Energy Consulting with the Passive House Planning Package (PHPP)

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1 Introduction

Building owners (clients) are often not sure which energy-standard they want to achieve when carrying out the refurbishment of a building. Energy Consulting can provide reliable information to help clients make a decision, by analysing various standards and evaluating their cost effectiveness.

Can Energy Consulting be carried out using PHPP? Is this approach sensible and efficient for clients and designers?

What are the benefits and costs compared to Energy Consulting according to DIN 4108/4701 and DIN 18599?

2 Method

The surface data (i.e. the skin enabling thermal transfer) was fed into a software three-dimensionally, to calculate the surface area and achieve a comprehensible documentation. Different material characteristics and outer temperatures are displayed in colour.

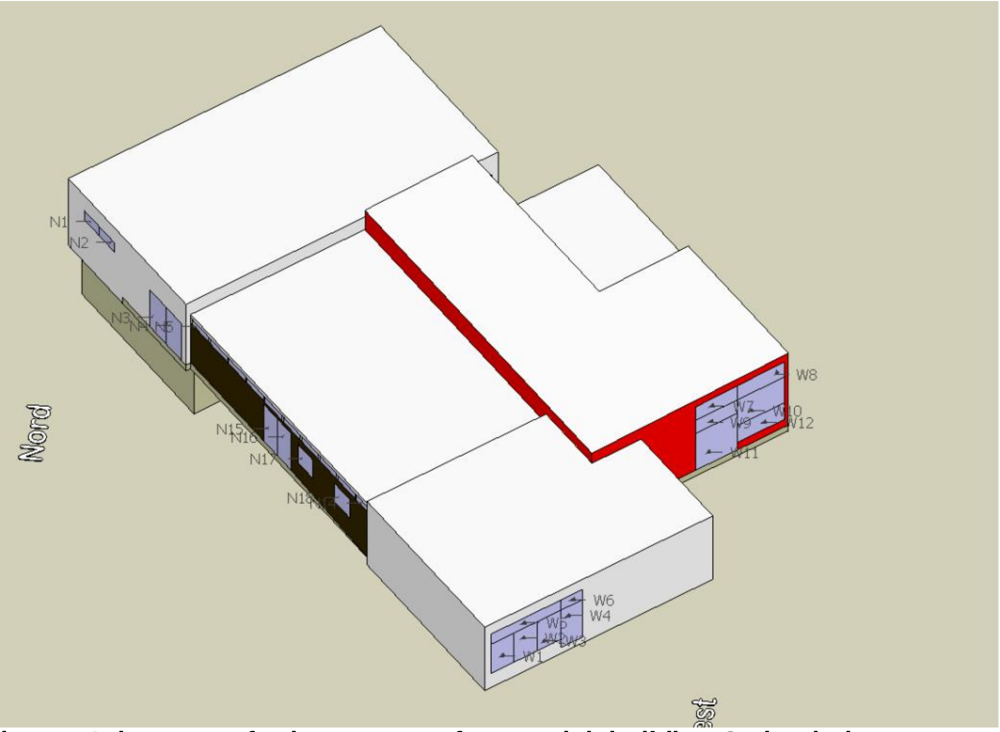

image 1: heat-transferring outer surface, parish building Gadernheim

The Data was fed in PHPP following the instructions specified in the handbook. Both clients decided against testing air tightness before the restructuring of the building. For this reason, an assumed value of 3,0 1/h was used to calculate the analysis of the current status. The decrease in temperature was taken into account by appointing an interior temperature of 19° C. The standard climate settings were applied. Thermal losses of building parts that contact the ground were considered at the fixed reduction factor.

Two different standards were examined with regard to energy consumption and economic feasibility.

Economic feasibility was assessed by calculating the price for every saved kilowatt-hour of final energy and alternatively using static amortisation.

3 Brief description

The parish hall and kindergarten in Gadernheim was built in 1964. In 1995, some windows were replaced, and in 2003 the nursery school/kindergarten was converted and an expansion was built. A new oil based heating system was installed in 1994. The current condition of the building is typical for its age.

Due to the poor thermal properties of the walls and ceilings, there is mold infestation in the interior of the building. The building is functional otherwise; some of the fitting and furniture needs to be replaced.

- energy reference area 551,06 m²
- heated gross volume 1.892,7 m³
- massive exterior walls 24 cm brick masonry.
- roof flat roof, metal covering
- windows see above
- heating from 1994, output: 63 kW, oil fuel
- warm water heating boiler
- ventilation system none

4 Variants

4.1. restructuring with passive house components

The proposed standard complies with EnerPHit (Passive house- components). The expansion from the year 2003 and the replaced windows remain untouched, as it is not economically feasible to renew these.

- Exterior Insulation — 22 cm Insulation Heat conduction group 0,035 W/m²K, U-Value 0,14 W/m²K
- Roof — 28 cm Insulation Heat conduction group 0,035 W/m²K, U-Value 0,12 W/m²K
- Crawl space: — 22 cm Insulation Heat conduction group 0,035 W/m²K. U-Value 0,14 W/m²K
- Windows — Triple glazing, max. Uw Value 0,085 W/m²K.
- Heating — pellet heating (Brennwert) pre-adjustable thermostatic valves, electr. pumps4.2.

4.2. Variant EnEV+

The proposed standard complies with § 9 of the EnEV. However, more than the minimum requirements regarding insulation is implemented. The walls are insulated with the same thickness as the roof, so the same insulation could be applied for both parts. Triple glazing was selected for the windows, since it is economically feasible if one considers the complete life cycle of the building.

- Exterior Insulation (walls, roof): — 16 cm Insulation Heat conduction group 0,035 W/m²K, U-Value 0,19 W/m²K
- Crawl space — 4cm insulation, Heat conduction group 0,035 W/m²K U-Value 0,44 W/m²K

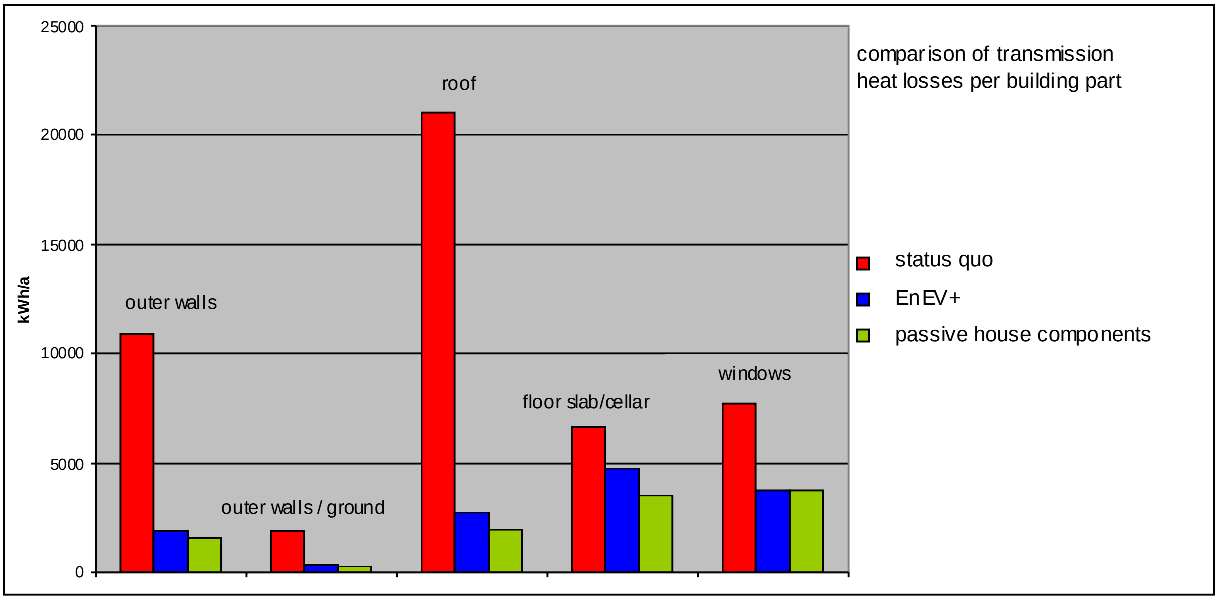

image 3: comparison of transmission heat losses per building part

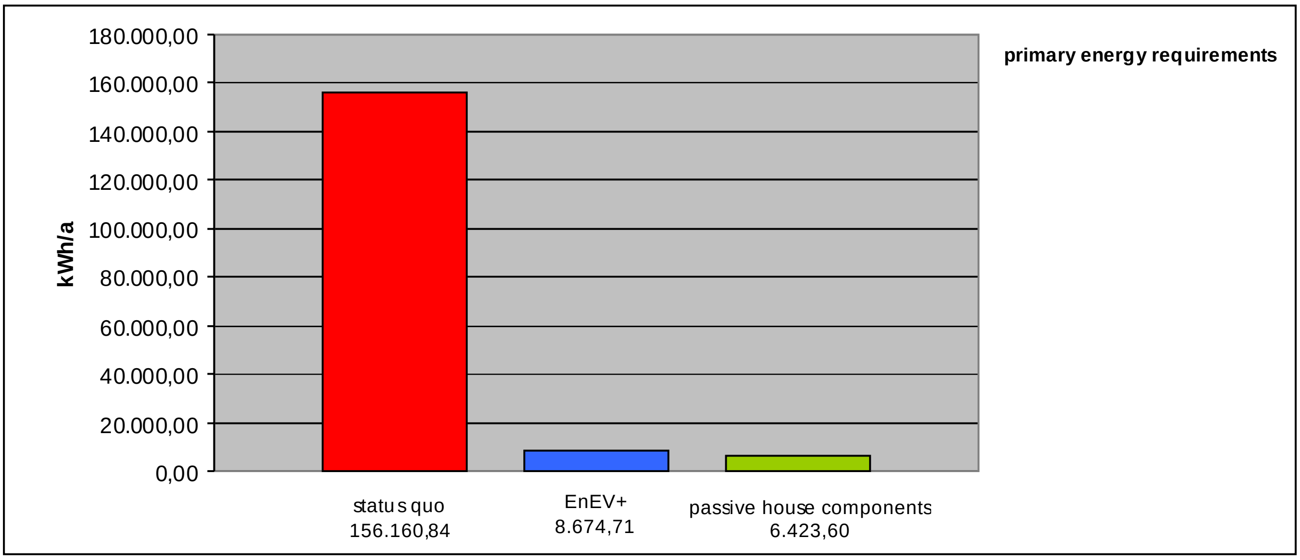

image 7: comparison of primary energy requirements

The implementation of measures of variant EnEV+ would lead to a reduction of primary energy consumption of 94%. The implementation of variant restructuring with passive house components would lead to a reduction of 96%.

5 Economic feasibility

Economic feasibility is assessed by calculating the price for every saved kilowatt-hour of final energy. The costs and savings are assessed for a period of 25 years, and the residual value at the end of this period is taken into account. The financing costs are disregarded as requested by the client.

Assessment period	25	a
Life cycle measures facade	50	a
Nominal interest	0	%
Iinflation	0,015	p

Table 1: calculation principles for the price for every saved kilowatt-hour of energy

5.1. Calculation of profitability (Variant: EnEV+)

initial value	190.038	€
final energy demand of variant	43.373,54	kWh/a
final energy demand status quo	141.964,40	kWh/a
final energy savings	0,69	p
average energy consumption (status quo)	65.975,27	kWh/a
final energy savings (based on consumption??)	45.818,24	kWh/a
price for every saved kilowatt-hour	**0,0604**	**€**

Table 2: Calculation of the price for every saved kilowatt-hour of energy (EnEV+)

5.2. Calculation of profitability (Variant: passive house components)

Calculation of profitability (Variant: passive house components)

initial value K0	210.961	€
final energy demand of variant	32.118,01	kWh/a
final energy demand (status quo)	141.964,40	kWh/a
energy saving demand	0,77	p
energy consumption average	65.975,27	kWh/a
energy saving (based on consumption)	51.049,03	kWh/a
price for every saved kilowatt-hour	**0,0585**	**€**

Table 3: Calculation of the price for every saved kilowatt-hour of energy (passive house components)

As indicated by the lower price for every saved kilowatt-hour, “restructuring with passive house components” is the more economically feasible variant, and is to be recommended.

5.3 Comparison of profitability calculations

Another frequently used method of calculation is static amortization. In this case the variant EnEV+ (the lower energy standard) is more profitable! Thus, the different methods of profitability calculations lead to different results. One cause for the differing results lies in the duration of the assessment period and in the residual value of the measures.

The assessment of profitability on the basis of the cost for every saved kilowatt-hour of energy has significant advantages. On the one hand, the higher energy standard is more profitable considering the life cycle of the measures. On the other hand, this approach does not require an assumption on the increase in energy prices since the costs can be directly compared to the current energy prices; the expected increase in energy prices is assessed by the client.

6 Effort for the consultant

Time and effort for the energy consulting services is higher when feeding the programme, and also when creating the report. Compared to energy consultancy for residential housing according to DIN V 4801-06, DIN V 4701-10/12 the effort is nearly twice as high.

Creating two variants within one PHPP file is rather difficult and fragmented. After creating a file for the existing building, copies can be made in order to generate variants. An automatic update of changes to the existing building is technically complicated once the variants are created. For this reason it is recommended to carefully examine the original file of the existing building before creating variant files.

The different results can be summarised on a parameter sheet or a linked working sheet, and compared clearly. Changes within the variants are updated via links.

PHPP can only create graphic diagrams/illustrations to a very limited extent (e.g. the illustration above, regarding heat requirement). Comparative diagrams of variants cannot be created using PHPP. These can be created in Excel or other Programmes. The example diagrams (as above) can be generated in a short time.

7 Conclusion

The Significant advantage of Energy Consulting using PHPP is that you can obtain a reliable calculation of the heating requirements as well as the heating load. This usually leads to a more economic dimensioning of the heating system.

The more precise calculation method also enables a more accurate calculation of profitability.

In the case of a refurbishment with passive-house components, the input of information is carried out in the consulting phase und does not need to be undertaken separately.

Experiences from previous consultancy services have shown that clients frequently choose a refurbishment with passive-house components following calculations using PHPP.

Both the analysis of the existing building and the building data input require more effort when providing Consultancy services using PHPP. The result is a more precise and building-oriented consultancy. The higher effort can be justified by the more accurate calculations.

Consultancy services are additional services. It is recommendable to communicate this to the client in advance and to provide an offer, in which the services are described, the effort is estimated and a price is named. The energy calculation method and the type of profitability calculation should be agreed in all cases. In this way, the consultancy services using PHPP can be carried out in a profitable manner for the builder and the designer.

For planners that are familiar with PHPP, consultancy using PHPP is a meaningful alternative to other approaches.

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