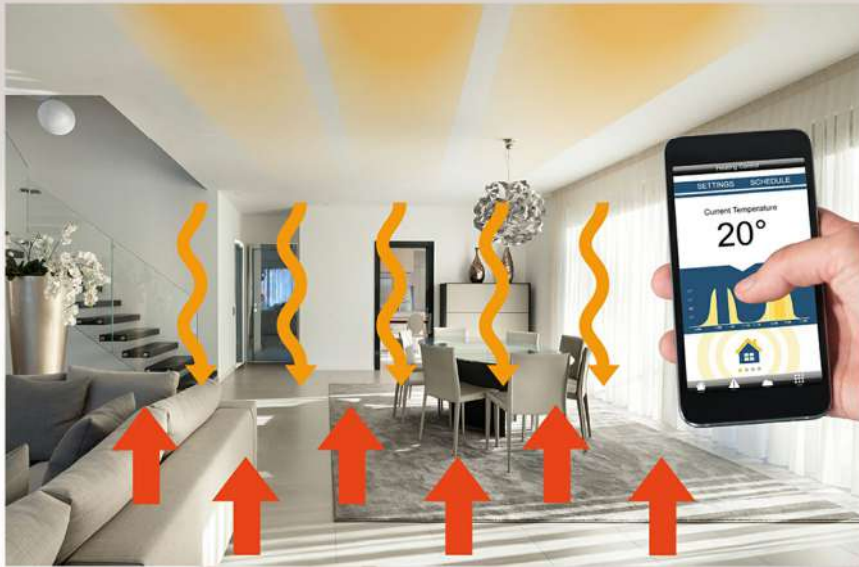


E-ENERGY CARBON

Comfortable warmth at the touch of a button
Innovative heating foils for ceiling, wall & floor



e:energycarbon
energy efficient ceiling heating



E-ENERGY CARBON

Electric surface heating for ceiling, wall & floor

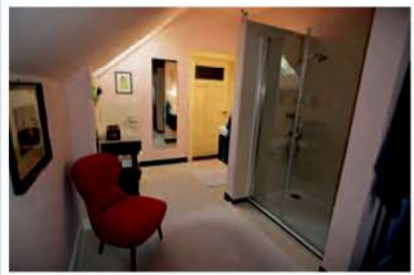
- + 35% less heat load than heat pump
- + Zone controllable
- + 97% efficient
- + Safe low voltage
- + Patented manufacturing process
- + Fast reaction time
- + Low surface temperature
- + Healthy heat
- + Dust and mould prohibiting
- + Safe to cut holes for lighting, screws etc.
- + Low embodied carbon
- + Full 10 year warranty from reputable German manufacturer with a 180 yr+ track record



NOW AVAILABLE
IN ULTRA LOW
WATTAGE FOR
PASSIVHAUSE



Full heating
in the family home



Comfort heating
in bathroom renovation

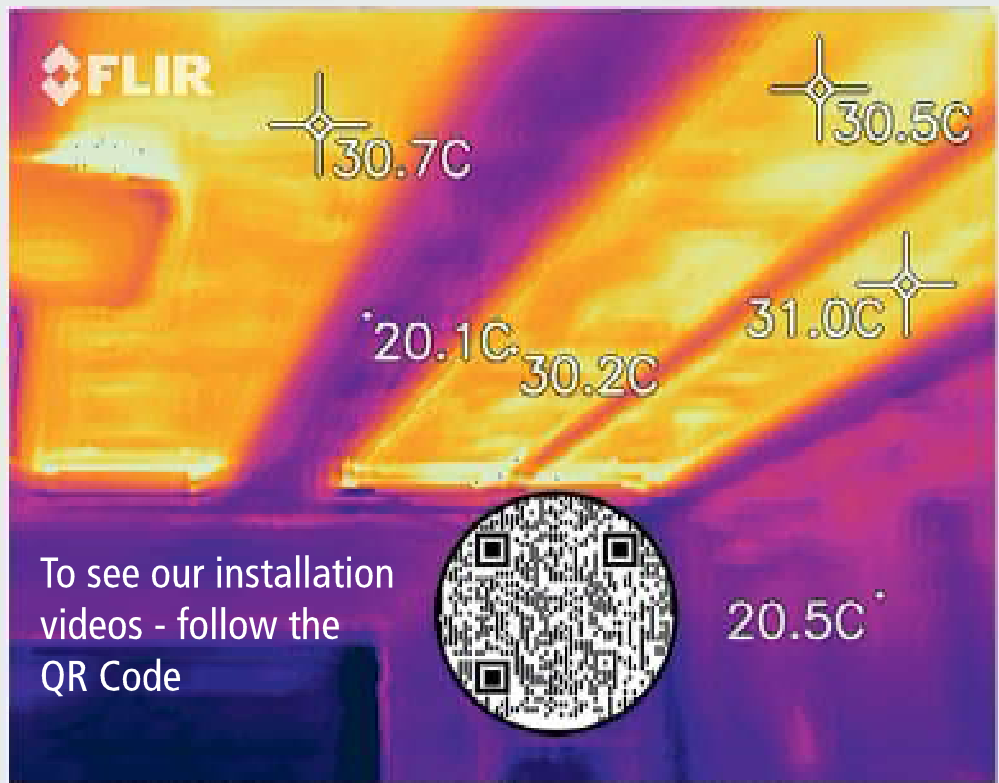


Moisture protection
at the studio



Total comfort heating for all scenarios

LOW SURFACE TEMPERATURE
ONE OF A KIND
LOW VOLTAGE
NO LAMINATION



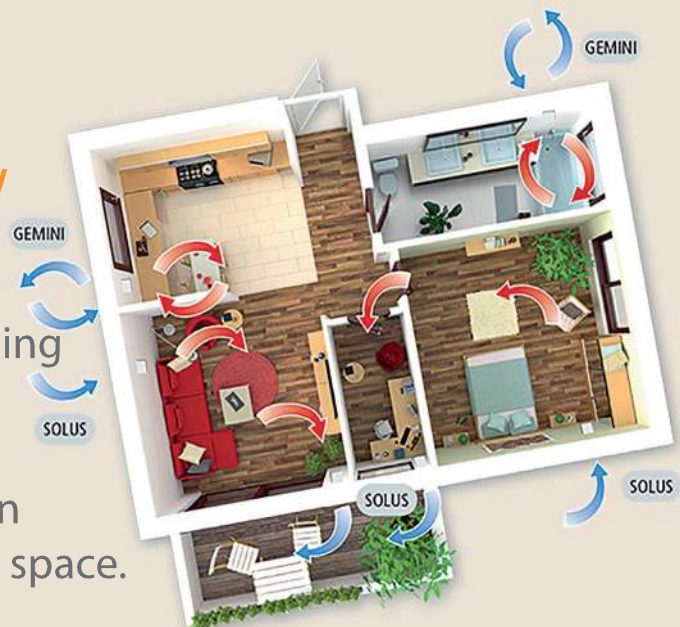
Also available

AIRVENT

Mechanical ventilation with heat recovery (MVHR)

At last the solution to messy, time consuming and expensive ductwork.

Our energy efficient, decentralised solution saves all this and frees up loft or cupboard space.

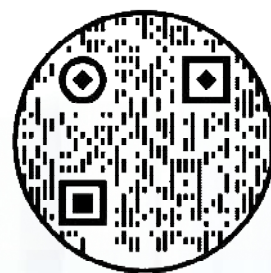


Energy Carbon Ltd

Kemp House,
152 - 160 City Road,
London EC1V 2NX

Tel+44203 507 1659

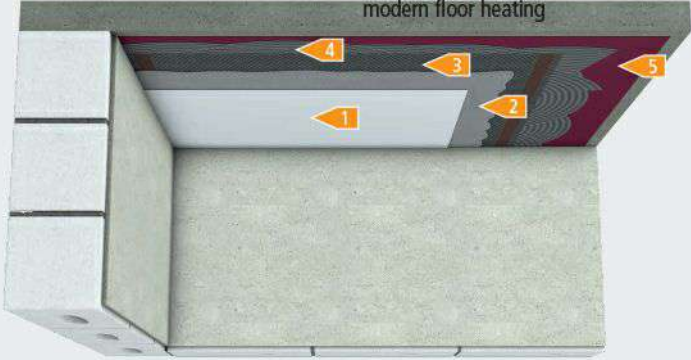
hello@energycarbon.co.uk



Ceiling heating with plaster

System E-ENERGY CARBON FLEECE

mfh systems
modern floor heating



- 1** Deckenbelag
 - 2** Putty / plaster system min 2 mm 2 mm
 - 3** E-ENERGY CARBON FLEECE 0.4 mm
 - 4** Putty / adhesive 2 mm
 - 5** Primer
- 5 mm

Without additional thermal insulation

| | | | | | |
|--|---|---------------------------------|--|-------------------------|--------------------------|
| | - | No thermal insulation available | | ~ 8 kg / m ² | Without ceiling covering |
|--|---|---------------------------------|--|-------------------------|--------------------------|

- Prepare level, clean, load-bearing substrate. Dry construction boards and wood-based panels must be crack-bridging in the joint area
- For adhesive and product recommendations see material approvals
- If an internal thermal insulation is laid on the ceiling against unheated rooms (attic) or outside air temperature (roof), a dew point calculation must be carried out. The manufacturer's specifications must be observed.
- The technical values are indicative and depend on the manufacturer and the used materials can vary. The manufacturer's instructions and generally accepted rules of technology must always be observed.

P 40013



e:energycarbon
energy efficient ceiling heating



E-ENERGY CARBON Power supply PRO TT

Product data



36V

E-ENERGY CARBON Power supply PRO TT

Power supply PRO TT 2.400 W: 550 x 300 x 140 mm (LxBxH), Art.-Nr. 2 03 591

Power supply PRO TT 3.200 W: 550 x 300 x 140 mm (LxBxH), Art.-Nr. 2 03 592



Ready in case



Room thermostat WiFi connectable




Intuitive connection electronics

Application

PRO TT series power supply units are designed as central power supply stations and are equipped with safety transformers according to EN 61558-2-6 with 36 V AC safety extra-low voltage (SELV) for connection of E-ENERGY CARBON system heating foils. For connection of whole housing units / floors, PRO TT series power supplies are equipped with 10 inputs for connection of room thermostats and 10 outputs for connection of heating foils. The control electronics have an integrated inrush current limiter, DC mains filter as well as spring-loaded terminals for a permanently safe electrical connection of all connections. The power supply stations are mounted in a surface-mounted metal housing and have an efficiency of up to 97 %.

Data

| | |
|---|---|
| Nominal power | 2.400 W 3.200 W |
| Nominal voltage primary | 230 V AC 50/60 Hz |
| Rated voltage secondary | 36 V AC (SELV, Safety Extra Low Voltage) |
| Mains connection 230 V (primary) | Spring clamp terminals 1.5 mm ² - 2.5 mm ² |
| Connection room thermostat 230 V | Spring clamp terminals 1.5 mm ² - 2.5 mm ² |
| Connection heating foils 36 V (secondary) | Spring clamp terminals 2.5 mm ² to 6.0 mm ² |
| Number of connections room thermostats | 10 |
| Number of connections Heating foil* | 10 |
| Fuse protection per connection Heating foil | 15 A |
| Ambient temperature | Max. 40°C |
| Internal safety temperature switch | 130°C automatic resetting |
| Insulating material class | B |
| Housing protection class | IP20 |
| Dimensions (LxWxH) | 2.400 W: 550 x 300 x 140 mm 3.200 W: 550 x 300 x 140 mm |
| Weight | 2.400 W: ca. 28,0 kg 3.200 W: ca. 34,0 kg |
| Bauform | Design |
| Protection class IEC/EN | I |
| EU conformity | CE mark, according to EN 61558-2-6, European Low Voltage Directive 2014/35/EU, EMC Directive 2014/30/EU and RoHS 2011/65/EU, Directive 2014/35/EU, EMC Directive 2014/30/EU and RoHS 2011/65/EU |
| Entsorgung |  WEEE-Reg.-Nr. : DE 97703783 |

* A maximum of 400 W may be connected per connection. The total connected power must not exceed the rated power of the power supply unit.

» HEATING FOIL E-ENERGY CARBON –Monthly energy costs under £35 in a single family house

"You don't heat with electricity" and "you don't heat on the ceiling". This was before the heat demand of the buildings was reduced and electricity could be produced regeneratively. In 2017 this was put to the test. The electrical heating foil **E-ENERGY CARBON** was installed invisibly as ceiling heating in a KfW 55 house. Heat generation, heat transfer, heat control, all in one product.

In the new building with 140 m² living space the 0.4 mm thin 36 Volt carbon heating foil was installed. Thanks to the patented production process, **E-ENERGY CARBON** is insensitive to damage. Holes can be drilled, spots and sockets inserted or screws fastened, even retrospectively. A flat perforation and an adhesion-optimising fleece lamination ensure a secure connection to the substrate on the ceiling, as the filler can press through the perforation during installation. The same principle is used for installation on walls, floors or roof slopes on the upper floor.

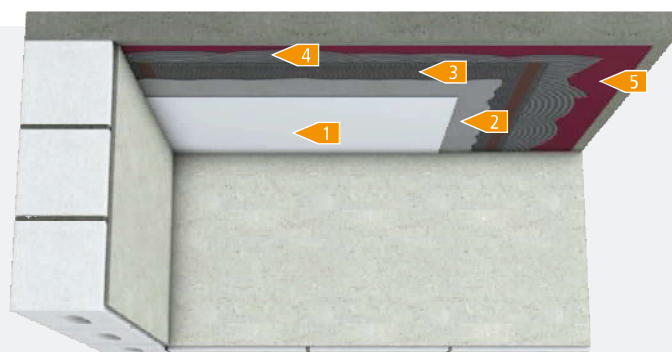
The ceiling heating system had an occupancy rate of 50% (70 m² active heating surface for 140 m² living space) and this is sufficient to generate a comfortable radiant heat that also pleasantly warms the floor. The installation close to the surface ensures rapid heating and efficient operation. The complete installation in the project has an output of 4.53 kW. The EnEV-compliant system technology was supplemented by a photovoltaic system and a central ventilation system with heat recovery. Electric instantaneous water heaters were installed for hot water preparation.

The annual energy costs of the 4 person household are impressive. Less than £35 / month (UK equiv) for heating, hot water and auxiliary energy. **E-ENERGY CARBON** provides an innovative and cost-effective heating solution for the 21st century. Low operating costs, low investment costs and no ongoing follow-up costs due to the maintenance-free system technology. Modern buildings need modern technology.



» CONSTRUCTION STRUCTURE CEILING

- | | | |
|---|--------------------------|--------|
| 1 | Ceiling covering | |
| 2 | Plaster system min. 2 mm | 2 mm |
| 3 | E-ENERGY CARBON FLEECE | 0.4 mm |
| 4 | Plaster | 2 mm |
| 5 | Paint | |
- 5 mm





Taboos deliberately broken

Electric ceiling heating in the low-energy house

There are things you simply don't do when it comes to heating a house – "you don't heat with electricity" and "you don't heat on the ceiling". At least that's how it was in the past. But that was before – before the heat demand of buildings was greatly reduced and electricity came from the sun. In a single-family house, the test was put to the test in 2017. The electric heating foil "**E-ENERGY CARBON**" from **mfh systems GmbH** was installed as a ceiling heating system. Heat generation, heat distribution, heat transfer, heat control, all in one product. After two years of operation, the users' summary is: It works - technically and economically.

In the new buildings of the present and the future, two technologies of the past are experiencing their renaissance. Ceiling heating and direct current heating – combined as electric surface heating. Both technologies were often criticised in the past, but in today's low-energy buildings the advantages of the combination are convincing – the low heat demand makes it possible. In the future, fast-reacting heating systems will be needed in houses in order to be able to respond precisely to the occupant's heat requirements. The ceiling offers optimal conditions for this – no carpets, no furniture that reduce or slow down the heat emission.

The necessary surface temperatures are low and comfortable for the residents due to the reduced heat requirement. Generating the required electricity on the roof using PV rounds off the new concept. In 2017, this promising combination was used as a full heating system in a single-family house. The property is a new wooden post-and-beam construction with 140 m² of living space. Instead of a classic heating system with hot water underfloor heating, the "**E-ENERGY CARBON**" heating foil from **mfh systems GmbH** was used in all rooms on the ceiling. Essentially, two aspects led to this solution. On the one hand, the desire for a high degree of self-sufficiency in order to generate the required energy themselves and to

be independent of the energy companies. On the other hand, cost efficiency was also an important aspect, both in terms of investment costs and long-term consumption costs. The adjustment/reduction of the investment costs of the heating to the low heat demand of the building was the decisive factor for the electric ceiling heating.

The basis of the installed system technology is the 0.4 mm thick **"E-ENERGY CARBON"** heating foil, which is operated with 36V protective extra-low voltage. The prefabricated foil strips contain carbon fibres as a conductive material and two parallel copper strips on the outer sides for power supply. The special feature of this foil lies in the production process, as it does not have a laminar structure, but all components are fused together. The homogeneous structure makes it insensitive to damage (i.e. drilling holes or nails is possible) and the subsequent installation of a plug-in socket is also possible without loss of function.

A look at the technology and electricity costs

In this specific building project, the **"CARBON FLEECE"** variant was used. This is particularly suitable for ceiling installation due to its flat perforation and fleece surface to optimise adhesion. The filler, into which the film is inserted during installation, can press through the perforation and thus create a secure bond to the substrate.

The basic decision in favour of ceiling installation was made in the project because of the installation costs. Whereas underfloor heating must always be laid out over the entire surface in order to avoid uncomfortable cold spots in the area, a degree of occupancy of 50 percent is sufficient for ceiling heating.

(in the example: 70 m² active heating surface, 4.53 kW heating output, for 140 m² living space) is sufficient to generate a comfortable radiant heat. At the same time, the investment costs are almost halved compared to the comparable

1 There is no longer "the right heating system" for all buildings. In the future, the framework conditions of the building and the demands of the user will decide which technology brings the most advantages for the individual project. Thus, electric heating systems will also play a stronger role again, as in the new building with 140 m² of living space presented here. Instead of a classic heating system with hot water underfloor heating, the **"E-ENERGY CARBON"** heating foil was used in all rooms on the ceiling. The system technology was supplemented by a PV system and a central ventilation system with heat recovery; electric instantaneous water heaters were installed for domestic hot water preparation.

EXTRA THIN. PATENTED. CERTIFIED.
FEEL-GOOD HEAT AT THE TOUCH OF A BUTTON. SAFE, ENERGY-EFFICIENT AND COMFORTABLE.





E-ENERGY CARBON
Electric heating foil for Ceiling, Wall & Floor



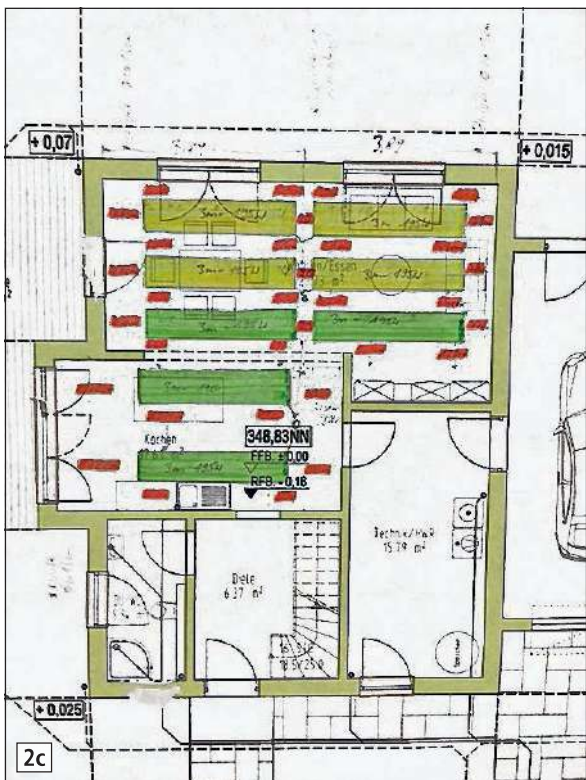


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2a–2c Whereas underfloor heating must always be laid out over the entire surface, with ceiling heating a degree of occupancy of 50 per cent (in the example: 70 m² active heating surface, 4.53 kW heating power, for 140 m² living space) is sufficient to generate comfortable radiant heat. heating capacity, for 140 m² living space) is sufficient to generate a comfortable radiant heat. In the specific building project, the „**CARBON FLEECE**“ variant was used. This is suitable due to perforation and a fleece lamination to optimise adhesion, it is particularly suitable for ceiling installation. The filler in which the film is placed during installation can press through the perforation and thus create a secure bond to the substrate.

installation with the system as underfloor heating. Of course, the floor is still pleasantly heated due to the high proportion of radiation, so walking barefoot is also comfortable with ceiling heating. Another advantage of ceiling installation is that it is laid close to the surface, which ensures rapid heating and thus efficient operation. Only in the bathrooms was the **“E-ENERGY CARBON FLEECE”** also fully embedded directly in the tile adhesive underneath the tiles and thus installed as supplementary underfloor heating.

In the context of cost efficiency, special attention was also paid to consumption costs, as direct current heating systems have generally been considered cost- intensive and unsuitable as a full heating system for an entire building. unsuitable. To track the real consumption situation, different electricity meters were installed so that heating, hot water and household electricity could be measured separately. In the consumption period from October 2017 to September 2018, the first year after construction of the building, the following energy consumption was measured:

- Final energy demand for heating: 4,580 kWh/a*
- Final energy demand for hot water preparation: 1,660 kWh/a
- The auxiliary energies of the ventilation system were not recorded separately from the household electricity.

The required regenerative share according to the EEWärmeG is taken into account in direct electricity heating by the supplementary PV system in the overall system. To this end, the PV electricity generated is also taken into account proportionally (taking into account the real yields per month) in the energy analysis. The real and chargeable own consumption was 2,525 kWh/a in the period under consideration 2017/2018, so that the annual final energy demand was reduced to 3,900 kWh/a (ventilation share added imputatively from the energy performance certificate), which meant costs of 1,020 euros/a, since the electricity was purchased at the normal household electricity costs. The

*Heating requirement in the UK is a standard 8 hour day x 170 days x kwh's this represents a 26% energy

"E-ENERGY CARBON" heating system is basically maintenance-free, so there are no annual follow-up costs or cleaning services.

Conclusion

There is no longer "the right heating system" for all buildings. In the future, the framework conditions of the building and the demands of the user will decide which technology brings the most advantages for the individual project. Hydraulic systems for surface temperature control, especially due to the cooling option and the extensive existing installations, will hold a significant share in the future. However, electric heating systems will also play a stronger role again, as these systems are already economical today when designed correctly and are also ecologically advantageous in combination with decentrally generated electricity from a PV system. Future technical developments (e.g. battery storage, increases in the efficiency of PV systems) and the use of special heating electricity tariffs will continue to have a positive influence on cost considerations. The "E-ENERGY CARBON" system can be flexibly installed on ceilings, walls and floors due to its versatility. Especially when used as a ceiling heating system, it can create a comfortable, energy-efficient surface heating system that also helps to save on investment and follow-up costs. A modern panel heating system for the future and a good opportunity for the trade.

For more information, see: www.mfh-systems.com
www.energycarbon.co.uk



3 The basis of the installed system technology is the 0.4 mm thick "E-ENERGY CARBON" heating foil from mfh systems, which is operated with 36 V protective extra-low voltage. The prefabricated foil strips contain carbon fibres as a conductive material and two parallel copper strips on the outer sides for power supply. The special feature of this foil is the production process, as it is not laminar, but all components are fused together. (Photos: mfh systems)



E-ENERGY CARBON

Electric ceiling heating as a modern new building concept in a low-energy house



» FULL HEATING

Comfortable warmth at the push of a button with E-ENERGY CARBON - the perfect heating system. There are no maintenance costs for this heating systems.

E-ENERGY CARBON makes heating with electricity a sensible alternative - ecological and economical! Plus With E-ENERGY CARBON you don't need a boiler room and you gain additional living space.

» QUALITY

Made
in
Germany



BDH
Bundesverband der
Deutschen Heizungsindustrie



» PLANT CONCEPT ACCORDING TO EnEV

Together with the TU Dresden, the plant concept was developed according to EnEV specs– **E-ENERGY CARBON** is 100% compliant with the standard.



| | VARIANT A | VARIANT B |
|------------------------------|--|--|
| Plant engineering | Surface heating E-ENERGY CARBON + instantaneous water heater + Controlled ventilation of living space + PV system | Surface heating E-ENERGY CARBON + Domestic hot water heat pump + Controlled ventilation of living space + PV system |
| | EnEV energy saving regulation | EnEV energy saving regulation |
| KfW Efficiency House 55 | ● | ● |
| KfW Efficiency House 40 | ● | ● |
| KfW Efficiency House 40 plus | ● | ● |

» FACTS

- ✓ 15 years application experience
- ✓ Comprehensive system warranty
- ✓ Future-proof, maintenance-free technology
- ✓ Boiler room becomes living space
- ✓ Patented production process
- ✓ 50+ Years Design Life

Further information:
www.energy-heating.com

