



## The "Passivhaus"

Building with the technology  
of tomorrow

It should be noted that details, illustrations, general technical information and diagrams contained in this document are only general proposals and details which merely describe basic functions schematically. No precise dimensions are included. The applicator/customer is independently responsible for determining the suitability and completeness for the product in question. Neighbouring works are described only schematically. All specifications and information must be adjusted or agreed in the light of local conditions and do not constitute work, detail or assembly plans. The technical specifications and information on the products contained in the Technical Data Sheets and system descriptions/ approvals must always be observed.

# The best way to pay less for energy is to use less.

Sto can play a decisive role.

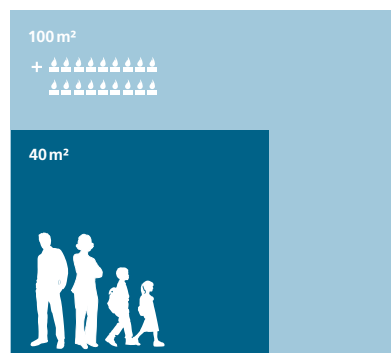


Nearly 90% of the energy we use comes from fossil fuels – and 40% of this energy is used for heating buildings.  
Private residence in Rosegg, A, Architect Dr. Gerhard Kopeinig (Dipl.-Ing.), Velden, A

**Energy is not limitless – and it is certainly not free! Anyone who has given thought to our environment knows this, but homeowners feel this particularly acutely at the end of the year, for this is when heating bills suddenly rise once again. People living in a "Passivhaus" do not need to worry about such things, for a "Passivhaus" does not even need its own heating system. Thanks to its external wall insulation systems, which have been in successful use for a number of decades, Sto is able to make an important contribution.**

Many people do not actually know what a "Passivhaus" is: How does a "Passivhaus" differ from a low energy house? What things need to be taken into account when building a "Passivhaus"? Which EWIS systems are actually suitable for use in a "Passivhaus"? This brochure provides owners, architects, planners and investors with an overview of the things they need to know – and clears up a few misconceptions in the process.

**In a "Passivhaus", each resident is able to heat 10 m<sup>2</sup> – completely by themselves**  
In order to heat 10 m<sup>2</sup> in a "Passivhaus", all that is needed are three tea lights or one person. In other words, if a family of four is sitting in a 40 m<sup>2</sup> living room, they are able to heat the room without any assistance.



## Advantages for residents

- Heating costs are reduced now and in future
- Outstanding living comfort and interior climate without temperature drops
- Fresh air and excellent air quality ensured all year round even for allergy sufferers, thanks to a lack of pollen, pollutants and impure air
- Healthy and well-balanced ambient interior climate in summer and winter alike

## Advantages for the environment

- Low energy consumption
- Active and passive utilisation of renewable energies
- Reduced environmental impact thanks to lower CO<sub>2</sub> emissions
- Conservation of resources

## Economic advantages

- Construction costs are only 5-8% higher than for conventional construction methods
- Government subsidies and low-interest loans
- Fast amortisation within only 0-10 years
- Increases value of residential properties (e.g. rental properties)
- Improved building preservation
- Safeguards investment thanks to better value retention

# It pays to construct a "Passivhaus".

Maximum comfort – minimum consumption.

The "Passivhaus" standard continues to gain ground – and not only for detached houses. Owners, planners and investors have also discovered the advantages of this sustainable construction method for multi-storey residential buildings, office complexes and industrial buildings: minimal energy costs coupled with maximised quality of life – and the extra costs are minimal. Nor should one forget the government subsidy programmes available which further reduce the expenditure required. No wonder that even those renovating or refurbishing old buildings are now achieving great savings by utilising "Passivhaus" elements.

## What exactly is a "Passivhaus"?

The term "Passivhaus" does not describe a particular method of building, but rather a building standard. The most important difference between a "Passivhaus" and a "normal" house is that a "Passivhaus" does not require a conventional heating system at all. This is because it draws its energy solely from "passive" sources, such as the heat recovered from exhaust air (e.g. from the kitchen and bathroom), from direct solar radiation or from heat emitted by the residents themselves.

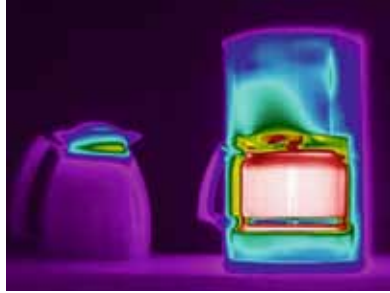
## "Passivhaus" – the definition

With a maximum heat load of 10 watts per m<sup>2</sup>, it is possible to do without a conventional heating system. Over the course of a year, this corresponds to a maximum energy requirement of no more than 15 kilowatt hours per m<sup>2</sup> for space heating – roughly one-tenth of the requirement for a conventional house.



The average heating costs for a 120 m<sup>2</sup> apartment are approx. 1,500 euros per year. A "Passivhaus" apartment of the same size can be heated for only 150 euros.





### Seeing red is expensive

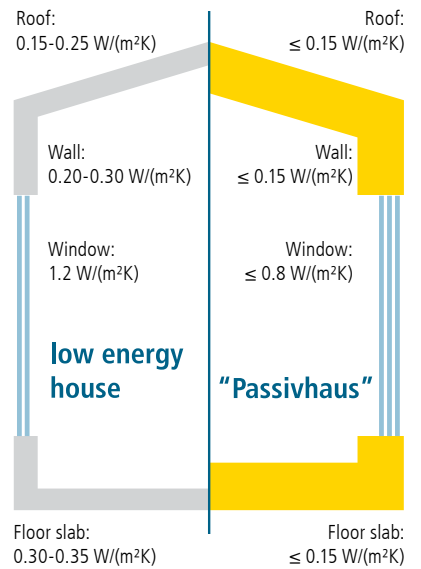
If heat is allowed to escape for no reason, the interior must be heated once again, and that is expensive. The "Passivhaus" guarantees optimum utilisation of heat in the winter and a cool ambient interior climate in summer.



### Low energy house vs. "Passivhaus"

The avoidance of heat loss in a "Passivhaus" is primarily based on the following three factors:

1. An airtight building envelope
2. Optimal insulation
3. Avoidance of thermal bridging at all critical locations such as windows etc.



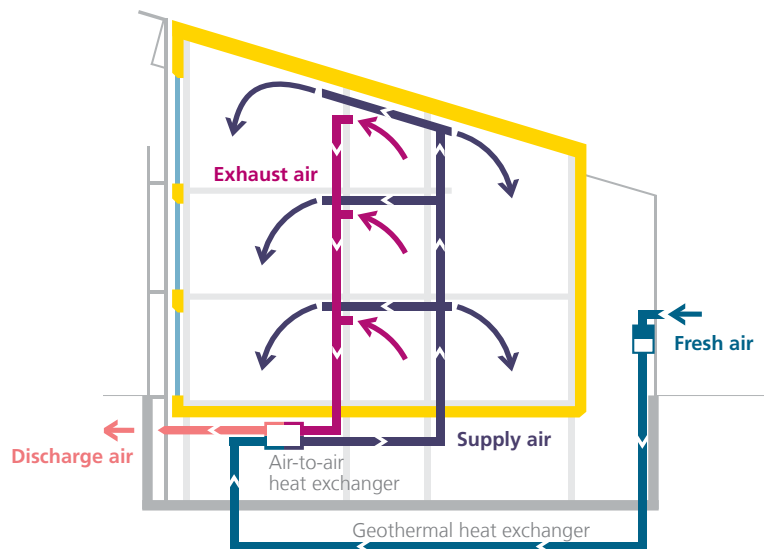
SP8, Neuss, D, Girzalsky Dohmen Architekten, Cologne, D

# There is no more intelligent way to build a house

The standards for a "Passivhaus".

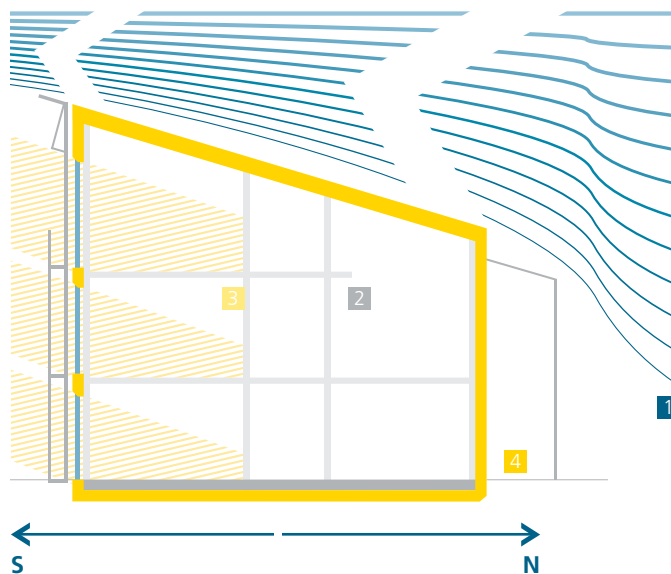
In order for a "Passivhaus" to "work", it must comply with the following technical and planning specifications: a building envelope which is completely airtight; a ventilation system with an efficient heat recovery system; optimised thermal insulation; avoidance of thermal bridging throughout, and triple-glazed windows with highly insulated frames integrated directly into the house's insulation layer. In addition, the primary glazing should be south facing, the structure should be compact in order to avoid possible cooling fins, and the structure should boast modern building installations – all of these features serve to optimise the house.

The "Passivhaus" standard ensures that the interior ambient climate is comfortable in summer as well as in winter without any need for a conventional heating system. Requirement: the energy required for space heating must not exceed 15 kilowatt hours per square metre per year (approx. 1/4 of the energy required to heat a standard new house). It is only during the cold season that heating energy may be supplied in order to maintain room temperature. In this case, it does not actually matter what type of heating is used to generate this energy.



- Three-pane heat protection glazing
- Thermal insulation with a heat transmission coefficient (U value) of less than 0.15 W/(m<sup>2</sup>K)

Unlike "normal" houses, where fresh air is only allowed in occasionally, the fresh air supply is permanently integrated into the "Passivhaus". Controlled ventilation supplies the living areas with a constant supply of fresh air, and ensures that the maximum level of heat is recovered from air discharged from such areas as the bathroom, kitchen, WC etc.



### South-facing compact structure

In order to make optimum use of solar radiation and avoid any possible "cooling fins", a "Passivhaus" should be built as a compact structure with the primary glazing facing south.

- 1 1. Compact structure
- 2 2. Floor plan
- 3 3. Solar radiation
- 4 4. Thermal insulation U value of less than 0.15 W/(m<sup>2</sup>K)



**By the way: opening the windows is perfectly okay!**  
 The widespread belief that "You can never open the windows in a 'Passivhaus'" is simply not true. Of course you are able to open the windows in a "Passivhaus". The thing is, you do not need to, for the rooms are continuously supplied with fresh air – air which is even free of pollen, pollutants and dust.

Architectural facts and figures for the "Passivhaus"	
Good thermal insulation and compact building envelope	Free of thermal bridging with a U value $\leq 15W/(m^2K)$
South-facing structure free of shadow	Passive solar radiation utilised
Triple glazing and optimised window frames	$U_w \leq 0.8 W / (m^2K)$ g-value of approx. 50%
Airtight construction	$n_{50} \leq 0,6 h^{-1}$
Heat recovery from exhaust air returning	$\geq 75\%$ of the heat to the building
Energy-saving devices*	Highly efficient energy-saving devices for the household
Recycled service water heating*	Solar collectors or heat pump
Passive air preheating*	Geothermal heat exchanger

\*optional

### Five advantages of the "Passivhaus"

- 1. Optimal thermal insulation**  
 All non-transparent surfaces (including the floor slab) are to be insulated to provide a fully closed building envelope
- 2. Avoidance of thermal bridges throughout**  
 This is to be ensured through proper planning and outstanding execution of all details
- 3. Airtightness**  
 The airtight building envelope is tested in advance using the so-called "blower-door test" to ensure that it offers reliable protection against uncontrolled air exchange
- 4. Heat protection glazing**  
 Three-pane heat protection glazing and highly insulated frames integrated directly into the house's insulation layer
- 5. Active ventilation**  
 This is ensured by a continuous supply of fresh air and the highly efficient recovery of heat from exhaust air

## 400 million square metres worldwide

EWIS components from Sto are unparalleled – and have been for more than 40 years

**The energy requirements of "Passivhaus" are directly dependent on the quality of its insulation. In other words, buildings which are otherwise well insulated can find their energy balance severely affected by even a few thermal bridges. As a specialist for detail solutions and leading provider of EWIS for more than 40 years, Sto is your ideal partner for state-of-the-art external wall insulation systems. 400 million square metres of Sto systems worldwide attest to that!**



Former post office in Bozen, I, Michael Tribus Architecture, Lana, I

**By the way: Sto is not only unbeatable when it comes to facades – they are also number one in the field of interiors free of harmful substances\*.**

The active ventilation of a "Passivhaus" ensures optimum air purity and quality. Anyone building a "Passivhaus" is also careful to ensure that substances utilised in the interior are also free of harmful substances. Sto interior products are perfect for these ventilation systems. Not only do they allow for unlimited design scope, but they are even produced without using any harmful substances whatsoever.





# Insulation systems deserve a closer look.

Sto offers optimum solutions for every detail.

When building a "Passivhaus" it is essential that potential thermal bridges are eliminated at the time of construction. Penetrations of the thermal envelope should be kept to a minimum and building components should be thermally insulated. The basic rule is, the better insulated the connections, building corners, projections, recesses, reveals etc., the fewer the thermal bridges that will be created. Those who want to be on the safe side rely on Sto's systems which have been specially certified for use with the "Passivhaus" – these have proven their worth for decades.

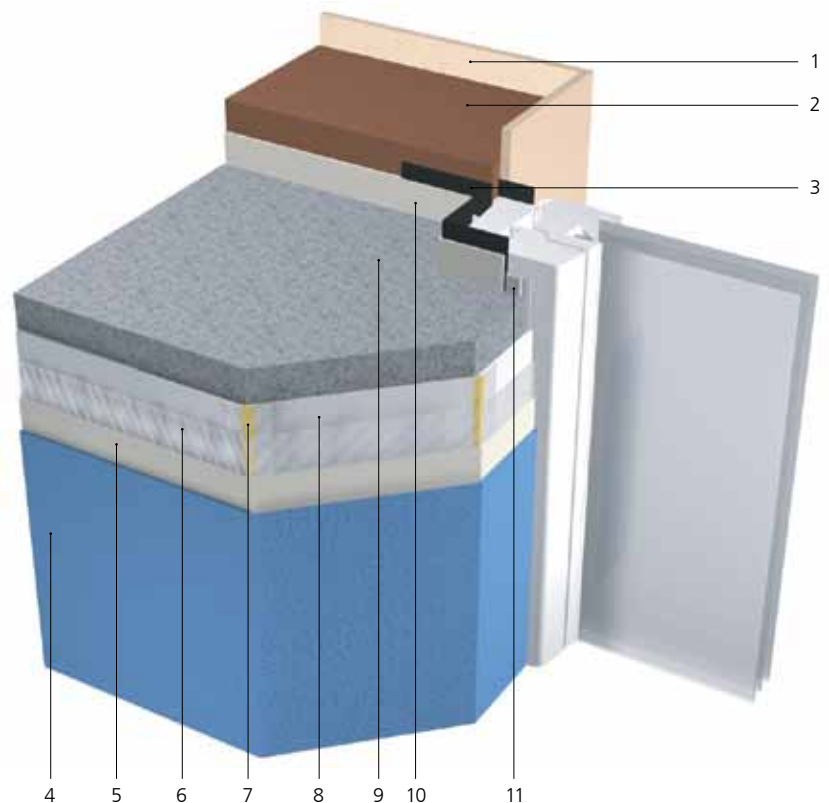
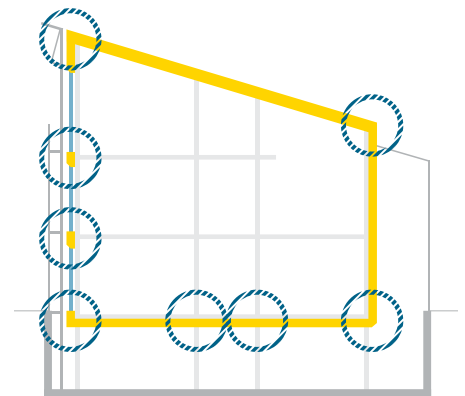


### Thermal image of a "Passivhaus"

The brighter the image, the greater the heat loss to the outside – a darker image shows that the house is better insulated. The thermal image makes it official: the "Passivhaus" building envelope is perfectly insulated

### Heat loss lurks in the details

An airtight building envelope without thermal bridging even at critical points like wall joints and windows: this is the fundamental – and effective – principle behind the "Passivhaus".



1. Interior plaster, 2. Masonry, 3. Airtight connection, 4. Top coat,
5. Reinforcing plaster, 6. Reinforcing mesh, 7. Mesh angle bead, 8. Reinforcing plaster,
9. Insulation board, 10. Adhesive compound, 11. Stop bead

### Triple-glazed – and integrated into the insulation level

With regard to the windows, it is essential not only that they be triple-glazed with highly insulated frames, but also that the windows have been built into the insulation layer of the external wall, for this additional insulation over the frame considerably reduces heat loss.

# EWIS solutions from the market leader.

Certified systems from Sto.

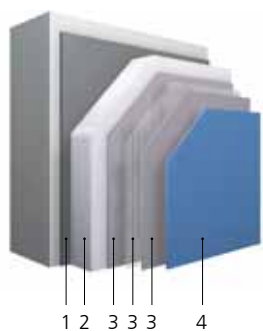
Weather, thermal insulation, sound insulation and fire protection... The diverse range of insulation systems available from Sto provides the ideal characteristics to meet all individual needs – and offers crucial advantages in terms of quality. Our quality assurance process ensures this, and external quality control organisations confirm it: the Sto EWIS product range is renowned among architects, planners and applicators for its durability, reliability and economy.

## Certified quality

In addition to careful planning, high-quality execution of even the smallest details is decisive for the quality of a "Passivhaus". This is only possible with certified systems, for independent certification organisations were set up in order to ensure that architects, engineers, owners and applicators would have a reliable foundation for making their decisions. As a result, these systems are subjected to critical examination, and only those actually able to deliver the characteristics they promise are certified.



StoTherm Classic has been the international benchmark in the field of facade insulation for over 40 years now. It was the very first EWIS subjected to reliability and long-term material quality tests right from the start and certified by the Passivhaus Institut Darmstadt. Some 100 million square metres of StoTherm Classic have been installed around the world, evidence enough that it is not only one of the best insulation systems around, but one of the most economical.



1. Bonding
2. Insulation
3. Reinforcement
4. Top coat

## StoTherm Classic – the globally successful facade insulation system

### Technical advantages

- Highly resistant to mechanical stress – maximum crack resistance
- Weather resistant and highly effective thermal insulant
- Permeable to CO<sub>2</sub> and water vapour
- Limited combustibility
- Insulation material thickness: up to 40 cm
- Broad scope for individual design with regard to colour and structure

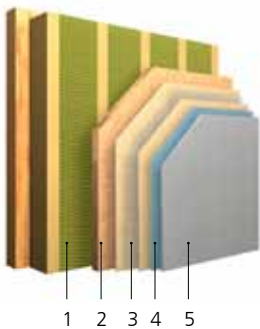


An exemplary case study: StoTherm Wood for a "Passivhaus".  
 Retter detached house, Ratten, A, Reinhard Hausbauer, Ratten, A



Awarded the internationally recognised natureplus seal of quality

With its soft wood fibre insulating board, StoTherm Wood fulfils the highest standards for environmental compatibility and sustainability. It is not only in timber construction that ecological insulation is good for the building biology, for it is free of emissions, compostable and easy to dispose of. It offers an economical and environmentally friendly way to insulate load-bearing timber structures and solid structures alike.



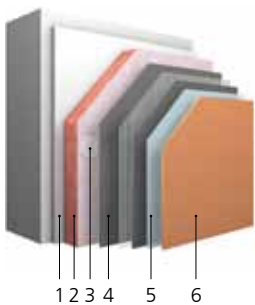
1. Wall structure
2. Insulation
3. Reinforcement
4. Adhesion promoters
5. Top coat

### StoTherm Wood – the ecological facade insulation

#### Technical advantages

- Resistant to mechanical stress – high crack resistance
- Weather resistant and highly effective thermal insulant
- Optimum thermal insulation in summer
- Permeable to CO<sub>2</sub> and water vapour
- Normal combustibility
- Very good sound insulation properties

The old rule that "good thermal insulation means thick insulation" is now obsolete. The new Sto-Resol Insulating Board 022 allows for equally good insulation with much lower wall thicknesses. This can result in as much as eight percent more useable living and floor space while ensuring thinner door and window reveals. This eliminates the "arrow-slit" effect by allowing more light to enter and reducing the size of window sill projections, which also reduces costs.



1. Bonding
2. Insulation
3. Fixing
4. Reinforcement
5. Primer
6. Top coat

### StoTherm Resol – the innovation for "Passivhaus" construction

#### Technical advantages

- Resistant to mechanical stress – high crack resistance
- Weather resistant and highly effective thermal insulant
- Highly permeable to CO<sub>2</sub> and water vapour
- Limited combustibility
- Overall system thickness reduced by up to 45%

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