RENTCAL

European Rental Housing Framework for the Profitability Calculation of Energetic Ret rofitting Investments

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Denmark – Technical Framework

When considering an energy efficiency retrofit within your national housing market, a wide plethora of consideration needs to be made. Below, we list key findings to facilitate your analysis of the retrofit investment. More details and backgrounds can be found on the website www.rentalcal.eu.

Residential buildings and building types in Denmark

- In Denmark, there is a total amount of 2.6 mill. housing units (2015). About 50 % are privately owned houses 7,4% are cooperative housing, 20 % are social housing organisations and another 20 % are privately rented houses.
- The housing stock in Denmark is shared almost fifty-fifty between owner occupied one family houses and rented multifamily houses.
- Relevant building types for the rental housing sector are mainly multi-family houses (560.000 flats mainly in MFH and flats for elderly approx. 80.000 equals 640.000 units – a little less than 50 %). But also single-family-houses and semi-detached houses are rented out (approx. 380.000 people lives in SFH/SDH).
- There was a high building activity before 1900, when the industrialisation made people from the country move into the cities. The activity slowed down during the First and Second World War. But during the 60's and 70's a large number of pre-fabricated, concrete multi-family houses were built to solve the housing problems.
- The main type of façade in the class of residential building has been brick. Brick façade forms 94 % from detached building class, 86% from attached building class and 55% from multi-dwelling buildings, when comparison base was built square meters. Next main façade material is concrete element and light weight concrete (respectively 4%, 11% and 40% in the building types detached, attached and multi-dwelling building). Wood façade remains in very low existence (2% in class detached and attached residential buildings) (Vares & Ketomäki 2015).
- Today 50 % of the heating and hot water supply in Denmark is provided by the district heating system, increasing to 62 % in 2035. The benefits of district heating primarily arise from effects of scale from exploiting solid fuels for combined heat and power, better possibilities of recovering surplus heat, and finally possibilities for increased flexibility and improved integration of wind power in the energy system. With increased focus on effective exploitation of scarce resources, efficient electricity from combined heat and power will be of higher value compared with electricity from condensing power plants, and this will benefit district heating. This will also increase the value of heat pump solutions; both for individual and collective solutions. Individual supply will be particularly favoured where the district heating grid needs high temperatures, which heat pumps in the district heating supply have difficulties providing in an energy-efficient manner (ENS 2016a).
- Ventilation of housing is regulated by the Building Regulations 2015. Demand for new housing is covered by mechanical ventilation. Cooling is almost not used in housing - only for offices and industrial buildings. There is an ongoing discourse in Denmark on the benefits of natural ventilation.
- Based on the owners' indication of where their properties are located, it is estimated that 65 per cent of the housing on average lie in larger cities and their suburbs. Professional landlords have more housing in the larger cities (80 per cent), while the small investors have the most housing in medium and small cities. Owners, who use the houses also for themselves, are most often found in the larger cities, while non-profit landlords are mostly in the small towns.

Energy saving measures and investment costs in Denmark:

- More than 70 per cent of the total current building area and more than 80 per cent of the detached area were built before 1979, i.e. before the building code really embodied energy requirements for new buildings. Many of these buildings need gradually a comprehensive energy renovation. In a number of the old buildings energy improvements have been carried out, but there are still significant opportunities to reduce energy consumption in these buildings.
- This can be illustrated by the fact that the average heating consumption in single-family homes built between 1931 and 1960 today is about 165 kWh per square meter per year, and that buildings constructed before 1979 consumes more than 80 % of the total heat consumption. For existing buildings, the average heat load is approx.135 kWh/m2/a. This can be compared with a new building, constructed according to low energy class 2018. This building will spend about 31 kWh/m2/a.
- In Denmark, the majority of the building stock will still be in use in 2050. That means that in order to achieve the Danish government's target that by 2050 Denmark's energy supply should be covered by renewable energy, a reduction of energy consumption in the existing building stock of approx.. 60 % must be performed. This would be possible and more affordable if the owners of the buildings carry out these energy measures while performing general renovations in their buildings (StEn 2014).

- The typical modernisation is a "package" with exchange of windows, improved insulation, installation of a ventilation system, modernisation of kitchen and bath including exchange of electrical household machines (washing machine, dish washer etc.). If necessary or possible, the heating system will be exchanged as well, and there will be additional installation of solar heating, PV and/or heat pumps.This goes for social as well as privately owned housing. Though the financing is different and influences on the extent to which the houses are renovated.
- Below an overview of energy use after building typology and age
- Average investment costs for maintenance, repair ('anyway costs') and energy saving costs are available for a large number of typical building and system measures.
- Institutional investors
- Mainly financially oriented, the main objective of this investor type is to get the highest rental yields. The fiscal optimisation is an entire part of their core business especially when banks or insurance companies propose to their richest customers financial packages with a tax exemption plan designed to strengthen the financial viability of their investments.

Energy performance calculation methods in Denmark::

- Energy performance is calculated after the criteria in the Building Regulations – the latest has entered into force by 1st January 2018.
- Buildings' energy performance is regulated using the energy frame, which calculates the amount of primary energy that may be used in the building for building operations.
- For new built housing, §259, colleges, hotels and similar buildings, the building's total need for energy for heating, ventilation, cooling and hot water per unit / m² heated floor area (primary energy) can be no more than 30.0 kWh / m² per year, added 1,000 kWh per year divided by the heated floor area.
- The following applies to the use of renovation classes for existing buildings, §280-282:
- - The need for energy must be reduced at least by 30.0 kWh / m² per. year.
- - *Renovation class 2*, when the total need for energy for heating, ventilation, cooling and hot water per day / m² of heated floor area does not exceed 110.0 kWh / m² per square meter a year plus 3,200 kWh per year, year divided by the heated floor area.
- - *Renovation Class 1*, when the total need for energy for heating, ventilation, cooling and hot water per unit / m² of heated floor area does not exceed 52.5 kWh / m² per year, added 1,650 kWh per year divided by the heated floor area.
- Several retrofit tools for energy balance calculation and/ profitability calculation either EXCEL or web based are available.

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