



Case 1 Copenhagen Rymsgade, Denmark

Problem to resolve:

The most common tool for CO₂ reduction in Europe consists in improving the thermal insulation of walls and roofs of old buildings (saving non renewable fuel). In order to avoid condensation of moisture within the walls the insulation is normally fixed on the outside of the building skin. In historic buildings with facing bricks or decorated facades special techniques, like the incorporation of a moisture barrier or a thick layer of light mud plaster allow to place the insulation on the inner side of the wall construction.

TOOL: Thermal roof insulation by adding extra floor

Application:

This listed building in central Copenhagen was poorly insulated and needed to improve its thermal performance. Since this measure required a new roof anyway, the addition of a supplementary floor incorporated the additional roof insulation, provided the finance for the remainder insulation and allowed densification of land use at the same time. In addition, photovoltaic panels alone, fixed on the penthouse roof, reduced energy demand by 5%. All together, the energy demand of this property could be reduced by 73% through the combination of different measures.



Copenhagen Rymsgade.

Photo: Carsten Ingemann



Details:

In Ryesgade, the combination of the renovation and the creation of penthouses serves as a "double" sustainable solution. There is a saving of energy in the existing dwellings, because the new penthouses constitute highly efficient insulation of roof and ceilings. The project also creates "penthouse-based urban densification", expanding the city upwards instead of outwards. This is an advantageous solution: the most sustainable building is that, which does not require any building.

Technical details

The facades of the property are worthy of preservation, so radical external re-insulation was out of the question. But experiments with the indoor climate of the dwellings and internal re-insulation have yielded an impressive result. **Energy consumption in the property in Ryesgade has been reduced by 73%**. With 43.5 kWh/m²/yr., the building almost achieved the intended low-energy class 1 (35.4 kWh/m²/yr.), whereas consumption prior to the renovation was 162 kWh/m²/yr.

The indoor climate of the dwellings was improved by installing a central ventilation system in two stairways and a de-central system in one stairway. The systems are controlled in relation to actual needs, so they provide an excellent indoor climate with no unnecessary loss of heat. When the amount of CO₂ drops in a flat, the system almost shuts down, and when there are people in the flat again, it is activated. The heat, which is extracted, is recovered and used to heat up the intake of fresh air in the dwellings, thus avoiding drops in temperature and draughts. Together with the insulation of water pipes, the ventilation systems have reduced energy consumption by 20%.

Inside, the flats were clad with a 5-cm thermal envelope, before restoring the original plaster. In tandem with the Class A windows, the internal insulation has reduced energy consumption by 27%. Exterior insulation of the firewall against the neighbouring property, together with the horizontal division towards the basement and the insulating effect of the penthouse flats, has reduced consumption by 21%. The remaining 5% of the reduced energy consumption has been created by solar panels on the roof.

The effect, energy consumption, "operational friendliness" and indoor climate in Ryesgade will be recorded and measured in the course of this year. But technologies do not do all the work by themselves. The behaviour of the residents also has a significant impact on energy consumption. That is why it is important to record statistics and provide guidance for the best possible use.

More housing in Copenhagen

It is not a straightforward affair to make such radical upgrades of buildings' energy class. If one is to realise the full potential of roofs, then the municipality must change their focus from the limitations of the past to options of the present, kissing goodbye to older forms of roofing. If one deploys the type of project utilised in Ryesgade, the sale or rental of new penthouses can lead to profits, which can then be used for the renovation of the building below. The typical blocks of flats in Copenhagen from 1850-1950 are completely brick-built, so can easily support one or two more storeys. The Technical University of Denmark have calculated that it is possible to establish enough, new penthouse flats to accommodate 20,000 residents. This amounts to approximately a quarter of the 100,000 new inhabitants, who are expected to move to the capital in the course of the next 10-15 years.

Copenhagen's older blocks of flats provide a unique opportunity to show the world that, by means of the innovative development of buildings and housing blocks, we can **combine strong cultural heritage values with excellent indoor climate**, ambitious environmental and energy-related considerations, providing attractive residential and urban environments for the citizens of tomorrow.

Data:

- Renovations such as this can significantly improve health and comfort in older Copenhagen properties.
- A holistic approach to renovation can usually upgrade an energy class D, E or F building to energy class B.
- Realised: 2012
- Location: Ryesgade 30 A-C, 2200 Copenhagen N
- Size: 2.801 Kvm

Credentials

Principal author

Florian Steinberg

With contributions by Stefan Werner

Edited by Kosta Mathéy