



Sufficiency in energy scenario studies: Taking the potential benefits of lifestyle changes into account



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ABSTRACT

In recent years, a number of energy scenario studies which aim to advise policy makers on appropriate energy policy measures have been developed. These studies highlight changes required to achieve a future energy system that is in line with public policy goals such as reduced greenhouse gas emissions and an affordable energy supply. We argue that behavioural changes towards energy-sufficient lifestyles have considerable potential to contribute to public policy goals and may even be indispensable for achieving some of these goals. This potential should, therefore, be reflected in scenario studies aiming to provide comprehensive advice to policy makers. We analyse the role that energy-sufficient lifestyles play in prominent recent global energy scenario studies and find that these studies largely ignore the potential of possible behavioural changes towards energy-sufficient lifestyles. We also describe how such changes have been considered in several other scenario studies, in order to derive recommendations for the future development of global energy scenarios. We conclude that the inclusion of lifestyle changes in energy scenarios is both possible and useful. Based on our findings, we present some general advice for energy scenario developers on how to better integrate sufficiency into future energy scenario studies in a quantitative manner.

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1. Introduction

In recent years, a number of global, regional and country-level scenario studies which aim to advise policy makers on appropriate energy policy measures have been developed (e.g. European Commission, 2011; IEA, 2015a, 2015b; Jeffries et al., 2011; Nagl et al., 2011; Teske et al., 2015). These studies highlight the changes that are needed to achieve a future energy system in line with public policy goals such as reduced greenhouse gas (GHG) emissions, reduced import dependency and/or an affordable and reliable energy supply. Ideally, such scenario studies should highlight the full range of credible options for achieving these public policy goals available to policy makers and societies, who should then choose the options they deem to be preferable or the most promising (Edenhofer and Kowarsch, 2015).

Lifestyles in which users consume less goods and services, have the potential to make a considerable contribution to achieving public policy goals associated with the energy system (Faber et al., 2012; Hallström

et al., 2015; Stehfest et al., 2009; van Sluisveld et al., 2016). Consequently, it might be expected that available scenario studies investigate to what extent and under what conditions energy-sufficient lifestyles can contribute to these goals. This article analyses whether this potential is actually discussed in prominent global energy scenario studies published by the International Energy Agency (IEA) and others. We contrast our findings from these studies with selected energy and emission scenario studies which explicitly include the role played by energy-sufficient lifestyles in their respective scenarios. This article aims to contribute to the theory and practice of energy scenario development by outlining the advantages of including future lifestyle changes in scenarios in a manner that is conducive to providing good energy policy advice.

In the next section (Section 2), we explain how we define the term “sufficiency” for the purpose of this article. We do so by differentiating sufficiency from efficiency and consistency and describing three types of sufficiency. In Section 3, we discuss key characteristics of energy scenarios and demonstrate why it is important for energy scenario studies to include scenarios highlighting the potential of future changes towards more sustainable lifestyles. In Section 4, we analyse to what extent prominent global energy scenario studies published recently by the IEA and Greenpeace et al. take the potential of sufficiency into account. We contrast the findings of this analysis by describing a number of scenario studies that have assumed considerable future changes towards energy-sufficient lifestyles. Finally, in Section 5, we draw upon

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the findings and arguments presented in the article to derive some general advice for energy scenario developers and the broader research community on how to better integrate sufficiency into future energy scenario studies in a quantitative manner.

2. Defining sufficiency

Depending on the scope of an analysis and the question to be answered, different aspects and boundaries are highlighted in the definition of sufficiency. The scientific discussion on sufficiency as a strategy was, among others, coined by Wolfgang Sachs. He developed the idea that the two strategies of efficiency and sufficiency should be combined. “While efficiency is about doing things right, sufficiency is about doing the right things” (Sachs, 1999).

Two authors who place the ethical dimension of sufficiency at the centre of their research are Princen (2003) and Muller (2009). Both point out that consumption limits should be defined not only on an individual level, but also on a societal one. Princen (2003) argues that “there can be enough and there can be too much.” Defining limits of resource- and energy-intensive behaviour is one of the most difficult and debated aspects of sufficiency. Even though there might be a broad consensus in the literature of the existence of certain thresholds, determining these thresholds is highly contested. Muller (2009) holds the view that energy sufficiency is a duty of all liberal societies to ensure social justice and to avoid external impacts from energy consumption which are harmful to other people.

There is a consensus among supporters of sufficiency that it can result in wellbeing and satisfaction. “Sustainable sufficiency is defined as achieving economic objectives consistent with the principle of right livelihood, ensuring the preservation of the natural environment and the welfare of each individual and society at large. [...] The concept of sustainable sufficiency focuses attention on unsustainable consumption patterns within a society obsessed with maximizing short term economic growth whilst ignoring the reality of limits resulting from a finite supply of natural resources” (Lamberton, 2005). This quote indicates that the concept of sufficiency is closely connected to the degrowth paradigm.¹ If widely adopted, sufficiency can be expected to affect economic growth, as it calls for a reduction in consumption levels. There is a debate among researchers whether or not economic activity in affluent societies needs to be reduced in the future in order for human activities to remain within planetary boundaries (Bergh and Kallis, 2012; Jakob and Edenhofer, 2015; Loske, 2015).

For the purpose of this article, sufficiency is especially relevant in regard to its potential to reduce energy consumption. It can be seen as an option to reduce GHG emissions from the energy sector. In the following, we develop a specific definition of sufficiency, bearing in mind how sufficiency can be relevant in the development of energy scenarios. In energy scenarios, political choices for achieving sustainability goals are among the main drivers of the energy system. At the highest level of aggregation, these options can be divided into three pillars: efficiency, consistency and sufficiency. Based on a literature review, these are the three main categories of options for achieving sustainability goals (e.g. Huber, 2000; Linz and Scherhorn, 2011; Mundaca, 2010).

Therefore, sufficiency can best be defined by contrasting it with efficiency and consistency. Efficiency is an option in which the input-output relation is improved (*better*). Fewer inputs of material or energy are needed per service unit, or more services are produced from the same amount of material or energy. Consistency aims at fundamental changes in production and consumption by substituting non-renewable resources with renewable resources (*different from today*). A prominent example is the use of renewable energy sources instead of fossil fuels. The option of sufficiency is linked to the level of demand for goods and services – in this context specifically to the level of

demand for energy-intensive goods and services. This demand should be limited to a level which still allows for a “good life”. In industrialised countries, fulfilling this requirement would certainly lead to a reduction in demand for such goods and services (*less/enough*) (Muller, 2009).

Regarding the implementation of behavioural changes towards energy-sufficient lifestyles, two general leverage points can be identified. On the one hand, there is the purchase, rental and investment phase (e.g. the purchase of a refrigerator, an apartment or a car). In this phase, sufficiency policies target a reduction in the equipment rate and size, or they promote the shared use of goods (“sharing economy”, as opposed to individual ownership). On the other hand, reductions can be made in the usage phase; for example by aiming to reduce journey frequency or length, or by moderating room temperature choice in winter.

In terms of energy scenarios, sufficiency can be categorised by the drivers that foster its implementation. Sufficiency in the context of energy-intensive goods and services can be achieved by:

- A) Modification of individual preferences
A change in the preference structure of individuals, leading to lower levels of consumption or more sustainable consumption patterns, constitutes one type of sufficiency. In this type of sufficiency, changes in consumption are made voluntarily by individuals and are not associated with any kind of sacrifice. The associated preference changes can be the result of cultural changes or changing societal ideas about what constitutes wellbeing and a “good life” (Schneidewind and Zahrnt, 2014). These changes may be triggered by a pioneer group causing others to follow (Linz, 2012). Policy can try to induce preference changes, e.g. through information campaigns or educational initiatives (Jackson, 2005). An example of the modification of individual preferences is a change in vacation patterns, when destinations that can be reached by bicycle or public transport are preferred over destinations that can only be reached by plane.
- B) Modification of relative prices
Consumer demand for goods and services can also be altered by external incentives without the premise of changes in preference structures. Policies can achieve desired changes in the demand for goods and services by changing their relative prices.² An example is an increase in taxation levels for energy or emission-intensive goods and services. It should be noted that political measures taken to influence the relative costs of goods and services should ideally result in market prices that mirror their actual societal costs, as only then do markets lead to a socially optimal allocation of goods and services, according to economic theory (Dahlman, 1979). In other words, any political modification of relative prices should be limited to the internalisation of external effects, such as the health costs associated with air pollution or the climate change damages caused by burning fossil fuels.
- C) Politically imposed bans or limits
It is also possible to bring about a reduction in the demand for energy-intensive goods and services by banning or limiting their sale or use. From a microeconomic point of view, such political measures lead to “forced sufficiency” and have cost impacts by cutting off certain options within consumers’ individual preference structures.³ This third type of sufficiency is, therefore,

² Another way for policy makers to reduce the demand for an environmentally harmful product without restricting its sale is to make an alternative and less environmentally harmful product more attractive. For example, public transport could be improved by increasing its comfort level, its frequency and/or its reliability, ideally leading to a reduction in car use. We consider such changes in goods or services to be a special case within our sufficiency type B.

³ However, it may be justifiable to challenge the typical assumption in economic theory that consumer preferences are formed in a sovereign way and that forced changes necessarily lead to reductions in welfare (e.g. Norton et al., 1998; Penz, 1986; Schubert and Chai, 2012). Furthermore, looking at society as a whole, orders and restrictions may result in positive net effects if they lead to reductions in adverse ecological impacts and if the saved resources are used, for example, to alleviate poverty.

¹ Degrowth can be defined as “the intentional limiting and downscaling of the economy to make it consistent with biophysical boundaries”, (Bergh and Kallis, 2012).

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