



Abstract Project Analysis Report

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Energetic Rehabilitation of a Residential Building in Ulaanbaatar **Energetic and indoor comfort effects of a building redevelopment in cold arid climate**

Up to 80 percent of the apartment houses in Ulaanbaatar (Mongolia) consist of concrete sandwich panels with 5, 9 or 12 floors. The building concept and its construction are insufficient according to present-day standard. Hence the existing apartments show severe energy losses besides uncomfortable indoor climate conditions and in some cases even mould growth. Within a redevelopment project of the "Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH" in Ulaanbaatar, a selected building was restored as an example with a certain insulation, new windows and a renovated heat supply system. Aim of the project was to show that it is possible even in the coldest capital in the world to improve indoor comfort, hygienic conditions and energy sufficiency to high standard by low budget, using simple methods and available materials. The improvement of the situation was scientifically guided, documented and examined by the IBP. Before and after retrofitting air tightness and thermal conditions of the apartments were measured. Furthermore, the climatic indoor conditions of 18 apartments were logged continuously for almost one year in the rehabilitated house and for comparison in another one, which is structurally identical.

After rehabilitation, which has been finished in September, it was obvious that the energy consumption in autumn has decreased up to 60 % by contrast to the comparison building. In winter time, consumption became equal, but the indoor temperatures were very different. Since the end of September, indoor temperatures decreased in the apartments of the not-rehabilitated building to 16 °C average temperature in January, while it was very comfortable with nearly 25 °C in the retrofitted building.

Beside the reduced energy consumption and the improved indoor comfort also the hygienic situation could be enhanced. For instance, the measured indoor surface temperature of an insulated wall in February was 20.6 °C (air temperature: 22.2 °C, relative humidity: 33 %, dew point:



4.5 °C), while it was 13.8 °C (air temperature: 16.4 °C, relative humidity: 63 %, dew point: 9.5 °C) in the compared building. In that way not only the risk of mould growth could be reduced, but the extreme radiation asymmetry as well providing a more comfortable indoor climate. As further measurements showed, the apartments are much more air-tight after retrofitting than before. The air change rate by infiltration could be reduced explicitly, but there is still a great heat loss through ventilation caused by the inhabitant behaviour of opening the windows. Nevertheless the project shows impressively that simple measures of thermal rehabilitation lead to a significant reduction of energy losses and to an improved indoor climate by low costs.

The measurement data analysis, we did up to now, shows obviously that a lot of heating energy can be saved with simple method, even in the coldest capital in the world. At the same time the indoor comfort increase. We can proceed from the assumption that the heating energy consumption can be reduced to less than one third. Related to the existing 426 similar buildings in Ulaanbaatar that would mean a reduction of approximately more than 800.000 tons of CO₂ emission per year.

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