

Measured energy consumptions of infrared heating versus night storage heating

Measurements carried out in Leipzig, Germany, heating period 2014/2015 –
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Brief description of the results of the result report “long-duration measurement to the thermal energy demand” from November 2015¹, elaborated by Kurt Schmidt under professional supervision of Mr. Dr. Dieter Achilles (IET Jena, BVIR)

Generalised statements

1. With the use of infrared heatings, energy and heating costs can be saved in comparison to the use of night storage heating and in consideration of the different electricity tariffs.
2. Main reasons are
 - The far better controllability of the infrared heatings
 - The specific effects of a high proportion of radiant energy (an uniform temperature distribution in the room reduces the U-value of the brickwork through a reduction of the brickwork humidity) as well as
 - The lower needed comfort-temperature by using of infrared heatings.
3. Through the use of infrared heatings in connection with photovoltaics, storage units and the absorption of a portion excess power², suitable single- and semidetached houses can lead to a high autarky in the heat sector resp. to further lower heating costs. Besides the possibility to store the electric power, also the building shell can be used as (heat) accumulator of excess power in certain cases.

Summarized results

1. Towards the use of night storage heating, savings of about 45-50% can be seen as achievable regarding the measurements of the infrared heating.
2. Exterior walls made of clinker masonry with ca. 40cm wall thickness do not require an additional outside insulation.
3. Windows with $U = 1,3 \text{ W/m}^2\text{K}$ laminated glass and high density provide sufficient heat protection.
4. Insulation, especially to the basement and roof, is necessary.
5. For the inhabitants of the tested objects, no additional expenditures in the energy costs arise through the use of infrared heatings. Through conscious handling (single-room control), you yourself can effectively influence the energy consumption. Especially providing of heat in unused rooms -except for the basic heat- can be waived.
6. Through the reduction of energy consumption under 40 kWh/m^2 , the theoretical CO₂ emission decreases beneath the one from hot-water heatings.

Background of the measurements

In the year 2013 it was agreed in a discussion of the BVIR with representatives of the Federal association of the consumer advice center to carry out a comparing measurement of infrared- and night storage heating in rented flats and single-family houses. The methodology was agreed by Mr. Kurt Schmidt and the consumer advice center and supervised by Mr. Dr. Achilles. Also the results were verified by Mr. Dr. Achilles. A statement of the Federal association of the consumer advice center is still to be made.

¹cf. <http://bvir.de/?ddownload=361>

²cf. exemplarily <http://www.senec-ies.com>

A long-duration measurement was carried out because the different influences on the thermal energy demand currently cannot yet be quantified.

Selected results

Used item: electrically operated wall heater as infrared heater

- with a maximum surface temperature of 70° until 110°C
- with a proven radiation efficiency **over 50%** according to the measuring method of the BVIR³

The energy consumption was measured, documented and verified monthly in the winter 2014/2015

Table 1: Summarization of selected measurement results (single-family house)

Building	Night storage heaters		Infrared heating	
	Installed power W/m ²	Energy consumption kW/m ² *a	Installed power W/m ²	Energy consumption kW/m ² *a
Old building terraced house	200	50	66	32
Single-family house freestanding (constructed 1994) 2 floors/1 flat 190m ²	126	75	52	39

Table 2: Selected information to the buildings

	Existing building	Single-family house
Building condition	Typical apartment house, listed as historical monument, clinker/brick (wall thickness 40cm without additional wall- and ceiling insulation)	Solid construction with insulation (roof and floor) wall thickness 40cm lightweight construction block and insulation plaster
Available consumption data	not available	available
Windows	laminated glass U=1,3 W/m K	laminated glass U=1,3 W/m K
Airing	partly window fold ventilation	shock ventilation-window opening
Heat recovery	none	none
Heat pump	none	none
Temperature level	Satisfying	satisfying
Night storage heating	23° - 24°C	21° - 22°C
Infrared heating	19° - 21°C	19° - 20°C

³cf. IET GmbH, Jena: Simplified comparing verification procedure regarding the proportion of radiation (http://bvir.de/wp-content/uploads/2014/06/120706a_BerichtIR_Messung.pdf)