



LUBLIN UNIVERSITY OF TECHNOLOGY  
Faculty of Environmental Engineering  
POLAND

# Influence of wind speed and insolation on heat consumption in buildings

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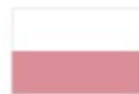
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# Introduction

- existing residential buildings -- 40% of the total heat consumption in the European Union
- the impact of the main external factors (outdoor air temperature, wind speed and solar radiation);
- proper control of heat supply, taking into account weather forecast

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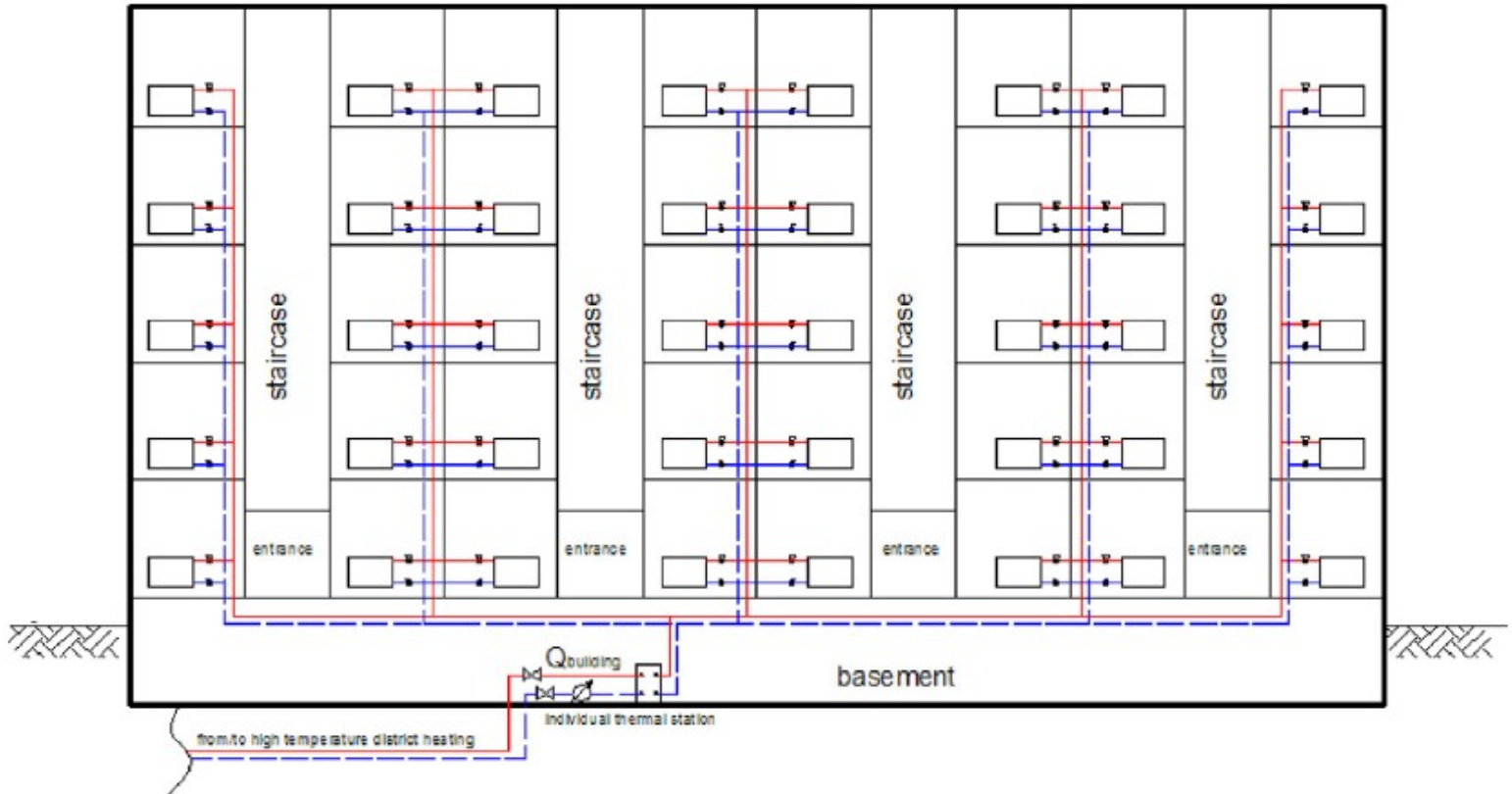
# Materials and Methods

- one multi-family residential building, located in Lublin (Poland), in one heating season;
- building after thermorenovation, heating medium parameters are 80/60°C;
- heat source for the building is an individual thermal station for heating and hot water purposes;
- calibrated heat meter measures hourly heat consumption used in the heating system.

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# Materials and Methods



**Fig. 1.** Schema of heating system in analyzed building.

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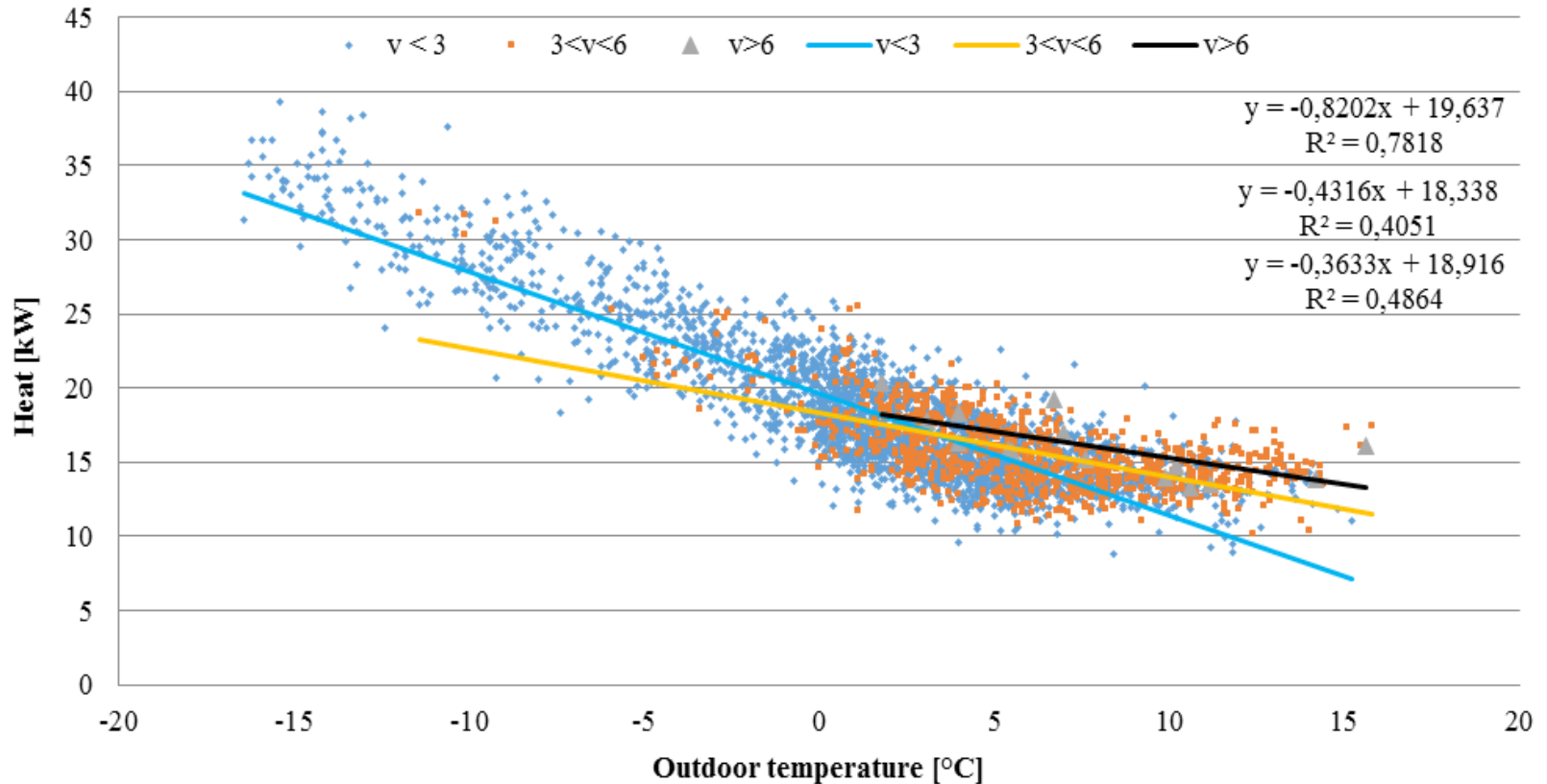
# Materials and Methods

- calibrated heat meter measures hourly heat consumption used in the heating system;
- measurement of outdoor parameters (outdoor air temperature, wind speed (average and maximum), insolation);
- various hourly ranges for the analyzed data (all day:0.00-23.59, 6.00-18.00, 18.00-6.00, 23.00-4.00);
- impact of wind speed on heat supplied to the analyzed building  $v < 3$  m/s,  $3 < v < 6$  m/s and  $v > 6$  m/s;
- impact of insolation ( $\text{J}/\text{cm}^2$ ) in the four ranges (0-35, 35-100, 100-200, above 200  $\text{J}/\text{cm}^2$ ).

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# Results



**Fig. 2.** Heat delivered to the building between hours 0.00 and 23.59 by average wind speed

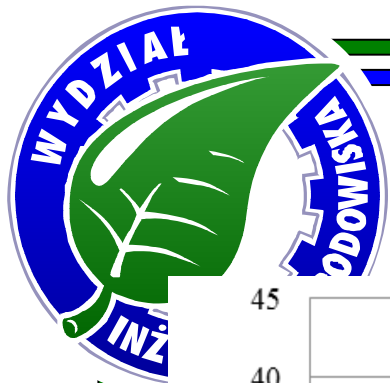
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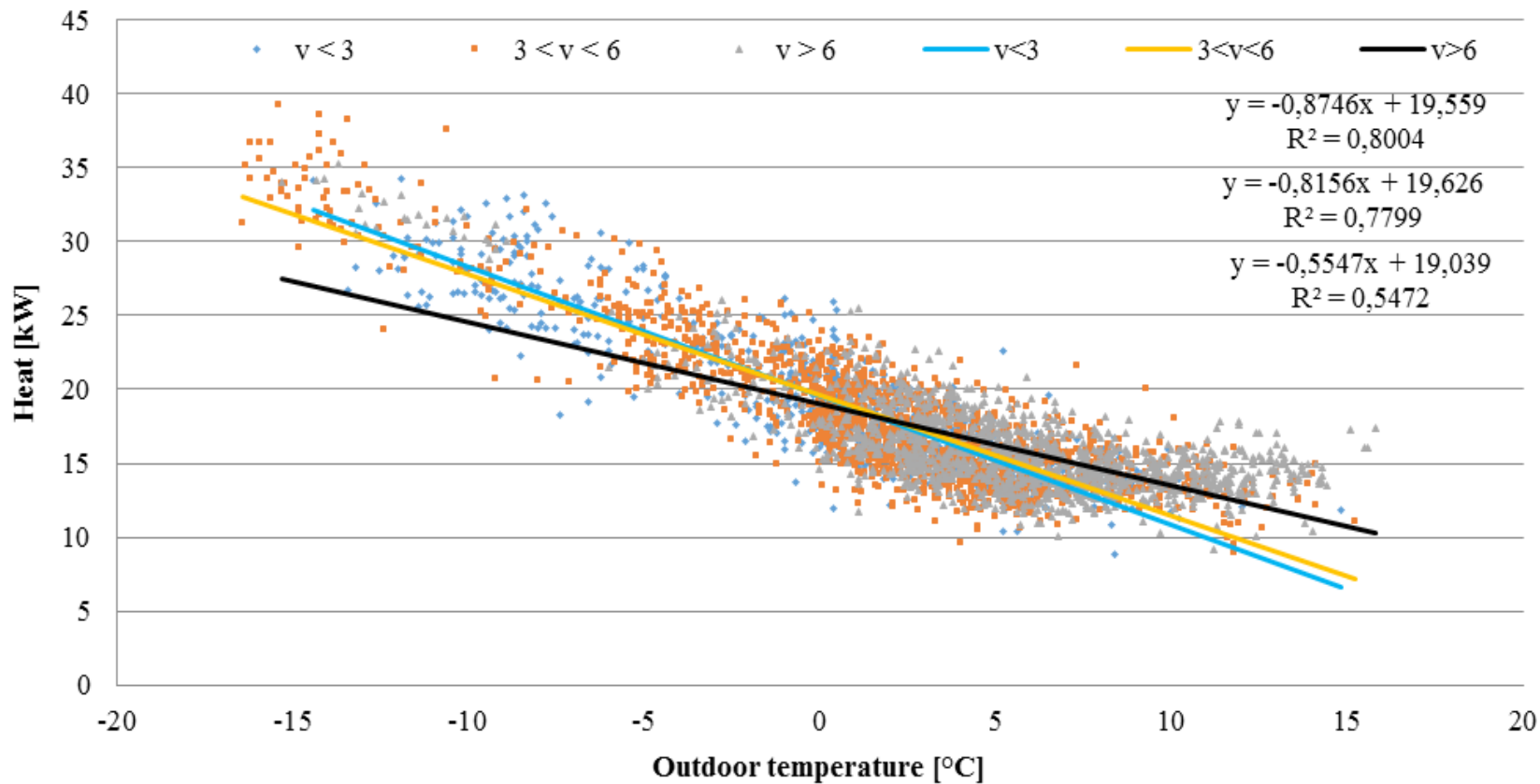
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# Results



**Fig. 3.** Heat delivered to the building between hours 0.00 and 23.59 by maximum wind speed

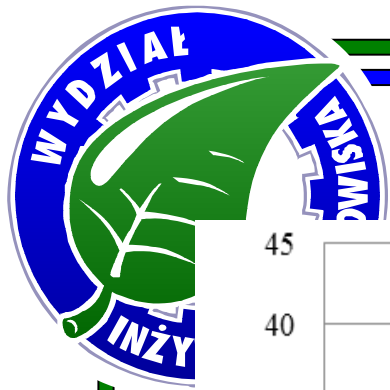
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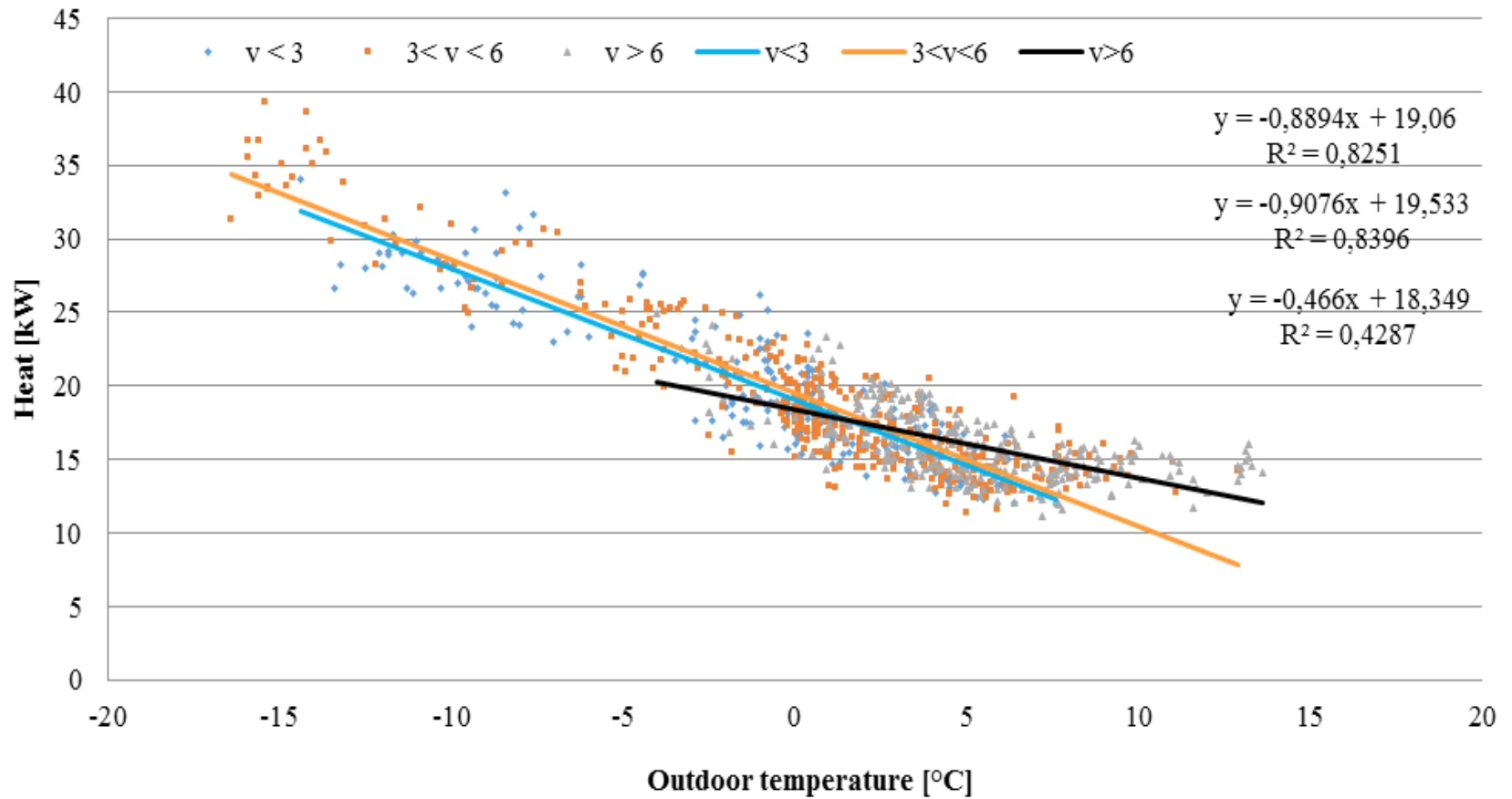
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# Results



**Fig. 4.** Heat delivered to the building between hours 23.00 and 4.00 by maximum wind speed.

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# Results

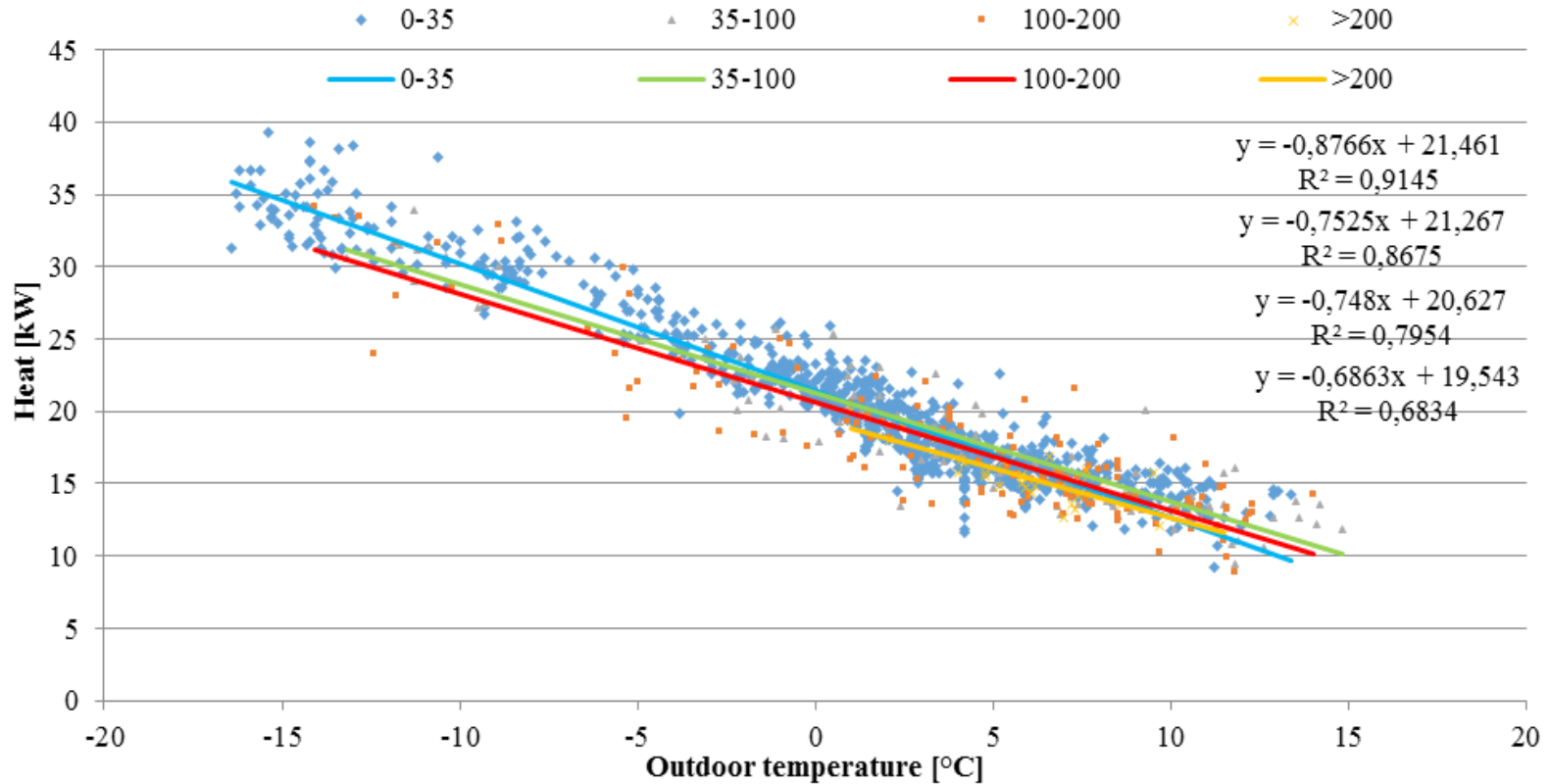
**Tab. 1.** The regression coefficients for analyzed cases for wind speed

Time	Wind speed	$v < 3\text{m/s}$	3-6 m/s	$v > 6\text{m/s}$
0.00- 23.59	average	0.7818	0.4051	0.4864
	maximum	0.8004	0.7799	0.5472
6.00-18.00	average	0.7681	0.4393	0.4136
	maximum	0.7823	0.7579	0.5867
18.00-6.00	average	0.8092	0.3538	0.9248
	maximum	0.8253	0.8176	0.4663
23.00-4.00	average	0.8168	0.3927	-
	maximum	<b>0.8251</b>	<b>0.8396</b>	<b>0.4287</b>

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# Results



**Fig. 5.** Heat delivered to the building for different levels of insolation by maximum wind speed

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# Conclusions

- Important issue is to determine the impact of major external factors (outdoor air temperature, wind speed and solar radiation) on the heat supplied to buildings.
- There are various methodological aspects that affect the accuracy of the obtained results.
- That is why, when determining the effect of on factor/aspect on the thermal power delivered to a building, one should try to minimize the simultaneous effect of others on the heat consumption.
- A detailed description of these methodological aspects and the methodology for determining the equivalent value of the outdoor air temperature, which takes into account the impact of wind speed and solar radiation or cloud cover, will be presented in the extended version of this paper.



**Thank you for attention**

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