economy and the individual consumer-citizen, but do not relate these dimensions to the bigger picture and ecological limits. Several approaches are conceivable to increase their interest in sufficiency.

- As an initial step, research may reveal how far sufficiency is required to make energy efficiency truly effective in limiting overall energy use. Efficiency has progressively become an acknowledged and nearly mainstream goal for policy intervention, and much is expected from it to achieve sustainability. But limitations, such as rebound effects (i.e. the potential increased use of energy services as they become more efficient), are not sufficiently considered or understood.
- There is also a needed step to 'de-demonise' sufficiency in the eyes of decision-makers. It may be done by debunking the myths that people are not interested in shifting to more sustainable lifestyles, and that energy consumption is freely and consciously decided. Evidence that sufficiency elements have been here for quite some time already in some existing national and local policy packages and business strategies may also be put forward (e.g. measures dating from last century's oil crisis).
- Considering the importance of assessments and quantifications in policy nowadays, research and modelling expertise has a role to play in confronting decision-makers with the potentials of sufficiency. Hence, the importance of systematising the consideration of sufficiency in the scope of climate and energy transition scenarios, and investigating how to increase the robustness and credibility of potential assessments. Working on definitions, indicators and methodological approaches are relevant areas for this. In particular, a shift from relative consumption and pollution indicators to absolute ones could help concretise the issue.
- It would also be useful to help decision-makers understand which actors have the power and (more or less) hidden agenda to hinder a shift towards sufficiency. This could be done by e.g. investigating more in-depth what sufficiency trends would change in the economy.
- Tied to the above could be a focus on engaging diverse actors in transdisciplinary and participative approaches, involving everyday people, civil society, the private sector, researchers and policy-makers, to start discussions on human needs in the context of sustainability.

Conclusion

This paper has highlighted a number of ideas to further develop research on energy sufficiency, fill some gaps, and render results more impactful – particularly in the policy arena. Although the term and concept of 'sufficiency' are not new, and have been mentioned by pioneer authors decades ago, it is clear that research in this field and its findings have not been popularised as of yet, as illustrated by the limited coverage of this sustainability strategy in authoritative reports (e.g. IPCC) and energy transition scenarios so far.

There is therefore a long road ahead, but also a significant increase in academic references and research projects that focus on sufficiency in the last years . We trust that the creation of the ENOUGH network and the publication of this overview will be milestones towards engaging more scholars and institutions, and reaching a 'critical mass' of research on sufficiency policy-making. More exchanges and cooperation among researchers are needed to build momentum around sufficiency and increase the visibility and impact of this research.

The constitution of ENOUGH currently suffers from Eurocentrism, as does the bulk of publications on sufficiency and the use of the term included in this review. Efforts should be made to enlarge the geographical scope, notably reaching out to researchers in developing countries and from more varied cultural backgrounds. Exploratory research on sufficient lifestyles, as well as investigations on the best policy portfolios to promote them, would certainly benefit from such a widening of the scope.

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