

Wood burning habits and its effect on the electrical energy demand of a retrofitted Norwegian detached house

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Introduction

Norwegian residential building stock

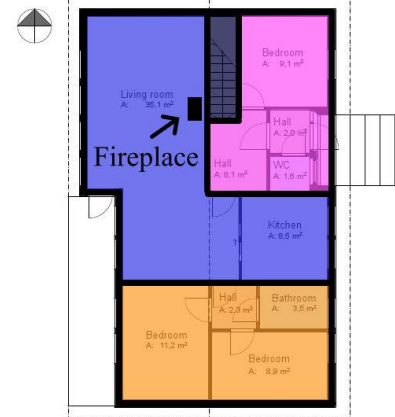
- 75% of all buildings
- Electricity as main heating source
- Use of firewood is popular & renewable

Fireplace behavior

- Limited statistics
- Few studies linking effect of behavior on energy

Case study building

Built year	1960 – 1980 (assumed before 1970)
Location	Trondheim, Norway
Construction	Timber frame and LECA blocks
Space heating source	Electricity and wood stove

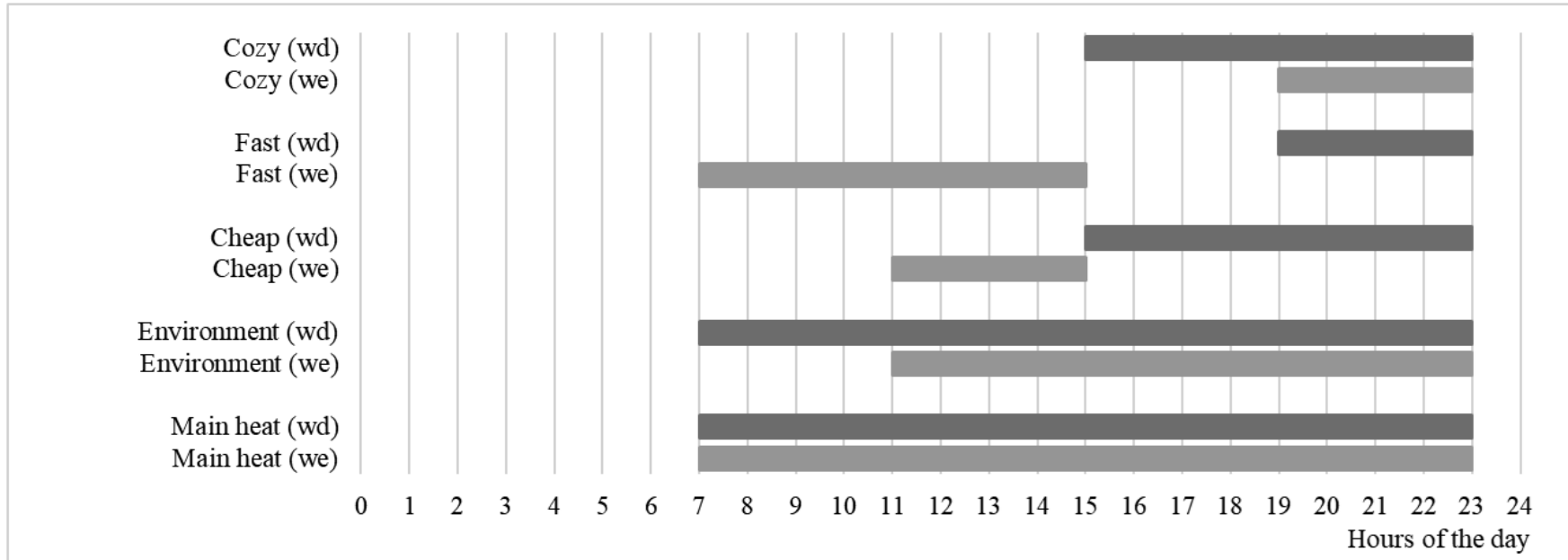


Methodology

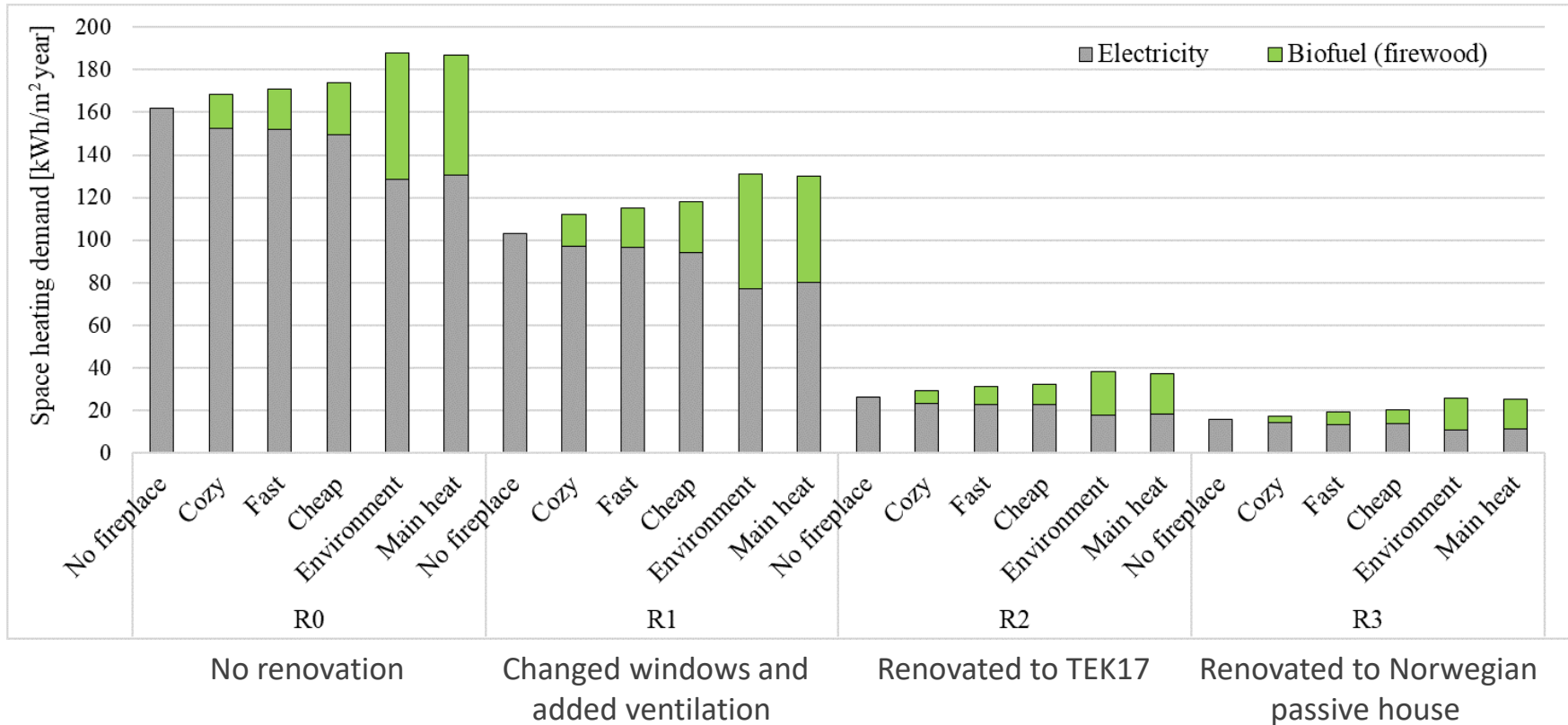
- Survey design “Use of fireplaces in Norway”
- Data analysis with SPSS
- Energy performance simulations and indoor climate assessment with IDA-ICE
 - 4 retrofitting packages
 - 6 fireplace behaviours



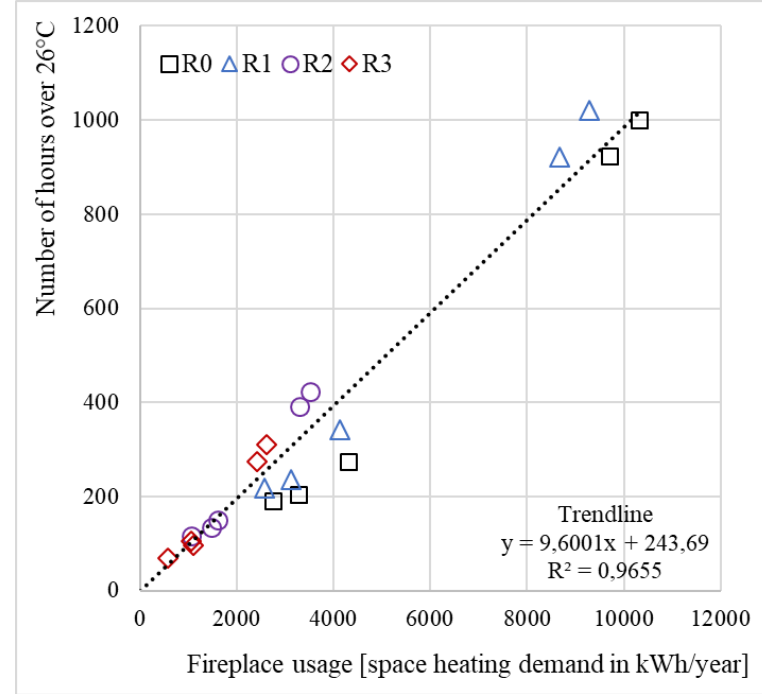
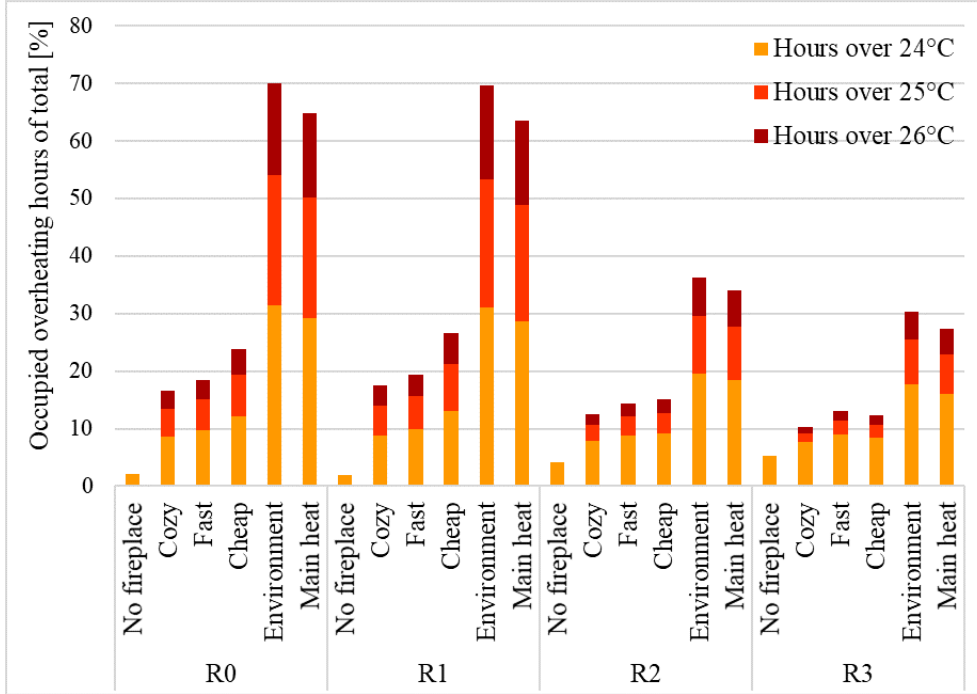
Survey results



Electricity savings



Overheating hours



Important conclusions

- Up to 32% electricity savings by using a wood stove
- Highest percentual reductions achieved after retrofitting to current building standard
- Efficient (retrofitting) measure to save fossil fuels
- Decreased use of wood stove and overheating hours after retrofitting
- More work is needed!

Thank you

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Abstract. Using firewood as a space heating source is a popular solution in Norwegian housing and can significantly reduce the electrical energy demand of houses. This study analysed habits and reasons for using a wood stove from survey data. From this, typical behaviour patterns were defined. These patterns were imported into a building performance simulation model of a typical Norwegian single-family detached house to evaluate the impact of the stove user behaviour on the electrical energy demand and on the overheating risk. Results showed that up to 32% of the electrical energy demand for space heating can be saved using a wood stove. The number of overheating hours increased when the wood stove was used more frequently. However, it decreased after full renovation because the stove is used less often, as the total space heating demand decreases and the indoor temperature drops less often below the temperature set-point when the stove is started. Active use of the wood stove is effective as retrofitting measure when the aim is to save electricity or fossil fuels. Nevertheless, if the stove power is not adapted to the building, it can be challenging to maintain a comfortable temperature in the room.

1. Introduction

Retrofitting the existing building stock has the potential to improve the overall energy efficiency and reduce CO₂-emissions [1]. There is a significant energy saving potential in upgrading housing as around 75% of the building stock is residential [2]. About 40% of the houses in Norway are detached single-family houses built before 1990 [3]. These houses typically have a wood burning stove in addition to electric heaters to cover the space heating demand. This makes it possible to use a renewable energy source for space heating and biofuel currently covers around 16% of the national energy consumption for households [4]. In addition, a wood stove improves the flexibility of the heating system (i.e. the possibility to choose between two heat generation systems) and decreases the dependence on non-renewable resources. Norway wants to increase its use of bioenergy by 2020, and firewood is the most promising bioenergy resource for both small houses and existing buildings without a water-borne heating system [5]. In the building code of 1969, small houses, if not connected to a central heating system, were required a chimney