Press Release

14 February 2024

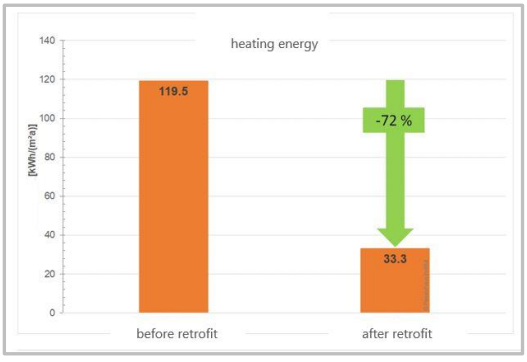
Does anyone offer higher savings?

Deep retrofit reduces heating energy consumption by more than 70 per cent

Darmstadt/Germany. **After a deep retrofit, a typical apartment block from the post-war era has become a model for energy-efficient buildings. The Passive House Institute carried out scientific monitoring of the project in Giessen, Germany, and has now published its research report. The retrofit planning in advance using the PHPP tool showed a significant reduction in the heating demand. The measured data shows that indeed, energy consumption for space heating already decreased by over 70 per cent in the first year after the renovation, and even decreased by over 80 per cent by the third year. At the same time, the indoor climate improved noticeably. Deep retrofits will also take the centre stage at the 27th International Passive House Conference in April.**

The deep retrofits using Passive House components significantly reduced the heating demand in this apartment block in Giessen. The Passive House Institute carried out scientific measurements, for which numerous cables and sensors had to be installed. © Passive House Institute

The housing association Wohnbau Giessen modernised a total of three buildings from the 1950s in order to significantly reduce the energy demand and noticeably increase living comfort at the same time. In one building with 12 residential units, the Passive House Institute carried out intensive measurements to investigate how successful the modernisation was. The reasons for any potential discrepancies between the advance calculations of the energy demand and the consumption values measured later should also be analysed. Through additional dynamic simulations the respective influences of the building envelope, building services and utilisation on heating energy consumption could be separated more precisely.



The energy consumption for heating dropped by 72 per cent. It fell even further in the third year after the deep retrofit. © Passive House Institute

Excellent thermal protection

In this retrofit with Passive House components, the housing association ensured a fundamental improvement in the energy efficiency from the basement to the roof: the buildings were equipped with high-quality thermal insulation of the exterior walls, a highly insulated flat roof with a large photovoltaic system and ventilation systems with heat recovery in each apartment.

Precise calculations with the PHPP

The new windows are now triple-glazed, and the entrance as well as cellar doors are also highly energy-efficient. The basement ceilings received insulation. New front-mounted balconies resulted in reduced thermal bridges and increased living space. Heat supply via the existing district heating connection was retained. "The energy-efficient retrofit was a complete success overall, as our research results clearly show. The energy balance calculation tool PHPP had already calculated savings in the same order of magnitude as were measured later. Excellent quality and highly energy-efficient components are a prerequisite for such successful deep retrofits," explains Søren Peper of the Passive House Institute.

From 120 to 33 to 21

Before the energy retrofit, heating energy consumption in the monitored apartment building was 119.5 kilowatt hours per square metre per year (kWh/(m²a)). It dropped to 33.3 kWh/(m²a) in the first year after improvement of the building's energy efficiency. The tenants were already saving 72 per cent in heating energy on average. The extensive measurements carried out by the Passive House Institute show that in the third year after the retrofit, heating energy consumption was even 82 per cent lower at 21.3 kWh/(m²a). At the same time, the indoor air temperatures in winter were comparatively high at 22.1 and 21.7 degrees Celsius.

Left: The monitored residential building in Giessen from post-war years before the deep retrofit. Right: An expert from the Passive House Institute prepares the measurements in the apartment block. © Passive House Institute

Verification of deviations

Søren Peper says that with the help of the PHPP, deviations from the scheduled operation can be demonstrated in addition to the precise calculations of the future energy demand. To do this, the PHPP calculations would have to be performed using the boundary conditions existing during the measurement subsequently, such as internal heat gains and suitable climate data. Minor deviations also occurred in the Giessen apartment block, but to such a small extent that the building functioned very well after the deep retrofit.

Dynamic simulations

Concerning the dynamic simulations of the exact influence of the building envelope, building services and occupants on heating energy consumption, the Passive House Institute emphasizes that good thermal protection is essential for the building envelope, which includes insulation of the exterior walls, roof and basement ceiling as well as a reduction of thermal bridges. The building services systems, especially the ventilation system with heat recovery, also contribute greatly to the efficiency of the entire building. Ventilation units that are certified as Passive House components must also have low power consumption and must meet high requirements for sound insulation. Insulating the heat distribution pipes in the building to a high level proved critical in addition.

Influence of users

The influence of the building's inhabitants on the energy demand is also significant. If they opt for a higher room temperature of two degrees more than the average room temperature of 22.1 degrees, the heating demand will increase noticeably. However, Jürgen Schnieders of the Passive House Institute, who was also involved in the project, clarifies: "Although there is a demonstrable influence of the room temperature level on the heating energy consumption, this does not fundamentally change the positive effect of the energy retrofit. In the original state before renovating, the additional consumption due to higher room temperatures would be much greater."

Advantage in summer

Highly energy-efficient buildings also have an advantage in summer: the excellent level of thermal protection keeps the heat outside. Also users do influence thermal summer comfort in their homes. For example, it is significantly cooler inside the building if the external shading elements of the windows are deployed during hot weather and the windows are kept closed during the day, with fresh air being supplied via the ventilation system. "In this project, we were able to show what really matters when it comes to low energy consumption. If Passive House components are used, a deep retrofit of an old building like the one in Giessen can achieve the EnerPHit standard, with correspondingly low actual consumption. If a renovation is carried out as part of the usual renovation cycles, then an energy retrofit also becomes economically advantageous," concludes Jürgen Schnieders.

Focus on deep retrofits

Successful and highly energy-efficient retrofits will also be a focus at the **27th International Passive House Conference**. The leading event for highly energy-efficient construction and renovation will take place from **5 to 7 April 2024** in Innsbruck, Austria. The conference will also include a trade exhibition with Passive House components. There will be excursions to the numerous highly energy-efficient projects in Innsbruck and Tyrol on the third day. Further information can be found at **www.passivehouse.com**

*The research report (in German) can be downloaded **here** free of charge. The Passive House Institute carried out scientific monitoring in Giessen as part of the International Energy Agency's (IEA) "InSitu Verification" project. This work was funded by the German Federal Ministry for Economic Affairs and Climate Protection*.

Passive House Institute

This press release together with visuals is available in different formats here.

General information

27th International Passive House Conference: **The #27intPHC will take place from 5 to 7 April 2024 in Innsbruck, Austria. www.passivehouse.com**

Passive House Award: **That's how diverse Passive House is! Finalists and winners of this international architecture prize are presented in this Flipbook. Just click and browse!**

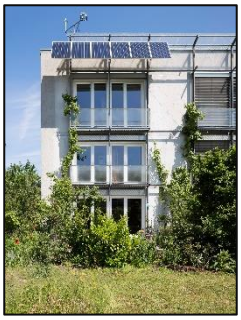
#EfficiencyNOW! **To save fossil energy the Passive House Institute has started the #EfficiencyNOW campaign. All information can be found on the platform Passipedia.**

Socially compatible and highly energy efficient: apartment blocks built to the Passive House standard. © Neue Heimat Tirol

Passive House buildings: **With the Passive House concept, the typical heat loss in buildings through the walls, windows and roof is drastically reduced. By applying the five basic principles 1. Excellent thermal insulation, 2. Windows with triple glazing, 3. A ventilation system with heat recovery, 4. Avoidance of thermal bridges, 5. An airtight building envelope, a Passive House building needs very little energy for heating and cooling and can dispense with a *traditional* heating system.**

A major part of the remaining, small heating demand is met through "passive" sources such as solar radiation or the heat emitted by occupants and technical appliances. The Passive House concept also works well in deep retrofits of existing buildings. The Passive House Institute has developed the EnerPHit standard for this purpose.

Other advantages of the Passive House & EnerPHit standards: **1. Increased thermal comfort. 2. In winter the heating demand is very low; the heat escapes out of the house very slowly. 3. The cooling demand of Passive House buildings in the summer is low; the excellent level of thermal protection keeps the heat out. 4. Social justice: low energy costs also mean low utility costs – which is the basis for affordable homes and social housing.**



In 2021, the world's first Passive House building in Darmstadt celebrated its 30th anniversary! © P. Cook

Passive House and renewable energy: **The Passive House standard and generation of renewable energy directly on-site or near the building is an excellent combination. The Passive House Institute has therefore introduced the building classes *Passive House Plus* and *Passive House Premium*. The world's first Passive House building in Darmstadt also generates renewable energy with a photovoltaic system subsequently installed in 2015 and therefore received the *Passive House Plus* certificate.**

Building uses: **There are now Passive House buildings for all types of building uses. In addition to residential-use and office buildings, there are also kindergartens, schools, sports halls, swimming pools, supermarkets, hotels, museums and production facilities built to the Passive House standard. The Passive House certificate was awarded for the first Passive House hospital in the world.**

PHPP: **The Passive House Institute developed the PHPP (Passive House Planning Package) for precise energy balance calculation of highly energy efficient buildings. The energy demand can be calculated reliably using this Excel-based tool.**

Prof Dr Wolfgang Feist © Peter Cook

Passive House Institute: **Founded by Professor Wolfgang Feist in 1996, the Passive House Institute is an independent organisation holding a leading position in research and development relating to highly energy efficient construction and building retrofits.**

iPHA: **The purpose of the membership based International Passive House Association (iPHA) is the dissemination of knowledge relating to highly energy efficient construction and retrofitting as well as networking.**

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