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Decreasing energy use in buildings by 50% by 2050 — A backcasting study using stakeholder groups

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ABSTRACT

This paper describes a backcasting study focusing on fulfilment of a national target to decrease energy consumption in residential and commercial buildings by 50% by 2050 compared with the consumption in 1995, and identifying possible measures for achieving it. A method based on a combination of backcasting methodology and focus group methodology was used. Two different scenarios were developed. They were used in discussions with stakeholders in the building sector, to explore and identify measures and actors important for target fulfillment. The main outcomes were ideas for strategies and measures needed to achieve the target. The current potential for target fulfilment was also analysed and discussed. The discussions in the different stakeholder groups were mainly concerned with changes in attitude and behaviour and the need for radical changes in social structures. For example, enhanced communication between actors in the building chain, and the need for relevant feedback in order to illustrate the link between the effort in decreasing energy use and actual outcome. The findings suggest that there is sufficient technical potential to achieve the target by 2050 but that this potential will not be realised to a sufficient extent. Achieving the target would be facilitated by policy that is oriented more towards identifying actors with direct influence to promote change. An analysis of incentives for these actors to act, and how different actors can cooperate for energy-efficient solutions should be integrated into the process of suggesting and implementing policy measures.

1. Introduction

The Swedish national environmental quality objective for "a good built environment" contains an interim target (referred to in this text as the 50/2050 target) stating that total energy consumption per unit area heated in residential and commercial buildings should have decreased by 50% by 2050 compared with the consumption in 1995, and that the dependence on fossil fuels should be broken by 2020 [1]. Today, possibilities exist both for constructing and refurbishing buildings in ways that increase their energy efficiency and for utilising some of the many energy-efficient solutions available or under development. In spite of this, there are indications that the 50/2050 target will be difficult to achieve in 40 years in Sweden, because measures for improving energy efficiency are not being implemented at a pace that is in accord with either the size of the problem or the established goals. The 50/2050 target might appear insufficient in consideration of climate change mitigation efforts, especially in nations where the energy use in buildings is mainly fossil fuel-based. However, it was used in this project for two reasons: This is the national target of the country we studied (Sweden) and a large proportion of the energy used in buildings in Sweden (for electricity, heating and hot water) is already mainly based on sources other than fossil fuels. Furthermore, the target encompasses the whole Swedish building

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stock, and as most of it will still stand in 2050 — achieving the target is a major challenge. Energy efficiency in the Swedish building sector improved during the 1970s and early 1980s but stagnated after that [2]. In order to achieve energy-saving targets and accomplish change, new perspectives and methods aimed at both tackling the problems and facilitating the solutions are needed.

Scenarios can be used to explore possible and desirable futures. Normative scenarios, such as backcasting, can provide an answer to the question of how a specific goal can be achieved [3]. In cases such as this, when goals seem unattainable and substantial transformation is required, backcasting can be a suitable method for exploring different ways of fulfilling the goal. In achieving such changes, complex processes are involved and many stakeholders are affected, and hence the process of finding ways forward should also include stakeholders and actors affected by the process [4]. This paper presents a participative backcasting study using a backcasting methodology framework in combination with stakeholder group interviews to explore changes needed to realise the 50/2050 target. The intention was to test the methodology for involving stakeholders in the process of identifying changes and strategies that could provide input for the authorities involved in the project. Hence, the project would hopefully contribute to the policy formulation processes associated with the 50/2050 target.

1.1. Objectives

The main aims of the study were to analyse potentials for fulfilment of the target of reduced energy consumption in the building stock by 2050; to illustrate target fulfilment in terms of images of the future and to identify changes required to attain elements of those futures. An additional aim was to involve stakeholder groups in the process.

1.2. Our approach to backcasting

As predictions are based on general trends, it is unlikely that they can contribute to solutions that include the breaking of trends, as they are built into the system [5]. The major concern in backcasting is not which futures are likely, but how to attain desirable futures [6], i.e. futures in which our goals are fulfilled. If we explore the feasibility and impacts of those futures we might also have the potential to influence what the future will be like, since what will happen in the future will depend upon the choices and decisions made in the present [7].

According to Dreborg [5], backcasting scenarios should represent solutions to a specified societal problem, in the present paper represented by a potentially unfulfilled environmental target. Backcasting studies can be characterised by specific methodological steps and their sequential order, which can differ between approaches [8]. In some backcasting approaches, e.g. [9,11,12], backcasting is framed as the actual analysis of how to attain desirable futures, i.e. the process of "working backwards from a particular future end-point to the present to determine what policy measures would be required to reach that future" — as it was expressed by Robinson [13, p. 337]. Others focus more on the actual visualisation of futures in which problems are solved or targets fulfilled [14]. These do not dwell much on the process of working backwards from the future but rather identify the possibilities for, and consequences of, any transformations needed. Höjer and Mattson [15, p. 630] argue that "[i]t is not possible to intentionally strive for a certain option, unless the option can be experienced".

We used a backcasting methodology with four main steps (Fig. 1), similar to the methodology proposed by Höjer and Mattson [15]. The first step is to define the problem, including establishment of criteria and targets for what is to be attained. In the second step current trends and forecasts are analysed. If the indication is that targets will not be reached and considerable changes are needed, the study moves to the third step where one or more alternative future images, are developed, in which established targets are attained. The final step is then to analyse how the desirable futures can be realised.

A few Swedish backcasting studies encompassing the building sector have already been carried out, one on reduction of greenhouse gases (GHG) [16] and two on reduction of energy use in the built environment [14,17]. These studies have developed detailed scenarios for energy use in buildings and developments and illustrate possibilities for fulfilling far-reaching targets of reducing both energy consumption and GHG emissions. We were able to lean upon these three studies in the first three backcasting steps, although they have somewhat different system boundaries. However, the last step in backcasting, to analyse how the desirable futures can be realised, was not elaborated on in those studies, so in our approach we placed more emphasis on this last step and less on the first three.

1.3. Our approach to participative backcasting

Participatory research processes can potentially reduce the distance between researchers and end-users through dialogue, and entail continuous learning among all participants [18]. In addition to this reciprocal learning potential and the obvious data input into research,

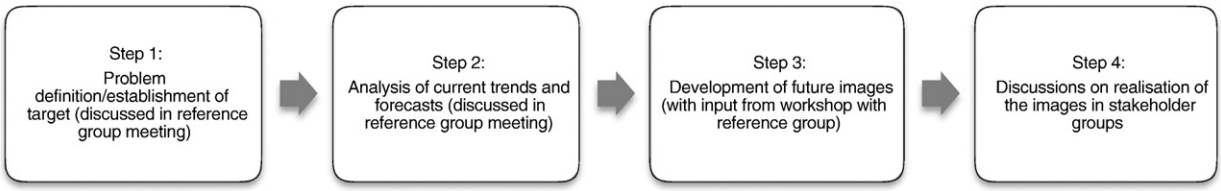

Fig. 1. The four backcasting steps.