

# Powerful Insulation – Sustainable and Efficient

A Study of Success from Ludwigshafen

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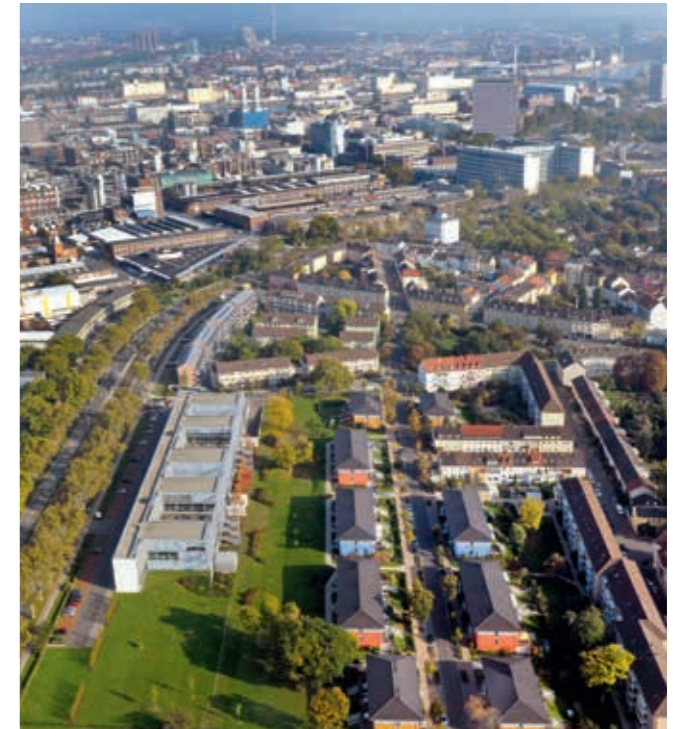


## THE BRUNCK DISTRICT: AN INTEGRATED CONCEPT

*In collaboration with the Ministry of Finance of the German State of Rhineland-Palatinate and various scientific institutions, the partners BASF SE and LUWOGÉ devised a long-term and comprehensive concept for modernisation of the „Brunck district“ in the centre of Ludwigshafen.*

This settlement for workers, which was created in the 1930s on the doorstep of the BASF site, was revitalised in its entirety from 1997 to 2006. The new and modernised buildings were provided with innovative system solutions in the areas of thermal insulation and renewable energies in order to achieve maximum scores for energy and eco-efficiency. For the first time, a external thermal insulation composite system (ETICS) comprising insulating material panels made of Neopor® from thermal conductivity group 035 was used and, compared to conventional EPS insulating materials, it displays insulation performance that is up to 20 per cent better.

The economic, ecological and socio-cultural objectives were finally examined in a long-term study, as part of the sustainable revitalization of the district. The goal was to validate the desired advantages of the sustainable structures and to continue with these in the future.



*Aerial shot of the modernised existing properties (3, 5, 7 litre houses) and the 1 litre houses (new build) in the Brunck district in Ludwigshafen*

*The Brunck district: This settlement for workers dating from the 1930s was completely revitalised from 1997 to 2006.*

## THE BRUNCK DISTRICT:

### Example of a major contribution to sustainable construction

The Brunck district in Ludwigshafen consists of 500 dwellings, most of which are blocks housing multiple flats. Back in the mid-1990s, it became apparent that the existing dwellings were in great need of renovation. This heralded the start of a pilot project in which BASF together with LUWOGÉ renovated the existing building stock up to the 3, 5 and 7 Litre standard, and designed new 1 litre house. This unique project allows us to answer a number of questions which are repeatedly asked in relation to EPS insulation:

- The Brunck district: an integrated concept
- Costs put to the test: Is insulation worth it?
- Does it last? Lifespan and durability of facade insulation
- Climate protection, energy efficiency and resource conservation: How ecological is EPS insulation?
- Greener living = better living? Studies of quality of living
- Is it safe? How do EPS insulation materials behave in a fire?

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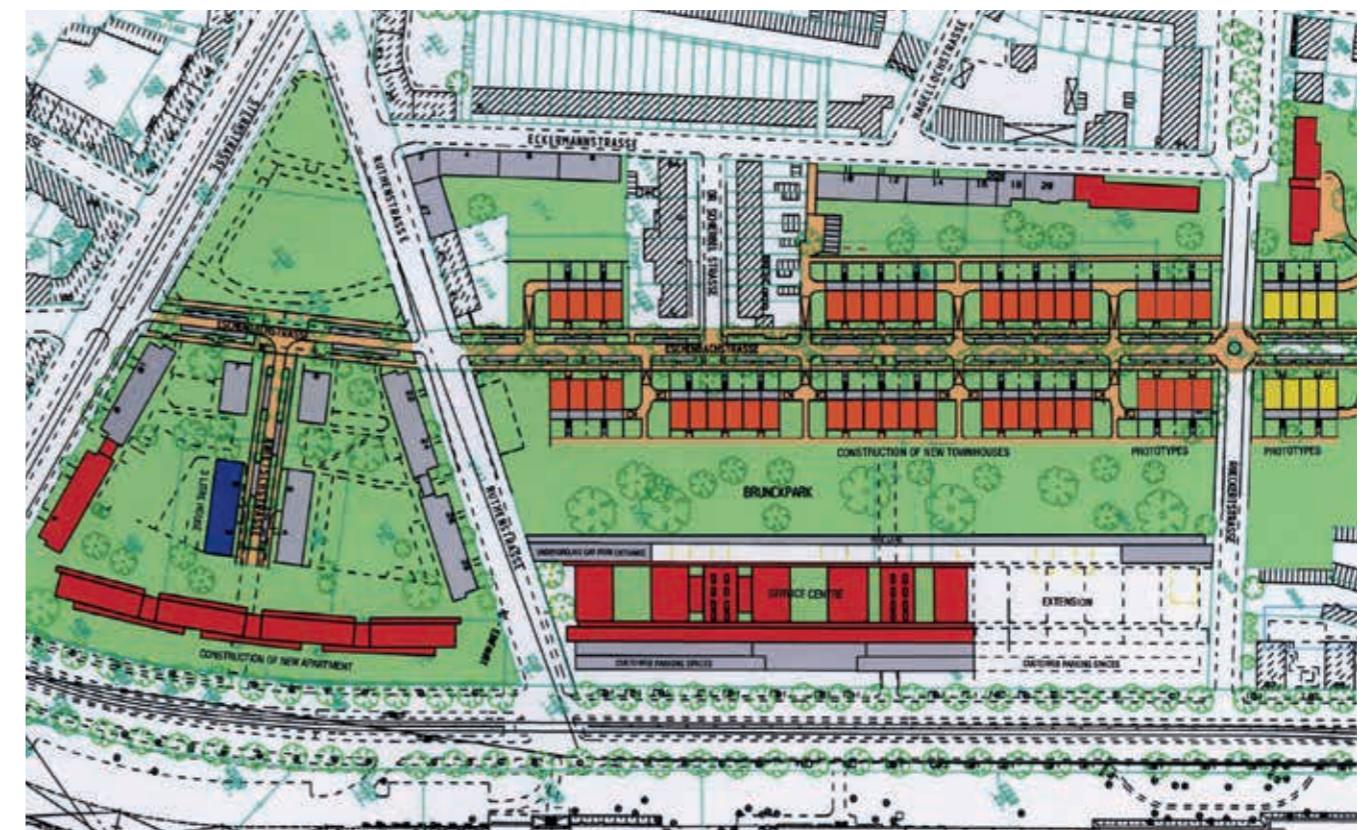
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■ New build

■ Planned new build

■ New build of 1 litre townhouses

■ 3 litre house in old building

■ Old building renovation

*Diagrammatic representation of the revitalisation measures*

# COSTS PUT TO THE TEST: IS INSULATION WORTH IT?

A comparison of the measures implemented in the Brunck district in order to increase the level of energy efficiency shows that, depending on the type of building, the payback periods for insulation measures in the basement ceiling, the roof and the external wall are between eight and 17 years.



The Brunck district case study shows that energy efficiency measures benefit both tenants and landlords equally.

The payback period represents a key parameter for assessing the economic viability of energy efficiency measures. It defines the period at the end of which the costs saved as a result of the reduction in energy will exceed the level of investments made in energy-related building work.

Various factors need to be taken into account here. The condition of the property prior to renovation plays a major role. The rule of thumb here is that, the greater the need for renovation, the higher the initial investment but also the greater the potential to save energy. If energy-related renovation is carried out as part of repair works that were required anyway, it usually does not account for more than 35% of the total costs. So if a building needs to have a new render applied to it, direct consideration should be given to facade insulation in order to save costs in the long run. In this connection, Werner Eicke-Hennig, an energy expert from the Energy Saving Campaign organised by the German state of Hesse, clearly summarises the situation:

“ If you are put off by constant false messages, you are losing real cash. If you do not implement energy-saving measures on your property, you are throwing your money out of the window on ever-rising heating costs. ”

Facade insulation is also of interest to tenants. This is because in new buildings and in the renovation of existing ones it is possible to considerably reduce heating energy consumption. Although some of the costs of modernising the building are apportioned to rents excluding heating charges, the saving in the ancillary costs usually more than compensates for this increase. Besides the higher quality of life that a renovated apartment offers, tenants also benefit from a fall in rents including heating charges.

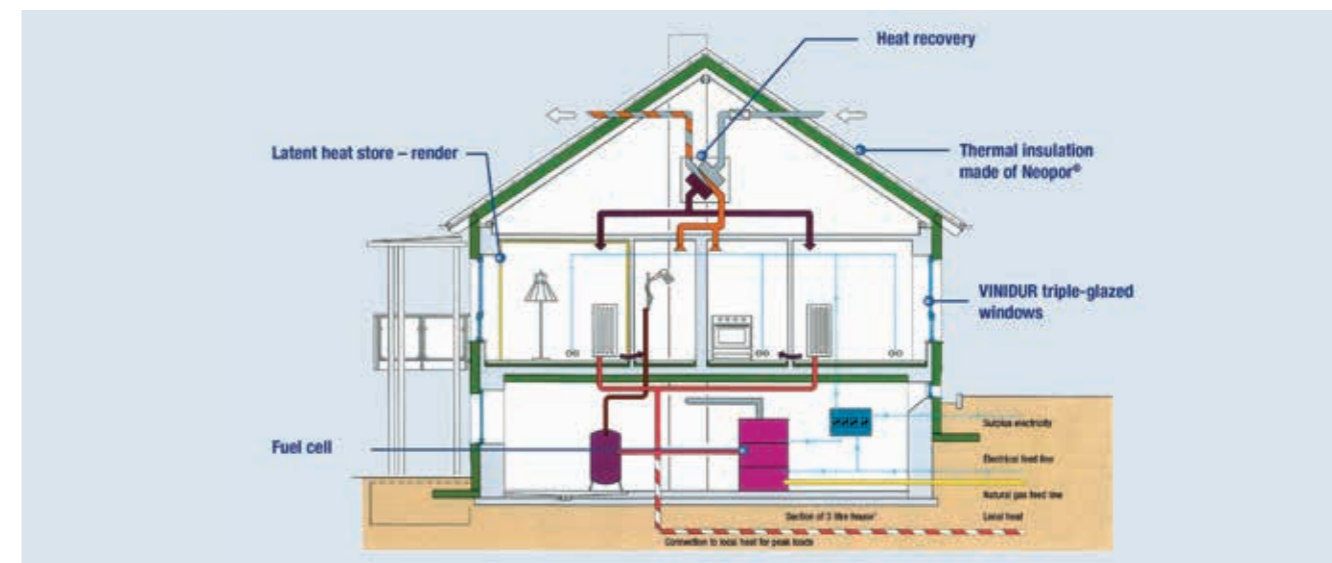
When it comes to new buildings, the payback period is essentially dependent on the target energy efficiency level that the new building is seeking to achieve. The rule here is that the more ambitious the energy specifications in relation to the energy efficiency levels stipulated by the German Energy Efficiency Ordinance (EnEV), which are already very good, the longer the payback period for individual energy-related measures. Using the five litre house in a new build in the Brunck district as an example, the different insulation measures had payback periods of just five to seven years.

## IMPORTANT INFORMATION ON THE COSTS OF ENERGY-RELATED BUILDING WORK

**In the case of renovation:** If you combine building work, you save costs: Insulation of the facade can take place, for example, as part of replacement of the render that needed to be carried out anyway. This produces considerable savings. It should also be noted that the complexity of the building and the original condition of the building from an energy point of view have a crucial bearing on the costs and therefore also on the payback period.

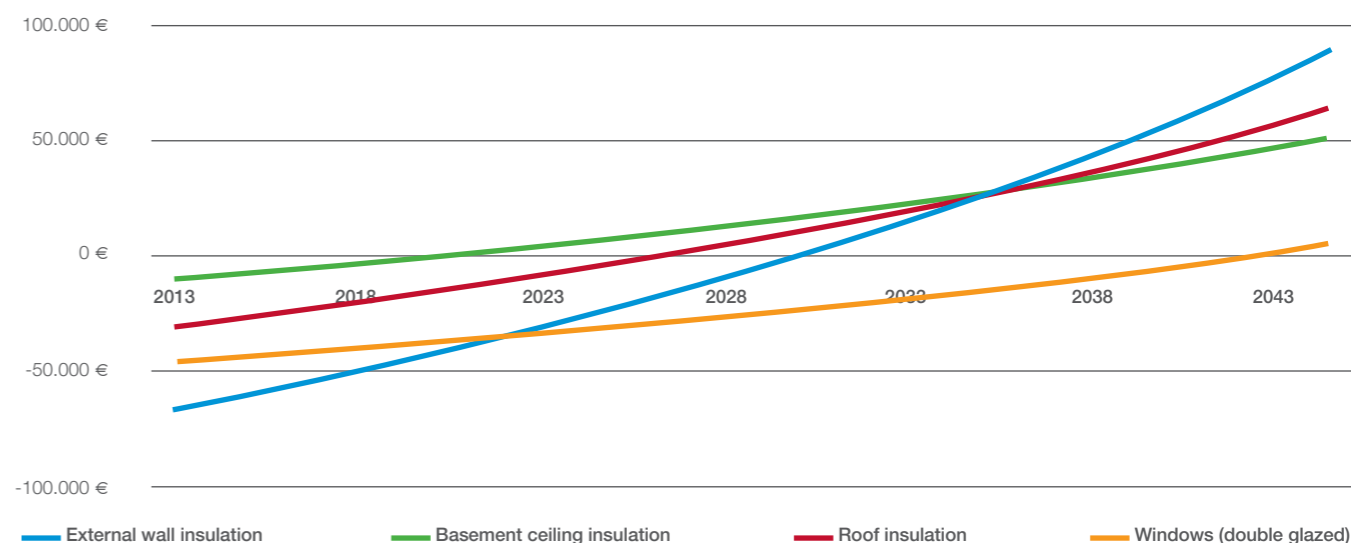
**In the case of new builds:** The desired energy efficiency target for the building firstly dictates the level of investment, but also dictates the level of savings that can be made.

**In the case of new builds and renovation,** it is essential to plan the works carefully. They should be carried out by specialist experts. It is advisable to recruit an energy specialist to do the planning because complex conditions – such as the geographical location of the property or coordination of the technical facilities with the shell of the building – need to be considered if the building work is to be sustainable.



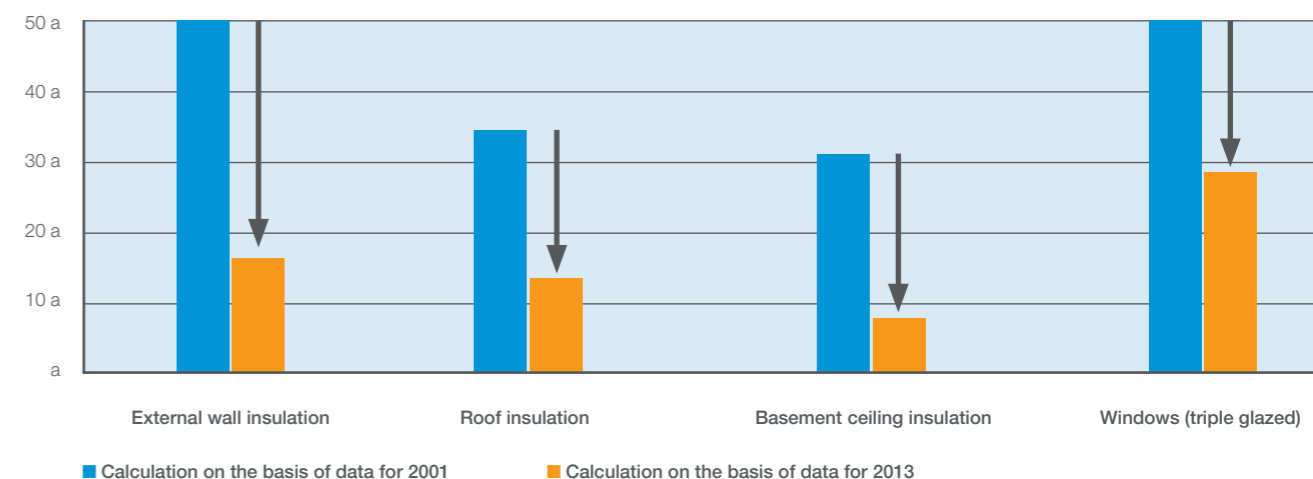
Section of 3 litre house<sup>1</sup>

## Economic efficiency of energy-related renovations in 2013<sup>1</sup> [3 litre house]



Payback profile for the individual energy-related modernisation measures in a 3 litre house based on today's economic climate (2013)

## Payback period of the investment costs - comparison of energy-related modernisation from 2001 to 2013<sup>1</sup> [3 litre house]



Comparison of the payback periods for individual energy-related modernisation measures in a 3 litre house (existing) based on changes to the economic climate

## DOES IT LAST? LIFESPAN AND DURABILITY OF FACADE INSULATION

*An investment in facade insulation – and in all energy-related renovation measures in general – is always a long-term investment. Despite this, the shortest possible payback period is of course desired.*

This is why as part of the monitoring for the Brunck district we also scrutinised the technical condition of the insulation system in greater detail – more than ten years after the renovation work was carried out.

An expert report prepared by an independent specialist in 2012 revealed that the thermal insulation measures which were implemented did not display any notable signs of wear and tear. An analysis of thermal images of the different buildings also showed that the buildings insulated with Neopor® did not have any new thermal bridges even after ten years. The expert did not identify any signs of algae formation either.

The fact that EPS insulation systems have already been employed and consistently developed further over the space of 50 years also offers peace of mind. The Fraunhofer Institute for Building Physics carried out a study into the durability of thermal insulation composite systems and reached the following conclusion<sup>2</sup>:

**“ If maintained properly, the lifespan can be categorised as being the same as that of rendered brickwork. ”**

This equates to a lifespan of between 40 and 50 years.



*The expert report on the building stock drawn up in 2012 could not identify any significant signs of aging or algae growth.*



## CLIMATE PROTECTION, ENERGY EFFICIENCY AND RESOURCE CONSERVATION: HOW ECOLOGICAL IS EPS INSULATION?

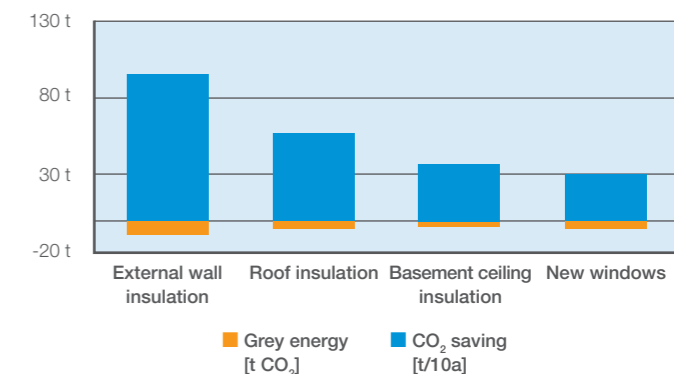
*Around 40% of all the energy consumption in the whole of society in Germany is produced in the housing sector. The example of the Brunck district in Ludwigshafen shows that an integrated overall energy concept makes a substantial contribution to reducing CO<sub>2</sub> emissions.*

In an ideal situation, appropriate insulating measures in combination with triple-glazed windows and a controlled ventilation system with heat recovery can reduce the demand for thermal heat and CO<sub>2</sub> emissions by more than 80 per cent compared to a building which has not been renovated. Spread over the whole of the revitalised Brunck district, it has thus been possible over the last ten years to save around 8,300 tons of CO<sub>2</sub> emissions and – depending on the type of building – between 70 per cent and 86 per cent of the energy demand. The 7, 5, and 3 litre houses in the existing stock save 387,000 litres of heating oil per year, which is equivalent to 13 full lorry loads.

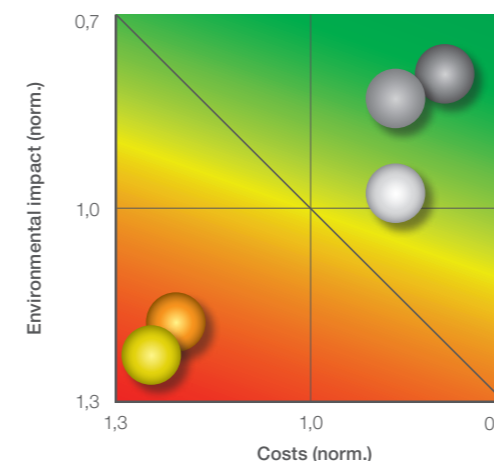
The balance of what is known as „grey energy“ (the energy consumed during the production and logistics processes for an insulating material) in relation to the energy savings achieved is also extremely positive, as the example of the Brunck district demonstrates: the grey energy is compensated by the savings in heating energy after around one year. After this, future energy savings will make a lasting contribution to relieving the impact on the environment and to achieving independence from reliance on the import of fossil fuels.

- With suitable insulation measures it is possible to save up to 80% of CO<sub>2</sub> emissions.
  - Thanks to the modernisation, 387,000 litres of heating oil are saved every year in the Brunck district.
  - After taking account of the energy consumed in the manufacturing process, the life cycle assessment is still positive.
- Studies confirm that insulation with EPS also makes sense from an ecological perspective**

CO<sub>2</sub> assessment over 10 years – 3 litre house<sup>1</sup>



### Eco-efficiency analysis of various insulating materials



The diagram arranges the insulating materials in terms of their economic efficiency and effects on the environment

- in relation to 1 m<sup>2</sup> of a thermal insulation composite system
- with a U value of 0.15 W/m<sup>2</sup>K
- viewed across the entire life cycle (raw material, production, logistics, processing, lifespan, disposal).

● Neopor 032 ● Neopor 035 ● Styropor 035 ● Mineral wool 035 ● Mineral wool 040

BASF eco-efficiency analysis 2013 – validated by TÜV Rheinland

# GREENER LIVING = BETTER LIVING? STUDIES OF QUALITY OF LIVING

“

**In our climatic zone, it is generally good for the heat to remain within a building. This is why we pretty much never have to heat, only on a few very cold days in winter.[...] For us the insulation and ventilation system has only brought benefits.**

*Peter Doland, tenant in Brunck district*

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*Our everyday quality of life is partly determined to a significant extent by the comfort of the living environment that we subjectively perceive. The proper management of an energy-efficient building requires a disciplined and methodical approach to be adopted by the residents:*

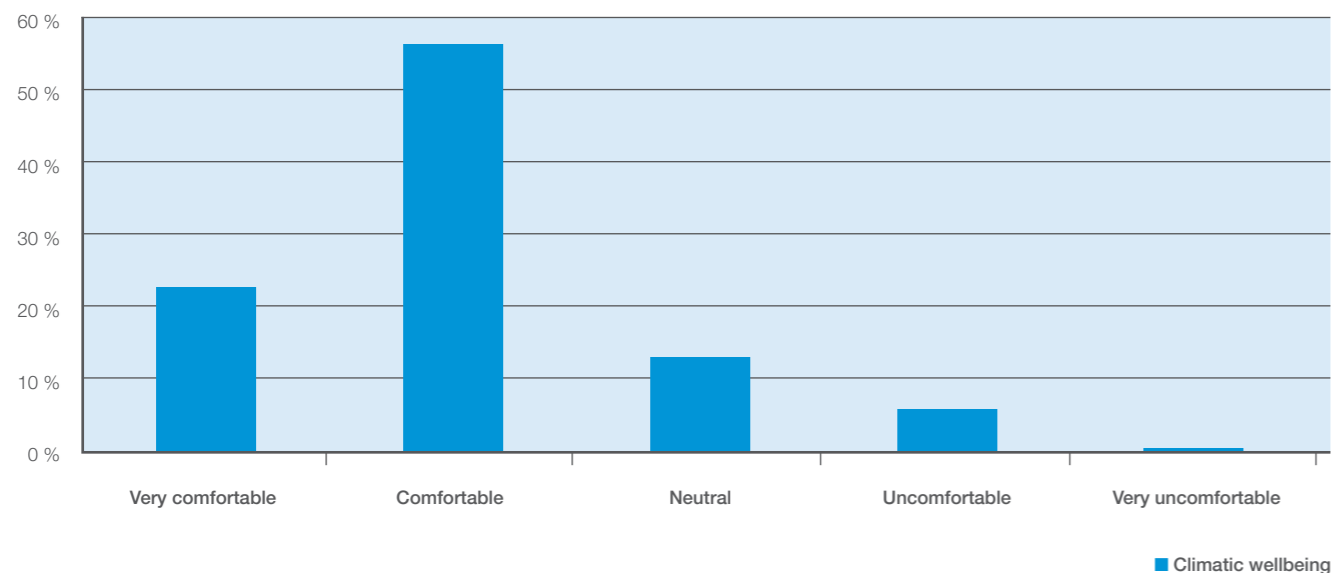
In well-insulated buildings, it is particularly important to exercise proper ventilation practices in order to guarantee healthy air quality and prevent great fluctuations in temperature in the living rooms. Residents who additionally have a modern ventilation system also report that the air inside the building is more or less

free of any dust and pollen. All in all, around 80 percent of the residents of the Brunck district were satisfied with the quality of the climate inside their dwellings, which have been modernised from an energy point of view, with just 7 per cent finding the indoor climate unpleasant. EPS insulation is also no worse than alternative systems when it comes to mould infestation. The experiences of specialist energy consultants and the studies conducted in the Brunck district show that EPS-insulated buildings are not affected by mould to any greater extent than buildings without any facade insulation. On the contrary, properly fitted EPS facade insulation can even help to prevent mould. Here too the importance of professional installation is apparent. Mould is usually caused in the insulation by incorrectly positioned wall plugs or insulation panels which are damaged during installation.

In addition, two thirds of the residents surveyed indicated that the new visual attractiveness of the residential area as a whole had also had a significant positive influence on their personal sense of quality of living.<sup>7</sup>

## Survey results regarding the climatic well-being of inhabitants:

How comfortable do you feel in your dwelling that has undergone energy-related modernisation?<sup>1</sup>



## IS IT SAFE? HOW DO EPS INSULATION MATERIALS BEHAVE IN A FIRE?



Correct processing by a skilled installer also ensures the safety of EPS facades.

*In the recent past, concerns have repeatedly been raised about the resistance of EPS insulation materials to fire and heat. Werner Eicke-Hennig, head of the Energy Saving Campaign organised by the German state of Hesse, puts the frequency of fires in which an EPS facade was involved into proportion:*

“ **Of the 180 000 fires per year, installed flame retardant insulation materials are only involved with a percentage of 0,025. In these incidents the material were never the cause of the fire.** ”

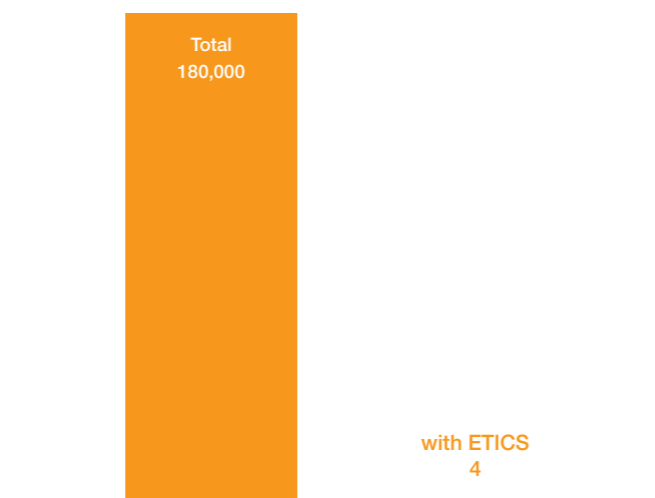
The fact is that EPS is an organic material – just like wood – and is therefore combustible. For building purposes, EPS is employed in Germany exclusively as a flame-retardant product

so that a facade which is insulated with EPS, for example, cannot be set on fire by a welding spark, a firework or cigarette ends – even if the protective layer of plaster has not yet been completed. In the case of a thermal insulation composite system (ETICS) which has been properly completed, the insulation can only catch fire if a fire burns for an extremely long period of time and intensely, for example if a rubbish skip or a pile of bulk refuse is on fire close to a facade. The fire safety is guaranteed because strict regulations in relation to fire prevention need to be complied with in the insulation of buildings:

- Licensing requirement for all building products used
- Numerous material tests in the laboratory and on original scale prior to market launch
- Prescribed structural measures (fire barriers) in buildings in which the floor of the highest occupied level is at a height of more than seven metres

### Fires per year in Germany:

Based on research by the Hessian Energy Saving Campaign



*If you opt for certified and tested insulating materials at the planning stage, you will not only save money in the long run but also enhance your quality of life and living environment.*

*What has been highlighted here using an entire residential district is of course also relevant to people who wish to develop their own homes. For they have the ability themselves to plan and implement energy-related measures on a sensible scale.*

On the one hand, questions relating to energy-related renovation can never simply be answered with one general response, but on the other hand the answer “it depends” is very unsatisfactory. Particularly as an energy-related measure always has to be assessed within the overall context of the “building as a system”, it makes sense to seek the advice of an expert. This can be provided by the trained craftsman or certified specialist energy consultants.

Sources:

<sup>1</sup> LUWOG Consult: Langzeitmonitoring Brunnckviertel (2013) Long-term monitoring of Brunck district (2013)

<sup>2</sup> IBP Notification 24 (1997), No. 316

**Important note**

The data contained in this publication is based on our current knowledge and experience and refers exclusively to our product with its properties at the time this document was prepared; no guarantee or contractually agreed properties of the product may be inferred from our information. When using it, the special conditions of the application must always be taken into consideration, especially as regards building physics, building technology, and building law.

