SUMMER COMFORT

in non-residential buildings

Examples from the Allgäu Passive House Provessionals Herz & Lang GmbH

The summer performance plays a special role in the design of a non residential building. As a rule the internal heat gains are normally much higher than that of a residential building. This is due to the denser occupancy and technical equipment. For example in meeting rooms or in an educational building there are certain times of the days that the rooms are densely occupied. In addition normally there is a large glazed area which is desirable for daylight and also for architectural reasons. These large areas of glass of course also bring high solar gains. There are a number of questions that you must ask yourself when planning a building, especially when it's a non residential building: what sun protection is required? Would there be comfort in the summer without active cooling? How high are the energy requirements for the cooling system in rooms with high internal gains? What power must the cooling system provide?

With the Passive House Planning Package (PHPP) (see also the article on page 86) the summer comfort levels can be seen in the form of a monthly balance method. The percentage of time the building is over heated can also be calculated. The Passive House Institute gives the following interpretations for the percent of overheating: 0-2% very good, 2-5% good, 5-10% moderate, 10-15% poor, >15% very poor. The evaluation procedure is however only accurate for spatially uniform conditions in a building.

To obtain exact information about particular rooms at certain times of the year a dynamic building simulation must be carried out. The investment in the calculation usually pays itself off with the results leading to economical solutions arising situations. The application and possibilities of the simulation will be demonstrated in the following article. The article includes two projects where the simulation was implemented. Herz & Lang were consultants on both projects.

House of Energy

This residential and office building from a Tiroler IG member was already mentioned in the 2013 edition. During the planning stage the question of a summer heat protection concept was raised. The main question from

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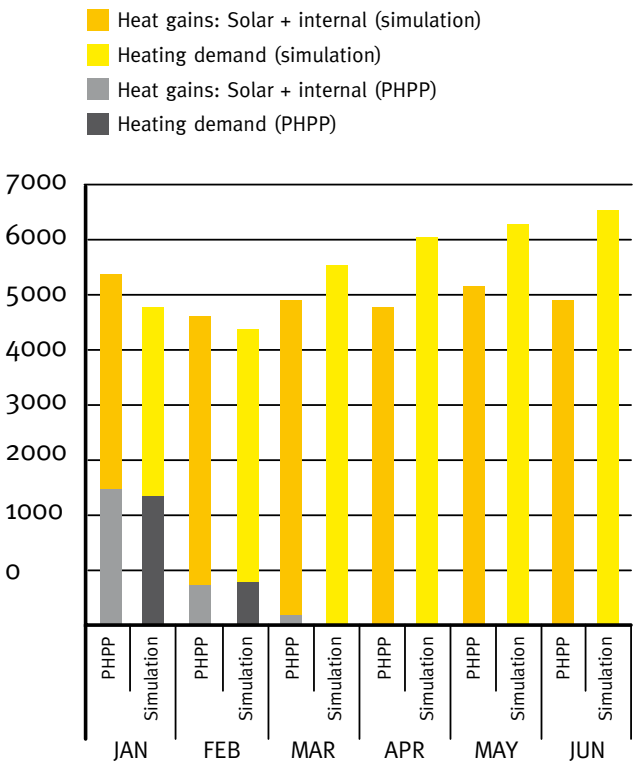

Source: Herz&Lang GmbH

Comparison of PHPP calculation and thermal dynamic simulation for the total building (program IES-VE) based on the monthly results of heat demand and heat gains.

the client was whether or not external blinds were necessary. During the course of the calculations a comparison between the results of the simulation and PHPP was created for the building.

The analysis shows that the simplified modeling of the PHPP provides reliable and realistic results for the heating period. This has been documented many times through research carried out by the Passive House Institute. However some large deviations between the simulation and the PHPP can be seen in the cooling period (summer months). In this case the PHPP is not on the safe side when calculating the percentage of overheating.

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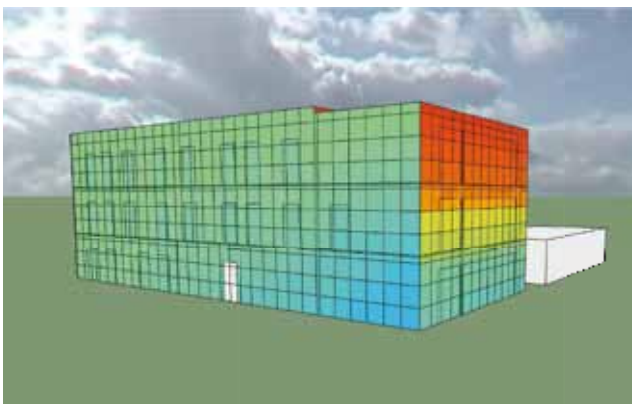


Source: Herz & Lang GmbH

The simulation is perfect to get a closer look at the high summer temperature variations and the thermal mass storage of the building. Following the calculation it was decided that a passive cooling concept would be installed, this system works without external blind and without air conditioning. An advantage with this building was the large office spaces, the open plan concept, the proportion of glass and the east west orientation, all of which had already been designed with the Passive House standard in mind.

> THE ELALUATION SHOWS THAT THE SIMPLIFIED MODELING OF THE PHPP PROVIDES RELIABLE AND REALISTIC RESULTS FOR THE HEATING PERIOD

The minimization of internal loads, particularly in relation to lighting, interior glare protection and a night time ventilation concept form the basis for the use of a passive cooling system. This system works through the use of borehole heat exchangers which ensure thermal comfort during the summer. Only the upper south facing apartment belonging to the managing director has a problem with overheating without an external shading system.

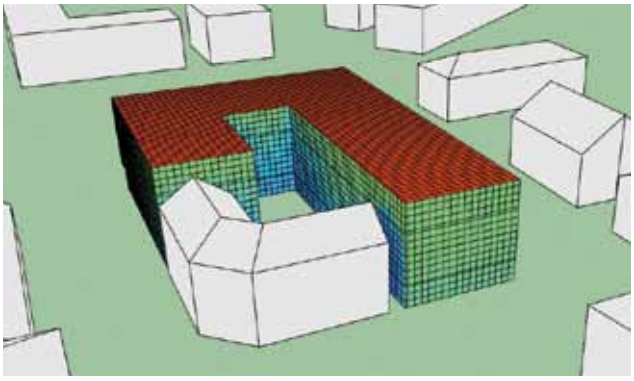
Postquartier Ravensburg

The Postquartier in Ravensburg (Germany) is a U-shaped new building located on the former post office complex, directly at the city train station, which is known primarily for the Ravensburger games. The design was one from a number of designs submitted to an architecture competition. The building is comprised of four heated storeys and an underground basement with some heated adjoining rooms and staircases. There were a number of unavoidable thermal bridges in the underground garage area. This caused a challenge in reaching the Passive House standard. To compensate for the thermal bridges in the garage area a thermal bridge free construction was used on the upper floors by using a highly insulted building envelope. The high internal heat gains from office use ensure a very low residual heat demand in winter. >>

Postquartier Ravensburg, Fa Reisch -. Passive House office building with retail space (in the process of being certified).

Source: berger röcker architekten, stuttgart

> THE RESIDUAL HEAT SUPPLY FOR POSTQUARTIER RAVENSBURG IS SUPPLIED BY PARALLEL SYSTEMS INCLUDING A GAS COMBINED HEAT AND POWER UNIT AND A BRINE HEAT PUMP

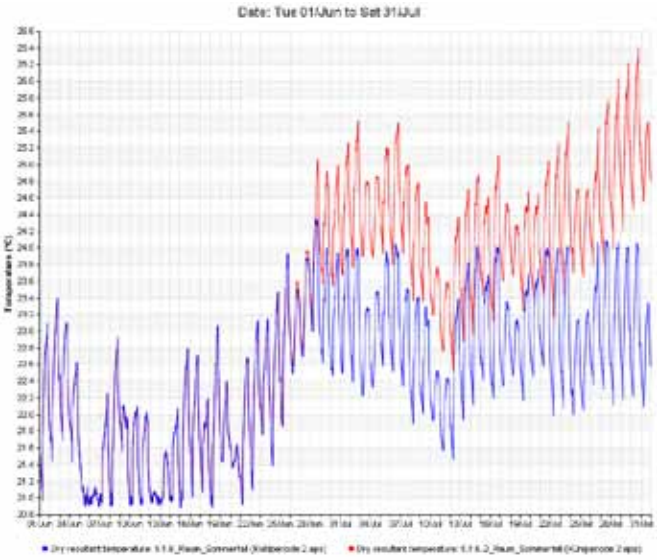


Source: Herz & Lang GmbH

The total solar radiation from 1st June to 30th June in kWh/m² of facade. Only the fixed shading elements are considered here. The movable sun protection measures are not shown.

Great care was taken to reduce the internal heat gain from the appliances, on one hand to reduce primary energy demand and on the other hand to reduce over heating in summer. For this reason LED technology was used throughout the building from the hallway light to the offices to the underground car park. The residual heat supply for the building is supplied by parallel systems i.e. a gas combined heat and power unit and a brine heat pump. The combination was chosen because the energy center must also supply the adjacent historic post office building with higher flow temperatures. The CHP unit provides the building with its own power, which again reduces primary energy. Due to the parallel operation of the CHP and heat pump the self produced electricity can be used to power the heat pump for supplying heat in winter or for cooling in summer.

The active cooling is reduced to a minimum and the passive cooling from the borehole heat exchangers should be fully utilized. As part of the DGnB requirements the building had to remain under 26 0C 95% of the time. To meet this requirement, unlike in the previous project, it was necessary to have an external shading system. External blinds were used on all windows with an orientation controlled automatic system. It was clear from the results of the dynamic building simulation that the DGnB requirements would be met with these measures in place. (See diagram below)



Internal temperature in the cooling period for an office space with and without cooling (blue curve: with cooling, red curve: without cooling).

Source: Herz & Lang GmbH

The dynamic simulation proves to be an ideal tool, in addition to PHPP to secure buildings in their usability and allow the user acceptance while ensuring the efficiency in planning, execution and operation.