UNGER DIFFUTHERM®

Environmentally-friendly, innovative, insulation systems

*Udi*SUN®

Temperature regulating carbon fibre sheet for warm surfaces

WWW.UDIDAEMMSYSTEME.DE

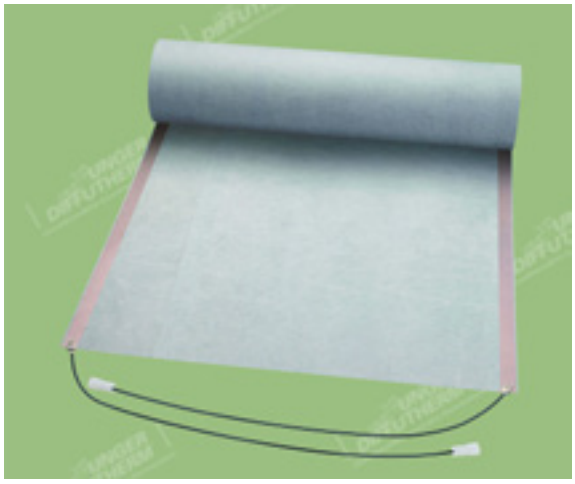
Insulation and Heating Combined

Insulation and heating are decisive for energy savings and a comfortable climate in your own four walls. If you combine both intelligently, this multiplies the positive effects. The combination that has proven to be particularly effective is the ***Udi*SUN**® System. Here, radiant heating based on state-of-the-art carbon sheets and wood fibre insulation boards from the new generation of ***Udi*INSULATION SYSTEMS**® merge to form a single unit.

- ✓ no air turbulence
- ✓ prevents bacterial development
- ✓ short response time
- ✓ balanced room climate

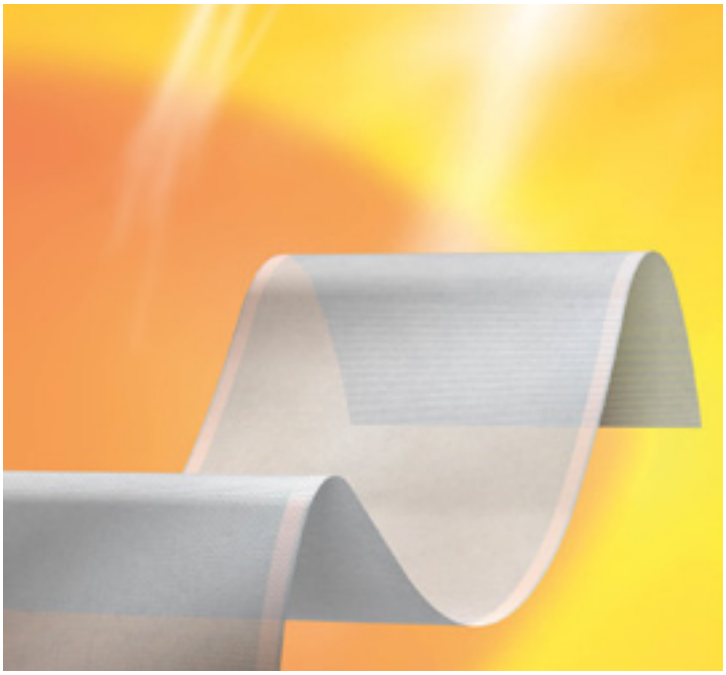
The combination makes the difference

A combination of a matrix of a multitude of chambers enclosing stationary air columns bonded to a capillary-active, wood-fibre insulation board with a construction depth of only 2 cm.



A special carbon fibre sheet, fed by low voltage, generates surface heat

The new sheet for an optimal feeling of warmth



The future for heating your home – heat-generating carbon fibre sheets

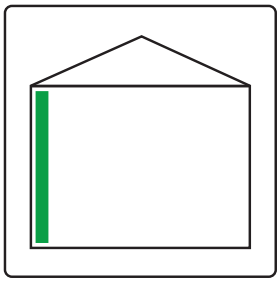
*Udi***SUN**® works according to the motto "We bring the sun into your house". When the sun's rays hit our body, we feel a pleasant sensation of warmth. The sun has invisible wavelengths that warm us and do us good. This is how the *Udi***SUN**® System behaves. A special carbon fibre sheet, fed by low voltage, generates surface heat which, when combined with thermal insulation such as *Udi***IN 2CM**® is radiated back into the room. The heat of the sheet hits our body and warms it up in a similar way to an infrared thermal booth. The special thing about this is that the air does not have to be heated as with previous heating systems. The warmth you feel on your body is extremely pleasant.

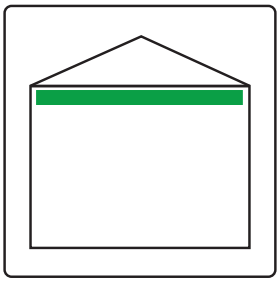
Mould doesn't have a chance

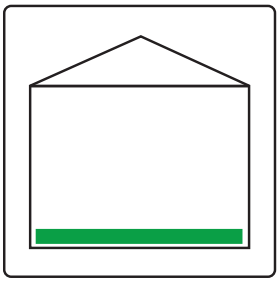
The insulating properties of the *Udi***IN 2CM**® insulating elements are based on a clever trait. They make use of the "double-glazing effect" in which the stationary air layer between the panes creates the insulating effect. In the wood-fibre insulation, this works using the "climate chambers" - a matrix encompassing a multitude of air columns bonded to a wood-fibre insulation board. Any moisture that accumulates is absorbed and transported away, thus effectively preventing waterlogging and mould growth and positively influencing the room climate. The system of heating and insulation with carbon fibre sheets and *Udi***WOOD** FIBERS reliably prevents problems with moisture, which lead to mould and structural damage. It also saves costs for boilers, installation and maintenance. The capillary-active system ensures a pleasant indoor climate in all seasons and reduces energy costs.

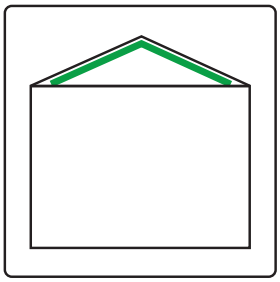
Areas of application for new construction and refurbishments

Applications


Walls


Ceilings


Floors


Roofs


Half-timbered buildings


Kinder gardens


Hospitals


Preservation of historic buildings


Private business premises


Residential buildings

Application in practice

On insulation

Beneath tiles

For mould remediation

On ceilings

On roof slopes

Floor renovations

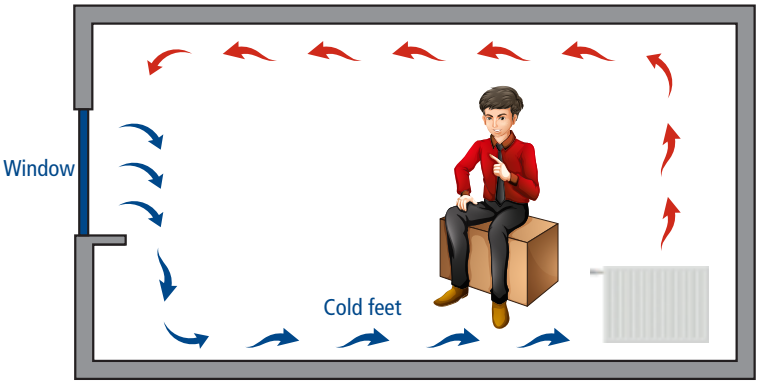
New floors

Types of heat transfer

There are three basic ways of transferring heat for comfortable living conditions. Heat transfer takes place in the form of thermal convection, thermal conduction or thermal radiation.

In effect, heat is a complex of the three options shown with different proportions depending on the temperature, the temperature-controlled medium and that of the receiver.

1. Thermal convection

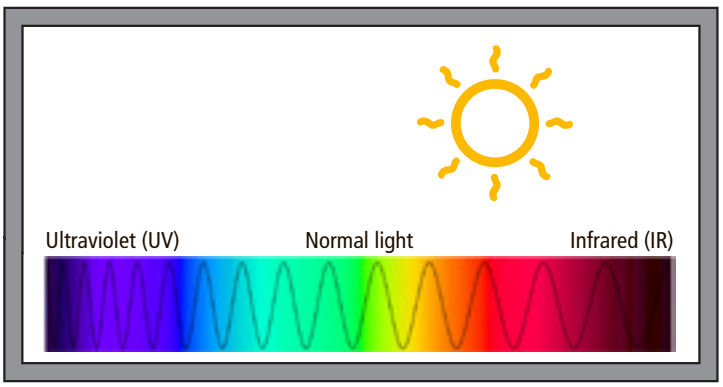


Moving heat carriers transport heat. In radiators, for example, the heat of the water is transferred by thermal convection on the metal walls of the radiators to their surface. In particular, the air near the radiator is heated. Warm air rises above the radiator. This creates a thermal convection flow of the air in the room. The air becomes drier.

2. Thermal conduction

Thermal conduction occurs on a body only when areas of different temperature are present. The heat is always transferred from areas of higher temperature to areas of lower temperature. An example: The temperature of a roof rises on the interior side when the sun shines. The heat is transferred.

3. Thermal radiation



From a physical point of view, thermal radiation is based on electromagnetic waves in the infrared range. In everyday life we experience it as a particularly pleasant form of thermal transfer during heating because it resembles the way in which the sun also transfers heat to our body. The energy is transferred as radiation with a wavelength of 3-5 µm across a vacuum. When this radiation strikes our body, we feel warmth and comfort. For this reason, radiant heating does not create an air stream that circulates dust or other particles in the building. Another advantage is that - at an identical air temperature - we have a greater sense of warmth when heat is transferred by radiation instead of convection. This is the operating principle of *Udi*SUN®.

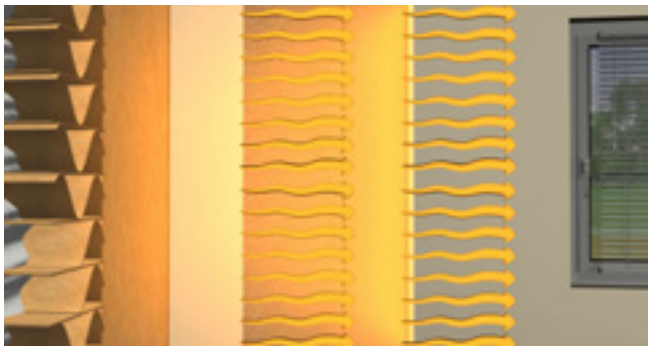
How it works

A temperature regulating carbon fibre sheet is excited by the supply of low voltage and emits radiation in the low temperature range with a wavelength comparable to that of the sun between 3 and 5 µm. This is also referred to as the relative wavelength range. The carbon fibre sheet is connected to the underlying wood fibre by bonding it in a layer of mineral reinforcement filler. In turn, the wood fibre board lies above an air chamber honeycomb, which is in contact with the outer wall through a mineral-based foundation coating. The radiation generated acts in two directions, on the room side and in the direction of the wood fibre. At the wood fibre this radiation is converted into heat. The air chamber columns inhibit significantly the heat exchange to the outer wall. The heat flow is interrupted. The wood fibre becomes a heat storage medium and radiates a small amount of heat via the air layer columns to the inner surface of the outer wall. Due to the heat conduction throughout the wood fibre board, an even temperature distribution is achieved. A vapour pressure gradient builds up between the wood fibre board and the surface of the outer wall via the air layer columns. This vapour pressure gradient persists as long as the inner surface of the wall can provide "moisture". The effect: The outer wall is dried. We get better insulating properties of the outer wall. Mould formation is prevented.

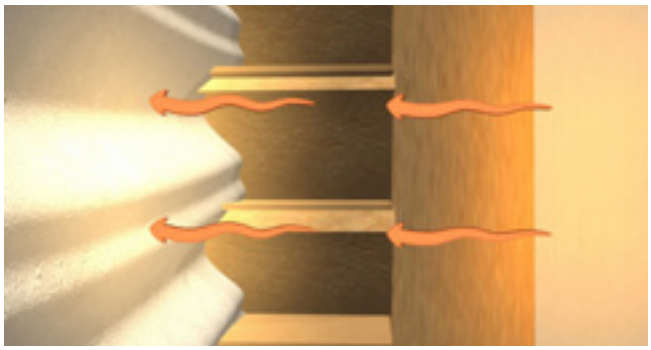
Result: For effective radiant heating, the decoupling of thermal conduction and thermal convection to the outer wall is a decisive criterion for its effectiveness and for the level of energy consumption. We meet these requirements through the use of *Udi***IN 2CM**®, *Udi***CLIMATE**® and the *Udi***IN RECO**® System which adapts to uneven surfaces. The *Udi***SUN**® system of radiant heating uses thermal radiation in conjunction with an intelligent insulation solution to reduce energy losses and ensure a comfortable room climate..

Conclusion: A fantastic room climate with a great energy-saving bottom line.

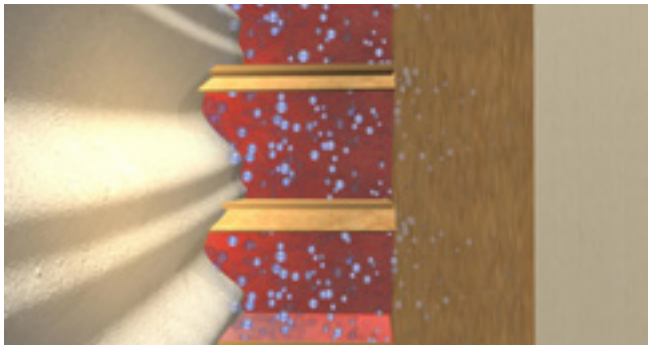
The combination of a special *Udi*WOOD FIBRE SYSTEM and surface heating makes the difference!



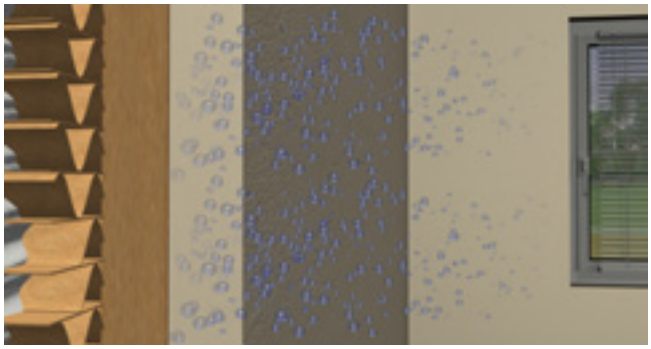
Most of the thermal radiation heats the interior.



Only a small proportion of the heat is transferred to the insulation with air layer columns.



The heating of the air in the honeycomb leads to improved moisture absorption from the outer wall.



The outer wall is dried. The moisture is transported away through the vapour-permeable structure.

Innovation with a Guarantee

- ✓ The surface heat is pleasant for the occupants, just like the sun
- ✓ We decouple the heat flow from the cold side as well as from the warm side
- ✓ *Udi***SUN**® is sufficient as the sole heating system for ceilings, walls or floors
- ✓ Use of radiant heat to dry out the walls
- ✓ Increase in the surface temperature, thus avoiding mould formation
- ✓ Space-saving, effective, concealed, each room can be used individually
- ✓ 15 year mould-free guarantee
- ✓ No turbulence of the air by heat flows, because of the heat is radiated
- ✓ Warm surfaces prevent the development of bacteria
- ✓ Short reaction time, no flow temperature necessary
- ✓ Balanced room climate
- ✓ Improvement of summer heat shielding

Who needs a guarantee?

It makes you feel good to know: IT WORKS!

And that is exactly what the guarantee stands for. No false facts but long-term experience is employed here. We give building owners/developers a full 15 year guarantee against mould growth on the *Udi***SUN**® system in conjunction with the *Udi***IN 2CM**® or *Udi***IN RECO**® interior construction board.

We do more than just insulate and heat. We develop innovative systems that are good for your health.

The *Udi***SUN**® heating and insulation system combines carbon fibre sheets with a special *Udi***WOOD FIBRE INSULATION BOARD** and stationary air layers. This ensures a diffusion- permeable, vapour-permeable and warm wall construction during the heating period. Any accumulated condensation is absorbed within the honeycomb matrix and wood fibres and, thanks to its quick-drying properties, is then transported into the room air by means of the capillary effect. *Udi***WOOD FIBRES** regulate the moisture balance in the room in a unique way. Moisture is optimally regulated. So mould has no chance.

Upon completion of the project and submission of the quality assurance protocol to *Udi***INSULATION SYSTEMS** we will issue your personal guarantee certificate for a 15 year guarantee against mould development.

Added value compared to existing solutions

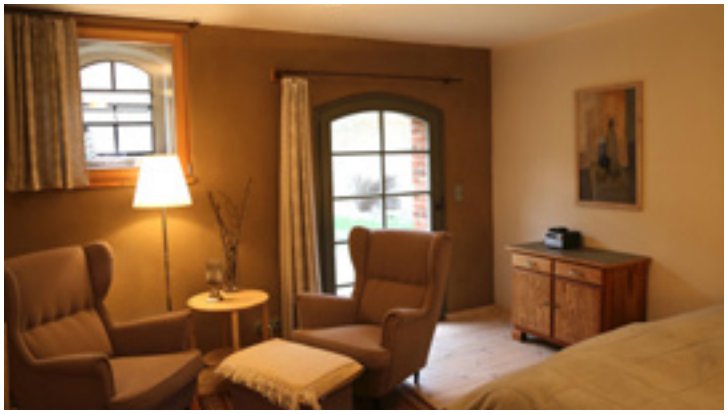
✓ Longevity - Climate protection has long been a central issue in heating

✓ Mould growth prevented by having warm walls

✓ Air chambers store the moisture of the wall, which then helps to dry the walls through heat radiation.

✓ Environmentally friendly, no follow-up or maintenance costs

✓ Effective use of solar energy e.g. with cloud storage



✓ Dry walls, improvement of the U-value

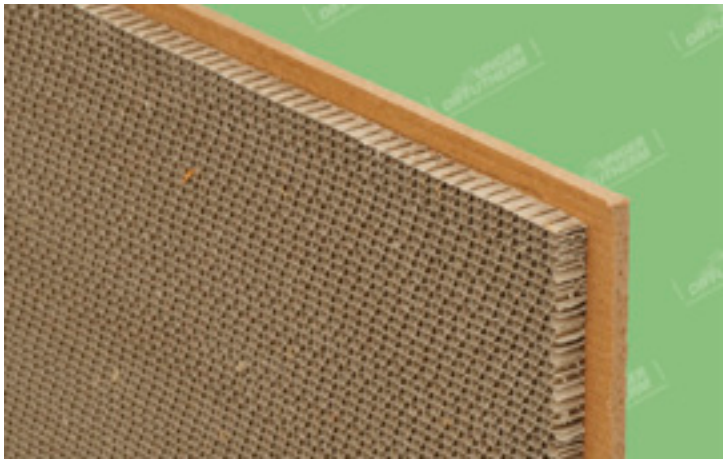
Combination of *Udi*SOFTWOOD FIBRE INSULATION® with *Udi*SUN®

The installation of *Udi***SUN**® in combination with a *Udi***NSULATION SYSTEM**® is a very effective thermal solution. All factors for the room climate - the summer heat shielding, the peace in the building due to the sound insulation and the energetically efficient mode of operation - come together here.

We recommend the following systems in combination with *Udi*SUN®:

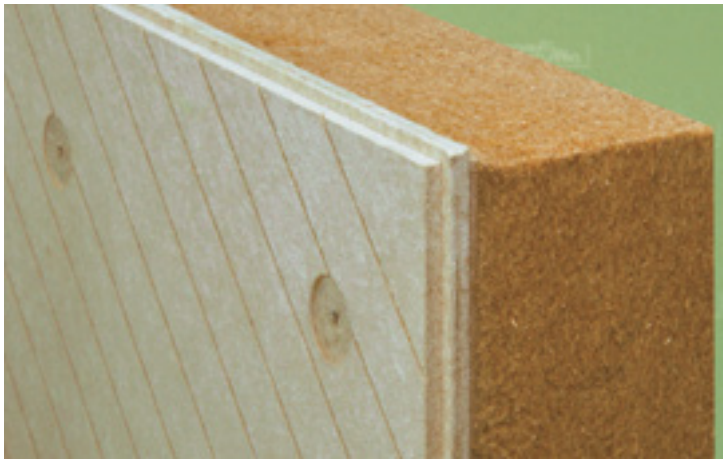
*Udi*CLIMATE®

For new buildings and renovations in roof slopes, ceilings and roof extensions in combination with *Udi***FLEX**® and *Udi***TOP**®. Reduction of sound energy by up to 50% due to innumerable layers of stationary air.



*Udi*IN 2CM®

Ideal for interior walls where space is at a premium; space-saving construction depth of only 2 cm. Easy installation by bonding to the substrate. Stabilizes the humidity and is energetically optimal due to stationary air chambers.



*Udi*IN RECO®

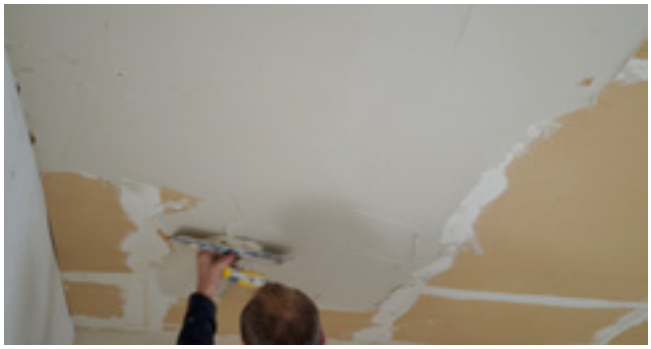
Particularly suitable for renovation work to compensate for uneven surfaces, as it adapts flexibly to the substrate and exceeds sound insulation requirements.

Installation – Step by step

Install *Udi***INSULATION**

Preparation of the heating sheet

Cut the heat sheet to size (if necessary)



Apply *Udi***FOUNDATION COAT**

Apply the heating sheet with a layer of *Udi***FOUNDATION COAT**

Install the reinforcement mesh in the same way

Install electrical socket

The room is finished

Project Report – 470 m² *Udi*SUN® Ceiling Heating

Conference room with ceiling heating

Apply the *Udi*SUN® heating sheet

View of the exterior

Consumption excerpt 1st floor

Consumption for an area of 250 m² to be heated using the *Udi*SUN® **System** in the ceiling area. This timber frame building extension is used as an office and seminar room.

Period	Consumption in kWh	Consumption in kWh/m²a
17.06.2018 - 17.06.2019	10,478.94	41.91
14.06.2017 - 17.06.2018	12,026.79	48.10

Project Report – 470 m² *Udi*SUN® Ceiling Heating

Report of a developer in Magdeburg

History: A near ruin with the dimensions 32 m x 12 m is the starting point. Its past: This building was built in 1870; made of quarry stone masonry and used as a storehouse and stable next to a station for changing horses. In the 2nd World War a rather sad chapter followed: The building with a timber-framed extension served as accommodation for forced labourers. After the war, however, it was, until the beginning of the 2000s, storage space for a toy wholesaler.

The idea: This building became an energetic challenge when the building authorities promised a timely building permit provided that its substance would be preserved. Familiarity with Unger Diffutherms' products made it seem possible to carry out an ecological refurbishment combined with an extension of the building. The aim was to meet the applicable energy efficiency standards and, in this respect, to meet the conditions to be eligible for funding. However, this meant breaking new ground.

The ruin before starting work

Timber-frame structure

Interior walls with *Udi*CLIMATE®

The implementation: The historic quarry stone masonry was restored in 2016. The partition walls and the addition of storeys were executed in timber frame construction. Only *Udi*NSULATION® SYSTEM products were used. On the basis of building physics advice, comparisons and calculations, I finally decided on the *Udi*SUN® SYSTEM. The decision, which was quite courageous at the time, but at the same time well thought out and repeatedly recalculated, included: to electrically heat all rooms with a total ceiling area of 470 m² and, in conjunction with this, to produce electricity ourselves using a photovoltaic system. In this solution, hot water is heated decentrally via electrically operated, volume-adapted, hot water storage tanks. With this concept, the guideline value for the primary energy requirement for heating was 5000 kWh/a based on 100 m². That is 50 KWh/m² per year. This means that the energy efficiency standards for energetic refurbishment should definitely be achieved and, if possible, undercut.

*Udi*SUN® in the ceiling coated with filler

Functional conference room

View of the exterior upon completion

The result: through the use of *Udi*SUN® and the well-balanced combination of the thermal insulation and heat storage properties of the *Udi*NSULATION used, the foreseeable heating consumption after slightly more than one year of operation is approx. 47 KWh/m² per year. At the same time, the photovoltaic system generated around 22,000 kWh of electricity in the first year. This means that the calculations were not only confirmed, but significantly undercut. A great result for *Udi*SUN® and the whole concept with *Udi*NSULATION SYSTEMS®. However, this result is not only interesting from an energy point of view. It also provides a pleasant and very balanced room climate for more comfort. What is additionally inspiring about the approach taken is that this heating solution is very responsive, offers a high level of individual control and is practically maintenance-free.

Prof. Dr. Renate Girmes, Magdeburg

Empirical guideline values from projects implemented using the *Udi*SUN® System

Area to be heated in	Power required	Consumption from – to	Optimal PV-system, if desired	ø solar portion used for UdiSUN	Cloud solution	Hot water preparation
m²	kW	kWh/a	kWp	kWh/a		
50	3,2	1300-1700	4	1000-1400	No/ Case-by-case review	Electric hot water cylinder
100	6,0	2000-3000	7	1500-2000	Case-by-case review	Electric hot water cylinder
150	8,7	5700-6500	10	4000-5000	Yes	Electric flow-type heater
200	11	7400-9500	13	7000-8000	Yes	Electric flow-type heater

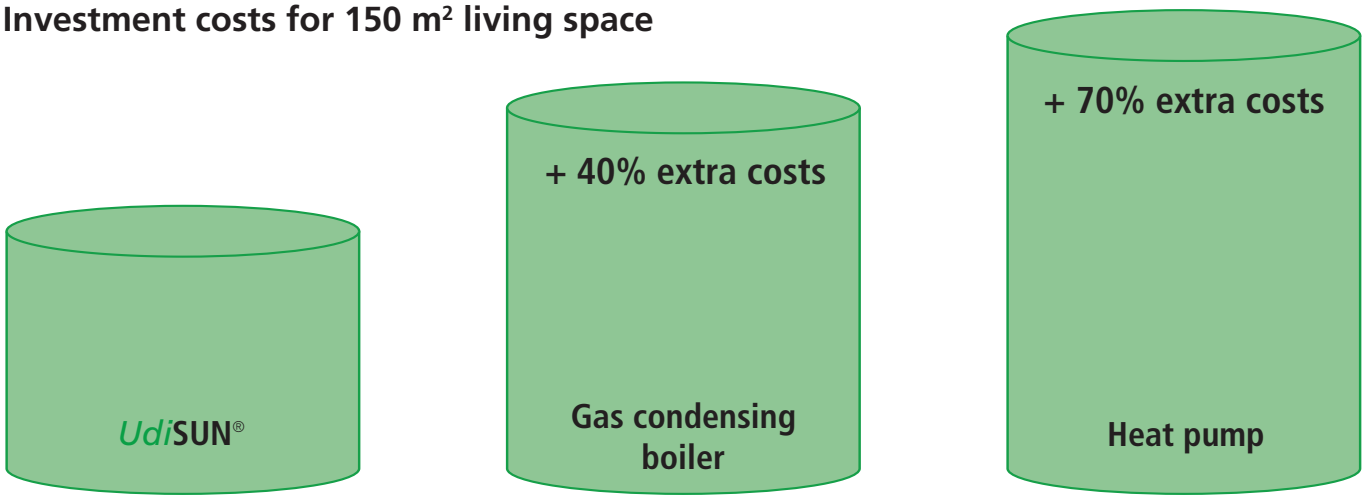
These reference values always depend on user behaviour, solar radiation, quality of the photovoltaic system, planning, etc.

The radiant heating system *Udi*SUN® System operates in the low temperature range. In combination with a rental or usage-fee based photovoltaic system and a cloud solution as well as an appropriate electric hot water system, it is one of the most advanced and efficient solutions even for stand-alone applications.

Save energy - and protect the environment at the same time

The reaction time of direct heating is shorter than with water-based heating systems. Drilling the heating sheet for pictures or for lamps in the ceiling etc. is no problem. Electric carbon-fibre surface heating systems have much lower acquisition costs than all other types of heating, as boilers, heat pumps and water pipes are not required. Here is a comparison of 3 systems. Irrespective of the acquisition costs, the annual energy consumption values must still be taken into account. These depend on the efficiency class of the building and the insulation material. The use of high-performance insulating materials for the optimum storage capacity of the heat produced is decisive for the design of the heating system.

Investment costs for 150 m² living space



Values are based on new construction. Refurbishment for a gas condensing boiler and heat pump was not taken into account.

A comparison of the properties:

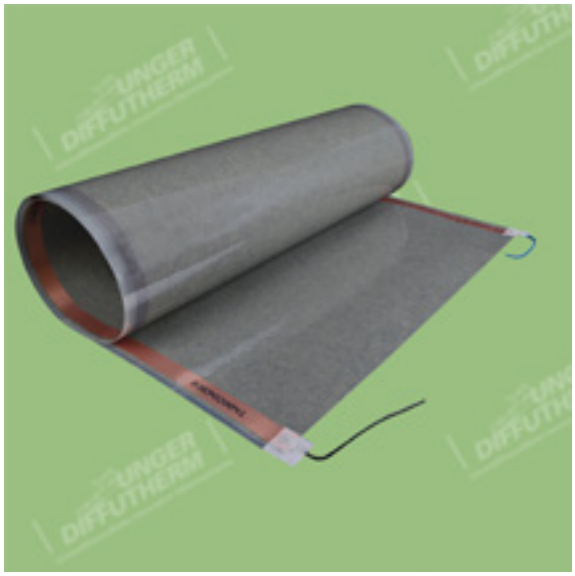
*Udi*SUN®	Conventional heating systems Convection heating
✓ Allergy-sufferer friendly, as there is hardly any air and dust turbulence	✘ Constant air and dust turbulence
✓ Radiant heat comparable to that of the sun	✘ Convection heat
✓ Hardly any heat loss during ventilation	✘ Ventilation cools down room air immediately
✓ Sheets as surface heating, the future	✘ Hot water radiators are no longer up to date
✓ Simple flat design	✘ Loss of space
✓ Optimum installation in ceiling areas, due to max. efficiency	✘ Hitherto hardly used for ceiling installations
✓ Pleasant surface temperature 35 °C	✘ High flow temperature of up to 70° C
✓ Energy-saving e.g. in combination with solar technology	✘ Energy-intensive due to various energy sources - oil, gas
✓ Easy installation, can also be retrofitted later without great effort, cost-effective purchase	✘ Major intervention / increased planning and installation effort
✓ Uncomplicated installation in the wall, the heating sheet can be drilled into directly to mount fixtures	✘ Space is limited and the installation of water-operated wall heating systems is hardly possible
✓ No complicated cable routing	✘ Heating pipes run through the entire building, thus increased energy loss
✓ No follow-up costs	✘ High maintenance requirements
✓ In combination with *Udi***IN 2CM**® heating costs can be reduced by up to 50 % (test was carried out on a sand-lime brick wall)	✘ Reduction of heating costs with *Udi***INSULATION** also possible
✓ No mould growth	✘ Cold surfaces remain
✓ Little influence on relative humidity	✘ Great influence on relative humidity
✓ Pleasant room climate is maintained	✘ Often leads to excessively dry air
✓ Improvement in summer heat shielding	✘ No influence on summer heat shielding

For ceilings, walls and floors

Fleece laminated

Supply voltage	230 V AC
Power	60 W/m² 110 W/m² 220 W/m²
Power per linear metre	36 W/lm 66 W/lm 132 W/lm
Secondary voltage	36 V
Safety measure	RCD protective circuit 30 mA
Max. permissible ambient temperature	+70 °C
Minimum installation temperature	+5 °C
Minimum bend radius	R10 mm
Dimensions	36-60 width 60 cm, length 1/3/5/7/9/11 m 36-110: width 60 cm, length 1/2/3/4/5/6 m 36-220: width 60 cm, length 1/1.5/2/2.5/3 m

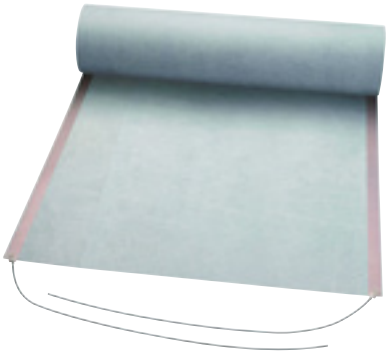
For floors – under laminate and parquet



PET laminated

Supply voltage	230 V AC
Power	115 W/m²
Power per linear metre	69 W/lm
Secondary voltage	36 V
Safety measure	RCD protective circuit 30 mA
Max. permissible ambient temperature	+70 °C
Minimum installation temperature	+5 °C
Minimum bend radius	R10 mm
Dimensions	36-115: width 60 cm, length 1.9/2.9/3.9/5.8 m

Accessories – Everything from one source for your wellbeing



*Udi*SUN® wafer-thin, conductive, carbon fibre sheet; width 60 cm; in various lengths

Flush-mounted power supply unit with flush-mounted installation box < 2000 W

Flush mounted power supply for surface-mounted housing

Power supply, surface-mounted version, 2000 W

Digital regulator, flush mounted, hard-wired - Standard.
The temperature is set by digital temperature controllers.

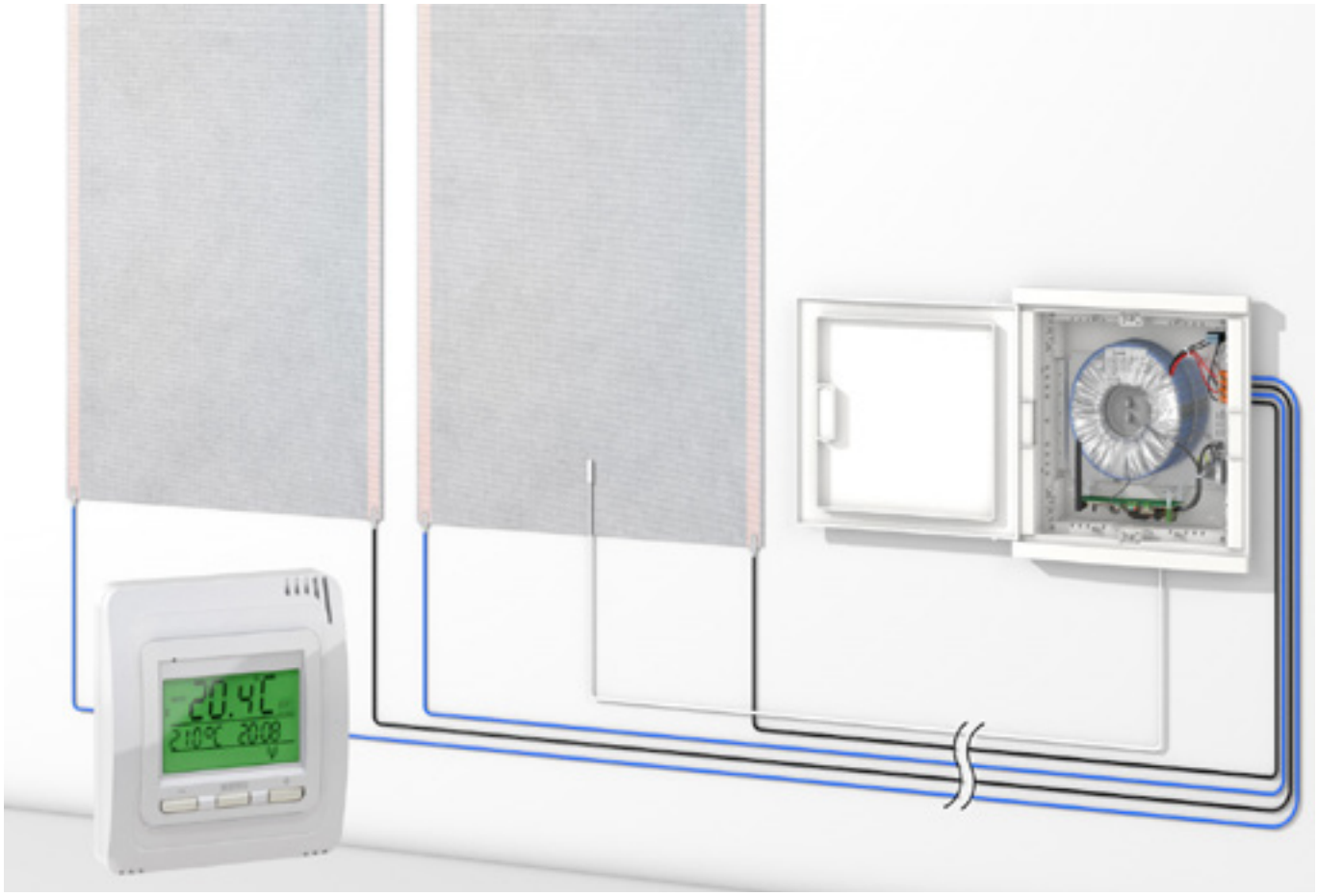
Digital controller WIFI with touch screen.
Controllable via app.

Renovation power supply 100 W incl. temperature sensor

Temperature sensor which limits the surface temperature

Fixings

Connection Details (Example)



Input voltage	230 V +/- 10% AC, 50/60 Hz
Output power	400 W bis 2,000 W (400 W-Steps)
Minimum requirements	Circuit breaker 16 A C / Safety fuse 16 A slow-blow
Safety class	IP 00
Output voltage per heating circuit	36 V AC
Additional connections	Room thermostat, Floor sensor, Antenna, Master/Slave
Fixing	Wall box, control cabinet, surface-mounted housing
Maximum ambient temperature	60 °C
Fuse ratings	Primary 4.00 A (bei 400 W) Primary 4.00 A (bei 800 W) Primary 6.00 A (bei 1,200 W) Primary 8.00 A (bei 1,600 W) Primary 10.00 A (bei 2,000 W)
Dimensions	182 x 212 x 52 mm (bei 400 W) 246 x 265 x 76 mm (bei 800 W) 246 x 265 x 86 mm (bei 1,200 W) 246 x 265 x 87 mm (bei 1,600 W) 246 x 265 x 87 mm (bei 2,000 W)

UNGER DIFFUTHERM®
Environmentally-friendly, innovative, insulation systems

Questionnaire for *Udi*SUN®

To receive a free estimate please send by email to info@udidaemmsysteme.de

Construction project

Surname: _____ Forename: _____

Address: _____ Post code: _____ Town: _____

E-Mail: _____ Mobile-No.: _____

Tel.-No.: _____ Fax: _____

Year of construction of the building

1900-1950	uninsulated brickwork with single layer glazing	☐
1950-1970	uninsulated brickwork with double glazing	☐
1970-2000	uninsulated brickwork with double glazing	☐
2000-2010	brickwork, partly insulated timber-frame, double glazing	☐
From 2010	Low-energy house, insulated envelope, double glazing	☐
From 2010	Passive house with energy performance certificate	☐

Wall structure:

Wall thickness: _____ cm Material of the wall: _____

Installation in: Ceiling ☐ Wall ☐ Floor ☐

Size of the rooms: _____ m² _____ m² _____ m²

_____ m² _____ m² _____ m²

Planned implementation period: _____

I would like to insulate using *Udi*SUN® with the following *Udi*INSULATION SYSTEM®:

*Udi*IN RECO® ☐ *Udi*IN 2CM® ☐ *Udi*CLIMATE® ☐

➞ ***Please enclose a sketch of the rooms/premises***

Special wishes:

HEADQUARTERS

UdiDÄMMSYSTEME GmbH
Oberfrohnaer Straße 2
D-09117 Chemnitz, Germany

Telefon +49 (0)371 33 71 38 0
Telefax +49 (0)371 33 71 38 64
E-Mail info@udidaemmsysteme.de

LOGISTICS / PICK-UP POINT

UdiDÄMMSYSTEME GmbH
Röhrsdorfer Allee 41
D-09247 Chemnitz OT Röhrsdorf

Telefon +49 (0)371 33 71 38 0
Telefax +49 (0)371 33 71 38 64
E-Mail info@udidaemmsysteme.de

MANAGEMENT

Anka Unger

Trade registration: HRB 30875
VAT-ID.-No.: DE 310 743 696
Tax-No.: 215/121/07696
Responsible court: Chemnitz

BANK DETAILS

Sparkasse Chemnitz
IBAN DE47 8705 0000 0710 0543 19
BIC/SWIFT CHEKDE81XXX

OUR SYSTEM RANGE:

UNGER DIFFUTHERM®
Environmentally-friendly, innovative, insulation systems

For the roof:

UdiFLEX® SYSTEM
Flexible planning with a flexible insulation to meet the highest of demands

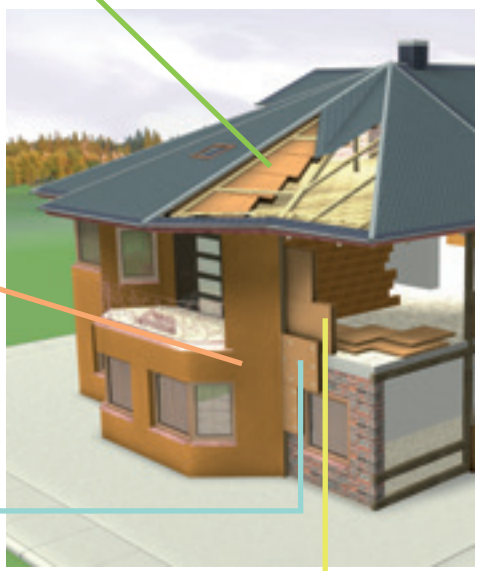
UdiTOP® SYSTEM
The complete program for your roof

For the façade:

UdiRECO® SYSTEM
External thermal insulation composite system with intelligent levelling compensation

UdiFRONT® SYSTEM
External thermal insulation composite system with a 15 year guarantee

UdiSPEED® SYSTEM
The efficient insulation system for pre-fabricated, timber-frame buildings



For interior insulation:

UdiIN® SYSTEM
Interior insulation system with a 15 year guarantee

UdiIN RECO® SYSTEM
The interior insulation system – specially designed for uneven surfaces

UdiIN 2CM® SYSTEM
The quick and slim internal insulation system

For interior construction:

UdiCLIMATE® SYSTEM
The interior insulation system with integrated climate chambers

UdiSTEP® SYSTEM
Wood-fibre, floor insulation

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Temperature regulating carbon fibre sheet for warm surfaces

BLAUER ENGEL – DAS UMWELTZEICHEN
40 Years
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Good for the environment

UdiDÄMMSYSTEME GmbH
Oberfrohnaer Straße 2
09117 Chemnitz, Germany

Telefon: +49 (0) 371 - 33 71 38 0
Telefax: +49 (0) 371 - 33 71 38 64
E-Mail: info@udidaemmsysteme.de

We are always happy to advise you:

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