

Press Release

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"During hot spells, we open the windows of our Passive House at night, and by morning, the house has cooled down to a pleasant level. Naturally, we keep the blinds closed during the daytime so that the heat stays out", explains Dr. Berthold Kaufmann from the Passive House Institute. He lives in one of these terraced houses in Darmstadt-Kranichstein. © PHI

Passive Houses: cooler inside!

Practical proof of pleasant climate even during heat waves - Professional planning

Darmstadt, Germany. On hot summer days, Passive House buildings can be noticeably cooler than conventional buildings. The excellent level of thermal insulation keeps the heat out, coupled with effective strategies such as "passive night cooling" ensure comfort in the summer months. Providing proof of a pleasant indoor climate in summer is also one of the requirements for quality assurance for Passive House certification. "Numerous practical examples in different climate zones very clearly show that Passive House buildings have a pleasant and cool indoor climate during heat waves. However, professional planning is crucial for this", says Zeno Bastian of the Passive House Institute.



With perfect beach weather, especially conventional buildings become overheated.

Good planning is essential

A common problem in summer is overheating. With climate change in mind, this problem is only set to intensify in the future. It is sometimes thought that well-insulated buildings are prone to overheating. However, this claim is unjustified. "There may certainly be isolated cases of well-insulated buildings that become overheated in summer. However, through careful planning particularly using the planning tool PHPP, this problem can be avoided from the outset. Buildings with little or no insulation will definitely become overheated. Not only will these buildings be warm in the summer, they will also be too cold in the winter," explains Zeno Bastian, head of building certification at the Passive House Institute.

"Passive" cooling measures

The Passive House Standard is suitable for various climatic conditions, including cold, temperate and also warm and humid climates. It can thus be applied anywhere in the world. Passive House buildings, among other things, are characterised by their high quality thermal insulation, triple-glazed windows, and an airtight building envelope. In winter, heat recovery by the ventilation system ensures that the air entering the building is preheated. What keeps heat inside the building in winter also helps in the summer: heat enters the building more slowly. "Passive" cooling measures ensure that a Passive House building does not heat up at all – or only heats up slowly – during a heat wave in the summer. These can also be helpful in conventional buildings for maintaining summer comfort without any additional active cooling:

- The first and foremost measure against heating up is **exterior shading elements**. For this reason, Venetian blinds or roller blinds should be kept closed for as long as possible on hot days. This is also applicable in older buildings. Here, the heat gain through the walls and roof is significantly higher, though.
- **Passive night cooling:** during the course of a hot summer day, even Passive House buildings can become warmer. The easiest way to remove this heat is at night by simply opening the windows. The warm air can be flushed out and the inside of the building will cool down; the walls and ceilings will keep this cool temperature for the following summer day. This option is also possible in old buildings. However, in a Passive House this cool state is maintained for much longer.
- If it is not possible to open the windows, then cool outdoor air can also be drawn into the home at night via the **ventilation system (summer bypass)**. However, window ventilation is more effective because it introduces bigger amounts of air into the building compared to the summer bypass of the ventilation system.
- After night-time cooling, when it is cooler inside compared to the outside, the **heat recovery of the ventilation system** in a Passive House building ensures that pre-cooled fresh air enters the house: the ventilation system transfers the heat of the outdoor air to the extract air before it comes into the building. The extract air is removed towards the outside, and only the pre-cooled air comes into the building. This option is only possible in a Passive House with a heat recovery ventilation system.
- **Energy efficient household appliances and energy-saving lighting not only reduce the electricity bill, they also** produce less unnecessary waste heat, so that the building remains cool for longer in the summer.
- **Hot water pipes must be well-insulated.** This not only reduces energy losses but also minimises the heating up of rooms in summer.



Practice has shown that Passive House buildings such as those in the Bahnstadt in Heidelberg have a pleasantly cool indoor climate even during hot periods in summer. However, proper planning is crucial.
© Passive House Institute

Active cooling

When a Passive House certifier is entrusted with the task of checking the planning, the certifier will also examine the summer behaviour of the building. If the criteria for summer comfort are not met, the certifier will request modification of the planning. In some cases, additional measures or active cooling may be necessary. For example, if summer ventilation strategies in inner cities are not feasible due to traffic noise or burglary protection, when extreme climatic conditions prevail in warm and humid climate zones, or if there is an altered requirement for comfort.

Hot and humid climate zones

In hot and humid climate zones all the “passive” measures to reduce overheating described above support the Air Conditioning systems which do cooling and dehumidification. Therefore, the cooling load and cooling energy demand in Passive House buildings is much smaller than in conventional buildings. Careful planning of all features and the calculation of cooling load are thus crucial.

Combined with renewable energy

Due to the small cooling load, a small cooling unit with a low output and therefore low electricity consumption will be sufficient for a Passive House building. "A photovoltaic system generates a lot of electricity particularly on hot summer days. Anyone who installs these on the roof can power the Passive House building's cooling unit through this self-generated renewable energy", says Zeno Bastian. The Passive House Institute recommends that expert advice should be sought before retrofitting or installation of an active cooling system.



The Bahnstadt in Heidelberg is currently the largest Passive House settlement. In some apartments, large balconies provide shading.

According to the city, reference is made to changing summer conditions in the future during consulting for further residential projects in the Bahnstadt.

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Cooling in Greece

Stefan Pallantzas is also very interested in the summer comfort in his Passive House retrofit in Greece. Temperatures over 33 degrees are normal in summer in Athens. Therefore, for the 95 square meters of his home, Pallantzas has installed a 2-kW split unit for heating and cooling. "The results were good. The single unit has managed to cool the whole residence without any problem. The temperatures measured inside and outside the building were very close to the ones used in PHPP. The highest temperature measured in summer was 25,70°C." says Pallantzas.

Comfort in New York

Matthew Brouwers of Rochester, New York, USA, is also very pleased with the comfort of his passive house during prolonged periods of heat: "We are certainly satisfying any concerns of comfort with a spot source cooling unit," writes Matthew in a recent article on Heat and Humidity in his [Rochester Passive House Blog](#).

General Information

Passive House

Passive House buildings feature a high quality of thermal insulation, triple-glazed windows, and an airtight building envelope. In winter, heat recovery by the ventilation system introduces preheated air into the building. Five basic Passive House principles ensure that these highly energy efficient buildings can do without a *classic* heating system. Such buildings are called "passive houses" because a major share of their low heating demand is met through "passive" sources such as solar radiation or the waste heat from occupants and technical appliances. A Passive House thus consumes about 90 percent less heating energy than an existing building and 75 percent less energy than an average new construction.

Passive House and NZEB

The Passive House Standard already meets the requirements of the European Union for Nearly Zero Energy Buildings. According to the European Buildings Directive *EPBD*, member states must specify the requirements for Nearly Zero Energy Buildings (nZEB) in their national building regulations. These will come into effect on 1.12.2018 for public buildings and on 31.12.2020 for all other buildings.

Pioneer project

The first Passive House in the world was built in Darmstadt-Kranichstein (Germany) 27 years ago by four private homeowners. Dr Wolfgang Feist was one of them. Ever since they moved in with their families in 1991, these terraced houses have been regarded as a pioneer project for the Passive House Standard. 25 years later, after extensive technical testing, building physicists attested to the unimpaired functioning of the first Passive House and its unchanged low heating energy consumption. With its newly installed photovoltaic system, the world's first Passive House now utilises renewable energy and received the Passive House Plus certificate for this reason.



The world's first Passive House in Darmstadt-Kranichstein.
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Passive House and renewable energy

The Passive House Standard can be combined well with on-site renewable energy generation. Since April 2015, the new building classes "Passive House Plus" and "Passive House Premium" have been available for this supply concept. The first buildings in these two categories have already been certified, including private houses as well as office buildings.

Passive Houses worldwide

Passive Houses buildings for all types of uses now exist everywhere. In addition to residential and office buildings there are also kindergartens and schools, sports halls, swimming pools and factories built as Passive House buildings. The first Passive House hospital in the world is currently being built in Frankfurt am Main, Germany. Interest in Passive House is growing. In view of the consumption of resources in industrialised countries and global warming, interest in Passive House is growing.

Passive House Institute

The Passive House Institute with its headquarters in Darmstadt, Germany, is an independent research institute for highly efficient use of energy in buildings. The Institute founded by Dr. Wolfgang Feist holds a leading position internationally with regard to research and development in the field of energy efficient construction. Among other things, Dr. Wolfgang Feist received the 2001 DBU Environmental Prize for developing the Passive House concept.



Dr. Wolfgang Feist
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Passive House Conference

The Passive House Institute is the organiser of the International Passive House Conference and the accompanying specialists' exhibition. The 23rd International Passive House Conference will take place on 21 and 22 September 2019 in Gaobeidian, China. www.passivehouse-conference.org. In addition, on 3 and 4 May 2019 the Passive House Conference "Besser Bauen" (Better Building) will be held in Heidelberg, Germany. www.heidelberg.passivhaustagung.de

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