Multi-Comfort House

Renovation for comfortable living

Solutions for saving energy

ISOVER

Increased living comfort means a better quality of life

What do you need to make you feel truly at home in your own four walls? A comfortable indoor environment. We at ISOVER, the world's leading manufacturer of insulation materials, have recognized this and therefore offer products for thermal insulation, waterproofing, sound and fire protection which can be easily and securely installed to give you long-term protection, even in extreme weather conditions.

But how can you enjoy ideal indoor temperatures all year round and at the same time benefit from significant savings in energy bills? Our Renovation Guide provides you with useful information on thermal insulation and refurbishment. Simply consider your home, from roof to basement, and then use the ideas in this brochure to create the ideal level of comfort for your family's needs.

Start with an old barn – end up with a new lifestyle. Refurbishment to ISOVER Multi-Comfort House level.

Contents

WHAT'S IN IT FOR YOU?
Enhance your comfort – Cut down on energy bills. 4

YOUR OPTIONS
Old buildings transformed into Multi-Comfort Houses – The sky is the limit with ISOVER. 13

OUR SOLUTIONS
Optimum living comfort – from loft to basement. 27

STEP-BY-STEP TO A BETTER HOME
Guiding the path to increased living comfort. 111

SHOWING THE WAY
Examples of inspirational building refurbishments 121

Why make life difficult when it can be so easy? ISOVER not only offers you the products you need to renovate and modernize your home, but in this brochure we show you how to get the best results at the lowest cost for each stage of the work involved. Go ahead and discover the most efficient solutions for your home. Create exactly the level of comfort and indoor environment you want for you and your family.

Information – Planning – Realization: Effective insulation systems for your home.

Live life to the full in a Multi-Comfort House

When you are renovating your own home, you can make exactly the changes you want. ISOVER's perfectly matched systems and customized solutions help you achieve the comfort level of a passive house. And should your family situation change, you can even create additional, high quality living space, for example by converting the loft into a bedroom, study or children's room.

Increasing comfort standards increases the value and security of your home, in every way. The latest generation of high-performance insulation systems also sets new benchmarks for damproofing, sound insulation and fire prevention. You'll add value, and have a quieter and more relaxed atmosphere in your home.

Proper insulation makes all the difference

Modern comfort standards mean you are able to enjoy a constantly pleasant, uniform room temperature as well as fresh, draught-free air. In older buildings, however, it is harder to achieve these conditions, for the following reasons:

- Insufficient thermal insulation causes indoor floor and wall surfaces to feel cold, causing discomfort for occupants
- Leaks in the building envelope lead to permanent, uncontrollable draughts and significant heat losses.
- Windows and doors are poorly insulated and therefore leaky.

The ISOVER Multi-Comfort House ...

- *has been derived from the passive house concept and aims at bioclimatic design*
- *is sustainable and takes ecological, economic and social aspects into account*
- *offers maximum thermal comfort combined with high energy savings*
- *provides excellent acoustic and visual comfort, indoor air quality, fire protection and safety*
- *allows highly flexible design solutions – both indoors and outdoors*

and is a central element of the ISOVER strategy for sustainable building development.

Even if you are willing to put up with high energy consumption and hefty heating bills, you can never satisfactorily compensate for these structural defects. It's as simple as that: When living in a poorly insulated home, you pay a high price without any return on your investment in terms of living comfort. Moreover, the inefficient use of energy wastes resources and causes lasting harm to our environment.

Uncompromising comfort

A perfectly insulated building envelope, free of thermal bridges, keeps the warmth where it should be – inside your home. As a result, the surfaces of interior walls are maintained at very nearly room temperature, which not only creates a 'cosy' feeling, but prevents the detrimental effects of condensation. Don't compromise: make sure every part of your home, including windows and doors, is well insulated so that you can enjoy a constant temperature throughout your home.

Thermal renovation to low-energy house or even ISOVER Multi-Comfort House level drastically reduces the heating energy demand and saves cash for the truly enjoyable things in life. Once you have made the decision to renovate the existing building envelope, don't stop halfway, aim to substantially improve the overall energy performance of your home, to protect your family from ever-rising energy prices. Take the long-term view – short-term compromises will inevitably lead to significant additional expenditure.

The Energy Performance Certificate – making thermal performance transparent

Housing quality and property value – inseparably linked

In the foreseeable future, the energy efficiency of both residential and non-residential housing will be the pivotal factor in the real estate market. All buildings will require a so-called "Energy Performance Certificate", which vendors or landlords will soon be obliged to submit to potential buyers or tenants. Houses with low-level comfort and high operating costs will be easily recognizable by a rating in the "red" area, and will become unattractive and dramatically drop in value. It therefore pays to invest in existing buildings and get them "out of the red".

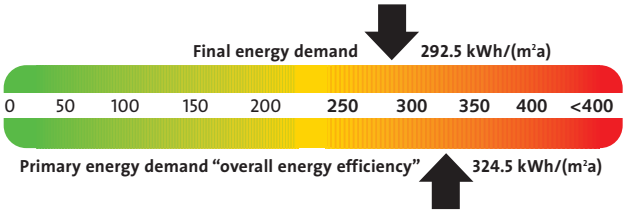
What exactly is an "Energy Performance Certificate"?

In the future, the energy efficiency of houses and flats will be rated, in the same way as household appliances. This rating is based on the type of construction, the architectural style, the building's use and its energy consumption at a defined level of operation. The energy certificate either indicates the calculated energy demand or the measured energy consumption of a building. In the near future, the certificate will also provide information on the building's carbon footprint (CO_2 emission) – like the registration certificate for vehicles. This will help raise our awareness that living, in the same way as car driving, has an impact on energy use and the environment.

Energy efficiency rating	Energy performance value Space heating requirement kWh/(m²a)
Low energy consumption	
A++	10
A+	< 15
A	< 25
B	< 50
C	< 100
D	< 150
E	< 200
F	< 250
High energy consumption	

Energy efficiency classes – a scale similar to that for the energy consumption of household appliances.

Future homeowners and tenants will keep a closer eye on energy performance indices since these have a decisive influence on the building's value and saleability. Houses will attract potential buyers if low energy costs can be certified. And if renovation work needs to be done, this should certainly include thermal refurbishment to increase the long-term value of the building.



Source: dena/BMVBS

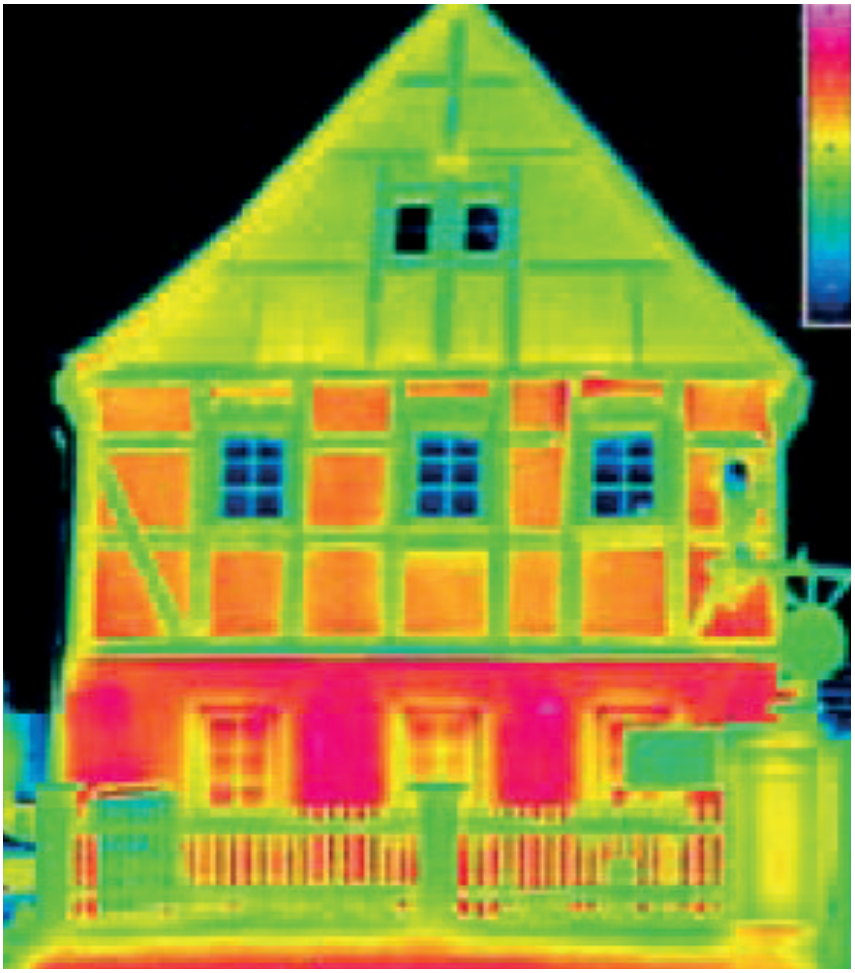
Climate and environment make growing demands on thermal insulation

It is a well-known fact that climates differ from region to region and that today, extremes of climate occur more frequently than just a few decades ago. Global warming is on the increase. But by protecting your roof, floors and walls with effective insulation, you can make your contribution to slowing down global warming and lowering carbon dioxide emissions. You can do your bit to ensure that future generations will find a world worth living in. Please remember: Energy efficiency is key to achieving the climate targets laid down in the Kyoto Protocol. Why not make a start by carrying out an energy-efficient refurbishment of your home?

Prepared for all eventualities – with efficient thermal insulation solutions.

First analyze, then renovate

When planning the low energy refurbishment of your house, the first step should be to insulate the exterior envelope so as to minimize heat loss. Only after the level of insulation achieved is acceptable, or better, should you look to further optimise energy efficiency and indoor environment by, for instance, installing an efficient ventilation system with heat recovery, combined with solar energy for water heating. But what exactly should your priorities be when carrying out a low-energy refurbishment of your house? These can best be determined via a thorough analysis performed by an expert.



The better the insulation, the higher the savings

Thermal insulation helps you to live more comfortably while at the same time cutting down on heating bills. Depending on which solutions you choose, you should be able to cut your energy usage by between 35% and 95%. The initial outlay for better thermal insulation will be quickly recouped, allowing you to reap lifelong benefits. And as the price of heating fuel is predicted to go even higher, your one-off investment in thermal renovation will pay back even faster every time energy costs rise in the future. Your savings will grow – year by year – while you reap the benefits in higher comfort levels.

A thermographic image shows the weak points in a building's insulation and helps you plan the necessary renovation steps. Red areas indicate very high heat losses.

It's your house – so go your own way

The steps you need to take to effectively reduce the heating energy demand of your house will only become clear following a thorough investigation of all of the existing construction elements. For your guidance, we have produced a table that focuses on three architectural periods and the most common building type of each: a classic old building (around 1900), a post-war building (around 1950) and a relatively recent building (around 1975) that is due for a first renovation The table below lists the thermal characteristics typical of each period.

Common building types and their typical insulation values.

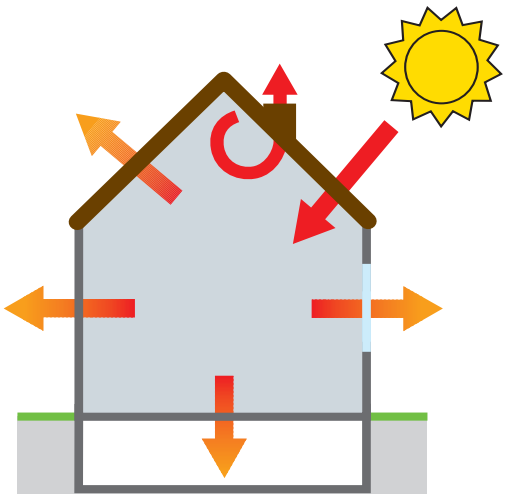
Building element	Built in 1900	Built in 1950	Built in 1975
Roof or top floor ceiling	Unheated attic, no insulation, U = 2.00 W/(m²K)	Unheated attic, 3 cm insulation, U = 0.90 W/(m²K)	Unheated attic, 5 cm insulation, U = 0.70 W/(m²K)
Exterior walls	40 cm natural stone U = 1.70 W/(m²K)	30 cm brickwork U = 1.10 W/(m²K)	30 cm lightweight brickwork U = 1.00 W/(m²K)
Basement ceiling	Wooden joists, no insulation, U = 1.00 W/(m²K)	Concrete, no insulation, U = 2.20 W/(m²K)	Concrete, 1.5 cm insulation from below, U = 1.00 W/(m²K)
Windows	Wooden frame, no gasket, single glazing, U = 5.00 W/(m²K)	Wooden frame, no gasket, single glazing, U = 5.00 W/(m²K)	PVC frame, with gasket, double glazing, U = 2.50 W/(m²K)
House doors	Wooden door, no gasket, 58 mm thick, U = 3.50 W/(m²K)	Wooden door, no gasket, 58 mm thick, U = 3.50 W/(m²K)	Wooden door, no gasket, 58 mm thick, U = 3.50 W/(m²K)
Ventilation	Window ventilation, joints, leaky building envelope	Window ventilation, joints, leaky building envelope	Window ventilation, reduced number of joints, leaky envelope
Airtightness	$n_{(50)}$ = 4.5 1/h	$n_{(50)}$ = 4.5 1/h	$n_{(50)}$ = 3.0 1/h
Space heating requirements (total energy demand)	Approx. 400 kWh/m²a	Approx. 300 kWh/m²a	Approx. 200 kWh/m²a

▶ *Please refer to the inside back cover for a glossary of all physical units and technical terms used.*

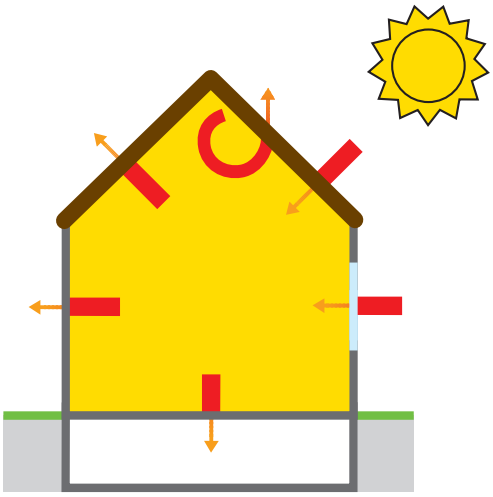
Trust your feelings

Even the greatest heat losses are normally invisible. But put your hand on the cool room-facing surface of a ceiling or external wall and you will immediately feel how much warmth is lost to the environment via the thermal envelope. Only by installing effective insulation can you put a stop to this constant and excessive loss of energy.

Keep the warmth where you need it most: inside your home.



Uninsulated



Insulated

What does a cold surface reveal?

Let's take a room which is regularly heated. If the wall or ceiling is cold to the touch, this is a clear indicator of significant thermal loss. As a result, more energy is needed to heat the room, and in most cases we don't even suspect the true extent of this. Compared to an ISOVER Multi-Comfort House, a poorly insulated building can actually consume twenty times (!) the amount energy for heating.

Let's get down to the details:
Calculate the savings you can realize through thermal renovation.

Energy demand of typical single-family houses		Very poor insulation	Inadequate insulation	Low-energy house	Multi-Comfort House
Building element					
Roof or top floor ceiling	U-value in W/(m²K) λ-value in W/(mK) Insulation thickness	0.90 λ= 0.040 4 cm	0.25 λ= 0.040 / 0.035 16 cm / 14 cm	0.15 λ= 0.040 / 0.035 26 cm / 22 cm	0.10 λ= 0.040 / 0.035 38 cm / 34 cm
Exterior walls (25 cm, solidly built)	U-value in W/(m²K) λ-value in W/(mK) Insulation thickness	1.30 0 cm	0.40 λ= 0.040 / 0.035 6 cm / 5 cm	0.20 λ= 0.040 / 0.035 16 cm / 14 cm	0.11 λ= 0.040 / 0.035 32 cm / 28 cm
Foundation slab	U-value in W/(m²K) λ-value in W/(mK) Insulation thickness	1.0 0 cm	0.40 λ= 0.040 / 0.035 6 cm / 5 cm	0.30 λ= 0.040 / 0.035 10 cm / 8 cm	0,10 λ= 0.040 / 0.035 30 cm / 28 cm
Windows		5.00 W/(m²K) Single glazing	2.50 W/(m²K) Double glazing	1.20 W/(m²K) Double insulation glazing	0.80 W/(m²K) Triple insulation glazing, insulated frame
Ventilation		Window ventilation, joints, leaky building envelope	Window ventilation, reduced number of joints, leaky envelope	Controlled ventilation of the living space	Controlled ventilation of the living space with heat recovery
CO_2 emission **Heating energy consumption (heating oil per m² per year)**		**75 kg/m²a** **30 litres**	**30 kg/m²a** **15 litres**	**12 kg/m²a** **4-5 litres**	**4.5 kg/m²a** **1.5 litres**
Heating energy demand		300 kWh/m²a	150 kWh/m²a	50 kWh/m²a	≤ 15 kWh/m²a
Household electricity consumption		30 kWh/m²a	30 kWh/m²a	25 kWh/m²a	≤ 20 kWh/m²a
Energy consumption for domestic hot water		25 kWh/m²a	25 kWh/m²a	20 kWh/m²a	≤ 10 kWh/m²a
Electricity consumption for living space ventilation		–	–	5 kWh/m²a	≤ 5 kWh/m²a
Total energy demand		355 kWh/m²a Total waste of heating energy	205 kWh/m²a Very high heating costs	100 kWh/m²a Low heating costs	<= 50 kWh/m²a More energy consumed for hot water than for heating

▶ *Please refer to the inside back cover for a glossary of all physical units and technical terms used.*

Your Options

Old buildings transformed into Multi-Comfort Houses – The sky is the limit with ISOVER

- Increase your living comfort, slash your energy bills 14
- Your future heating oil savings 16
- How to reduce heat losses 18
- Energy-efficient ventilation 22
- Your guide to renovation 24

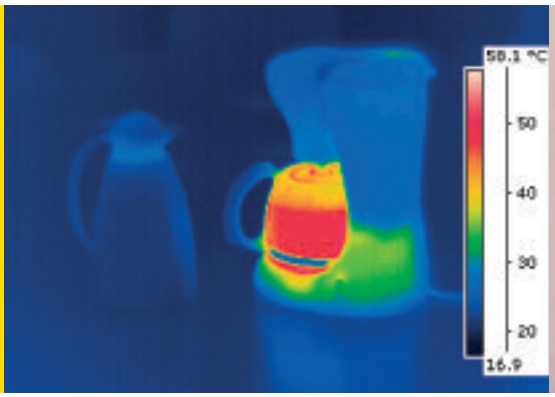
Welcome home:
Experience a new comfort of living

Whatever the weather outside: get cosy at home and feel more comfortable all year round. Renovate your home with products and energy-efficient solutions by ISOVER that are perfectly matched to give you exactly the level of comfort you desire. And what's more, you can rest assured your heating bill will be only a fraction of what it was. Excellence in comfort, cost efficiency and environmental protection – made so easy with the help of ISOVER.

Achieve long-term savings – but start today!

Once you've installed insulation the benefits will last a lifetime. The ISOVER thermal renovation solutions in this brochure will remain effective for as long as the building design stays unchanged. You can always rely on an excellent cost benefit ratio, and if you want to go further, the table opposite shows the kind of additional savings you can achieve by moving to higher insulation standards such as the "low-energy house" or the "ISOVER Multi-Comfort House". This table will help you to compare the annual and accumulated energy and heating cost savings directly with your current expenditure – and find your optimum solution.

Like a thermos flask, excellent thermal insulation keeps the warmth inside and minimizes the demand for heating energy.



ISOVER thermal renovation standards

		Low-energy house	Multi-Comfort House
Roof or top floor ceiling	U-value in W/(m²K) λ-value in W/(mK) Insulation thickness	U = 0.15 λ = 0.040 / 0.035 / 0.032 26 cm / 22 cm / 20 cm	U = 0.10 λ = 0.040 / 0.035 / 0.032 38 cm / 34 cm / 30 cm
Exterior walls	U-value in W/(m²K) λ-value in W/(mK) Insulation thickness	U = 0.20 λ = 0.040 / 0.035 / 0.032 16 cm / 14 cm / 13 cm	U = 0.11 λ = 0.040 / 0.035 / 0.032 30 cm / 28 cm / 26 cm
Basement ceiling	Insulation thickness λ-value in W/(mK) U-value in W/(m²K)	10 cm / 8 cm / 7 cm λ = 0.040 / 0.035 / 0.032 U = 0.30	30 cm / 28 cm / 26 cm λ = 0.040 / 0.035 / 0.032 U = 0.11
Windows		Plastic frames with 5 chambers, double gasket, double glazing U = 1.20 W/(m²K)	Insulated frame, triple gasket, triple glazing U = 0.80 W/(m²K)
House doors		Low-energy house doors U = 1.50 W/(m²K)	Passive house doors U = 0.80 W/(m²K)
Ventilation		Controlled ventilation of living space $n_{(50)}$ = 1.5 1/h	Controlled ventilation of living space, with heat exchanger $n_{(50)} \leq$ 0.6 1/h
Heating energy demand		~ 50 kWh/m²a	~ 15 kWh/m²a
Savings compared to poorly insulated house		67 %	90 %

▶ *Please refer to the inside back cover for a glossary of all physical units and technical terms used.*

Numerous recent studies have shown that low energy refurbishment of buildings produces huge savings, and can therefore be highly recommended as part of your later-years planning. Bearing in mind that energy costs almost doubled between 1998 and 2002 alone, we can expect the trend to be for ongoing higher energy prices, and even energy shortages, despite short term price reductions. It stands to reason therefore, that the decision to renovate will in the future be increasingly driven by economic motives.

Experience has shown that the structural components of a building are only renovated every 20 to 50 years. With modernisation currently supported, in many areas, by government grants or tax reliefs, it is more advisable than ever to go straight to the best available level, and renovate your house to 'passive house' standards – 'while you're at it, do the job properly'. After all, leaving renovation of the building envelope for a later time will incur a second round of high, and unnecessary, additional costs for items like scaffolding, roof covering removal and replacement of interior linings.

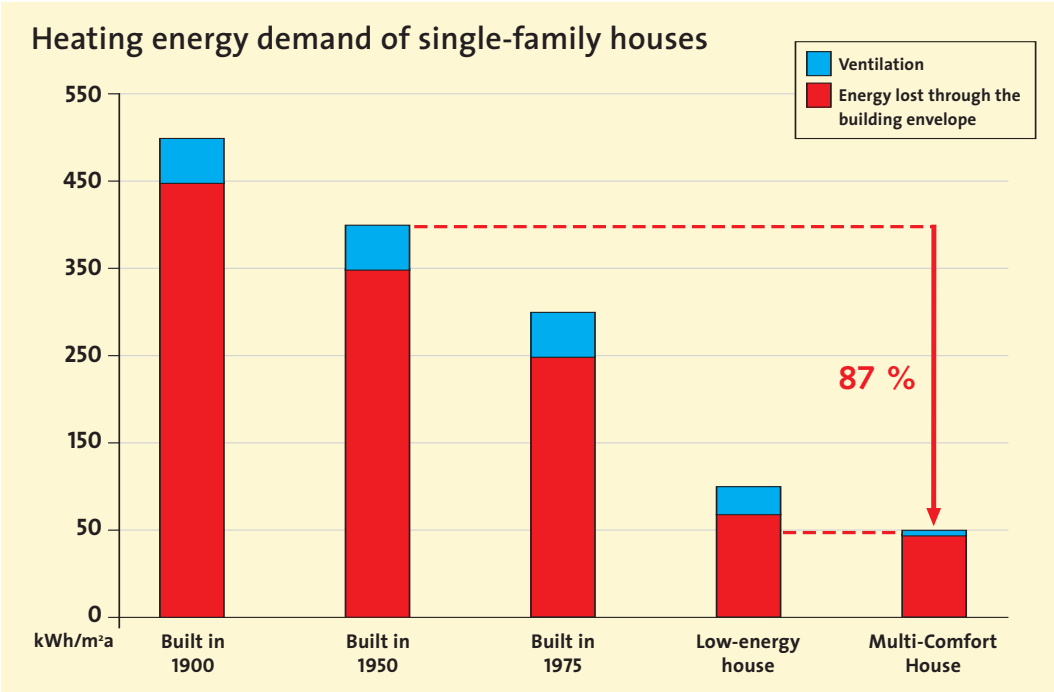
How often do you order heating oil?

Your heating energy consumption is calculated using a formula based on heating energy demand per square metre of living space per year. This is a rather abstract figure, but you can get a better idea by basing it on something more easily measurable, such as the annual amount of heating oil consumed, or the number of heating oil deliveries per year. Whether this figure is high or low depends on the insulation quality of your house – it's as simple as that.

This is how a refurbished single-family house can save 19 truckloads of heating oil

Let's take a real example to better grasp the value of good thermal insulation. A single-family house, built in 1950, with a living space of approx. 100 m², underwent a low energy refurbishment in 2005 and consequently reached the insulation efficiency of a low-energy house. As a result, the demand for heating energy fell drastically – by 35,000 kWh or approx. 3,500 litres of heating oil per year. In other words: If, when the house was built, the owners had installed better quality insulation, they would by now have saved the equivalent of 19 truckloads of heating oil.

Energy savings realized thanks to thermal renovation.



Please refer to the inside back cover for a glossary of all physical units and technical terms used.

Everything starts with meticulous planning

Every renovation project must be based on a coherent master plan. Start by assigning your house to one of the architectural periods listed below. The table shows average values for the different periods of construction, which may differ from region to region due to local building culture. However, it will give you a rough idea of current performance, which, in conjunction with a building energy performance certificate, or consultation with the relevant experts, will enable you to draw up a detailed and well-founded plan. Then refer to the tables and construction drawings later in the brochure to show which thermal improvements are technically feasible and likely to ensure a favourable cost-benefit ratio.

Optimal planning and coordination at every stage

In the ideal case, it is possible to plan and execute a full renovation in a single operation. But in many cases, especially where larger renovation projects are involved, they will often need to be scheduled over longer periods of time. In order to ensure that later steps can build on what has been done before and proceed without hitches and additional costs, it is vital to consider certain interdependencies. ISOVER has compiled a detailed list for you in the appendix.

Average values for different years of construction

Thermal insulation level U-value in W/(m²K)	Built in 1900	Built in 1950	Built in 1975	Low-energy house	Multi-Comfort house
Roof **Top floor ceiling** **Insulation thickness (cm)**	U = 2.60-1.10 U = 1.22-0.78 0	U = 1.41-1.11 U = 0.78 3	U = 1.11-0.77 U = 0.78-0.52 5	U = 0.15 U = 0.15 26	U = 0.11 U = 0.11 38
Exterior walls **Insulation thickness (cm)**	U = 2.48-0.86 0	U = 1.85-0.86 0	U = 1.30-0.52 3	U = 0.20 16	U = 0.11 30
Basement ceiling **Insulation thickness (cm)**	U = 1.37-0.73 0	U = 2.20-1.01 2	U = 1.20-0.85 2	U = 0.30 10	U = 0.11 30
Foundation slab **Insulation thickness (cm)**			U = 1.20-0.85 2	U = 0.30 10	U = 0.10 30
Windows / Doors	U = 5.20-2.57	U = 5.20-2.57	U = 4.30-2.57	U = 1.30-1.50	U = 0.80

▶ *Please refer to the inside back cover for a glossary of all physical units and technical terms used.*

Reduce heat loss – save ready cash

The biggest heat loss is caused by heat being transmitted through the exterior thermal envelope of the building, which is why the systematic insulation of the existing weak points should take priority over any other measures. The decisive factor is the so-called "U-value", indicating the rate of heat flow through a construction. Better (i.e. lower) U-values are achieved by using thicker insulation and/or products with better insulation properties. The lower the U-values of the structural elements, the more warmth stays exactly where you need it – inside your home.

Maximum performance even in tough conditions: insulation by ISOVER

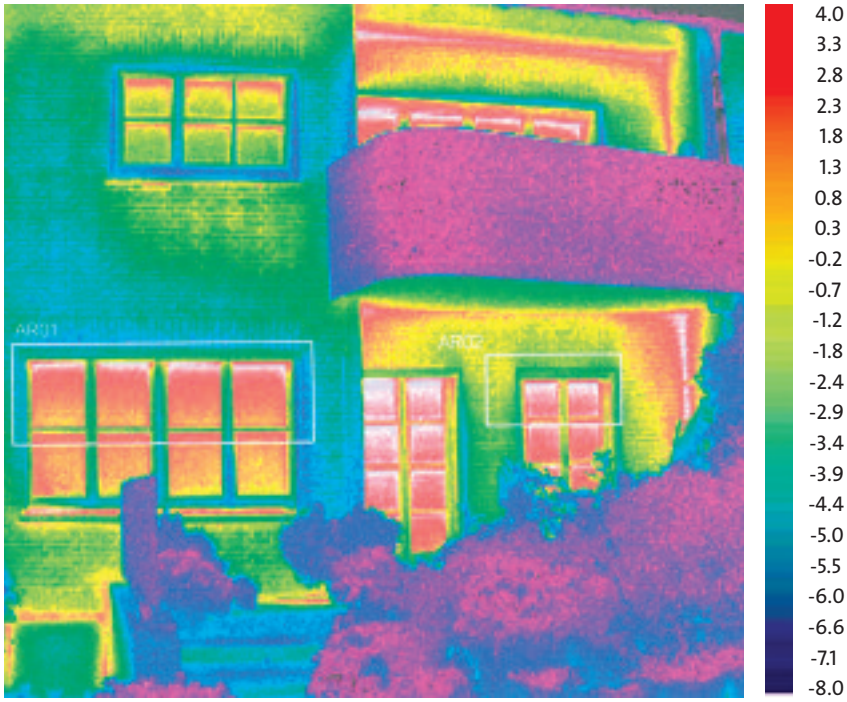
It goes without saying that insulation is particularly important where the thermal envelope is in direct contact with outside air. This is where dedicated ISOVER products really come into their own. To ensure superior performance for the building as a whole, you need high strength, high performance materials that will work in even the most demanding conditions. This is why insulation solutions by ISOVER help you to reduce heat transfer losses through your walls, roof and basement – in some cases by as much as 95 %.

Heat losses made visible

Every building component absorbs, transfers or emits thermal radiation. However, the intensity of this radiation varies considerably depending on the materials used. Thermographic imaging will show you the variation in heat loss using a colour scale (see example below). The most reliable way to reduce thermal radiation and curb your heat losses is to install proper insulation. With ISOVER you can be sure to get the right products and solutions for every area of application.

Useful contacts if you need thermographic images:

- *Energy information centres*
- *Architects*
- *Civil engineers*
- *The builders' guild*
- *Municipal utilities*
- *Power supply companies*



Thermographic imaging provides a coloured picture of the thermal energy radiated by an object. The red colour shows areas with very high heat losses.

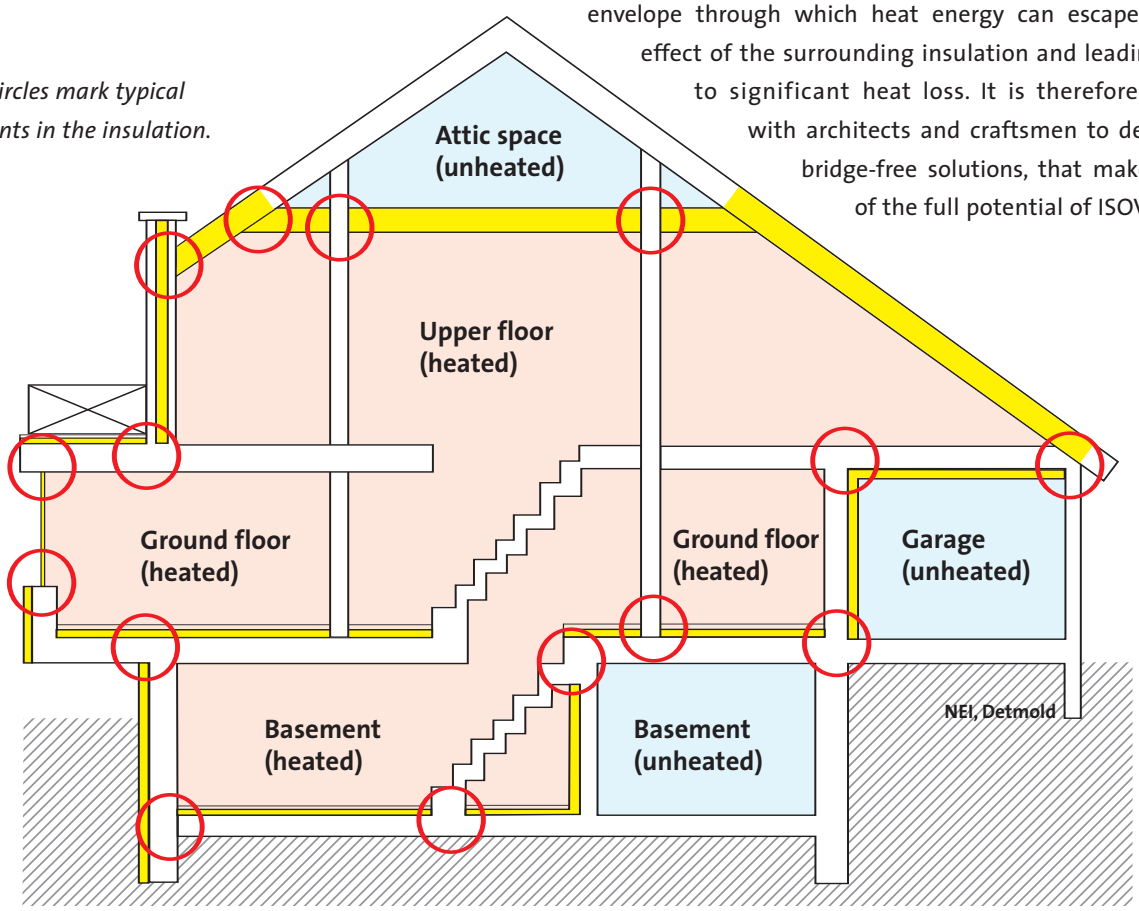
A chain is only as strong as its weakest link

How to identify and eliminate thermal weak points

Heat is lost from buildings by three different routes – ventilation, transmission, and radiation. Ventilation heat loss occurs, for instance, through open windows and doors and, in an uncontrolled way, through small cracks and gaps in the building envelope. Heat will always flow from a warm area to a cooler area, and transmission heat loss therefore occurs because of the temperature differential between the inside and the outside of the building. This is affected by the quality of the thermal envelope the better the insulation, the lower the transmission heat loss. Heat is also radiated from the outside of the building into the cold external air, and is again affected by the quality of the thermal envelope.

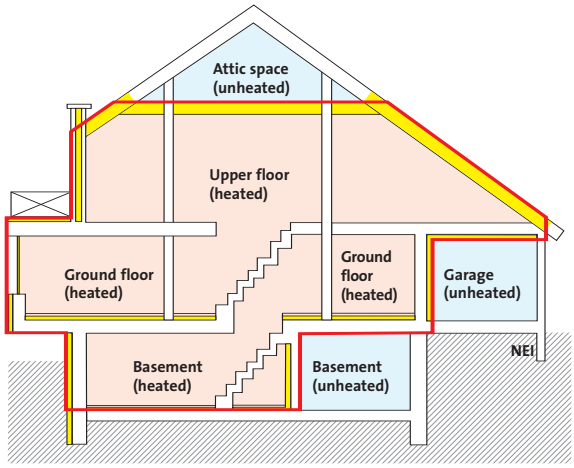
It is crucially important to have a design free of thermal bridges. These are weak points in the building envelope through which heat energy can escape, reducing the effect of the surrounding insulation and leading, potentially, to significant heat loss. It is therefore vital to work with architects and craftsmen to develop thermal bridge-free solutions, that make effective use of the full potential of ISOVER products.

The red circles mark typical weak points in the insulation.



What is the thermal envelope?

The thermal envelope separates the outside of your home from the inside, i.e. the permanently heated living space (above 19°C) from its "cold" surroundings: outside air, the ground, and any basement or loft space that is either unheated or only sporadically heated. The thermal envelope will often, therefore, run inside the building.



The red line indicates the thermal envelope.

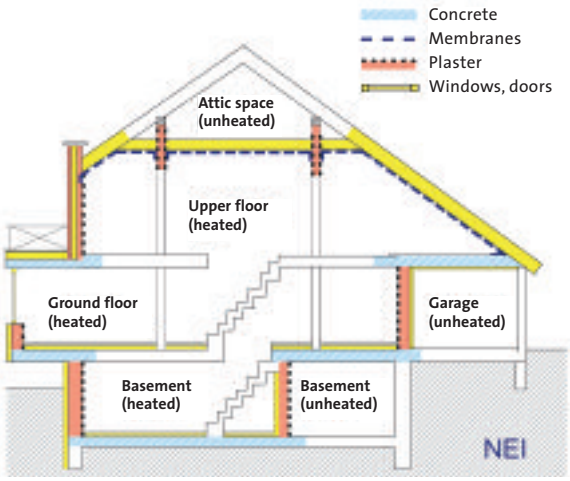
The most important thermal bridges at a glance

Thermal bridges lead to excessive loss of energy – for two main reasons. Firstly, highly conductive materials – such as metal, concrete or brick – may cause weak points in the insulation, and secondly, certain structural elements may actually increase the heat loss, projections, roof tips, pillars and building corners for instance can produce the so-called "cooling fin effect", which is due to an amplification of the surface area.

Thermal bridges are most frequently found around:

- *foundation slabs and basement ceilings*
- *stairs*
- *upper edges of walls (roof area)*
- *wall penetrations between heated and unheated areas*
- *balconies, landings and other cantilevered elements*
- *windows and roller shutter boxes*
- *rafters and support posts used in timber frame constructions*
- *anchoring elements etc.*

These thermal bridges must be taken into account when calculating the U-value of the affected building components. Apart from increased heat loss, thermal bridges may also cause structural damage. Special care must therefore be given to the detailed planning and execution of these critical building components.



Checking the airtightness

Enjoy fresh air – but don't sacrifice your thermal comfort

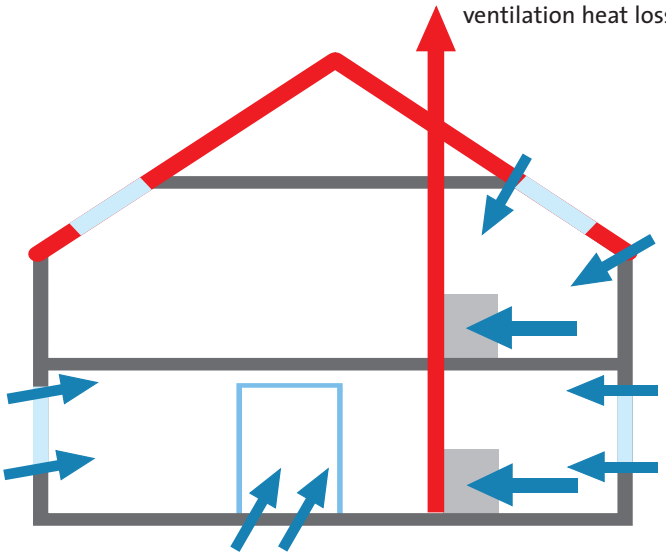
The movement of air between heated rooms and their cooler surroundings has a big effect on the amount of heat that is typically lost in older houses. Cracks and crevices in the brickwork, leaky chimneys and windows cause constant, uncontrollable draughts, resulting in high heat losses. Even an energy-conscious approach to ventilation has little effect.

Warm air: gone with the wind?

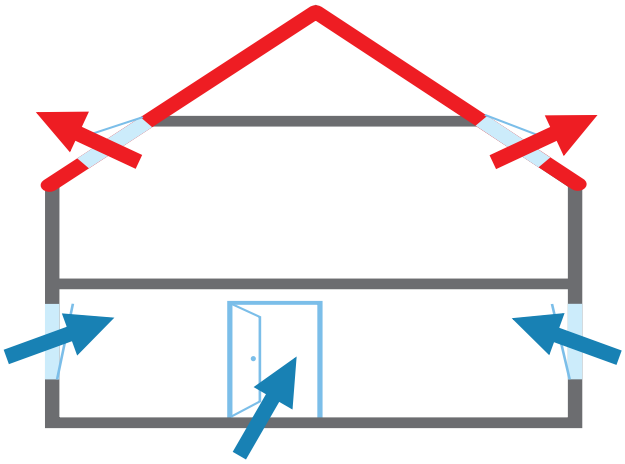
When ventilating rooms manually, there is a direct relationship between fresh air supplied and warm air lost. Even disciplined, regular "shock airing" has a big impact on indoor temperatures – and is often not feasible simply because the residents are away at work. But it is possible to have energy-efficient ventilation that is also resident-friendly. The best choice is a ventilation system with an integrated heat exchanger, controlled either automatically or via air humidity sensors. This not only ensures a constant supply of fresh air in your home, but also reduces ventilation heat loss by up to 85 %.

Don't let your warm air go up the chimney

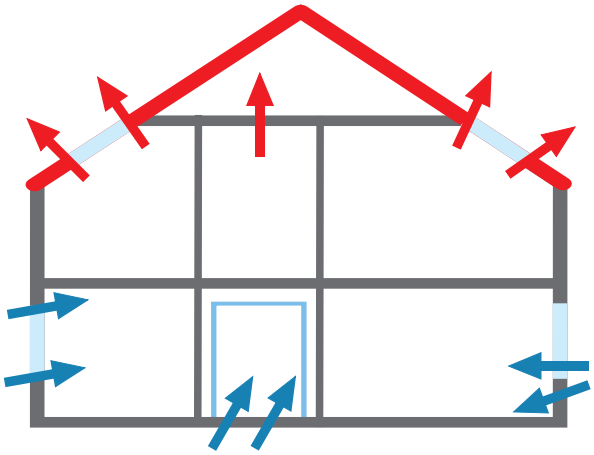
Old fireplaces and stoves draw the combustion air they need from the room while at the same time pulling in outside air through the chimney. As there is always danger of being poisoned by toxic gases, these old appliances need a steady stream of fresh air through leaks and penetrations in the thermal envelope. Since the incoming air is cold, additional heating will be needed to compensate: a textbook example of wasted energy. When thermally renovating your house to ISOVER Multi-Comfort House level, it is therefore advisable to install a fireplace with an integrated air supply hose. This operates independent of the room air, making it more energy-efficient – and healthier.



Required supply of air when operating old fireplaces and stoves.



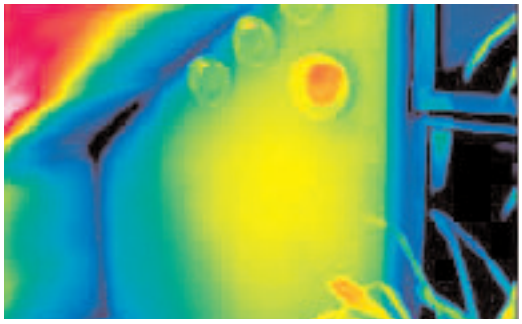
Airtight building: controlled ventilation via windows and doors.

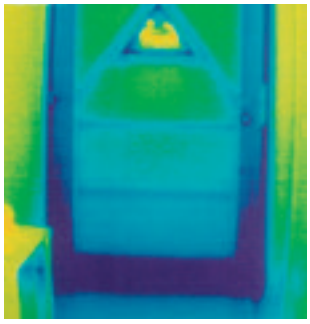


Leaky building: uncontrolled exchange of air through cracks and crevices.

ISOVER helps you stop draughts – easily and effectively

Storms, changes in barometric pressure and thermal effects can all cause cold air to penetrate through leaks in the thermal envelope. Even in heated rooms, this may cause large areas to become significantly cooler, especially at ground level. To tackle this problem effectively simply install airtight membranes and suitably coated ISOVER insulation materials. Stop the energy thieves and get rid of unwanted draughts once and for all – retake control of the fresh air and humidity levels in your home.





Whether visible or hidden: detect all leaks.

Many weak points, such as cracks, gaps or holes, are clear to see, but others may be more difficult to find. Once you feel a draught, however, the cause can often be located using, for instance, a moistened finger or some well-placed tea lights. In more difficult cases, the Blower Door Test can be combined with thermographic imaging to make diagnosis easier. Once the pressure difference between the inside and outside air reaches 50 Pa, any leaks will become immediately visible on the thermogram.

A practical guide: Analysis – Planning – Realisation

The renovation or refurbishment of a building is a large-scale project. To manage it effectively requires consistent, detailed planning. But what do you need to watch out for? Where should you set your priorities? Our indispensible guide will help you, as the building client, to prepare for your discussions with all of the other parties involved. Following the preliminary talks, you will then be able to discuss the planning details and required work steps with the respective experts, including energy advisers, architects, the builders' guild, craftsmen, municipal utilities and energy supply companies.

▶ *Please refer to pages 116-119 for printable checklists.*

1) Carry out the building analysis

Get someone to check the present insulation performance of your house for weak points and carefully record all results. Start with the roof area, including the roof covering, the trusses, all dormers, the gutters and the chimney. Include the top floor ceiling, the facade and the windows. Pay special attention to issues such rising damp and salt attack in these components, the condition of interior plasters and external renders, and any mould growth inside the rooms or the basement. If facade insulation already exists, make sure that it is in good condition and have its effectiveness checked.

With windows you should check carefully the quality of the glass and frame, their year of installation and the condition of any roller shutters and boxes. Inside your home, check in particular the thermal quality of the following areas: the floor above the basement and the foundation slab, the ceiling below the non-insulated attic and any ceiling/floor exposed to outside air.

2) Check the domestic service installations (HVAC)

After recording the present condition of the building as a whole, you should also examine the domestic service installations. This includes an expert check of the heating system, followed by a functional check of all indoor plumbing and electrical systems: cables, gas and water pipes, sewers, telephone and internet lines, security systems etc. A systematic record of the results and of the respective years of installation is vital.

3) Determine the future use

Lay down, as precisely as possible, what you require of your house in the future. Keeping these requirements in mind, check the current floor plan and – if this needs to be modified – check what effect this will have on the structural design and the thermal renovation. If, for instance, you are planning to convert a loft into fully developed living space, the construction of the insulated timber trusses may need to be adapted accordingly.

4) Work out concrete measures

First of all, decide on the quality of the thermal insulation you need for the roof, facade and basement. Next, schedule the required work steps. In particular, make sure that the thermal bridges and leaks detected by the building analysis are eliminated in the course of thermal renovation. Pay particular attention to windows – they not only require excellent insulation quality and expert installation, but if they are exposed to intense solar radiation on south facing walls, they may also require external shading. This brochure will provide you with a host of tried and trusted constructions to help you achieve a comfortable indoor climate.

5) Optimize the energy efficiency

Once the more important insulation measures have been taken care of, you can further optimize the energy efficiency of your house, using some of the following options. By installing a ventilation system with heat recovery, you can reduce your heating energy demand and at the same time further improve your indoor climate through continuous air exchange. And if you also want to minimize your dependence on external energy providers: why not consider locally available, renewable resources such as geothermal or solar energy? You just need to find out first about local grid connections. Another smart tip is to collect rainwater for domestic use: this cuts down on the consumption of precious drinking water.

Legal security and financial benefits

Before setting out on your renovation project, get answers to the following questions:

- *Is your house listed and therefore under a conversation order?*
- *Are the planned refurbishment measures subject to prior approval?*
- *Are state funds or grants available for the planned renovation works?*

Our Solutions

Maximum living comfort – from loft to basement

- The roof: High-end insulation 28
- The exterior walls: Your shield against cold, heat and rain 64
- The basement: Your foundation for perfect thermal comfort 76
- The foundation slab: Top insulation at the very bottom 89
- Acoustic comfort: An integral part of all ISOVER solutions 98
- Windows and doors: Just closed or really tight? 104
- Balcony, loggia and terrace: Detect and remedy weak spots 106
- Ventilation without heat loss: Systems that provide more comfort 108

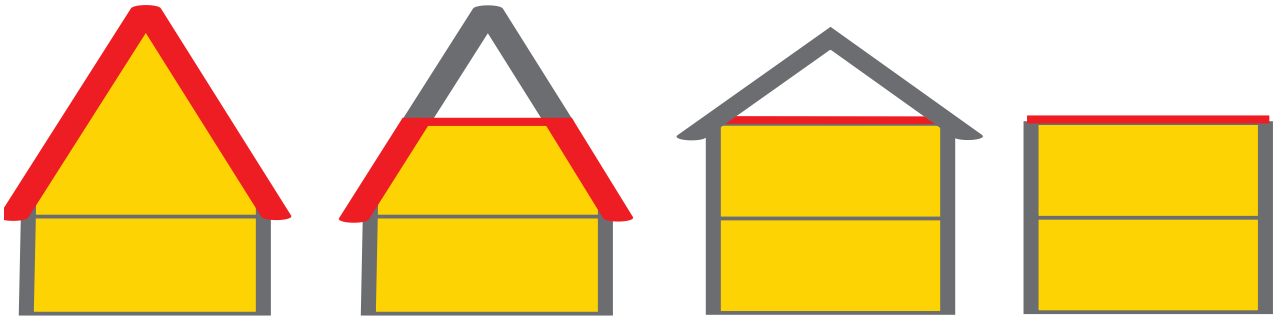
The roof: High-end insulation

In most cases, an extensive low energy renovation of a house starts with the effective insulation of the roof or top floor ceiling – the most cost-effective single way to minimize heat loss and make significant energy savings. Although this part of the house accounts for only 8 to 30 % of the thermal envelope, if it is poorly insulated it could easily account for up to 35 % of all heat lost. So, what's in it for you if you decide on insulation products made by ISOVER? There are a number of benefits, including fast and secure installation, even with flat or low-pitched roofs, plus a very favourable cost-benefit ratio.

Different roofs – one solution: ISOVER

ISOVER Insulation products not only provide effective protection against heat loss and solar heat gain, they also ensure long-term improvement in the roof construction and, when installed correctly, prevent structural damage. On the following pages, we have therefore included details of a range of solutions that have been developed to meet the low energy renovation requirements of different roof types. Before starting any work, however, you should always have the condition of your roof checked by an expert – ideally at the initial planning stage of the project.

Snow that has melted in uneven patches or smoke escaping during an airtightness test are strong indicators of a leaky and poorly insulated roof.



Steep roof | Steep roof and collar-beam ceiling | Top floor ceiling | Flat roof

Different roof shapes call for different solutions

As you will see from the above illustrations, depending on the construction of your house, it is either the external roof structure or the top floor ceiling that separates the permanently heated living space from an unheated space or from the outside air. The building components marked red in the sketches must therefore be equipped with good thermal insulation and an airtight barrier. But whether you are insulating a steep roof, flat roof or a top floor ceiling, in either timber or solid construction, the wide choice of solutions offered by ISOVER always ensures a successful result.

Flexible, fast and reliable: Loft conversions with ISOVER

There are a number of arguments in favour of a loft extension. On the one hand, the fast and inexpensive creation of additional living space, on the other, the unique atmosphere of rooms beneath the roof. ISOVER supplies a wide range of dedicated drywall construction solutions that not only ensure comfortable living conditions, but also high levels of thermal, acoustic and fire protection. Drywall elements minimize the ingress of moisture and their light weight means that the extra load can generally be carried by the existing construction, without additional strengthening. They also offer the added benefits of quick and easy construction and minimal drying out time.

Top-class thermal comfort for loft living

Even a hitherto uninhabited attic can be converted into a snug and beautiful living space in only a short time – thanks to a low energy retrofit with ISOVER. Even if your loft was converted some time ago, you can enhance its thermal and acoustic comfort by upgrading the insulation to current standards, at any time. And, depending on the existing design, you may be able to install insulation either internally or externally. On the following pages you will find some useful tips that will help you in achieving a reasonably priced conversion.

The right approach: Your path to fully developed roof space

It is advisable to work from the outside of the roof if:

- the roof covering and the flashing need to be replaced anyway,
- the insulation layers on the inside are still intact,
- the attic is already inhabited or in use,
- the attic ceiling is so low that sufficiently thick insulation cannot be installed.

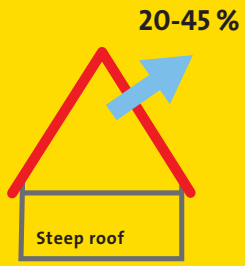
In these cases, use a reinforced thermal insulation – like the ISOVER VARIO system – which also ensures airtightness, and can be efficiently installed from the outside. This system is described in further detail on pages 34-35.

It is advisable to install the insulation from inside if:

- the roof covering and flashing are still intact,
- the attic was hitherto only used as a storeroom,
- the main objective is to create new living space.

Remember that the thickness of the insulation installed will affect the future ceiling height. If you want to reach the insulation level of an ISOVER Multi-Comfort House, it may be necessary to double up the rafters or joists.

Depending on the condition of the roof covering and structure, it may be sensible to use a combination of internal and external insulation. Before making a decision and starting the planning phase, however, make sure that you have the existing structure checked by building experts.



Insulate yourself from rising fuel bills

Rafters are normally between 10 and 20 cm deep, although this may differ dependant on region, climatic conditions and local building regulations. It may therefore be necessary to double the depth of the rafters if you want to achieve effective thermal insulation – a minimum 30 cm of insulation is required to achieve low-energy house standards, while to reach the excellent energy efficiency level of an ISOVER Multi-Comfort House, you will need at least 40 cm of insulation. With these kinds of insulation thicknesses, you can enjoy an ideal indoor climate while cutting down on your utility bills – with cost savings of up to 95 %!

Energy use and potential savings based on a steep roof with a roof area of 100 m²				**Low-energy house**			**ISOVER Multi-Comfort House**		
				Thermal conductivity W/(mK)			**Thermal conductivity W/(mK)**		
				0.032	**0.035**	**0.040**	**0.032**	**0.035**	**0.040**
Insulation thickness in cm	**0**	**5**	**10**	**28**	**30**	**33**	**38**	**40**	**43**
U-value in W/(m²K)	2.87	0.74	0.40	0.15			0.11		
Energy heating demand in kWh per year	24,108	6,216	3,360	1,260			924		
Heating energy demand in kWh over a period of 40 years	964,320	248,640	134,400	50,400			36,960		

The calculation is based on a moderate climate with 3500 Kd heating degree days and a construction with 10 % timber content

▶ *Please refer to the inside back cover for a glossary of all physical units and technical terms used.*

VARIO climate membrane – perfect moisture control down to the last detail

It's not surprising that uncontrolled ingress of moisture due to open joints or a missing vapour barrier can cause considerable damage to your roof structure. A timber frame construction, therefore, needs to be airtight – and this can only be ensured by a combination of good quality workmanship, and a high quality integrated system, such as the ISOVER VARIO system. You could say that VARIO is a form of "life insurance" for your property.

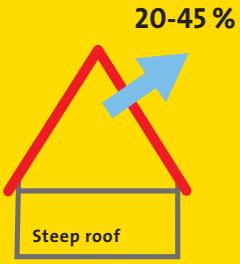
From inside the roof: the easy route to higher insulation comfort

A major advantage of renovating the roof from inside the building is that the work can be carried out independent of the weather – and often you can do it yourself. When planning to install higher thicknesses of insulation, it is often necessary to double up the rafters or joists. ISOVER clamping felts are then installed in the spaces between the rafters. For the best results, however, always install the maximum thickness of thermal insulation.

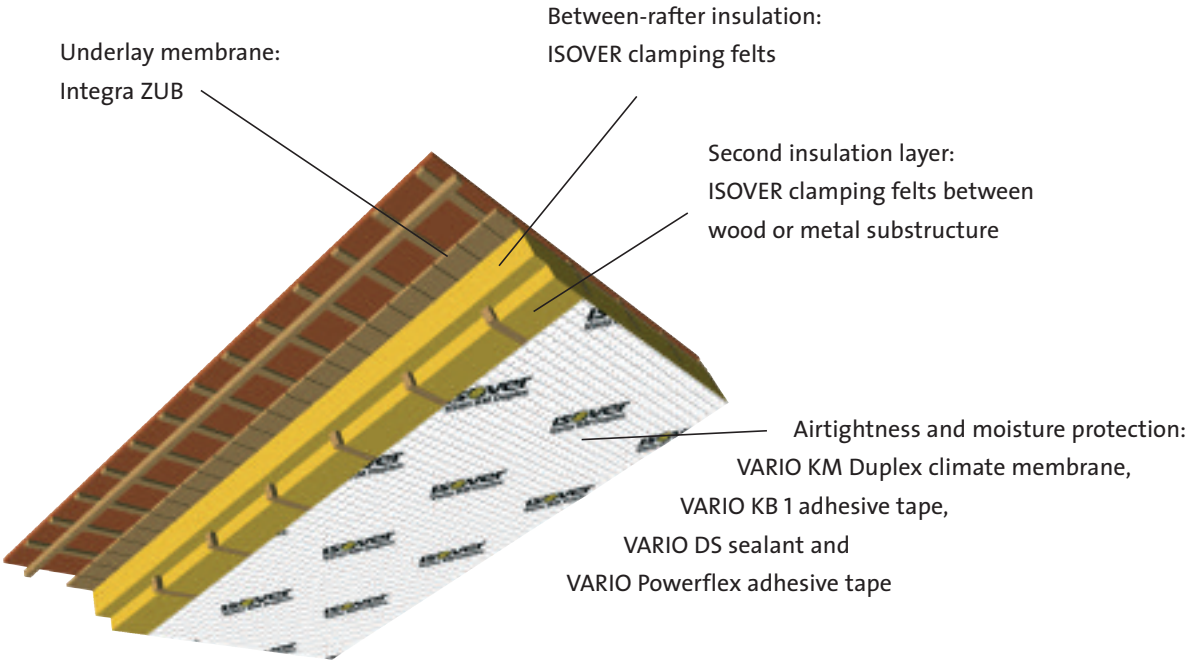
Reliable prevention of moisture damage

Living in the roof space in comfortable and energy efficient conditions means you must have a dry, airtight building envelope. And this is precisely where ISOVER's VARIO package sets new standards in air and moisture control with its perfectly matched range of bonding and sealing products. Thanks to the moisture-controlling effect of the VARIO KM and VARIO KM Duplex climate membranes, significantly less moisture penetrates the roof than is dried out over the year. During the cold season, the membrane prevents moisture from entering the roof, whilst in summer, it allows the roof to dry out and moisture to diffuse harmlessly into the building interior.

Installation tip:
Install the second layer of thermal insulation at right angles to the rafters to minimize the thermal bridge effect.



Schematic diagram of an air and wind tight roof structure meeting the performance level of an ISOVER Multi-Comfort House



VARIO, the multitasking membrane: the benefits at a glance

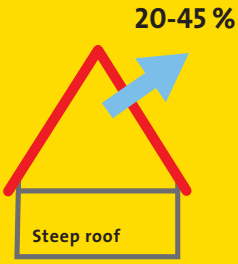
- Airtight and breathable
- Very high drying potential
- High security in the event of increased water loads
- Reliable protection against vapour convection and energy loss thanks to well-matched system components
- No need for chemical wood preservative treatments
- Aroma tightness protects from any toxic gases from old wood preservatives

VARIO – Perfect moisture control down to the last detail

Perfectly matched: the components of the VARIO system

Climate membranes	Properties	Applications
VARIO KM	• Vapour control climate membrane • Variable s_d-value from 0.2 m to 5.0 m	• For sealing the insulation layers installed on roofs and walls • Perfect moisture protection
VARIO KM Duplex	• Nylon-reinforced vapour control climate membrane • Variable s_d-value from 0.3 m to 5.0 m - Highly resistance to tearing - Easy to install thanks to line markings	
Adhesives and sealants	**Properties**	**Applications**
VARIO KB 1	Single-sided adhesive tape with high adhesion	Extra wide to ensure airtight seam sealing of the VARIO KM / VARIO KM Duplex climate membranes
VARIO KB 3	Single-sided, highly flexible adhesive tape	To ensure wind- and air-tight bonding of all penetrations and joints in VARIO KM / VARIO KM Duplex climate membranes
VARIO DS	Permanently elastic and self-adhesive sealant	For producing perfectly wind- and air-tight joints in VARIO KM / VARIO KM Duplex climate membranes
VARIO ProTape	Permanently elastic and self-adhesive sealant from the roll. 50 % faster than application by cartridge. Nonwater-soluble and stormproof up to 150 km/h wind speed.	
VARIO MultiTape	Flexible and ductile adhesive tape with high adhesion	For producing permanently airtight junctures between VARIO KM / VARIO KM Duplex climate membranes and Velux windows, pipes, roof penetrations and membrane overlaps
VARIO MultiTape SL	Flexible adhesive tape with a split liner	
Vario SilverFast	Waterproof and powerful adhesive tape with increased strength	Suitable for various bonding tasks both indoors and outdoors. Main application: bonding underlays, sarking and facade membranes.

▶ *Please refer to the inside back cover for a glossary of all physical units and technical terms used.*



Three simple steps to airtightness

After installing the second insulation layer staple the VARIO KM / VARIO KM Duplex climate membrane to the substructure. In case of metal structures, bond the membrane on top.

Install the membrane sheets with overlaps of approx. 10 cm. Tape over the seams with VARIO KB1 adhesive tape to ensure an airtight seal.

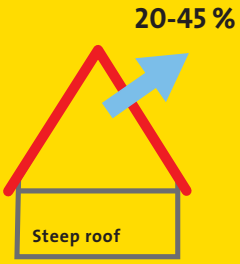
Seal any joints between the membrane and the building structure, e.g. gable, roof, walls or chimney, with VARIO DS sealant or VARIO ProTape. Produce permanently airtight joints around Velux windows, pipes, roof penetrations and the like with VARIO MultiTape or VARIO MultiTape SL.

Adding external insulation to enhance your comfort

When you need to strip and re-tile your old pitched roof, or even fit a completely new roof, you have the ideal opportunity to install low-cost, energy-saving thermal insulation. ISOVER's SANIDACH system has been developed precisely for this application.

SANIDACH – Perfectly suited for roof renovation from outside

The system is simple. Start by installing the patented VARIO KM or VARIO KM Duplex climate membrane between and above the rafters, from outside, to ensure both air tightness and moisture protection. Fit the matching clamping felts and cover with the Integra ZUB underlay, which also serves as a wind barrier, in order to complete the system. And because you are working from outside, you can continue to use the attic space, undisturbed, throughout the entire operation.



Installation procedure:

- Remove the roof covering, lathing, counterlathing and any underlay membrane and boarding, if it exists. Remove any screws and nails from below. Double up the roof timbers if you want to achieve a higher insulation thickness.
- Install the VARIO KM or VARIO KM Duplex climate membrane, without tension, on top of the internal lining and across the rafters. Where membranes join, overlap seams by approx. 10 cm and seal with VARIO adhesive tape. If the tips of screws or nails are visibly, install a protective layer (e.g. an ISOVER impact sound insulation board) underneath the VARIO KM membrane.
- Use the VARIO DS sealant to produce a rainproof seal between the membrane and adjoining elements like eaves, verge and chimney.
- Cut the ISOVER clamping felt to size (between-rafter width plus 1 cm) and position the cut felt between the rafters, from above, to produce tight joints. An insulation thickness of 40 cm will be needed to meet ISOVER Multi-Comfort House requirements.
- Install the remaining roof layers in accordance with the national building regulations. To prevent moisture damage, provide ventilation space below the roof skin, independent of the roof covering. Your carpenter or roofer will be able to advise you. Normally, the Integra ZUB underlay membrane is installed either directly on top of the insulation or on a solid timber board subroof.

Open to excellent ideas: Roof renovation from the inside out

Only by completely exposing the roof trusses do you create the ideal conditions for insulating your roof to the ISOVER Multi-Comfort House level. Once exposed, the existing rafters can be doubled in depth by adding additional timber either below or above. The cavity thus created is then insulated with ISOVER clamping felt over the entire roof area, to the full cavity depth and with tightly fitting joints. Here again, an insulation thickness of 40 cm will meet the ISOVER Multi-Comfort House standard and ensure maximum living comfort.

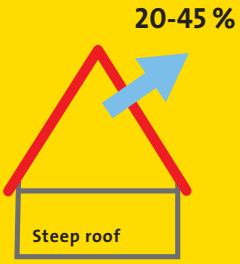
Indispensable: Reliable wind and air tightness

Fitting insulation between fully exposed roof trusses

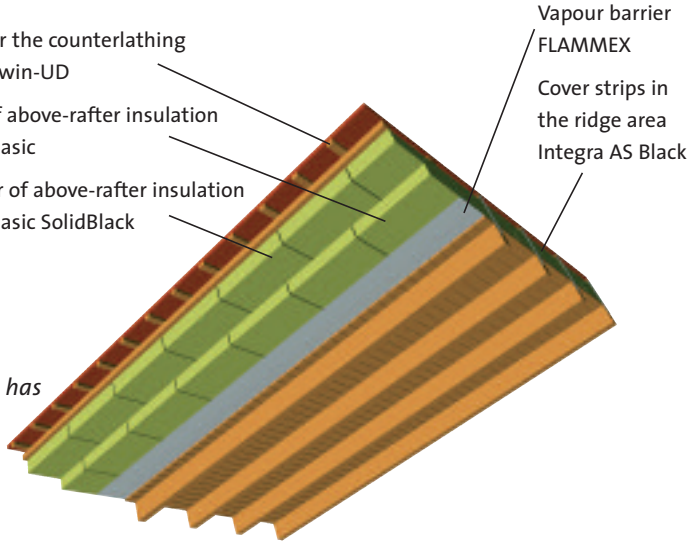
Since the insulation and other roof components are being newly installed, there is no need to compromise on quality or installation standards. In fact, with the roof timbers exposed on both sides, and no old existing layers of insulation to consider, access is far easier and the whole installation process is more straightforward than with single sided access. The key to success is a combination of VARIO KM or VARIO KM Duplex and Integra ZUB. When installed on the inside of the roof structure, the VARIO membrane prevents air and moisture ingress, whilst, on the external side, our CE-certified Integra ZUB ensures that the roof is both rainproof and windtight.

Above-rafter insulation: Gain space, save time

The advantage of using an above-rafter insulation system like Integra AP is that you can include the entire truss into your interior design plans. And during renovation it is possible to carry out several different jobs at the same time. Why? Because above-rafter mineral wool insulation slabs come complete with an integral breathable underlay membrane and overlapping adhesive tape edges to securely prevent leaks during installation. Moreover, Integra AP SolidBlack, which is generally used for the upper layer, has a laminated underlay with a surface that is both water-tight and skid-proof. What you get is a 3-in-1 product, combining insulation, underlay and adhesive tape that not only allows you to produce a thermal bridge-free insulation layer across the rafters, but also has



excellent fire and sound protection properties. The two-layered structure of Integra AP makes installation fast and easy. While the underside of the Integra AP insulation slab stays adaptable and flexible, the top is extremely hard, allowing it to be walked on – at any stage.



Schematic diagram of a pitched roof area that has been optimally insulated above the rafters

Integra AP: Installation in three steps

Step 1: Position ISOVER Integra AP SolidBlack on the roof area.
Step 2: Join the edges of the slabs together with the integrated, overlapping adhesive tape.

Step 3: Screw the load-distributing Integra AB Twin-UD fasteners into the rafters to secure the counterlathing.

A pivotal point: Insulation of the top floor ceiling

If the attic above is not used as living space, and is therefore unheated, the top floor ceiling forms the "thermal dividing line" between the heated and unheated spaces. It is absolutely essential therefore that the top floor ceiling is insulated, and an insulation thickness of 40 cm will ensure that you achieve the insulation level of an ISOVER Multi-Comfort House. The benefits to you will include a comfortable indoor climate in the rooms below, year-round round low energy consumption – and, of course, significant savings.

ISOVER glass wool flexibly adapts to every construction

Regardless of whether the top floor ceiling is timber or concrete, ISOVER insulation solutions, in combination with the VARIO system, will make make sure that you are well-prepared for all eventualities. Naturally, different solutions will be needed depending on whether the insulation is installed from above, below or both sides.

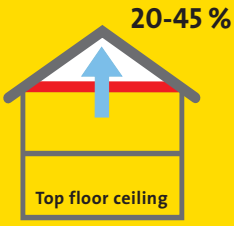
Energy use and potential savings based on a timber joist top floor ceiling with 100 m² floor space				**Low-energy house**			**ISOVER Multi-Comfort House**		
				Thermal conductivity W/(mK)			**Thermal conductivity W/(mK)**		
				0.032	**0.035**	**0.040**	**0.032**	**0.035**	**0.040**
Insulation thickness in cm	**0**	**5**	**10**	**28**	**30**	**33**	**38**	**40**	**43**
U-value in W/(m²K)	3.20	0.76	0.44	0.13			0.09		
Heating energy demand in kWh per year	26,880	6,384	3,696	1,260			924		
Heating energy demand in kWh over a period of 40 years	1,075,200	255,360	147,840	50,400			36,960		

The calculation is based on a moderate climate with 3500 Kd heating degree days and a construction with 10 % timber content

▶ *Please refer to the inside back cover for a glossary of all physical units and technical terms used.*

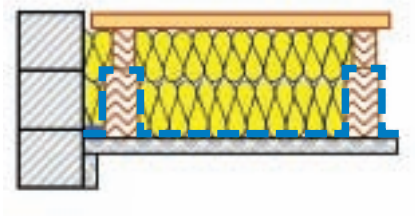
A cost-effective step that enhances your living comfort

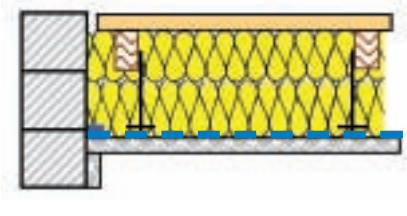
Provided the attic is not used for living space, it is possible to install effective insulation on the top floor ceiling of your house at any time – even insulation that fulfils the requirements of an ISOVER Multi-Comfort House. This solution is especially economical as the total cost, including installation, will be recouped in lower energy bills within just one or two years.



Doubling up for more living comfort

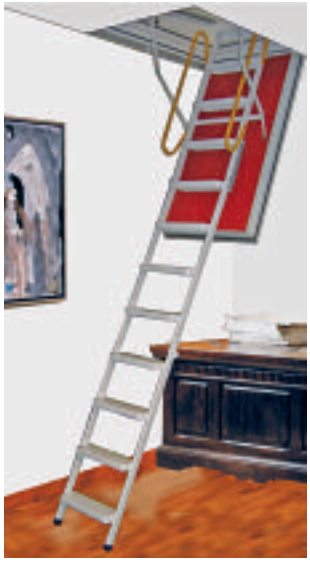
Insulation of the top floor ceiling will be especially cost-effective if the depth of the existing construction is doubled up. Depending on access, the additional depth can be added either above or below the existing joists. The VARIO KM or VARIO KM Duplex climate membrane has an important role to play in this construction, and can also be installed from either above or below, as the following illustrations show.





Doubling up the construction of the top floor ceiling

VARIO climate membrane



"Thermo Star", a Passive House certified attic access hatch with retractable ladder.

Source: company Steiner, Purgstall, Austria

Roof hatches – high heat loss in a confined space

Attic access hatches, used for instance with retractable roof ladders, must be installed by an expert. The hatch must be thermally insulated and the frame must always provide an airtight seal, or high energy losses and structural damage will be inevitable.

Lower weight – higher benefits

Thanks to its low weight, ISOVER glass wool has considerable benefits when used for insulating the intermediate ceiling. Unlike heavyweight building materials that make high demands on the load-bearing strength of the ceiling below, the uniquely lightweight ISOVER glass wool allows you much more freedom of planning and design.

Effective protection against chimney sooting

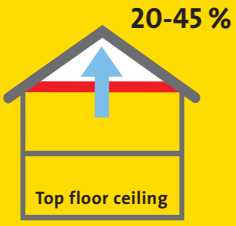
Sooting occurs when the water vapour in the flue gases caused by the burning of fossil fuels, such as coal or wood, condenses on the inner surface of the chimney. One reason for the sudden occurrence of sooting can be a change in flue gas temperature. In such a case, it is necessary to build in a steel or ceramic pipe. Additional insulation of the chimney wall will also reduce the thermal bridge effect of the chimney if the attic is unheated.

The solution: ISOVER SAW chimney insulation slabs

How can you avoid damage to your fireplace or chimney? Quite easily with purpose-made SAW stonewool insulation slabs developed by ISOVER. They are a sustainable way to prevent sooting and the gradual destruction of your chimney.

Installation procedure:

- Take the exact measurements, then cut the SAW insulation slabs to size with a knife or saw.
- Apply a mineral, non-flammable construction adhesive on the uncoated side of the slab. If the background is level, spread the adhesive over the entire slab surface. If the background is uneven, apply spots of adhesive. Position the insulation slab against the chimney and press home firmly.
- Protect the slab edges with commercially available angle or corner beads and apply a mineral plaster coat directly on top of the slabs. Embed a reinforcement fabric in the plaster when wet to avoid cracking.



ISOVER blowing wool for fast-track renovation

ISOVER blowing wool is high quality glass wool that has been specially manufactured for blowing into roof and wall cavities. On site, a purpose-built machine uses pneumatic air and vacuum technology to process the glass wool and blow it into the cavities via a hose. This ensures that the glass wool is applied uniformly throughout the construction that is being insulated. Using ISOVER blowing wool, uneven backgrounds and irregularly shaped spaces can be insulated without any problems.

Application by means of vacuum technology

Sucking and blowing the glass wool into the desired space helps to fill it with air and give it more body. In cavity walls the wool is injected through a regular pattern of holes drilled in one of the leaves. The special blowing machines are capable of injecting up to 6 m² of blowing wool per hour, at a height of up to 50 m, which is more than adequate for most normal height buildings.

ISOVER blowing wool – ideally suited for:

- *Roof cavities of low height*
- *Cavities in intermediate ceilings*
- *Cavities in double-leaf (cavity) walls*
- *Cavities in pitched roof areas*
- *Cavities in vaulted structures*
- *Cavities in old, suspended ceilings*

The advantages of using blowing wool

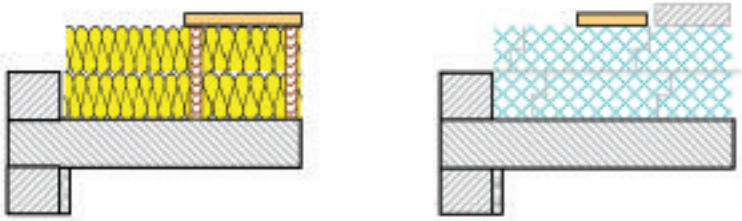
Existing wall and roof cavities can be difficult to access, so the ideal solution is to retro-fill with ISOVER blowing wool. Post construction thermal insulation with blowing wool, does not involve expensive and time structural measures. It will significantly reduce mould growth, condensation and other structurally damaging conditions, and can be installed quickly and cost-effectively, without any waste, offcuts or other material loss.

Solid soffits – lightweight thermal renovation

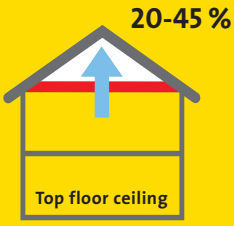
Often, solid concrete ceilings or brick ceilings topped with concrete form the upper limit of the thermal envelope. Good news: they are easy to insulate, simply by adding any thickness of thermal insulation directly on top. To be sure add at least two layers of insulation over the entire area, in order to reach the standard of an ISOVER Multi-Comfort House. Installation is not only easy and quick, it also noticeably lowers the amount of energy lost – and your heating bills.

Effective protection against moisture

Solid ceilings or floors are generally accepted as having a certain level of vapour-resistance and air tightness, however, to be on the safe side when building new, it is sensible to include an effective vapour resistant membrane. It should be applied over the whole area, with joints overlapped by at least 10 cm and sealed with adhesive tape, and all junctions with walls, structural brickwork and the like, properly sealed to maintain air tightness. Once the surface has been properly prepared, there is a whole choice of ISOVER solutions and materials – walkable or non-walkable that can be used alone or in combination.



We highly recommend "laying it on thick" when insulating the top floor ceiling. And no matter if you use ISOVER glass wool or expanded or extruded polystyrene (EPS or XPS): walkways facilitate the use and are suitable for sporadic foot traffic.



Realize high savings with ISOVER

Thanks to the technical ease of installation, there is very little that you need to budget for, other than material costs, when renovating or insulating the top floor ceiling. As a rule of thumb, the thicker the insulation, the better the cost-benefit ratio. A hitherto uninsulated concrete ceiling can therefore be quickly and inexpensively upgraded to reach the efficiency level of an ISOVER Multi-Comfort House. Who wouldn't want to make a saving of more than 95 % on the previous heating costs?

Examples for the insulation of solid ceilings

Energy use and potential savings based on a concrete top floor ceiling with 100 m² floor space				Low-energy house			ISOVER Multi-Comfort House		
				Thermal conductivity W/(mK)			Thermal conductivity W/(mK)		
				0.032	0.035	0.040	0.032	0.035	0.040
Insulation thickness in cm	**0**	**5**	**10**	**20**	**23**	**26**	**30**	**34**	**38**
U-value in W/(m²K)	3.50	0.65	0.36	0.15			0.10		
Heating energy demand in kWh per year	29,400	5,460	3,024	1,260			840		
Heating energy demand in kWh over a period of 40 years	1,176,000	218,400	120,960	50,400			33,600		

The calculation is based on a moderate climate with 3500 Kd heating degree days.

▶ *Please refer to the inside back cover for a glossary of all physical units and technical terms used.*

Insulation at its purest: Non-walkable insulation for solid ceilings

You need only standard insulation products if you are insulating an unused roof space at floor level – it's simple. High efficiency ISOVER thermal insulation felts are your best choice for the job, because they are low in cost, non-combustible and offer optimal insulation properties, combined with the extra benefits of compressed packing and ease of installation. Simply unroll the felt on the top floor ceiling, close any gaps – job done!

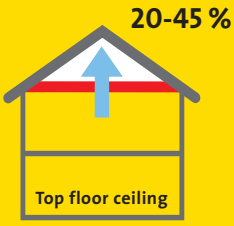
Get a secure return on investment through insulation

ISOVER thermal insulation felts help you achieve the highest possible insulation performance for only a small outlay in material and installation costs. That is why this type of thermal insulation pays for itself in only a short time and then goes on to provide you with lifelong savings in energy costs.

Easy installation but powerful performance

Thanks to their fibrous construction, ISOVER insulation felts offer seamless insulation when installed in two layers. But as they are not strong enough to take foot traffic, it is recommended that you install a walkway if you need access for maintenance work on the chimney, or if you are using areas of the roof space for storage.

Step 1: Cover the floor with a FLAMMEX vapour-resistant membrane, overlapping edges by 15 cm and sealing all joints with VARIO KB1 adhesive tape. At floor edges, extend the vapour retarder up the adjoining structure, then produce an airtight seal with VARIO DS sealant and a pressure lath. The vapour resistant membrane protects the construction against damage caused by condensation.



Step 2: Construct the attic walkway as a kind of "wooden box" or frame. Take two studs of a height to corresponding to the desired thickness of insulation and fasten to the floor with bolts and standard metal brackets.

Step 3: Cut the thermal insulation felt to the required width and fit inside the wooden frame. Fasten a layer of battens on top of the studs and, if required by local fire regulations, install a layer of fibrous plasterboard.

Step 4: Install a second layer of insulation felt on top of the first one with staggered joints. Also place felt around the wall plate to ensure the insulation is free of thermal bridges.

Solid ceilings: The advantages of a walkable attic

For all those with little time to spare but who want to walk around their insulted attic as quickly as possible, ISOVER insulation blocks are the perfect choice. These "heat blockers" not only offer highly efficient thermal insulation, but are also ready for foot traffic immediately after installation – thanks to a fibreboard facing.

Thermal insulation blocks: Rapid installation and sure-footed use

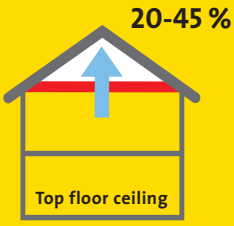
ISOVER's prefabricated attic insulation elements consist of glass wool or expanded polystyrene (EPS) with fibreboard bonded on top. The elements have a handy 110 x 60 cm or 100 x 50 cm format and an all-round shiplap edge between the insulation material and the fibreboard to facilitate installation and produce a homogeneous and level floor. As a result, the entire attic space can be used for storage purposes and occasional foot traffic. The insulation elements carry loads up to 150 kg/m² as well as offering excellent impact sound insulation.

Walkable attic insulation in only 3 steps

Step 1: *Level out uneven areas of the uninsulated ceiling with sand or another filler material.*
Step 2: *Cover the ceiling with a vapour-resisting membrane, such as FLAMMEX. Overlap adjacent edges by 15 cm and seal all joints with VARIO KB1 adhesive tape. At ceiling edges, extend the vapour resistant membrane up the adjoining structure and produce an airtight seal with VARIO DS sealant.*
Step 3: *Then, simply place the insulation blocks with staggered joints on top of the ceiling – job done!*

Ready for future loft conversion: the TEL raised floor system

If you, at this stage, just want to insulate the loft floor, but are considering using the space in the future as a walkable attic or even planning a complete loft conversion, the TEL raised floor is the best solution for you. Being an ideal subfloor construction, the TEL raised floor is not only dry, light weight and fast to install, it comes ready for covering with a variety of flooring materials – from carpet to parquet.



How to level out uneven ceilings without loose fill

The TEL raised floor system consists of "legs" or pedestals which support 32 mm thick solid wooden panels. Since these pedestals are available for floor heights of between 5 cm and 29 cm, they can easily be used to level out very uneven areas without need for a filler material. Afterwards, the cavity between the floor panel and the ceiling below is completely filled with ISOVER insulation slabs, thus allowing all service pipes and cables to conveniently disappear in the subfloor.

The cavity below the wooden floor panel hides away the insulation and all ductwork and cables.

Fast and easy installation – even if you Do It Yourself

Drive the TEL pedestals into the TEL raised floor panel. Place suitably sized ISOVER insulation slabs on top (format 120 cm x 60 cm). Slip sound absorber disks onto the pedestals and turn the complete panel over.

One turn of the screw from above is sufficient to level out any height differences.

Benefits of the TEL raised floor at a glance:

- *Low weight of only 22 kg/m²*
- *Can be covered with flooring after just one day*
- *Ductwork and cables can be routed through the cavity*
- *Level adjustment of the ceiling without need for a loose fill*
- *Installation heights of 5 to 29 cm*

The flat roof: Perfect insulation for "cold" and "warm" constructions

What distinguishes a "cold" flat roof from a "warm" flat roof? The sole difference is the relative position of the insulating layer, and the waterproof membrane. "Cold" or "warm" says nothing about the insulation effect of the construction.

Proper solutions for every roof: Insulation by ISOVER

Depending on the roof construction, the approach to renovation will be different. With "cold" roofs, there are two options: either open the roof and replace the interior insulation layers, or completely install the new insulation elements on top of the existing structure. With "warm" roofs, renovation is always done on the external face of the roof, without interfering with the load-bearing construction. In recent years, the so-called "duo roof" has come into existence which is actually a combination of a warm and an inverted roof. But whether "cold" or "warm", concrete or timber: ISOVER's comprehensive range of insulation products always offers you the right solution, making sure that you attain energy-efficient insulation that meets the standard of an ISOVER Multi-Comfort House.

Even flat roofs have a pitch

Even flat roofs need to have a slight pitch or slope so the rainwater can drain away. This slope is usually between 2 and 20 degrees, depending on the local regulations. With a slope of between 2 and 5 degrees, drainage may be impeded and water pools and collects in puddles. There is an even higher risk with roof slopes of less than 2 degrees.

"Cold" and "warm" roofs at a glance

Cold flat roof

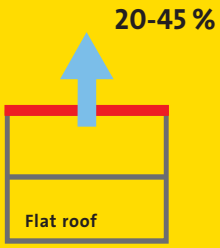
A "cold" flat roof is also referred to as a "ventilated" roof. First of all, a vapour-retarding layer is installed between the rafters or on top of a solid floor/ceiling. This is covered with thermal insulation and a ventilation layer on top. Above the rafters, wooden boarding is installed, covered with a waterproof membrane and the final roof finish.

Warm flat roof

With a so-called "warm" flat roof, the insulation layers are usually installed above the load-bearing ceiling or floor construction which may consist of concrete or wood. On top of the ceiling/floor, a waterproof membrane and a vapour barrier are installed. This is followed by continuous thermal insulation and a final layer of waterproof membrane or roofing felt.

Inverted roof

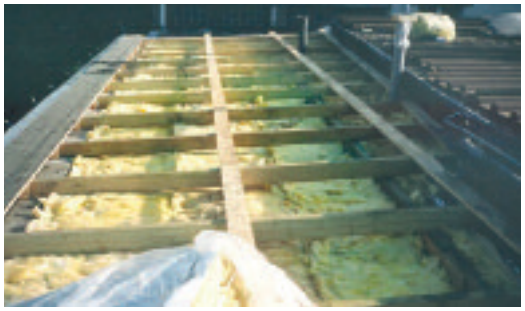
A special variant of the flat roof is the "inverted roof" where the thermal insulation and waterproofing roof layers have been arranged in reverse order. Since the insulation installed on top of the waterproofing layer is located in the wet area, it must only absorb a minimal amount of water. For this reason, insulation slabs made of extruded polystyrene foam (XPS) are primarily used for this purpose.



Thermal comfort and high-level savings

Regardless of the existing roof construction and the renovation approach taken, an insulation thickness of 30 cm is sufficient to bring your flat roof up to the standard of a low-energy house. Going one step further and installing 40 cm, however, will bring you greater benefits in every area: optimum indoor climate, extremely low energy consumption and higher cost savings. In other words, you will have reached the top level of an ISOVER Multi-Comfort House.

Renovation of a "warm" roof with expanded polystyrene boards



Renovation of a "cold" roof with additional insulation installed from above

Energy use and potential savings based on a "cold" flat roof with 100 m² floor space				Low-energy house			ISOVER Multi-Comfort House		
				Thermal conductivity W/(mK)			Thermal conductivity W/(mK)		
				0.032	0.035	0.040	0.032	0.035	0.040
Insulation thickness in cm	**0**	**5**	**10**	**28**	**30**	**33**	**38**	**40**	**43**
U-value in W/(m²K)	2.64	0.72	0.44	0.15			0.11		
Heating energy demand in kWh per year	22,176	6,048	3,969	1,260			924		
Heating energy demand in kWh over a period of 40 years	887,040	241,920	147,840	50,400			36,960		

The calculation is based on a moderate climate with 3500 Kd heating degree days.

▶ *Please refer to the inside back cover for a glossary of all physical units and technical terms used.*

Renovate "cold" flat roofs – enjoy new living comfort

The low energy refurbishment of a ventilated flat roof can also be achieved without disturbing the top floor ceiling. In this case, the new insulation elements can be completely installed from above, on top of the existing roof surface. The "cold" construction effectively becomes a "warm" one, in two respects – firstly because of the new roof structure and secondly, and much more importantly, because of the higher comfort levels achieved. There is no problem with space for high thickness insulation in this type of renovation, as the installation is carried out from existing roof level upwards – and because of the efficiency of ISOVER insulation, the effect on the proportions of the house will be minimal.

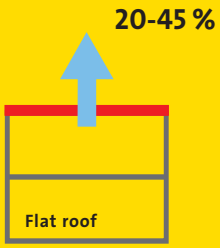
New tasks for old construction layers

Because of the position of the new insulation layer, the structure and operation of the roof construction will change. The old watertight surface is now located between the old and the new insulation layer and thus automatically has the effect of a vapour seal. The previous ventilation space needs to be closed and the new insulation layer sealed from above. Before undertaking this job therefore you should have the technical performance of the planned construction checked by an expert.

Renovation of a cold flat roof from above, including the waterproofing layer and the roof covering.

3 to 1: An insulation ratio that ensures perfect results

If you renovate the roof and do not remove the old waterproofing layer, there will now be a vapour-tight layer located below the new insulation layer. To prevent condensation forming in the old thermal insulation, the performance of the new insulation must be at least three times that of the old. In most cases, this requirement is met if the new insulation is three times as thick as the old insulation.



Thermal improvement – from the inside or from below

If renovation from the outside or from above is not possible, or not required, for instance because the waterproofing layer of the roof is still in a good shape, it is advisable to refurbish from the inside or from below. To achieve this a metal or timber frame sub-construction is built beneath the existing ceiling. The space between the framework and the original ceiling is then filled with suitably sized ISOVER clamping felt, and the whole area covered with a VARIO KM or VARIO KM Duplex membrane to provide an airtight seal. Saint-Gobain plasterboards are generally used to line the new ceiling. In multi-family houses, this method can be used to treat individual flats, with the advantage that it does not require the prior approval of all residents – and because of the relatively low cost it will generally not require a financing scheme.

Suitable even for individual rooms: insulation of the ceiling from inside. Highly important: airtight sealing of all joints with the VARIO system.

This is how "warm" flat roofs truly live up to their name

With so-called "warm" flat roofs, the existing insulation is entirely located on top of the load-bearing construction. Renovation is therefore exclusively done from outside. Before new thermal insulation can be installed, the old layers generally need to be removed, although in some cases they can be retained subject to a thorough analysis of their current condition. In most cases, however, an effective long-term solution can only be achieved by a complete replacement and renewal of all layers.

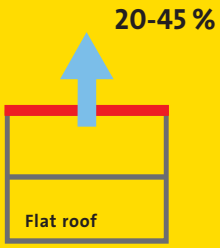
After the load-bearing construction has been exposed and checked, a vapour resistant layer must first be installed prior to fitting the insulation layer – ideally either ISOVER mineral wool or expanded polystyrene (EPS). Finally, the new waterproofing layer is installed.

Flat roof with ISOVER glass wool

Energy use and potential savings based on a "warm" flat roof with 100 m² floor space				Low-energy house			ISOVER Multi-Comfort House		
				Thermal conductivity W/(mK)			Thermal conductivity W/(mK)		
				0.032	0.035	0.040	0.032	0.035	0.040
Insulation thickness in cm	**0**	**5**	**10**	**23**	**26**	**29**	**30**	**34**	**38**
U-value in W/(m²K)	3.20	0.72	0.44	0.13			0.10		
Heating energy demand in kWh per year	26,880	6,048	3,696	1,092			840		
Heating energy demand in kWh over a period of 40 years	1,075,200	241,920	147,840	48,680			33,600		

The calculation is based on a moderate climate with 3500 Kd heating degree days.

▶ *Please refer to the inside back cover for a glossary of all physical units and technical terms used.*



The "duo roof" gives new life to your flat roof

In the past few years, the so-called "duo roof" has been developed especially for renovation purposes. Basically, it combines a warm roof with an inverted roof. The duo roof requires as a base an existing warm roof construction, with a well-preserved and fully functional waterproofing layer that needs to be checked before the renovation starts. A water-resistant insulation material, such as ISOVER XPS extruded polystyrene, is then laid on top. Thanks to the all-round shiplap edge of ISOVER XPS slabs, the thermal bridge effect of butt joints is minimized. Continuous construction sheeting and ballast layers are then installed over the insulation layer to prevent the lightweight boards from being lifted by wind suction. The final layer can then be either gravel fill, exposed aggregate concrete slabs or a plant substrate, if planning a green roof – the final choice depends on the intended use and desired look of the roof.

Roof vegetation: for aesthetic and ecological reasons

The thickness of the substrate layer and consequently the load to be carried by the entire roof construction, varies depending on the type and variety of vegetation. In practice, there are two basic types of roof vegetation – extensive roof vegetation that consists of a thin substrate layer only and largely sustains itself, and intensive roof vegetation, which can include big plants and even trees, and which requires special irrigation and care.

Green roofs are trendy and enhance the quality of life – not only of residential housing.

ISOVER products for roof insulation

VARIO KM Duplex

Reinforced climate membrane (vapour retarder) for waterproofing roofs and walls. Moisture-variable s_d-value of 0.3 m to 5 m. Equipped with a practical installation aid (line marking).

Length – Width	Packaging
40 m – 1.5 m	60 m²/roll

VARIO KM

Climate membrane (vapour retarder) for protecting roofs and walls from moisture damage. Moisture-variable s_d-value of 0.2 to 5 m.

Length – Width	Packaging
60 m – 2 m	120 m²/roll
30 m – 2 m	60 m²/roll
15 m – 2 m	30 m²/roll

VARIO KB 1

Extra wide, single-sided adhesive tape for sealing joints in membranes to provide an airtight seal. Perfect for use with VARIO KM / KM Duplex climate membranes.

Length – Width	Packaging
20 m – 60 mm	12 rolls = 240 m
40 m – 60 mm	5 rolls = 200 m

VARIO KB 3

Single-sided, highly flexible adhesive tape to provide a wind- and air-tight seal at all joints and penetrations in VARIO KM / VARIO KM Duplex climate membranes.

Length – Width	Packaging
15 m – 60 mm	12 rolls = 180 m
25 m – 60 mm	10 rolls = 250 m

VARIO DB

Self-adhesive joint sealing tape from the roll that is used, together with clamping rails, for producing airtight joints between lightweight and solid constructions.

Length – Width	Packaging
8 m – 17 mm	6 rolls = 48 m

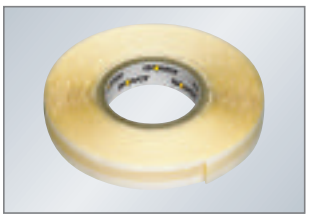
VARIO DS

Permanently elastic sealant in a handy cartridge or sausage. Used for producing airtight joints between VARIO KM / KM Duplex climate membranes and floors, ceilings and walls. Also used for fixing the overlapping seam areas.

Product	Volume	Packaging
Cartridge	310 ml	12 units
Sausage	600 ml	12 units

VARIO Pro Tape

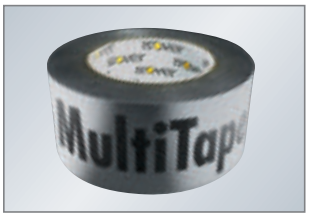
Permanently elastic, self-adhesive sealant from the roll for producing airtight joints between VARIO KM / KM Duplex climate membranes and floors, ceilings and walls. Also used for fixing the overlapping seam areas.



Length – Width	Packaging
10 m – 25 mm	5 rolls = 50 m

VARIO MultiTape

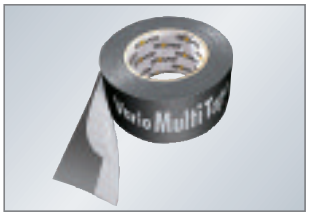
Single-sided, flexible and ductile adhesive tape with a high bonding strength for producing durable airtight seals between VARIO KM / VARIO KM Duplex climate membranes and Velux windows, pipes and roof penetrations. Also suitable for taping overlapping membrane seams (indoors and outdoors).



Length – Width	Packaging
25 m – 60 m	10 rolls = 250 m

VARIO MultiTape SL

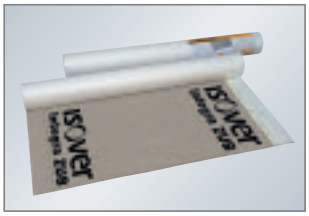
Single-sided, flexible adhesive tape with a split liner for producing durable airtight seals between VARIO KM / VARIO KM Duplex climate membranes and Velux windows, pipes and roof penetrations. Especially suited for use in corners and difficult-to-access areas, thanks to the split liner.



Length – Width	Packaging
25 m – 60 m	10 rolls = 250 m

ISOVER INTEGRA ZUB

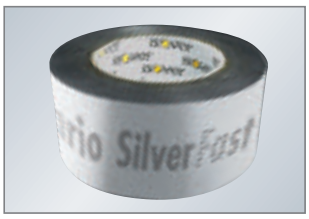
Robust and easy to install Polyolefin roofing underlay and sarking membrane, with integrated adhesive tape, used for steep roofs and timber frame constructions. Extremely breathable, rainproof and windtight.



Length – Width	Packaging
50 m – 1.5 m	75 m²/roll

VARIO SilverFast

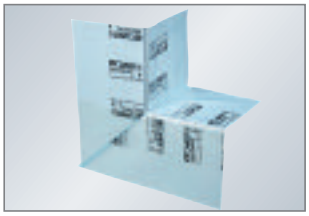
Single-sided adhesive tape used outdoors for producing durabe airtight bonds between the overlapping seams of underlay and sarking membranes as well as for sealing all junctures between the membranes and adjoining building components, e.g. Velux windows, pipes, etc. Also ideal for taping overlapping seams in VARIO climate membranes indoors and outdoors.



Length – Width	Packaging
25 m – 60 m	10 rolls = 250 m

VARIO TightTec

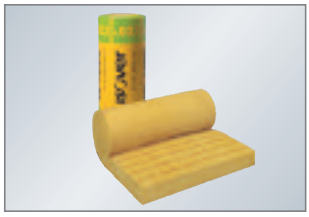
Facilitates the airtight sealing of junctions to exterior walls, windows, doors and inner corners. Easily foldable and adaptable to corners due to the line markings. Connections to the climate membrane must be taped over with VARIO Powerflex or VARIO MultiTape.



Product	Dimensions	Packaging
TightTec X	200 x 400 mm	60 pcs
TightTec X	120 x 400 mm	60 pcs
TightTec I	200 x 400 mm	60 pcs

ISOVER clamping felts of λ_d = 0.032 W/(mK)

- Used for loft conversions and timber construction as insulation between, above and under the rafters
- Ideal for insulating top floor ceilings
- Non-flammable (Euroclass A1)
- Easily cut to size thanks to a line marking



ISOVER clamping felts of λ_d = 0.035 W/(mK)

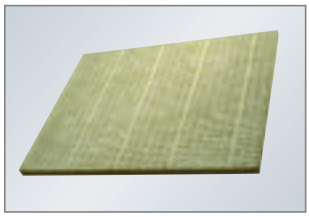
- Used for loft conversions and timber construction as insulation between, above and under the rafters
- Ideal for insulating top floor ceilings
- Non-flammable (Euroclass A1)
- Easily cut to size thanks to a line marking

ULTIMATE fire protection clamping felt of λ_d = 0.035 W/(mK)

- The new generation of high-performance insulation materials
- Used for loft conversions and timber construction as insulation between, above and under the rafters
- Non-flammable (Euroclass A1)
- 30 minutes fire resistance without lining
- Easily cut to size thanks to a line marking

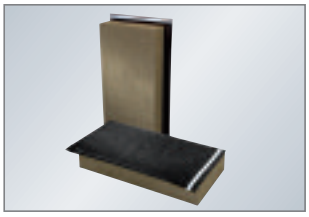
ISOVER SAW insulation board of λ_d = 0.035 W/(mK)

- Used for the external insulation of chimneys
- Non-flammable (Euroclass A1)



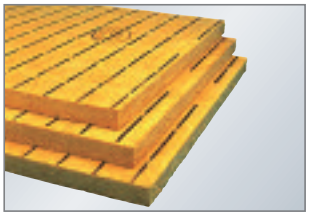
ISOVER Integra SolidBlack insulation slab of λ_d = 0.035 W/(mK)

- Used for robust, continuous insulation on top of roof boarding
- Integrated underlay membrane and adhesive tape facilitate installation



ISOVER LURO insulation slab of λ_d = 0.035 W/(mK)

- Used for robust, continuous insulation on top of roof boarding
- Non-flammable (Euroclass A2-s1, d0)

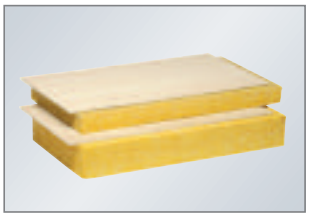


ISOVER blowing wool of λ_d = 0.040 W/(mK)

- Machine-applied insulation for difficult to access roof, wall and ceiling cavities
- Also suitable as non-walkable insulation for the attic floor
- Non-flammable (Euroclass A1)

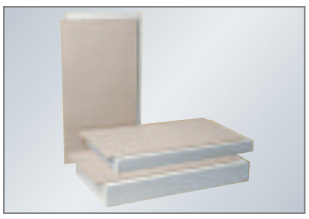
ISOVER insulation blocks of λ_d = 0.036 W/(mK)

- Composite element consisting of a non-flammable fibreboard and mineral wool.
- Used for thermal and acoustic insulation of top floor ceilings
- Load-bearing up to 150 kg/m²



ISOVER insulation blocks of λ_d = 0.035 W/(mK)

- Composite element made of non-flammable fibreboard and expanded polystyrene (EPS).
- Used for thermal insulation of top floor ceilings
- Load-bearing up to 150 kg/m²



ISOVER TEL raised access floor system

- Dry and lightweight floor construction used for renovation and future loft conversion
- Variable height of 5-29 cm, optimally adaptable to all room conditions
- Levels out differences in height and uneven areas without problems
- System comprises wooden panels, pedestals with sound absorbers, flexible edge strips and ISOVER insulation slabs.

ISOVER stonewool slabs for dry screeds of λ_d = 0.035 W/(mK)

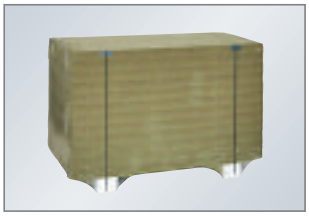
- Double-layered stonewool slabs with a highly pressure-resistant top layer
- For walkable thermal insulation of top floor ceilings under dry screed
- Dry screed can consist of fibreboard (thickness: 18 mm or two layers of 10 mm each) or chipboard (min. thickness: 19 mm).

ISOVER glass wool slabs for flat roofs of λ_d = 0.037 W/(mK)

- For load-bearing insulation of warm or cold flat roofs, also used as bottom layer in duo roofs
- Suitable for wood, concrete and metal constructions
- Range of pre-shaped elements and sloping insulation boards facilitates installation
- Non-flammable (Euroclass A2-s1, d0)

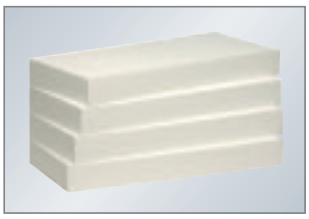
ISOVER stonewool insulation slabs for flat roofs of λ_d = 0.040 W/(mK) or 0.039 W/(mK)

- For highly load-bearing insulation of warm or cold flat roofs, also used as bottom layer in duo roofs
- Suitable for wood, concrete and metal constructions
- Range of pre-shaped elements and sloping insulation boards facilitates installation
- Non-flammable (Euroclass A1)



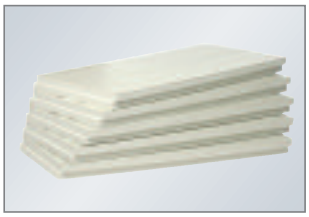
ISOVER EPS insulation slabs for flat roofs of λ_d = 0.035 W/(mK)

- Made of expanded polystyrene foam
- For highly load-bearing insulation of warm flat roofs and as bottom layer in duo roofs
- Range of preshaped elements and sloping insulation boards facilitates installation
- Fire behaviour: Euroclass E



ISOVER XPS insulation slabs for flat roofs

- Made of extruded polystyrene foam
- For highly load-bearing insulation of inverted roofs and as top layer in duo roofs
- λ_d = 0.033 to 0.039 W/(mK) (thickness related)
- Fire behaviour: Euroclass E



ISOVER products do not limit the creative freedom and aspirations of building owners and planners. Material structures and colours are variable and can be adapted to the individual style of the house.

The exterior walls: Your shield against cold, heat and rain

On a daily basis, the exterior walls of our homes have to stand up to high loads and stresses, as they provide us with a valuable shield against heat, cold and rain. Nearly half of a building's entire heat loss takes place through the exterior walls, and since they are the main "visual hallmark" of the house and its occupants, their optimization naturally takes high priority when undertaking renovation. Depending on the type of construction and the conditions on site, different solutions are possible, but before deciding on the precise measures to be taken, a thorough status analysis is essential. Whether you decide on interior or exterior insulation, whether you prefer a ventilated facade or a composite thermal insulation system, or whether you are planning to fill the cavity inside a two-leaf wall, however, ISOVER products will meet all of the your requirements for a low energy refurbishment.

Overview of typical wall constructions

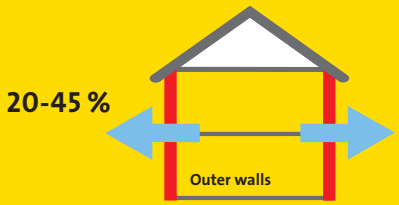
The table below shows some of the most common wall structures and their respective insulation properties. The values will help you determine the current insulation standard of your home and define your future actions.

U-values of different wall constructions				Low-energy house			ISOVER Multi-comfort House		
				Thermal conductivity W/(mK)			Thermal conductivity W/(mK)		
				0.032	0.035	0.040	0.032	0.035	0.040
Insulation thickness in cm	**0**	**5**	**10**	**14**	**16**	**18**	**27**	**30**	**33**
Natural stones 40 cm	2.59	0.61	0.35	0.21			0.11		
Lime-sand bricks 30 cm	1.35	0.50	0.31	0.20			0.11		
Full bricks 30 cm (around 1900)	1.25	0.49	0.30	0.20			0.11		
Perforated bricks or light cement stones 30 cm (around 1950)	1.03	0.45	0.29	0.19			0.11		
Pumice stone or light perforated bricks 30 cm (around 1970)	0.76	0.39	0.26	0.18			0.10		
Double-leaf cavity walls 41.5 cm (around 1970)	0.66	0.36	0.25	0.17			0.10		
Timber-framed walls 15 cm (around 1970)	0.54	0.32	0.23	0.16			0.10		

The calculation is based on a moderate climate with 3500 Kd heating degree days.

Very high energy losses — *High energy losses* — *Low-energy House* — *Multi-Comfort House*

▶ *Please refer to the inside back cover for a glossary of all physical units and technical terms used.*



Indicators of insufficient insulation

The warning signs of poor thermal insulation are easy to spot. For example the facade where snow quickly melts either on or near the wall, the cool internal surfaces of walls, or the cold draughts that disturb the family's thermal comfort. In fact, a low temperature on room facing wall surfaces not only reduces thermal comfort, but means high heating costs and can bring with it structural risks. Humid air may form condensation on, on even within, the walls and, over time,, trigger mould growth and other common moisture-related damage.

Wall moisture: one problem, numerous causes

House building is a continuous battle against the damaging effects of water and moisture – both not only affect the comfort, useful life and appearance of the house, but also result in higher heating bills and may ultimately harm our health. Undesired moisture can originate from different sources: rising damp (due to missing or insufficient horizontal waterproofing), lateral moisture, seepage water, rainwater, water splashes, condensation or leaky sanitary facilities.

An efficient way to optimum living comfort: Insulation with ISOVER

If you want to achieve high levels of thermal insulation in the exterior walls, your primary consideration should be the performance of the insulation material you use. However, the opaque walls will also need to compensate for the heat lost through the transparent parts of the building, such as windows and doors, so when undertaking renovation, it makes sense to replace old windows and doors with new energy-saving alternatives. Depending on the energy performance of the existing wall construction (see table below), a 30 cm thick layer of ISOVER insulation should be sufficient to attain the level of a Multi-Comfort House. This guarantees a pleasant indoor climate and minimal heating costs all year round.

Energy use and potential savings based on an exterior solid brick wall, built around 1900, with 100 m² floor space				**Low-energy house**			**ISOVER Multi-comfort House**		
				Thermal conductivity W/(mK)			**Thermal conductivity W/(mK)**		
				0.032	**0.035**	**0.040**	**0.032**	**0.035**	**0.040**
Insulation thickness in cm	**0**	**5**	**10**	**14**	**16**	**18**	**27**	**30**	**33**
U-value in W/(m²K)	1.25	0.75	0.43	0.20			0.11		
Heating energy demand in kWh per year	10,500	6,300	3,612	1,680			942		
Heating energy demand in kWh over a period of 40 years	420,000	252,000	144,480	67,200			36,960		

The calculation is based on a moderate climate with 3500 Kd heating degree days.

▶ *Please refer to the inside back cover for a glossary of all physical units and technical terms used.*

Facade insulation from outside: Lots of space for lots of thermal comfort

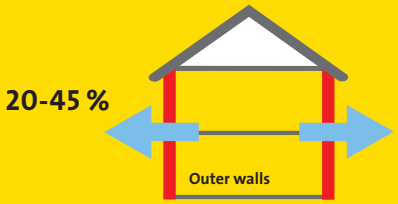
It stands to reason that the thermal refurbishment of the exterior walls has enormous advantages: the entire building can be effectively "wrapped up" so that thermal bridges don't stand a chance. Whilst fitting insulation inside the building can often reduce your living space, there is usually no limits to extending outwards, so thicker layers of insulation can be used. The result: enhanced living comfort and your heat loss reduced by up to 95%.

Systems for exterior wall insulation

In most cases, the exterior walls of a building can be refurbished by using some kind of composite thermal insulation or a ventilated facade. In the case of double-leaf cavity walls, however, cavity insulation can be used in combination with other systems.

• Composite thermal insulation systems
Following a thorough analysis of the external render and its load-bearing strength, the wall is directly covered with ISOVER mineral wool or expanded polystyrene (EPS) insulation slabs, secured by dowels if necessary. Window and door reveals must also be insulated to prevent thermal bridges. The whole surface is then covered with a reinforcement fabric embedded in an adhesive filler, before the final external render is applied for additional protection and to give the necessary aesthetic appearance.

If the windows and doors are not replaced, the reveals must also be insulated to avoid thermal bridges.



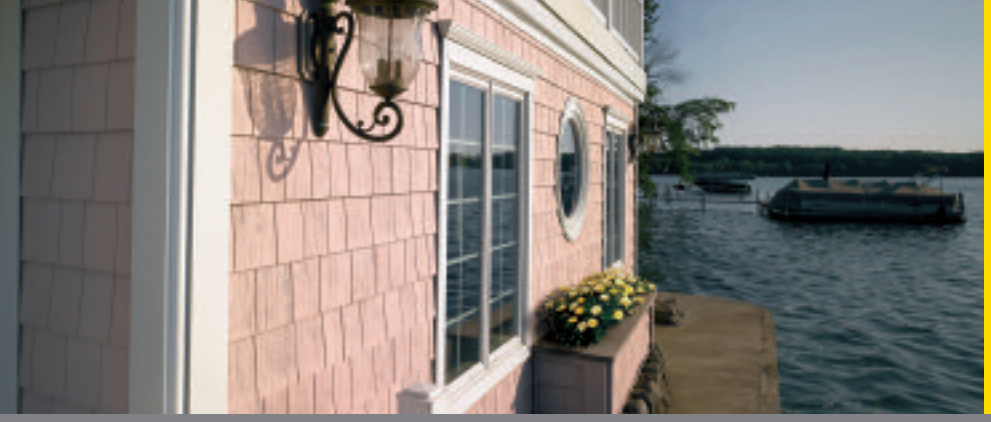
• **Ventilated facades**

Following a thorough analysis of the external render and its load-bearing strength, ISOVER mineral wool is clamped between the battens of a support lathing and secured by dowels if necessary. The facade cladding may consist of timber or wood-based materials, natural stone, artificial stone, fibrous cement, metal, plastic boards or other materials. To ensure ventilation of the facade, an air space of at least 3 cm must be provided, with openings to ensure that both fresh and exhaust air can circulate through the facade. This makes this system ideal for walls that are saturated with moisture. If speed is important, fast-track renovation is possible using large prefabricated, lightweight insulation panels that are mounted on timber frames and installed on site – just ask your carpenter for advice.

Watch out for thermal bridges

Great care must be taken to avoid thermal bridges. The insulation must cover all adjoining and non-insulated building components by a minimum of 50 cm. Pay particular attention to junctions between insulation and balconies or cellar walls, which are prone to thermal bridges.

Ventilated facade with untreated timber cladding – functional and attractive.



Insulation of double-leaf cavity walls

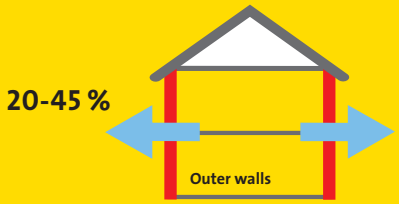
After a thorough analysis of the existing construction, the cavity between the two leaves of the wall can be completely filled by blowing insulation inside. Your choice of materials includes ISOVER blowing wool or ISOVER RigiBead® granulate made of expanded polystyrene foam (EPS). Since the cavity is generally no more than 6 cm wide, you should install additional interior or exterior insulation to ensure the desired level of comfort.

The energy efficiency of well-preserved clinker facades can be improved by cavity insulation.

Many facades – for example those made of clinker or travertine – have a high material value. It is therefore worth considering renovating the exterior walls from inside the house. Please refer to page 70 for further details.

Three steps towards a better insulation of double-leaf cavity walls:

- After inspecting the cavity, a regular pattern of small holes is drilled in the wall.
- The cavity is then completely filled by blowing insulation material.
- The drillholes are made good with matching mortar.



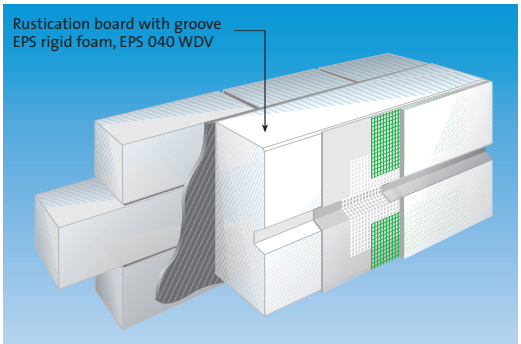
ISOVER rustication boards – Comfort behind a structured facade

The question is often asked whether an old, beautifully structured facade is compatible with state-of-the-art insulation. ISOVER has provided the solution with rusticated ISOVER facades. These innovative products not only offer significant energy savings thanks to a composite thermal insulation system, but they also visually upgrade and embellish thanks to a well defined facade surface – all achieved in just one operation.

New insulation – new look

Are you planning to upgrade your building facade to blend with the local architecture, or simply reinstate its original appearance? Whatever your plans, a rusticated facade using special ISOVER rustication boards provides the answer. You can choose from three different standard cross-sections that each give a natural stone appearance. Made by ISOVER from expanded polystyrene (EPS), the boards are precision grooved in the factory to give a regular structured appearance. They are installed using the same techniques as conventional composite thermal insulation systems.

System structure and facade cross-section



Three standard groove cross-sections lend an individual design to rusticated facades.