Benchmarking sufficiency assumptions: Comparison of energy and climate scenarios and build-up of a sufficiency potential database

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Abstract:

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1 Introduction

Sufficiency is a key strategy to achieve net zero GHG emissions and other sustainability goals. Despite its potential to reduce energy demand, it is still underrepresented in energy and climate scenarios. This is partly because there is often a misunderstanding that sufficiency is an individual consumption decision that cannot be reliably controlled by policy, and partly because the quantified potentials of sufficiency are too little known. However, recent studies have shown that demand-side solutions are compatible with a high level of prosperity, and that - as with other strategies - a broad policy instrument mix is available to set the framework and remove barriers to sufficiency [1]–[4]. Sufficiency is thus desirable and designable and needs to be both quantified in modelling and implemented in policy. This insight was partly taken into account in the latest IPCC report [5], which published aggregated potentials of demand-side mitigation options, including sufficiency options. However, due to their high degree of aggregation, these potentials are not yet readily usable, especially for in-depth modelling. Therefore, we provide and compare quantified sufficiency potentials from energy and climate scenarios in a structure database. The potentials can be used as inputs for modelling as well as for policy design.

2 Methods

In a first step, we researched existing ambitious scenarios (net zero and 1.5 degrees compatible with a focus on Germany and comparable countries as well as EU and global studies) that explicitly consider demand-side options. In order to make the sufficiency assumptions and results comparable and transparent, we have derived sufficiency indicators for all sectors. The scenarios are analysed for the target years 2045/2050 for the twelve selected sectoral parameters on energy service levels contained therein, such as living space per capita, passenger kilometres travelled, final energy demand per capita overall as well as in the industrial sector and meat consumption per person. The resulting ranges are placed in the context of historical values and equity approaches, so-called ”decent living standards” [6]. Figure 1 shows an example of the results.

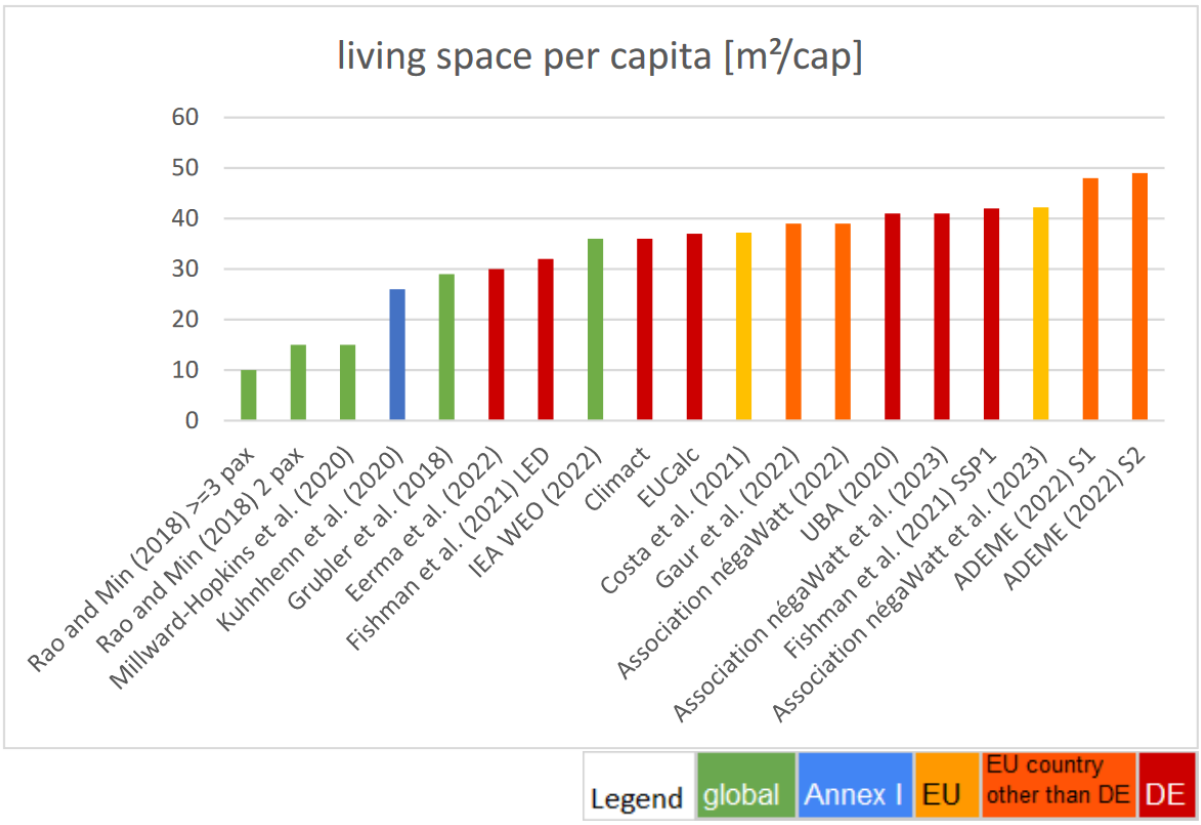

Figure 1. Comparison of assumptions on living space per capita in the year 2045/2050 in various ambitious climate neutrality scenarios

A median of 37 m²/capita is found in the scenario studies (range: 26 - 49 m²/capita), which roughly corresponds to the German average in 1995. The upper end of the range roughly corresponds to the per capita living space in Germany in 2021. An adequate standard of living requires a minimum of 10 to 15 m²/capita to secure basic human needs.

In this way, we want to expand the leeway that modellers have for paramter setting in their scenarios and show which - in terms of sufficiency - ambitious parameters realistic scenarios are based on. With this benchmark, we want to provide knowledge to apply sufficiency mitigation options on par with the other options and thus reduce the sufficiency quantification gap for modelling.

3 Conclusion and outlook

The question that arises is which sufficiency strategies and measures are decisive and to which reduction in demand for energy services they lead. To answer this question, we conduct a systematic review of the peer-reviewed and grey literature on quantified potentials of sufficiency measures in Germany. In doing so, we identified more than 450 literature sources and examined about 50 of them in detail. Based on this data, we are building a sufficiency potential database of studies that quantify the effects empirically or theoretically. The main indicator of this database is the reduction of energy demand, but it also includes greenhouse gas savings and - if available - land, water or cost savings from sufficiency options. This database provides data for researchers, e.g. energy system modellers, to enable the integration of sufficiency options into energy and climate scenarios and the corresponding modelling. The database also serves

as a basis for calculating aggregated sectoral potentials for the case study Germany, which can be used for energy and climate policy advice. In summary, the aim of this work is to make sufficiency applicable as a political strategy by providing knowledge about its potentials and for its consideration in scenarios and modelling.

Author contributions

Conceptualization, F.W., C.Z.-Z., C.B., M.S. ; methodology, F.W., C.Z.-Z., C.B., Y.K., M.S. writing—original draft preparation, F.W., C.Z.-Z.; writing—review and editing, F.W., C.Z.-Z., C.B., Y.K., M.S.

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Competing interests

The authors declare that they have no competing interests.

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