

INVENTORY OF SCHOOL-FACILITIES STOCK IN THE CITY OF BYDGOSZCZ (POLAND) REQUIRING DEVELOPMENT OF EGSMP

N. DELIVERABLE D.T1.1.3

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1. Energy@School - Project overview

The building sector has high potential for energy optimization being the most consuming one in EU. In terms of public buildings heritage, energy consumption in schools is the second highest expenditure of Municipalities total running costs. This sector offers potential remarkable achievements in terms of Energy Efficiency (EE), Renewable Energy Sources (RES) application and carbon footprint reduction and several disparities exist among Central Europe countries as for planning and implementing performances of proper sector-based strategies, action plans and managerial capacities.

With reference to the public stock of buildings and infrastructures, for sure educational facilities are an important opportunity to achieve substantial energy savings, as they constitute a relevant part of the overall amount of energy consumption and therefore of the expenses paid by the national budgets. Energy consumption in schools is the second most significant expense to total running costs and they account up to 70% of the thermal energy cost of Municipalities. Schools, being such an important line in energy-related budget, represent an important sector of public administration to tackle with reference to buildings' upgrade, retrofitting and renovation. Furthermore, schools are the best environment for behavior change and awareness raising of students and, indirectly, their families because they are the privileged place for the dissemination of culture and information as a whole and therefore also in the field of energy saving and efficiency. Consumption in schools can be quite variable depending on country, climate, building year of construction and type. However considering an average energy use profile, consumes can be roughly divided as follows: 47% heating; 14% lighting; 10% cooling; 9% ventilation; 7% water heating; 4% PC; 2% refrigeration; 1% cooking; 1% office equipment; 5% other. It is estimated that just by making small changes in behavior, schools could save up to 20% of their energy use (and bills). This amount can noticeably increase if energy retrofit interventions are associated to behavioral changes (e.g. around 50% with 0.5 to only 2 years payback period).

Public building sector with reference to schools is therefore one of the main issues and there is concrete need to develop energy-efficient management for schools and strategies on how to improve the energy efficiency. There is also need to raise the awareness of school staff and students, and to involve them in the energy saving activities. People have a crucial role in this process, therefore they need to be supported and provided with the best available solutions.

Main ENERGY@SCHOOL objective is to increase the capacity of the public sector to implement Energy Smart Schools, by application of an integrated approach that educate and train schools





staff and pupils to become Senior and Junior Energy Guardians (EGs) who will engage on progressive and sustainable energy efficiency of buildings and an adequate transfer of a correct attitude towards energy consumption ("energy culture"). Thanks to a commitment to high-performance schools, many school districts are discovering that smart energy choices can have lasting benefits for their students, communities, environment. The key idea is to provide concrete technical Tools and Devices and specialized trainings for School Planning Managers on financing opportunities, designing, operating & maintaining energy solutions. The innovative character lies in the active involvement of employees, experts, students, teachers, families in the process of transforming the school into an energy smart school through specific and targeted training and education activities.

The project will therefore address common barriers associated with energy smart-school management, it will develop and provide a Methodology & Approach usable and replicable within other school buildings, together with the necessary Tools, Devices & Protocols. In this way all parties involved in the energy decisions of a public school (technicians and ICT professionals, administrators, school employees Energy managers) can face in a coordinated manner the issue of Energy Efficiency by implementing effective and validated solutions.

The project will deliver:

- ⇒ 1 Common/Transferrable and 8 customized Strategies for Smart Schools,
- ⇒ 1 joint and 7 customized Energy Smart-school Management Plans,
- ⇒ 3 smart phones APPs for Energy Guardians,
- ⇒ 8 tested pilot solutions of EE & RES application in schools under direct contribution of Energy Guardians, in the form of Guidelines, Toolbox, Best Practices as reference documents and experiences to be capitalized far beyond the project end.
- ⇒ Training & education programs as adaptable & replicable models for capacity-raising and Energy Culture rooting.

ENERGY@SCHOOL expected results:

- I. Optimization of energy consumption in schools,
- II. Concrete and progressive increase of EE and RES use in schools not only thanks to technical application of smart solutions, but also to non-technical factors such as a better management capacity and responsible behavior toward energy use,
- III. Increase of capacity of public sector to deal with increase of EE and RES use in schools thanks to strategy, action plans, tools (methods, approaches), trainings, pilot actions defined and implemented within the project,





- IV. Increase in managerial and organizational competences as well as in human resources to ensure the progressive and sustainable energy efficiency and renewable energy se in public schools (trainings),
- V. Creation of conditions for new job opportunities (trainings),
- VI. Creation of "energy culture", thus responsible attitude towards energy use, thanks to education and raising awareness activities, as it is demonstrated that amount of saved energy can noticeably increase if energy retrofit interventions are associated to behavioral changes.

List of Project Partners

- 1 Union of Municipalities of Low Romagna Region, Lead Partner Italy
- 2 CertiMaC s.c.r.l. Italy
- 3 City of Bydgoszcz Poland
- 4 ENERGY AGENCY OF SAVINJSKA, ŠALEŠKA AND KOROŠKA REGION Slovenia
- 5 City of Karlovac Croatia
- 6 University of Bologna Dept of Industrial Chemistry Italy
- 7 Municipality of the CITY Szolnok with County Rank Hungary
- 8 Local Government of Town Újszilvás Hungary
- 9 City of Stuttgart Germany
- 10 Klagenfurt Austria
- 11 Graz Energy Agency Austria
- 12 City municipality of Celje Slovenia

Responsible Partner of Thematic Work Package "Analysis phase and definition of Energy Guardians Smart-school Management Plans" and the present document: CertiMaC - Research Laboratory - Italy





2. Rationale of the Inventory

The present Deliverable/technical document has been developed in the framework of several project core activities specifically designed for the set-up of Energy Guardians Smarts-school Management Plans (EGSMPs) indicating actions necessary to achieve higher energy savings. All such activities contribute to carry out a customized analysis within the territories of the Partner organizations involved so as to create a Common Strategy For Smart Schools (CSSS) and sustain both Energy Guardians and schools during implementation and management of own Energy-Efficiency and Renewable-Energy-Sources interventions.

Purpose of the present Inventory is to describe the analysis carried out within 12 school facilities and, in 6 of them, also within gym or swimming pool, located in the city of Bydgoszcz. The results shown within the Inventory will support Energy Guardians and Energy Managers to evaluate which interventions would be implemented into EGSMP (Energy Guardian School Management Plain) in order to foster a virtuous approach devoted to energy-consumption reduction. In this sense, the Inventory represents a real operational decision-support Tool at their availability. Actually, it has to be underlined that the document is much more than a mere Inventory since it presents the results of an in-depth and thorough energy analysis (very close to an energy audit) of each school involved: it detects energy consumption trends and energy performance indicators then, according to pre-defined evaluation criteria, it displays and suggests a set of priorities of interventions in terms of Energy Efficiency and Renewable Energy Sources implementation, together with standards costs of each intervention and related energy-consumption reductions.

The above explained completeness of results within the present Inventory has been technically possible thanks to the application - during data collection and analysis phases carried out - of the specific Tools and Models (developed by Partner CertiMaC for project purposes) referred in ENERGY@SCHOOL as Deliverables D.T1.1.1 and D.T1.1.2, namely "List of jointly defined homogeneous criteria for implementation of the transnational school-facilities inventory" and "Common methodology for evaluation of school-facilities energy consumption and for assessment of priority EE interventions" (these Deliverables are available for open and free re-use by any interested Municipality and school, at website http://www.interreg-central.eu/Content.Node/ENERGYATSCHOOL.html).





3. Context of the City area



City name	Bydgoszcz		
Number of inhabitants	Ca. 355 645		
Area [km2]	175,98		

Picture 1 - Map of the City of Bydgoszcz

Bydgoszcz is the capital of Kujawsko - Pomorskie Voivodeship and the eighth biggest city in Poland. It is picturesquely located on the rivers Brda, Vistula, and the Bydgoszcz Canal. the city the climate can be described as temperated and continental.

Major motor roads, railways and waterways (international waterway E70) intersect in the area. Ignacy Jan Paderewski Airport operates in the city. The city with its centuries-old traditions is a popular tourist destination thanks to its attractive location on the river and canals running through its centre. Bydgoszcz places growing emphasis on water, since the daily life, cultural, sports and business activities of the city take place

Bydgoszcz is a city with three state universities and sixteen other universities and colleges.





4. Energy consumptions analysis carried out within 12 schools: results and priority of interventions towards Energy Efficiency

In the above described city context, the following table shows the total number of existing schools and the number of schools for which the in-depth energy consumptions analysis and related energy data collections have been carried out in the framework of Energy@School project:

	Total number of schools in the city area	Number of analysed schools in the framework of Energy@Scool project
Kindergarten	24	0
Primary	18	3
Junior High School	10	0
Secondary (High School, Technical School)	0	0
Vocational School	1	0
General Education Schools Team (Junior High School and High School)	7	1
Vocational Schools Team	14	4
Schools Team (Kindegarten and Primary School and Junior High School)	31	4
Special Educational Center	2	0

As already explained, the data collected for each school - of the 12 analysed ones - allowed to detect *energy consumption trends* and *energy performance indicators* then, according to predefined evaluation criteria, it has been possible to obtain as a result a set of priorities of interventions in terms of Energy Efficiency and Renewable Energy Sources implementation.

The achieved results for each school are showed as follows.





4.1. Secondary school "Zespół Szkół nr 12 im. Jana III Sobieskiego, General Education Schools Team" (Junior High School and High School)



Picture 2 - Zespół Szkół nr 12 im. Jana III Sobieskiego, General Education Schools Team (Junior High School):

GENERALITIES

School type	Secondary
Student age range	13-21

BUILDING GEOMETRY

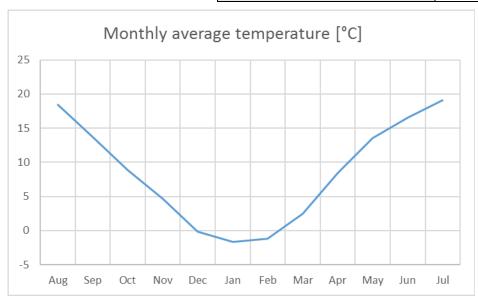
Total floor heated area [m ²]	3685
Volume [m³]	48495
S/V	0,12

GEOGRAPHICAL LOCATION AND WEATHER CONDITIONS

Country	Poland
City	Bydgoszcz

OCCUPATION AND USE OF THE BUILDING

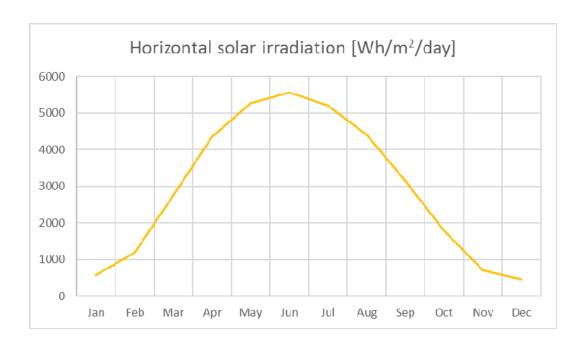
Number of students	491
Total days of use	290
Daily hours of use	13
Total area allocated to classrooms [%]	10



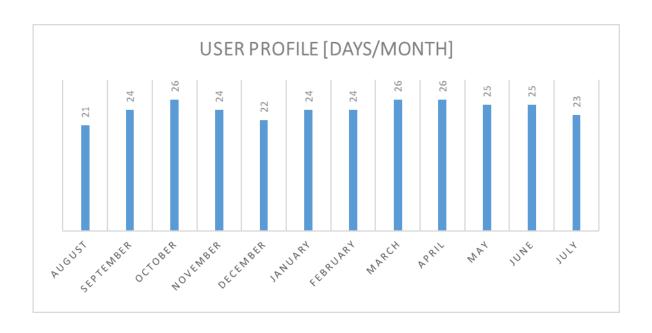
Picture 3 - Graphic representation of monthly average temperature [°C]







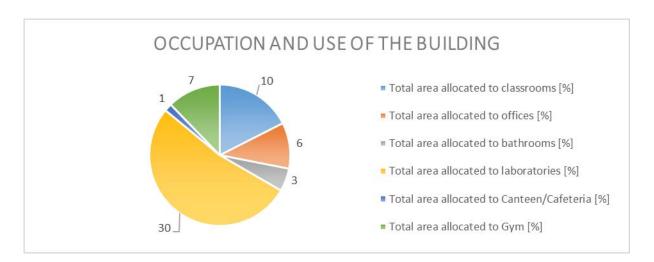
Picture 4 - Graphic representation of the Horizontal solar irradiation [Wh/m²/day] per Months. This value is the monthly/yearly average of the sum of the solar radiation energy that hits one square meter in a horizontal plane in one day.



Picture 5 - Graphic representation of the user profile during school period [working days/month]





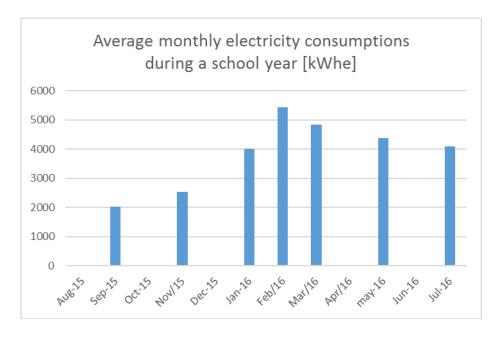


Picture 6 - Division of the School areas for intended use [%]

BUILDING ENVELOPE

Year of construction	1960-1970				
Type of structure	Reinforced concrete structure				
External wall insulation	High [>10 cm]				

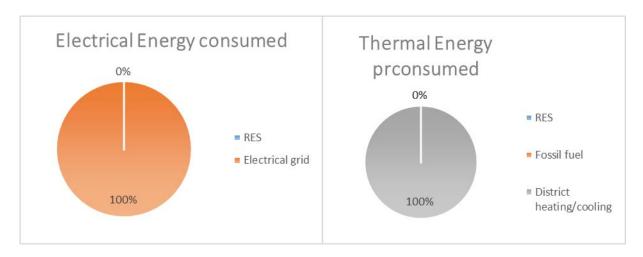
Heat generation system	District heating
RES systems	



Picture 7 - Average monthly electricity consumptions during a school year [kWhe]







Picture 8 - Pie Graph of Electrical and Thermal energy consumptions, related to the different energy carriers/fuels or systems [%] in use into the school

		Total consumption per year	Consumption per volume	Consumption per heated area	Consumption per classrooms area	Consumption per number of students	Consumption per number of days	Total energy consumption per year	kg CO2 equivalent per year	Tonnes of oil equivalent per year
Energy carrier/Fuel/ Power source	u.m.	u.m.	u.m./m³	u.m./m²	u.m./m²	u.m./student	u.m./day	kWh	kg CO₂ equiv	tep
Electricity	kWh _{el}	27298	0,56	7,41	74,08	55,60	94,13	27298	11825	5
Natural gas	Sm3	0						0		0
Fuel oil/Diesel	t	0						0		0
GPL	t	0						0		0
Biomass	t	0						0		0
District heating	kWh _t	316741	6,53	85,95	859,54	645,09	1092,21	0	114027	30
District cooling	kWh _f	0						0		0
Pho to voltaic s	kWh _{el}	0						0		
Solar thermal collectors	kWh _t	0						0		
Geothermal	kWh _t	0						0		
Other - energy produced	0	0								
Tonnes of oil equivalent	tep	35,4	0,00	0,01	0,10	0,07	0,12		125852	35

Table 1 - Energy performance indicators





Priorities of interventions, standard costs per intervention and energy reduction estimations

		Unit cost of	fintervention	ĺ		Cost of interv	/ontion	Energy reduction [%] **		
	Is . 6		1						Theres reduction [//s]	
	Retrofit external walls with insulation	100	€/m2	2432,4	m2	0	€			
	Retrofit roof with insulation	200	€/m2	1416,8	m2	0	€			
	Replace windows	450	€/m2	919,6	m2	0	€			
	Install solar shading systems	150	€/m2	919,6	m2	0	€			
	Replace heat generator with a more efficient one	160	€/kW	0,0	kW	0	€			
✓	Install thermostatic valves	70	€/valve	59	valves*	4124	€	-2÷5%	thermal energy reduction for heating system	
✓	Replace lights with LED	25	€/lamp	457,0	lamps	11425	€	-53%	light consumptions	
✓	Install Energy Saving Switchs and Presence Sensors	250	€/point	50	points*	12500	€	-2÷20%	light consumptions	
✓	Install smart metering	5000	€			5000	€	-2÷10%	overall consumptions	
✓	Install a photovoltaic system	1600	€/kWp	20,0	kWp*	32000	€	-81%	Eletrical energy reduction [%]	
✓	Install a solar thermal system	600	€/m2	4,0	m2*	2400	€	up to 50%	thermal energy consumptions for DHW production	
	Replace electrical boilers with heat pumps	1500	€/kW	0,0	kW	0	€			
1	Install building automation system (automatic centralized control of a building's heating, ventilation and air conditioning, lighting)	25	€/m2	3685,0	m2	92125	€	up to 15%	overall consumptions [depending on technology installed]	
✓	Change end-user behaviour: control devices stand- by (monitors, PCs, laboratory equipment, lights, etc.)	0	€			0	€	-2÷5%	electricity consumptions	

^{*=} estimated values

Table 2 - Priorities of interventions, standard costs per intervention and energy consumptions reductions. Items with * are referred to estimated values.



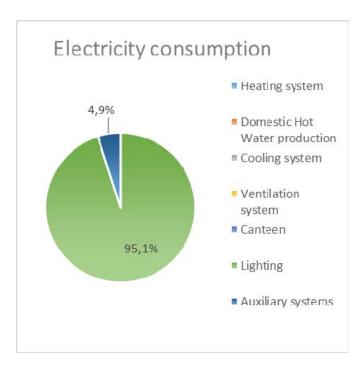


**Most relevant energy consumption reduction

Lamp replacement with LED

	Q[kWh_t/year]
Current situation	47603,9764
After intervention	22250,25
Energy consumption reduction [%]	-53%

Electrical energy reduction with PV system	Q[kWh_el/year]
Current situation	27297,8333
Energy produced by RES	22000
After intervention	5297,83333
Eletrical energy reduction [%]	-81%



Picture 9 - Pie Graph of Electrical consumptions subdivision [%] for each final intended use





4.2. Secondary school "Zespół Szkół Budowlanych im. J. Gagarina ul. Jana Pestalozziego 18. Technical School, Vocational Schools Team"





Picture 10 - Zespół Szkół Budowlanych im. J. Gagarina, Technical School, Vocational Schools Team

GENERALITIES

School type	Secondary
Student age range	16-20

GEOGRAPHICAL LOCATION AND WEATHER CONDITIONS

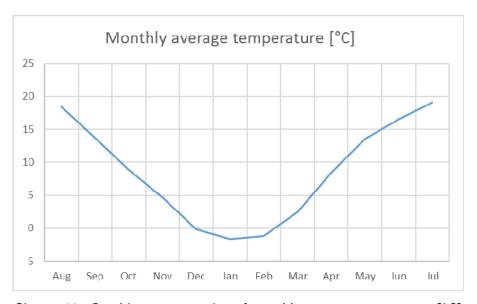
Country	Poland
City	Bydgoszcz

BUILDING GEOMETRY

Total floor heated area [m ²]	5747
Volume [m³]	73562
S/V	0,14

OCCUPATION AND USE OF THE BUILDING

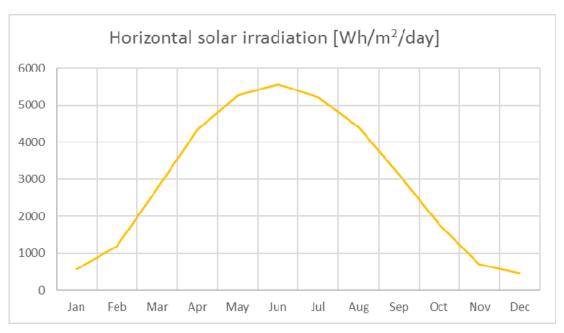
Number of students	416
Total days of use	365
Daily hours of use	4
Total area allocated to classrooms [%]	27



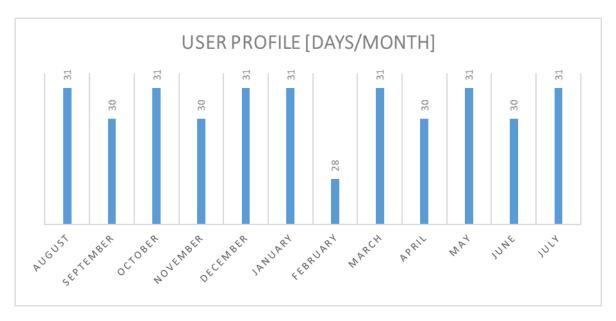
Picture 11 - Graphic representation of monthly average temperature [°C]







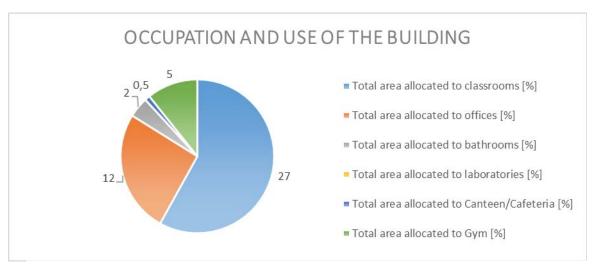
Picture 12 - Graphic representation of the Horizontal solar irradiation [Wh/m²/day] per Months. This value is the monthly/yearly average of the sum of the solar radiation energy that hits one square meter in a horizontal plane in one day.



Picture 13 - Graphic representation of the user profile during school period [working days/month]





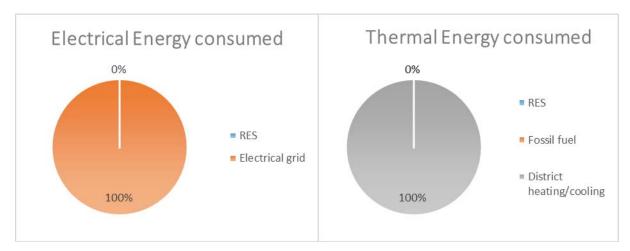


Picture 14 - Division of the School areas for intended use [%]

BUILDING ENVELOPE

Year of construction	1960-1970
Type of structure	Load bearing masonry wall
External wall insulation	No insulation

Heat generation system	District heating
RES systems	



Picture 15 - Pie Graph of Electrical and Thermal energy consumptions, related to the different energy carriers/fuels or systems [%] in use into the school.





		Total consumption per year	Consumption per volume	Consumption per heated area	Consumption per classrooms area	Consumption per number of students	Consumption per number of days	Total energy consumption per year	kg CO2 equivalent per year	Tonnes of oil equivalent per year
Energy carrier/Fuel/ Power source	u.m.	u.m.	u.m./m³	u.m./m²	u.m./m²	u.m./student	u.m./day	kWh	kg CO ₂ equiv	tep
Elec tric ity	kWh _{el}	73423	1,00	12,78	47,32	176,50	201,16	73423	31807	14
Natural gas	Sm3	0						0		0
Fuel oil/Diesel	t	0						0		0
GPL	t	0						0		0
Biomass	t	0						0		0
District heating	kWh _t	763972	10,39	132,93	492,35	1836,47	2093,07	0	275030	73
District cooling	kWh _f	0						0		0
Photovoltaics	kWh _{el}	0						0		
Solar thermal collectors	kWh _t	0						0		
Geothermal	kWh _t	0						0		
Other - energy produced	0	0								
Tonnes of oil equivalent	tep	87	0,00	0,02	0,06	0,21	0,24		306837	87

Table 3 - Energy performance indicators





Priorities of interventions, standard costs per intervention and energy reduction estimations

		llait and af	::=====================================	1		C+ -f :-+-		[
_		Unit cost of	intervention			Cost of intervention			Energy reduction [%]**	
✓	Retrofit external walls with insulation	100	€/m2	3306,3	m2	330628	€			
✓	Retrofit roof with insulation	200	€/m2	3253,0	m2	650600	€	-40%	Energy need for space heating reduction [%]	
✓	Replace windows	450	€/m2	1323,7	m2	595674	€			
	Install solar shading systems	150	€/m2	1323,7	m2	0	€			
	Replace heat generator with a more efficient one	160	€/kW	0,0	kW	0	€			
✓	Install thermostatic valves	70	€/valve	50	valves*	3494	€	-2÷5%	thermal energy reduction for heating system	
✓	Replace lights with LED	25	€/lamp	424,0	lamps	10600	€	-55%	light consumptions	
✓	Install Energy Saving Switchs and Presence Sensors	250	€/point	50	points*	12500	€	-2÷20%	light consumptions	
✓	Install smart metering	5000	€			5000	€	-2÷10%	overall consumptions	
✓	Install a photovoltaic system	1600	€/kWp	20,0	kWp*	32000	€	-30%	Eletrical energy reduction [%]	
✓	Install a solar thermal system	600	€/m2	4,0	m2*	2400	€	up to 50%	thermal energy consumptions for DHW production	
	Replace electrical boilers with heat pumps	1500	€/kW	0,0	kW	0	€			
✓	Install building automation system (automatic centralized control of a building's heating, ventilation and air conditioning, lighting)	25	€/m2	5747,0	m2	143675	€	up to 15%	overall consumptions [depending on technology installed]	
✓	Change end-user behaviour: control devices stand- by (monitors, PCs, laboratory equipment, lights, etc.)	0	€			0	€	-2÷5%	electricity consumptions	

*= estimated values

Table 4 - Priorities of interventions, standard costs per intervention and energy consumptions reductions. Items with * are referred to estimated values.





**Most relevant energy consumption reduction

Energy need for space heating - envelope

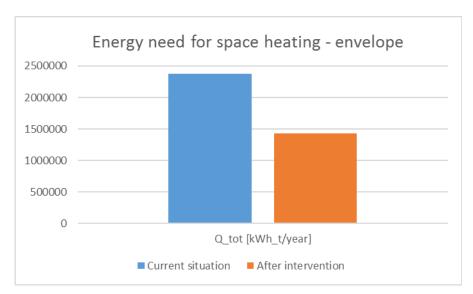
	Q_tot[kWh_t/year]
Current situation	2373580,482
After intervention	1432190,229
Energy need for space heating reduction [%]	-40%

Lamp replacement with LED

	Q [kWh_t/year]
Current situation	18072,61
After intervention	8194,25
Energy consumption reduction [%]	-55%

Electrical energy reduction with PV system

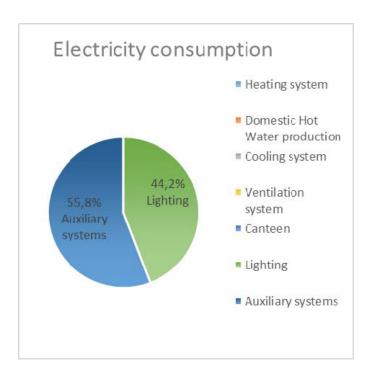
	Q [kWh_el/year]
Current situation	73423,00133
Energy produced by RES	22000
After intervention	51423,00133
Eletrical energy reduction [%]	-30%



Picture 16 - Energy need for space heating before and after (predicted) the intervention - envelope $[kWh_t/year]$







Picture 17 - Pie Graph of Electrical consumptions subdivision [%] for each final intended use





4.3. Primary school "Zespół Szkół Ogólnokształcących nr 4, General Education Schools Team" - Main school building



Picture 18 - Zespół Szkół Ogólnokształcących nr 4, General Education Schools Team

GENERALITIES

School type	Secondary
Student age range	13-19

GEOGRAPHICAL LOCATION AND WEATHER CONDITIONS

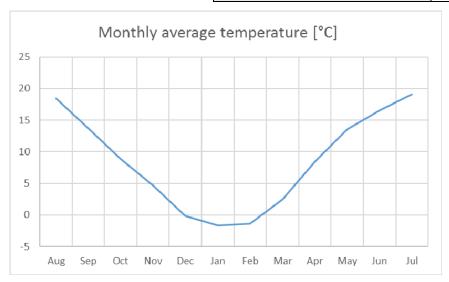
Country	Poland
City	Bydgoszcz

BUILDING GEOMETRY

Total floor heated area [m ²]	3646
Volume [m³]	47403
S/V	0,14

OCCUPATION AND USE OF THE BUILDING

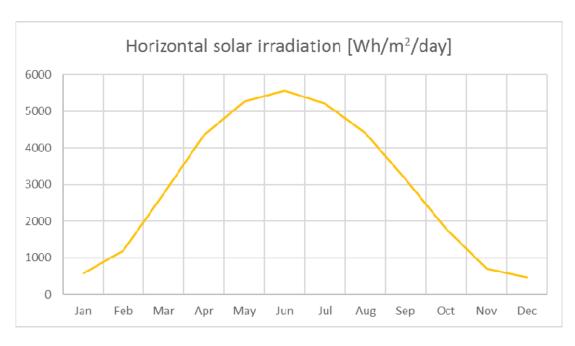
Number of students	467
Total days of use	175
Daily hours of use	16
Total area allocated to classrooms [%]	37



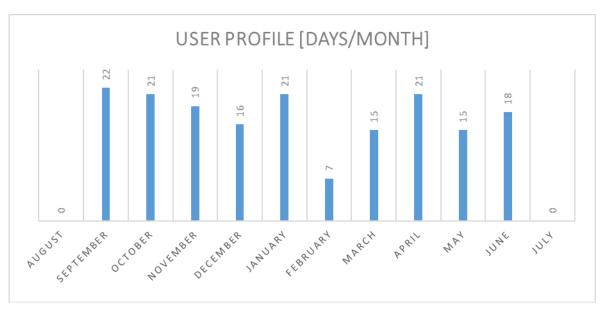
Picture 19- Graphic representation of monthly average temperature [°C]







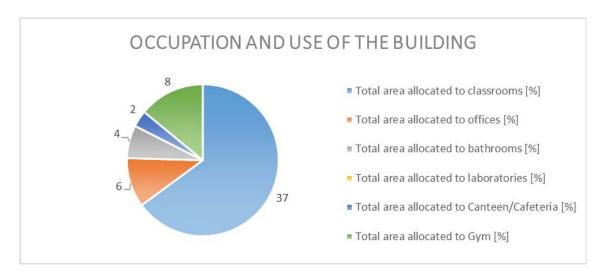
Picture 20 - Graphic representation of the Horizontal solar irradiation [Wh/m²/day] per Months. This value is the monthly/yearly average of the sum of the solar radiation energy that hits one square meter in a horizontal plane in one day.



Picture 21 - Graphic representation of the user profile during school period [working days/month]





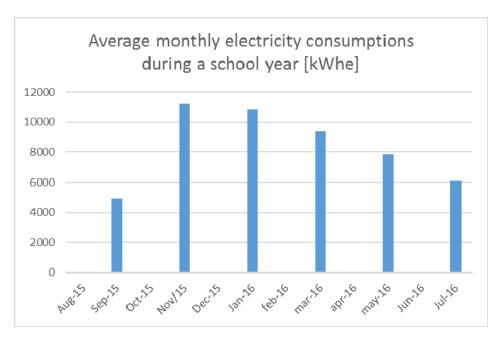


Picture 22 - Division of the School areas for intended use [%]

BUILDING ENVELOPE

Year of construction	1960-1970
Type of structure	Prefab modules
External wall insulation	High [>10 cm]

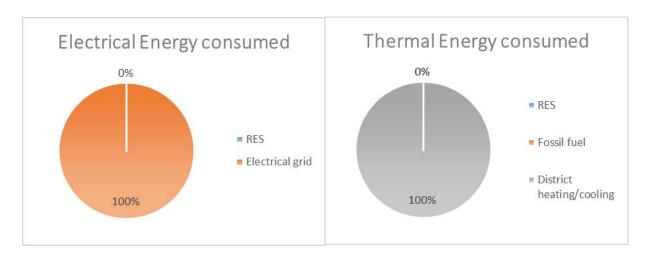
Heat generation system	District heating
RES systems	



Picture 23 - Average monthly electricity consumptions during a school year [kWhe]







Picture 24 - Pie Graph of Electrical and Thermal energy consumptions, related to the different energy carriers/fuels or systems [%] in use into the school.

		Total consumption per year	Consumption per volume	Consumption per heated area	Consumption per classrooms area	Consumption per number of students	Consumption per number of days	Total energy consumption per year	kg CO2 equivalent per year	Tonnes of oil equivalent per year
Energy carrier/Fuel/ Power source	u.m.	u.m.	u.m./m³	u.m./m²	u.m./m²	u.m./student	u.m./day	kWh	kg CO ₂ equiv	tep
Electricity	kWh _{el}	50280	1,06	13,79	37,27	107,67	287,31	50280	21781	9
Natural gas	Sm3	0						0		0
Fuel oil/Diesel	t	0						0		0
GPL	t	0						0		0
Biomass	t	0						0		0
District heating	kWh _t	382278	8,06	104,84	283,34	818,58	2184,44	0	137620	37
District cooling	kWh _f	0						0		0
Photovoltaics	kWh _{el}	0						0		
Solar thermal collectors	kWh _t	0						0		
Geothermal	kWh _t	0						0		
Other - energy produced	0	0								
Tonnes of oil equivalent	tep	46	0,00	0,01	0,03	0,10	0,26		159401	46

Table 5 - Energy performance indicators





Priorities of interventions, standard costs per intervention and energy reduction estimations

		Unit cost of	intervention			Cost of inte	rvention		Energy reduction [%] **
	Retrofit external walls with insulation	100	€/m2	2024,4	m2	0	€		
	Retrofit roof with insulation	200	€/m2	2034,9	m2	0	€		
	Replace windows	450	€/m2	959,6	m2	0	€		
	Install solar shading systems	150	€/m2	959,6	m2	0	€		
	Replace heat generator with a more efficient one	160	€/kW	0,0	kW	0	€		
√	Install thermostatic valves	70	€/valve	56	valves*	3923	€	-2÷5%	thermal energy reduction for heating system
√	Replace lights with LED	25	€/lamp	668,0	lamps	16700	€	-56%	light consumptions
✓	Sensors	250	€/point	50	points*	12500	€	-2÷20%	light consumptions
✓	Install smart metering	5000	€			5000	€	-2÷10%	overall consumptions
✓	Install a photovoltaic system	1600	€/kWp	20,0	kWp*	32000	€	-44%	Eletrical energy reduction [%]
✓	Install a solar thermal system	600	€/m2	4,0	m2*	2400	€	up to 50%	thermal energy consumptions for DHW production
	Replace electrical boilers with heat pumps	1500	€/kW	0,0	kW	0	€		
✓	Install building automation system (automatic centralized control of a building's heating, ventilation and air conditioning, lighting)	25	€/m2	3646,4	m2	91160	€	un to 15%	overall consumptions [depending on technology installed]
✓	Change end-user behaviour: control devices stand- by (monitors, PCs, laboratory equipment, lights, etc.)	0	€			0	€	-2÷5%	electricity consumptions

^{*=} estimated values

Table 6 - Priorities of interventions, standard costs per intervention and energy consumptions reductions. Items with * are referred to estimated values.





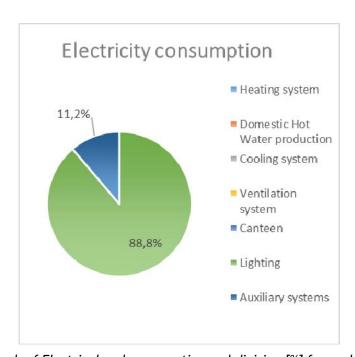
**Most relevant energy consumption reduction

Lamp replacement with LED

	Q[kWh_t/year]
Current situation	52987,65
After intervention	23486,25
Energy consumption reduction [%]	-56%

Electrical energy reduction with PV system

	Q[kWh_el/year]
Current situation	50279,66667
Energy produced by RES	22000
After intervention	28279,66667
Eletrical energy reduction [%]	-44%



Picture 25 - Pie Graph of Electrical and consumptions subdivision [%] for each final intended use





4.4. Primary and Secondary school "Zespół Szkół Ogólnokształcących nr 4, General Education Schools Team" - Swimming pool

GENERALITIES

	Primary and secondary
Student age range	7-19

BUILDING GEOMETRY

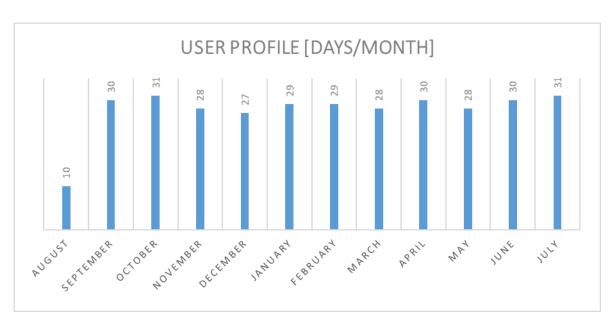
Total floor heated area [m ²]	2024
Volume [m³]	70435
S/V	0,07

GEOGRAPHICAL LOCATION AND WEATHER CONDITIONS

Country	Poland
City	Bydgoszcz

OCCUPATION AND USE OF THE BUILDING

Number of students	390
Total days of use	331
Daily hours of use	15



Picture 26 - Graphic representation of the user profile during school period [working days/month]

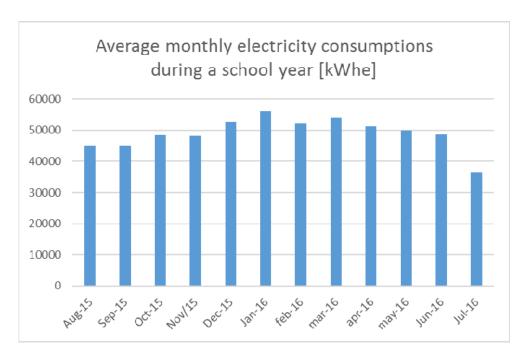
BUILDING ENVELOPE

Year of construction	>2010
Type of structure	Steel frame structure
External wall insulation	High [>10 cm]

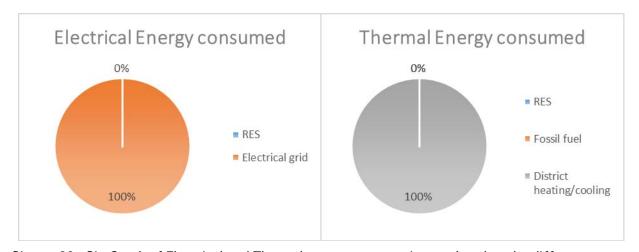
Heat generation system	District heating
RES systems	







Picture 27 - Average monthly electricity consumptions during a school year [kWhe]



Picture 28 - Pie Graph of Electrical and Thermal energy consumptions, related to the different energy carriers/fuels or systems [%] in use into the school.





		Total consumption per year	Consumption per volume	Consumption per heated area	Consumption per classrooms area	Consumption per number of students	Consumption per number of days	Total energy consumption per year	kg CO2 equivalent per year	Tonnes of oil equivalent per year
Energy carrier/Fuel/ Power source	u.m.	u.m.	u.m./m³	u.m./m²	u.m./m²	u.m./student	u.m./day	kWh	kg CO ₂ equiv	tep
Electricity	kWh _{el}	588405	8,35	290,71	/	1508,73	1777,66	588405	254897	110
Natural gas	Sm3	0						0		0
Fuel oil/Diesel	t	0						0		0
GPL	t	0						0		0
Biomass	t	0						0		0
District heating	kWh _t	615463	8,74	304,08	/	1578,11	1859,40	0	221567	59
District cooling	kWh _f	0						0		0
Photovoltaics	kWh _{el}	0						0		
Solar thermal collectors	kWh _t	0						0		
Geothermal	kWh _t	0						0		
Other - energy produced	0	0								
Tonnes of oil equivalent	tep	169	0,00	0,08	/	0,43	0,51		476464	169

Table 7 - Energy performance indicators





Priorities of interventions, standard costs per intervention and energy reduction estimations

		Unit cost of	fintervention			Cost of interv	/ention		Energy reduction [%] **
	Retrofit external walls with insulation	100	€/m2	1108,6	m2	0	€		
	Retrofit roof with insulation	200	€/m2	1834,0	m2	0	€	1	
	Replace windows	450	€/m2	759,0	m2	0	€	1	
	Install solar shading systems	150	€/m2	759,0	m2	0	€		
	Replace heat generator with a more efficient one	160	€/kW	0,0	kW	0	€		
	Install thermostatic valves	70	€/valve	0	valves*	0	€		
√	Replace lights with LED	25	€/lamp	32,0	lamps	800	€	-38%	light consumptions
	Install Energy Saving Switchs and Presence Sensors	250	€/point	50,0	points*	0	€		
✓	Install smart metering	5000	€			5000	€	-2÷10%	overall consumptions
✓	Install a photovoltaic system	1600	€/kWp	20,0	kWp*	32000	€	-4%	Eletrical energy reduction [%]
✓	Install a solar thermal system	600	€/m2	4,0	m2*	2400	€	up to 50%	thermal energy consumptions for DHW production
	Replace electrical boilers with heat pumps	1500	€/kW	0,0	kW	0	€		
✓	Install building automation system (automatic centralized control of a building's heating, ventilation and air conditioning, lighting)	25	€/m2	2024,0	m2	50600	€	up to 15%	overall consumptions [depending on technology installed]
>	Change end-user behaviour: control devices stand-by (monitors, PCs, laboratory equipment, lights, etc.)	0	€			0	€	-2÷5%	electricity consumptions

^{*=} estimated values

Table 8 - Priorities of interventions, standard costs per intervention and energy consumptions reductions. Items with * are referred to estimated values.





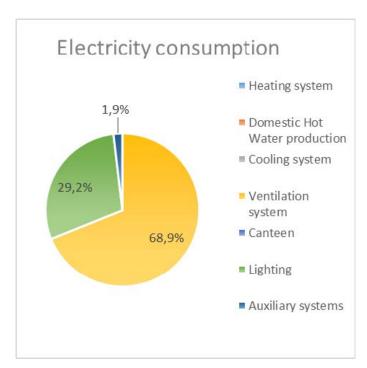
**Most relevant energy consumption reduction

Lamp replacement with LED

	Q[kWh_t/year]
Current situation	6711,450571
After intervention	4139,864286
Energy consumption reduction [%]	-38%

Electrical energy reduction with PV system

	Q[kWh_el/year]
Current situation	588405,45
Energy produced by RES	22000
After intervention	566405,45
Eletrical energy reduction [%]	-4%



Picture 29 - Pie Graph of Electrical and Natural gas consumptions subdivision [%] for each final intended use.





4.5. Primary and Secondary school "Zespół Szkół nr 10" - Main building

GENERALITIES

	Primary and Secondary
Student age range	6-15

GEOGRAPHICAL LOCATION AND WEATHER CONDITIONS

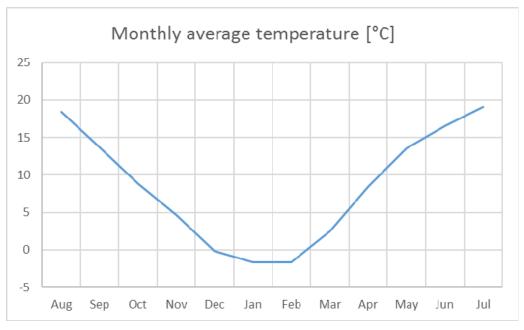
Country	Poland
City	Bydgoszcz

BUILDING GEOMETRY

Total floor heated area [m ²]	3094
Volume [m ³]	40835
S/V	0,11

OCCUPATION AND USE OF THE BUILDING

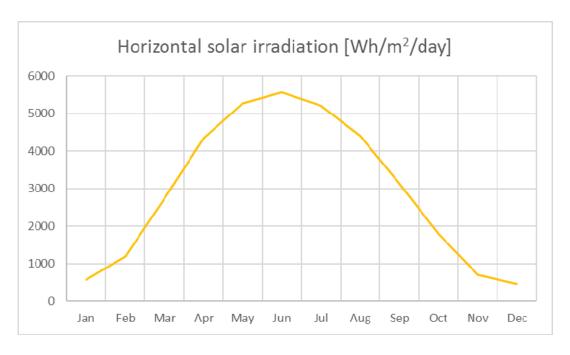
Number of students	809
Total days of use	242
Daily hours of use	14
Total area allocated to classrooms [%]	48



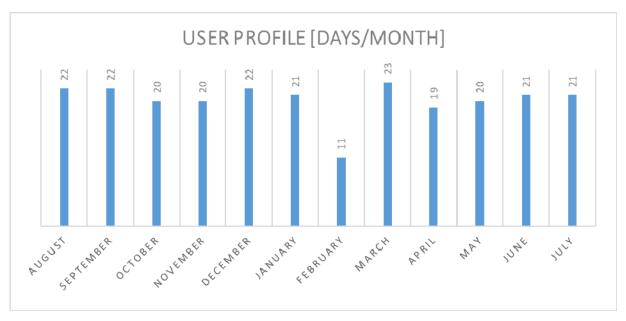
Picture 30 - Graphic representation of monthly average temperature [°C]







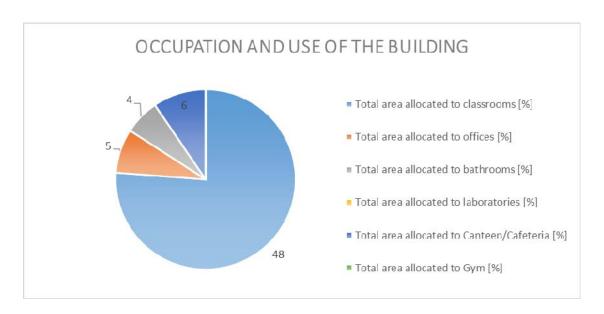
Picture 31 - Graphic representation of the Horizontal solar irradiation [Wh/m²/day] per Months. This value is the monthly/yearly average of the sum of the solar radiation energy that hits one square meter in a horizontal plane in one day.



Picture 32 - Graphic representation of the user profile during school period [working days/month]





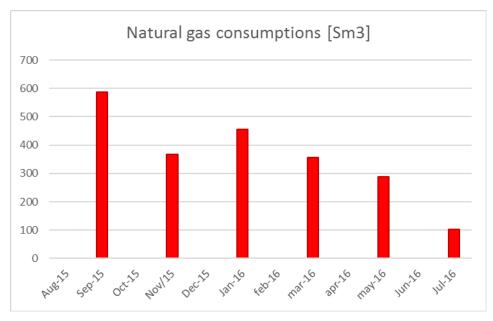


Picture 33 - Division of the School areas for intended use [%]

BUILDING ENVELOPE

Year of construction	1970-1980
Type of structure	Prefab modules
External wall insulation	High [>10 cm]

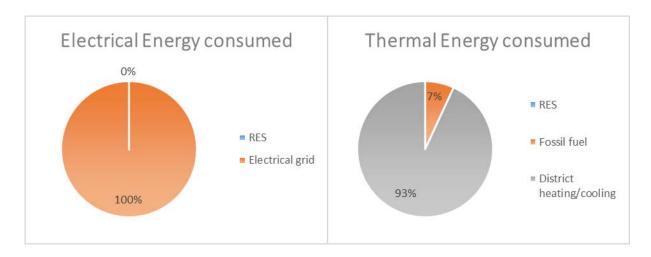
Heat generation system	District heating
RES systems	



Picture 34 - Natural gas consumptions during a school year [Sm³]







Picture 35 - Pie Graph of Electrical and Thermal energy consumptions, related to the different energy carriers/fuels or systems [%] in use into the school.

		Total consumption per year	Consumption per volume	Consumption per heated area	Consumption per classrooms area	Consumption per number of students	Consumption per number of days	Total energy consumption per year	kg CO2 equivalent per year	Tonnes of oil equivalent per year
Energy carrier/Fuel/ Power source	u.m.	u.m.	u.m./m³	u.m./m²	u.m./m²	u.m./student	u.m./day	kWh	kg CO ₂ equiv	tep
Electricity	kWh _{el}	82199	2,01	26,57	55,36	101,61	339,67	82199	35609	15
Natural gas	Sm3	2159	0,05	0,70	1,45	2,67	8,92	20731	431	2
Fuel oil/Diesel	t	0						0		0
GPL	t	0						0		0
Biomass	t	0						0		0
District heating	kWh _t	279991	6,86	90,51	188,56	346,09	1156,99	0	100797	27
District cooling	kWh _f	0						0		0
Photovoltaics	kWh _{el}	0						0		
Solar thermal collectors	kWh _t	0						0		
Geothermal	kWh _t	0						0		
Other - energy produced	0	0								
Tonnes of oil equivalent	tep	44	0,00	0,01	0,03	0,05	0,18		136837	44

Table 9 - Energy performance indicators





						<u> </u>			F
		Unit cost of	intervention			Cost of inte	rvention		Energy reduction [%] **
	Retrofit external walls with insulation	100	€/m2	1619,1	m2	0	€		
✓	Retrofit roof with insulation	200	€/m2	1107,0	m2	221400	€	-18%	Energy need for space heating reduction [%]
	Replace windows	450	€/m2	537,9	m2	0	€		
	Install solar shading systems	150	€/m2	537,9	m2	0	€		
	Replace heat generator with a more efficient one	160	€/kW	0,0	kW	0	€		
✓	Install thermostatic valves	70	€/valve	97	valves*	6796	€	-2÷5%	thermal energy reduction for heating system
√	Replace lights with LED	25	€/lamp	463,0	lamps	11575	€	-57%	light consumptions
√	Sensors	250	€/point	50	points*	12500	€	-2÷20%	light consumptions
1	Install smart metering	5000	€			5000	€	-2÷10%	overall consumptions
4	Install a photovoltaic system	1600	€/kWp	20,0	kWp*	32000	€	-27%	Eletrical energy reduction [%]
√	Install a solar thermal system	600	€/m2	4,0	m2*	2400	€	up to 50%	thermal energy consumptions for DHW production
	Replace electrical boilers with heat pumps	1500	€/kW	0,0	kW	0	€		
✓	Install building automation system (automatic centralized control of a building's heating, ventilation and air conditioning, lighting)	25	€/m2	3093,5	m2	77339	€	up to 15%	overall consumptions [depending on technology installed]
\	Change end-user behaviour: control devices stand-by (monitors, PCs, laboratory equipment, lights, etc.)	0	€			0	€	-2÷5%	electricity consumptions

^{*=} estimated values

Table 10 - Priorities of interventions, standard costs per intervention and energy consumptions reductions. Items with * are referred to estimated values.





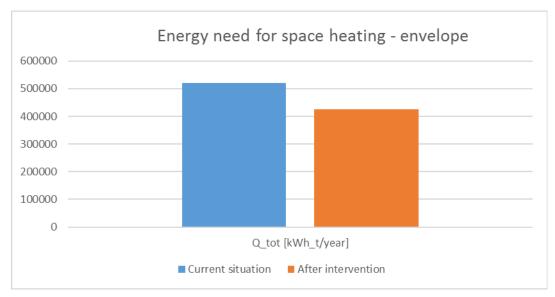
Energy need for space heating - envelope

	Q_tot[kWh_t/year]
Current situation	519689,1755
After intervention	426033,2505
Energy need for space heating reduction [%]	-18%

Lamp replacement with LED

	Q [kWh_t/year]
Current situation	44255,20429
After intervention	19044,375
Energy consumption reduction [%]	-57%

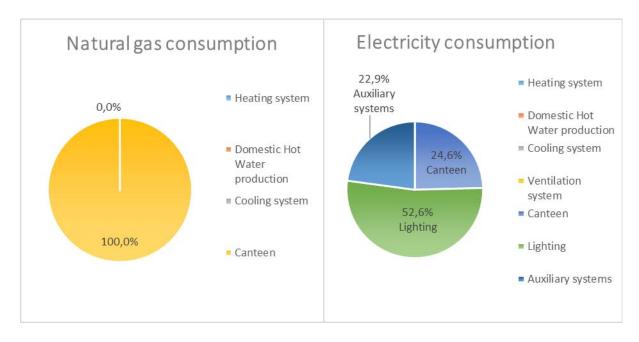
	Q [kWh_el/year]
Current situation	82199
Energy produced by RES	22000
After intervention	60199
Eletrical energy reduction [%]	-27%



Picture 36 - Energy need for space heating before and after (predicted) the intervention - envelope $[kWh_t/year]$







Picture 37 - Pie Graph of Electrical and Natural gas consumptions subdivision [%] for each final intended





4.6. Primary and Secondary school "Zespół Szkół nr 10" - Ggym

GENERALITIES

School type	Primary and Secondary
Student age range	6-15

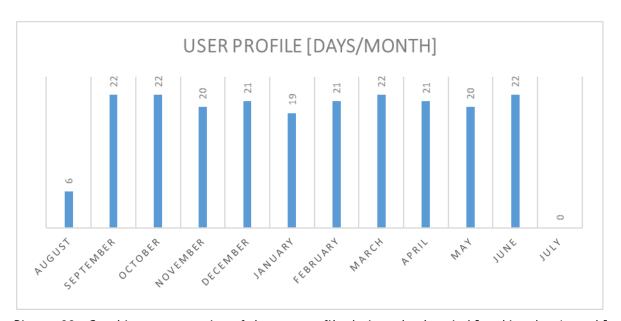
GEOGRAPHICAL LOCATION AND WEATHER CONDITIONS

Country	Poland
City	Bydgoszcz

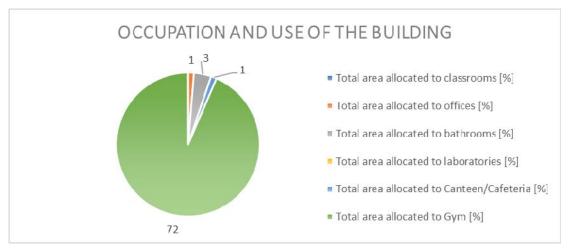
BUILDING GEOMETRY

Total floor heated area [m ²]	2578
Volume [m ³]	82496
S/V	0,08

Number of students	809
Total days of use	2016
Daily hours of use	13



Picture 38 - Graphic representation of the user profile during school period [working days/month]



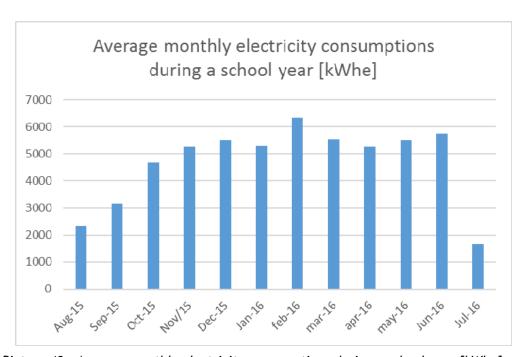
Picture 39 - Division of the School areas for intended use [%]





Year of construction	>2010				
Type of structure	Prefab modules				
External wall insulation	High [>10 cm]				

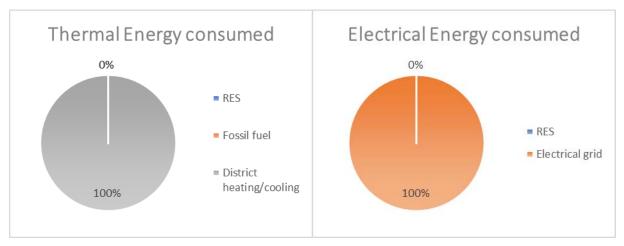
Heat generation system	District heating				
RES systems					



Picture 40 - Average monthly electricity consumptions during a school year [kWhe]







Picture 41 - Pie Graph of Electrical and Thermal energy consumptions, related to the different energy carriers/fuels or systems [%] in use into the gym

		Total consumption per year	Consumption per volume	Consumption per heated area	Consumption per classrooms area	Consumption per number of students	Consumption per number of days	Total energy consumption per year	kg CO2 equivalent per year	Tonnes of oil equivalent per year
Energy carrier/Fuel/ Power source	u.m.	u.m.	u.m./m³	u.m./m²	u.m./m²	u.m./student	u.m./day	kWh	kg CO ₂ equiv	tep
Electricity	kWh _{el}	56331	0,68	21,85	/	69,63	260,79	56331	24402	11
Natural gas	Sm3	0						0		0
Fuel oil/Diesel	t	0						0		0
GPL	t	0						0		0
Biomass	t	0						0		0
District heating	kWh _t	141898	1,72	55,04	/	175,40	656,94	0	51083	14
District cooling	kWh _f	0						0		0
Photovoltaics	kWh _{el}	0						0		
Solar thermal collectors	kWh _t	0						0		
Geothermal	kWh _t	0						0		
Other - energy produced	0	0	_	_	_		_	_	_	_
Tonnes of oil equivalent	tep	24	0,00	0,01	/	0,03	0,11		75486	24

Table 11 - Energy performance indicators





		Unit cost of	f intervention			Cost of intervention		1	Energy reduction [%] **
	Retrofit external walls with insulation	100	€/m2	1793,4	m2	0	€		5,
	Retrofit roof with insulation	200	€/m2	2310,0	m2	0	€		
	Replace windows	450	€/m2	366,6	m2	0	€		
	Install solar shading systems	150	€/m2	366,6	m2	0	€		
	Replace heat generator with a more efficient one	160	€/kW	0,0	kW	0	€		
✓	Install thermostatic valves	70	€/valve	97	valves*	6796	€	-2÷5%	thermal energy reduction for heating system
√	Replace lights with LED	25	€/lamp	53,0	lamps	1325	€	-32%	light consumptions
√	Install Energy Saving Switchs and Presence Sensors	250	€/point	50	points*	12500	€	-2÷20%	light consumptions
√	Install smart metering	5000	€			5000	€	-2÷10%	overall consumptions
√	Install a photovoltaic system	1600	€/kWp	20,0	kWp*	32000	€	-39%	Eletrical energy reduction [%]
✓	Install a solar thermal system	600	€/m2	4,0	m2*	2400	€	up to 50%	thermal energy consumptions for DHW production
	Replace electrical boilers with heat pumps	1500	€/kW	0,0	kW	0	€		
✓	Install building automation system (automatic centralized control of a building's heating, ventilation and air conditioning, lighting)	25	€/m2	2578,0	m2	64450	€	up to 15%	overall consumptions [depending on technology installed]
✓	Change end-user behaviour: control devices stand-by (monitors, PCs, laboratory equipment, lights, etc.)	0	€			0	€	-2÷5%	electricity consumptions

*= estimated values

Table 12 - Priorities of interventions, standard costs per intervention and energy consumptions reductions. Items with * are referred to estimated values.

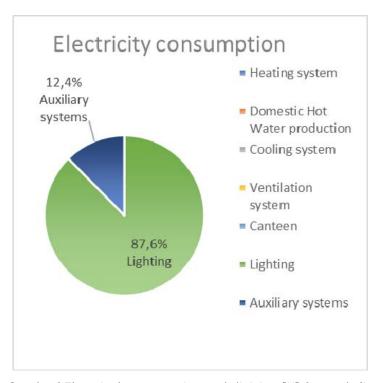




Lamp replacement with LED

	Q[kWh_t/year]
Current situation	2722,988571
After intervention	1839,857143
Energy consumption reduction [%]	-32%

	Q[kWh_el/year]
Current situation	56330,7
Energy produced by RES	22000
After intervention	34330,7
Eletrical energy reduction [%]	-39%



Picture 42 - Pie Graph of Electrical consumptions subdivision [%] for each final intended use.





4.7. Secondary school "Zespół Szkół Mechanicznych nr 2, Technical School, Vocational Schools Team" - Main school building





Picture 43 - Zespół Szkół Mechanicznych nr 2, Technical School, Vocational Schools Team - main building

GENERALITIES

School type	Secondary
Student age range	16-50

BUILDING GEOMETRY

Total floor heated area [m ²]	3674
Volume [m ³]	48503
S/V	0,10

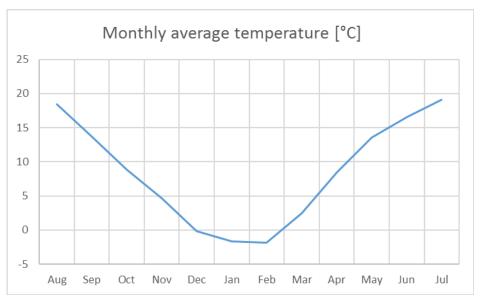
GEOGRAPHICAL LOCATION AND WEATHER CONDITIONS

Country	Poland
City	Bydgoszcz

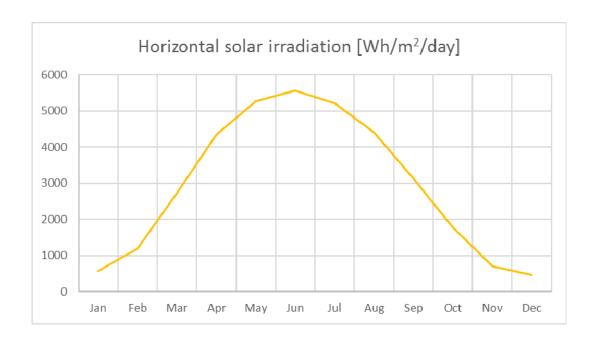
Number of students	549
Total days of use	209
Daily hours of use	14
Total area allocated to classrooms [%]	42







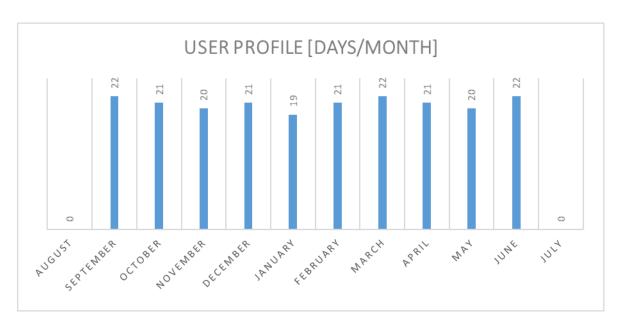
Picture 44 - Graphic representation of monthly average temperature [°C]



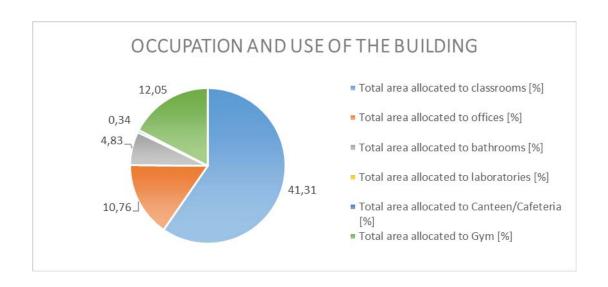
Picture 45 - Graphic representation of the Horizontal solar irradiation [Wh/m²/day] per Months. This value is the monthly/yearly average of the sum of the solar radiation energy that hits one square meter in a horizontal plane in one day.







Picture 46 - Graphic representation of the user profile during school period [working days/month]



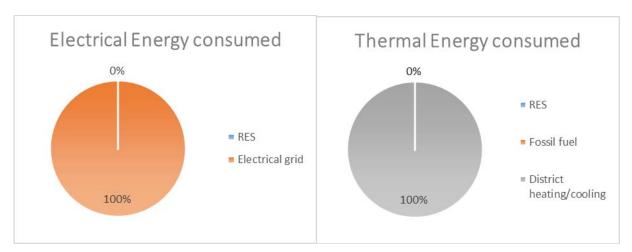
Picture 47 - Division of the School areas for intended use [%]

Year of construction	1970-1980
Type of structure	Prefab modules
External wall insulation	No insulation

Heat generation system	District heating
Treat generation system	
RES systems	
RES Systems	







Picture 48 - Pie Graph of Electrical and Thermal energy consumptions, related to the different energy carriers/fuels or systems [%] in use into the school.

		Total consumption per year	Consumption per volume	Consumption per heated area	Consumption per classrooms area	Consumption per number of students	Consumption per number of days	Total energy consumption per year	kg CO2 equivalent per year	Tonnes of oil equivalent per year
Energy carrier/Fuel/ Power source	u.m.	u.m.	u.m./m³	u.m./m²	u.m./m²	u.m./student	u.m./day	kWh	kg CO ₂ equiv	tep
Electricity	kWh _{el}	58202	1,20	15,84	38,34	106,02	278,48	58202	25213	11
Natural gas	Sm3	0						0		0
Fuel oil/Diesel	t	0						0		0
GPL	t	0						0		0
Biomass	t	0						0		0
District heating	kWh _t	556024	11,46	151,32	366,31	1012,79	2660,40	0	200168	53
District cooling	kWh _f	0						0		0
Photovoltaics	kWh _{el}	0						0		
Solar thermal collectors	kWh _t	0						0		
Geothermal	kWh _t	0						0		
Other - energy produced	0	0								
Tonnes of oil equivalent	tep	64,02	0,00	0,02	0,04	0,12	0,31		225382	64

Table 13 - Energy performance indicators





				t .						
	_	Unit cost o	f intervention			Cost of inter	vention		Energy reduction [%] **	
✓	Retrofit esternal walls with insulation	100	€/m2	1806,1	m2	180607	€			
✓	Retrofit roof with insulation	200	€/m2	1212,6	m2	242518	€	-20%	Energy need for space heating reduction [%]	
	Replace windows	450	€/m2	855,4	m2	0	€			
	Install solar shading systems	150	€/m2	855,4	m2	0	€			
	Reaplace heat generator with a more efficient one	160	€/kW	0,0	kW	0	€			
✓	Install thermostatic valves	70	€/valve	66	valves*	4612	€	-2÷5%	thermal energy reduction for heating system	
	Replace lights with LED	25	€/lamp		lamps	0	€			
✓	Install Energy Saving Switchs and Presence Sensors	250	€/point	50	points*	12500	€	-2÷20%	light consumptions	
✓	Install smart metering	5000	€			5000	€	-2÷10%	overall consumptions	
✓	Install a photovoltaic system	1600	€/kWp	20,0	kWp*	32000	€	-38%	Eletrical energy reduction [%]	
✓	Install a solar thermal system	600	€/m2	4,0	m2*	2400	€	up to 50%	thermal energy consumptions for DHW production	
	Replace electrical boilers with heat pumps	1500	€/kW	0,0	kW	0	€			
✓	Install building automation system (automatic centralized control of a building's heating, ventilation and air conditioning, lighting)	25	€/m2	3674,5	m2	91861	€	up to 15%	overall consumptions [depending on technology installed]	
✓	Change end-user behaviour: control devices stand-by (monitors, PCs, laboratory equipment, lights, etc.)	0	€			0	€	-2÷5%	electricity consumptions	

^{*=} estimated values

Table 14 - Priorities of interventions, standard costs per intervention and energy consumptions reductions. Items with * are referred to estimated values



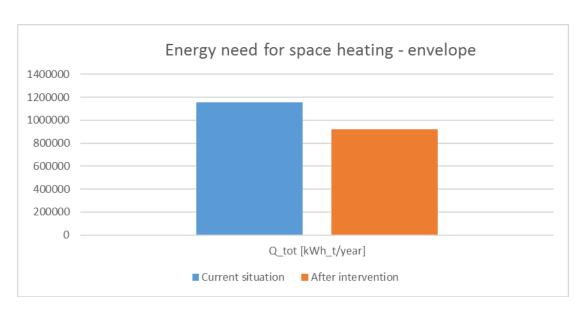


Energy need for space heating - envelope

	Q_tot[kWh_t/year]
Current situation	1157918,83
After intervention	922881,531
Energy need for space heating reduction [%]	-20%

Lamp replacement with LED	
	Q [kWh_t/year]
Current situation	40643,275
After intervention	17601,25
Energy consumption reduction [%]	-57%

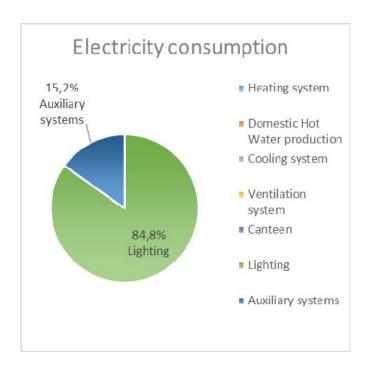
	Q [kWh_el/year]
Current situation	58202,458
Energy produced by RES	22000
After intervention	36202,458
Eletrical energy reduction [%]	-38%



Picture 49 - Energy need for space heating before and after (predicted) the intervention - envelope [kWh_t/year]







Picture 50 - Pie Graph of Electrical consumptions subdivision [%] for each final intended use.





4.8. Secondary school "Zespół Szkół Mechanicznych nr 2, Technical School, Vocational Schools Team" - Practical education centre



Picture 51 - Zespół Szkół Mechanicznych nr 2, Technical School, Vocational Schools Team - Practical education centre

GENERALITIES

School type	Secondary
Student age range	16-50

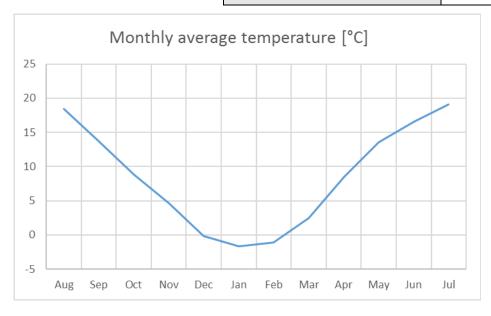
BUILDING GEOMETRY

Total floor heated area [m ²]	4481
Volume [m ³]	80656
S/V	0,11

GEOGRAPHICAL LOCATION AND WEATHER CONDITIONS

Country	Poland
City	Bydgoszcz

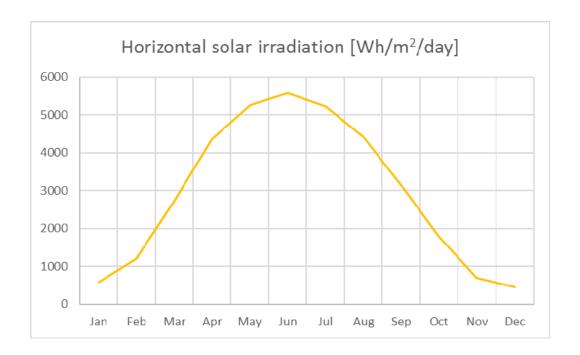
Number of students	549
Total days of use	209
Daily hours of use	14
Total area allocated to classrooms [%]	2,3



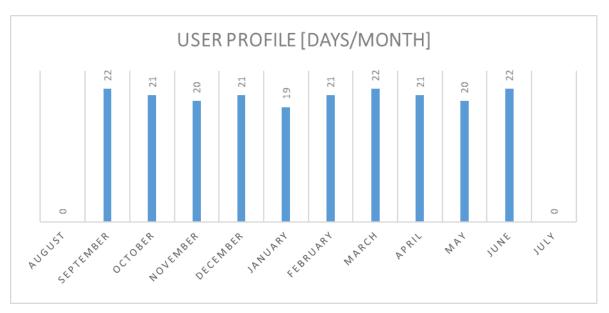




Picture 52 - Graphic representation of monthly average temperature [°C]



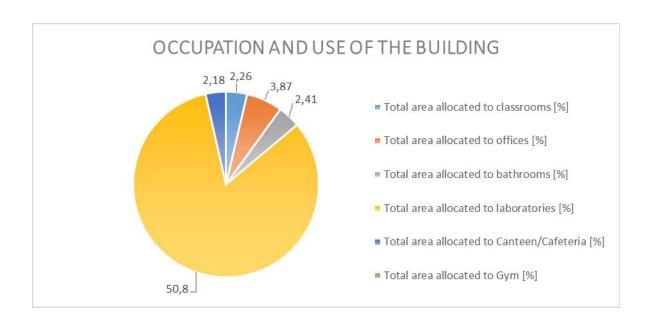
Picture 53 -Graphic representation of the Horizontal solar irradiation [Wh/m²/day] per Months. This value is the monthly/yearly average of the sum of the solar radiation energy that hits one square meter in a horizontal plane in one day.



Picture 54 - Graphic representation of the user profile during school period [working days/month]







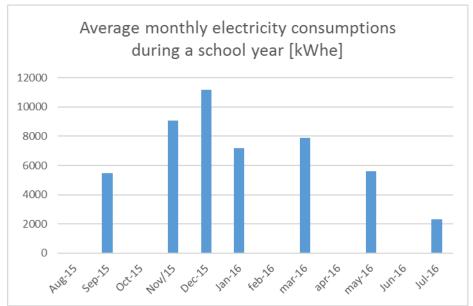
Picture 55 - Division of the School areas for intended use [%]

Year of construction	1960-1970
Type of structure	Reinforced concrete structure
External wall insulation	No insulation

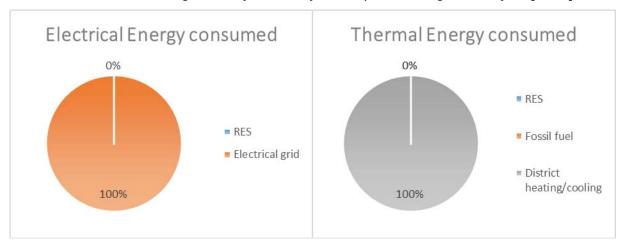
Heat generation system	District heating
neat generation system	
RES systems	
RE3 Systems	







Picture 56 - Average monthly electricity consumptions during a school year [kWhe]



Picture 57 - Pie Graph of Electrical and Thermal energy consumptions, related to the different energy carriers/fuels or systems [%] in use into the school.





		Total consumption per year	Consumption per volume	Consumption per heated area	Consumption per classrooms area	Consumption per number of students	Consumption per number of days	Total energy consumption per year	kg CO2 equivalent per year	Tonnes of oil equivalent per year
Energy carrier/Fuel/ Power source	u.m.	u.m.	u.m./m³	u.m./m²	u.m./m²	u.m./student	u.m./day	kWh	kg CO ₂ equiv	tep
Electricity	kWh _{el}	48704	0,60	10,87	480,94	88,71	233,03	48704	21099	9
Natural gas	Sm3	0						0		0
Fuel oil/Diesel	t	0						0		0
GPL	t	0						0		0
Biomass	t	0						0		0
Distric t heating	kWh _t	110724	1,37	24,71	1093,38	201,68	529,78	0	39861	11
Distric t cooling	kWh _f	0						0		0
Photovoltaics	kWh _{el}	0						0		
Solar thermal collectors	kWh _t	0						0		
Geothermal	kWh _t	0						0		
Other - energy produced	0	0								
Tonnes of oil equivalent	tep	20	0,00	0,00	0,19	0,04	0,09		60959	20

Table 15 - Energy performance indicators





		Unit cost of	intervention			Cost of inte	rvention		Energy reduction [%] **	
1	Retrofit external walls with insulation	100	€/m2	1284,9	m2	128488	€		Energy reduction [70]	
√	Retrofit roof with insulation	200	€/m2	3593,8	m2	718750	€	-21%	 Energy need for space heating reduction [%]	
	Replace windows	450	€/m2	536,3	m2	0	€			
	Install solar shading systems	150	€/m2	536,3	m2	0	€			
	Replace heat generator with a more efficient one	160	€/kW	0,0	kW	0	€			
✓	Install thermostatic valves	70	€/valve	66	valves*	4612	€	-2÷5%	thermal energy reduction for heating system	
✓	Replace lights with LED	25	€/lamp	399,0	lamps	9975	€	-57%	light consumptions	
✓	Install Energy Saving Switchs and Presence Sensors	250	€/point	50	points*	12500	€	-2÷20%	light consumptions	
	Install smart metering	5000	€			0	€			
✓	Install a photovoltaic system	1600	€/kWp	20,0	kWp*	32000	€	-45%	Eletrical energy reduction [%]	
✓	Install a solar thermal system	600	€/m2	4,0	m2*	2400	€	up to 50%	thermal energy consumptions for DHW production	
	Replace electrical boilers with heat pumps	1500	€/kW	0,0	kW	0	€			
✓	Install building automation system (automatic centralized control of a building's heating, ventilation and air conditioning, lighting)	25	€/m2	4480,9	m2	112022	€	up to 15%	overall consumptions [depending on technology installed]	
1	Change end-user behaviour: control devices stand- by (monitors, PCs, laboratory equipment, lights, etc.)	0	€			0	€	-2÷5%	electricity consumptions	

^{*=} estimated values

Table 16 - Priorities of interventions, standard costs per intervention and energy consumptions reductions. Items with * are referred to estimated values





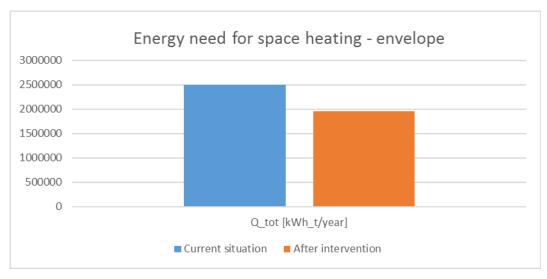
Energy need for space heating - envelope

	Q_tot[kWh_t/year]
Current situation	2495846,407
After intervention	1959863,117
Energy need for space heating reduction [%]	-21%

Lamp replacement with LED

	Q [kWh_t/year]
Current situation	33856,746
After intervention	14593,425
Energy consumption reduction [%]	-57%

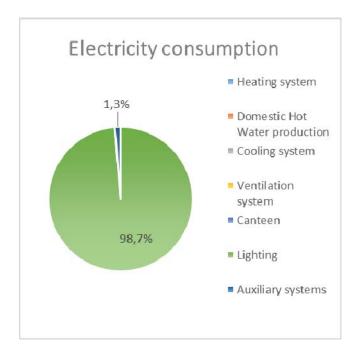
	Q [kWh_el/year]
Current situation	48704,12667
Energy produced by RES	22000
After intervention	26704,12667
Eletrical energy reduction [%]	-45%



Picture 58 - Energy need for space heating before and after (predicted) the intervention - envelope $[kWh_t/year]$







Picture 59 - Pie Graph of Electrical consumptions subdivision [%] for each final intended use





4.9. Primary school "Szkoła Podstawowa nr 10"



Picture 60 - Primary School "Szkoła Podstawowa nr 10"

GENERALITIES

School type	Primary
Student age range	6-13

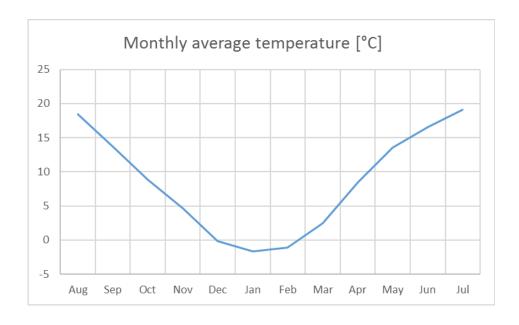
BUILDING GEOMETRY

Total floor heated area [m ²]	2799
Volume [m ³]	35715
S/V	0,14

GEOGRAPHICAL LOCATION AND WEATHER CONDITIONS

Country	Poland
City	Bydgoszcz

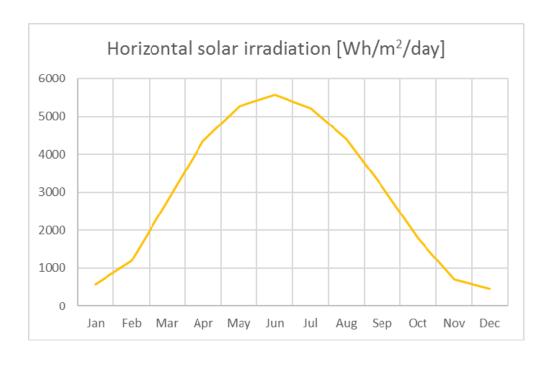
Number of students	329
Total days of use	184
Daily hours of use	14
Total area allocated to classrooms [%]	36



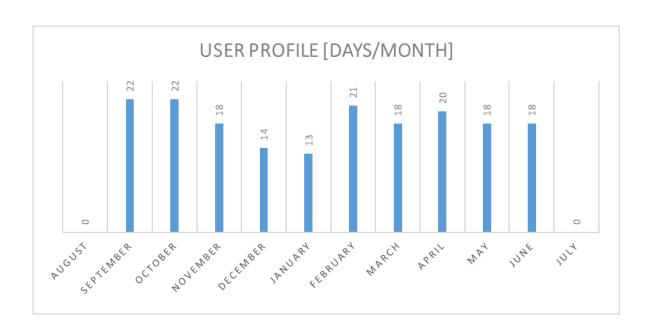
Picture 61 - Graphic representation of monthly average temperature [°C]







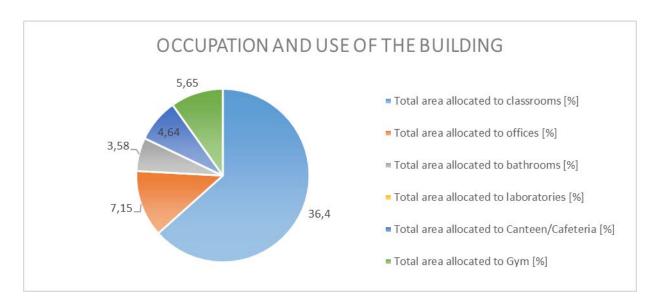
Picture 62 - Graphic representation of the Horizontal solar irradiation [Wh/m²/day] per Months. This value is the monthly/yearly average of the sum of the solar radiation energy that hits one square meter in a horizontal plane in one day.



Picture 63 - Graphic representation of the user profile during school period [working days/month]



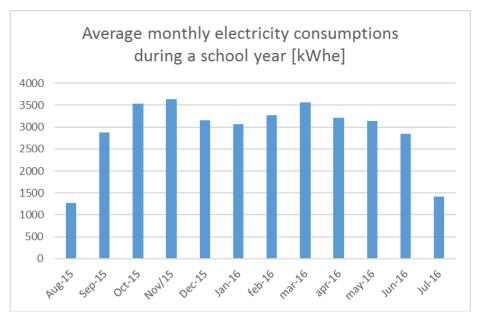




Picture 64 - Division of the School areas for intended use [%]

Year of construction	1950-1960
Type of structure	Load bearing masonry wall
External wall insulation	High [>10 cm]

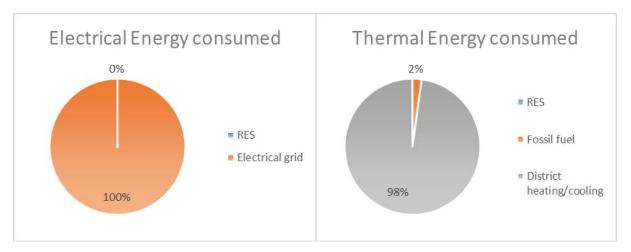
Heat generation system	District heating
RES systems	



Picture 65 - Average monthly electricity consumptions during a school year [kWhe]







Picture 66 - Pie Graph of Electrical and Thermal energy consumptions, related to the different energy carriers/fuels or systems [%] in use into the school.

		Total consumption per year	Consumption per volume	Consumption per heated area	Consumption per classrooms area	Consumption per number of students	Consumption per number of days	Total energy consumption per year	kg CO2 equivalent per year	Tonnes of oil equivalent per year
Energy carrier/Fuel/ Power source	u.m.	u.m.	u.m./m³	u.m./m²	u.m./m²	u.m./student	u.m./day	kWh	kg CO₂ equiv	tep
Electricity	kWh _{el}	34986	0,98	12,50	34,34	106,34	190,14	34986	15156	7
Natural gas	Sm3	504	0,01	0,18	0,50	1,53	2,74	4842	101	0
Fuel oil/Diesel	t	0						0		0
GPL	t	0						0		0
Biomass	t	0						0		0
District heating	kWh _t	216889	6,07	77,49	212,88	659,24	1178,74	0	78080	21
District cooling	kWh _f	0						0		0
Photovoltaics s	kWh _{el}	0						0		
Solar thermal collectors	kWh _t	0						0		
Geothermal	kWh _t	0						0		
Other - energy produced	0	0								
Tonnes of oil equivalent	tep	28	0,00	0,01	0,03	0,08	0,15		93337	28

Table 17 - Energy performance indicators





		Unit cost of	intervention			Cost of inter	rvention		Energy reduction [%] **
	Retrofit external walls with insulation	100	€/m2	2664,0	m2	0	€		
	Retrofit roof with insulation	200	€/m2	1164,6	m2	0	€	-	
	Replace windows	450	€/m2	415,3	m2	0	€		
	Install solar shading systems	150	€/m2	415,3	m2	0	€		
	Replace heat generator with a more efficient one	160	€/kW	0,0	kW	0	€		
✓	Install thermostatic valves	70	€/valve	39	valves*	2764	€	-2÷5%	thermal energy reduction for heating system
✓	Replace lights with LED	25	€/lamp	469,0	lamps	11725	€	-57%	light consumptions
✓	Install Energy Saving Switchs and Presence Sensors	250	€/point	50	points*	12500	€	-2÷20%	light consumptions
✓	Install smart metering	5000	€			5000	€	-2÷10%	overall consumptions
✓	Install a photovoltaic system	1600	€/kWp	20,0	kWp*	32000	€	-63%	Eletrical energy reduction [%]
✓	Install a solar thermal system	600	€/m2	4,0	m2*	2400	€	up to 50%	thermal energy consumptions for DHW production
	Replace electrical boilers with heat pumps	1500	€/kW	0,0	kW	0	€		
✓	Install building automation system (automatic centralized control of a building's heating, ventilation and air conditioning, lighting)	25	€/m2	2799,0	m2	69975	€	up to 15%	overall consumptions [depending on technology installed]
√	Change end-user behaviour: control devices stand- by (monitors, PCs, laboratory equipment, lights, etc.)	0	€			0	€	-2÷5%	electricity consumptions

^{*=} estimated values

Table 18 - Priorities of interventions, standard costs per intervention and energy consumptions reductions. Items with * are referred to estimated values

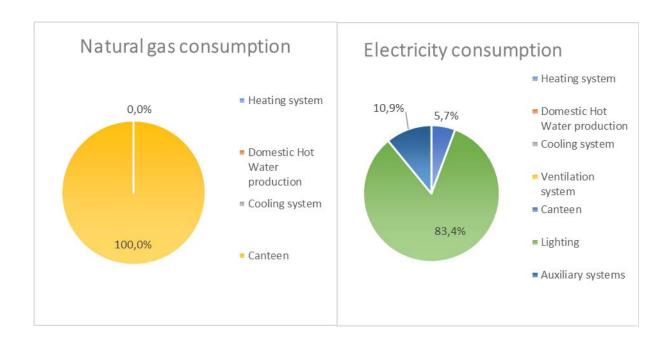




Lamp replacement with LED

	Q[kWh_t/year]
Current situation	35285,344
After intervention	15209,2
Energy consumption reduction [%]	-57%

	Q[kWh_el/year]
Current situation	34986,285
Energy produced by RES	22000
After intervention	12986,285
Eletrical energy reduction [%]	-63%



Picture 67 - Pie Graph of Electrical and Natural gas consumptions subdivision [%] for each final intended use





4.10. Primary school "Szkoła Podstawowa nr 65" - Main school building





Picture 68 - Primary school "Szkoła Podstawowa nr 65"

GENERALITIES

School type	Primary
Student age range	6-13

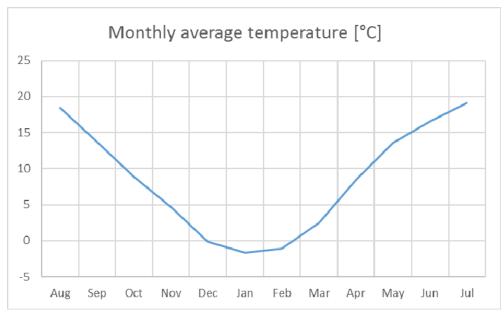
GEOGRAPHICAL LOCATION AND WEATHER CONDITIONS

Country	Poland
City	Bydgoszcz

BUILDING GEOMETRY

Total floor heated area [m ²]	10463
Volume [m ³]	138112
S/V	0,10

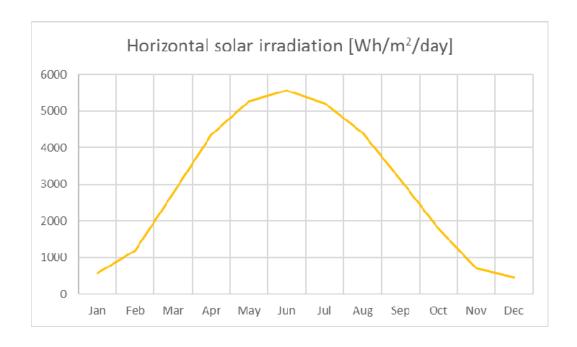
Number of students	958
Total days of use	254
Daily hours of use	16
Total area allocated to classrooms [%]	27



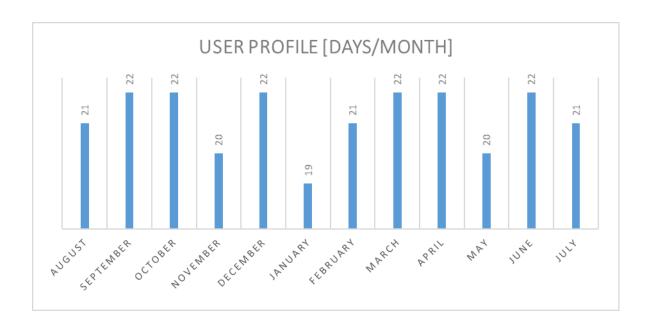
Picture 69 - Graphic representation of monthly average temperature [°C]







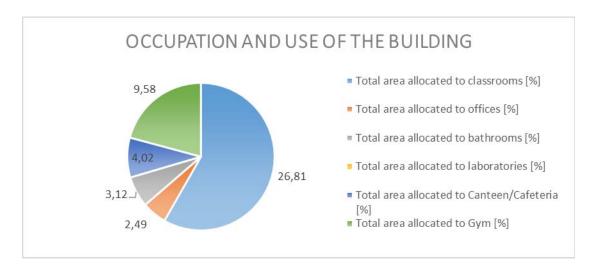
Picture 70 - Graphic representation of the Horizontal solar irradiation [Wh/m²/day] per Months. This value is the monthly/yearly average of the sum of the solar radiation energy that hits one square meter in a horizontal plane in one day.



Picture 71 - Graphic representation of the user profile during school period [working days/month]



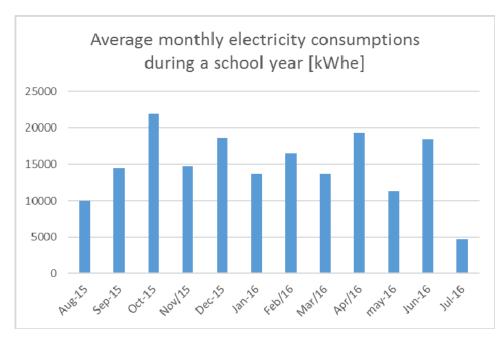




Picture 72 - Division of the School areas for intended use [%]

Year of construction	1990-2000
Type of structure	Reinforced concrete structure
External wall insulation	High [>10 cm]

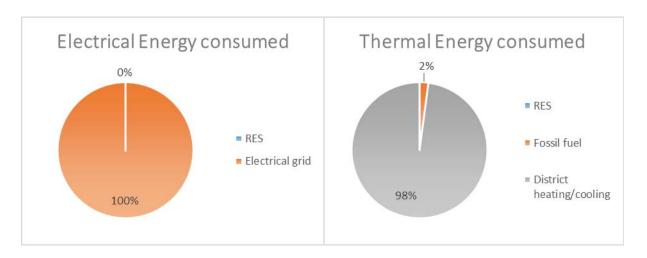
Heat generation system	District heating
RES systems	



Picture 73 - Average monthly electricity consumptions during a school year [kWhe]







Picture 74 - Pie Graph of Electrical and Thermal energy consumptions, related to the different energy carriers/fuels or systems [%] in use into the school.

		Total consumption per year	Consumption per volume	Consumption per heated area	Consumption per classrooms area	Consumption per number of students	Consumption per number of days	Total energy consumption per year	kg CO2 equivalent per year	Tonnes of oil equivalent per year
Energy carrier/Fuel/ Power source	u.m.	u.m.	u.m./m³	u.m./m²	u.m./m²	u.m./student	u.m./day	kWh	kg CO ₂ equiv	tep
Electricity	kWh _{el}	177557	1,29	16,97	63,30	185,34	699,04	177557	76918	33
Natural gas	Sm3	2126	0,02	0,20	0,76	2,22	8,37	20406	425	2
Fuel oil/Diesel	t	0						0		0
GPL	t	0						0		0
Biomass	t	0						0		0
District heating	kWh _t	949333	6,87	90,73	338,43	990,95	3737,53	0	341760	91
District cooling	kWh _f	0						0		0
Photovoltaics	kWh _{el}	0						0		
Solar thermal collectors	kWh _t	0						0		
Geothermal	kWh _t	0						0		
Other - energy produced	0	0								
Tonnes of oil equivalent	tep	126	0,00	0,01	0,04	0,13	0,49		419102	126

Table 19 - Energy performance indicators





				Ī				F 1 1 1 F07 11	
_	_	Unit cost of	intervention		1	Cost of intervention			Energy reduction [%] **
	Retrofit external walls with insulation	100	€/m2	-3797,1	m2	0	€		
	Retrofit roof with insulation	200	€/m2	3573,8	m2	0	€		
	Replace windows	450	€/m2	10103,1	m2	0	€		
	Install solar shading systems	150	€/m2	10103,1	m2	0	€		
	Replace heat generator with a more efficient one	160	€/kW	0,0	kW	0	€		
✓	Install thermostatic valves	70	€/valve	115	valves*	8047	€	-2÷5%	thermal energy reduction for heating system
√	Replace lights with LED	25	€/lamp	578,0	lamps	14450	€	-57%	light consumptions
√	Install Energy Saving Switchs and Presence Sensors	250	€/point	50	points*	12500	€	-2÷20%	light consumptions
✓	Install smart metering	5000	€			5000	€	-2÷10%	overall consumptions
√	Install a photovoltaic system	1600	€/kWp	20,0	kWp*	32000	€	-12%	Eletrical energy reduction [%]
✓	Install a solar thermal system	600	€/m2	4,0	m2*	2400	€	up to 50%	thermal energy consumptions for DHW production
	Replace electrical boilers with heat pumps	1500	€/kW	0,0	kW	0	€		
✓	Install building automation system (automatic centralized control of a building's heating, ventilation and air conditioning, lighting)	25	€/m2	10463,0	m2	261575	€	up to 15%	overall consumptions [depending on technology installed]
✓	Change end-user behaviour: control devices stand-by (monitors, PCs, laboratory equipment, lights, etc.)	0	€			0	€	-2÷5%	electricity consumptions

^{*=} estimated values

Table 20 - Priorities of interventions, standard costs per intervention and energy consumptions reductions. Items with * are referred to estimated values

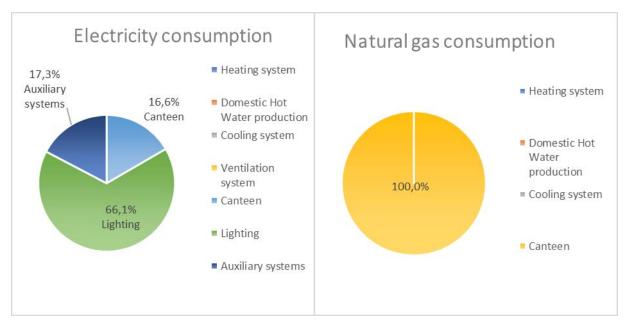




Lamp replacement with LED

	Q[kWh_t/year]
Current situation	68120,768
After intervention	29362,4
Energy consumption reduction [%]	-57%

	Q[kWh_el/year]
Current situation	177557,2533
Energy produced by RES	22000
After intervention	155557,2533
Eletrical energy reduction [%]	-12%



Picture 75 - Pie Graph of Electrical and Natural gas consumptions subdivision [%] for each final intended use





4.11. Primary school "Szkoła Podstawowa nr 65" - Swimming pool

GENERALITIES

School type	Primary
Student age range	6-16

BUILDING GEOMETRY

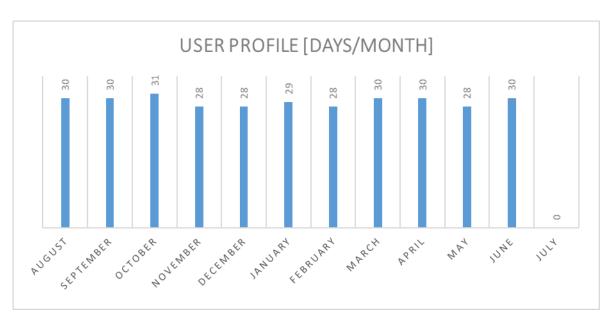
Total floor heated area [m ²]	2314
Volume [m ³]	20826
S/V	0,24

GEOGRAPHICAL LOCATION AND WEATHER CONDITIONS

Country	Poland
City	Bydgoszcz

OCCUPATION AND USE OF THE BUILDING

Number of students	500
Total days of use	322
Daily hours of use	15



Picture 76 - Graphic representation of the user profile during school period [working days/month]

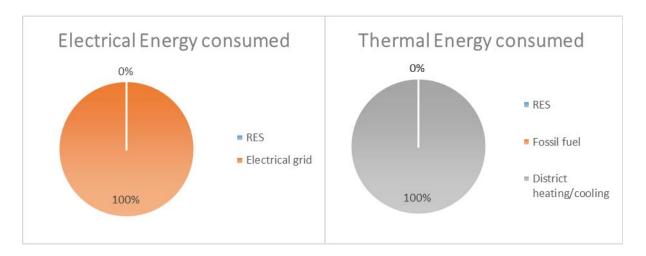
BUILDING ENVELOPE

Year of construction	2000-2010
Type of structure	Steel frame structure
External wall insulation	Low [2-5 cm]

Heat generation system	District heating
RES systems	







Picture 77 - Pie Graph of Electrical and Thermal energy consumptions, related to the different energy carriers/fuels or systems [%] in use into the school

		Total consumption per year	Consumption per volume	Consumption per heated area	Consumption per classrooms area	Consumption per number of students	Consumption per number of days	Total energy consumption per year	kg CO2 equivalent per year	Tonnes of oil equivalent per year
Energy carrier/Fuel/ Power source	u.m.	u.m.	u.m./m³	u.m./m²	u.m./m²	u.m./student	u.m./day	kWh	kg CO ₂ equiv	tep
Electricity	kWh _{el}	269910	12,96	116,64	#DIV/0!	539,82	838,23	269910	116925	50
Natural gas	Sm3	0						0		0
Fuel oil/Diesel	t	0						0		0
GPL	t	0						0		0
Biomass	t	0						0		0
District heating	kWh _t	1170093	56,18	505,66	#DIV/0!	2340,19	3633,83	0	421233	112
District cooling	kWh _f	0						0		0
Photovoltaics	kWh _{el}	0						0		
Solar thermal collectors	kWh _t	0						0		
Geothermal	kWh _t	0						0		
Other - energy produced	0	0								
Tonnes of oil equivalent	tep	162	0,01	0,07	#DIV/0!	0,32	0,50		538158	162

Table 21 - Energy performance indicators





		Unit cost of	fintervention			Cost of intervention			Energy reduction [%] **
	Retrofit external walls with insulation	100	€/m2	1426,1	m2	0	€		
	Retrofit roof with insulation	200	€/m2	1850,0	m2	0	€		
	Replace windows	450	€/m2	145,9	m2	0	€		
	Install solar shading systems	150	€/m2	145,9	m2	0	€		
	Replace heat generator with a more efficient one	160	€/kW	0,0	kW	0	€		
√	Install thermostatic valves	70	€/valve	60	valves*	4200	€	-2÷5%	thermal energy reduction for heating system
√	Replace lights with LED	25	€/lamp	159,0	lamps	3975	€	-48%	light consumptions
√	Install Energy Saving Switchs and Presence Sensors	250	€/point	50	points*	12500	€	-2÷20%	light consumptions
√	Install smart metering	5000	€			5000	€	-2÷10%	overall consumptions
✓	Install a photovoltaic system	1600	€/kWp	20,0	kWp*	32000	€	-8%	Eletrical energy reduction [%]
✓	Install a solar thermal system	600	€/m2	4,0	m2*	2400	€	up to 50%	thermal energy consumptions for DHW production
	Replace electrical boilers with heat pumps	1500	€/kW	0,0	kW	0	€		
✓	Install building automation system (automatic centralized control of a building's heating, ventilation and air conditioning, lighting)	25	€/m2	2314,0	m2	57850	€	up to 15%	overall consumptions [depending on technology installed]
✓	Change end-user behaviour: control devices stand- by (monitors, PCs, laboratory equipment, lights, etc.)	0	€			0	€	-2÷5%	electricity consumptions

^{*=} estimated values

Table 22 - Priorities of interventions, standard costs per intervention and energy consumptions reductions. Items with * are referred to estimated values

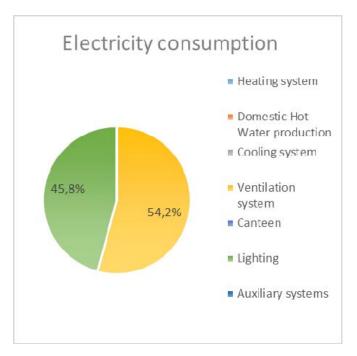




Lamp replacement with LED

	Q[kWh_t/year]
Current situation	18877,894
After intervention	9812,95
Energy consumption reduction [%]	-48%

	Q[kWh_el/year]
Current situation	269909,7726
Energy produced by RES	22000
After intervention	247909,7726
Eletrical energy reduction [%]	-8%



Picture 78 - Pie Graph of Electrical consumptions subdivision [%] for each final intended use





4.12. Secondary school "Zespół Szkół Medycznych - Vocational Schools Team" - Main building





Picture 79 - Secondary school ""Zespół Szkół Medycznych - Vocational Schools Team"

GENERALITIES

School type	Secondary
Student age range	16-21

GEOGRAPHICAL LOCATION AND WEATHER CONDITIONS

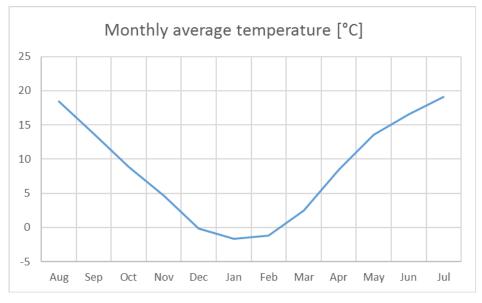
Country	Poland
City	Bydgoszcz

BUILDING GEOMETRY

Total floor heated area [m ²]	6669
Volume [m ³]	110033
S/V	0,10

OCCUPATION AND USE OF THE BUILDING

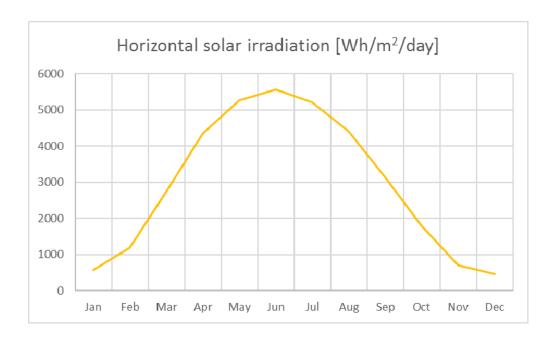
Number of students	486
Total days of use	259
Daily hours of use	13
Total area allocated to classrooms [%]	30



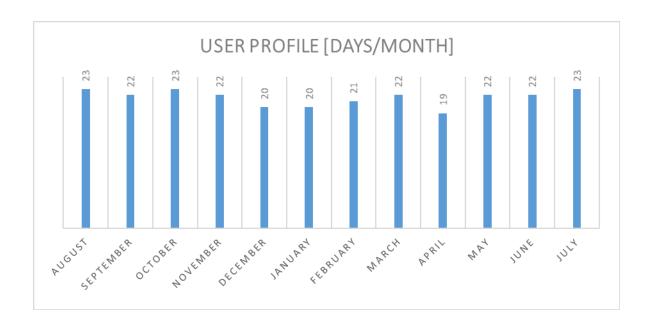
Picture 80 - Average monthly electricity consumptions during a school year [kWhe]







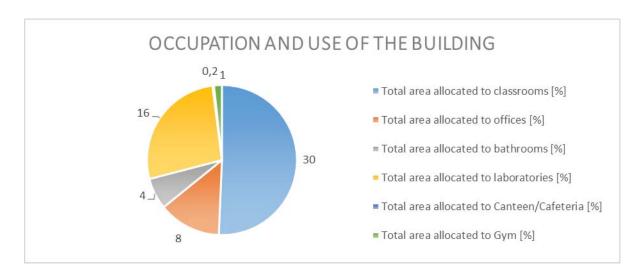
Picture 81 - Graphic representation of the Horizontal solar irradiation [Wh/m²/day] per Months. This value is the monthly/yearly average of the sum of the solar radiation energy that hits one square meter in a horizontal plane in one day.



Picture 82 - Graphic representation of the user profile during school period [working days/month]





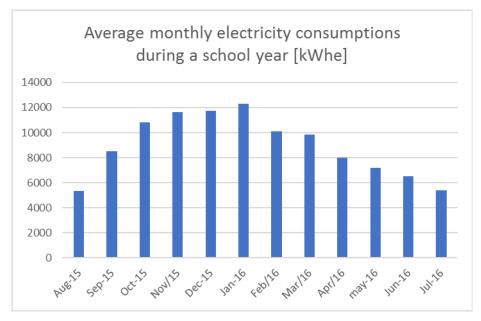


Picture 83 - Division of the School areas for intended use [%]

BUILDING ENVELOPE

Year of construction	1980-1990
Type of structure	Prefab modules
External wall insulation	No insulation

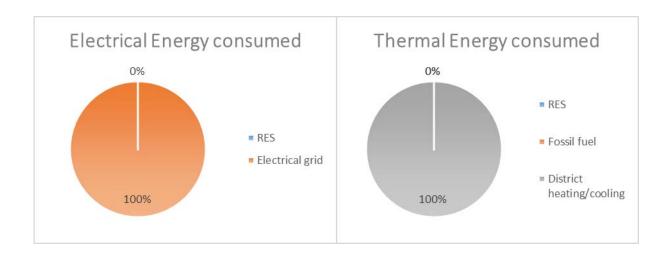
Heat generation system	District heating
RES systems	



Picture 84 - Average monthly electricity consumptions during a school year [kWhe]







Picture 85 - Pie Graph of Electrical and Thermal energy consumptions, related to the different energy carriers/fuels or systems [%] in use into the school

				1						
		Total consumption per year	Consumption per volume	Consumption per heated area	Consumption per classrooms area	Consumption per number of students	Consumption per number of days	Total energy consumption per year	kg CO2 equivalent per year	Tonnes of oil equivalent per year
Energy carrier/Fuel/ Power source	u.m.	u.m.	u.m./m³	u.m./m²	u.m./m²	u.m./student	u.m./day	kWh	kg CO ₂ equiv	tep
Electricity	kWh _{el}	107466	0,98	16,12	53,72	221,12	414,93	107466	46554	20
Natural gas	Sm3	0						0		0
Fuel oil/Diesel	t	0						0		0
GPL	t	0						0		0
Biomass	t	0						0		0
District heating	kWh _t	974838	8,86	146,18	487,27	2005,84	3763,85	0	350942	93
District cooling	kWh _f	0						0		0
Photovoltaics	kWh _{el}	0						0		
Solar thermal collectors	kWh _t	0						0		
Geothermal	kWh _t	0						0		
Other - energy produced	0	0								
Tonnes of oil equivalent	tep	113	0,00	0,02	0,06	0,23	0,44		397496	113

Table 23 - Energy performance indicators





				1				•	
_		Unit cost of	intervention			Cost of inter	rvention		Energy reduction [%] **
✓	Retrofit external walls with insulation	100	€/m2	4192,9	m2	419291	€		
~	Retrofit roof with insulation	200	€/m2	3035,8	m2	607164	€	-20%	Energy need for space heating reduction [%]
	Replace windows	450	€/m2	1037,1	m2	0	€		
	Install solar shading systems	150	€/m2	1037,1	m2	0	€		
	Replace heat generator with a more efficient one	160	€/kW	0,0	kW	0	€		
✓	Install thermostatic valves	70	€/valve	58	valves*	4082	€	-2÷5%	thermal energy reduction for heating system
✓	Replace lights with LED	25	€/lamp	2015,0	lamps	50375	€	-57%	light consumptions
	Install Energy Saving Switchs and Presence Sensors	250	€/point	50,0	points*	0	€		
✓	Install smart metering	5000	€			5000	€	-2÷10%	overall consumptions
✓	Install a photovoltaic system	1600	€/kWp	20,0	kWp*	32000	€	-20%	Eletrical energy reduction [%]
✓	Install a solar thermal system	600	€/m2	4,0	m2*	2400	€	up to 50%	thermal energy consumptions for DHW production
	Replace electrical boilers with heat pumps	1500	€/kW	0,0	kW	0	€		
~	Install building automation system (automatic centralized control of a building's heating, ventilation and air conditioning, lighting)	25	€/m2	6668,6	m2	166716	€	up to 15%	overall consumptions [depending on technology installed]
•	Change end-user behaviour: control devices stand-by (monitors, PCs, laboratory equipment, lights, etc.)	0	€			0	€	-2÷5%	electricity consumptions

^{*=} estimated values

Table 24 - Priorities of interventions, standard costs per intervention and energy consumptions reductions. Items with * are referred to estimated values





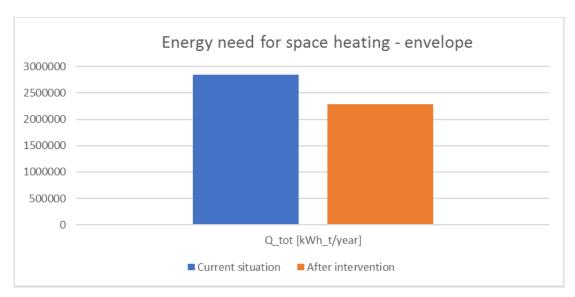
Energy need for space heating - envelope

	Q_tot[kWh_t/year]
Current situation	2850181,57
After intervention	2281501,26
Energy need for space heating reduction [%]	-20%

Lamp replacement with LED

	Q [kWh_t/year]
Current situation	197304,095
After intervention	85262,5625
Energy consumption reduction [%]	-57%

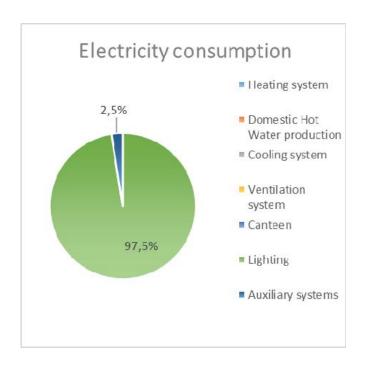
	Q [kWh_el/year]
Current situation	107466,247
Energy produced by RES	22000
After intervention	85466,2467
Eletrical energy reduction [%]	-20%



Picture 86 - Energy need for space heating before and after (predicted) the intervention - envelope $[kWh_t/year]$







Picture 87 - Pie Graph of Electrical consumptions subdivision [%] for each final intended use





4.13. Secondary school "Zespół Szkół Medycznych - Vocational Schools Team" - Swimming pool

GENERALITIES

School type	Secondary
Student age range	9-21

GEOGRAPHICAL LOCATION AND WEATHER CONDITIONS

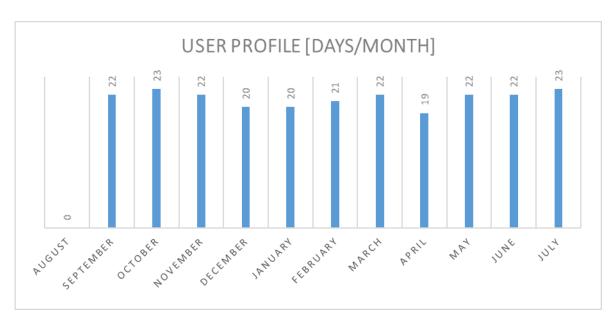
Country	Poland
City	Bydgoszcz

BUILDING GEOMETRY

Total floor heated area [m ²]	1482
Volume [m ³]	17784
S/V	0,23

OCCUPATION AND USE OF THE BUILDING

Number of students	819
Total days of use	236
Daily hours of use	8



Picture 88 - Graphic representation of the user profile during school period [working days/month]

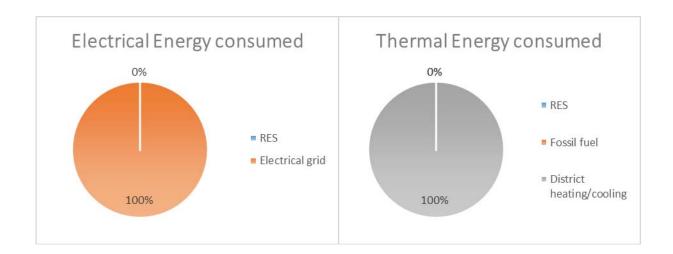
BUILDING ENVELOPE

Year of construction	1980-1990
Type of structure	Load bearing masonry wall
External wall insulation	High [>10 cm]

Heat generation system	District heating
RES systems	







Picture 89 - Pie Graph of Electrical and Thermal energy consumptions, related to the different energy carriers/fuels or systems [%] in use into the school

		Total consumption per year	Consumption per volume	Consumption per heated area	Consumption per classrooms area	Consumption per number of students	Consumption per number of days	Total energy consumption per year	kg CO2 equivalent per year	Tonnes of oil equivalent per year
Energy carrier/Fuel/ Power source	u.m.	u.m.	u.m./m³	u.m./m²	u.m./m²	u.m./student	u.m./day	kWh	kg CO ₂ equiv	tep
Electricity	kWh _{el}	114081	6,41	76,98	/	139,29	483,39	114081	49420	21
Natural gas	Sm3	0						0		0
Fuel oil/Diesel	t	0						0		0
GPL	t	0						0		0
Biomass	t	0						0		0
District heating	kWh _t	928755	52,22	626,69	/	1134,01	3935,40	0	334352	89
District cooling	kWh _f	0						0		0
Photovoltaics	kWh _{el}	0						0		
Solar thermal collectors	kWh _t	0						0		
Geothermal	kWh _t	0						0		
Other - energy produced	0	0								
Tonnes of oil equivalent	tep	110	0,01	0,07	/	0,13	0,47		383771	110

Table 25 - Energy performances indicators





		r			,			1	
		Unit cost of	intervention			Cost of intervention			Energy reduction [%] **
	Retrofit external walls with insulation	100	€/m2	1102,5	m2	0	€		Energy need for space heating reduction [%]
	Retrofit roof with insulation	200	€/m2	1100,0	m2	0	€	-20%	
✓	Replace windows	450	€/m2	747,5	m2	336375	€		
	Install solar shading systems	150	€/m2	747,5	m2	0	€		
	Replace heat generator with a more efficient one	160	€/kW	0,0	kW	0	€		
✓	Install thermostatic valves	70	€/valve	98	valves*	6880	€	-2÷5%	thermal energy reduction for heating system
✓	Replace lights with LED	25	€/lamp	129,0	lamps	3225	€	-48%	light consumptions
✓	Install Energy Saving Switchs and Presence Sensors	250	€/point	50	points*	12500	€	-2÷20%	light consumptions
✓	Install smart metering	5000	€			5000	€	-2÷10%	overall consumptions
√	Install a photovoltaic system	1600	€/kWp	20,0	kWp*	32000	€	-19%	Eletrical energy reduction [%]
✓	Install a solar thermal system	600	€/m2	4,0	m2*	2400	€	up to 50%	thermal energy consumptions for DHW production
	Replace electrical boilers with heat pumps	1500	€/kW	0,0	kW	0	€		
✓	Install building automation system (automatic centralized control of a building's heating, ventilation and air conditioning, lighting)	25	€/m2	1482,0	m2	37050	€	up to 15%	overall consumptions [depending on technology installed]
✓	Change end-user behaviour: control devices stand-by (monitors, PCs, laboratory equipment, lights, etc.)	0	€			0	€	-2÷5%	electricity consumptions

^{*=} estimated values

Table 26 - Priorities of interventions, standard costs per intervention and energy consumptions reductions. Items with * are referred to estimated values





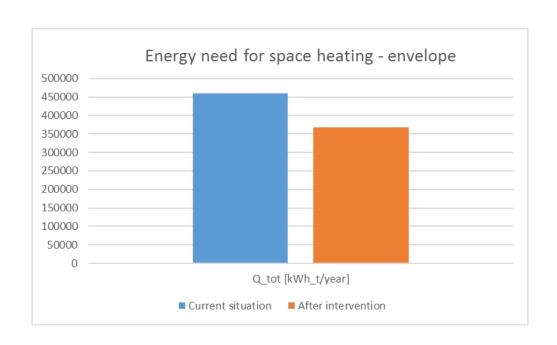
Energy need for space heating - envelope

	Q_tot[kWh_t/year]
Current situation	460400,5885
After intervention	366941,4335
Energy need for space heating reduction [%]	-20%

Lamp replacement with LED

	Q [kWh_t/year]
Current situation	5893,392
After intervention	3044,4
Energy consumption reduction [%]	-48%

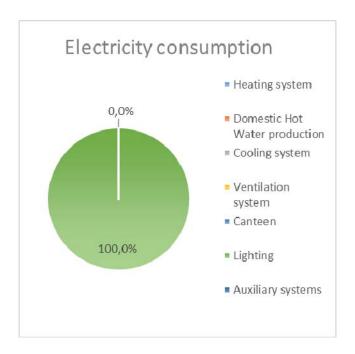
	Q [kWh_el/year]
Current situation	114080,75
Energy produced by RES	22000
After intervention	92080,75
Eletrical energy reduction [%]	-19%



Picture 90 - Energy need for space heating before and after (predicted) the intervention - envelope [kWh_t/year]







Picture 91 - Pie Graph of Electrical consumptions subdivision [%] for each final intended use





4.14. Primary school "Szkoła Podstawowa nr 65"-Main school building



Picture 92 - Primary school "Szkoła Podstawowa nr 65"

GENERALITIES

School type	Primary
Student age range	6-13

GEOGRAPHICAL LOCATION AND WEATHER CONDITIONS

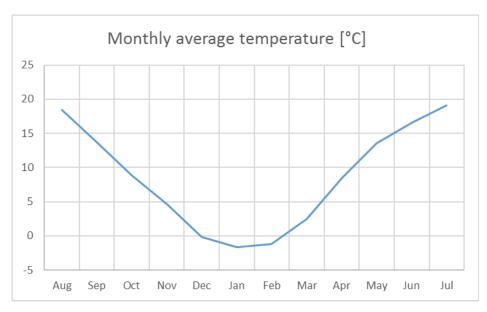
Country	Poland
City	Bydgoszcz

BUILDING GEOMETRY

Total floor heated area [m ²]	8020
Volume [m³]	339727
S/V	0,04

OCCUPATION AND USE OF THE BUILDING

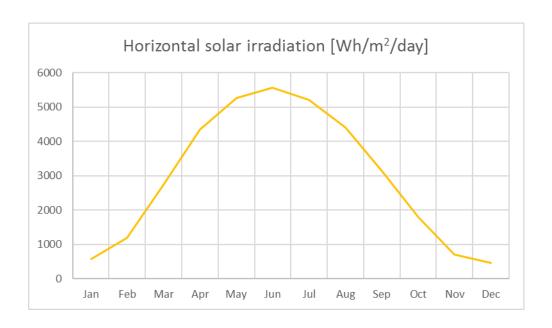
Number of students	923
Total days of use	186
Daily hours of use	14
Total area allocated to classrooms [%]	49



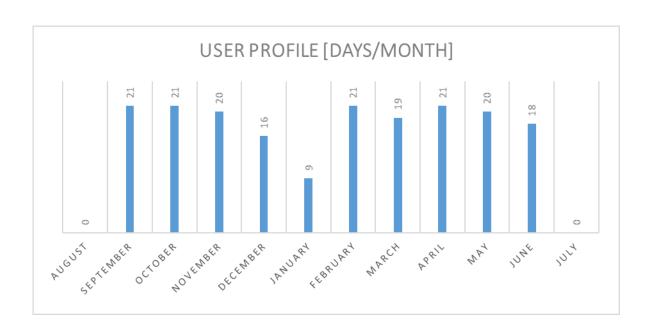
Picture 93 - Average monthly electricity consumptions during a school year [kWhe]







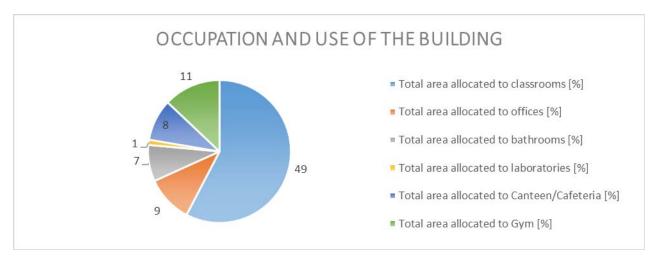
Picture 94 - Graphic representation of the Horizontal solar irradiation [Wh/m²/day] per Months. This value is the monthly/yearly average of the sum of the solar radiation energy that hits one square meter in a horizontal plane in one day.



Picture 95 - Graphic representation of the user profile during school period [working days/month]





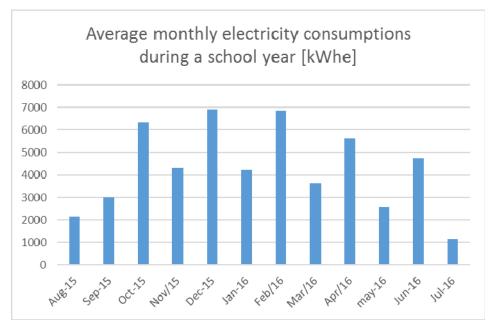


Picture 96 - Division of the School areas for intended use [%]

BUILDING ENVELOPE

Year of construction	1990-2000
Type of structure	Prefab modules
External wall insulation	No insulation

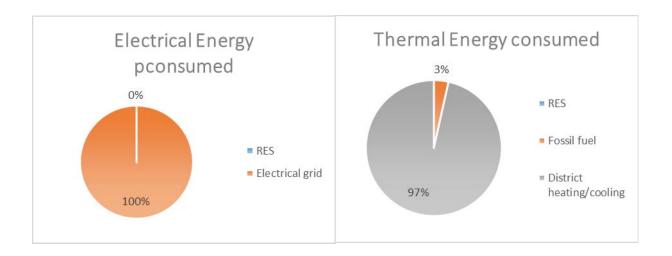
Heat generation system	District heating
RES systems	



Picture 97 - Average monthly electricity consumptions during a school year [kWhe]







Picture 98 - Pie Graph of Electrical and Thermal energy consumptions, related to the different energy carriers/fuels or systems [%] in use into the school

		Total consumption per year	Consumption per volume	Consumption per heated area	Consumption per classrooms area	Consumption per number of students	Consumption per number of days	Total energy consumption per year	kg CO2 equivalent per year	Tonnes of oil equivalent per year
Energy carrier/Fuel/ Power source	u.m.	u.m.	u.m./m³	u.m./m²	u.m./m²	u.m./student	u.m./day	kWh	kg CO₂ equiv	tep
Electricity	kWhel	51625	0,15	6,44	13,14	55,93	277,56	51625	22364	10
Natural gas	Sm3	2856	0,01	0,36	0,73	3,09	15,35	27416	571	2
Fuel oil/Diesel	t	0						0		0
GPL	t	0						0		0
Biomass	t	0						0		0
District heating	kWht	757935	2,23	94,51	192,87	821,16	4074,92	0	272857	72
District cooling	kWh _f	0						0		0
Photovoltaics	kWh _{el}	0						0		
Solar thermal collectors	kWh _t	0						0		
Geothermal	kWht	0						0		
Other - energy produced	0	0								
Tonnes of oil equivalent	tep	84	0,00	0,01	0,02	0,09	0,45		295791	84

Table 27 - Energy performance indicators





					ſ			1		
		Unit cost of	intervention			Cost of inter	vention	Energy reduction [%] **		
✓	Retrofit external walls with insulation	100	€/m2	4147,0	m2	414700	€		Energy need for space heating reduction [%]	
✓	Retrofit roof with insulation	200	€/m2	3923,0	m2	784600	€	-16%		
✓	Replace windows	450	€/m2	1603,0	m2	721350	€			
	Install solar shading systems	150	€/m2	1603,0	m2	0	€			
	Replace heat generator with a more efficient one	160	€/kW	0,0	kW	0	€			
✓	Install thermostatic valves	70	€/valve	111	valves*	7753	€	-2÷5%	thermal energy reduction for heating system	
✓	Replace lights with LED	25	€/lamp	837,0	lamps	20925	€	-55%	light consumptions	
✓	Install Energy Saving Switchs and Presence Sensors	250	€/point	50	points*	12500	€	-2÷20%	light consumptions	
✓	Install smart metering	5000	€			5000	€	-2÷10%	overall consumptions	
✓	Install a photovoltaic system	1600	€/kWp	20,0	kWp*	32000	€	-43%	Eletrical energy reduction [%]	
✓	Install a solar thermal system	600	€/m2	4,0	m2*	2400	€	up to 50%	thermal energy consumptions for DHW production	
	Replace electrical boilers with heat pumps	1500	€/kW	0,0	kW	0	€			
✓	Install building automation system (automatic centralized control of a building's heating, ventilation and air conditioning, lighting)	25	€/m2	8020,0	m2	200500	€	up to 15%	overall consumptions [depending on technology installed]	
✓	Change end-user behaviour: control devices stand- by (monitors, PCs, laboratory equipment, lights, etc.)	0	€			0	€	-2÷5%	electricity consumptions	

^{*=} estimated values

Table 28 - Priorities of interventions, standard costs per intervention and energy consumptions reductions. Items with * are referred to estimated values





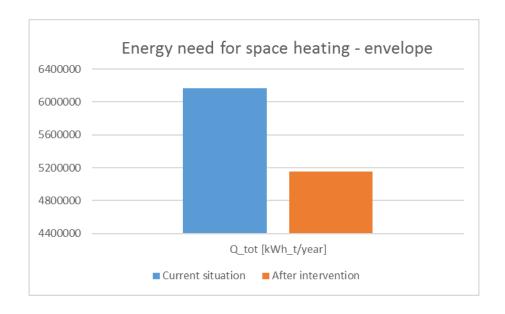
Energy need for space heating - envelope

	Q_tot[kWh_t/year]
Current situation	6164834,643
After intervention	5152100,309
Energy need for space heating reduction [%]	-16%

Lamp replacement with LED

	Q [kWh_t/year]
Current situation	62099,138
After intervention	27893,025
Energy consumption reduction [%]	-55%

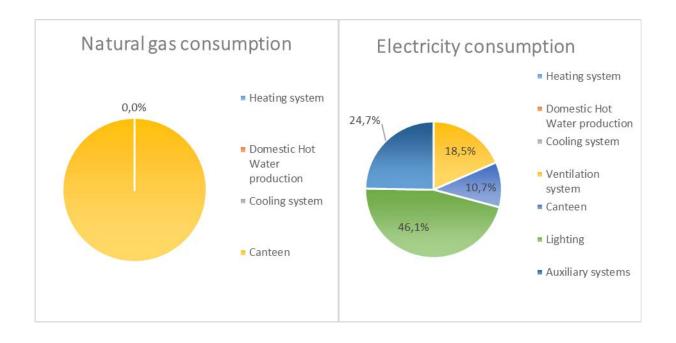
	Q [kWh_el/year]
Current situation	51625,35833
Energy produced by RES	22000
After intervention	29625,35833
Eletrical energy reduction [%]	-43%



Picture 99 - Energy need for space heating before and after (predicted) the intervention - envelope [kWh_t/year]







Picture 100 - Pie Graph of Electrical and Natural gas consumptions subdivision [%] for each final intended use





4.15. Primary school "Szkoła Podstawowa nr 65"-Swimming pool

GENERALITIES

School type	Primary
Student age range	6-13

GEOGRAPHICAL LOCATION AND WEATHER CONDITIONS

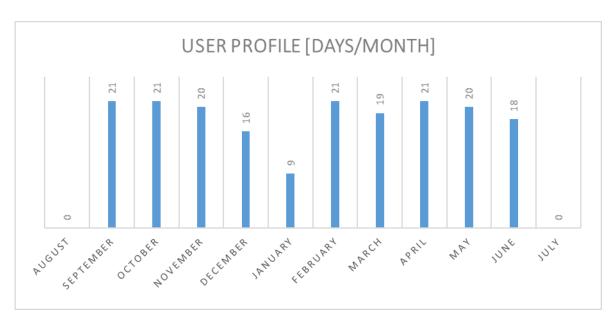
Country	Poland
City	Bydgoszcz

BUILDING GEOMETRY

Total floor heated area [m ²]	2460
Volume [m ³]	97416
S/V	0,06

OCCUPATION AND USE OF THE BUILDING

Number of students	1500
Total days of use	186
Daily hours of use	15



Picture 101 - Graphic representation of the user profile during school period [working days/month]

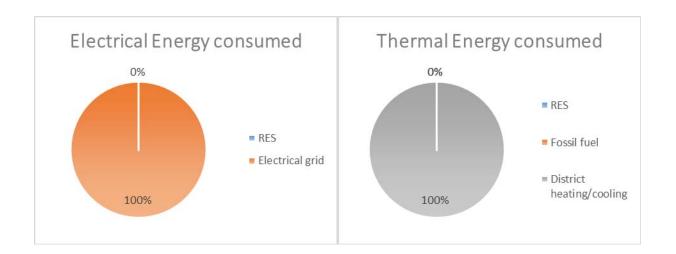
BUILDING ENVELOPE

Year of construction	2000-2010
Type of structure	
External wall insulation	High [>10 cm]

Heat generation system	District heating
RES systems	







Picture 102 - Pie Graph of Electrical and Thermal energy consumptions, related to the different energy carriers/fuels or systems [%] in use into the school

		Total consumption per year	Consumption per volume	Consumption per heated area	Consumption per classrooms area	Consumption per number of students	Consumption per number of days	Total energy consumption per year	kg CO2 equivalent per year	Tonnes of oil equivalent per year
Energy carrier/Fuel/ Power source	u.m.	u.m.	u.m./m³	u.m./m²	u.m./m²	u.m./student	u.m./day	kWh	kg CO ₂ equiv	tep
Electricity	kWh _{el}	241520	2,48	98,18	/	161,01	1298,50	241520	104627	45
Natural gas	Sm3	0						0		0
Fuel oil/Diesel	t	0						0		0
GPL	t	0						0		0
Biomass	t	0						0		0
District heating	kWh _t	671176	6,89	272,84		447,45	3608,47	0	241623	64
District cooling	kWh _f	0						0		0
Photovoltaics	kWh _{el}	0						0		
Solar thermal collectors	kWh _t	0						0		
Geothermal	kWh _t	0						0		
Other - energy produced	0	0								
Tonnes of oil equivalent	tep	109	0,00	0,04		0,07	0,59		346250	109

Table 29 - Energy performance indicators





		Unit cost of	intervention			Cost of inter	rvention		Energy reduction [%] **
	Retrofit external walls with insulation	100	€/m2	1529,3	m2	0	€		
	Retrofit roof with insulation	200	€/m2	2100,0	m2	0	€		
	Replace windows	450	€/m2	823,5	m2	0	€		
•	✓ Install solar shading systems	150	€/m2	823,5	m2	123522	€	-5÷10%	cooling consumptions
	Replace heat generator with a more efficient one	160	€/kW	0,0	kW	0	€		
•	✓ Install thermostatic valves	70	€/valve	180	valves*	12600	€	-2÷5%	thermal energy reduction for heating system
	Replace lights with LED	25	€/lamp	0,0	lamps	0	€		
•	✓ Install Energy Saving Switchs and Presence Sensors	250	€/point	50	points*	12500	€	-2÷20%	light consumptions
•	✓ Install smart metering	5000	€			5000	€	-2÷10%	overall consumptions
•	✓ Install a photovoltaic system	1600	€/kWp	20,0	kWp*	32000	€	-9%	Eletrical energy reduction [%]
•	✓ Install a solar thermal system	600	€/m2	4,0	m2*	2400	€	up to 50%	thermal energy consumptions for DHW production
	Replace electrical boilers with heat pumps	1500	€/kW	0,0	kW	0	€		
•	Install building automation system (automatic centralized control of a building's heating, ventilation and air conditioning, lighting)	25	€/m2	2460,0	m2	61500	€	up to 15%	overall consumptions [depending on technology installed]
•	Change end-user behaviour: control devices stand-by (monitors, PCs, laboratory equipment, lights, etc.)	0	€			0	€	-2÷5%	electricity consumptions

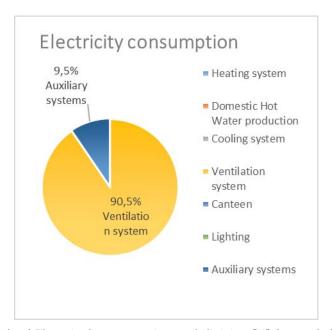
^{*=} estimated values

Table 30 - Priorities of interventions, standard costs per intervention and energy consumptions reductions. Items with * are referred to estimated values





	Q[kWh_el/year]
Current situation	241520,3958
Energy produced by RES	22000
After intervention	219520,3958
Eletrical energy reduction [%]	-9%



Picture 103 - Pie Graph of Electrical consumptions subdivision [%] for each final intended use





4.16. Secondary school "Zespół Szkół Samochodowych" Technical School, Vocational Schools Team



Picture 104 - Secondary school "Zespół Szkół Samochodowych" Technical School, Vocational Schools Team

GENERALITIES

School type	Secondary
Student age range	16-19

BUILDING GEOMETRY

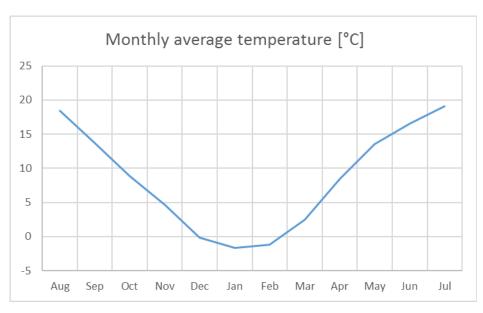
Total floor heated area [m ²]	4440
Volume [m ³]	56832
S/V	0,11

GEOGRAPHICAL LOCATION AND WEATHER CONDITIONS

Country	Poland
City	Bydgoszcz

OCCUPATION AND USE OF THE BUILDING

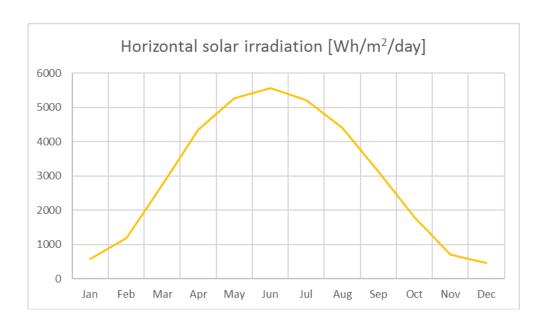
Number of students	623
Total days of use	239
Daily hours of use	16
Total area allocated to classrooms [%]	26



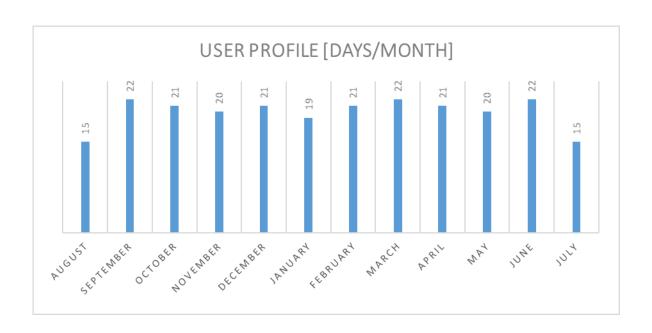
Picture 105 - Average monthly electricity consumptions during a school year [kWhe]







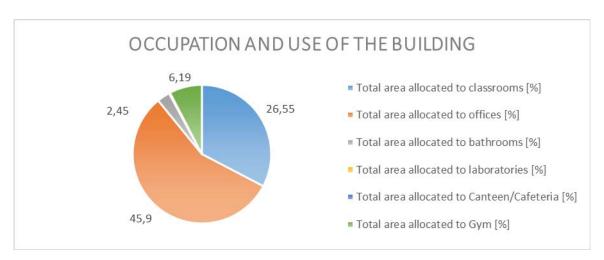
Picture 106 - Graphic representation of the Horizontal solar irradiation [Wh/m²/day] per Months. This value is the monthly/yearly average of the sum of the solar radiation energy that hits one square meter in a horizontal plane in one day.



Picture 107 - Graphic representation of the user profile during school period [working days/month]





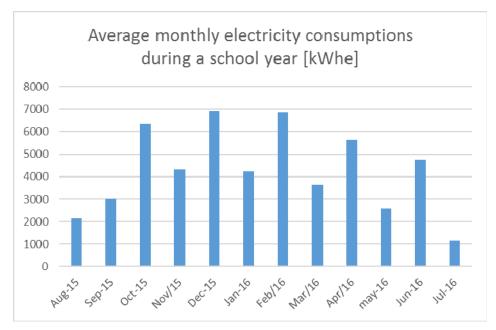


Picture 108 - Pie Graph of Electrical and Thermal energy consumptions, related to the different energy carriers/fuels or systems [%] in use into the school

BUILDING ENVELOPE

Year of construction	>2010				
Type of structure	Prefab modules				
External wall insulation	No insulation				

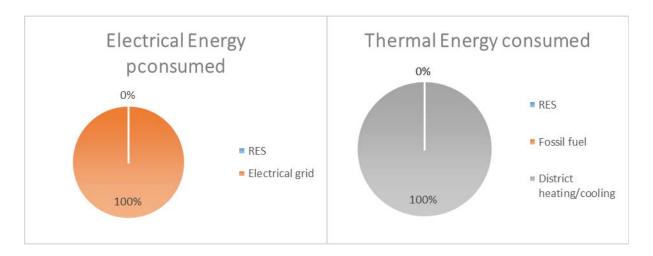
Heat generation system	District heating							
RES systems								



Picture 109 - Average monthly electricity consumptions during a school year [kWhe]







Picture 110 - Pie Graph of Electrical and Thermal energy consumptions, related to the different energy carriers/fuels or systems [%] in use into the school

		Total consumption per year	Consumption per volume	Consumption per heated area	Consumption per classrooms area	Consumption per number of students	Consumption per number of days	Total energy consumption per year	kg CO2 equivalent per year	Tonnes of oil equivalent per year
Energy carrier/Fuel/ Power source	u.m.	u.m.	u.m./m³	u.m./m²	u.m./m²	u.m./student	u.m./day	kWh	kg CO₂ equiv	tep
Electricity	kWh _{el}	118432	2,08	26,67	100,47	190,10	495,53	118432	51305	22
Natural gas	Sm3	0						0		0
Fuel oil/Diesel	t	0						0		0
GPL	t	0						0		0
Biomass	t	0						0		0
District heating	kWh _t	522824	9,20	117,75	443,51	839,20	2187,55	0	188217	50
District cooling	kWh _f	0						0		0
Photovoltaics	kWh _{el}	0						0		
Solar thermal collectors	kWh _t	0						0		
Geothermal	kWh _t	0						0		
Other - energy produced	0	0								
Tonnes of oil equivalent	tep	72	0,00	0,02	0,06	0,12	0,30		239522	72

Table 31 - Energy performance indicators





				1				T	
		Unit cost of	intervention			Cost of inter	vention		Energy reduction [%] **
✓	Retrofit external walls with insulation	100	€/m2	1261,8	m2	126180	€		
	Retrofit roof with insulation	200	€/m2	2101,8	m2	0	€	-5%	Energy need for space heating reduction [%]
	Replace windows	450	€/m2	859,4	m2	0	€		
	Install solar shading systems	150	€/m2	859,4	m2	0	€		
	Replace heat generator with a more efficient one	160	€/kW	0,0	kW	0	€		
✓	Install thermostatic valves	70	€/valve	75	valves*	5233	€	-2÷5%	thermal energy reduction for heating system
✓	Replace lights with LED	25	€/lamp	437,0	lamps	10925	€	-55%	light consumptions
✓	Install Energy Saving Switchs and Presence Sensors	250	€/point	50	points*	12500	€	-2÷20%	light consumptions
✓	Install smart metering	5000	€			5000	€	-2÷10%	overall consumptions
✓	Install a photovoltaic system	1600	€/kWp	20,0	kWp*	32000	€	-19%	Eletrical energy reduction [%]
✓	Install a solar thermal system	600	€/m2	4,0	m2*	2400	€	up to 50%	thermal energy consumptions for DHW production
✓	Replace electrical boilers with heat pumps	1500	€/kW	0,0	kW	0	€	up to -50÷70%	electrical energy consumptions for DHW production
✓	Install building automation system (automatic centralized control of a building's heating, ventilation and air conditioning, lighting)	25	€/m2	4440,0	m2	111000	€	up to 15%	overall consumptions [depending on technology installed]
✓	Change end-user behaviour: control devices stand-by (monitors, PCs, laboratory equipment, lights, etc.)	0	€			0	€	-2÷5%	electricity consumptions

^{*=} estimated values

Table 32 - Priorities of interventions, standard costs per intervention and energy consumptions reductions. Items with * are referred to estimated values



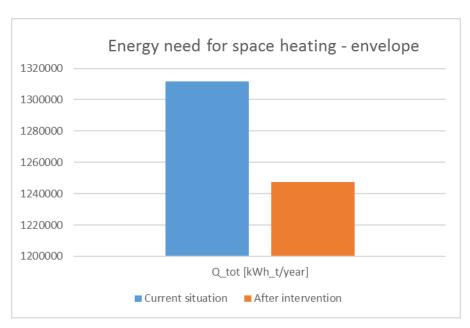


Energy need for space heating - envelop	Q_tot[kWh_t/year]
Current situation	1311497,121
After intervention	1247367,985
Energy need for space heating reduction [%]	-5%

Lamp replacement with LED

	Q [kWh_t/year]
Current situation	46322,144
After intervention	20853,8
Energy consumption reduction [%]	-55%

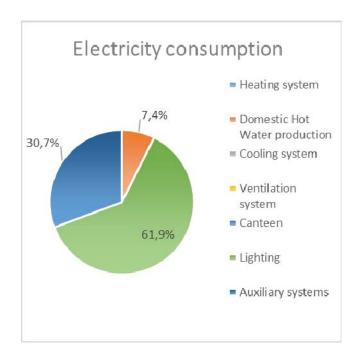
	Q [kWh_el/year]
Current situation	118432,4867
Energy produced by RES	22000
After intervention	96432,48667
Eletrical energy reduction [%]	-19%



Picture 111 - Energy need for space heating before and after (predicted) the intervention - envelope $[kWh_t/year]$







Picture 112 - Pie Graph of Electrical consumptions subdivision [%] for each final intended use





4.17. Primary and Secondary school "Zespół Szkół nr 25"



Picture 113 - Primary and Secondary school "Zespół Szkół nr 25"

GENERALITIES

I SCHOOL TVDO	Primary and Secondary
Student age range	6-16

GEOGRAPHICAL LOCATION AND WEATHER CONDITIONS

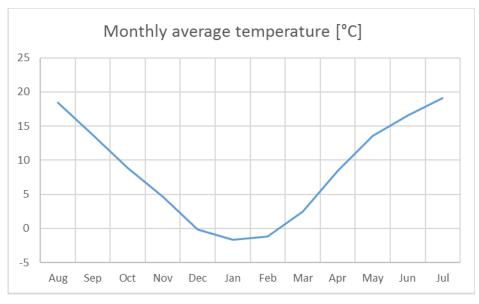
Country	Poland
City	Bydgoszcz

BUILDING GEOMETRY

Total floor heated area [m ²]	14166
Volume [m ³]	186987
S/V	0,02

OCCUPATION AND USE OF THE BUILDING

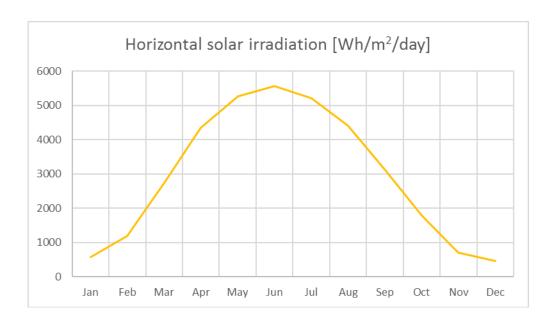
Number of students	417
Total days of use	258
Daily hours of use	15
Total area allocated to classrooms [%]	29



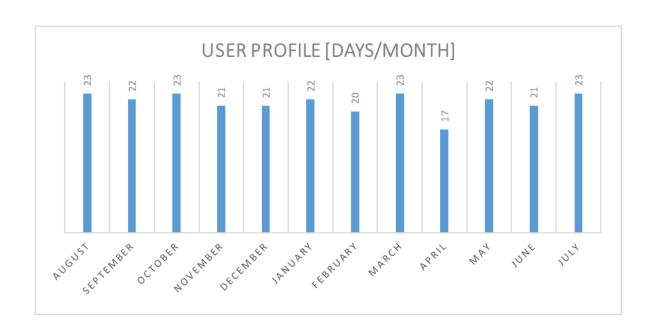
Picture 114 - Average monthly electricity consumptions during a school year [kWhe]







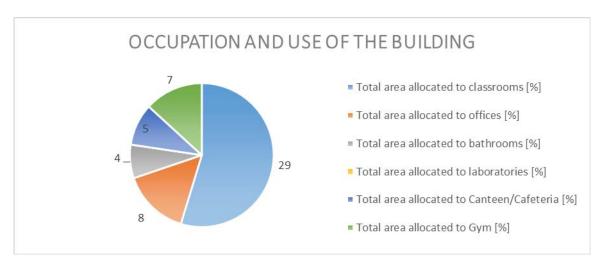
Picture 115 - Graphic representation of the Horizontal solar irradiation [Wh/m²/day] per Months. This value is the monthly/yearly average of the sum of the solar radiation energy that hits one square meter in a horizontal plane in one day.



Picture 116 - Graphic representation of the user profile during school period [working days/month]







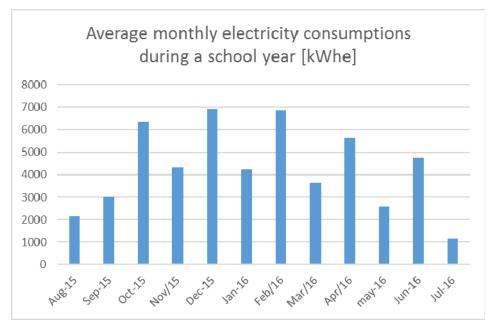
Picture 117 - Pie Graph of Electrical and Thermal energy consumptions, related to the different energy carriers/fuels or systems [%] in use into the school

BUILDING ENVELOPE

Year of construction	1960-1970
Type of structure	Prefab modules
External wall insulation	High [>10 cm]

HVAC AND RES SYSTEMS

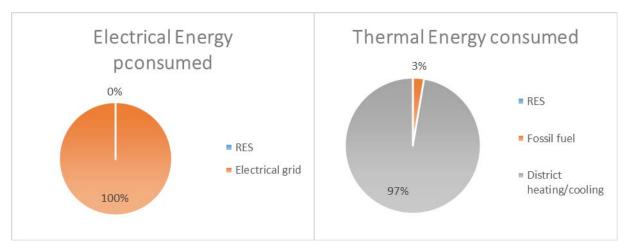
Heat generation system	District heating
RES systems	



Picture 118 - Average monthly electricity consumptions during a school year [kWhe]







Picture 119 - Pie Graph of Electrical and Thermal energy consumptions, related to the different energy carriers/fuels or systems [%] in use into the school

		Total consumption per year	Consumption per volume	Consumption per heated area	Consumption per classrooms area	Consumption per number of students	Consumption per number of days	Total energy consumption per year	kg CO2 equivalent per year	Tonnes of oil equivalent per year
Energy carrier/Fuel/ Power source	u.m.	u.m.	u.m./m³	u.m./m²	u.m./m²	u.m./student	u.m./day	kWh	kg CO ₂ equiv	tep
Electricity	kWh _{el}	39857	0,21	2,81	9,70	95,58	154,48	39857	17266	7
Natural gas	Sm3	797	0,00	0,06	0,19	1,91	3,09	7648	159	1
Fuel oil/Diesel	t	0						0		0
GPL	t	0						0		0
Biomass	t	0						0		0
District heating	kWh _t	278639	1,49	19,67	67,83	668,20	1080,00	0	100310	27
District cooling	kWh _f	0						0		0
Photovoltaics	kWh _{el}	0						0		
Solar thermal collectors	kWh _t	0						0		
Geothermal	kWh _t	0						0		
Other - energy produced	0	0								
Tonnes of oil equivalent	tep	35	0,00	0,00	0,01	0,08	0,13		117735	35

Table 33 - Energy performance indicators





Priorities of interventions, standard costs per intervention and energy reduction estimations

		Unit cost of	intervention	1		Cost of inter	vontion	Energy reduction [%] **		
Г	Retrofit esternal walls with insulation			1011 =		cost of fifter	vention		Energy reduction [76]	
L		100	€/m2	1011,7	m2	0	€			
	Retrofit roof with insulation	200	€/m2	699,5	m2	0	€			
	Replace windows	450	€/m2	305,3	m2	0	€			
	Install solar shading systems	150	€/m2	305,3	m2	0	€			
	Reaplace heat generator with a more efficient one	160	€/kW	0,0	kW	0	€			
✓	Install thermostatic valves	70	€/valve	50	valves*	3503	€	-2÷5%	thermal energy reduction for heating system	
✓	Replace lights with LED	25	€/lamp	309,0	lamps	7725	€	-55%	light consumptions	
✓	Install Energy Saving Switchs and Presence Sensors	250	€/point	50	points*	12500	€	-2÷20%	light consumptions	
✓	Install smart metering	5000	€			5000	€	-2÷10%	overall consumptions	
✓	Install a photovoltaic system	1600	€/kWp	20,0	kWp*	32000	€	-55%	Eletrical energy reduction [%]	
✓	Install a solar thermal system	600	€/m2	4,0	m2*	2400	€	up to 50%	thermal energy consumptions for DHW production	
	Replace electrical boilers with heat pumps	1500	€/kW	0,0	kW	0	€			
~	Install building automation system (automatic centralized control of a building's heating, ventilation and air conditioning, lighting)	25	€/m2	14165,7	m2	354143	€	up to 15%	overall consumptions [depending on technology installed]	
~	Change end-user behaviour: control devices stand-by (monitors, PCs, laboratory equipment, lights, etc.)	0	€			0	€	-2÷5%	electricity consumptions	

*= estimated values

Table 34 - Priorities of interventions, standard costs per intervention and energy consumptions reductions. Items with * are referred to estimated values





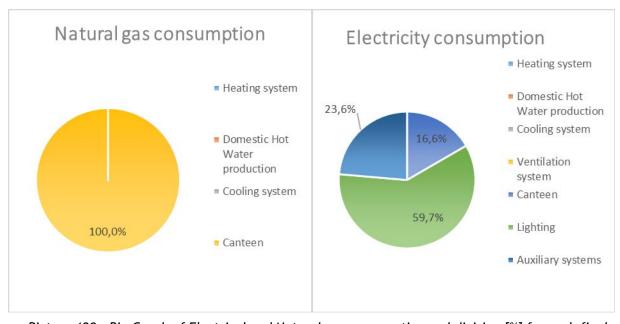
**Most relevant energy consumption reduction

Lamp replacement with LED

	Q[kWh_t/year]
Current situation	33313,695
After intervention	14931,375
Energy consumption reduction [%]	-55%

Electrical energy reduction with PV system

	Q[kWh_el/year]
Current situation	39857
Energy produced by RES	22000
After intervention	17857
Eletrical energy reduction [%]	-55%



Picture 120 - Pie Graph of Electrical and Natural gas consumptions subdivision [%] for each final intended use





4.18. Primary and Secondary school "Zespół Szkół nr 7"

GENERALITIES

	Primary and Secondary
Student age range	5-19

GEOGRAPHICAL LOCATION AND WEATHER CONDITIONS

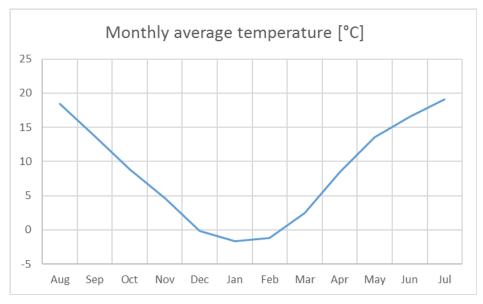
Country	Poland
City	Bydgoszcz

BUILDING GEOMETRY

Total floor heated area [m ²]	3706
Volume [m ³]	35355
S/V	0,14

OCCUPATION AND USE OF THE BUILDING

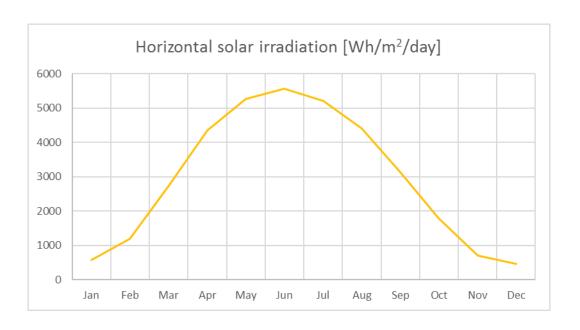
Number of students	477
Total days of use	234
Daily hours of use	16
Total area allocated to classrooms [%]	28



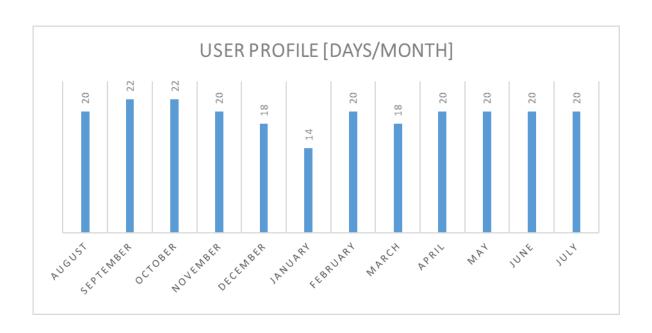
Picture 121 - Average monthly electricity consumptions during a school year [kWhe]







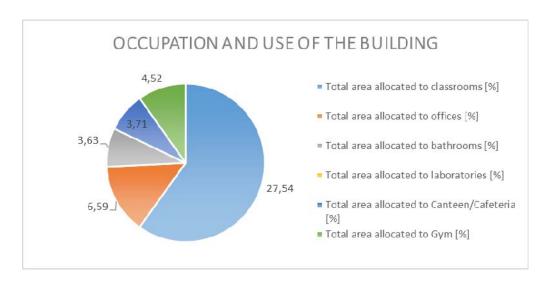
Picture 122 - Graphic representation of the Horizontal solar irradiation [Wh/m²/day] per Months. This value is the monthly/yearly average of the sum of the solar radiation energy that hits one square meter in a horizontal plane in one day.



Picture 123 - Graphic representation of the user profile during school period [working days/month]







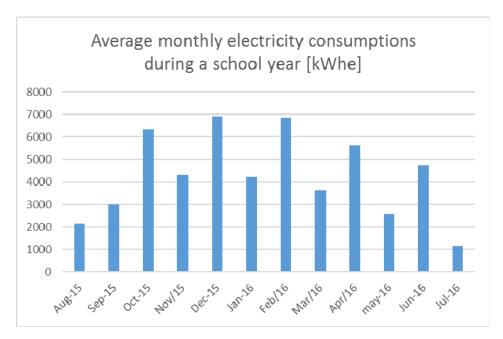
Picture 124 - Pie Graph of Electrical and Thermal energy consumptions, related to the different energy carriers/fuels or systems [%] in use into the school

BUILDING ENVELOPE

Year of construction	1960-1970
Type of structure	Prefab modules
External wall insulation	High [>10 cm]

HVAC AND RES SYSTEMS

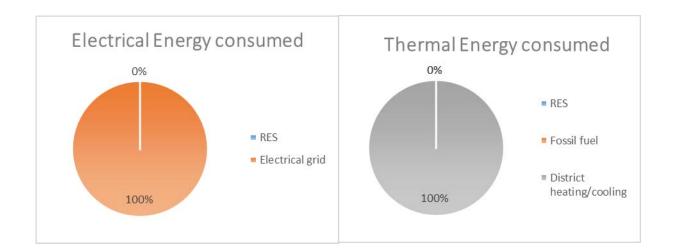
Heat generation system	District heating
Treat generation system	
RES systems	
RES Systems	



Picture 125 - Average monthly electricity consumptions during a school year [kWhe]







Picture 126 - Pie Graph of Electrical and Thermal energy consumptions, related to the different energy carriers/fuels or systems [%] in use into the school

		Total			Consumption	Consumption	Consumption	Total energy	kg CO2	Tonnes of oil
		consumption	Consumption	Consumption	per classrooms	per number	per number of	consumption	equivalent	equivalent per
		per year	per volume	per heated area	area	of students	days	per year	per year	year
Energy carrier/ Fuel/Power source	u.m.	u.m.	u.m./m³	u.m./m²	u.m./m²	u.m./student	u.m./day	kWh	kg CO ₂ equiv	tep
Electricity	kWh _{el}	172790	4,89	46,62	169,30	362,24	738,42	172790	74852	32
Natural gas	Sm3	0						0		0
Fuel oil/Diesel	t	0						0		0
GPL	t	0						0		0
Biomass	t	0						0		0
District heating	kWh _t	380250	10,76	102,60	372,56	797,17	1625,00	0	136890	36
District cooling	kWh _f	0						0		0
Photovoltaics	kWh _{el}	0						0		
Solar thermal collectors	kWh _t	0						0		
Geothermal	kWh _t	0						0		
Other - energy produced	0	0								
Tonnes of oil equivalent	tep	69	0,00	0,02	0,07	0,14	0,29		211742	69

Table 35 - Energy performance indicators





Priorities of interventions, standard costs per intervention and energy reduction estimations

				1		6 1 6: 1		I	F 1 1 10/1 **
		Unit cost of	intervention		ı	Cost of interv	ention/		Energy reduction [%] **
	Retrofit external walls with insulation		€/m2	2029,5	m2	0	€		
	Retrofit roof with insulation	200	€/m2	2099,0	m2	0	€		
	Replace windows	450	€/m2	447,3	m2	0	€		
	Install solar shading systems	150	€/m2	447,3	m2	0	€		
	Replace heat generator with a more efficient one	160	€/kW	0,0	kW	0	€		
√	Install thermostatic valves	70	€/valve	57	valves*	4007	€	-2÷5%	thermal energy reduction for heating system
√	Replace lights with LED	25	€/lamp	561,0	lamps	14025	€	-47%	light consumptions
√	Install Energy Saving Switchs and Presence Sensors	250	€/point	50	points*	12500	€	-2÷20%	light consumptions
√	Install smart metering	5000	€			5000	€	-2÷10%	overall consumptions
√	Install a photovoltaic system	1600	€/kWp	20,0	kWp*	32000	€	-13%	Eletrical energy reduction [%]
√	Install a solar thermal system	600	€/m2	4,0	m2*	2400	€	up to 50%	thermal energy consumptions for DHW production
	Replace electrical boilers with heat pumps	1500	€/kW	0,0	kW	0	€		
√	Install building automation system (automatic centralized control of a building's heating, ventilation and air conditioning, lighting)	25	€/m2	3706,0	m2	92650	€	up to 15%	overall consumptions [depending on technology installed]
✓	Change end-user behaviour: control devices stand-by (monitors, PCs, laboratory equipment, lights, etc.)	0	€			0	€	-2÷5%	electricity consumptions

^{*=} estimated values

Table 36 - Priorities of interventions, standard costs per intervention and energy consumptions reductions. Items with * are referred to estimated values





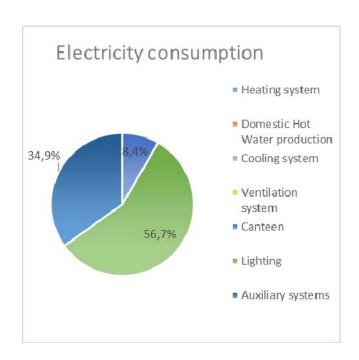
**Most relevant energy consumption reduction

Lamp replacement with LED

	Q[kWh_t/year]
Current situation	50241,73029
After intervention	26470,10357
Energy consumption reduction [%]	-47%

Electrical energy reduction with PV system

	Q[kWh_el/year]
Current situation	172789,57
Energy produced by RES	22000
After intervention	150789,57
Eletrical energy reduction [%]	-13%



Picture 127 - Pie Graph of Electrical consumptions subdivision [%] for each final intended use

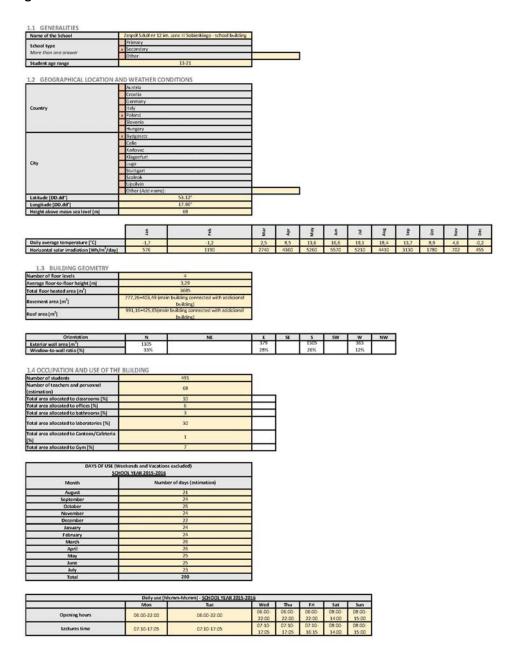




5. Inventory: all data set

5.1. Secondary school "Zespół Szkół nr 12 im. Jana III Sobieskiego, General Education Schools Team" (Junior High School and High School)

DataSet1: information about geographical location, building geometry and typical use of the school building.







DataSet2: information about energy consumption, related to different energy carriers/fuels or systems.

					SCHOOL Y	EAR 2015-201	6							
Energy carrier/Fuel/Power source		Aug-15	Sep-15	Oct-15	Nov/15	Dec-15	Jan-16	Feb/16	Mar/16	Apr/16	may-16	Jun-16	Jul-16	TOT
. Electricity [kWh _e]	1		2524		1421		4993	5433			2601	()	6037	23009
o. Natural gas [Sm ³]	1											g .		
. Fuel oil/Diesel [kg]	i													
I. GPL [kg]	1													
e. Biomass [kg]	1	-		1										
f. District heating [kWh _t]	1	1583	2917	35667	39361	40611	67861	49472	45500	24111	7667	3583	3222	321556
	1	1303	4317	33007	33301	40011	07801	43472	43300	27111	7007	3303	3666	361330
g. District cooling [kWh _t]				5 .										
n. Photovoltaics [kWh _e]	Produced			2 1					8 8			4		
G 47	Consumed	_												
. Solar thermal collectors [kWh,]	Produced													
	Consumed		- 3	1								4		
. Geothermal energy [kWh _t]	Produced													
	Consumed											2		
k. Other carrier/fuel/power source*											1			
specify the measuring unit														
							2							
		1				EAR 2014-201		11.00						we v
Energy carrier/Fuel/Power source		Aug-14	Sep-14	Oct-14	Nov/14	Dec-14	Jan-15	feb-15	mar-15	apr-15	may-15	Jun-15	Jul-15	TOT
a. Electricity [kWhe]	l	\vdash	2590		2044		5312		5430		5432		2742	23550
b. Natural gas [Sm3]	l													
c. Fuel oil/Diesel [kg]	1	_										8		
d. GPL [kg]	1	_												
e. Biomass [kg]	1			7								7		
f. District heating (kWht)	1	3556	3972	21500	41083	57889	53667	48861	39778	28194	8667	4083	2611	313861
g. District cooling [kWht]														
h. Photovoltaics [kWhe]	Produced		¥	1					8 8		3			
ii. Pilotovoitaits (kwiie)	Consumed													
i. Solar thermal collectors [kWht]	Produced													
i. Solai diermai conectors [kwiit]	Consumed	9		3								8		j .
j. Geothermal energy [kWht]	Produced	3							E 3		8	8		1
j. Geothermai energy [kwnt]	Consumed													
k. Other carrier/fuel/power source*													^	
k. Other carrier/rue/power source-														
specify the measuring unit														
					SCHOOL Y	EAR 2013-201	4							
Energy carrier/Fuel/Power source		Aug-13	Sep-13	Oct-13	Nov/13	Dec-13	Jan-14	feb-14	mar-14	apr-14	may-14	Jun-14	Jul-14	TOT
a. Electricity [kWh _e]	1		967		4.123		1.698		4.231		5.113	8	3.506	19.638
b. Natural gas [Sm³]	1		8	1										
c. Fuel oil/Diesel [kg]	1			4							7	7		
d. GPL [kg]	1													
e. Biomass [kg]	1													
f. District heating [kWh _t]	1	1389	9944	22389	43556	48667	68056	46028	35667	20667	11528	3611	3306	314806
		1303	3344	25303	43330	46007	00030	40020	33007	20007	11320	3011	3300	314000
g. District cooling [kWh _t]														
h. Photovoltaics [kWh _a]	Produced											et +		
	Consumed													
. Solar thermal collectors [kWh,]	Produced													
	Consumed		8				11		4		1	9	6	
. Geothermal energy [kWh _e]	Produced													
	Consumed		1	4 1					1			8		1
c. Other carrier/fuel/power source*			9						2			4		
specify the measuring unit														





DataSet3: information about building envelope characteristics, heating and cooling systems, lighting and auxiliary systems.

Building structure								
		<1940						
		1940-1950						
		1950-1960						
	U	1960-1970						
a. Year of construction	×	1970-1980						
a. Year of construction		- TANA AND AND AND AND AND AND AND AND AND						
		1980-1990						
		990-2000						
		2000-2010						
		>2010						
		Load bearing masonry wall						
	х	Reinforced concrete structure						
		Steel frame structure						
b. Type of structure		Wood framed						
		Prefab modules						
		Other:						
		other.						
External walls								
		Traditional fired-clay brick masonry						
		Cavity wall						
		Concrete hollow blocks						
		Fired-clay hollow blocks						
a. Type		Prefab wall (sandwich)						
1.5								
	\vdash	Prefab wall (concrete)						
	х	Other: reinforced concrete						
		(add U value)						
		No insulation						
b. Insulation		Low [2-5 cm]						
D. Ilisulation		Medium [5-10 cm]						
s	x	High [>10 cm]						
		Light						
c. Main external coloring	х	Medium						
		Dark						
Roofs								
		Wooden roof						
		Mixed structure of hollow brick and concrete						
a. Type	х	Concrete flat roof (accessible plane)						
		Other:						
		(add U value)						
		No insulation						
2		Low [2-5 cm]						
b. Insulation		Medium [5-10 cm]						
	×	High [>10 cm]						
	^							
a Main automatical and		Light						
c. Main external coloring	Х	Medium						
	-	Dark						
Basement								
		Basement on crawl space/Floor on ground						
		Hollow-core concrete floor on pilotis						
a. Type								
	х	Basement on under-ground cavity						
		Other:						
		No insulation						
20 0 24 K		Low [2-5 cm]						
b. Insulation		Medium [5-10 cm]						
	X	High [>10 cm]						





Windows							
		Wood					
a. Frame	X	PVC					
a. ridille		Aluminium					
		Steel					
		Single pane glass					
10 100		Laminated glass					
b. Glass	X	Double pane glass					
		Triple pane glass					
		Other:					
	х	Good/New					
c. Condition		Medium					
		Bad/Old					
		External curtain					
d. Solar shading	х	Internal curtain					
u. Joiai Silauliig	х	Blinds					
		Shutters					

3.2 HVAC - HEATING, VENTILATING AND AIR CONDITIONING

Heating system		
a. District heating?	Х	Yes
a. District fleating:		No
b. Combined heating+domestic hot		Yes
water?		No
		Natural gas boiler
		Oil/GPL boiler
c. Heat generation system		Heat pump
More than one answer		Ground coupled heat pump (geothermal)
wore than one answer		Electrical heating
		Biomass boiler
		Cogeneration
		Electricity
		Natural gas
d. Energy carrier/Fuel		Fuel oil/Diesel/GPL
More than one answer		Biomass
		Solar thermal power
		Geothermal power
e. Total installed thermal* power [kW]		
		Air/air
		Air/water
f. Type of Heat Pump (if Heat pump is		Water/air
selected)		Water/water
		Brine/air (if geothermal)
		Brine/water (if geothermal)
g. Year of installation/retrofit		
		Floor/ceiling radiant panels
h. Emission system		Radiators
***		Fan coils
i. Control system		Not present
More than one answer		On/off
		External climate probe
		Zone thermostat
		Thermostatic Valves





j. T set-point ON (Suggested value: 20°C) [°C]							
k. T set-point during closing hours							
I. Winter period [dd.mm-dd.mm]							
m. Starting external temperature the		ger o	-2	7701	_		
	Mon	Tue	Wed	Thu	Fri	Sat	Sun
n. Time of use [hh:mm-hh:mm]	06:00-	06:00-	06:00-	06:00-	06:00-	08:00-	08:00-
	22:00	22:00	22:00	22:00	22:00	14:00	15:00

Domestic Hot Water					
	Electrical boiler				
	Natural gas boiler				
	Oil/GPL boiler				
a. Heat generation system	Heat pump				
More than one answer	Ground coupled heat pump (geothermal)				
	Solar thermal collectors				
	Biomass boiler				
	Cogeneration				
	Electricity				
	Natural gas				
	Fuel oil/Diesel/GPL				
b. Energy carrier/Fuel	Biomass				
	Solar thermal power				
	Geothermal power				
c. Installed power [kW]					
(if Heat pump is selected)	Air/air				
d. Type of Heat Pump	Air/water				
	Water/air				
	Water/water				
	Brine/air (if geothermal)				
	Brine/water (if geothermal)				
e. Year of installation/retrofit	2006				
f. N of users	491				
g. N of showers	7				
h. Average daily use of the gym [h/day]					

Cooling system							
a Caeling system?	X	Yes					
a. Cooling system?		No					
b. District cooling?		Yes					
b. District cooling:	X	No					
c. Cooling generation system		Heat pump					
		Trigeneration	Trigeneration				
50.000	×	Other:	3 classrooms have it's own device				
	X	Electricity					
d. Energy carrier/Fuel		Natural gas/Fuel oil/Diesel/GPL					
u. Ellergy Carrier/Fuer		Geothermal					
		Solar thermal collectors					
o Cooling gonoration system		Centralised					
e. Cooling generation system		One for each room					
		Air/air					
		Air/water					
f Time of Heat Divine (automatività)		Water/air					
f. Type of Heat Pump (external unit)		Water/water					
		Brine/air (if geothermal)					





	Brine/water (if geothermal)
g. Total installed electrical power [kW]	
h. Year of installation/retrofit	
i. Emission system	Radiant ceiling
	Fan coils
	Not present
: Control outtons	On/off
j. Control system More than one answer	External climate probe
wore than one answer	Zone thermostat
	Thermostatic Valves
 k. Percentage of the floor space cooled above the total floor heated area [%] 	

Ventilation		
a. Controlled mechanical ventilation		Yes
unit?	х	No
b. Type of ventilation		Mechanical ventilation without heat recovery system
b. Type of ventuation		Mechanical ventilation with heat recovery system (HRS)
c. (If HRS is present) Year of installation		
d. Percentage of the floor space ventilated above the total floor heated area [%]		

3.3 LIGHTING AND AUXILIARY SYSTEMS

Lighting					
		× 0 0 E	OOEE	0 > E	Tat.
	Traditional incandescent light				
	Halogen light bulbs				
a. Type	Fluorescent tubes	x(287)	x (106)		
	Compact fluorescent light (CFL)	x (62)	x (2)		
	LED	ays ON x 5			
	Always ON				
b. Control	Manual	х	х	х	
b. Control	Manual on and automatic off				
	Automatic				
c. Number of lights		349	113	60	

Canteen	
a. N of hot meals per day	
h Engrand comica /fivel/power course	Electricity
b. Energy carrier/fuel/power source used to cook	Natural gas
used to cook	GPL

Equipment and machineries			
	[number]	Typical power [W]	Average daily hours
a. PCs	121		6
b. Projectors/Light boards	14+2		4
c. Printers/copiers	34		2
d. Vending machines	1		2



Other RES a. Type

c. Year of installation

a. Type b. Power



e. Coolers (in canteen, cafeteria)		4	350	24				
f. Elevators								
g. Laboratories		(Brief description of equipment installed with power, time of use)						
		There are four specialist laboratories in which are located sets of electrica						
h. Other								
3.4 ON SITE RENEWABLE ENER	GΥ	SOURCES (RES) INSTALLED	1					
PV systems								
a. PV cells		Yes						
	Х	No Ciliana mana amatallina						
b. Cells typology	Н	Silicon mono-crystalline Silicon poly-crystalline						
b. Cells typology	Н	Silicon amorphous						
c. Power installed [kW]	Т							
d. Year of installation	T							
e. PV cells area [m²]	Г							
f. Slope [°]								
g. Orientation [N,NE,E,SE,S,SW,W,NW								
Solar thermal collectors		Yes						
a. Solar thermal system	×	No						
b. Power installed [kW]								
c. Collector area [m²]	T							
d. Year of installation	Т							
e. Slope [°]								
f. Orientation [N,NE,E,SE,S,SW,W,NW]								
g. Hot water storage [L]	I							





5.2. Secondary school "Zespół Szkół Budowlanych im. J. Gagarina ul. Jana Pestalozziego 18. Technical School, Vocational Schools Team"

DataSet1: information about geographical location, building geometry and typical use of the school building.

Name of the School	Zespół	Szkół]									
School type	Primary]									
More than one answer	x Secondar	y										
	Other:											
Student age range	16-	20	1									
.2 GEOGRAPHICAL LOCATION	AND WEAT	HED CON	DITIONS									
.2 GEOGRAPHICAL LOCATION	Austria	HER CON	I									
	Croatia		ł									
	Germany		ł									
Country	Italy	_	i									
	x Poland		1									
	Slovenia		ı									
	Hungary		1									
	x Bydgoszc	t	1									
	Celle		1									
	Karlovac	9	1									
	Klagenfur	t	1									
City	Lugo]									
	Stuttgart]									
	Szolnok		1									
	Ujszilvás			_	r .							
Latitude [DD.dd*]	S3.	id name):	11		l,							
Longitude [DD.dd*]	18.0	-	ł									
Height above mean sea level [m]	4.		1									
resigne above mean sea level [III]												
	FE	Feb	Mar	Apr	May	Jun	2	Aug	Sep	Oct	Nov	
Daily average temperature [°C]	-1,7	-1,2	2,5	8,5	13,6	16,6	19,1	18,4	13,7	8,9	4,6	-
Horizontal solar irradiation (Wh/m²/d		1190	2740	4360	5260	5570	5210	4410	3130	1780	702	4

1.3	BUIL	DING	GEOM	ETRY

Number of floor levels	4	ī
Average floor-to-floor height [m]	3,2	Ī
Total floor heated area [m²]	5747	Ī
Basement area [m²]	2622	ī
Roof area [m²]	3253	Ī

Orientation	N	NE	E	SE	5	SW	W	NW
Exterior wall area [m²]	1231	0	1089	0	1221	0	1089	0
Window-to-wall ratio [%]	24	0	31	0	20	0	41	0

1.4 OCCUPATION AND USE OF THE BUILDING

Number of students	416	
Number of teachers and personnel (estimation)	84	
Total area allocated to classrooms [%]	27	
Total area allocated to offices [%]	12	- 70
Total area allocated to bathrooms [%]	2	
Total area allocated to laboratories [%]	0	
Total area allocated to Canteen/Cafeteria [%]	0,5	
Total area allocated to Gym [%]	5	

DAYS OF USE (Weekends an SCHOOL YEAR 2	
Month	Number of days (estimation)
August	31
September	30
October	31
November	30
December	31
January	31
February	28
March	31
April	30
May	31
June	30
July	31
Total	365

Opening hours 24:00 24:00 24:00 24:00 24:00 24:00 24:00 24:00				Thu	Fri	Sat	Sun
Opening hours 24:00 24:00 24:00 24:00 24:00 24:00 24:00 24:00	0.00						
		C 100 (00 (00 (00 (00 (00 (00 (00 (00 (00	700000000	95000000	1100000000	310110000	0:00-
						-	24:00
Lectures time			24:00 24:00 7:00- 7:00-	24:00 24:00 24:00 7:00- 7:00- 7:00-	24:00 24:00 24:00 24:00 7:00- 7:00- 7:00- 7:00-	24:00 24:00 24:00 24:00 24:00 7:00- 7:00- 7:00- 7:00- 7:00-	24:00 24:00 24:00 24:00 24:00 24:00 7:00- 7:00- 7:00- 7:00- 7:00- 8:00-





DataSet2: information about energy consumption, related to different energy carriers/fuels or systems.

				S	CHOOL YEAR	2015-2016								
Energy carrier/Fuel/Power source		Aug-15	Sep-15	Oct-15	Nov/15	Dec-15	Jan-16	feb-16	mar-16	apr-16	may-16	Jun-16	Jul-16	TOT
. Electricity [kWh _a]														71784
b. Natural gas [Sm³]														
c. Fuel oil/Diesel [kg]														
d. GPL [kg]														
e. Biomass [kg]														
f. District heating [kWh _t]		8806	9694	91111	109889	92167	151250	107583	99750	76556	22000	5917	5583	780306
		8806	3034	91111	103003	92167	151230	107363	39730	76336	22000	3917	2203	780306
g. District cooling [kWh _t]														
h. Photovoltaics [kWh,]	Produced							- 3	8					1
	Consumed					9		3)						4
i. Solar thermal collectors [kWh,]	Produced													
,	Consumed													
j. Geothermal energy [kWh,]	Produced									į.				
) acomermia energy (mms)	Consumed				- 3	2		- 3						i i
k. Other carrier/fuel/power source*														
*specify the measuring unit						_								
The state of the s														
				50	CHOOL YEAR	2014-2015								
Energy carrier/Fuel/Power source		Aug-14	Sep-14	Oct-14	Nov/14	Dec-14	Jan-15	feb-15	mar-15	apr-15	may-15	Jun-15	Jul-15	TOT
a. Electricity [kWhe]		1.08-2-4	5.07	54-14		500-24	TURE LA			opzo		JUIL ED	JU. 23	75373
b. Natural gas [Sm3]									E					10010
c. Fuel oil/Diesel [kg]													_	
d. GPL [kg]		-												
e. Biomass [kg]														
f. District heating [kWht]		3694	4417	73444	106556	131111	134500	114972	81194	61500	26722	8389	8389	754889
g. District cooling [kWht]		3034	9917	/3444	100550	131111	134300	114372	01134	01500	20722	0303	0303	7,54003
g. District cooling (KWIII)	Produced	_							-					
h. Photovoltaics [kWhe]	Consumed	_	-	-										
THE STATE OF THE S	Produced	_	-	_	_									
i. Solar thermal collectors [kWht]	Consumed	_	_	_	_		_						_	-
	Produced	_	_						0		_			
j. Geothermal energy [kWht]	Consumed	_			-	4								
- 2 22 2	Consumed	_		-										
k. Other carrier/fuel/power source*														
*specify the measuring unit														
specify the meaning one						10								
				SI	CHOOL YEAR	2013,2014								
Energy carrier/Fuel/Power source		Aug-13	Sep-13	Oct-13		Dec-13	Jan-14	feb-14	mar-14	apr-14	may-14	Jun-14	Jul-14	TOT
a. Electricity [kWh _a]		Aug 13	Jep 23	Ott 13	1101/13	Dec 15	2011 Z-1	100 24	mui 24	upi z-t	may 24	Juli 24	701 24	
		\vdash	_	_										7311
b. Natural gas [Sm³]														
c. Fuel oil/Diesel [kg]				_										
d. GPL [kg]						2			8					
e. Biomass [kg]					- 3									
f. District heating [kWh _t]		5000	22972	78417	109806	102778	149528	101833	89389	67500	22111	4000	3389	756722
g. District cooling [kWh _t]					1	ā		8	Ş				- 5	4
	Produced				- 8	() ==			9				- 5	
h. Photovoltaics [kWh _e]	Consumed													
	Produced													
i. Solar thermal collectors [kWh _t]	Consumed												- 7	
	Produced				- 2				8.					6
j. Geothermal energy [kWh _t]	Consumed								9					U.
k. Other carrier/fuel/power source*														
specify the measuring unit														





DataSet3: information about building envelope characteristics, heating and cooling systems, lighting and auxiliary systems.

D. Haling a street of the stre								
Building structure								
		<1940						
		1940-1950						
		1950-1960						
	Х	1960-1970						
a. Year of construction		1970-1980						
		1980-1990						
		1990-2000						
		2000-2010						
		>2010						
	X	Load bearing masonry wall						
		Reinforced concrete structure						
b. Type of structure		Steel frame structure						
b. Type of structure		Wood framed						
		Prefab modules						
		Other:						
External walls								
	Х	Traditional fired-clay brick masonry						
		Cavity wall						
		Concrete hollow blocks						
a. Type		Fired-clay hollow blocks						
.,,,,,		Prefab wall (sandwich)						
		Prefab wall (concrete)						
		Other:						
		(add U value)						
	X	No insulation						
b. Insulation		Low [2-5 cm]						
b. Ilisulation		Medium [5-10 cm]						
		High [>10 cm]						
		Light						
c. Main external coloring		Medium						
	X	Dark						
Roofs	_	water						
	Н	Wooden roof						
		Mixed structure of hollow brick and concrete						
a. Type	X	Concrete flat roof (accessible plane)						
		Other:						
	-	(add U value) No insulation						
	X							
b. Insulation		Low [2-5 cm]						
	H	Medium [5-10 cm]						
	+	High [>10 cm]						
a Main outcomel coloris		Light						
c. Main external coloring		Medium Dark						
	X	Ddiv						
Basement								
		Basement on crawl space/Floor on ground						
5		Hollow-core concrete floor on pilotis						
a. Type		Other:						
	х	(add U value) Basement on under-ground cavity						
Š	х	No insulation						
		Low [2-5 cm]						
b. Insulation		Medium [5-10 cm]						
		High [>10 cm]						





Windows							
		Wood					
a. Frame	Х	PVC					
a. Flattie		Aluminium					
		Steel					
		Single pane glass					
b. Glass		Laminated glass					
b. Glass	X	Double pane glass					
		Triple pane glass					
		Other: (add U _{window} value)					
		Good/New					
c. Condition		Medium					
	x	Bad/Old					
		External curtain					
d. Solar shading	X	Internal curtain					
u. Joiai silauliig	X	Blinds					
	X	Shutters					

3.2 HVAC - HEATING, VENTILATING AND AIR CONDITIONING

Heating system		
a. District heating?	Х	Yes
		No
b. Combined heating+domestic hot	х	Yes
water?		No
		Natural gas boiler
		Oil/GPL boiler
c. Heat generation system		Heat pump
More than one answer		Ground coupled heat pump (geothermal)
Wore than one answer		Electrical heating
		Biomass boiler
		Cogeneration
		Electricity
d. Energy carrier/Fuel More than one answer		Natural gas
		Fuel oil/Diesel/GPL
		Biomass
		Solar thermal power
		Geothermal power
e. Total installed thermal* power [kW]		
		Air/air
		Air/water
f. Type of Heat Pump (if Heat pump is		Water/air
selected)		Water/water
		Brine/air (if geothermal)
		Brine/water (if geothermal)
g. Year of installation/retrofit		
		Floor/ceiling radiant panels
h. Emission system		Radiators
		Fan coils
i. Control system		Not present
More than one answer		On/off
		External climate probe
		Zone thermostat
		Thermostatic Valves





j. T set-point ON (Suggested value: 20°C) [°C]							
k. T set-point during closing hours							
l. Winter period [dd.mm-dd.mm]							
m. Starting external temperature the heating turns ON (Suggested value: 12°C) [°C]							
	Mon	Tue	Wed	Thu	Fri	Sat	Sun
n. Time of use [hh:mm-hh:mm]	07:00-	07:00-	07:00-	07:00-	07:00-	08:00-	
	22:00	22:00	22:00	22:00	22:00	22:00	

Domestic Hot Water						
	Electrical boiler					
	Natural gas boiler					
	Oil/GPL boiler					
a. Heat generation system	Heat pump					
More than one answer	Ground coupled heat pump (geothermal)					
	Solar thermal collectors					
	Biomass boiler					
	Cogeneration					
	Electricity					
b. Energy carrier/Fuel	Natural gas					
	Fuel oil/Diesel/GPL					
	Biomass					
	Solar thermal power					
	Geothermal power					
c. Installed power [kW]						
(if Heat pump is selected)	Air/air					
d. Type of Heat Pump	Air/water					
	Water/air					
	Water/water					
	Brine/air (if geothermal)					
	Brine/water (if geothermal)					
e. Year of installation/retrofit	1963					
f. N of users	420					
g. N of showers	4					
h. Average daily use of the gym [h/day]						

Cooling system							
a. Cooling system?		Yes					
a. Cooling system?		No					
b. District cooling?		Yes					
b. District cooling:	X	No					
		Heat pump					
c. Cooling generation system		Trigeneration					
		Other:					
		Electricity					
d. Energy carrier/Fuel		Natural gas/Fuel oil/Diesel/GPL					
d. Ellergy Carrier/Fuel		Geothermal					
		Solar thermal collectors					
a Cooling generation system		Centralised					
e. Cooling generation system		One for each room					
		Air/air					
		Air/water					
f Time of Heat Dimen (automaticula)		Water/air					
f. Type of Heat Pump (external unit)		Water/water					





	Brine/air (if geothermal)
	Brine/water (if geothermal)
g. Total installed electrical power [kW]	
h. Year of installation/retrofit	
i. Emission system	Radiant ceiling
	Fan coils
	Not present
j. Control system	On/off
More than one answer	External climate probe
Wore than one answer	Zone thermostat
	Thermostatic Valves
k. Percentage of the floor space cooled above the total floor heated area [%]	

Ventilation		
a. Controlled mechanical ventilation		Yes
unit?	х	No
b. Type of ventilation		Mechanical ventilation without heat recovery system
		Mechanical ventilation with heat recovery system (HRS)
c. (If HRS is present) Year of installation		
d. Percentage of the floor space ventilated above the total floor heated area [%]		

3.3 LIGHTING AND AUXILIARY SYSTEMS

Lighting						
		Rooms (classroom, offices, laboratories)	Common spaces (corridors, atrium, canteen)	Gym	External	
	Traditional incandescent light	x (15)	x (7)			
	Halogen light bulbs			x (24)		
a. Type	Fluorescent tubes	x (292)	x (86)			
	Compact fluorescent light (CFL)					
	LED				x (10)	
	Always ON					
b. Control	Manual	Х	Х	Х		
	Manual on and automatic off					
	Automatic				Х	
c. Number of lights		307	93	24	10	

Canteen	
a. N of hot meals per day	
h Enganism for all accounts accounts	Electricity
b. Energy carrier/fuel/power source used to cook	Natural gas
	GPL





Equipment and machineries		,	
	[number]	Typical power [W]	Average daily hours of use [h/day]
a. PCs	110	500	5
b. Projectors/Light boards	23	200	2
c. Printers/copiers	25	300	2
d. Vending machines	2	1800	2
e. Coolers (in canteen, cafeteria)	2	250	24
f. Elevators	0		
	(Brief description of equipm	ent installed with pow	er, time of use)
g. Laboratories			
h. Other	1	2000	2

3.4 ON SITE RENEWABLE ENERGY SOURCES (RES) INSTALLED

PV systems		
a. PV cells		Yes
a. PV Cells	X	No
		Silicon mono-crystalline
. Cells typology		Silicon poly-crystalline
		Silicon amorphous
c. Power installed [kW]		
d. Year of installation		
e. PV cells area [m²]		
f. Slope [°]		
g. Orientation [N,NE,E,SE,S,SW,W,N	IW]	

a. Solar thermal system	Yes
a. Joiai tilerillai system	x No
b. Power installed [kW]	
c. Collector area [m²]	
d. Year of installation	
e. Slope [°]	
f. Orientation [N,NE,E,SE,S,SW,W,	NW]
g. Hot water storage [L]	

Ot	Other RES					
a.	Туре					
b.	Power					
c.	Year of installation					





5.3. Primary school "Zespół Szkół Ogólnokształcących nr 4, General Education Schools Team" - Main school building

DataSet1: information about geographical location, building geometry and typical use of the school building.

1.1	G			KΑ	-	٠.	ES
Nar	ne	of t	the	Sc	ho	ool	16

Name of the School	Zespôł Szkôł	
Eshard house	Primary	
School type More than one answer	x Secondary	
wore than one answer	Other:	
Student age range	13-19	

1.3 GEOGRAPHICAL LOCATION AND WEATHER CONDITIONS

·	Austria	
	Croatia	
	Germany	
Country	Italy	
	x Poland	
	Slovenia	
	Hungary	
	x Bydgoszcz	
	Celie	
	Karlovac	
	Klagenfurt	
City	Lugo	
	Stuttgart	
	Szolnok	
	Ujszilvás	
10 VI	Other (Add name):	
Latitude [DD.dd*]	53.12°	
Longitude [DD.dd*]	17.97°	
Height above mean sea level [m]	66	

	ner	Feb	Mar	Apr	May	nır	Pr	Aug	Sep	Oct.	Nov	Dec
Daily average temperature [°C]	-1,7	-1,4	2,5	8,5	13,6	16,6	19,1	18,4	13,7	8,9	4,6	-0,2
Horizontal solar irradiation [Wh/m²/day]	576	1190	2740	4360	5260	5570	5210	4410	3130	1780	702	455

1.3 BUILDING GEOMETRY

Number of floor levels	4
Average floor-to-floor height [m]	3,25
Total floor heated area [m²]	3646,4
Basement area [m²]	1744,3
Roof area [m²]	2034,9

Orientation	N	NE	E	SE	5	SW	W	NW
Exterior wall area [m ²]	840	0	480	132	840	0	480	212
Window-to-wall ratio [%]	41	0	19	45	42	0	18	12

1.4 OCCUPATION AND USE OF THE BUILDING

Number of students	467	
Number of teachers and personnel (estimation)	57	
Total area allocated to classrooms [%]	37	
Total area allocated to offices [%]	6	
Total area allocated to bathrooms [%]	4	
Total area allocated to laboratories [%]	0	
Total area allocated to Canteen/Cafeteria [%]	2	
Total area allocated to Gym [%]	8	_

DAYS OF USE (Weekends an SCHOOL YEAR)	
Month	Number of days (estimation)
August	0
September	22
October	21
November	19
December	16
January	21
February	7
March	15
April	21
May	15
June	18
July	0
Total	175

Dail	Daily use [hh:mm-hh:mm] - SCHOOL YEAR 2015-2016								
	Mon	Tue	Wed	Thu	Fri	Sat	Sun		
O	6:00-	6:00-	6:00-	6:00-	6:00-				
Opening hours	22:00	22:00	22:00	22:00	22:00				
I manuscrations	7:10-	7:10-	7:10-	7:10-	7:10-		40		
Lectures time	15:05	15:05	15:05	15:05	15:05				





DataSet2: information about energy consumption, related to different energy carriers/fuels or systems

				SCH	OOL YEAR									
Energy carrier/Fuel/Power source		Aug-15	Sep-15	Oct-15	Nov/15	Dec-15	Jan-16	feb-16	mar-16	apr-16	may-16	Jun-16	Jul-16	TOT
a. Electricity [kWh _e]			3705		10249		10095		8568		7735		4330	44682
b. Natural gas [Sm³]														
c. Fuel oil/Diesel [kg]														
d. GPL [kg]														
e. Biomass [kg]														
f. District heating [kWh _t]		6472	52750	32833	45334	45889	74888	53334	50695	27139	11722	8445	8083	417584
g. District cooling [kWh _t]														
h. Photovoltaics [kWh _a]	Produced													
n. Photovoitaits [kwin _e]	Consumed													
i. Solar thermal collectors [kWh,]	Produced													
i. Join the mar conectors [kwing]	Consumed													
j. Geothermal energy [kWh _t]	Produced													
j. Geodiermarenergy (xvvvij	Consumed			100						100				
k. Other carrier/fuel/power source*														
*specify the measuring unit														
				SCH	OOL YEAR	2014-2015								
Energy carrier/Fuel/Power source		Aug-14	Sep-14	Oct-14	Nov/14	Dec-14	Jan-15	feb-15	mar-15	apr-15	may-15	Jun-15	Jul-15	TOT
a. Electricity [kWhe]			4615		10884		10818		10967		6110		6247	49641
b. Natural gas [Sm3]				į.		į.								
c. Fuel oil/Diesel [kg]														
d. GPL [kg]														
e. Biomass [kg]														
f. District heating [kWht]		6667	6111	24111	45639	56333	65083	54250	43445	32972	12666	5861	4944	358082
g. District cooling [kWht]														
h. Photovoltaics [kWhe]	Produced													
ii. Thotovoidalis [kwine]	Consumed													
i. Solar thermal collectors [kWht]	Produced													
	Consumed													
j. Geothermal energy [kWht]	Produced													
,	Consumed	_												
k. Other carrier/fuel/power source*														
*specify the measuring unit														
-specify the measuring unit			8		1			8						
				SCH	OOL YEAR	2013-2014								
Energy carrier/Fuel/Power source		Aug-13	Sep-13	Oct-13	Nov/13	Dec-13	Jan-14	feb-14	mar-14	apr-14	may-14	Jun-14	Jul-14	TOT
a. Electricity [kWh _e]		177	6347		12495		11623		8526		9740		7785	56516
b. Natural gas [Sm³]														
c. Fuel oil/Diesel [kg]														
d. GPL [kg]														
e. Biomass [kg]						2				2				
f. District heating [kWh _t]		5333	13917	28834	48861	56416	71334	52111	38917	24167	16778	7611	6888	371167
g. District cooling [kWh _t]					10001	30.10	1300	54444	30327		30170		0000	4,110,
	Produced													
h. Photovoltaics [kWh _e]	Consumed													
	Produced													
i. Solar thermal collectors [kWh _t]	Consumed													
	Produced													
j. Geothermal energy [kWh,]	Consumed													
k. Other carrier/fuel/power source*														





DataSet3: information about building envelope characteristics, heating and cooling systems, lighting and auxiliary systems.

Building structure		
	<1940	
	1940-1950	
	1950-1960	
	x 1960-1970	
a. Year of construction	1970-1980	
	1980-1990	
	1990-2000	
	2000-2010	
	>2010	
	Load bearing masonry wall	
	Reinforced concrete structure	
b. Type of structure	Steel frame structure	
	Wood framed	
	x Prefab modules	
	Other:	
	•	
External walls		
	Traditional fired-clay brick masonry	
	Cavity wall	
	Concrete hollow blocks	
	Fired-clay hollow blocks	
a. Type	Prefab wall (sandwich)	
	x Prefab wall (concrete)	_
	Other:	_
	(add U value)	
	No insulation	
	Low [2-5 cm]	
b. Insulation	Medium [5-10 cm]	
	x High [>10 cm]	_
	Light	
c. Main external coloring	x Medium	_
c. Main external coloring	Dark	_
1	Dark	
Roofs		
ROOTS	- Wardanasa C	_
	Wooden roof Mixed structure of hollow brick and concrete	_
_ T		_
a. Type	x Concrete flat roof (accessible plane)	
	Other:	
	(add U value) No insulation	
b. Insulation	Low [2-5 cm]	
	Medium [5-10 cm]	
	x High [>10 cm]	
12.5	Light	_
c. Main external coloring	x Medium	
	Dark	
		_
Basement		
	Basement on crawl space/Floor on ground	
a. Type	Hollow-core concrete floor on pilotis	
а. туре	Other: X Basement on-under ground cavity	
	(add U value)	
	No insulation	
E. 1	Low [2-5 cm]	
b. Insulation	Medium [5-10 cm]	
	x High [>10 cm]	
	A MODEL OF THE PROPERTY OF THE	_





Windows							
		Wood					
a. Frame	Х	PVC					
a. Flattic		Aluminium					
		Steel					
		Single pane glass					
b. Glass		Laminated glass					
b. Glass	X	Double pane glass					
		Triple pane glass					
		Other: (add U _{window} value)					
	X	Good/New					
c. Condition		Medium					
		Bad/Old					
		External curtain					
d. Solar shading	X	Internal curtain					
u. Joiai silauliig	X	Blinds					
	X	Shutters					

3.2 HVAC - HEATING, VENTILATING AND AIR CONDITIONING

Heating system	_						
a. District heating?	X	Yes					
a. District fleating.		No					
b. Combined heating+domestic hot water?		Yes					
		No					
		Natural gas boiler					
		Oil/GPL boiler					
c. Heat generation system More than one answer		Heat pump					
		Ground coupled heat pump (geothermal)					
		Electrical heating					
		Biomass boiler					
		Cogeneration					
		Electricity					
		Natural gas					
d. Energy carrier/Fuel		Fuel oil/Diesel/GPL					
More than one answer		Biomass					
		Solar thermal power					
		Geothermal power					
e. Total installed thermal* power [kW]							
		Air/air					
		Air/water					
f. Type of Heat Pump (if Heat pump is		Water/air					
selected)		Water/water					
		Brine/air (if geothermal)					
		Brine/water (if geothermal)					
g. Year of installation/retrofit		2006					
		Floor/ceiling radiant panels					
h. Emission system		Radiators					
		Fan coils					
i. Control system		Not present					
More than one answer		On/off					
		External climate probe					
		Zone thermostat					
		Thermostatic Valves					





j. T set-point ON (Suggested value: 20°C) [°C]							
k. T set-point during closing hours							
l. Winter period [dd.mm-dd.mm]							
m. Starting external temperature the heating turns ON (Suggested value: 12°C) [°C]							
	Mon	Tue	Wed	Thu	Fri	Sat	Sun
n. Time of use [hh:mm-hh:mm]	6:00-	6:00-	6:00-	6:00-	6:00-		1
	22:00	22:00	22:00	22:00	22:00		10.00

Domestic Hot Water						
	Electrical boiler					
	Natural gas boiler					
	Oil/GPL boiler					
a. Heat generation system More than one answer	Heat pump					
	Ground coupled heat pump (geothermal)					
	Solar thermal collectors					
	Biomass boiler					
	Cogeneration					
	Electricity					
b. Energy carrier/Fuel	Natural gas					
	Fuel oil/Diesel/GPL					
	Biomass					
	Solar thermal power					
	Geothermal power					
c. Installed power [kW]						
(if Heat pump is selected)	Air/air					
d. Type of Heat Pump	Air/water					
	Water/air					
	Water/water					
	Brine/air (if geothermal)					
	Brine/water (if geothermal)					
e. Year of installation/retrofit	2006					
f. N of users	467					
g. N of showers	6					
h. Average daily use of the gym [h/day]						

Cooling system							
Cooling system?		Yes					
a. Cooling system?	X	No					
b. District cooling?		Yes					
b. District cooling?	X	No					
		Heat pump					
c. Cooling generation system		Trigeneration					
11 1994		Other:					
		Electricity					
d Cusum samiau/Cust		Natural gas/Fuel oil/Diesel/GPL					
d. Energy carrier/Fuel		Geothermal					
		Solar thermal collectors					
a Capling gonoration system		Centralised					
e. Cooling generation system		One for each room					
		Air/air					
		Air/water					
f Time of Heat Primer (automaticula)		Water/air					
f. Type of Heat Pump (external unit)		Water/water					





	Brine/air (if geothermal)
	Brine/water (if geothermal)
g. Total installed electrical power [kW]	
h. Year of installation/retrofit	
I Emission austam	Radiant ceiling
i. Emission system	Fan coils
	Not present
j. Control system	On/off
More than one answer	External climate probe
Wore than one answer	Zone thermostat
	Thermostatic Valves
k. Percentage of the floor space cooled above the total floor heated area [%]	

Ventilation		
a. Controlled mechanical ventilation		Yes
unit?	X	No
b. Type of ventilation		Mechanical ventilation without heat recovery system
		Mechanical ventilation with heat recovery system (HRS)
c. (If HRS is present) Year of installation		
d. Percentage of the floor space ventilated above the total floor heated area [%]		

3.3 LIGHTING AND AUXILIARY SYSTEMS

Lighting					
		Rooms (classroom, offices, laboratories)	Common spaces (corridors, atrium, canteen)	Gym	External
	Traditional incandescent light				
	Halogen light bulbs			х	Х
a. Type	Fluorescent tubes	х	X		
	Compact fluorescent light (CFL)				
	LED				
	Always ON				
b. Control	Manual	Х	Х	Х	
	Manual on and automatic off				x
	Automatic				
c. Number of lights		455	165	38	10

Canteen				
a. N of hot meals per day				
b. Energy carrier/fuel/power source used to cook	Electricity			
	Natural gas			
used to cook	GPL			





Equipment and machineries		·	
	[number]	Typical power [W]	Average daily hours of use [h/day]
a. PCs	47	500	6
b. Projectors/Light boards	19	200	6
c. Printers/copiers	20	300	2
d. Vending machines	1	1800	2
e. Coolers (in canteen, cafeteria)	1	250	24
f. Elevators	0		
g. Laboratories	(Brief description of equipm	ent installed with pow	er, time of use)
h. Other - washing maschine	1	2000	2

3.4 ON SITE RENEWABLE ENERGY SOURCES (RES) INSTALLED

PV systems		
a. PV cells		Yes
a. PV Cells	х	No
		Silicon mono-crystalline
b. Cells typology		Silicon poly-crystalline
STOCKED AND CONTRACT		Silicon amorphous
c. Power installed [kW]		
d. Year of installation		
e. PV cells area [m²]		
f. Slope [°]		
g. Orientation [N,NE,E,SE,S,SW,W,NW]	

a. Solar thermal system		Yes
a. Joiai tilerillai system	х	No
b. Power installed [kW]		
c. Collector area [m²]		
d. Year of installation		
e. Slope [°]		
f. Orientation [N,NE,E,SE,S,SW,W	,NW]	
g. Hot water storage [L]		

Other RES						
a. Type						
b. Power						
c. Year of installation						





5.4. Primary and Secondary school "Zespół Szkół Ogólnokształcących nr 4, General Education Schools Team" - Swimming pool

DataSet1: information about geographical location, building geometry and typical use of the school building

Name of the School	Zespó	ł Szkół	1									
Fabrual Name	x Primary		1									
School type More than one answer	x Seconda	ry										
More trial one arswer	Other:				1							
Student age range	7	19										
	1177		-									
1.2 GEOGRAPHICAL LOCA	TION AND WEAT	THER CON	DITIONS									
	Austria											
	Croatia]									
	German	/										
Country	Italy		1									
	x Poland		1									
	Siovenia		1									
	Hungary		1									
i i	x Bydgosz	Z	1									
	Celie		1									
	Karlovac		1									
	Klagenfu	rt	1									
City	Lugo		1									
	Stuttgan		1									
	Szolnok		1									
	Ujszilvás		_									
		dd name):			ı							
Latitude [DD.dd ^e]		.12*	-									
Longitude [DD.dd*]		.97*	4									
Height above mean sea level [m]		8	J									
						9	8		3		- 2	т
	Jan	윤	Mar	Apr	May	된	3	Aug	Sep	ö	Nov	ı
Daily average temperature [°C]	-1,7	-1,6	2,5	8,5	13,6	16,6	19,1	18,4	13,7	8,9	4,6	t
Horizontal solar irradiation [Wh/	m ² /day] 576	1190	2740	4360	5260	5570	5210	4410	3130	1780	702	•

	Jan	ag.	Mar	Apr	May	Jun	7	Aug	Sep	Oct.	Nov	ĕ
Daily average temperature [*C]	-1,7	-1,6	2,5	8,5	13,6	16,6	19,1	18,4	13,7	8,9	4,6	-0,2
Horizontal solar irradiation [Wh/m²/day]	576	1190	2740	4360	5260	5570	5210	4410	3130	1780	702	455
						100		7.0				

1.3 BUILDING GEOMETRY	to the
Number of floor levels	3
Average floor-to-floor height [m]	11,6
Total floor heated area [m²]	2024
Basement area [m²]	1404
Roof area [m ²]	1834

Orientation	N	NE	E	SE	S	SW	W	NW
Exterior wall area [m²]	655,4		324,8		655,4	k 3	232	8
Window-to-wall ratio [%]	32		42		46		48	

1.4	OCCUPATION	AND	USE	OF	THE	BUILDING

Number of students	390 and commercial services average 454
Number of teachers and personnel (estimation)	28
Total area allocated to classrooms [%]	10.00
Total area allocated to offices [%]	4,89
Total area allocated to bathrooms [%]	7,06
Total area allocated to laboratories [%]	
Total area allocated to Canteen/Cafeteria [%]	
Total area allocated to Gym [%]	

SCHOOL YEAR 2	
Month	Number of days (estimation)
August	10
September	30
October	31
November	28
December	27
January	29
February	29
March	28
April	30
May	28
June	30
July	31
Total	331

Daily use [hh:mm-hh:mm] - SCHOOL YEAR 2015-2016												
	Mon	Tue	Wed	Thu	Fri	Sat	Sun					
Opening hours	07.00-	07.00-	07.00-	07.00-	07.00-	08.00- 22.00	08.00					
	22.00 07.00-	22.00 07.00-	22.00 07.00-	22.00 07.00-	22.00 07.00-	22.00	22.00					
Lectures time	15.15	15.15	15.15	15.15	15.15	0	0					





DataSet2: information about energy consumption, related to different energy carriers/fuels or systems

Energy carrier/Fuel/Power source		Aug-15	Sep-15	Oct-15	Nov/15	Dec-15	Jan-16	feb-16	mar-16	apr-16	may-16	Jun-16	Jul-16	TOT
. Electricity [kWh _a]		45202							53470		49545			583955
		45202	45202	48506	47706	52121	55589	51672	534/0	50703	49545	48239	36000	583955
Natural gas [Sm³]		-												
Fuel oil/Diesel [kg]		\vdash												
. GPL [kg]														
. Biomass [kg]														
District heating [kWh _t]		31111	60556	96111	105000	93889	140833	130556	120000	96944	86389	59444	56389	1077222
. District cooling [kWh _t]														
Physical Lands (Lands 1	Produced										Š.			
. Photovoltaics [kWh _e]	Consumed													
5 b at a 1 a 1 a 2 a 2 a 2	Produced													
Solar thermal collectors [kWh _t]	Consumed	1												
	Produced													
Geothermal energy [kWh,]	Consumed									į.		i i		
Other carrier/fuel/power source*														
pecify the measuring unit														
				SCH	OOL YEAR	2014-2015								
Energy carrier/Fuel/Power source		Aug-14	Sep-14	Oct-14	Nov/14	Dec-14	Jan-15	feb-15	mar-15	apr-15	may-15	Jun-15	Jul-15	TOT
Electricity [kWhe]					48660	53163	56701	52705	54539	51717	50536	49204	36720	453946
. Natural gas [Sm3]														
Fuel oil/Diesel [kg]														
GPL [kg]														
Biomass [kg]														
District heating [kWht]		0	0	0	70556	91944	97500	91389	116944	105556	63056	71389	60833	769167
. District cooling [kWht]			· ·	-	70330	31344	37300	31303	110344	100000	03030	71303	00033	703107
. District Cooling [KWHL]	Produced	_												
. Photovoltaics [kWhe]	Consumed	_	_											
	Produced	+	_	_	_									
Solar thermal collectors [kWht]		_		_				_						
	Consumed	_	_											
Geothermal energy [kWht]	Produced	_	_	_	_	_								
	Consumed	-												
. Other carrier/fuel/power source*														
specify the measuring unit														
				SCH	OOL YEAR	2013-2014								
Energy carrier/Fuel/Power source		Aug-13	Sep-13	Oct-13	Nov/13	Dec-13	Jan-14	feb-14	mar-14	apr-14	may-14	Jun-14	Jul-14	TOT
Electricity [kWh _e]														
		-		_				_						
. Natural gas [Sm ³]		-	_	_	_			_						
Fuel oil/Diesel [kg]		-												
. GPL [kg]														
. Biomass [kg]														
District heating [kWh _t]		0	0	0	0	0	0	0	0	0	0	0	0	0
District cooling [kWh _t]														
Photovoltaics [kWh _a]	Produced													
. Filotovoltaits [Kwiii _e]	Consumed													
6 1 - d - 1 - B B 1	Produced													
Solar thermal collectors [kWh _t]	Consumed													
	Produced													
Geothermal energy [kWh _t]	Consumed													
Other carrier/fuel/namer remark														
Other carrier/fuel/power source*														
specify the measuring unit														





DataSet3: information about building envelope characteristics, heating and cooling systems, lighting and auxiliary systems.

Suilding structure <1940 1940-1950 1950-1960 1950-1960						
1940-1950						
1950-1960						
1960-1970						
a. Year of construction 1970-1980						
1980-1990						
1990-2000						
2000-2010						
Load bearing masonry wall						
Reinforced concrete structure						
b. Type of structure x Steel frame structure						
wood framed						
Prefab modules						
Other:						
External walls						
Traditional fired-clay brick masonry						
Cavity wall						
Concrete hollow blocks						
Fired-clay hollow blocks						
a. Type Prefab wall (sandwich)						
Prefab wall (concrete)						
Other: brick mensory						
(add U value)						
No insulation						
b. Insulation						
Medium [5-10 cm]						
x High [>10 cm]						
x Light						
c. Main external coloring Medium						
Dark	Dark					
Roofs						
Wooden roof						
Mixed structure of hollow brick and concrete						
a. Type x Concrete flat roof (accessible plane)						
Other:						
(add U value)						
No insulation						
Low [2-5 cm]						
Medium [5-10 cm]						
	High [>10 cm]					
Light						
The Control of the Co	Medium					
c. Main external coloring x Medium						
c. Main external coloring x Medium Dark						
Dark						
Basement Basement on crawl space/Floor on ground Hollow-core concrete floor on pilotis						
Basement Basement on crawl space/Floor on ground Hollow-core concrete floor on pilotis Other:						
Basement Basement on crawl space/Floor on ground Hollow-core concrete floor on pilotis Other: Basement on crawl space/Floor on ground Hollow-core concrete floor on pilotis	,					
Basement Basement on crawl space/Floor on ground Hollow-core concrete floor on pilotis Other: (add U value) Basement on-under ground cavit	/					
Basement Basement on crawl space/Floor on ground Hollow-core concrete floor on pilotis Other: (add U value) No insulation	Y					
Basement Basement on crawl space/Floor on ground Hollow-core concrete floor on pilotis Other: (add U value) Basement on-under ground cavit No insulation Low [2-5 cm]	/					
Basement Basement on crawl space/Floor on ground Hollow-core concrete floor on pilotis Other: (add U value) No insulation Low [2-5 cm]	/					





Windows					
a. Frame		Wood			
		PVC			
	Х	Aluminium			
		Steel			
		Single pane glass			
b. Glass		Laminated glass			
b. Glass		Double pane glass			
	X	Triple pane glass			
		Other: (add U _{window} value)			
	X	Good/New			
c. Condition		Medium			
		Bad/Old			
d. Solar shading	Х	External curtain			
		Internal curtain			
u. Solai Silauliig	X	Blinds			
		Shutters			

3.2 HVAC - HEATING, VENTILATING AND AIR CONDITIONING

3.2 HVAC – HEATING, VENTILATING AND AIR CONDITIONING Heating system						
a District hasting?		Yes				
a. District heating?	х	No				
b. Combined heating+domestic hot		Yes				
water?	х	No				
		Natural gas boiler				
- Harttionto		Oil/GPL boiler				
		Heat pump				
c. Heat generation system More than one answer		Ground coupled heat pump (geothermal)				
		Electrical heating				
		Biomass boiler				
		Cogeneration				
		Electricity				
		Natural gas				
d. Energy carrier/Fuel		Fuel oil/Diesel/GPL				
More than one answer		Biomass				
		Solar thermal power				
		Geothermal power				
e. Total installed thermal* power [kW]						
		Air/air				
		Air/water				
f. Type of Heat Pump (if Heat pump is		Water/air				
selected)		Water/water				
		Brine/air (if geothermal)				
		Brine/water (if geothermal)				
g. Year of installation/retrofit		2015				
	Х	Floor/ceiling radiant panels				
h. Emission system	х	Radiators				
	х	Fan coils				
i. Control system		Not present				
More than one answer	х	On/off				
	х	External climate probe				
	х	Zone thermostat				
	Х	Thermostatic Valves				





j. T set-point ON (Suggested value: 20°C) [°C]				26			
k. T set-point during closing hours			_	26			
I. Winter period [dd.mm-dd.mm]	11.12-19.02						
m. Starting external temperature the heating turns ON (Suggested value: 12°C) [°C]							
- Ti	Mon	Tue	Wed	Thu	Fri	Sat	Sun
n. Time of use [hh:mm-hh:mm]	24/day	24/day	24/day	24/day	24/day	24/day	24/day

Domestic Hot Water				
	Electrical boiler			
a. Heat generation system More than one answer	Natural gas boiler			
	Oil/GPL boiler			
	Heat pump			
	Ground coupled heat pump (geothermal)			
	Solar thermal collectors			
	Biomass boiler			
	Cogeneration			
	Electricity			
	Natural gas			
b. Energy carrier/Fuel	Fuel oil/Diesel/GPL			
	Biomass			
	Solar thermal power			
	Geothermal power			
c. Installed power [kW]				
(if Heat pump is selected)	Air/air			
d. Type of Heat Pump	Air/water			
	Water/air			
	Water/water			
	Brine/air (if geothermal)			
	Brine/water (if geothermal)			
e. Year of installation/retrofit	2015			
f. N of users	0			
g. N of showers	31			
h. Average daily use of the gym [h/day]				

Cooling system						
a. Cooling system?		Yes				
	X	No				
b. District cooling?		Yes				
	Х	No				
		Heat pump				
c. Cooling generation system		Trigeneration				
3 Sept. (1997)		Other:				
d. Energy carrier/Fuel		Electricity				
		Natural gas/Fuel oil/Diesel/GPL				
u. Ellergy Carrier/Fuer		Geothermal				
		Solar thermal collectors				
e. Cooling generation system		Centralised				
e. Cooling generation system		One for each room				
		Air/air				
f. Type of Heat Pump (external unit)		Air/water				
		Water/air				
		Water/water				
		Brine/air (if geothermal)				





	Brine/water (if geothermal)
g. Total installed electrical power [kW]	
h. Year of installation/retrofit	
i. Emission system	Radiant ceiling
i. Emission system	Fan coils
	Not present
: Cambrid arressur	On/off
j. Control system More than one answer	External climate probe
wore than one answer	Zone thermostat
	Thermostatic Valves
 k. Percentage of the floor space cooled above the total floor heated area [%] 	

Ventilation				
a. Controlled mechanical ventilation unit?		Yes		
		No		
b. Type of ventilation		Mechanical ventilation without heat recovery system		
	х	Mechanical ventilation with heat recovery system (HRS)		
c. (If HRS is present) Year of installation		2015		
d. Percentage of the floor space ventilated above the total floor heated area [%]				

3.3 LIGHTING AND AUXILIARY SYSTEMS

Lighting						
		Rooms (classroom, offices, laboratories)	Common spaces (corridors, atrium, canteen)	Gym	External	
	Traditional incandescent light					
	Halogen light bulbs					
a. Type	Fluorescent tubes	Х				
	Compact fluorescent light (CFL)					
	LED	X	Х	X		
	Always ON					
b. Control	Manual	х		Х		
	Manual on and automatic off		×			
	Automatic				V	
c. Number of lights		32	36			

Canteen				
a. N of hot meals per day				
h Engrape comics/fuel/neuros course	Electricity			
b. Energy carrier/fuel/power source used to cook	Natural gas			
used to cook	GPL			

Equ	ipment and	machine	ries





		[number]	[number] Typical power [W]	
a.	PCs			
b.	Projectors/Light boards			
c.	Printers/copiers			
d.	Vending machines	2	360	4
e.	Coolers (in canteen, cafeteria)	1	117 kWh/y	24
f.	Elevators	2	7	16
g.	Laboratories	(Brief description of equipm	ent installed with powe	er, time of use)
h.	Other			
			-	

3.4 ON SITE RENEWABLE ENERGY SOURCES (RES) INSTALLED

PV systems			
a. PV cells			Yes
a. PV Cells		Х	No
			Silicon mono-crystalline
b. Cells typ	oology		Silicon poly-crystalline
Here's			Silicon amorphous
c. Power	installed [kW]		
d. Year of	installation		
e. PV cells	area [m²]		
f. Slope [°]	10		
g. Orienta	tion [N,NE,E,SE,S,SW,W,NW]		

Solar thermal collectors				
a. Solar thermal system	Yes			
a. Joiai theiliai system	x No			
b. Power installed [kW]				
c. Collector area [m²]				
d. Year of installation				
e. Slope [°]				
f. Orientation [N,NE,E,SE,S,SW,W,NW]				
g. Hot water storage [L]				

Other RES				
a. Type				
b. Power				
c. Year of installation				





5.5. Primary and Secondary school "Zespół Szkół nr 10" - Main building

DataSet1: information about geographical location, building geometry and typical use of the school building

Name of the School	Zespół Szkół nr 10 -	
	x Primary	
School type	x Secondary	- 5
More than one answer	Other:	
Student age range	6-15	
.2 GEOGRAPHICAL LOCATIO	N AND WEATHER CO	NDITIONS
L GEOGRAFITICAL EDUATIO	Austria	1
	Croatia	
	Germany	
Country	Italy	- 2
	x Poland	
	Slovenia	
	Hungary	
	x Bydgoszcz	
	Celie	
	Karlovac	
	Klagenfurt	
City	Lugo	- 3
	Stuttgart	-3
	Szolnok	
	Ujszilvás	
	Other (Add name)	
Latitude [DD.dd*]	53.12*	
Longitude [DD.dd*]	18.02*	-
Height above mean sea level [m]	30	

05	Jan	Feb	Mar	Apr	May	Ling.	Pr	Aug	des	Oct	Nov	Dec
Daily average temperature [*C]	-1,7	-1,7	2,5	8,5	13,6	16,6	19,1	18,4	13,7	8,9	4,6	-0,2
Horizontal solar irradiation [Wh/m²/day]	576	1190	2740	4360	5260	5570	5210	4410	3130	1780	702	455

1.3 BUILDING GEOMETRY

2.5 DOILDING GLOWILING	
Number of floor levels	4
Average floor-to-floor height [m]	3,3
Total floor heated area [m²]	3093,54
Basement area [m²]	1102
Roof area [m²]	1107

Orientation	N	NE	E	SE	S	SW	W	NW
Exterior wall area [m²]	957	0	166	0	883	0	151	0
Window-to-wall ratio [%]	23	0	2	0	31	0	27	0

1.4 OCCUPATION AND USE OF THE BUILDING

Number of students	809	
Number of teachers and personnel (estimation)	117	
Total area allocated to classrooms [%]	48	
Total area allocated to offices [%]	5	
Total area allocated to bathrooms [%]	4	
Total area allocated to laboratories [%]	0	
Total area allocated to Canteen/Cafeteria [%]	6	
Total area allocated to Gym [%]	0	

DAYS OF USE (Weekends and Vacations excluded) SCHOOL YEAR 2015-2016					
Month	Number of day: (estimation)				
August	22				
September	22				
October	20				
November	20				
December	22				
January	21				
February	11				
March	23				
April	19				
May	20				
June	21				
July	21				
Total	242				

Daily use [hh:mm-hh:mm] - <u>SCHOOL YEAR 2015-2016</u>										
	Mon	Tue	Wed	Thu	Fri	Sat	Sun			
Ol b	06:00-	06:00-	06:00-	06:00-	06:00-	08:00-	08:00-			
Opening hours	22:30	22:30	22:30	22:30	23:00	15:00	15:00			
1-4	07:00-	07:00-	07:00-	07:00-	07:00-					
Lectures time	16:45	16:45	16:45	16:45	15:05					





DataSet2: information about energy consumption, related to different energy carriers/fuels or systems

y				SC	HOOL YEAR	2015-2016								
Energy carrier/Fuel/Power source		Aug-15	Sep-15	Oct-15	Nov/15	Dec-15	Jan-16	feb-16	mar-16	apr-16	may-16	Jun-16	Jul-16	TOT
a. Electricity [kWh,]	1													798
o. Natural gas [Sm³]	1		672		349		434		340		275		99	2169
c. Fuel oil/Diesel [kg]														
f. GPL [kg]														
e. Biomass [kg]				- 3	1.0						- 1			
f. District heating [kWh ₁]	i	1111	2500	20389	33111	33306	55000	37194	35389	17611	9083	4917	2389	252000
g. District cooling [kWh _t]		****	2300	20000	33111	33300	55555	97 X9-1	35303	27022	3403	45.11	2505	#D#000
g. District cooling [Kwint]		_		_			_	_		_		_		
h. Photovoltaics [kWh _e]	Produced Consumed	+					-				-			1
	1,000,000,000,000	_			4			_						
i. Solar thermal collectors [kWh _t]	Produced	_		_				_		_		_		
X 2	Consumed	_		_										
j. Geothermal energy [kWh _t]	Produced													
	Consumed	_						_		_				
k. Other carrier/fuel/power source*														
specify the measuring unit														
				sc	HOOL YEAR	2014-2015								
Energy carrier/Fuel/Power source		Aug-14	Sep-14	Oct-14	Nov/14	Dec-14	Jan-15	Feb/15	Mar/15	Apr/15	may-15	Jun-15	Jul-15	TOT
a. Electricity [kWhe]														83809
b. Natural gas [Sm3]			530		366		456		357		289		104	2102
c. Fuel oil/Diesel [kg]											200		7	
d. GPL [kg]	1													
e. Biomass [kg]	1													
f. District heating [kWht]	1	278	3611	14222	30556	49278	48139	41750	27528	20417	7194	3000	889	246861
g. District cooling [kWht]		270	3011	14222	30250	43270	40133	41750	27320	20417	7.154	3000	003	240001
g. District cooling [KWIII]	Produced	+			-			_			- 6			-
h. Photovoltaics [kWhe]	Consumed	+			-			_						
Control of the Contro	Produced	+		_				_		_		_		
i. Solar thermal collectors [kWht]	Consumed	+		_			_	_		_		_		
	Produced	+	_					_						
j. Geothermal energy [kWht]		+						_						
	Consumed	_												
k. Other carrier/fuel/power source*														
*specify the measuring unit														
spendy the measuring unit														
				sc	HOOL YEAR	2013-2014								
Energy carrier/Fuel/Power source		Aug-13	Sep-13	Oct-13	Nov/13	Dec-13	Jan-14	feb-14	mar-14	apr-14	may-14	Jun-14	Jul-14	TOT
a. Electricity [kWh,]	1		1/2											82970
b. Natural gas [Sm³]		-	557		385		478		375		303		109	2207
c. Fuel oil/Diesel [kg]		-	557		303		470		313		303		105	2207
d. GPL [kg]	1	\vdash					_	-					C 10	
		\vdash						_					-	
e. Biomass [kg]														
f. District heating [kWh,]		1389	2778	26389	51389	55000	72778	50833	44722	17222	14722	3611	278	341111
g. District cooling [kWh _t]					<u>E</u>							3		1
h. Photovoltaics [kWh _e]	Produced				1			V				N N		
ii. Filocovoitaits [kwii _e]	Consumed				0			J				1		
Solar thormal collectors (ktd-1	Produced													
. Solar thermal collectors [kWh _t]	Consumed													
Control Page 1	Produced											3		
. Geothermal energy [kWh _t]	Consumed			- 0	6							1 0	()	
k. Other carrier/fuel/power source*														





DataSet3: information about building envelope characteristics, heating and cooling systems, lighting and auxiliary systems.

Concrete hollow blocks Prefab wall (concrete)	a. Year of construction b. Type of structure	
1940-1950 1950-1960 1950-1960 1960-1970 1970-1980 1980-1990 1990-2000 2000-2010 >2010 Load bearing masonry wall Reinforced concrete structure Wood framed x Prefab modules Other:	b. Type of structure	
1950-1960 1960-1970 1960-1970 1970-1980 1980-1990 1990-2000 2000-2010 >2010	b. Type of structure	
1960-1970 1970-1980 1980-1990 1990-2000 2000-2010 >2010	b. Type of structure	
a. Year of construction X 1970-1980 1980-1990 1990-2000 2000-2010 > 2010	b. Type of structure	
1980-1990 1990-2000 2000-2010 >2010	b. Type of structure	
1990-2000 2000-2010 >2010		
1990-2000 2000-2010 >2010		
2000-2010 >2010		
b. Type of structure Load bearing masonry wall		
Load bearing masonry wall Reinforced concrete structure Steel frame structure Wood framed x Prefab modules Other: External walls Traditional fired-clay brick masonry Cavity wall Concrete hollow blocks Fired-clay hollow blocks Prefab wall (sandwich) x Prefab wall (concrete) Other: (add U value) No insulation Low [2-5 cm] Medium [5-10 cm]		
B. Type of structure Steel frame structure		
b. Type of structure Wood framed x Prefab modules Other: External walls Traditional fired-clay brick masonry Cavity wall Concrete hollow blocks Fired-clay hollow blocks Prefab wall (sandwich) x Prefab wall (concrete) Other: (add U value) No insulation Medium [5-10 cm]		
b. Type of structure Wood framed X Prefab modules		
External walls Traditional fired-clay brick masonry	External walls	
External walls Traditional fired-clay brick masonry Cavity wall Concrete hollow blocks Fired-clay hollow blocks Prefab wall (sandwich) x Prefab wall (concrete) Other: (add U value) No insulation Low [2-5 cm] Medium [5-10 cm]	External walls	
External walls Traditional fired-clay brick masonry Cavity wall Concrete hollow blocks Fired-clay hollow blocks Prefab wall (sandwich) x Prefab wall (concrete) Other: (add U value) No insulation Low [2-5 cm] Medium [5-10 cm]	External walls	
Traditional fired-clay brick masonry Cavity wall Concrete hollow blocks Fired-clay hollow blocks Prefab wall (sandwich) x Prefab wall (concrete) Other: (add U value) No insulation Low [2-5 cm] Medium [5-10 cm]	External walls	
Traditional fired-clay brick masonry Cavity wall Concrete hollow blocks Fired-clay hollow blocks Prefab wall (sandwich) x Prefab wall (concrete) Other: (add U value) No insulation Low [2-5 cm] Medium [5-10 cm]	External walls	
Cavity wall Concrete hollow blocks Fired-clay hollow blocks Prefab wall (sandwich) X Prefab wall (concrete) Other:		
Concrete hollow blocks Fired-clay hollow blocks Prefab wall (sandwich) x Prefab wall (concrete) Other: (add U value) No insulation Low [2-5 cm] Medium [5-10 cm]		
a. Type Fired-clay hollow blocks Prefab wall (sandwich)		
Prefab wall (sandwich) x Prefab wall (concrete) Other: (add U value) No insulation Low [2-5 cm] Medium [5-10 cm]		
Prefab wall (sandwich)	a. Type	
Other: (add U value) No insulation Low [2-5 cm] Medium [5-10 cm]		
(add U value) No insulation Low [2-5 cm] Medium [5-10 cm]		
b. Insulation No insulation Low [2-5 cm] Medium [5-10 cm]		
b. Insulation Low [2-5 cm] Medium [5-10 cm]		
b. Insulation Medium [5-10 cm]		
Medium [5-10 cm]	h Ingulation	
111-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-	b. Insulation	
x High [>10 cm]		
Light		
c. Main external coloring Medium	c. Main external coloring	
x Dark	out 6. Contract Contr	
Roofs	Roofs	
Wooden roof		
Mixed structure of hollow brick and concrete		
a. Type x Concrete flat roof (accessible plane)	a. Type	
Other:	500 M M M M M M M M M M M M M M M M M M	
(add U value)		
No insulation		
Low [2-5 cm]		
b. Insulation Medium [5-10 cm]	b. Insulation	
High [>10 cm]		
Light		
c. Main external coloring Medium	c. Main external coloring	
x Dark	. Main external coloring	
A Dark		
Basement	Rasement	
Basement on crawl space/Floor on ground	DUSCHIERL	
Hallow-care concrete floor on pilotis	Se Worther	
a. Type	a. Type	
Basement on-under ground cavity		
(add U value)		
No insulation		
b. Insulation Low [2-5 cm]		
Medium [5-10 cm]	b. Insulation	
x High [>10 cm]	b. Insulation	





Windows							
		Wood					
a. Frame	X	PVC					
a. France		Aluminium					
		Steel					
		Single pane glass					
b. Glass		Laminated glass					
b. Glass	X	Double pane glass					
		Triple pane glass					
		Other: (add U _{window} value)					
	X	Good/New					
c. Condition		Medium					
		Bad/Old					
		External curtain					
d. Solar shading		Internal curtain					
u. Joiai silauliig		Blinds					
	X	Shutters					

3.2 HVAC - HEATING, VENTILATING AND AIR CONDITIONING

Heating system						
a. District heating?		Yes				
a. District fleating:	х	No				
b. Combined heating+domestic hot		Yes				
water?	Х	No				
		Natural gas boiler				
		Oil/GPL boiler				
c. Heat generation system		Heat pump				
c. Heat generation system More than one answer		Ground coupled heat pump (geothermal)				
		Electrical heating				
		Biomass boiler				
		Cogeneration				
		Electricity				
		Natural gas				
d. Energy carrier/Fuel More than one answer		Fuel oil/Diesel/GPL				
		Biomass				
		Solar thermal power				
		Geothermal power				
e. Total installed thermal* power [kW]						
		Air/air				
		Air/water				
f. Type of Heat Pump (if Heat pump is		Water/air				
selected)		Water/water				
		Brine/air (if geothermal)				
		Brine/water (if geothermal)				
g. Year of installation/retrofit		2012				
		Floor/ceiling radiant panels				
h. Emission system		Radiators				
		Fan coils				
i. Control system		Not present				
More than one answer		On/off				
		External climate probe				
		Zone thermostat				
		Thermostatic Valves				





j. T set-point ON (Suggested value: 20°C) [°C]				20			
k. T set-point during closing hours				20			
I. Winter period [dd.mm-dd.mm]			1	1.12-19.02			
m. Starting external temperature the heating turns ON (Suggested value: 12°C) [°C]							
-	Mon	Tue	Wed	Thu	Fri	Sat	Sun
n. Time of use [hh:mm-hh:mm]	06:00-	06:00-	06:00-	06:00-	06:00-	08:00-	08:00-
	22:30	23:00	23:30	22:30	23:00	16:00	16:00

Domestic Hot Water							
	Electrical boiler						
	Natural gas boiler						
	Oil/GPL boiler						
a. Heat generation system	Heat pump						
More than one answer	Ground coupled heat pump (geothermal)						
	Solar thermal collectors						
	Biomass boiler						
	Cogeneration						
	Electricity						
b. Energy carrier/Fuel	Natural gas						
	Fuel oil/Diesel/GPL						
	Biomass						
	Solar thermal power						
	Geothermal power						
c. Installed power [kW]							
(if Heat pump is selected)	Air/air						
d. Type of Heat Pump	Air/water						
	Water/air						
	Water/water						
	Brine/air (if geothermal)						
	Brine/water (if geothermal)						
e. Year of installation/retrofit	2012						
f. N of users	809						
g. N of showers	14						
h. Average daily use of the gym [h/day]							

Cooling system							
a. Cooling system?	X	Yes					
a. Cooling system:		No					
b. District cooling?		Yes					
b. District cooling:	x	No					
		Heat pump					
c. Cooling generation system	Trigeneration						
The state of the s		Other:					
		Electricity					
d. Energy carrier/Fuel		Natural gas/Fuel oil/Diesel/GPL					
d. Ellergy carrier/ruer		Geothermal					
		Solar thermal collectors					
e. Cooling generation system		Centralised					
e. Cooling generation system	х	One for each room					
		Air/air					
		Air/water					
f Type of Heat Dumin (systemal unit)		Water/air					
f. Type of Heat Pump (external unit)		Water/water					





	Brine/air (if geothermal)
	Brine/water (if geothermal)
g. Total installed electrical power [kW]	
h. Year of installation/retrofit	
i. Emission system	Radiant ceiling
i. Emission system	Fan coils
	Not present
j. Control system	On/off
More than one answer	External climate probe
Wide than one answer	Zone thermostat
	Thermostatic Valves
 k. Percentage of the floor space cooled above the total floor heated area [%] 	

Ventilation		
a. Controlled mechanical ventilation		Yes
unit?	X	No
h Tuno of contilation		Mechanical ventilation without heat recovery system
b. Type of ventilation		Mechanical ventilation with heat recovery system (HRS)
c. (If HRS is present) Year of installation		
d. Percentage of the floor space ventilated above the total floor heated area [%]		

3.3 LIGHTING AND AUXILIARY SYSTEMS

Lighting					
		Rooms (classroom, offices, laboratories)	Common spaces (corridors, atrium, canteen)	Gym	External
	Traditional incandescent light	x (4)	x (18)		
	Halogen light bulbs				
a. Type	Fluorescent tubes	x (283)	x (150)		X
*Control	Compact fluorescent light (CFL)				
	LED				
	Always ON				
	Manual	Х	Х		
b. Control	Manual on and automatic off				
	Automatic	9- -			Х
c. Number of lights		287	168		8

Canteen		
a. N of hot meals per day		570
b. Energy carrier/fuel/power source	x Electricity	
b. Energy carrier/fuel/power source used to cook	х	Natural gas
used to cook		GPL





	[number]	Typical power [W]	Average daily hours of use [h/day]
a. PCs	52	575	8
b. Projectors/Light boards	41	250	8
c. Printers/copiers	18	550	8
d. Vending machines	0		
e. Coolers (in canteen, cafeteria)	5	160	24
f. Elevators	0		
g. Laboratories	(Brief description of eq	uipment installed with pow	er, time of use)
h. Other		1	

3.4 ON SITE RENEWABLE ENERGY SOURCES (RES) INSTALLED

PV systems	27.1.3	
a. PV cells		Yes
a. PV Cells	X	No
		Silicon mono-crystalline
b. Cells typology		Silicon poly-crystalline
		Silicon amorphous
c. Power installed [kW]		
d. Year of installation		
e. PV cells area [m²]		
f. Slope [°]		
g. Orientation [N,NE,E,SE,S,SW,W,	NW]	

a. Solar thermal system	Yes
a. Solar thermal system	x No
b. Power installed [kW]	
c. Collector area [m²]	
d. Year of installation	
e. Slope [°]	
f. Orientation [N,NE,E,SE,S,SW,W,	vw]
g. Hot water storage [L]	

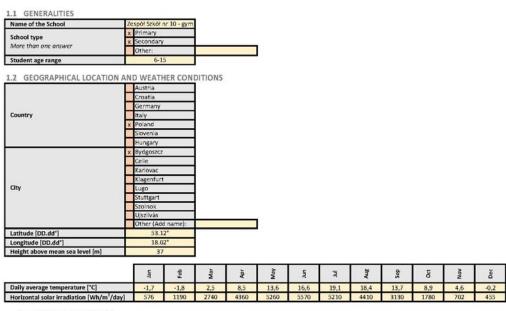
Ot	ner RES	
a.	Туре	
b.	Power	
c.	Year of installation	





5.6. Primary and Secondary school "Zespół Szkół nr 10" - Ggym

DataSet1: information about geographical location, building geometry and typical use of the school building



1.3	BU	LDIN	G	GEOM	ETRY

Number of floor levels	4
Average floor-to-floor height [m]	8
Total floor heated area [m²]	2578
Basement area [m²]	2154
Roof area [m²]	2310

Orientation	N	NE	E	SE	S	SW	W	NW
Exterior wall area [m²]	504	0	568	0	600	0	488	0
Window-to-wall ratio [%]	23	0	15	0	17	0	13	0

1.4 OCCUPATION AND USE OF THE BUILDING

Number of students	809
Number of teachers and personnel (estimation)	117
Total area allocated to classrooms [%]	0
Total area allocated to offices [%]	1
Total area allocated to bathrooms [%]	3
Total area allocated to laboratories [%]	0
Total area allocated to Canteen/Cafeteria [%]	1
Total area allocated to Gym [%]	72

Month	Number of day		
Mondi	(estimation)		
August	6		
September	22		
October	22		
November	20		
December	21		
January	19		
February	21		
March	22		
April	21		
May	20		
June	22		
July	0		
Total	216		

Daily	use [hh:mm-hh:	mm] - <u>SCH</u> (DOL YEAR 2	015-2016			
_	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Opening hours	06:00- 22:30	06:00- 23:00	06:00- 23:30	06:00- 22:30	06:00- 23:00	08:00- 12:00	09:00- 12:00
Lectures time	07:00- 16:45	07:00- 15:55	07:00- 16:45	07:00- 16:45	07:00- 15:55	08:00- 12:00	





DataSet2: information about energy consumption, related to different energy carriers/fuels or systems

					CHOOL YEAR					-				
Energy carrier/Fuel/Power source		Aug-15	Sep-15	Oct-15	Nov/15	Dec-15	Jan-16	feb-16	mar-16	apr-16	may-16	Jun-16	Jul-16	TOT
Electricity [kWh _e]		7004	9518	14050	15831	16571	15873	19030	16608	15773	16512	17242	4981	168992
. Natural gas [Sm³]	1													
Fuel oil/Diesel [kg]	1	8	A .			8	- 3	6	§				6	7
. GPL [kg]	1													
. Biomass [kg]	1						23						8	
District heating [kWh,]	1	2722	5583	16194	26306	28417	54889	41889	35167	15750	3889	1111	889	232806
	4	2/22	2363	10134	20300	2041/	34003	41003	33107	13/30	3003	1111	003	232000
. District cooling [kWh _i]													Ų.	
. Photovoltaics [kWh,]	Produced													
a - materialis (ming)	Consumed		1										1	4
Solar thermal collectors [kWh,]	Produced													
Solar diction concerns (ning)	Consumed			3			12	8					8	
South and a south last 1	Produced													
Geothermal energy [kWh _t]	Consumed						- 8	3					25	1
. Other carrier/fuel/power source*														
specify the measuring unit														
					CHOOL YEAR									***
Energy carrier/Fuel/Power source	4	Aug-14	Sep-14	Oct-14	Nov/14	Dec-14	Jan-15	feb-15	mar-15	apr-15	may-15	Jun-15	Jul-15	TOT
. Electricity [kWhe]	1	0	0	0	0	0	0	0	0	0	0	0	0	0
. Natural gas [5m3]							- 3					- 3	10	
. Fuel oil/Diesel [kg]														
. GPL [kg]		()	i)			100	1		()	17		0	Ø.	- P
. Biomass [kg]		the second	9			6		I		201201				
District heating [kWht]	1	0	0	0	28611	41111	41111	30278	22889	13806	6306	5000	3778	192889
. District cooling [kWht]	1		2					0				- 10	0	0
	Produced					7 .	- 0	E .					1	-
i. Photovoltaics [kWhe]	Consumed							0	-		A		A.	
SAME RESIDENCE OF CONTRACTOR	Produced													
Solar thermal collectors [kWht]	Consumed						- 3							-
The state of the second second	Produced	_												
. Geothermal energy [kWht]	Consumed	+											7.	
	Consumed	_										_		
c. Other carrier/fuel/power source*														
specify the measuring unit														
specify the measuring unit			_	_			_	_	-			_		_
					CHOOL YEAR	2012 2014								
- 1 to 1 to			Sep-13	Oct-13	Nov/13	Dec-13	Jan-14	feb-14	mar-14	apr-14	may-14	Jun-14	Jul-14	TOT
Energy carrier/Fuel/Power source	1	Aug-13												
. Electricity [kWh _e]		0	0	0	0	0	0	0	0	0	0	0	0	0
. Natural gas [Sm³]														
. Natural gas [Sm ³] . Fuel oil/Diesel [kg]	-							6					10	
Fuel oil/Diesel [kg]														
. Fuel oil/Diesel [kg] l. GPL [kg]														
Fuel oil/Diesel [kg] GPL [kg] Biomass [kg]			0	0	0	0	0	0	0	0	0	0	0	0
Fuel oil/Diesel [kg] GPL [kg] Biomass [kg] District heating [kWh _t]		0	0	0	0	0	0	0	0	0	0	0	0	0
Fuel oil/Diesel [kg] GPL [kg] Biomass [kg]		0	0	0	0	0	0	0	0	0	0	0	0	0
Fuel oll/Diesel [kg] GPL [kg] Biomass [kg] District heating [kWh _t] District cooling [kWh _t]	Produced	0	0	0	0	0	0	0	0	0	0	0	0	0
Fuel oil/Diesel [kg] GPL [kg] Biomass [kg] District heating [kWh _t]	Consumed	0	0	0	0	0	0	0	0	0	0	0	0	0
Fuel oll/Diesel [kg] GPL [kg] Biomass [kg] District heating [kWh ₁] District cooling [kWh ₁] Photovoltaics [kWh ₄]		0	0	0	0	0	0	0	0	0	0	0	0	0
Fuel oil/Diesel [kg] GPL [kg] Biomass [kg] District heating [kWh _t] District cooling [kWh _t]	Consumed	0	0	0	0	0	0	0	0	0	0	0	0	0
Fuel oli/Diesel [kg] GPL [kg] Biomass [kg] District heating [kWh ₁] District cooling [kWh ₄] Photovoltaics [kWh ₄] Solar thermal collectors [kWh ₄]	Consumed Produced	0	0	0	0	0	0	0	0	0	0	0	0	0
Fuel oll/Diesel [kg] GPL [kg] Biomass [kg] District heating [kWh ₁] District cooling [kWh ₁] Photovoltaics [kWh ₄]	Consumed Produced Consumed Produced	0	0	0	0	0	0	0	0	0	0	0	0	0
Fust oll/Dissel [kg] GPL [kg] Slomass [kg] District heating [kWh ₁] District cooling [kWh ₄] Photovoltaics [kWh ₄] Solar thermal collectors [kWh ₄] Geothermal energy [kWh ₄]	Consumed Produced Consumed	0	0	0	0	0	0	0	0	0	0	0	0	0
Fust of (Oloses [kg] Biomass [kg] Biomass [kg] District heading [kWh ₁] District cooling [kWh ₂] Photovoltales [kWh ₂] Solar thermal collectors [kWh ₃]	Consumed Produced Consumed Produced	0	0	0	0	0	0	0	0	0	0	0	0	0





DataSet3: information about building envelope characteristics, heating and cooling systems, lighting and auxiliary systems.

Building structure	
	<1940
	1940-1950
	1950-1960
	1960-1970
a. Year of construction	1970-1980
	1980-1990
	1990-2000
	2000-2010
	x >2010
	Load bearing masonry wall
	Reinforced concrete structure
h Toma of atmostration	Steel frame structure
b. Type of structure	Wood framed
	x Prefab modules
	Other:
	•
External walls	
	Traditional fired-clay brick masonry
	Cavity wall
	Concrete hollow blocks
	Fired-clay hollow blocks
a. Type	Prefab wall (sandwich)
	x Prefab wall (concrete)
	Other:
	(add U value)
1	No insulation
b. Insulation	Low [2-5 cm]
	Medium [5-10 cm]
	x High [>10 cm]
	x Light
c. Main external coloring	Medium
	Dark
Roofs	
Noois	Wooden roof
	Mixed structure of hollow brick and concrete
a. Type	x Concrete flat roof (accessible plane)
· · · · · · · · · · · · · · · · · ·	Other:
	(add U value)
	No insulation
	Low [2-5 cm]
b. Insulation	Medium [5-10 cm]
	x High [>10 cm]
	x Light
c. Main external coloring	Medium
c. Wall external coloring	Dark
	Journ N.
Parament	
Basement	Basement on crawl space/Floor on ground
	Hollow-core concrete floor on pilotis
a. Type	
	Other: (add Harakia) Basement on-under ground cavity
	(add U value)
	No insulation
b. Insulation	Low [2-5 cm]
The state of the s	Medium [5-10 cm]
	x High [>10 cm]





Windows	7117 7107						
	W	/ood					
a. Frame	THE REAL PROPERTY AND ADDRESS OF THE PERTY ADDRESS OF THE PERTY ADDRESS OF THE PERTY AND ADDRESS OF THE PERTY ADDR	VC					
a. Flame	A	Aluminium					
		reel					
		ngle pane glass					
b. Glass		Laminated glass					
b. Glass		Double pane glass					
		riple pane glass					
	10925	ther: dd U _{window} value)					
	x G	ood/New					
c. Condition	N	1edium					
	Ba	ad/Old					
		kternal curtain					
d. Solar shading	x In	ternal curtain					
u. Joiai silauliig	x BI	linds					
	x SI	nutters					

3.2 HVAC - HEATING, VENTILATING AND AIR CONDITIONING

Heating system	_						
a. District heating?	X	Yes					
a. District fleating.		No					
b. Combined heating+domestic hot		Yes					
water?		No					
		Natural gas boiler					
		Oil/GPL boiler					
c. Heat generation system		Heat pump					
More than one answer		Ground coupled heat pump (geothermal)					
Wore than one unswer		Electrical heating					
		Biomass boiler					
		Cogeneration					
		Electricity					
d. Energy carrier/Fuel More than one answer		Natural gas					
		Fuel oil/Diesel/GPL					
		Biomass					
		Solar thermal power					
		Geothermal power					
e. Total installed thermal* power [kW]							
		Air/air					
		Air/water					
f. Type of Heat Pump (if Heat pump is		Water/air					
selected)		Water/water					
		Brine/air (if geothermal)					
		Brine/water (if geothermal)					
g. Year of installation/retrofit		2014					
		Floor/ceiling radiant panels					
h. Emission system		Radiators					
		Fan coils					
i. Control system		Not present					
More than one answer		On/off					
		External climate probe					
		Zone thermostat					
		Thermostatic Valves					





j. T set-point ON (Suggested value: 20°C) [°C]				20			
k. T set-point during closing hours				20			
Winter period [dd.mm-dd.mm]			1	1.12-19.02			
m. Starting external temperature the heating turns ON (Suggested value: 12°C) [°C]							
-	Mon	Tue	Wed	Thu	Fri	Sat	Sun
n. Time of use [hh:mm-hh:mm]	06:00-	06:00-	06:00-	06:00-	06:00-	08:00-	09:00-
	22:30	23:00	23:30	22:30	23:00	12:00	12:00

Domestic Hot Water						
	Electrical boiler					
	Natural gas boiler					
	Oil/GPL boiler					
a. Heat generation system	Heat pump					
More than one answer	Ground coupled heat pump (geothermal)					
	Solar thermal collectors					
	Biomass boiler					
	Cogeneration					
	Electricity					
	Natural gas					
b. Energy carrier/Fuel	Fuel oil/Diesel/GPL					
	Biomass					
	Solar thermal power					
	Geothermal power					
c. Installed power [kW]						
(if Heat pump is selected)	Air/air					
d. Type of Heat Pump	Air/water					
	Water/air					
	Water/water					
	Brine/air (if geothermal)					
	Brine/water (if geothermal)					
e. Year of installation/retrofit	2014					
f. N of users	809					
g. N of showers	14					
h. Average daily use of the gym [h/day]	12					

Cooling system						
a. Cooling system?	Yes					
a. Cooling system?	No					
b. District cooling?	Yes					
b. District cooling:	No					
	Heat pump					
. Cooling generation system	Trigeneration					
10 100	Other:					
	Electricity					
d. Energy carrier/Fuel	Natural gas/Fuel oil/Diesel/GPL					
d. Ellergy carrier/Fuel	Geothermal					
	Solar thermal collectors					
e. Cooling generation system	Centralised					
e. Cooling generation system	One for each room					
	Air/air					
	Air/water					
f Type of Heat Rump (sytemal unit)	Water/air					
f. Type of Heat Pump (external unit)	Water/water					





	Brine/air (if geothermal)
	Brine/water (if geothermal)
g. Total installed electrical power [kW]	
h. Year of installation/retrofit	
f Funtantan annasan	Radiant ceiling
i. Emission system	Fan coils
	Not present
j. Control system	On/off
More than one answer	External climate probe
Wore than one answer	Zone thermostat
	Thermostatic Valves
k. Percentage of the floor space cooled above the total floor heated area [%]	

Ventilation		
a. Controlled mechanical ventilation		Yes
unit?	X	No
L T		Mechanical ventilation without heat recovery system
b. Type of ventilation		Mechanical ventilation with heat recovery system (HRS)
c. (If HRS is present) Year of installation		
d. Percentage of the floor space ventilated above the total floor heated area [%]		

3.3 LIGHTING AND AUXILIARY SYSTEMS

Lighting					
		Rooms (classroom, offices, Iaboratories)	Common spaces (corridors, atrium, canteen)	Gym	External
	Traditional incandescent light				
	Halogen light bulbs			Х	
a. Type	Fluorescent tubes				
	Compact fluorescent light (CFL)				
	LED				į
	Always ON			Х	
A CARACTER	Manual				
b. Control	Manual on and automatic off				6
	Automatic				
c. Number of lights				53	

Canteen			
a. N of hot meals per day			
h Enganism for all accounts accounts	Electricity		
b. Energy carrier/fuel/power source used to cook	Natural gas		
	GPL		





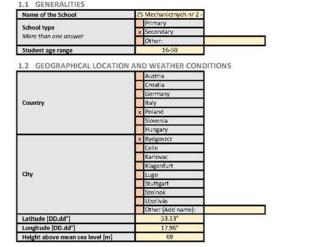
Eq	uipment and machineries				
			[number]	Typical power [W]	Average daily hours of use [h/day]
a.	PCs				
b.	Projectors/Light boards				
C.	Printers/copiers				
d.	Vending machines		ll .		
e.	Coolers (in canteen, cafeteria)		2	110	24
f.	Elevators				
			(Brief description of equipm	ent installed with pow	er, time of use)
g.	Laboratories				
h.	Other				
3.4		ŝΥ	SOURCES (RES) INSTALLED		
PV	systems	_			
a.	PV cells		Yes		
_	day no One (Co.)	Х	No		
	Calle to make an	H	Silicon mono-crystalline		
D.	Cells typology		Silicon poly-crystalline Silicon amorphous		
_	Power installed [kW]	H	Silicon amorphous		
c.	Year of installation	⊢			
_		H			
_	PV cells area [m²]	⊢			
т.	Slope [°]	H			
g.	Orientation [N,NE,E,SE,S,SW,W,NW]				
C o	lar thermal collectors				
30	iai tiletiliai collectors		Yes		
a.	Solar thermal system	х	No		
Ь.	Power installed [kW]	^	NO		
с.	Collector area [m²]	H			
d.	Year of installation	┝			
	Slope [°]	H			
f.	Orientation [N,NE,E,SE,S,SW,W,NW]				
g.	Hot water storage [L]				
Ot	her RES				
a.	Туре				
b.	Power				
C.	Year of installation				





5.7. Secondary school "Zespół Szkół Mechanicznych nr 2, Technical School, Vocational Schools Team" - Main school building

DataSet1: information about geographical location, building geometry and typical use of the school building



	Jan	Feb	Mar	Apr	May	nnr	Int	Aug	Sep	0ct	Nov	Dec
Daily average temperature ["C]	-1,7	-1,9	2,5	8,5	13,6	16,6	19,1	18,4	13,7	8,9	4,6	-0,2
Horizontal solar irradiation [Wh/m²/day]	576	1190	2740	4360	5260	5570	5210	4410	3130	1780	702	455

1.3 BUILDING GEOMETRY

T'3 BOILDING GEOMETKI	
Number of floor levels	4
Average floor-to-floor height [m]	3,3
Total floor heated area [m²]	3674,45
Basement area [m²]	763,74
Roof area [m²]	1212 59

Orientation	N	NE	E	SE	5	SW	w	NW
Exterior wall area [m²]	332,83	0	997,92	0	332,83	0	997,92	0
Window-to-wall ratio [%]	21.79	0	24.45	0	22.19	0	26.61	

1.4 OCCUPATION AND USE OF THE BUILDING

Number of students	549
Number of teachers and personnel (estimation)	100
Total area allocated to classrooms [%]	41,31
Total area allocated to offices [%]	10,76
Total area allocated to bathrooms [%]	4,83
Total area allocated to laboratories [%]	0
Total area allocated to Canteen/Cafeteria [%]	0,34
Total area allocated to Gym [%]	12,05

10 CAN A ST	Number of days
Month	(estimation)
August	0
September	22
October	21
November	20
December	21
January	19
February	21
March	22
April	21
May	20
June	22
July	0
Total	209

Dai	Daily use [hh:mm-hh:mm] - SCHOOL YEAR 2015-2016													
	Mon Tue Wed Thu Fri Sat													
C	06:00-	06:00-	06:00-	06:00-	06:00-	07:00-	07:00-							
Opening hours	22:00	22:00	22:00	22:00	22:00	16:00	16:00							
Lectures time	07:00-	07:00-	07:00-	07:00-	07:00-	07:00-	07:00-							
Lectures time	16:00	16:00	16:00	16:00	21:00	16:00	16:00							





DataSet2: information about energy consumption, related to different energy carriers/fuels or systems

					SCHOOL Y			4.1.44						
Energy carrier/Fuel/Power source		Aug-15	Sep-15	Oct-15	Nov/15	Dec-15	Jan-16	feb-16	mar-16	apr-16	may-16	Jun-16	Jul-16	TOT
. Electricity [kWh _e]	1			(1		11				17				57630
. Natural gas [Sm³]														
Fuel oil/Diesel [kg]	1				£ 7:			1	- 1					
I. GPL [kg]	1								J.					
. Biomass [kg]	1		- 19	8	1 8			1						3
. District heating [kWh,]	1	4.088	2.053	50,579	74.051	74.014	119.160	90.754	79.321	46,479	11.796	3.421	6,176	561.893
	1	4,000	2,033	30.373	74.001	14.024	115,100	30.734	15,561	40.473	341730	3.441	0.170	5021033
g. District cooling [kWh ₁]		_											$\overline{}$	
n. Photovoltaics [kWh,]	Produced													
CONTRACTOR OF THE CONTRACTOR O	Consumed													
. Solar thermal collectors [kWh,]	Produced													
	Consumed													
. Geothermal energy [kWh _t]	Produced													
. Geodieimin energy (kreng)	Consumed			10	1									
k. Other carrier/fuel/power source* specify the measuring unit														
					SCHOOL Y	EAR 2014-201	5							
Energy carrier/Fuel/Power source		Aug-14	Sep-14	Oct-14	Nov/14	Dec-14	Jan-15	feb-15	mar-15	apr-15	may-15	Jun-15	Jul-15	TOT
a. Electricity (kWhe)		, mg- 24	orp 2.4	00.11		011.21	J. 100	110-25	11101-12	40.15		7411-22	7411-425	58783
b. Natural gas [Sm3]	1		-		1					-				30/03
. Fuel oil/Diesel [kg]	ł											_	-	
	1		-	_			-						-	
f. GPL [kg]	1		-	11						2		_		
e. Biomass [kg]									20.000		10.000			
. District heating [kWht]	1	3.468	2.998	40.239	74.961	81.167	107.155	86.848	69.599	53.133	19.508	810	1.296	541.183
g. District cooling [kWht]				H										
h. Photovoltaics [kWhe]	Produced													
a raccroans (anne)	Consumed													
. Solar thermal collectors [kWht]	Produced													
. Solai diermai conectors (Kwiit)	Consumed		- 1	i i						2		3		
Control of the Bullet	Produced													
. Geothermal energy [kWht]	Consumed			U .	1			1	-					
k. Other carrier/fuel/power source*														
specify the measuring unit														
		de la			_					-	-			
					SCHOOL Y	EAR 2013-201	4							
Energy carrier/Fuel/Power source		Aug-13	Sep-13	Oct-13	Nov/13	Dec-13	Jan-14	feb-14	mar-14	apr-14	may-14	Jun-14	Jul-14	TOT
a. Electricity [kWh _a]	i		3.5					144.27	1000 20			1000	100 2.1	58195
									-					30133
b. Natural gas [Sm³]				_										
r. Fuel oil/Diesel [kg]														
d. GPL [kg]														
e. Biomass [kg]		4	0	(0)					1/2					
f. District heating [kWh _t]		4.607	19.674	51.614	89.946	89.870	101.674	78.350	73.671	43.940	4.350	2.452	4.847	564,995
g. District cooling [kWh _t]	1													
	Produced	-		-								-		
n. Photovoltaics [kWh _e]				-										_
	Consumed						1		-					
. Solar thermal collectors [kWh _i]	Produced													_
	Consumed			50			2							
. Geothermal energy [kWh _t]	Produced			_										
•••••	Consumed		- 3						- N					
. Other carrier/fuel/power source*														





DataSet3: information about building envelope characteristics, heating and cooling systems, lighting and auxiliary systems.

Building structure									
		<1940							
		1940-1950							
		1950-1960							
		1960-1970							
a. Year of construction	×	1970-1980							
	^	1980-1990							
		1990-2000							
		2000-2010							
		>2010							
ļ		Load bearing masonry wall							
		Reinforced concrete structure Steel frame structure							
b. Type of structure									
The second of the second secon		Wood framed							
	Х	Prefab modules							
		Other:							
External walls									
		Traditional fired-clay brick masonry							
		Cavity wall							
		Concrete hollow blocks							
		Fired-clay hollow blocks							
a. Type		Prefab wall (sandwich)							
	х	Prefab wall (concrete)							
		Other:							
		(add U value)							
	x	No insulation							
	^	Low [2-5 cm]							
b. Insulation		Medium [5-10 cm]							
		High [>10 cm]							
		Light							
c. Main external coloring	х	Medium							
		Dark							
Roofs									
		Wooden roof							
		Mixed structure of hollow brick and concrete							
а. Туре	X	Concrete flat roof (accessible plane)							
		Other:							
		(add U value)							
	X	No insulation							
h temperatur		Low [2-5 cm]							
b. Insulation		Medium [5-10 cm]							
		High [>10 cm]							
		Light							
c. Main external coloring	х	Medium							
- man external coloring	^	Dark							
	- 2	Dan							
D									
Basement		D							
		Basement on crawl space/Floor on ground							
a. Type		Hollow-core concrete floor on pilotis							
aro SMes		Other: Basement on-under ground cavity							
		(add U value)							
	х	No insulation							
b. Insulation		Low [2-5 cm]							
w. Ilisulation		Medium [5-10 cm]							
		High [>10 cm]							





Windows							
		Wood					
a. Frame	Х	PVC					
a. Flaile		Aluminium					
		Steel					
		Single pane glass					
b. Glass		Laminated glass					
b. Glass	X	Double pane glass					
		Triple pane glass					
		Other: (add U _{window} value)					
	X	Good/New					
c. Condition		Medium					
		Bad/Old					
		External curtain					
d. Solar shading	X	Internal curtain					
u. Joiai silauliig	X	Blinds					
		Shutters					

3.2 HVAC - HEATING, VENTILATING AND AIR CONDITIONING

Heating system		
a. District heating?	х	Yes
d. District fiedding.		No
b. Combined heating+domestic hot		Yes
water?		No
		Natural gas boiler
		Oil/GPL boiler
c. Heat generation system		Heat pump
More than one answer		Ground coupled heat pump (geothermal)
		Electrical heating
		Biomass boiler
		Cogeneration
		Electricity
d. Energy carrier/Fuel More than one answer		Natural gas
		Fuel oil/Diesel/GPL
		Biomass
		Solar thermal power
		Geothermal power
e. Total installed thermal* power [kW]		
		Air/air
		Air/water
f. Type of Heat Pump (if Heat pump is		Water/air
selected)		Water/water
		Brine/air (if geothermal)
		Brine/water (if geothermal)
g. Year of installation/retrofit	Г	
		Floor/ceiling radiant panels
h. Emission system		Radiators
		Fan coils
i. Control system		Not present
More than one answer		On/off
		External climate probe
		Zone thermostat
		Thermostatic Valves





j. T set-point ON (Suggested value: 20°C) [°C]							
k. T set-point during closing hours							
Winter period [dd.mm-dd.mm]							
m. Starting external temperature the heating turns ON (Suggested value: 12°C) [°C]							
	Mon	Tue	Wed	Thu	Fri	Sat	Sun
n. Time of use [hh:mm-hh:mm]	06:00-	06:00-	06:00-	06:00-	06:00-	06:00-	07:00-
	22:00	22:00	22:00	22:00	22:00	16:00	16:00

Domestic Hot Water						
	Electrical boiler					
	Natural gas boiler					
	Oil/GPL boiler					
a. Heat generation system	Heat pump					
More than one answer	Ground coupled heat pump (geothermal)					
	Solar thermal collectors					
	Biomass boiler					
	Cogeneration					
	Electricity					
	Natural gas Natural gas					
b. Energy carrier/Fuel	Fuel oil/Diesel/GPL					
	Biomass					
	Solar thermal power					
	Geothermal power					
c. Installed power [kW]						
(if Heat pump is selected)	Air/air					
d. Type of Heat Pump	Air/water					
	Water/air					
	Water/water					
	Brine/air (if geothermal)					
	Brine/water (if geothermal)					
e. Year of installation/retrofit	2015					
f. N of users	450					
g. N of showers	6					
h. Average daily use of the gym [h/day]						

Cooling system							
a. Cooling system?		Yes					
a. Cooling system:	X	No					
b. District cooling?		Yes					
b. District cooling:	X	No					
		Heat pump					
c. Cooling generation system		Trigeneration					
		Other:					
		Electricity					
d Engraveranton/Fuel		Natural gas/Fuel oil/Diesel/GPL					
d. Energy carrier/Fuel		Geothermal					
		Solar thermal collectors					
a Cooling generation system		Centralised					
e. Cooling generation system		One for each room					
		Air/air					
		Air/water					
f Time of Heat Dimen (automaticula)		Water/air					
f. Type of Heat Pump (external unit)		Water/water					





	Brine/air (if geothermal)
	Brine/water (if geothermal)
g. Total installed electrical power [kW]	
h. Year of installation/retrofit	
i. Emission system	Radiant ceiling
i. Emission system	Fan coils
	Not present
j. Control system	On/off
More than one answer	External climate probe
Wide than one answer	Zone thermostat
	Thermostatic Valves
 k. Percentage of the floor space cooled above the total floor heated area [%] 	

Ventilation				
a. Controlled mechanical ventilation		Yes		
unit?	X	No		
b. Type of ventilation		Mechanical ventilation without heat recovery system		
		Mechanical ventilation with heat recovery system (HRS)		
c. (If HRS is present) Year of installation				
d. Percentage of the floor space ventilated above the total floor heated area [%]				

3.3 LIGHTING AND AUXILIARY SYSTEMS

Lighting					
		Rooms (classroom, offices, laboratories)	Common spaces (corridors, atrium, canteen)	Gym	External
	Traditional incandescent light		X		
	Halogen light bulbs				Х
a. Type	Fluorescent tubes	х	Х	х	
	Compact fluorescent light (CFL)	х			
	LED	х	х	х	
	Always ON				
S Harrison	Manual	Х	Х	Х	
b. Control	Manual on and automatic off				х
	Automatic				
c. Number of lights		201	187	87	5

Canteen			
a. N of hot meals per day			
b. Energy carrier/fuel/power source used to cook	Electricity		
	Natural gas		
	GPL		





Equipment and machineries					
	[number]	Typical power [W]	Average daily hours of use [h/day]		
a. PCs	100	230	5		
b. Projectors/Light boards	24	200	2		
c. Printers/copiers	18	500	2		
d. Vending machines	0				
e. Coolers (in canteen, cafeteria)	4	230	24		
f. Elevators	0				
	(Brief description of equipm	nent installed with pow	er, time of use)		
g. Laboratories					
h. Other - washing maschines	2	230	2		

3.4 ON SITE RENEWABLE ENERGY SOURCES (RES) INSTALLED

PV systems		
a. PV cells		Yes
a. PV cells	X	No
		Silicon mono-crystalline
b. Cells typology		Silicon poly-crystalline
		Silicon amorphous
c. Power installed [kW]		
d. Year of installation		
e. PV cells area [m²]		
f. Slope [°]		
g. Orientation [N,NE,E,SE,S,SW,W	/,NW]	

a. Solar thermal system	Yes
a. Joiai tilerillai systelli	x No
b. Power installed [kW]	
c. Collector area [m²]	
d. Year of installation	
e. Slope [°]	
f. Orientation [N,NE,E,SE,S,SW,W	vw]
g. Hot water storage [L]	

Other RES					
a. Type					
b. Power					
c. Year of installation					





5.8. Secondary school "Zespół Szkół Mechanicznych nr 2, Technical School, Vocational Schools Team" - Practical education centre

DataSet1: information about geographical location, building geometry and typical use of the school building

Name of the School	ZS Mechanic	nych nr 2 -	ı									
Education	Primary		1									
School type More than one answer	x Secondar	/										
Wore than one arswer	Other:				1							
Student age range	16-	50										
2 CEOCRAPHICAL LOCATION A	ND WEAT	IED CON	DITIONS									
I.2 GEOGRAPHICAL LOCATION A		HER CON	DITIONS									
	Austria		l									
	Croatia		l									
	Germany		l									
Country	Italy		l									
	x Poland		l									
	Slovenia		l									
	Hungary		l									
T I	x Bydgoszcz Celie		l									
			1									
	Karlovac		l									
City	Klagenfur		l									
city	Lugo		l									
	Stuttgart Szolnok	-	l									
	Ujszilvás		1									
	Other (Ad	d namel:			1							
Latitude [DD.dd*]	53.1				•							
Longitude [DD.dd*]	17.9		ı									
Height above mean sea level [m]	69		i									
	100		•									
				1	>	In	3	Aug	Sep	Det	Nov	y
	Le L	윤	ŝ	Apr	2	2		₹	Š	0	ž	ĕ
Daily average temperature [°C]	-1,7	-1,1	2,5	8,5	13,6	16,6	19,1	₹ 18,4	13,7	8,9	ž 4,6	-0,2

1.3 BUILDING GEOMETRY	
Number of floor levels	2
Average floor-to-floor height [m]	9
Total floor heated area [m²]	4480,87
Basement area [m²]	3593,75
Doof area (m²)	2502.75

Orientation	N	NE	E	SE	S	SW	W	NW
Exterior wall area [m²]	195,4		541,6		670,2	de S	414	
Window-to-wall ratio [%]	50.5		26.8		34.5		14.8	

1.4	OCCUP	PATION	AND	USE OF	THE	BUILDING

Number of students	549	
Number of teachers and personnel (estimation)	100	
Total area allocated to classrooms [%]	2,26	
Total area allocated to offices [%]	3,87	
Total area allocated to bathrooms [%]	2,41	
Total area allocated to laboratories [%]	50,8	
Total area allocated to Canteen/Cafeteria [%]	2,18	
Total area allocated to Gym [%]		

DAYS OF USE (Weekends and Vacations excluded) SCHOOL YEAR 2015-2016					
Month	Number of day: (estimation)				
August	0				
September	22				
October	21				
November	20				
December	21				
January	19				
February	21				
March	22				
April	21				
May	20				
June	22				
July	0				
Total	209				

Dai	Daily use [hh:mm-hh:mm] - SCHOOL YEAR 2015-2016										
	Mon	Tue	Wed	Thu	Fri	Sat	Sun				
Opening hours	06:00-	06:00-	06:00-	06:00-	06:00-	07:00-	07:00-				
Opening nours	22:00	22:00	22:00	22:00	22:00	16:00	16:00				
t - a	07:00-	07:00-	07:00-	07:00-	07:00-	07:00-	07:00-				
Lectures time	16:00	16:00	16:00	16:00	21:00	16:00	16:00				





DataSet2: information about energy consumption, related to different energy carriers/fuels or systems

		_				EAR 2015-2016								
Energy carrier/Fuel/Power source		Aug-15	Sep-15	Oct-15	Nov/15	Dec-15	Jan-16	feb-16	mar-16	apr-16	may-16	Jun-16	Jul-16	TOT
Electricity [kWh _e]			4729,78	9	6560,74		6145,12	S 19	5270,2	3	5434,86		1825,82	29967
Natural gas [Sm ³]			10	(1	(5)	0		()		(-)	1 - 3			
Fuel oil/Diesel [kg]			6 8	1 1	\$ S	W.		0 0						
GPL [kg]														
. Biomass [kg]			1		0 0				8 9					9
District heating [kWh _t]		2.453	2.464	8.710	11.238	12.146	25.659	15.656	15.366	9.688	5.233	4.025	7.206	119.8
. District cooling [kWh _t]		8.755	2.404	0.710	11.230	12.140	23.055	15.000	15.500	3.000	3,233	7.043	7.200	113.0
District cooling [KWnt]		4	1	1	1			1	0 9					17.
. Photovoltaics [kWh _e]	Produced	_		2 5		3:								
17 77	Consumed	_												
Solar thermal collectors [kWh,]	Produced		3		1 1	8		9		2 3	3			
	Consumed		1 3											
Geothermal energy [kWh,]	Produced													
Geomethia energy (Kasié)	Consumed			1	8	8								
Other context(selfeeters			1				1	5	-	1			- S	
Other carrier/fuel/power source*														
pecify the measuring unit				Į.										
					SCHOOL Y	EAR 2014-2015								
Energy carrier/Fuel/Power source	10	Aug-14	Sep-14	Oct-14	Nov/14	Dec-14	Jan-15	feb-15	mar-15	apr-15	may-15	Jun-15	Jul-15	TOT
Electricity [kWhe]			3598,3		6919		7654		8487,9		4131		2327	33117
Natural gas [5m3]					8 1	9		1		0			-	
Fuel oil/Diesel [kg]				0 0										
GPL [kg]		\vdash		1	_				-					_
		\vdash									J			
Biomass [kg]		5 025	4.477	2 220	12.201	47.470	15.075	43.300	43.530	0.000	0.500	1.013	1.475	100.0
District heating [kWht]		6.936	4.437	7.728	13.284	12.139	15.976	13.250	13.620	9.859	8.600	1.013	1.426	108.20
District cooling [kWht]														
Photovoltaics [kWhe]	Produced			1		8)		0 0	3 3	10 1				
Timecoronial Cartines	Consumed				8		5	8		8				
Solar thermal collectors [kWht]	Produced													
Joint diermat conectors [kwitt]	Consumed	ŝ	9		8 8	8		3		8	9		1 1	4
Goothousel anomy (bittle)	Produced		å ä	8	8	<u> </u>	27.	ž š	\$ \$	6 3	V 3			
Geothermal energy [kWht]	Consumed													
				9	* *	4								
. Other carrier/fuel/power source*														
specify the measuring unit														
		•												
					SCHOOL Y	EAR 2013-2014								
Energy carrier/Fuel/Power source		Aug-13	Sep-13	Oct-13	Nov/13	Dec-13	Jan-14	feb-14	mar-14	apr-14	may-14	Jun-14	Jul-14	TOT
Electricity [kWh _a]			8111		13724	11184	7777	8 3	9895		7194		2777	60661
		\vdash			33.21				3030					
Natural gas [Sm ³]		$\overline{}$			1			2	0 0					
Fuel oil/Diesel [kg]				10					i					
GPL [kg]		_												
Biomass [kg]				(c)	S 53			2) ()	3	3				
District heating [kWh _t]		3.686	2.222	9.805	12.824	15.185	16.177	12.357	11.770	7.940	4.893	3.678	3.525	104.0
District cooling [kWh _t]	l.				2	3		7	9	4				
	Produced				4.	2		8						
Photovoltaics [kWh _e]	Consumed	-												
in er	Produced				0				0	7				
Solar thermal collectors [kWh _t]					- 1				1					
	Consumed	_												
Geothermal energy [kWh _t]	Produced	_												
	Consumed					8 1				V				7
Other carrier/fuel/power source*	1		1	S (2)	E	-		4	4	1			-	
specify the measuring unit														





DataSet3: information about building envelope characteristics, heating and cooling systems, lighting and auxiliary systems.

A close							
1940-1950 1950-1960 1950	Building structure						
a. Year of construction 1990-1990			<1940				
x 1960-1970			1940-1950				
x 1960-1970			1950-1960				
1990-1990 1990-2000 2000-2010 2000		x					
1990-1990 1990-2000 2000-2010 2000	a. Year of construction		117 GEAN AVAILABLE 115				
1990-2000 2000-2010 2001		2 3					
Section							
b. Type of structure Concept		- 1					
V Reinforced concrete structure			Light Wild Control of the Control of				
Steel frame structure Wood framed Prefab modules Other:							
Wood framed Prefab modules Other: Other:		V					
Prefab modules Other: Prefab modules Other:	b. Type of structure	Н					
Other:	Fig. 5. C. 7 Rep. 15 Congress Congress Congress		D. D				
External walls Traditional fired-clay brick masonry Cavity wall Concrete hollow blocks Fired-clay hollow blocks Prefab wall (sandwich) X Prefab wall (sandwich) X Prefab wall (sandwich) X Prefab wall (concrete) Other: (add U value) X No insulation X Medium (S-10 cm) X Medium (S-10 cm) X Medium X No insulation X Medium							
Traditional fired-clay brick masonry Cavity wall Concrete hollow blocks Fired-clay hollow blocks Prefab wall (sandwich) Prefab wall (concrete) Other: (add U value) No insulation Low [2-5 cm] Medium [5-10 cm] High [>-10 cm] Light A Wooden roof Mixed structure of hollow brick and concrete X Concrete flat roof (accessible plane) Other: (add U value) No insulation Medium No Dark Roofs Roofs X Wooden roof Mixed structure of hollow brick and concrete X Concrete flat roof (accessible plane) Other: (add U value) High [>-10 cm] Dark Basement Basement Basement Other: (add U value) Basement on-under ground cavity (add U value) Basement on-under ground cavity Medium [>-10 cm] Hollow-core concrete floor on pilotis Other: (add U value) Basement on-under ground cavity Medium [>-10 cm] Hollow-core concrete floor on pilotis Other: (add U value) Basement on-under ground cavity Medium [>-10 cm]			Other:				
a. Type Traditional fired-clay brick masonry Cavity wall Concrete hollow blocks Fired-clay hollow blocks Prefab wall (sandwich) X Prefab wall (sand University of the sandwich) X Prefab wall (sand University of the sandwich) X Prefab wall (sandwich) X Prefab wall (sandwich							
a. Type Cavity wall Concrete hollow blocks Fired-clap hollow blocks Prefab wall (sandwich) X Prefab wall (concrete) Other: (add U value) X No insulation	External walls						
a. Type Concrete hollow blocks Fired-clay hollow blocks Fired-clay hollow blocks Fired-clay hollow blocks Prefab wall (candwich) x Prefab wall (concrete) Other:			Traditional fired-clay brick masonry				
a. Type Concrete hollow blocks Fired-clay hollow blocks Fired-clay hollow blocks Fired-clay hollow blocks Prefab wall (candwich) x Prefab wall (concrete) Other:			Cavity wall				
Prefab wall (sandwich) x Prefab wall (concrete) Other: (add U value) (add U value) (add U value) (add U value)							
Prefab wall (sandwich) x Prefab wall (concrete) Other: (add U value) (add U value) (add U value) (add U value)	-						
Other: (add U value)	a. Type		Prefab wall (sandwich)				
Other: (add U value)		x	Prefab wall (concrete)				
b. Insulation Low [2-5 cm] Medium [5-10 cm] High [>10 cm]							
Low [2-5 cm] Medium [5-10 cm] High [>10		v					
Medium [5-10 cm] Light Medium Medium Medium Medium Dark Roofs Roofs Roofs Wooden roof Mixed structure of hollow brick and concrete Concrete flat roof (accessible plane) Other: (add U value) Medium [5-10 cm] Mixed structure of hollow brick and concrete Concrete flat roof (accessible plane) Other: (add U value) Medium [5-10 cm] High [5-10 cm] Light Light Medium Dark Basement Basement Basement Basement on crawl space/Floor on ground Hollow-core concrete floor on pilotis Other: (add U value) Basement on crawl space/Floor on ground Medium [5-10 cm]		^					
High > 10 cm	b. Insulation	-					
c. Main external coloring Light		- 1					
C. Main external coloring Medium X Dark Wooden roof Mixed structure of hollow brick and concrete X Concrete flat roof (accessible plane) Other: (add U value) X No insulation Light X Medium Dark Basement Basement Type Basement A Type Basement or crawl space/Floor on ground Hollow-core concrete floor on pilotis Other: (add U value) Basement on crawl space/Floor on ground Hollow-core concrete floor on pilotis Other: (add U value) A No insulation Medium [5-10 cm] Basement on crawl space/Floor on ground Hollow-core concrete floor on pilotis Other: (add U value) Basement on crawl space/Floor on ground Hollow-core concrete floor on pilotis Other: (add U value) Medium [5-10 cm]							
Roofs Wooden roof Mixed structure of hollow brick and concrete X Concrete flat roof (accessible plane)	64-1						
Roofs Wooden roof Mixed structure of hollow brick and concrete X Concrete flat roof (accessible plane)	c. Iviain external coloring						
Wooden roof Mixed structure of hollow brick and concrete X Concrete flat roof (accessible plane) Other: (add U value) Low [2-5 cm] High [>10 cm] Light X Medium Dark Dark Basement Basement Hollow-core concrete floor on pilotis Other: (add U value) Dasement A Wedium Dasement Basement on crawl space/Floor on ground Hollow-core concrete floor on pilotis Other: (add U value) Dasement on crawl space/Floor on ground Hollow-core concrete floor on pilotis Other: (add U value) Dasement on crawled space/Floor on ground Hollow-core concrete floor on pilotis Other: (add U value) Dasement on crawled space/Floor on ground Dasement on crawled space/Floor on pilotis Other: (add U value) Dasement on crawled space/Floor on pilotis Other: (add U value) Dasement on crawled space/Floor on pilotis Other: (add U value) Dasement on crawled space/Floor on pilotis Other: (add U value) Dasement on crawled space/Floor on pilotis Other: (add U value) Dasement on crawled space/Floor on pilotis Other: (add U value) Dasement on crawled space/Floor on pilotis Other: (add U value) Dasement on crawled space/Floor on pilotis Other: (add U value) Dasement on crawled space/Floor on pilotis Other: (add U value) Dasement on crawled space/Floor on pilotis Other: (add U value) Dasement on crawled space/Floor on pilotis Dasement on crawled space/Floor on pi		Х	Dark				
Wooden roof Mixed structure of hollow brick and concrete X Concrete flat roof (accessible plane) Other: (add U value) Low [2-5 cm] Medium Light X Medium Dark Dark Basement Basement High so on pilotis Other: (add U value) Dasement Basement on crawl space/Floor on ground Hollow-core concrete floor on pilotis Other: (add U value) Dasement on crawl space/Floor on pilotis Other: (add U value) Dasement on crawl space Das	NAME OF THE OWNER OWNER OF THE OWNER OWNE						
A. Type Mixed structure of hollow brick and concrete x Concrete flat roof (accessible plane) Other: (add U value)	Roofs						
a. Type x Concrete flat roof (accessible plane) Other: (add U value) x No insulation Low [2-5 cm] Medium [5-10 cm] High [>10 cm] Light x Medium Dark Basement Basement			Control before control of the Contro				
Dother: (add U value) x No insulation Low [2-5 cm] Medium [5-10 cm] High [>10 cm] Light x Medium Dark Basement Basement Basement on crawl space/Floor on ground Hollow-core concrete floor on pilotis Other: (add U value) b. Insulation X No insulation x No insulation Low [2-5 cm] Medium [5-10 cm]	in the second se						
(add U value)	a. Type	X	Concrete flat roof (accessible plane)				
b. Insulation X No insulation			Other:				
b. Insulation Low [2-5 cm] Medium [5-10 cm] High [>10 cm] Light X Medium Dark Dark Basement Basement on crawl space/Floor on ground Hollow-core concrete floor on pilotis Other:							
Medium [5-10 cm] High [>10 cm] Light x Medium Dark Basement Basement on crawl space/Floor on ground Hollow-core concrete floor on pilotis Other: (add U value) x No insulation Low [2-5 cm] Medium [5-10 cm]		X	No insulation				
Medium [5-10 cm] Light x Medium Dark Basement Basement Hollow-core concrete floor on ground Hollow-core concrete floor on pilotis Other: (add U value) x No insulation Medium [5-10 cm]	h Inculation						
Basement Basement Basement Basement on crawl space/Floor on ground Hollow-core concrete floor on pilotis Other: (add U value) X No insulation Medium [5-10 cm]	D. MSUIAUON		Medium [5-10 cm]				
Light x Medium Dark Basement Basement on crawl space/Floor on ground Hollow-core concrete floor on pilotis Other: (add U value) x No insulation Low [2-5 cm] Medium [5-10 cm]							
C. Main external coloring X Medium							
Basement Basement on crawl space/Floor on ground Hollow-core concrete floor on pilotis Other: (add U value) x No insulation Low [2-5 cm] Medium [5-10 cm]	c. Main external coloring	×					
Basement Basement on crawl space/Floor on ground Hollow-core concrete floor on pilotis Other: (add U value) x No insulation Low [2-5 cm] Medium [5-10 cm]							
a. Type Basement on crawl space/Floor on ground			TO STURBUS				
a. Type Basement on crawl space/Floor on ground	Basement						
a. Type Hollow-core concrete floor on pilotis Other: (add U value) basement on-under ground cavity (add U value) x No insulation Low [2-5 cm] Medium [5-10 cm]	Dasement	7	Basement on crawl space/Floor on ground				
Other: basement on-under ground cavity							
b. Insulation (add U value) x No insulation Low [2-5 cm] Medium [5-10 cm]	a. Type						
b. Insulation X No insulation			hasement on-under ground cavity				
b. Insulation Low [2-5 cm] Medium [5-10 cm]							
Medium [5-10 cm]		х					
Medium [5-10 cm]	b. Insulation						
High [>10 cm]							
	V		High [>10 cm]				





Windows	7117 7107					
	W	/ood				
a. Frame	THE REAL PROPERTY AND ADDRESS OF THE PERTY ADDRESS OF THE PERTY ADDRESS OF THE PERTY AND ADDRESS OF THE PERTY ADDR	VC				
a. Flame	A	luminium				
		reel				
		ngle pane glass				
b. Glass		aminated glass				
b. Glass		Double pane glass				
		riple pane glass				
	10925	ther: dd U _{window} value)				
	x G	ood/New				
c. Condition	N	1edium				
	Ba	ad/Old				
		kternal curtain				
d. Solar shading	x In	ternal curtain				
u. Joiai silauliig	x BI	linds				
	x SI	nutters				

3.2 HVAC - HEATING, VENTILATING AND AIR CONDITIONING

Heating system		
a. District heating?	х	Yes
d. District fiedding.		No
b. Combined heating+domestic hot		Yes
water?		No
		Natural gas boiler
		Oil/GPL boiler
c. Heat generation system		Heat pump
More than one answer		Ground coupled heat pump (geothermal)
Wore than one answer		Electrical heating
		Biomass boiler
		Cogeneration
		Electricity
		Natural gas
d. Energy carrier/Fuel		Fuel oil/Diesel/GPL
More than one answer		Biomass
		Solar thermal power
		Geothermal power
e. Total installed thermal* power [kW]		
		Air/air
		Air/water
f. Type of Heat Pump (if Heat pump is		Water/air
selected)		Water/water
		Brine/air (if geothermal)
		Brine/water (if geothermal)
g. Year of installation/retrofit	Г	
		Floor/ceiling radiant panels
h. Emission system		Radiators
		Fan coils
i. Control system		Not present
More than one answer		On/off
		External climate probe
		Zone thermostat
		Thermostatic Valves





j. T set-point ON (Suggested value: 20°C) [°C]							
k. T set-point during closing hours							
l. Winter period [dd.mm-dd.mm]							
m. Starting external temperature the heating turns ON (Suggested value: 12°C) [°C]							
	Mon	Tue	Wed	Thu	Fri	Sat	Sun
n. Time of use [hh:mm-hh:mm]	06:00-	06:00-	06:00-	06:00-	06:00-	07:00-	07:00-
	22:00	22:00	22:00	22:00	22:00	16:00	16:00

Domestic Hot Water						
	Electrical boiler					
	Natural gas boiler					
	Oil/GPL boiler					
a. Heat generation system	Heat pump					
More than one answer	Ground coupled heat pump (geothermal)					
	Solar thermal collectors					
	Biomass boiler					
	Cogeneration					
	Electricity					
	Natural gas					
b. Energy carrier/Fuel	Fuel oil/Diesel/GPL					
b. Ellergy carrier/Fuer	Biomass					
	Solar thermal power					
	Geothermal power					
c. Installed power [kW]						
(if Heat pump is selected)	Air/air					
d. Type of Heat Pump	Air/water					
	Water/air					
	Water/water					
	Brine/air (if geothermal)					
	Brine/water (if geothermal)					
e. Year of installation/retrofit						
f. N of users	450					
g. N of showers	6					
h. Average daily use of the gym [h/day]						

Cooling system						
a. Cooling system?		Yes				
a. Cooling system:		No				
b. District cooling?		Yes				
b. District cooling:		No				
		Heat pump				
c. Cooling generation system		Trigeneration				
		Other:				
		Electricity				
d Francisconico/Post	Natural gas/Fuel oil/Diesel/GPL					
d. Energy carrier/Fuel	Geothermal					
		Solar thermal collectors				
a. Cooling governtion system		Centralised				
e. Cooling generation system		One for each room				
		Air/air				
		Air/water				
f Tune of Heat Dumn (external unit)	Water/air					





i. Type of fleat ruling (external unit)	Water/water
	Brine/air (if geothermal)
	Brine/water (if geothermal)
g. Total installed electrical power [kW]	
h. Year of installation/retrofit	
f Factorious and an	Radiant ceiling
i. Emission system	Fan coils
	Not present
1. Combust sustains	On/off
j. Control system More than one answer	External climate probe
Wore than one answer	Zone thermostat
	Thermostatic Valves
k. Percentage of the floor space cooled above the total floor heated area [%]	

Ventilation				
a. Controlled mechanical ventilation		Yes		
unit?	х	No		
h Tuna of vontilation		Mechanical ventilation without heat recovery system		
b. Type of ventilation		Mechanical ventilation with heat recovery system (HRS)		
c. (If HRS is present) Year of installation				
d. Percentage of the floor space ventilated above the total floor heated area [%]				

3.3 LIGHTING AND AUXILIARY SYSTEMS

Lighting					
		Rooms (classroom, offices, laboratories)	Common spaces (corridors, atrium, canteen)	Gym	External
	Traditional incandescent light		х		
	Halogen light bulbs				
a. Type	Fluorescent tubes	х	Х		
States:	Compact fluorescent light (CFL)	х			į
	LED				Ţ
	Always ON				
b. Control	Manual	Х	X		
	Manual on and automatic off				
	Automatic				
c. Number of lights		326	73		1

Canteen			
a. N of hot meals per day			
b. Energy carrier/fuel/power source used to cook	х	Electricity	
	х	Natural gas	
used to cook		GPL	





	[number]	Typical power [W]	Average daily hours of use [h/day]	
a. PCs				
b. Projectors/Light boards				
c. Printers/copiers				
d. Vending machines	1	230	2	
e. Coolers (in canteen, cafeteria)	1	230	24	
f. Elevators				
	(Brief description of eq	uipment installed with pow	er, time of use)	
g. Laboratories	measurements. Workshops s	lents and teacher with deski	ons, dishes, computer top computers with	
h. Other - wasching machines	1	230	2	

3.4 ON SITE RENEWABLE ENERGY SOURCES (RES) INSTALLED

PV systems		
a. PV cells		Yes
a. PV cells	х	No
		Silicon mono-crystalline
b. Cells typology		Silicon poly-crystalline
		Silicon amorphous
c. Power installed [kW]		
d. Year of installation		
e. PV cells area [m²]		
f. Slope [°]		
g. Orientation [N,NE,E,SE,S,SW,W,I	NW]	

Solar thermal collectors	
a. Solar thermal system	Yes
a. Solar thermal system	x No
b. Power installed [kW]	
c. Collector area [m²]	
d. Year of installation	
e. Slope [°]	
f. Orientation [N,NE,E,SE,S,SW,W,NW]	
g. Hot water storage [L]	

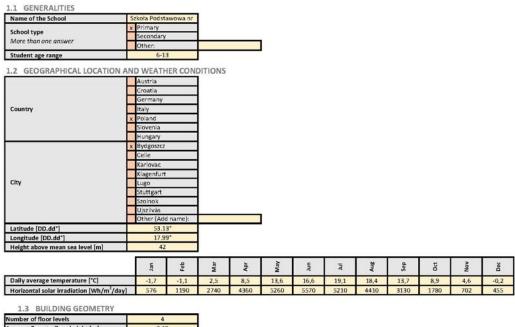
Ot	her RES	
a.	Туре	
b.	Power	
c.	Year of installation	





5.9. Primary school "Szkoła Podstawowa nr 10"

DataSet1: information about geographical location, building geometry and typical use of the school building



Number of floor levels	4
Average floor-to-floor height [m]	3,19
Total floor heated area [m²]	2799
Basement area [m²]	729,25
Roof area [m²]	1164,6

Orientation	N	NE	E	SE	5	SW	w	NW
Exterior wall area [m²]		942,24		597,4		942,24	8 5	597,4
Window-to-wall ratio [%]		19,9		8,5		12,7	8 2	9,6

1.4 OCCUPATION	AND USE	OF THE	BUILDING

Number of students	329
Number of teachers and personnel (estimation)	53
Total area allocated to classrooms [%]	36,4
Total area allocated to offices [%]	7,15
Total area allocated to bathrooms [%]	3,58
Total area allocated to laboratories [%]	
Total area allocated to Canteen/Cafeteria [%]	4,64
Total area allocated to Gym [%]	5,65

Month	Number of day: (estimation)
August	0
September	22
October	22
November	18
December	14
January	13
February	21
March	18
April	20
May	18
June	18
July	0
Total	184

Dail	Daily use [hh:mm-hh:mm] - SCHOOL YEAR 2015-2016								
	Mon	Tue	Wed	Thu	Fri	Sat	Sun		
Opening hours	06:30-	06:30-	06:30-	06:30-	06:30-	1	47		
Opening nours	20:00	20:00	20:00	20:00	20:00				
Lectures time	08:00-	08:00-	08:00-	08:00-	08:00-				
Lectures time	14:30	14:30	14:30	14:30	14:30				





DataSet2: information about energy consumption, related to different energy carriers/fuels or systems

					SCHOOL YE	AR 2015-2016								
Energy carrier/Fuel/Power source		Aug-15	Sep-15	Oct-15	Nov/15	Dec-15	Jan-16	feb-16	mar-16	apr-16	may-16	Jun-16	Jul-16	TOT
a. Electricity [kWh _a]	1	1352	2949	3558	3696	3204	2657	3508	3275	3260	3026	2757	1090	34331
b. Natural gas [Sm³]	1			72.0										476
c. Fuel oil/Diesel [kg]	1						3							
d. GPL [kg]	1													
e. Biomass [kg]	1	-					1 3	21 2					- 8	
f. District heating [kWh _t]	i	1.528	1.917	19.722	28.861	24.667	47.611	33.861	31.278	15.111	4.694	2.111	1.306	212.667
	ł	1.340	1.317	19.722	20.001	24.007	47.011	33.001	31.270	15.111	4.034	2.111	1.300	212.007
g. District cooling [kWh _t]		-												
h. Photovoltaics [kWh _e]	Produced	-					2							
21 V	Consumed	-									_			
i. Solar thermal collectors [kWh _t]	Produced	_	_			-	-							
	Consumed	_											-	
j. Geothermal energy [kWh,]	Produced	-	_					_			_			
	Consumed	_												
k. Other carrier/fuel/power source*														
*specify the measuring unit			-											
					ECHOOL VE	AR 2014-2015	2							
Energy carrier/Fuel/Power source		Aug-14	Sep-14	Oct-14	Nov/14	Dec-14	Jan-15	feb-15	mar-15	apr-15	may-15	Jun-15	Jul-15	TOT
a. Electricity [kWhe]		1186	2819	3507	3589	3095	3472	2459	3259	2965	2986	2669	1413	33420
	ł	1186	2819	3307	3283	3093	34/2	2439	3239	2903	2986	2009	1413	501
b. Natural gas [Sm3]	1	\vdash										-		501
c. Fuel oil/Diesel [kg]	ł	\vdash	_				2 7					-		
d. GPL [kg]	l	\vdash									_			
e. Biomass [kg]	l	-												
f. District heating [kWht]		1.389	2.444	15.528	32.194	43.056	33.417	33.111	26.028	18.167	6.694	2.306	1.444	215.778
g. District cooling [kWht]		_												
h. Photovoltaics [kWhe]	Produced													
	Consumed		9										- 0	
i. Solar thermal collectors [kWht]	Produced													
a som didinal concessors [arrang	Consumed		-										· ·	
j. Geothermal energy [kWht]	Produced		- 3					di i					- 9	
j. Geodiermai energy (krenc)	Consumed													
k. Other carrier/fuel/power source*														
*specify the measuring unit														
						AR 2013-2014								
Energy carrier/Fuel/Power source		Aug-13	Sep-13	Oct-13	Nov/13	Dec-13	Jan-14	feb-14	mar-14	apr-14	may-14	Jun-14	Jul-14	TOT
a. Electricity [kWh _e]							77	3830	4143	3429	3408	3103	1752	19665
b. Natural gas (Sm³)	1		- 3				3						-	536
c. Fuel oil/Diesel [kg]	1													
d. GPL [kg]	1													
e. Biomass [kg]	1													
f. District heating [kWh _t]	1	0	278	11.944	38.056	35.556	45.556	35.556	28.611	14.167	8.611	1.944	1.944	222.222
	1	-	410	11.544	30.030	33.530	45.530	33.230	20.011	14.107	0.011	1.544	1.344	444.444
g. District cooling [kWh _t]								4						
h. Photovoltaics [kWh _a]	Produced							0						
	Consumed													
i. Solar thermal collectors [kWh _t]	Produced													
	Consumed		- 8	1			1	1					- 1	
. Geothermal energy [kWh,]	Produced													
	Consumed		- 5											
k. Other carrier/fuel/power source*							1	7						
specify the measuring unit														





DataSet3: information about building envelope characteristics, heating and cooling systems, lighting and auxiliary systems.

Duilding shows them.								
Building structure								
		<1940						
		1940-1950						
	Х	1950-1960						
a. Year of construction		1960-1970 1970-1980						
a. Year of construction	3 3	1980-1990						
		CONTROL PROPERTY.						
		1990-2000 2000-2010						
		>2010						
		Load bearing masonry wall						
	x	Reinforced concrete structure						
		Steel frame structure						
b. Type of structure		Wood framed						
		Prefab modules						
		Other:						
N		Other.						
External walls								
	х	Traditional fired-clay brick masonry						
		Cavity wall						
		Concrete hollow blocks						
		Fired-clay hollow blocks						
a. Type		Prefab wall (sandwich)						
		Prefab wall (concrete)						
		Other:						
		(add U value)						
		No insulation						
b. Insulation		Low [2-5 cm]						
b. Insulation		Medium [5-10 cm]						
	X	High [>10 cm]						
	×	Light						
c. Main external coloring		Medium						
		Dark						
Roofs								
	X	Wooden roof						
		Mixed structure of hollow brick and concrete						
a. Type		Concrete flat roof (accessible plane)						
		Other:						
	-	(add U value) No insulation						
		Low [2-5 cm]						
b. Insulation		Medium [5-10 cm]						
	×	High [>10 cm]						
	^	Light						
c. Main external coloring	×	Medium						
-	^	Dark						
		000000000						
Basement								
		Basement on crawl space/Floor on ground						
2 7.44		Hollow-core concrete floor on pilotis						
а. Туре		Other						
		(add U value) Basement on-under ground cavity						
		No insulation						
h. Incidation		Low [2-5 cm]						
b. Insulation		Medium [5-10 cm]						
	x	High [>10 cm]						





Windows	110						
		Wood					
a. Frame	х	PVC					
d. Fidilic		Aluminium					
		Steel					
		Single pane glass					
b. Glass		Laminated glass					
b. Glass	X	Double pane glass					
		Triple pane glass					
		Other: (add U _{window} value)					
	х	Good/New					
c. Condition		Medium					
		Bad/Old					
		External curtain					
d. Solar shading	X	Internal curtain					
u. Joiai silauliig	X	Blinds					
	X	Shutters					

3.2 HVAC - HEATING, VENTILATING AND AIR CONDITIONING

Heating system		
a. District heating?	х	Yes
		No
b. Combined heating+domestic hot water?		Yes
		No
		Natural gas boiler
		Oil/GPL boiler
c. Heat generation system		Heat pump
More than one answer		Ground coupled heat pump (geothermal)
Wore than one answer		Electrical heating
		Biomass boiler
		Cogeneration
d. Energy carrier/Fuel More than one answer		Electricity
		Natural gas
		Fuel oil/Diesel/GPL
		Biomass
		Solar thermal power
		Geothermal power
e. Total installed thermal* power [kW]		
		Air/air
		Air/water
f. Type of Heat Pump (if Heat pump is		Water/air
selected)		Water/water
		Brine/air (if geothermal)
		Brine/water (if geothermal)
g. Year of installation/retrofit		
		Floor/ceiling radiant panels
h. Emission system		Radiators
		Fan coils
i. Control system		Not present
More than one answer		On/off
		External climate probe
		Zone thermostat
		Thermostatic Valves





j. T set-point ON (Suggested value: 20°C) [°C]							
k. T set-point during closing hours							
l. Winter period [dd.mm-dd.mm]							
m. Starting external temperature the heating turns ON (Suggested value: 12°C) [°C]							
_	Mon	Tue	Wed	Thu	Fri	Sat	Sun
n. Time of use [hh:mm-hh:mm]	06:30- 20:00	06:30- 20:00	06:30- 20:00	06:30- 20:00	06:30- 20:00		

Domestic Hot Water						
	Electrical boiler					
	Natural gas boiler					
a. Heat generation system More than one answer	Oil/GPL boiler					
	Heat pump					
	Ground coupled heat pump (geothermal)					
	Solar thermal collectors					
	Biomass boiler					
	Cogeneration					
	Electricity					
b. Energy carrier/Fuel	Natural gas Natural gas					
	Fuel oil/Diesel/GPL					
	Biomass					
	Solar thermal power					
	Geothermal power					
c. Installed power [kW]						
(if Heat pump is selected)	Air/air					
d. Type of Heat Pump	Air/water					
	Water/air					
	Water/water					
	Brine/air (if geothermal)					
	Brine/water (if geothermal)					
e. Year of installation/retrofit	2012					
f. N of users	337					
g. N of showers	2					
h. Average daily use of the gym [h/day]						

Cooling system							
a. Cooling system?		Yes					
a. Cooming system:		X					
b. District cooling?		Yes					
		No					
c. Cooling generation system		Heat pump					
		Trigeneration					
11 1000		Other:					
		Electricity					
d. Energy carrier/Fuel		Natural gas/Fuel oil/Diesel/GPL					
d. Ellergy carrier/Fuel		Geothermal					
		Solar thermal collectors					
a Cooling gonoration system		Centralised					
e. Cooling generation system		One for each room					
		Air/air					
		Air/water					
f Time of Heat Brown (automal rosit)		Water/air					
f. Type of Heat Pump (external unit)		Water/water					