ENERGY BASE, SUSTAINABLE PASSIVHOUSE OFFICE BUILDING

Arch. Dipl. Ing. Ursula Schneider
pos architekten ZT KG, Maria Treu Gasse 3/15, 1080 Wien, Austria, office@pos-architecture.com

1 Building Features

ENERGYbase, a certified passivehouse office building in Vienna with 7.500 m² useful floor area focuses on energy efficiency, users comfort and the use of renewable energy.

1.1 Solar and energy efficient architectural concept

Compact volume and solar orientation of the building shape, high ratio of glazing to provide high daylight quality, still matching PH cooling standard.

Folded south façade with maximum daylight, maximum passive and active solar gains, (400 m² PV, 300 m² solar thermal), maximum sun protection in summer through intelligent design. South facade reacts like a north façade in summer.

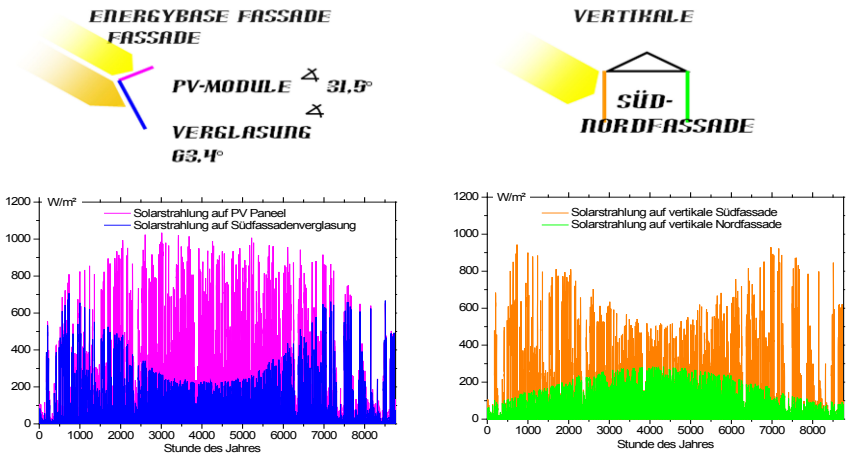


Fig. 1 scomparison of the solar radiation on the glazing and PV panels of energy base (left) and on a normal south/north façade (right).

1.2 Heating and cooling

All the minimum amount of Heating and cooling is done by ground water via heat pumps in winter and free cooling with heat exchanger in sommer.

1.3 End energy demand

The end energy demand for heating, cooling, WW, ventilation, lighting, aux. Energy is 26 kWh/m²,a, 5 of those produced by building integrated PV, 21kWh/m²,are taken out of the net (austrian water power)

1.4 Users comfort

Ecological air humidification by using 500 plants in buffer rooms integrated in the ventilation system (min. 40% rel. humidity in winter)

Energy distribution system operates by using thermal mass activation, therefor high indoor comfort by radiant heating and cooling.

2 Assessment 1: PHPP

The PHPP is an assessment tool which only deals with energy efficiency not with sustainability on the whole. For assessing energy efficiency it is quite a reasonable tool, although it is better designed for housing than for office buildings.

2.1 Internal loads

In the PHPP you are supposed to take 3,5 W/m² as internal loads for office buildings. This is ok for the winter season but for summer it is necessary to take realistic internal loads, which tend to be much higher.

The internal loads of an office building depend very much on how many people are working/m² and what devices they use. In the PHPP you are supposed to take a minimum of 20 m²/person up to 50 m²/pers., and very energy efficient PC devices, whereas in reality you normally have 12m²/person and when the owner lets the building, he has no influence on the efficiency of the PC, printers and so on. So, the internal loads are more than double the ones used in PHPP.

In energy base therefore we did 2 PHPPs. On for winter with internal loads of 3,5 W/m², as is demanded in PHPP, and the second for summer season, where we took realistic internal loads of at least 7,3 W/m². With both heating and cooling demand we match the PH criteria.

2.2 Windows and daylighting:

The passive house institute recommends to have only moderate glazing on the facades to avoid cooling load.

If we only focuss on cooling, minimizing the windows might be a good solution. But as we are dealing also with comfort by day light and working conditions of 500 lux, the matter is to be considered more differentiatedly.

In energy base we use a large amount of glazing (especially on the folded south façade) with very slim frames. In summer the windows on E,W and north sides are shaded

with exterior blinds, the folded south sides shades itself, therefore only needs interior shading against glaring.

By minimizing the frames we can achieve a positive solar gain in the average over all facades. East and west facades have almost equal transmission losses and solar gains, but the large openings to the south (60% of façade) and the smaller openings to the north (30% of façade) provide more solar gains than losses on south and north sides counted together. (even with considering the shadow by neighbouring buildings).

The heating load climbs up to 13,2 W/m², but the daylight conditions are excellent and the cooling demand stays below 15 kWh/m²,a and can be provided very efficiently by ground water. The end energy for cooling is only 1,8 kWh/m²,a.

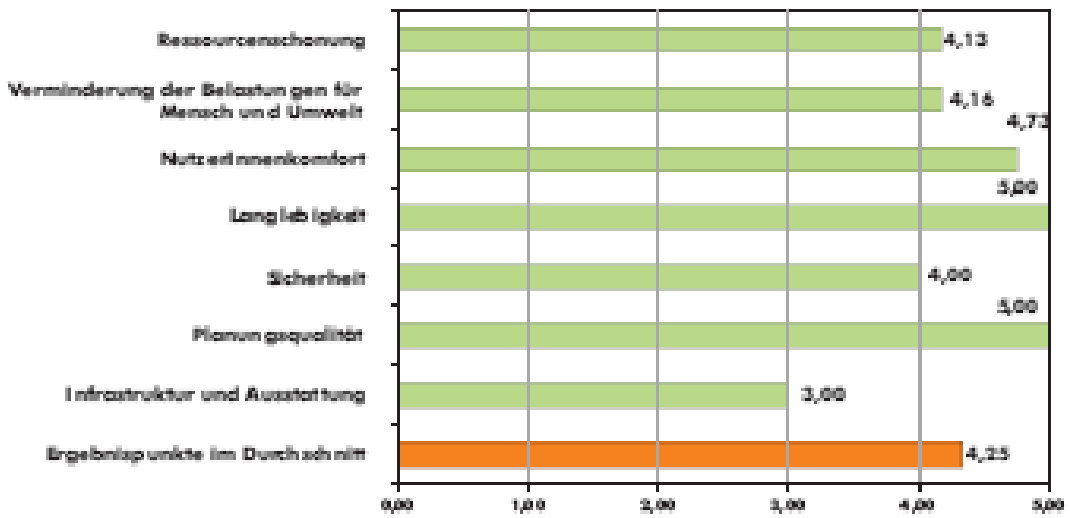
Therefore, acting with good exterior shading, the very large windows are of human and energetic advantage for the building.

3 Assessment 2: TQB (ÖGNB)

Energy base has also been assessed by the austrian sustainablity assessment tools TQB.

In this tool, the sustainability is considered on a much wider range than in the PHPP.

In TQB the building is qualified by 0 to 5 of 5 possible points in several categories. 1:preservation of resources, 2:minimizing the impact of humans and environment, 3: users comfort, 4: durability,5: security, 6: quality of planning, 7: Infrastructure and facilities.



Energy base can achieve excellent results in durability, users comfort and quality of planning (4,75-5 of 5). In the preservation of resources it fails the 5, because it uses new land, and because 25% of the surface left over is a sealed surface. It does not use enough recycled material and the transport management of the construction site was considered only medium.

In minimizing the impact of humans and environment energy base only gets 4,16 points. This is due to a weak traffic reduction because the number of bikeports (energy base has only 60 for 600 users) is not enough. Another part that influences the evaluation of nr.2 is, that the focus of energy base was very much on energy efficiency and comfort and not so much on the ecological impacts of the materials. Several proposals of the architects did not undergo construction because of the costs. The architects f.e. wanted to use slag stare in all concrete slabs (a cement free concrete) and clay plaster on the

interior walls. We suggested a special environmentally friendly carpet and wanted to avoid PVC and PUR completely. In this the architects were not followed by the owner, so that we avoid PVC now mostly but not totally.

Why energy base only has a grade 4 for safety we can not understand, because it meets all up to date fire protection standards and has 2 escape routes from every unit.

The worst result energy base is achiving is in infrastructure and facilities. This is due to the location in the far north of Vienna, where there are only a few super markets around, no school, no kindergarten, only 1 restaurant, no doctors, no park, no sports facilities and car sharing opportunities.

In the building there is no reception, no call center, no delivery service, no cafeteria, no copy service and so on.

As we can see, it is quite hard to meet all sustainability requirements. In our opinion, the values that are measurable like GWP or AP or the amout of TVOC in the indoor air are very good indicators.

All the “soft” indicators like the quality of orientation in the building f.e. and whether it is sustainable to have a receptionist in a building or not, stay up to the personal mind of the experts who set up the evaluation system.

Nevertheless, for us as architects, assessment tools serve as very good chechlists to help us convince the participants in the planning process that only sustainable buildings are the buildings of the future.

References

[1] *Total quality building certificate, www.oegnb.at*

[2] Research project energy base, final report:
http://www.hausderzukunft.at/publikationen/view.html/id717