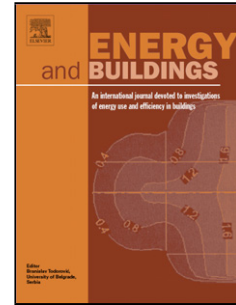


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EVALUATION OF THE RENOVATION OF A DANISH SINGLE-FAMILY HOUSE BASED ON MEASUREMENTS

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Highlights A Danish single-family house renovated for durability, functions and energy

- Simulation of the house before and after renovation
- Measurement of energy and indoor climate for a year before and after
- 53% reduction in heating consumption with better indoor climate
- Mortgage bank estimates increase in house value corresponds to 77% of the investment.

Abstract

Building renovation is too often carried out with only one objective: necessary maintenance, updating design and functions, or reducing energy consumption. But, if a necessary maintenance is exploited as an opportunity for renovation, energy improvements can be implemented, house functions can be updated, and indoor climate improved with minimal nuisance and expense. This paper illustrates this approach by documenting the renovation of a single-family house in Denmark, and monitoring its energy consumption and indoor climate before and after the renovation. Building elements were replaced where necessary, and the total energy consumption was reduced by 23%, giving the house owners a saving of about DKK 8400 per year. The energy consumption for heating was reduced by 53%, close to the 58% found using dynamic simulations. The temperatures reached a more comfortable level, and the house owners were satisfied with the result. The increased value of the house was estimated to cover about 77% of the investment.

Keywords: Measurement and verification; ; ; , simulation, energy renovation, detached single-family house

1 Introduction

The energy renovation of existing building stock is one way to reduce the overall use of fossil fuels and achieve a society based on sustainable energy. The large potential for savings through the renovation of the many single-family houses built in Denmark in the period 1960–1980 has been pointed out by many researchers (Gram-Hanssen 2014; Tommerup and Svendsen 2006; Vanhoutteghem et al. 2009). But while this potential for savings has been supported by simulations and surveys, actual case studies based on measurements are rare. An international literature review by Ma et al. (2012) concludes that while measurement and verification are effective ways of documenting energy savings achieved as a result of renovation, most studies have been based on simulations. There is still a need for more research with practical cases, because the actual savings achieved through energy renovations might not be the same as

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