Monitoring: Project results

Within the framework of the "EnEff:Stadt" support initiative and with funding from the German Federal Ministry of Economics and Technology, the building was evaluated in detail by the Technical University of Berlin within the focal area of energy efficiency for the measures carried out. The most striking exterior feature is the facades that are planted with vegetation on the south-facing side and in the five inner courtyards. A number of innovative measures have also been implemented and evaluated inside the building.

Passive building cooling

Impermeable surfaces such as roofs and roads can change microclimates by altering radiation and energy balance. This results in an increase in temperatures close to buildings and an unpleasant indoor climate and/or an increase in the energy consumption for air-conditioning for buildings. One solution here is greening of buildings and the associated evaporative cooling effect. Roofs without greenery convert 95 % of net radiation into heat, whereas roofs that are extensively planted with vegetation use 70 % of net radiation for evaporation of rainwater in summer. The greening of the facades increase the impact on the building: an average of 280 kWh a day of cooling energy results from evaporation for each facade.

Facade greening

Greening of facades has a direct effect on the energy optimisation of buildings. The facade should be covered in greenery in summer, whereas sunlight can enter through the glass facade in an unhindered manner in winter when there are no leaves on the plants. A second impact is the cooling effect due to evaporative cooling, which improves the microclimate inside the building and directly around the building too. As part of the selection of climbing plants, particular importance was attached to species that can grow in plant tubs under extreme conditions. A special form of irrigation and three different substrates were used for comparative purposes. Facade greening is to be regarded as a very positive measure for saving primary energy for cooling and heating. Eighteen different species of climbing plants were planted in 150 facade tubs on nine different facades. An average of 26 % of primary energy was saved per annum for office rooms on the south-facing facade relative to conventional sun protection. Indeed, the annual average energy saving was 49 % relative to office rooms with no exterior sun protection. The operating costs for facade greening for watering, fertilisers and care were just 10 % of the costs of maintenance and repair for conventional sun protection.

Adiabatic exhaust air cooling

Rainwater is used in air-conditioning systems to cool buildings in the summer months. Adiabatic exhaust air cooling involves water being sprayed into the exhaust air flow from the building and the supply air being pre-cooled by means of a heat exchanger. In the case of external temperature of up to 30 °C, the supply air can be pre-cooled to 20 to 22 °C without having to make use of conventional cooling equipment. When the annual average is considered, around 90 % of the conventional cooling performance of air-conditioning systems can be saved. The evaporation of one cubic metre of rainwater produces 700 kWh of evaporative cooling. With average costs of 63 euros for a compression refrigeration unit and 113 euros for absorption refrigeration for 700 kWh of cooling, electricity costs of 0.74 euros are the only costs that arise for the evaporation of one cubic metre of rainwater. This represents savings of 99 % on operating costs for a process that is also more environmentally friendly.

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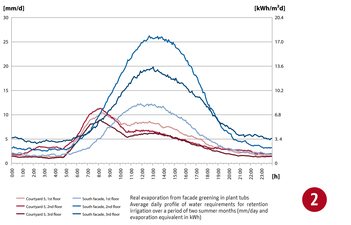
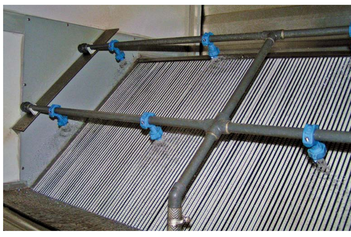


2



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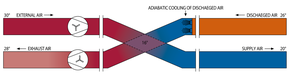
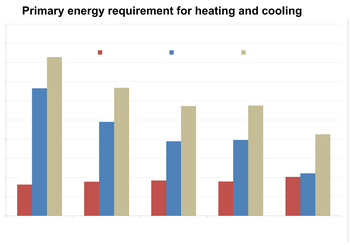


1 **Measuring sensors on the roof of the Department of Physics**

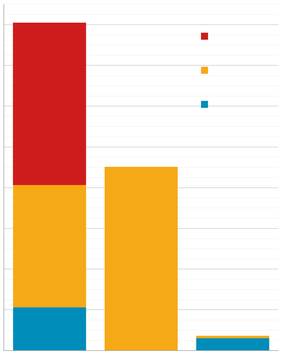
2 **Average evaporation from facade greening Adlershof/Physics 15/7/05–14/9/05**

3 **Adiabatic exhaust air cooling**



Source: TU Berlin (2014): "HighTech-LowEx: Energieeffizienz Berlin Adlershof 2020"; final report

4 **Influence of sun protection system on the primary energy requirement for heating and cooling of a group of office rooms (IBP: 18599) in kWh per square metre per annum**



Source: TU Berlin (2014): "HighTech-LowEx: Energieeffizienz Berlin Adlershof 2020"; final report

5 **Comparison of operating costs for three different refrigeration units at the Department of Physics of Humboldt University Berlin**

Further information:
www.gebaeudekuehlung.de
www.phasenwechsel.com

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