PROJECT:
BREAK-EVEN BETWEEN MATERIAL USE AND ENERGY SAVINGS IN RENOVATIONS

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English summary

Website (DK): https://vbn.aau.dk/en/projects/balancepunkt-mellem-materialeforbrug-og-energibesparelser

The purpose of this project is to examine the break-even in greenhouse (GHG) emissions between material use and energy saving in renovations. The project includes the interventions thermal insulation, windows and photovoltaics (PV). Furthermore, the project seeks to illustrate opportunities as well as obstacles when employing this type of assessments for decision making in consultancy practice.

According to the Danish 2019 Climate Act, Denmark is committed to reduce GHG emissions by 70% in 2030 compared to 1990 and be climate neutral in 2050. It is thus urgent to identify renovation strategies with the highest potential to mitigate GHG emissions in the building stock and thereby use investments most effectively. The building sector is responsible for 40% of the total energy consumption in Denmark. On the other hand, half of all construction activity is related to existing buildings, providing opportunities for cutting operational energy consumption. This would reduce the emissions directly and make the transition towards fossil-free energy supply cheaper.

The project pivots on climate efficiency in building renovation. Viewed from a life cycle perspective, a building's GHG emissions are caused by its erection, operation and demolition. Main impacts of existing buildings, however are related to operational energy consumption. Beyond optimizing building operation, a major potential for cutting GHG emissions in existing buildings is energy conservation through renovation. However, renovations come along with embodied GHG emissions in the added materials. Therefore, interventions have to balance both embodied and operational impacts in order to achieve climate efficient renovations. Climate efficiency has a long- and a short-term perspective. The first one is the total reduction of greenhouse gasses over 50 year's period, while the second one is the speed, how fast renovations reduce the current emissions of existing buildings.

Results regarding renovating with thermal insulation shows a considerable climate efficiency when renovating poorly insulated existing buildings. The choice of insulation material as well as cladding material should be based on a life cycle assessment in order to optimise climate efficiency.

For windows, the primary GHG emission contributor is embodied in the glass, which is why reducing glass thickness and layers is key. Here, some of the analysed buildings show the lowest GHG emissions when combining double glazing towards East, South and West with triple glazing in the North. Also make sure to include solar shading in the equation, so that indoor climate improvements keep from compromising the welcome solar heat gains during the heating season. Unfortunately, lacking environmental product declaration for Danish windows complicate assessments.

The PV study shows that a many PV panels are not climate efficient over 50 years using the data sources available. Generally, thin film cells are more climate efficient than crystalline cells. Producing thinner crystalline cells and applying renewable energy

sources can improve the climate efficiency. Again, there is a lack of environmental product declarations on PV panels used in Denmark. The generic environmental data are not representative for Danish conditions and the data lack transparency.

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