SuRHiB

Sustainable Renovation of Historical Buildings

Concepts, technologies and tools for low energy renovations

This project started in 2008.

Scope of project

Historical buildings count for about 20 % of the existing building stock. Most of these buildings have been built during the 19th century and at the beginning of the 20th century. Many of them are not protected buildings but they are characterizing the centres and history of European cities and are part of our cultural heritage. However, these buildings, if normally heated, cause relatively high energy consumption. Without improving the energy efficiency of historical buildings, this part of our building stock providing 20 % of heated space would be responsible for about 60 % of the thermal energy demand of the total building stock (assuming, the other buildings will be retrofitted according CCEM-Retrofit).

Summary of project

Due to the fact, that the façades of historical buildings should be conserved, the thermal insulation of these buildings becomes more difficult and risky. The moisture balance of walls has to be carefully considered besides the energy balance. Inside insulation that could effectively reduce thermal losses will hinder the drying process of walls. Accumulated moisture could destroy valuable historic façades within short time. A careful risk assessment and robust guidelines have to be developed.

Another, less risky option could be highly insulating light weight plaster finishes that insulate like polystyrene but that are open for moisture diffusion. The development of such a new building material, based on aerogel particles is a central element of the project. It will allow a thermal resistance of ≈ 30 mW/(m·K) and may be applied inside and outside of a wall. This new material will be compared with existing insulation such as mineral wool, wood fibre and cellulose internal insulation materials and the advantages and disadvantages will be evaluated.

In addition, appropriate heating systems and optimal solar integration are studied. Finally, historic buildings will not become zero energy buildings, but will be reasonably energy efficient to be operated and maintained in the future.

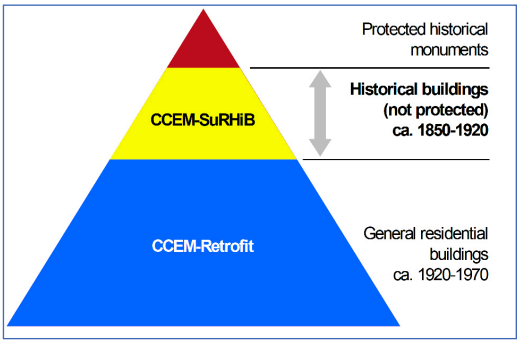

Figure 1: CCEM-SuRHiB is concentrating on nonprotected historical buildings, which are not covered by the CCEM-Retrofit project.

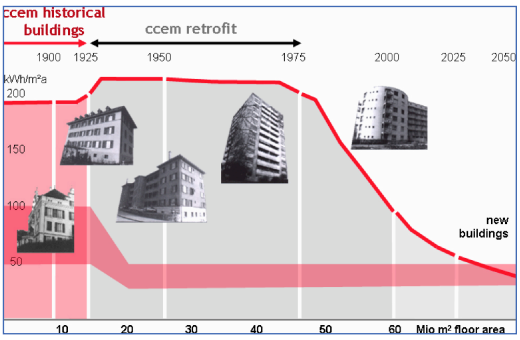

Figure 2: Heat Energy Demand and Heated Floor Area of Dwellings in the Canton of Zurich. The energy consumption of historical buildings should be reduced by 50 – 70 % (50 – 100 kWh/(m²·a))

Goals and activities

The focus is not primarily on protected buildings but on buildings with façades that should be preserved (19th century, beginning of 20th century). The aim is to develop, test and promote low risk solutions that are in line with building preservation and that reduce the ener-

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gy consumption of these buildings by 50 – 70 % (50 – 100 kWh/(m²·a). This will be achieved by reducing the thermal losses of facades to about U ≈ 0.3 W/m²K and by developing suitable concepts for heating, ventilation, humidity control and hot water.

The specific goals are:

- Typology of historic buildings and characterisation of challenges related to low energy renovation, as a knowledge base for the technology development. Overview of measures that have already been done.
- Evaluated methods for risk assessment for building physics performance (as part of proposed IEA Annex RAP-RETRO) and tool set for the performance diagnosis of exposed construction parts (wet heads of wood beams, humidity in masonry walls).
- Highly insulating plaster finish ($\lambda \approx 0.03$ W/(m·K)) based on an optimised aerogel/cement mixture that can be applied as inside or outside layers of about 2 – 6 cm thickness.
- Highly moisture tolerant mortars that allow a rapid and homogeneous distribution of humidity and therefore avoid the risk of local condensation. Evaluation of suitable painting systems and assessment risk reduction.
- Robust concepts for the safe application of high performance thermal insulation (vacuum insulation panels (VIP), aerogel blankets, polyurethane boards, traditional insulation) at inner surfaces, considering façade orientation and driving rain loads, typical thermal bridges, condensation risks, wall cracks and air tightness of constructions.
- Guidelines for low energy heating systems and for humidity control.
- Guidelines for solar system integration in historic sensitive environments.

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