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The nZEB as an active element of the energy system

4 years of operation!

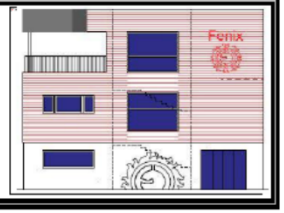
The building's energy label

calculated according to the 2020 standard

ENERGY PERFORMANCE CERTIFICATE OF THE BUILDING

issued in compliance with the Act No. 406/2000 Coll., on energy management, and the Decree No. 78/2013 Coll., on energy performance of the buildings

Street, No.:
Postcode, place: **cadastral area of JESENÍK – parcel No.: 2037/4**
Type of building: **Administrative building**
Building envelope surface: 714 m²
Shape volume factor A/V: 0,66 m²/m³
Overall energy reference surface: 316 m²



ENERGY PERFORMANCE OF THE BUILDING

	Total energy delivered (input energy at the building)		*Non-renewable primary energy (impact of building operation on the environment)*
	Specific values kWh/(m2.year)		
Extremely efficient A	41,8	A	61,1
44,5			102,2
Very efficient B		B	
66,7			153,2
Efficient C		C	
89,0			204,3
Less efficient D		D	
133,4			306,5
Inefficient E		E	
177,9			408,6
Very inefficient F		F	
222,4			510,8
Extremely inefficient G		G	
Values for entire building MWh/year	13,22		19,33

RECOMMENDED MEASURES

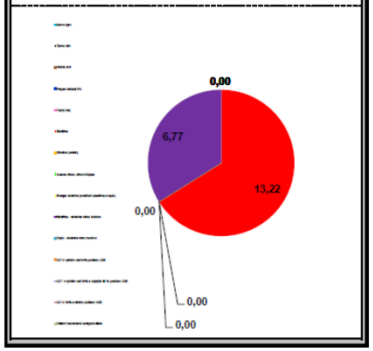
Measures for	Set
Outer walls	☐
Windows and doors	☐
Roof	☐
Floor	☐
Heating	☐
Cooling/air conditioning	☐
Ventilation	☐
Warm water preparation	☐
Lighting	☐
Others	☐

Description of the measures is in the certificate protocol and assessment of their impact on energy performance is shown by the arrow

Recommendation

PARTICIPATION OF ENERGY CARRIERS ON DELIVERED ENERGY

Values for entire building MWh/year



ENERGY PERFORMANCE INDICATORS OF THE BUILDING

	Building envelope	Heating	Cooling	Ventilation	Humidity adjustment	Warm water	Lighting
	U_{em} W/(m².K)	Particular energy delivered			Specific values kWh(m2. year)		
A		8,5					8,5
B	0,243		11,9			4,9	
C							
D				8,0			
E							
F							
G							
Values for entire building MWh/year		2,7	3,8	2,5	0,0	1,6	2,7

Elaborated by: Ing. Miroslav Urban, PhD., verified by: Ing. Roman Musil, PhD.
Certificate No. 1011
Issued on: 20th August 2015
Contact: roman.musil@fsv.cvut.cz
Signature:

Built to the nZEB standard, the fully electrified building features an electric radiant heating system.

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Office center - a building with nZEB parameters

A fully electrified building operating as an active element of the grid

Presentation of the idea of an nZEB as an active element of the grid - 2013-2014.

Building design - cooperation with the Czech Technical University in Prague (CTU) from 04/2015 to 08/2015
Construction commenced – 10/2015
Construction completed – 05/2016

Cooperation between a 7.2 kWh rooftop PV system with a 26kWh home battery and the energy distribution grid.
The battery is used not only to enable the building to make 100% use of the energy from the PV system but also to allow active cooperation with the grid. This means that it is charged during the low-tariff period, and fully takes over the task of supplying the building with energy during the high-tariff period.

A group of specialists representing the Ministry of Industry and Trade, the Ministry of the Environment, the Energy Regulatory Office, ČEZ-ESCO, ČEZ - Distribution, ČEPS and the CTU was appointed to monitor the nZEB for two years and evaluate the achievement of goals.
Data concerning energy consumption as well as the quality of the indoor environment were collected by CTU – UCEEB.

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Comparison of expected and real results after 24 months of operation:

Expected yearly energy consumption	**UCEEB –**	**approx. 27 000 kWh**	
Real energy consumption		**26 626 kWh (2017)**	**- 1.4%**
		27 193 kWh (2018)	
		24 454 kWh (2019)	
		23 727 kWh (2020)	
Energy consumption from the grid		**21 000 kWh (2017)**	
		20 100 kWh (2018)	
		17 223 kWh (2019)	
		16 750 kWh (2020,	**-20.3%**
Energy consumption for heating and hot water:		**12 402 kWh (2016/2017)**	
:		**10 500 kWh (2017/2018)**	**-15.4%**
:		**7 300 kWh (2018/2019)**	**- 31 %**
		6 750 kWh (2020,	**- 45.6%)**
Energy from the building's own PV system		**PV – 7 200 kWh**	
Real production		**6 050 kWh (2017)**	
		7 123 kWh (2018)	
		7 221 kWh (2019)	
		6 977 kWh (2020	

Electricity consumption for heating 18,5 kWh/year m^{-2}

Heating

Electric radiant system with individual control of each room (9 kW installed).

Heating energy consumption was higher than expected, reaching 12 045 kWh between 10/16 and 5/17, 10 050 kWh from 10/17- 05/18 (-15.3%) and 7 300 kWh from 10/18-5/19 (-31%) , 9/19-5/20 – 6 750 kWh , 18.5 kWh/m^2 $year^{-1}$.

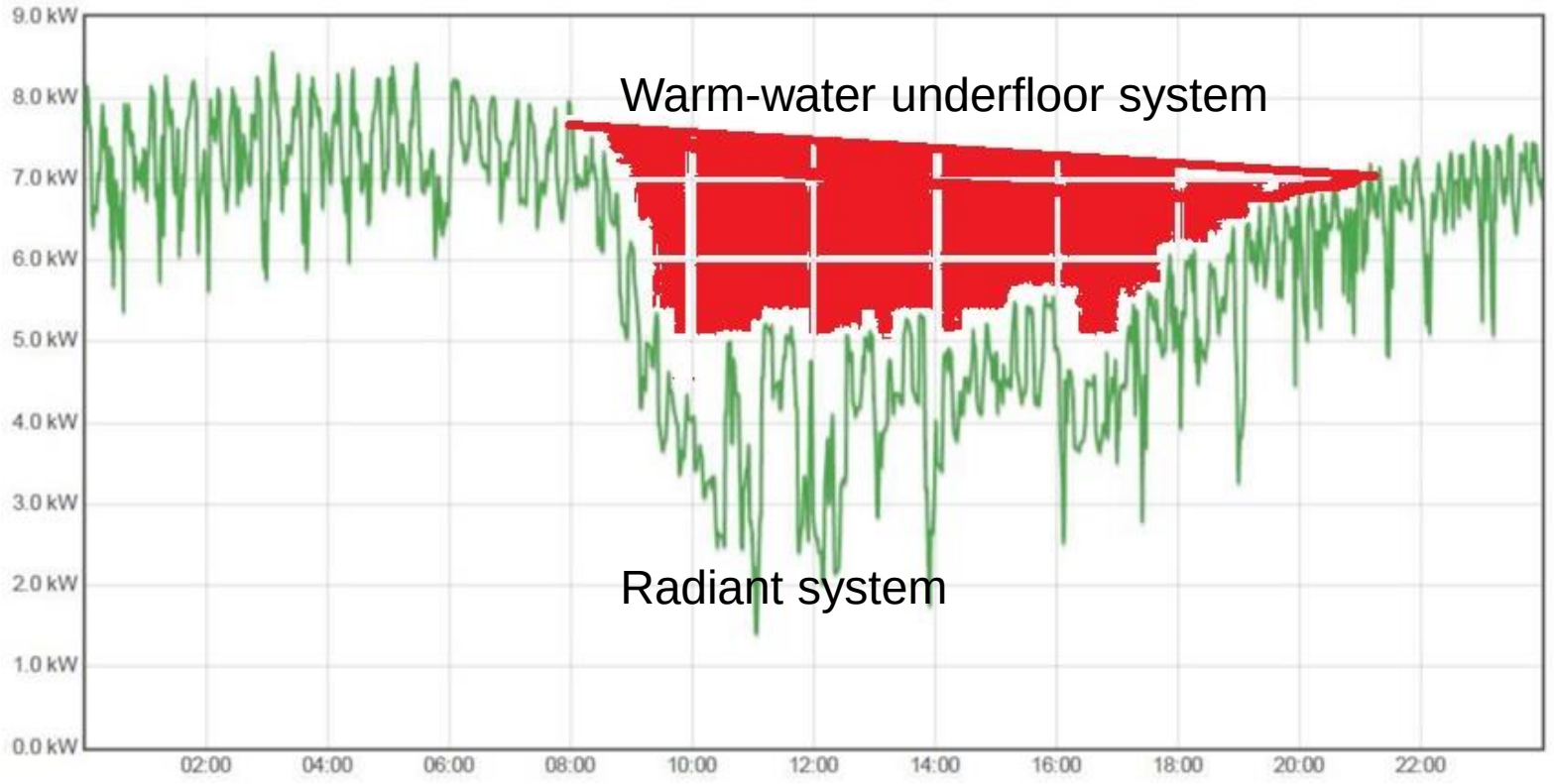
The results for 2019 clearly show the potential for savings in flexible radiant heating. According to information from the Association for District Heating of the Czech Republic, non-flexible warm-water systems had savings of only 8% in the same period.

During the test, the advantages and disadvantages of the “attenuation mode” were examined (- 2°C). The savings achieved are very interesting (17%), though it causes large morning consumption peaks which can be solved by increasing the capacity of the battery.

Overall, the heating system reacted very flexibly both to temperature changes and the occupancy of the individual heated zones. It clearly proved its significant advantages over “warm-water systems” with their high inertia!

An extremely cold day (-12°C) - overcast

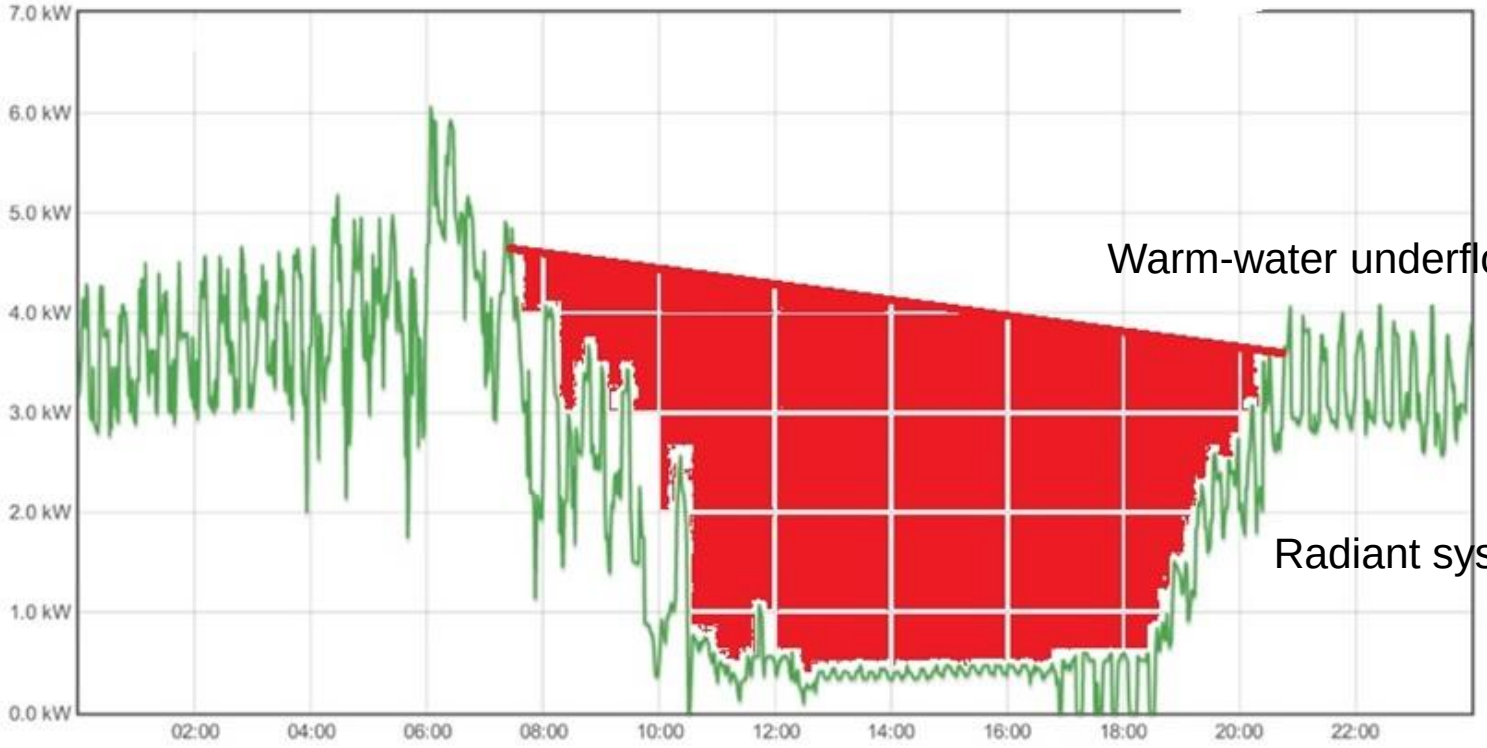
Electric radiant heating in comparison with a warm-water system
Energy supply to the heated area



The energy consumed for heating (radiant heating system) reacts flexibly to changes in outdoor temperatures and particularly to random heat gains (people – equipment).
In contrast, the warm-water system with its high inertia and long reaction time isn´t capable of reacting fast and thus significant energy losses occur.

Sunny day 16. 2. 2017 - average temperature +4.7 °C

An even more significant difference in efficiency



The significant effect of heat gains (sun-people-equipment) on energy consumption can be seen from this graph, which shows energy consumption for heating. In order to make full use of this effect, it is essential to use a flexible heating system capable of reacting swiftly in each heated area independently.

Standard warm-water systems (with any source) do not have this ability in nZEB!