After thermomodernization one observed considerable making worse of environment conditions. Respondents signalled making worse qualities of airs and lack of sufficient ventilation. One noted intensification oneself of symptoms of syndrome, in peculiarities irritations of air passages and headache. Lack possibilities of adjustment of temperature, unsuitable ventilation, and bad airs quality in research rooms were effective with necessity additional, frequent ventilations of rooms. Put into port on excessive warm waste, considerably above appointed seasonal applications on warmly.

Conceived at present on wide scale energy-saving activities not always lead to improvements of microclimate conditions existing in closed rooms whether but their maintenances in original state. Requirements behaving to microclimate of rooms and people thermal comfort can be found in conflict with too categorical order of minimize quantities of thermal energy used up in process of exploitation of buildings. Does not mark necessities of entire resignation with energy-saving activities. Outgoings connected with realisation the programme of rational uses of thermal energy in building, at maintenance correct conditions of thermal comfort, are relatively not very high in relation to entire investment costs.

This situation is more profitable then, when energy-saving recommendations initiating on projecting phase and not in already existing building. In perspective superior value should be state good frames of mind and health of persons spending one's own time in the rooms.

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Lis Anna

MATERIAL-CONSTRUCTION INDEXES IN CORRELATION TO THERMAL REQUIREMENTS OF BUILDING

Energy-saving is current one of the important problems in designing and exploitation of building. The idea of the research was to find the correlation between the material and constructional features of educational buildings and the heat consumption of these building. Energy consumption in educational building sector in Poland present Fig. 1.

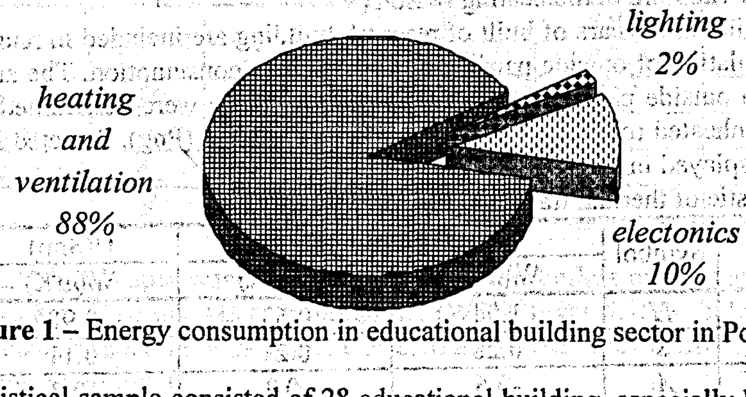

Figure 1 – Energy consumption in educational building sector in Poland

The studied statistical sample consisted of 28 educational building, especially building for children in nursery age. This paper presents an analysis of material-construction indexes of educational buildings from the point of view of their influence on heat consumption on cubic metre of cubature in the heating season. General characteristic of research building are presented in Table 1.

Table 1 – The characteristic of research building

Years of built					
1950-1960 – *14%*	1961-1970 – *11%*	1971-1980 – *29%*	1981-1990 - *32%*	1991-2000 - *14%*	
Number of storeys					
One storey - *67%*			Two storey - *33%*		
Cellar					
Completely - *45%*		Partly - *46%*		Lack - *9%*	
Completely heated - *2%*		Partly heated - *32%*		Unheated - *66%*	
Technology of realisation					
Traditional - *50%*		Prefabricated - *39%*		Framed (Wood)- *11%*	
Type of windows					
Wooden: -*88%*		Plastic-*10%*		Metal -*2%*	

Typical nursery school building, have specific functional arrangement itself. Characteristic is south-northern location with reference to cardinal points. The rooms for children are arranged in southern part of the building. In northern part of the building are arranged administrative-economic rooms. Usable floor space of statistic building for children is 970 m^2. In research building are situated generally 5 rooms with surface about 320 m^2.

Selected statistic measuring of research structure, are displayed in Table 2.

Table 2 – Selected statistic measuring of research structure

Statistic measure	Symbol	Usable floor space	Cubature	Number of rooms	Usable floor space of rooms	Cubature of rooms
		m^2	m^3		m^2	m^3
Arithmetic mean	$\bar{x}$	971.8	4538.1	5	318.5	971.2
Standard deviation	s	418.3	1800.3	1	68.5	231.5
Clasical assimetric coef.	A_s	-1.6	0.2	0	-0.3	-0.5
Curtosis	K	-0.3	0.6	1	0.3	0.7

The building was heated from different sources, especially from urban net (WPEC) and from one's own boilers. The characteristic of the heating systems is displayed in Table 3.

Table 3 – The characteristic of the heating systems research building

The characteristic of the heating systems		
One's own boilers: coal, coke - *52%*		Urban net (WPEC) - *48%*
Additional elements		
Thermostatic elements - *7%*	Automated regulation - *2%*	Periodical reducing of temperature - *40%*

In building heated from one's own boilers reduced heating during the work breaks, in Saturdays, Sundays and during the national or religious holidays. Existing thermostatic elements was unused and out of order. For the sake of diverse scale of analysed structure of building heat use to heating these building (Q) referenced to cubic metre of cubature in the heating season (V).

Typical changeability area years of built of research building are included in range 1950-1973. Its determine low thermal insulation of outside partitions and high heat consumption. The analysis dealt value of thermal transmittance on outside partitions U. Thermal transmittance were determined for wools (S), roofs (Std), ceilings over the unheated room (Snp), and floors on the ground (Png). Selected statistic measuring of research structure, are displayed in Table 4.

Table 4 – The characteristic of thermal transmittance U

Statistic measure	Symbol	U(S)	U(Std)	U(Snp)	U(Png)
		W/(m^{2}K)	W/(m^{2}K)	W/(m^{2}K)	W/(m^{2}K)
Harmonic mean	H	1.04	0.63	0.98	0.74
Standard deviation	s	0.28	0.21	0.11	0.15
Clasical assimetric coef.	A_s	-0.6	-0.3	-0.7	-0.9
Curtosis	K	1.3	0.9	1.0	-1.0

The thermal transmittance on outside all partitions are higher then recommended now value. Mean value of thermal transmittance for research building present Table 5.

Table 5 – Mean value of thermal transmittance in research building

Outside partitions	U	U range	U_{max}
	W/(m²K)	W/(m²K)	W/(m²K)
Wools (S)	1.04	0.31 – 1.53	0.45
Roofs (Std)	0.98	0.30 – 1.20	0.30
Ceilings over the unheated room (Snp)	0.63	0.58 – 1.10	0.60
Floors on the ground (Png)	0.74	0.51 – 0.98	0.66

In analysis structure higher influence on heat consumption have wools and roofs thermal isolation. Fig. 2 and 3 describes the connection between heat consumption and thermal transmittance value for wools and roofs. Thermal isolation of remaining partitions has a lower importance on heat consumption. It is shown on Figs. 4 and 5.

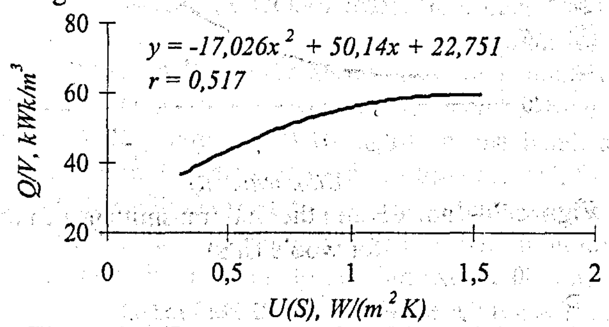

Figure 2 – Heat consumption Q/V and thermal transmittance value for wools U(S)

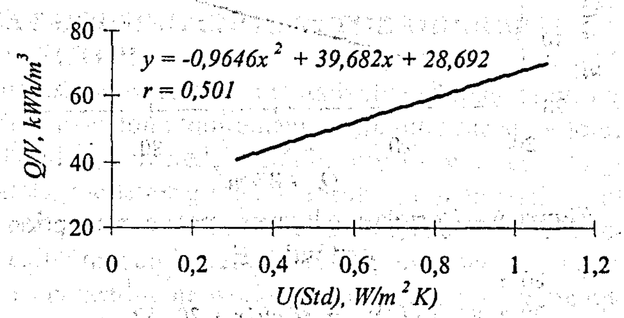

Figure 3 – Heat consumption Q/V and thermal transmittance value for roofs U(Std)

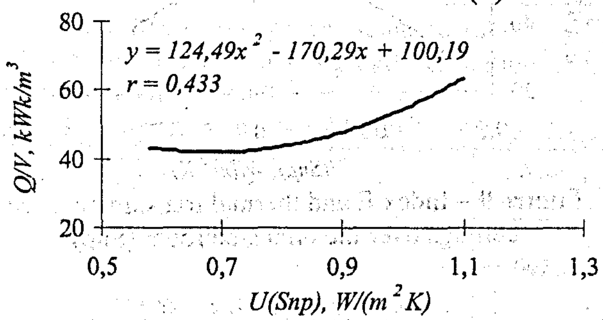

Figure 4 – Heat consumption Q/V and thermal transmittance for ceilings over the unheated room (Snp)

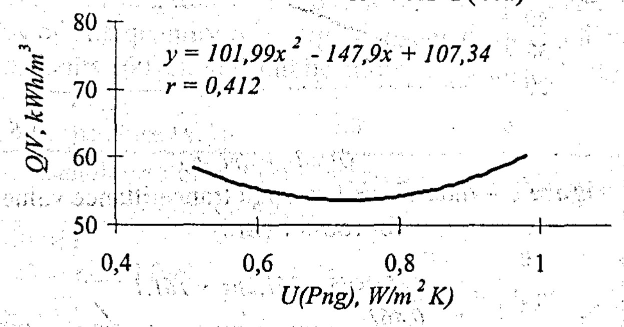

Figure 5 – Heat consumption Q/V and thermal transmittance value for floors on the ground (Png)

Heat consumption in research building was higher then calculated index E sesonal denand for heat for these building. Selected statistic measuring of research structure, are displayed in Table 6.

Table 6 – Selected statistic measuring of research structure

Statistic measure	Symbol	E	E_0	Q/V	Heating cost	
		kWh/m³	kWh/m³	kWh/m³	\$/m³	\$/GJ
Harmonic mean	***H***	43.3	32.2	53.3	1.18	5.33
Standard deviation	*s*	12.7	1.3	14.2	0.41	0.76
Clasical assimetric coef.	A_Q	0.5	-	0.4	-	-0.3
Curtosis	*K*	-1.1	-0.1	-0.1	-1.1	0.1

In research building cheaper was one GJ from one's own boilers on coal and coke. Coast one GJ in these building was 4.48 \$. Cost one GJ from urban net (WPEC) was 5.75 \$. Indexes E sesonal denand for heat is higher then recommended now E_0 value. Correlation between heat consumption and index E sesonal denand for heat is showed on Fig. 6.

On higher heat consumption in research building was first of all influence of insufficient ventilation in the rooms, bad air quality in these rooms and necessity of supplementary ventilation through opening windows.

Fig. 7 and 8 describes the connection between index E sesonal denand for heat and thermal transmittance value for wools and roofs.

Thermal isolation of remaining partitions has also a lower importance on index E sesonal denand for heat (Figs. 9 and 10).

Significant influence on heat consumption was also a destruction of research outside partitions. These partitions were a lot of defects and faults. Correlation between heat consumption and destruction of outsides partitions is shown on Fig. 11.

Thermal characteristic of the building partitions in research building was an influence, especially on the indexes E sesonal denand for heat. This influence didn't significant on the heat consumption Q/V. It follows that on the heat consumption significant influence was other factors, didn't take into consideration in calculation e.g. defects and faults of outsides partitions or excessive ventilation in the rooms.

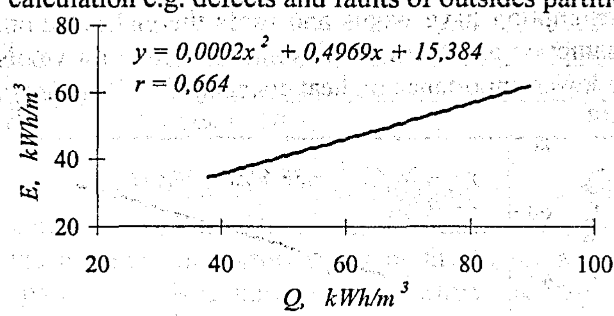

Figure 6 – Correlation between heat consumption and index E

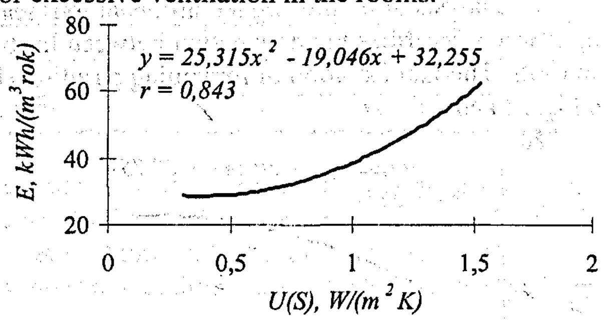

Figure 7 – Index E and thermal transmittance value for wools U(S)

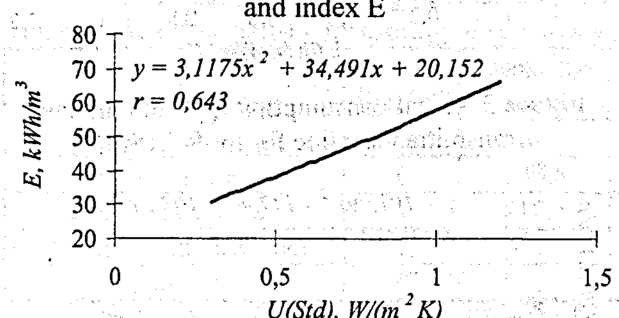

Figure 8 – Index E and thermal transmittance value for roofs U(Std)

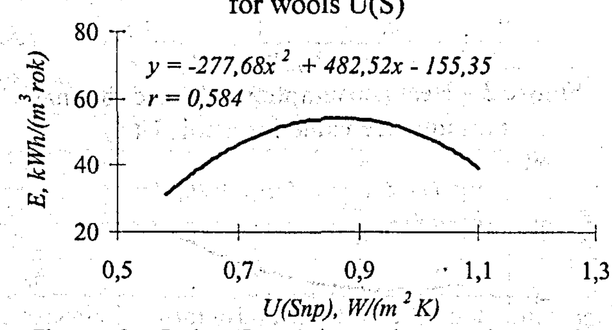

Figure 9 – Index E and thermal transmittance for ceilings over the unheated room (Snp)

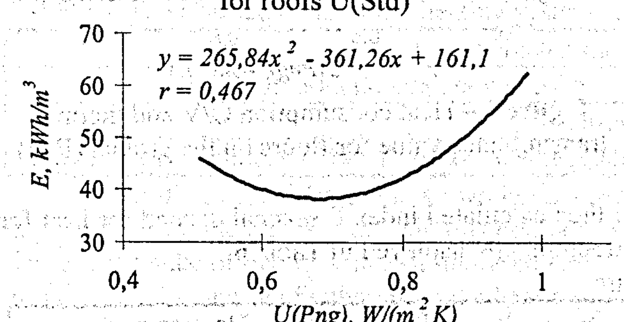

Figure 10 – Index E and thermal transmittance value for floors on the ground (Png)

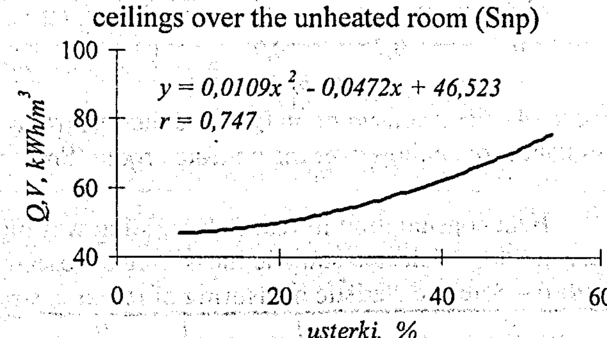

Figure 11 – Correlation between heat consumption and destruction of partitions

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Lis Piotr

ENERGY USE FOR HEATING AS A HOUSING SELECTION CRITERION

For the last several years, a rapid decrease in the number of housing units commissioned in Poland may be observed. The main reason behind this situation is shortage of financial resources and available housing credits. Modest incomes of the majority of Polish families result in increasing numbers of families possessing housing units, yet not making payments for costs of maintenance thereof, in which heating costs constitute about 70%. It is due to these facts that a buyer of a product, which housing units have now become, more and more often tends to take into account, while making a decision, also the rate of housing units maintenance payments to be made over the period of dozens of years.

ENERGY CONSUMPTION USED TO HEAT HOUSING UNITS IN THE MUNICIPAL HOUSEHOLD SECTOR

When analyzing the above issue, one should distinguish between two qualitatively different cases, i.e. buildings erected prior to year 1991, when building thermal isolation requirements were introduced by force of Polish Standard PN-91/B-02020 on one hand, and buildings erected in conformity to requirements as mentioned in the said Standard, on the other. Unfortunately, the latter group, as results from an analysis of GUS (Chief Office of Statistics) data, comprises merely about 2.5% of all Polish housing resources. The remaining 97.5% of housing units are located in buildings exhibiting an increased heating level demand, influenced, inter alia, by: heat losses and excessive water losses in heating networks, as well as inappropriate operation of central heating installations. All these factors contribute to increased energy consumption levels in the municipal households sector, and high costs of housing heating. As early as in mid-eighties, the municipal households sector's share in the national primary energy consumption was about 40%, which was equal to 53.1 mln MT of theoretical standard fuel (t. s. f.). Out of this quantity of energy consumed, as much as 71% was absorbed by heating and ventilation of housing units (60%), and public utility buildings (11%), which is depicted in Table 1.

Table 1 – Municipal household sector's energy consumption structure [4,5]

Consumption	Municipal household sector's energy consumption structure in the eighties.	
	mln MT of theoretical standard fuel (t. s. f.)	% of total consumption
Total consumption	53,1	100
Heating and ventilation	37,7	71
Preparation of hot usable water	6,9	13
Preparation of meals	4,8	9
Lights and electrical facilities	3,7	7

The above facts find their reflection also in values of heat demand factor E, which for most Polish housing units are within the range of 235-310 kWh / (m^2a) (Table 2). For the sake of comparison, the value of E factor is lower by about 25% in France, and by about 46% in Denmark (Table 2), taking into account different weather conditions. In Poland, only the users of housing units erected in conformance to the 1991 heat standard requirements, and "Building Technical Requirements" of 1995, or users of buildings that were subjected to thorough thermal renovation, would have a chance to reach similar heat / energy parameters of their housing units. What should be pointed out now is that in Poland, within the group of potential buyers of housing units, quite restricted for financial / crediting reasons, over the half decides to purchase apartments in several or several dozen years old buildings, rather than in new ones.

Over the last several years, a rapid increase in housing heating costs may be observed. The main reason behind this growing tendency is an increase in prices of heat-carrying agents, which, as per GUS (Chief Office of Statistics) data, within the years 1996 - 2002, rose in real terms by: electricity about 2 times, natural gas about 2 times. Price changes of the basic heat-carrying agents are illustrated in Table 3.

The said price increase has been brought about by two main factors. The first one is inflation, and relative of it periodical updating of prices to bring them to more realistic levels, as well as the state's gradual