NEW DIRECTIONS in Energy Balance

In Friedrichshafen the new Metzstraße Quater has been created, based on the sophisticated Passive House concept

The certified Passive Houses in the Metzstraße neighborhood will primarily accommodate medical practices. The Passive House professionals Herz & Lang from the Allgäu have mastered a number of special challenges in this project. The PHPP calculation was complemented by a dynamic building simulation. Strengths and weaknesses of the two accounting calculations were combined to trim the building's high requirements.

The district Metzstraße is centrally located in Friedrichshafen near the railway station and the waterfront of Lake Constance. As an important district in the urban context, a competition was held to redesign the 4600 m² large area in 2010. The property is built now in line with the competition winners, with a central triangular building consisting of four buildings. It is constructed on two underground garages and up to six storey's tall. The so named Doctors House 1 and 2 were created in the first phase, these primarily include medical practices. The most striking is House 1, directly adjacent to the promenade, the Eckenerstrasse and has a double glazed façade. Additionally a health food store and pharmacy will be located on the ground floor. Given the increasing importance of energy-efficient building the investor, Frankel AG, decided to set the requirement that both houses were to be built as certified Passive Houses and furthermore to achieve the silver certificate from the DGNB (German Sustainable Building Council). The contract for the construction was awarded to the company Reisch, Bad Saulgau.They had previous experience in building to this standard, one such example the Art Museum in Ravensburg, which won the Passive House Award won in 2014.

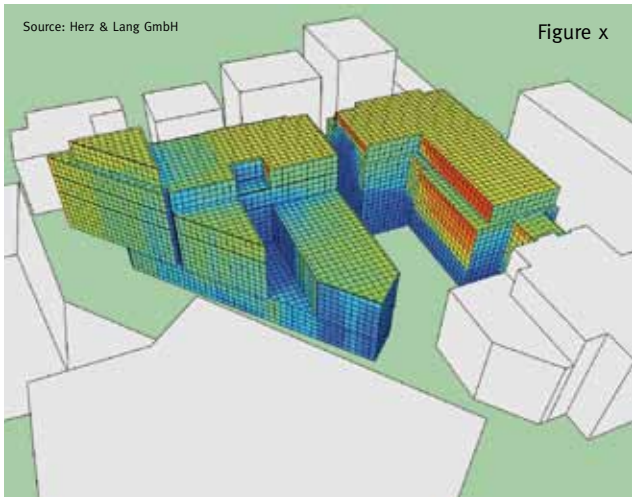
Difficult task for the Passive House Designer

It was an extremely difficult task to achieve the Passive House standard given the complexity of building cubature, the foundation of the garage, the high glass content and the foggy location. This task fell to the designers of Herz & Lang, a member of the IG PH Tirol. For the realization of this standard, new ways were sought in the energy balance. So the PHPP calculation was complemented by a dynamic building simulation. The strengths and weaknesses of the two accounting methods were combined in order to optimize the building to the high demands.

The Passive House Planning Package is the tool for calculating the energy balance in a Passive House. It was developed by the Passive House Institute from a dynamic simulation program. Through this program reliable results can be obtained for monthly heating demand or primary energy demand. >>

The high glass content is partly responsible for the high demands on the Passive House Planning.

Picture: Fränkel AG

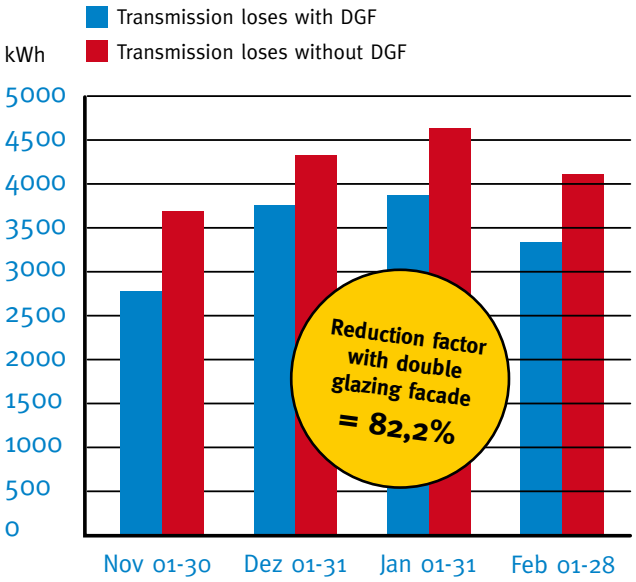


Source: Herz & Lang GmbH

Figure x

Total solar radiation from 1st to 31st December (shading analysis, Quartier Metzstraße).

It is validated by accompanying scientific research and has proven itself time and time again in practice. In order to guarante that the configured values represent the values in practice it is essential to carry out quality control. For planning and quality assurance during construction the PHPP is the best basis. >>



Source: Herz & Lang GmbH

Monthly transmission losses in the heating season with and without double glazing facade (DGF).

For example, the window with all of its components, dimensions and mounting position are entered explicitly. From glazing to frames to individual glass holders, all are accounted for. The Excel tool enables different systems to be simply compared in the planning and tendering phase for the optimum ratio of gains and losses and also the see the cost-benefit aspects.

Thermal dynamic building simulation

The thermal dynamic building simulation is a transient three-dimensional calculation of buildings or parts thereof. It includes all design, plant and machinery components and offers the possibility of reducing the sampling rates to a minute. This allows the user to clearly examine the thermal indoor comfort with respect to the room temperature and the humidity. The dynamic simulation is therefore used mainly with non-residential buildings to accurately examine the summer case. It can then be established whether solar protection devices or cooling devices are necessary or not.

For the DGNB certification thermal comfort is an important criterion, therefore a room by room simulation for the different usage areas was mandatory for the Metzstraße project. The necessary shading study, see Figure x, was evaluated so that the results can be incorporated into the PHPP. Although the simplified algorithms from the PHPP for the shading calculation deliver in terms of the heating demand the results are on the safe side.

When dealing with a built up area, patio situations or projections and recesses in facades, the annual simulation of solar radiation provides more realistic results for the project to optimize and thus save costs.

Heating demand of 15.1 kWh/(m²a)

The shading analysis makes the difficult situation at the triangular "House 1" clear as the building will receive almost no solar gains recorded in the middle of winter due to the neighboring buildings. This places the emphasis on retaining the heat and utilizing the existing internal gains as much as possible. As a key measure to achieve the Passive House standard the double glass facade was closed at both ends. The temperature in this glass space provides a buffing effect. To clearly establish the temperature in this area of the facade the dynamic simulation was used again.

The calculated reduction factor is now part of the zones as established in the Passive House Planning. In the current planning state the building has a heating demand of 15,1 kWh/(m²a). In contrast to other possible measures an economical solution could be found through simulation to achieve the required Passive House standard. >>

The building site in June 2014. The aim is to have the project complete by 2015

> DURING BOTH PLANNING AND CONSTRUCTION THE BEST FOUNDATION FOR QUALITY ASSURANCE IS THE PASSIVE HOUSE PLANNING PACKAGE (PHPP)

Source: Fränkel AG

The closing of the double façade has the additional benefit of increased sound insulation on the busy road. The facade now has opening wings at the lower and upper end and is monitored by temperature and humidity sensors. Through the controlled ventilation there is no humidity on the outer pane in the transitional months and over heating is avoided in summer.

Location: Friedrichshafen, Baden-Württemberg

Usage: Doctors' offices, retail space, offices

Special feature: certifiable Passive House under construction

Construction: Flat roofs, 22-30 cm insulation, U = 0.11 W / (m²K); Concrete frame exterior walls, 30 cm thermal insulation, U = 0,11W / (m²K); Underground garage roof, 30 cm insulation, U = 0,08W / (m²K); Exterior basement walls 20 cm insulation, U = 0,17W / m²K; Mullion and transom curtain wall and window Uw/Ucw (installed) in the medium = 0,69W / (m²K); Incl. Reduction through the double glass facade

Building Services: Brine heat pump, gas-CHP, central comfort ventilation with heat recovery

Construction period: 2013 - 2015

Energy reference area: 2,578 m² (PHPP House 1)

Heating demand: 15 kWh / (m² p/a) (PHPP)

Primary energy requirement: 164 kWh / (m² p/a) (PHPP)

Air tightness: n50 = 0.4 1/h projected

Investor: Frankel AG, Friedrichshafen

General contractor: Georg Reisch GmbH, Bad Saulgau

Architect: Adelheid Maier-Kirmaier, Friedrichshafen

Facade planning: Scharl facade technology, Ehingen

HLS: Greiner & Partner, Immenstaad

Electrical: Engineering Office Schwarz, Friedrichshafen

Site Management: Saile architects, Ravensburg

Structural design: Design office Abts, Friedrichshafen

Passive House: Herz & Lang GmbH, Weitnau Building Physics, Passive House Consulting, Quality assurance, air tightness measurement, simulation