

## Zukunft Bau

### STRUKTUR / GLIEDERUNG KURZBERICHT

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#### Titel

Langfassung Titel: „Potential of IR heating systems for highly energy efficient residential buildings“

#### Anlass/ Ausgangslage

kurze Beschreibung des Problems und des Lösungsansatzes  
max. 450 Zeichen (mit Leerzeichen)

Developments in energy-efficient construction in Germany show a clear trend towards systems using electricity as an energy source for heat production. Heat pumps are taking a dominant role here. However, these require a high technical and financial effort. Infrared heating elements, on the other hand, are the simplest way of supplying thermal heat. Yet previous studies on IR heating systems do not provide a reliable basis for planning in building practice.

#### Gegenstand des Forschungsvorhabens

Beschreibung der Arbeitsschritte und des Lösungswegs  
max. 4.300 Zeichen (mit Leerzeichen)

The research project discussed the potential of infrared heating systems in highly energy-efficient housing construction. On the basis of the accompanying scientific research of a pilot experiment as well as comparative measurements under laboratory conditions and supplementary calculations, new foundations for the ecologic, economic and planning-related assessment of IR heating systems could be created.

Extensive measurements under laboratory conditions were carried out in the project. With the help of comparative studies, it was possible to show that infrared heating systems, compared to optimally designed and operated water based floor heating systems, have an efficiency advantage of approx. 5 - 10 % in terms of useful heat demand due to the heating system's lower inertia. However, compared to floor heating systems in combination with an optimally designed air-to-water heat pump, infrared heating has an approx. 2.5 to 3 times higher power consumption in operation.

In a second line of research, a residential building with 16 residential units heated exclusively with IR systems was scientifically monitored over two heating periods. Here it could be shown that the consumption values predicted through EnEV calculation were achieved. The specific electricity consumption for heating was on average approx. 20 kWh per square meter and year. Furthermore, the accompanying user survey showed that the residents perceived the IR heating system comfortable and easy to operate.

A comparative ecological consideration over 50 years has shown that the energy used to manufacture the systems has no relevance for the CO<sub>2</sub> balance between air heat pumps with underfloor heating and IR heating. The CO<sub>2</sub> emission is about twice as high for a heating system with IR-heating and energy source electricity mix as for a heat pump variant. In order to achieve a comparable ecological quality, it is therefore essential to combine an infrared heating system with systems for the generation of renewable electricity.

A comparative economic analysis for a period of 50 years suggested that a heat pump system is, due to the lower operating costs, economically advantageous compared to an IR heating system, despite significantly higher initial investment costs. However, if the difference in the initial investment costs is used to supplement the infrared heating system with a photovoltaic system, the life cycle costs are significantly lower for the same investment. Yet the locally generated environmental energy can only to a certain extent be used directly by the IR heating system, so a more detailed consideration of the entire system, including the grid and storage infrastructure, is necessary.

#### Fazit

Beschreibung der geplanten Ziele und der erreichten Ergebnisse  
max. 700 Zeichen (mit Leerzeichen)

The project provides a scientific basis for the evaluation of the potential of IR heating systems in buildings. According to the results of this study, infrared heating systems in combination with a photovoltaic system have the potential to offer significant ecological and economic advantages over heat pump systems at the same investment costs. The following applies here: the lower the heat turnover of a building, the greater the economic advantages of an IR heating

system, compared to a heat pump system. Infrared heating systems can help to reduce the technical complexity of heating systems and promote the expansion of renewable energy in Germany.

## **Eckdaten**

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Kurztitel: IR-BAU

Forscher / Projektleitung:

Prof. Dr. Thomas Stark, Jan Heider M.A.,

Gesamtkosten: 353.967,04 € €

Anteil Bundeszuschuss: 198.660,00 €

Projektlaufzeit: 30 Monate

## **BILDER/ ABBILDUNGEN:**

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