BOOSTEE-CE

DELIVERABLE T3.3.1

D.T3.3.1 –Pilot actions preparation **06/2018**

D.T3.3.1: Pilot actions preparation

A.T3.3 Preparation and procurement of pilot actions

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1. Introduction and aims

This deliverable contains all information and data about buildings that allow for a description of the condition of the buildings and the pilot action. This pilot action has no funds.
Conducting research and analysis of selected buildings as pilot actions is necessary to ensure the identification of energy-related problem areas. Data collected from building owners given in the chapters below determine the current state of the facilities. It also provides the information needed to specify the energy profile of the buildings. In addition, it defines the measures and actions that were taken to implement the pilot action.
The aim of the document is presentation of plan preparatory activities for the PA. This document describes activities as part of the tasks undertaken for each pilot action.

PILOT ACTION - **PA8. Testing the project platform in PL/CZ cross-border regions (PL/CZ) - Town Hall**

2. Description of the PA building(s)

The description of the building provides basic building and administrative information. It allows to determine the location and the prevailing geographical conditions, the surroundings of the building. In addition, construction data is an example for similar construction solutions.

Type of building: Town hall
Owner / investor: Municipality of Lubawka
Year of construction: 1723-1726
Year of use (if different from year of construction): 1945
Gross building area [m^2]: 527,74
Building volume [m^3]: 5 928,38
Building envelope total surface area [m^2]: no data
Shape factor (A/V ratio) [m^{-1}]: 0,42
The shape factor A/V is the ratio of the total surface area of all external walls (including windows and doors), roofs, floors on the ground or ceilings over the unheated basement, ceilings above the crossings, separating the heated part of the building from outside air to the volume of the heated part of the building, increased by the volume of heated rooms in the utility attic or in the basement and reduced by the volume of separate staircases, elevator shafts, open recesses, loggias and galleries.
It is best if the building shape factor is as low as possible. This means that the building should be as compact as possible, similar in shape to a sphere or cube, that is, solids characterized by the lowest A/V ratio. Considering energy consumption, a building with a high A/V ratio "consumes" more energy.
Typology (number of floors): 3
Number of building users: 32
Location: Lubawka st. Plac Wolności 1

Available technical documentation: ○ **Yes** ◉ **No**

Figure 1: Photo of building available for the PA8 (source: https://pl.wikipedia.org/wiki/Plik:Lubawka,_pl._Wolno%C5%9Bci_Ratusz_DSC_0031-1.JPG)

3. Energy PA building(s) profile

Collecting energy data allows to determine the energy profile of the building. It provides information on the insulation of external partitions and the condition of energy systems (heating/cooling, ventilation, electricity, hot water preparation) in buildings.

3.1. External partitions

The technical and construction status of the building envelope influences significantly the heat loss to the environment. The used construction and thermal insulation material is important. In order to improve standards, a norm, regulation is established for each partition in each country. For existing buildings in the case of low insulation, it is recommended to carry out thermo-modernization.

3.1.1. External walls

Walls total surface area[m^2]: 1 083,60

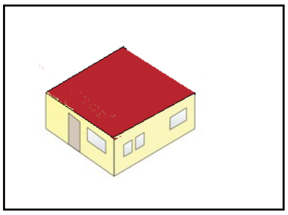
Envelope material (different layers):

No.	Material	Thickness [m]	Thermal conductivity [W/mK]	Heat transfer coefficientfor external wall [W/m²K]	Defined heat transfer coefficientfor external wall (according to the norm, national regulations) [W/m²K][1]
1	brick			0,69	0,20

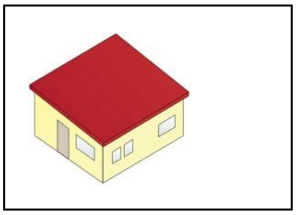
3.1.2. Roof

Type of roof:

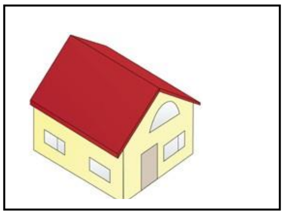
☐Flat roof



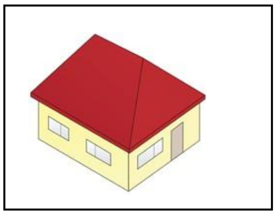
☐Pent roof



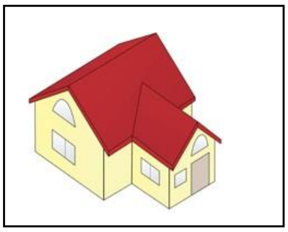
☐Gable roof



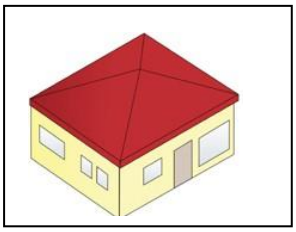
☐Hip roof



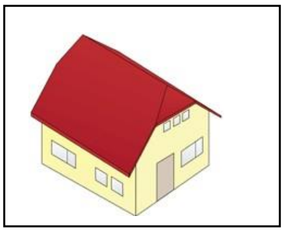
☒Multi-hip roof



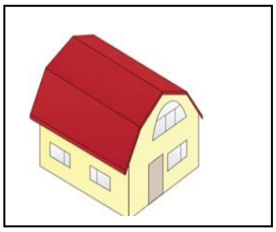
☐Tented roof



☐Half-hipped roof



☐Mansard roof



Roof slope [°]**:** no data **in direction**: no data
Roof total surface area [m²]: 563,49
Envelope material (different layers):

No.	Material	Thickness [m]	Thermal conductivity [W/mK]	Heat transfer coefficientfor roof [W/m²K]	Defined heat transfer coefficientfor roof (according to the norm, national regulations) [W/m²K]
1	roofing slate			1,0	0,15

3.1.3. Ground floor

Floor total surface area [m²]: 1 391

[1] If there are more U coefficients than one in your country, exchange all of them with the division, what they mean (e.g. recommended, required etc.)

Envelope material (different layers):

No.	Material	Thickness [m]	Thermal conductivity [W/mK]	Heat transfer coefficientfor floor [W/m²K]	Defined heat transfer coefficientfor floor (according to the norm, national regulations) [W/m²K]
1			0,89	No data	0,30

3.1.4. Basement ceiling (if the building has a basement)

Total surface area [m²]:
Envelope material (different layers):

No.	Material	Thickness [m]	Thermal conductivity [W/mK]	Heat transfer coefficientfor floor [W/m²K]	Defined heat transfer coefficientfor floor (according to the norm, national regulations) [W/m²K]
1					

<u>Basement</u>
Is the basement heated ? ☐ **Yes** ☐ **No**
Basement walls total surface area[m²]:
Envelope material (different layers):

No.	Material	Thickness [m]	Thermal conductivity [W/mK]	Heat transfer coefficientfor external wall [W/m²K]	Defined heat transfer coefficientfor external wall (according to the norm, national regulations) [W/m²K]
1					

3.1.5. Windows

Type:
☐ single window, single glazed
☐ combined window, double glazed
☐ combined window, three panes
☐ single-frame window, double low-emission glass, argon chamber
☐ single-frame window, three glass panes, two (external) glasses are made of ordinary glass, and the inner glass of low-emission glass, the chambers between the glasses are filled with argon
☐ single-frame window,three glass panes,all glasses are made of low-emission glass, the chambers between the glasses are filled with argon
☒ other (what ?) ……………………………………..casement window…………………………………………………………………

Shading (sun protection):
☐ curtains
☐ roller shutters
☐ wooden shutters
☐ internal blinds
☐ awnings
☐ other (what ?) ………

Material (PVC, wood,aluminum, wood-aluminum): wood
Number of windows: 53
Windows total surface area [m^2]: 114,11
Diffusers in windows (YES or NO): NO
Heat transfer coefficient [W/m^2K]: 2,6
Defined heat transfer coefficient (according to the norm, national regulations) [W/m^2K]: 0,9

3.1.6. Doors

Material (wood, aluminum, PVC etc.): wood
Number of doors: 21
Doors total surface area [m^2]: 51,45
Heat transfer coefficient [W/m^2K]: 1,5
Defined heat transfer coefficient (according to the norm, national regulations) [W/m^2K]: 1,3

3.2. Energy systems data

High efficiency of energy systems and the type of energy source determines its consumption. Also important is the issue of installed control and control systems that help ensure optimal thermal conditions.
Energy parameters characterizing the building:
Total non renewable primary energy demand [GJ/year or kWh/year]: 683 201,65 kWh/year
Energy consumption (heating) [GJ/year or kWh/year]: 1650 GJ/year
Efficiency of the heating system [%]: 90
Energy consumption (hot water preparation) [GJ/year or kWh/year]: 14,515 GJ/year
Efficiency of the hot water preparation system [%]: 95
Energy consumption (cooling) [GJ/year or kWh/year]: no cooling system
Type of energy source (gas boiler, coal boiler, electricity, municipal heating network, biomass boiler, cogeneration, RES etc.): gas boiler
Regulation and control of systems in the building:
☒ thermostatic valves
☐ heat dividers
☐ motion sensors
☐ electricity meters
☐ water meters
☐ other (what ?)……………………………………………………………………………………………………
Annual fuel consumption [kg or m^3 or kWh or GJ]: 480 000 kWh
Electricity consumption [kWh/year]: 58 200
Ordered power [MW]: 0,04
Lighting type (traditional incandescent lamps; halogen bulbs; fluorescent lamps; LED lamps): LED
Power of light bulbs [W]: 1800
Number of lighting points: 120
Ventilation type (according to the table 1): natural ventilation

Ventilation type	Short description
Natural ventilation	based on natural processes occurring in the environment (using gravity)
Mechanical (forced) ventilation	air exchange is due to the operation of an electric motor driven ventilator. Using the mechanism gives us the ability to control the system
Mechanical	operates on the principle of mechanical ventilation extended by a recuperator

ventilation with heat recovery	responsible for the recovery of heat from exhaust air from the building
Hybrid ventilation	combination of natural and mechanical ventilation. This system works alternately depending on atmospheric conditions, using natural forces due to the difference in temperature and external air movement (wind) and the mechanics of the fan in the ventilation duct improving the ventilation conditions in case of need
Mixing (blasting) ventilation	based on mixing the contaminated air in the building with clean air and expelling it out. Fresh air flows through the air diffuser system
Displacement ventilation	based on the separation of the two zones (the lower zone to about 1.1 m (sitting position) or the 1.8 m (standing position) and the upper part) in which the different characteristics of the air will be felt

Table 1: Description of type ventilation.

Building energy profile

The energy consumption in construction is distinguished by three types of energy - primary energy (EP), final energy (EK) and utility energy (EU). Primary energy refers to the energy contained in sources, including fuels and carriers, necessary to cover the final energy demand, taking into account the efficiency of the entire chain of acquisition, conversion and transport to the end user. A concept that is important from the point of view of a sustainable development strategy. The ratio of non-renewable primary energy inputs to the generation and delivery of an energy or energy carrier for technical systems is the difference between primary energy and final energy. The final energy is heat and auxiliary energy, which must be delivered to the boundary of the heating system (building) with a given efficiency in order to cover the energy demand for heating and ventilation of rooms. A concept that is important from the point of view of the building's user who incurs costs related to the operation of the building. The efficiency of the system is a conversion of final energy into utility energy. The utility energy concerns energy for heating and ventilation as well as for preparing domestic hot water, regardless of the type and efficiency of the heating device. A concept that is important from the designer's point of view, characterizing thermal insulation and building tightness. The concepts are presented below.

$$EU \xrightarrow{\eta} EK \xrightarrow{w_i} EP$$

Annual demand for non renewable primary energy EP [kWh/m²/year]

Non renewable primary energy demand for heating	Non renewable primary energy demand for cooling	Non renewable primary energy demand for ventilation	Non renewable primary energy demand for preparation of hot water	Non renewable primary energy demand for electricity	Sum (1+2+3+4+5)
1	**2**	**3**	**4**	**5**	**6**
955,34	-	-	8,40	330,84	1 294,58

Annual final energy demand EK [kWh/m²/year]

Final energy demand for heating	Final energy demand for cooling	Final energy demand for ventilation	Final energy demand for preparation of hot water	Final energy demand for electricity	Sum (1+2+3+4+5)
1	**2**	**3**	**4**	**5**	**6**
868,49	-	-	7,64	110,28	986,41

Annual utility energy demand EU [kWh/m²/year]

Utility energy demand for heating	Utility energy demand for cooling	Utility energy demand for ventilation	Utility energy demand for preparation of hot water	Utility energy demand for electricity	Sum (1+2+3+4)
1	**2**	**3**	**4**	**5**	**6**
781,64	-	-	7,26		788,90

Energy class of the building (according to the table 2): F high-energy consuming building

The EU indicator is a building quality indicator. In general, the smaller the EU, the less energy we lose through the outer baffles of the building. It refers to the energy which is consumed and goes from the building's heating system to the individual rooms, and the heat loss (through penetration and ventilation) to the environment. The EU indicator valuein the table below includes only heating/cooling.

Energy class	Energy assessment	EU indicator [kWh/m²/year]
A++	zero-energy building	≤ 10
A+	passive building	up to 15
A	low-energy building	from 15 to 45
B	energy-saving building	from 45 to 80
C	average energy efficient building	from 80 to 100
D	average energy-intensive building	from 100 to 150
E	energy-consuming building	from 150 to 250
F	high-energy consuming building	over 250

Table 2: Building energy class (source: Association for Sustainable Development).

Electricity price [in your own currency: CZK or EUR or HRK or HUF or PLN]

Fixed fee [per MW-month]: 0,1728 PLN
Variable fee [per kWh]: 40,70 PLN
Subscription [per month]: 2,40 PLN

Energy (heating) price [in your own currency: CZK or EUR or HRK or HUF or PLN]

Fixed fee [per MW-month]: 9,70 PLN
Variable fee [per GJ]: 17,60 PLN
Subscription [per month]:

Summary and evaluation of the energy building status

The external partitions do not meet the technical requirements in terms of the value of heat transfer coefficient. The building's energy system includes the heating system, the hot water preparation system and the power system. The efficiency of the heating system and the preparation of hot water is very high (90% and 95% respectively). In total, the building uses annually 520 565 kWh, 88% of which is for heating despite installed thermostatic valves. The energy class classifies it as an high energy consuming building.
The building is not equipped with cooling systems and ventilation is done through windows and ventilation ducts.

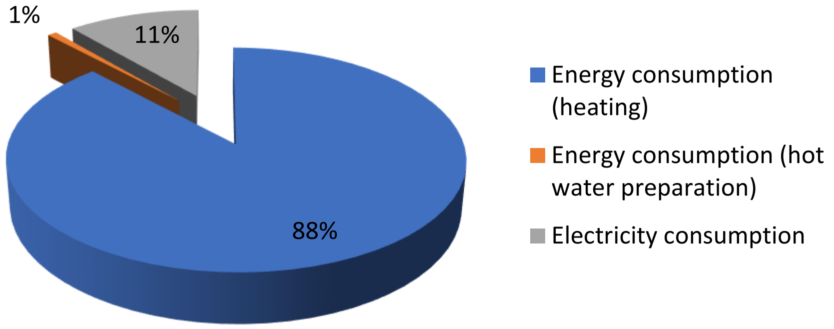


Figure 2: Energy consumption balance of the building for the PA8 – Town Hall.

PILOT ACTION - **PA8. Testing the project platform in PL/CZ cross-border regions (PL/CZ) - ZGM**

2. Description of the PA building(s)

The description of the building provides basic building and administrative information. It allows to determine the location and the prevailing geographical conditions, the surroundings of the building. In addition, construction data is an example for similar construction solutions.

Type of building: Institution of urban economy
Owner / investor: Municipality of Lubawka
Year of construction: 1987
Year of use (if different from year of construction): -
Gross building area [m^2]: 278
Building volume [m^3]: 1 558
Building envelope total surface area [m^2]: 676, 00
Shape factor (A/V ratio) [m^{-1}]: 0,178
The shape factor A/V is the ratio of the total surface area of all external walls (including windows and doors), roofs, floors on the ground or ceilings over the unheated basement, ceilings above the crossings, separating the heated part of the building from outside air to the volume of the heated part of the building, increased by the volume of heated rooms in the utility attic or in the basement and reduced by the volume of separate staircases, elevator shafts, open recesses, loggias and galleries.
It is best if the building shape factor is as low as possible. This means that the building should be as compact as possible, similar in shape to a sphere or cube, that is, solids characterized by the lowest A/V ratio. Considering energy consumption, a building with a high A/V ratio "consumes" more energy.
Typology (number of floors): 2
Number of building users: 25
Location: Lubawka st. Zielona 12

Available technical documentation: ○ **Yes** ◉ **No**

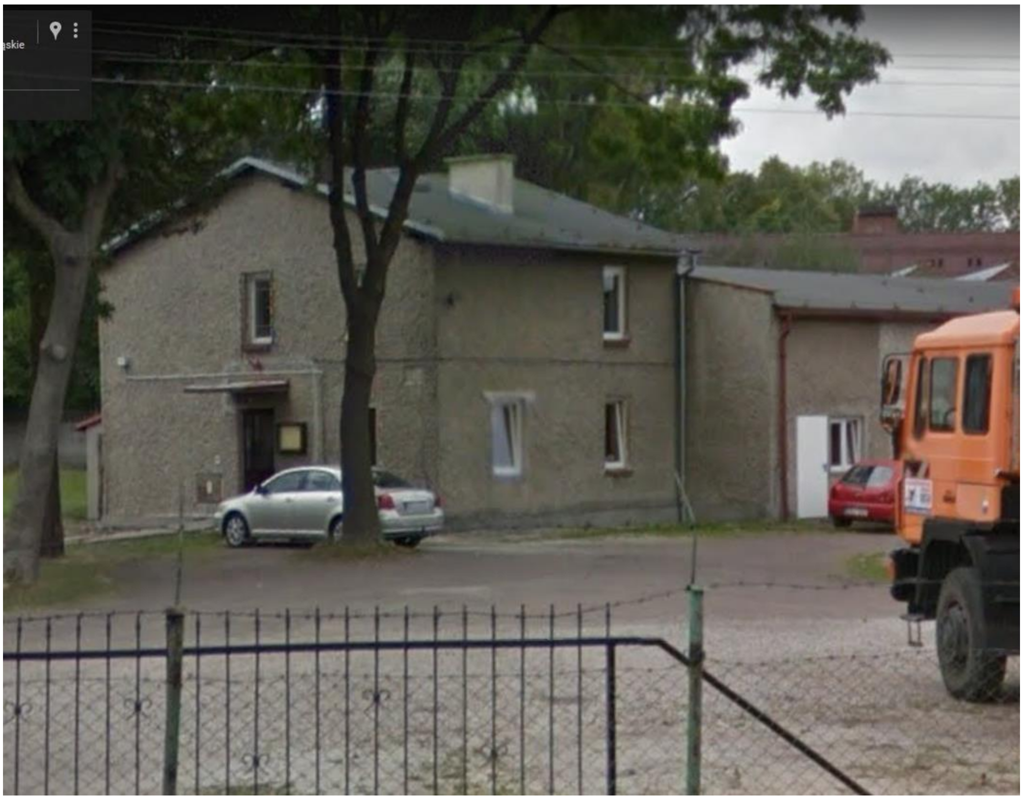


Figure 3: Photo of building available for the PA8 (source: Google Maps).

3. Energy PA building(s) profile

Collecting energy data allows to determine the energy profile of the building. It provides information on the insulation of external partitions and the condition of energy systems (heating/cooling, ventilation, electricity, hot water preparation) in buildings.

3.1. External partitions

The technical and construction status of the building envelope influences significantly the heat loss to the environment. The used construction and thermal insulation material is important. In order to improve standards, a norm, regulation is established for each partition in each country. For existing buildings in the case of low insulation, it is recommended to carry out thermo-modernization.

3.1.1. External walls

Walls total surface area [m^2]: 362

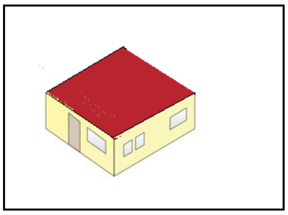
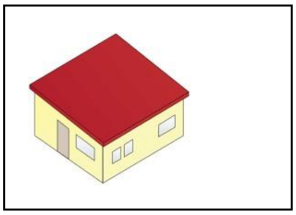
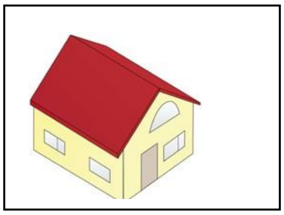
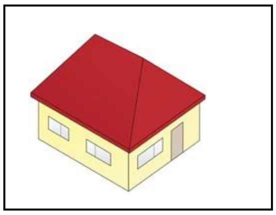
Envelope material (different layers):

No.	Material	Thickness [m]	Thermal conductivity [W/mK]	Heat transfer coefficient for external wall [W/m^2K]	Defined heat transfer coefficient for external wall (according to the norm, national regulations) [W/m^2K][2]
1	Brick			1,166	0,20
2	Cement-lime internal plaster				
3	Cement internal plaster				

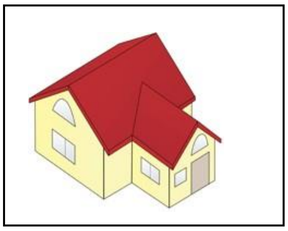
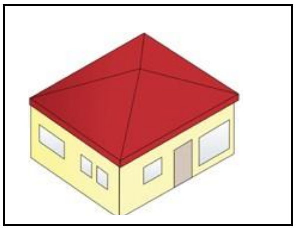
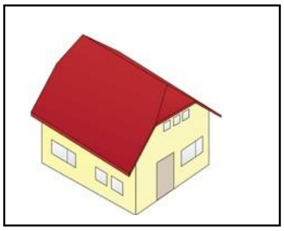
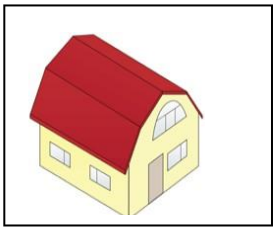
3.1.2. Roof

Type of roof:

☐ Flat roof ☐ Pent roof ☒ Gable roof ☐ Hip roof

☐ Multi-hip roof ☐ Tented roof ☐ Half-hipped roof ☐ Mansard roof

Roof slope [°]**:** no data **in direction:** no data
Roof total surface area [m^2]: 314
Envelope material (different layers):

No.	Material	Thickness [m]	Thermal conductivity [W/mK]	Heat transfer coefficient for roof [W/m^2K]	Defined heat transfer coefficient for roof (according to the norm, national regulations) [W/m^2K]
1	reinforced concrete			2,357	0,15
2	thermo-weldable roofing paper				

[2] If there are more U coefficients than one in your country, exchange all of them with the division, what they mean (e.g. recommended, required etc.)

3.1.3. Ground floor

Floor total surface area [m^2]: 235
Envelope material (different layers):

No.	Material	Thickness [m]	Thermal conductivity [W/mK]	Heat transfer coefficient for floor [W/m^{2}K]	Defined heat transfer coefficient for floor (according to the norm, national regulations) [W/m^{2}K]
1	gravel			0,395	0,30
2	lean concrete				
3	Styrofoam				
4	Cement screed				
5	terracotta				

3.1.4. Basement ceiling (if the building has a basement)

Total surface area [m^2]:
Envelope material (different layers):

No.	Material	Thickness [m]	Thermal conductivity [W/mK]	Heat transfer coefficient for floor [W/m^{2}K]	Defined heat transfer coefficient for floor (according to the norm, national regulations) [W/m^{2}K]
1					

Basement
Is the basement heated ? ☐ **Yes** ☐ **No**
Basement walls total surface area [m^2]:
Envelope material (different layers):

No.	Material	Thickness [m]	Thermal conductivity [W/mK]	Heat transfer coefficient for external wall [W/m^{2}K]	Defined heat transfer coefficient for external wall (according to the norm, national regulations) [W/m^{2}K]
1					

3.1.5. Windows

Type:
☐ single window, single glazed
☐ combined window, double glazed
☐ combined window, three panes
☐ single-frame window, double low-emission glass, argon chamber
☐ single-frame window, three glass panes, two (external) glasses are made of ordinary glass, and the inner glass of low-emission glass, the chambers between the glasses are filled with argon
☐ single-frame window, three glass panes, all glasses are made of low-emission glass, the chambers between the glasses are filled with argon
☒ other (what ?) ....single window with two panes ....

Shading (sun protection):

☐ curtains
☐ roller shutters
☐ wooden shutters
☐ internal blinds
☐ awnings
☐ other (what ?) ……

Material (PVC, wood, aluminum, wood-aluminum): PCV
Number of windows: 12
Windows total surface area [m^2]: 13,5
Diffusers in windows (YES or NO): NO
Heat transfer coefficient [W/m^2K]: 2,2
Defined heat transfer coefficient (according to the norm, national regulations) [W/m^2K]: 0,9

Thermo-modernization (if carried out)
Year: 2006
Type of windows: Single window with two panes
Material: PCV
Number of windows (if all windows are not replaced on the new ones): 12
Windows total surface area [m^2]: 13,5
Diffusers in windows (YES or NO): NO
Heat transfer coefficient [W/m^2K]: 2,2

3.1.6. Doors

Material (wood, aluminum, PVC etc.): aluminum
Number of doors: 1
Doors total surface area [m^2]: 2,1
Heat transfer coefficient [W/m^2K]: 2,2
Defined heat transfer coefficient (according to the norm, national regulations) [W/m^2K]: 1,3

Thermo-modernization (if carried out)
Year: 2006
Material: aluminum
Number of doors (if all doors are not replaced on the new ones): 1
Doors total surface area [m^2]: 2,1
Heat transfer coefficient [W/m^2K]: 2,2

3.2. Energy systems data

High efficiency of energy systems and the type of energy source determines its consumption. Also important is the issue of installed control and control systems that help ensure optimal thermal conditions.
Energy parameters characterizing the building:
Total non renewable primary energy demand [GJ/year or kWh/year]: 169 646,72 kWh/year
Energy consumption (heating) [GJ/year or kWh/year]: 432 GJ/year
Efficiency of the heating system [%]: 49

Energy consumption (hot water preparation) [GJ/year or kWh/year]: 3 GJ/year
Efficiency of the hot water preparation system [%]: 39,5
Energy consumption (cooling) [GJ/year or kWh/year]: no cooling system
Type of energy source (gas boiler, coal boiler, electricity, municipal heating network, biomass boiler, cogeneration, RES etc.): coal boiler
Regulation and control of systems in the building:

☒ thermostatic valves
☐ heat dividers
☐ motion sensors
☒ electricity meters
☒ water meters
☐ other (what ?)……………………………………………………………………………………………………

Annual fuel consumption [kg or m^3 or kWh or GJ]: 16 000 kg
Electricity consumption [kWh/year]: 12 244
Ordered power [MW]: 21
Lighting type (traditional incandescent lamps; halogen bulbs; fluorescent lamps; LED lamps): traditional incandescent lamps and LED lamps
Power of light bulbs [W]: 50
Number of lighting points: 30
Ventilation type (according to the table 1): mechanical (forced) ventilation

Building energy profile

The energy consumption in construction is distinguished by three types of energy - primary energy (EP), final energy (EK) and utility energy (EU). Primary energy refers to the energy contained in sources, including fuels and carriers, necessary to cover the final energy demand, taking into account the efficiency of the entire chain of acquisition, conversion and transport to the end user. A concept that is important from the point of view of a sustainable development strategy. The ratio of non-renewable primary energy inputs to the generation and delivery of an energy or energy carrier for technical systems is the difference between primary energy and final energy. The final energy is heat and auxiliary energy, which must be delivered to the boundary of the heating system (building) with a given efficiency in order to cover the energy demand for heating and ventilation of rooms. A concept that is important from the point of view of the building's user who incurs costs related to the operation of the building. The efficiency of the system is a conversion of final energy into utility energy. The utility energy concerns energy for heating and ventilation as well as for preparing domestic hot water, regardless of the type and efficiency of the heating device. A concept that is important from the designer's point of view, characterizing thermal insulation and building tightness. The concepts are presented below.

$$EU \xrightarrow{\eta} EK \xrightarrow{w_i} EP$$

Annual demand for non renewable primary energy EP [kWh/m²/year]

Non renewable primary energy demand for heating	Non renewable primary energy demand for cooling	Non renewable primary energy demand for ventilation	Non renewable primary energy demand for preparation of hot water	Non renewable primary energy demand for electricity	Sum (1+2+3+4+5)
1	**2**	**3**	**4**	**5**	**6**
474,83	-	No data	3,29	132,12	610,24

Annual final energy demand EK [kWh/m²/year]

Final energy demand for heating	Final energy demand for cooling	Final energy demand for ventilation	Final energy demand for preparation of hot water	Final energy demand for electricity	Sum (1+2+3+4+5)
1	**2**	**3**	**4**	**5**	**6**
431,66	-	No data	2,99	44,04	478,69

Annual utility energy demand EU [kWh/m²/year]

Utility energy demand for heating	Utility energy demand for cooling	Utility energy demand for ventilation	Utility energy demand for preparation of hot water	Utility energy demand for electricity	Sum (1+2+3+4)
1	**2**	**3**	**4**	**5**	**6**
211,51	-	No data	1,18		212,69

Energy class of the building (according to the table 2): E energy-consuming building
The EU indicator is a building quality indicator. In general, the smaller the EU, the less energy we lose through the outer baffles of the building. It refers to the energy which is consumed and goes from the building's heating system to the individual rooms, and the heat loss (through penetration and ventilation) to the environment. The EU indicator value in the table below includes only heating/cooling.

Electricity price [in your own currency: CZK or EUR or HRK or HUF or PLN]
Fixed fee [per MW-month]: 250,31 PLN
Variable fee [per kWh]: no data
Subscription [per month]: 2,40 PLN

Energy (heating) price [in your own currency: CZK or EUR or HRK or HUF or PLN]
Fixed fee [per MW-month]:
Variable fee [per GJ]:
Subscription [per month]:

Summary and evaluation of the energy building status
The external partitions do not meet the technical requirements in terms of the value of heat transfer coefficient. The building's energy system includes the heating system, the hot water preparation system, mechanical ventilation system and the power system. The efficiency of the heating system and the preparation of hot water is low (49% and 39,5% respectively). In total, the building uses annually 133 077 kWh, 90% of which is for heating despite installed thermostatic valves. The energy class classifies it as an energy consuming building.
The building is not equipped with cooling system.

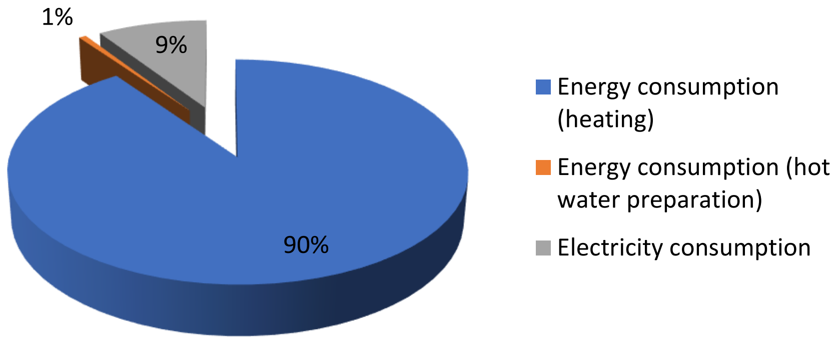


Figure 4: Energy consumption balance of the building for the PA8 – ZGM.

PILOT ACTION - **PA8. Testing the project platform in PL/CZ cross-border regions (PL/CZ) - SP ZOZ**

2. Description of the PA building(s)

The description of the building provides basic building and administrative information. It allows to determine the location and the prevailing geographical conditions, the surroundings of the building. In addition, construction data is an example for similar construction solutions.

Type of building: public health care institution
Owner / investor: Municipality of Lubawka
Year of construction: -
Year of use (if different from year of construction): -
Gross building area [m^2]: 696,70
Building volume [m^3]: 8 070,00
Building envelope total surface area [m^2]: -
Shape factor (A/V ratio) [m^{-1}]: -
The shape factor A/V is the ratio of the total surface area of all external walls (including windows and doors), roofs, floors on the ground or ceilings over the unheated basement, ceilings above the crossings, separating the heated part of the building from outside air to the volume of the heated part of the building, increased by the volume of heated rooms in the utility attic or in the basement and reduced by the volume of separate staircases, elevator shafts, open recesses, loggias and galleries.
It is best if the building shape factor is as low as possible. This means that the building should be as compact as possible, similar in shape to a sphere or cube, that is, solids characterized by the lowest A/V ratio. Considering energy consumption, a building with a high A/V ratio "consumes" more energy.
Typology (number of floors): 2
Number of building users: max. 70
Location: Lubawka st. Kościuszki 19

Available technical documentation: ◉ **Yes** ○ **No**

Technical inventory of the building Year: 1996

*Figure 5: Photo of building available for the PA8 (*source: Google Maps).

3. Energy PA building(s) profile

Collecting energy data allows to determine the energy profile of the building. It provides information on the insulation of external partitions and the condition of energy systems (heating/cooling, ventilation, electricity, hot water preparation) in buildings.

3.1. External partitions

The technical and construction status of the building envelope influences significantly the heat loss to the environment. The used construction and thermal insulation material is important. In order to improve standards, a norm, regulation is established for each partition in each country. For existing buildings in the case of low insulation, it is recommended to carry out thermo-modernization.

3.1.1. External walls

Walls total surface area [m^2]:

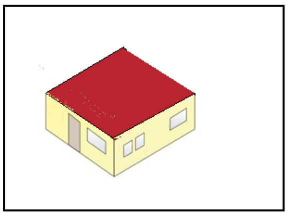
Envelope material (different layers):

No.	Material	Thickness [m]	Thermal conductivity [W/mK]	Heat transfer coefficient for external wall [W/m²K]	Defined heat transfer coefficient for external wall (according to the norm, national regulations) [W/m²K][3]
			WALL type 1		
1	MAX blocks	0,29			0,20
2	styrofoam	0,04			
3	air gap	0,01			
4	hollow blocks	0,12			
			WALL type 2		
1	concrete blocks				0,20
2	styrofoam				
3	smooth plaster noble three-layer				

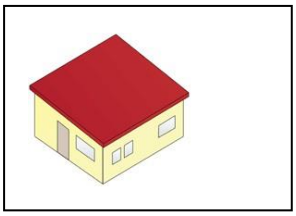
3.1.2. Roof

Type of roof:

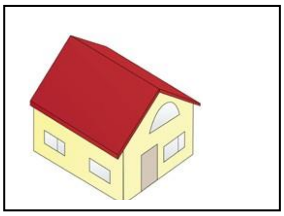
☐ Flat roof



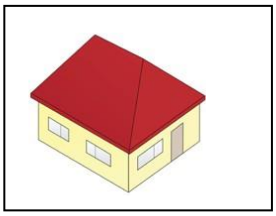
☐ Pent roof



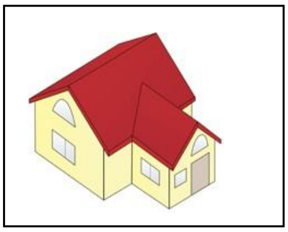
☐ Gable roof



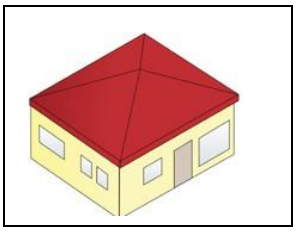
☐ Hip roof



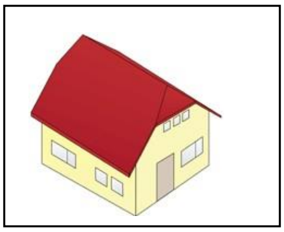
☒ Multi-hip roof



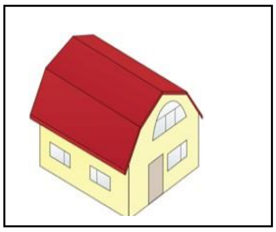
☐ Tented roof



☐ Half-hipped roof



☐ Mansard roof



Roof slope [°]**:** no data **in direction:** no data
Roof total surface area [m²]:

[3] If there are more U coefficients than one in your country, exchange all of them with the division, what they mean (e.g. recommended, required etc.)

Envelope material (different layers):

No.	Material	Thickness [m]	Thermal conductivity [W/mK]	Heat transfer coefficient for roof [W/m²K]	Defined heat transfer coefficient for roof (according to the norm, national regulations) [W/m²K]
1	ceramic cover				0,15
2	tile				

3.1.3. Ground floor

Floor total surface area [m²]:
Envelope material (different layers):

No.	Material	Thickness [m]	Thermal conductivity [W/mK]	Heat transfer coefficient for floor [W/m²K]	Defined heat transfer coefficient for floor (according to the norm, national regulations) [W/m²K]
1					

3.1.4. Basement ceiling (if the building has a basement)

Total surface area [m²]: 462,40
Envelope material (different layers):

No.	Material	Thickness [m]	Thermal conductivity [W/mK]	Heat transfer coefficient for floor [W/m²K]	Defined heat transfer coefficient for floor (according to the norm, national regulations) [W/m²K]
1					

Basement
Is the basement heated ? ☐ **Yes** ☐ **No**
Basement walls total surface area [m²]:
Envelope material (different layers):

No.	Material	Thickness [m]	Thermal conductivity [W/mK]	Heat transfer coefficient for external wall [W/m²K]	Defined heat transfer coefficient for external wall (according to the norm, national regulations) [W/m²K]
1					

3.1.5. Windows

Type:
☐ single window, single glazed
☒ combined window, double glazed
☐ combined window, three panes
☐ single-frame window, double low-emission glass, argon chamber
☐ single-frame window, three glass panes, two (external) glasses are made of ordinary glass, and the inner glass of low-emission glass, the chambers between the glasses are filled with argon
☐ single-frame window, three glass panes, all glasses are made of low-emission glass, the chambers between the glasses are filled with argon

☐ other (what ?)……………………………………………………………………………………………………

Shading (sun protection):
☐ curtains
☐ roller shutters
☐ wooden shutters
☐ internal blinds
☐ awnings
☐ other (what ?) ……

Material (PVC, wood, aluminum, wood-aluminum): PVC
Number of windows:
Windows total surface area [m^2]:
Diffusers in windows (YES or NO):
Heat transfer coefficient [W/m^2K]:
Defined heat transfer coefficient (according to the norm, national regulations) [W/m^2K]: 0,9

3.1.6. Doors

Material (wood, aluminum, PVC etc.):
Number of doors:
Doors total surface area [m^2]:
Heat transfer coefficient [W/m^2K]:
Defined heat transfer coefficient (according to the norm, national regulations) [W/m^2K]: 1,3

3.2. Energy systems data

High efficiency of energy systems and the type of energy source determines its consumption. Also important is the issue of installed control and control systems that help ensure optimal thermal conditions. Energy parameters characterizing the building:
Total non renewable primary energy demand [GJ/year or kWh/year]: 659 610,8324 kWh/year
Energy consumption (heating) [GJ/year or kWh/year]: 445,375 GJ/year
Efficiency of the heating system [%]: 92
Energy consumption (hot water preparation) [GJ/year or kWh/year]:
Efficiency of the hot water preparation system [%]:
Energy consumption (cooling) [GJ/year or kWh/year]:
Type of energy source (gas boiler, coal boiler, electricity, municipal heating network, biomass boiler, cogeneration, RES etc.): gas boiler
Regulation and control of systems in the building:
☒ thermostatic valves
☐ heat dividers
☐ motion sensors
☐ electricity meters
☐ water meters
☐ other (what ?)……………………………………………………………………………………………………
Annual fuel consumption [kg or m^3 or kWh or GJ]: 12 725 m^3
Electricity consumption [kWh/year]: 19 356
Ordered power [MW]:

Lighting type (traditional incandescent lamps; halogen bulbs; fluorescent lamps; LED lamps):
Power of light bulbs [W]:
Number of lighting points:
Ventilation type (according to the table 1): mechanical (forced) ventilation

Building energy profile

The energy consumption in construction is distinguished by three types of energy - primary energy (EP), final energy (EK) and utility energy (EU). Primary energy refers to the energy contained in sources, including fuels and carriers, necessary to cover the final energy demand, taking into account the efficiency of the entire chain of acquisition, conversion and transport to the end user. A concept that is important from the point of view of a sustainable development strategy. The ratio of non-renewable primary energy inputs to the generation and delivery of an energy or energy carrier for technical systems is the difference between primary energy and final energy. The final energy is heat and auxiliary energy, which must be delivered to the boundary of the heating system (building) with a given efficiency in order to cover the energy demand for heating and ventilation of rooms. A concept that is important from the point of view of the building's user who incurs costs related to the operation of the building. The efficiency of the system is a conversion of final energy into utility energy. The utility energy concerns energy for heating and ventilation as well as for preparing domestic hot water, regardless of the type and efficiency of the heating device. A concept that is important from the designer's point of view, characterizing thermal insulation and building tightness. The concepts are presented below.

$$EU \xrightarrow{\eta} EK \xrightarrow{w_i} EP$$

Annual demand for non renewable primary energy EP [kWh/m²/year]

Non renewable primary energy demand for heating	Non renewable primary energy demand for cooling	Non renewable primary energy demand for ventilation	Non renewable primary energy demand for preparation of hot water	Non renewable primary energy demand for electricity	Sum (1+2+3+4+5)
1	**2**	**3**	**4**	**5**	**6**
177,57	-	No data	No data	27,78	205,35

Annual final energy demand EK [kWh/m²/year]

Final energy demand for heating	Final energy demand for cooling	Final energy demand for ventilation	Final energy demand for preparation of hot water	Final energy demand for electricity	Sum (1+2+3+4+5)
1	**2**	**3**	**4**	**5**	**6**
195,33	-	No data	No data	83,34	278,67

Annual utility energy demand EU [kWh/m²/year]

Utility energy demand for heating	Utility energy demand for cooling	Utility energy demand for ventilation	Utility energy demand for preparation of hot water	Utility energy demand for electricity	Sum (1+2+3+4)
1	**2**	**3**	**4**	**5**	**6**
179,71	-	No data	-		179,71

Energy class of the building (according to the table 2): E energy-consuming building
The EU indicator is a building quality indicator. In general, the smaller the EU, the less energy we lose through the outer baffles of the building. It refers to the energy which is consumed and goes from the building's heating system to the individual rooms, and the heat loss (through penetration and ventilation) to the environment. The EU indicator value in the table below includes only heating/cooling.

Electricity price [in your own currency: CZK or EUR or HRK or HUF or PLN]
Fixed fee [per MW-month]:
Variable fee [per kWh]:
Subscription [per month]:

Energy (heating) price [in your own currency: CZK or EUR or HRK or HUF or PLN]
Fixed fee [per MW-month]:
Variable fee [per GJ]:
Subscription [per month]:

Summary and evaluation of the energy building status
The building's energy system includes the heating system, mechanical ventilation system and the power system. The efficiency of the heating system is very high (92%). In total, the building uses annually 143 071 kWh, 86% of which is for heating despite installed thermostatic valves. The energy class classifies it as an energy consuming building.

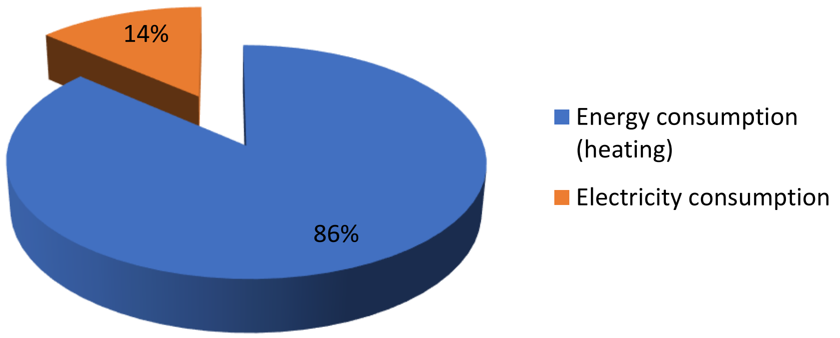


Figure 6: Energy consumption balance of the building for the PA8 – SP ZOZ.

PILOT ACTION - **PA8. Testing the project platform in PL/CZ cross-border regions (PL/CZ) - SP MICKIEWICZA**

2. Description of the PA building(s)

The description of the building provides basic building and administrative information. It allows to determine the location and the prevailing geographical conditions, the surroundings of the building. In addition, construction data is an example for similar construction solutions.

Type of building: School

Owner / investor: Municipality of Lubawka
Year of construction:
Year of use (if different from year of construction):
Gross building area [m^2]: 2 467,05
Building volume [m^3]: 27 269,65
Building envelope total surface area [m^2]: 5 765,7075
Shape factor (A/V ratio) [m^{-1}]:
The shape factor A/V is the ratio of the total surface area of all external walls (including windows and doors), roofs, floors on the ground or ceilings over the unheated basement, ceilings above the crossings, separating the heated part of the building from outside air to the volume of the heated part of the building, increased by the volume of heated rooms in the utility attic or in the basement and reduced by the volume of separate staircases, elevator shafts, open recesses, loggias and galleries.
It is best if the building shape factor is as low as possible. This means that the building should be as compact as possible, similar in shape to a sphere or cube, that is, solids characterized by the lowest A/V ratio. Considering energy consumption, a building with a high A/V ratio "consumes" more energy.
Typology (number of floors): 4
Number of building users: 715
Location: Lubawka st. Mickiewicza 4

Available technical documentation: ◉ **Yes** ○ **No**

Technical inventory of the building Year: 2010

Figure 7: Photo of building available for the PA8 (source: http://fotopolska.eu/foto/927/927275.jpg)

3. Energy PA building(s) profile

Collecting energy data allows to determine the energy profile of the building. It provides information on the insulation of external partitions and the condition of energy systems (heating/cooling, ventilation, electricity, hot water preparation) in buildings.

3.1. External partitions

The technical and construction status of the building envelope influences significantly the heat loss to the environment. The used construction and thermal insulation material is important. In order to improve standards, a norm, regulation is established for each partition in each country. For existing buildings in the case of low insulation, it is recommended to carry out thermo-modernization.

3.1.1. External walls

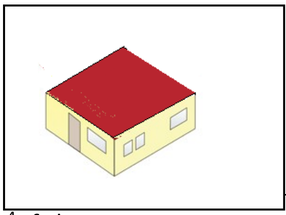
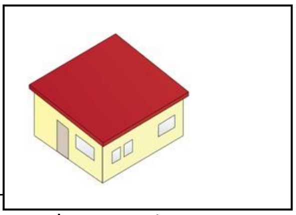
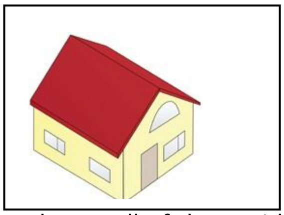
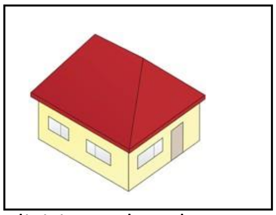
Walls total surface area [m^2]:
Envelope material (different layers):

No.	Material	Thickness [m]	Thermal conductivity [W/mK]	Heat transfer coefficient for external wall [W/m^2K]	Defined heat transfer coefficient for external wall (according to the norm, national regulations) [W/m^2K][4]
1	Porotherm blocks on cement and lime mortar			0,206	0,20
2	Styrofoam				
3	Fiberglass mesh				
4	Mineral plaster				
5	Plaster mosaic				

Thermo-modernization (if carried out)
Year: 2009
Applied thermal insulation material:
Thickness [cm]:
Thermal conductivity [W/mK]:

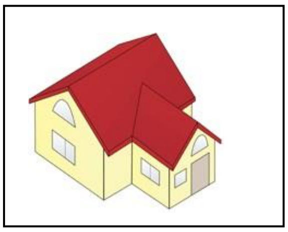
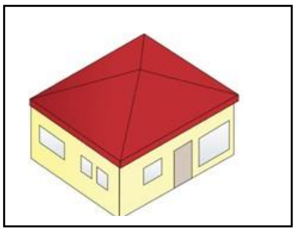
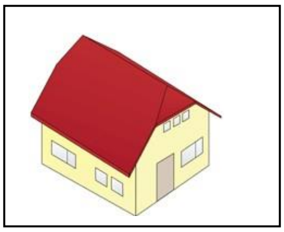
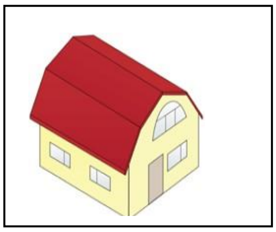
3.1.2. Roof

Type of roof:
☐ Flat roof ☒ Pent roof ☐ Gable roof ☐ Hip roof

[4] If there are more U coefficients than one in your country, exchange all of them with the division, what they mean (e.g. recommended, required etc.)

☐ Multi-hip roof ☐ Tented roof ☐ Half-hipped roof ☐ Mansard roof

Roof slope [°]**:** 2,8° and 2,18° **in direction:** N/A
Roof total surface area [m^2]:
Envelope material (different layers):

No.	Material	Thickness [m]	Thermal conductivity [W/mK]	Heat transfer coefficient for roof [W/m^2K]	Defined heat transfer coefficient for roof (according to the norm, national regulations) [W/m^2K]
1	reinforced concrete slabs			0,136	0,15
2	roofing felt				

Thermo-modernization (if carried out)
Year: 2009
Applied thermal insulation material:
Thickness [cm]:
Thermal conductivity [W/mK]:

3.1.3. Ground floor

Floor total surface area [m^2]: 1 643,96
Envelope material (different layers):

No.	Material	Thickness [m]	Thermal conductivity [W/mK]	Heat transfer coefficient for floor [W/m^2K]	Defined heat transfer coefficient for floor (according to the norm, national regulations) [W/m^2K]
1				0,182	0,30

3.1.4. Basement ceiling (if the building has a basement)

Total surface area [m^2]: 1 643,96
Envelope material (different layers):

No.	Material	Thickness [m]	Thermal conductivity [W/mK]	Heat transfer coefficient for floor [W/m^2K]	Defined heat transfer coefficient for floor (according to the norm, national regulations) [W/m^2K]
1					

<u>Basement</u>

Is the basement heated ? ☐ **Yes** ☐ **No**
Basement walls total surface area [m^2]:
Envelope material (different layers):

No.	Material	Thickness [m]	Thermal conductivity [W/mK]	Heat transfer coefficient for external wall [W/m^2K]	Defined heat transfer coefficient for external wall (according to the norm, national regulations) [W/m^2K]
1				0,172	

3.1.5. Windows

Type:
☐ single window, single glazed
☐ combined window, double glazed
☐ combined window, three panes
☐ single-frame window, double low-emission glass, argon chamber
☐ single-frame window, three glass panes, two (external) glasses are made of ordinary glass, and the inner glass of low-emission glass, the chambers between the glasses are filled with argon
☐ single-frame window, three glass panes, all glasses are made of low-emission glass, the chambers between the glasses are filled with argon
☐ other (what ?)………

Shading (sun protection):
☐ curtains
☐ roller shutters
☐ wooden shutters
☐ internal blinds
☐ awnings
☐ other (what ?)………

Material (PVC, wood, aluminum, wood-aluminum): PCV
Number of windows:
Windows total surface area [m^2]:
Diffusers in windows (YES or NO): YES
Heat transfer coefficient [W/m^2K]: 1,1
Defined heat transfer coefficient (according to the norm, national regulations) [W/m^2K]: 0,9

3.1.6. Doors

Material (wood, aluminum, PVC etc.): PCV and glass P4
Number of doors:
Doors total surface area [m^2]:
Heat transfer coefficient [W/m^2K]: 2,6
Defined heat transfer coefficient (according to the norm, national regulations) [W/m^2K]: 1,3

3.2. Energy systems data

High efficiency of energy systems and the type of energy source determines its consumption. Also important is the issue of installed control and control systems that help ensure optimal thermal conditions. Energy parameters characterizing the building:

Total non renewable primary energy demand [GJ/year or kWh/year]: 959 619,5 kWh/year
Energy consumption (heating) [GJ/year or kWh/year]: 2 374,58 GJ/year
Efficiency of the heating system [%]: 100
Energy consumption (hot water preparation) [GJ/year or kWh/year]:
Efficiency of the hot water preparation system [%]:
Energy consumption (cooling) [GJ/year or kWh/year]:
Type of energy source (gas boiler, coal boiler, electricity, municipal heating network, biomass boiler, cogeneration, RES etc.): coal boiler
Regulation and control of systems in the building:

☒ thermostatic valves
☐ heat dividers
☐ motion sensors
☐ electricity meters
☐ water meters
☐ other (what ?)………………………………………………………………………………………………………

Annual fuel consumption [kg or m^3 or kWh or GJ]: 91 330 kg
Electricity consumption [kWh/year]: 78 018
Ordered power [MW]:
Lighting type (traditional incandescent lamps; halogen bulbs; fluorescent lamps; LED lamps):
Power of light bulbs [W]:
Number of lighting points:
Ventilation type (according to the table 1): no data

Building energy profile

The energy consumption in construction is distinguished by three types of energy - primary energy (EP), final energy (EK) and utility energy (EU). Primary energy refers to the energy contained in sources, including fuels and carriers, necessary to cover the final energy demand, taking into account the efficiency of the entire chain of acquisition, conversion and transport to the end user. A concept that is important from the point of view of a sustainable development strategy. The ratio of non-renewable primary energy inputs to the generation and delivery of an energy or energy carrier for technical systems is the difference between primary energy and final energy. The final energy is heat and auxiliary energy, which must be delivered to the boundary of the heating system (building) with a given efficiency in order to cover the energy demand for heating and ventilation of rooms. A concept that is important from the point of view of the building's user who incurs costs related to the operation of the building. The efficiency of the system is a conversion of final energy into utility energy. The utility energy concerns energy for heating and ventilation as well as for preparing domestic hot water, regardless of the type and efficiency of the heating device. A concept that is important from the designer's point of view, characterizing thermal insulation and building tightness. The concepts are presented below.

$$EU \xrightarrow{\eta} EK \xrightarrow{w_i} EP$$

Annual demand for non renewable primary energy EP [kWh/m²/year]

Non renewable primary energy demand for heating	Non renewable primary energy demand for cooling	Non renewable primary energy demand for ventilation	Non renewable primary energy demand for preparation of hot water	Non renewable primary energy demand for electricity	Sum (1+2+3+4+5)
1	**2**	**3**	**4**	**5**	**6**
267,37	-	-	No data	31,62	298,99

Annual final energy demand EK [kWh/m²/year]

Final energy demand for heating	Final energy demand for cooling	Final energy demand for ventilation	Final energy demand for preparation of hot water	Final energy demand for electricity	Sum (1+2+3+4+5)
1	**2**	**3**	**4**	**5**	**6**
294,11	-	-	No data	94,86	388,97

Annual utility energy demand EU [kWh/m²/year]

Utility energy demand for heating	Utility energy demand for cooling	Utility energy demand for ventilation	Utility energy demand for preparation of hot water	Utility energy demand for electricity	Sum (1+2+3+4)
1	**2**	**3**	**4**	**5**	**6**
294,11	-	-	No data		294,11

Energy class of the building (according to the table 2): F high-energy consuming building
The EU indicator is a building quality indicator. In general, the smaller the EU, the less energy we lose through the outer baffles of the building. It refers to the energy which is consumed and goes from the building's heating system to the individual rooms, and the heat loss (through penetration and ventilation) to the environment. The EU indicator value in the table below includes only heating/cooling.

Electricity price [in your own currency: CZK or EUR or HRK or HUF or PLN]
Fixed fee [per MW-month]: 2,16
Variable fee [per kWh]: 0,22
Subscription [per month]: 2,40

Energy (heating) price [in your own currency: CZK or EUR or HRK or HUF or PLN]
Fixed fee [per MW-month]:
Variable fee [per GJ]:
Subscription [per month]:

Summary and evaluation of the energy building status
The thermo-modernization in 2009 included the roof, ground floor and walls insulation, so these external partitions meet the technical requirements in terms of the value of heat transfer coefficient. The building's energy system includes the heating system and the power system. The efficiency of the heating system is 100%. In total, the building uses annually 737 623 kWh, 89% of which is for heating despite installed thermostatic valves. The energy class classifies it as an high energy consuming building.

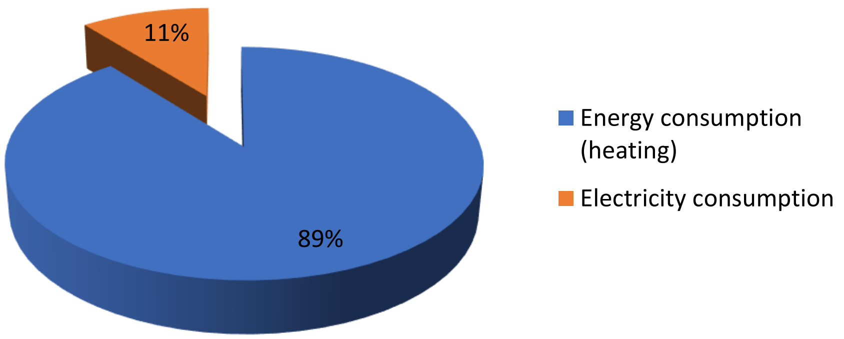


Figure 8: Energy consumption balance of the building for the PA8 – SP MICKIEWICZA.

PILOT ACTION - **PA8. Testing the project platform in PL/CZ cross-border regions (PL/CZ) - Zacler Skola**

2. Description of the PA building(s)

The description of the building provides basic building and administrative information. It allows to determine the location and the prevailing geographical conditions, the surroundings of the building. In addition, construction data is an example for similar construction solutions.

Type of building: Primary school
Owner / investor: Mesto Zacler
Year of construction: 1732
Year of use (if different from year of construction): 1897
Gross building area [m^2]: 889,64
Building volume [m^3]: 441,71
Building envelope total surface area [m^2]: 818,15
Shape factor (A/V ratio) [m^{-1}]: 0,29
The shape factor A/V is the ratio of the total surface area of all external walls (including windows and doors), roofs, floors on the ground or ceilings over the unheated basement, ceilings above the crossings, separating the heated part of the building from outside air to the volume of the heated part of the building, increased by the volume of heated rooms in the utility attic or in the basement and reduced by the volume of separate staircases, elevator shafts, open recesses, loggias and galleries.
It is best if the building shape factor is as low as possible. This means that the building should be as compact as possible, similar in shape to a sphere or cube, that is, solids characterized by the lowest A/V ratio. Considering energy consumption, a building with a high A/V ratio "consumes" more energy.
Typology (number of floors): 4 floors + basement
Number of building users:
Location: Mesto Zacler, Komenského 339, 542 01 Žacléř

Available technical documentation: ◉ **Yes** ○ **No**

Energy audit Year: 2005

Technical inventory of the building Year: 2013


Figure 9: Photo of building available for the PA8 (source: https://mobatime.cz/zs-zacler/)

3. Energy PA building(s) profile

Collecting energy data allows to determine the energy profile of the building. It provides information on the insulation of external partitions and the condition of energy systems (heating/cooling, ventilation, electricity, hot water preparation) in buildings.

3.1. External partitions

The technical and construction status of the building envelope influences significantly the heat loss to the environment. The used construction and thermal insulation material is important. In order to improve standards, a norm, regulation is established for each partition in each country. For existing buildings in the case of low insulation, it is recommended to carry out thermo-modernization.

3.1.1. External walls

Walls total surface area [m^2]: no data

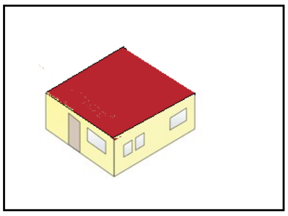
Envelope material (different layers):

No.	Material	Thickness [m]	Thermal conductivity [W/mK]	Heat transfer coefficient for external wall [W/m²K]	Defined heat transfer coefficient for external wall (according to the norm, national regulations) [W/m²K][5]
WALL type 1					
1	Plaster of lime cement			0,10	0,3 required/0,25 recommended
2	Grapieny				
3	Plaster of lime cement				
WALL type 2					
1	Plaster of lime cement			0,02	0,3 required/0,25 recommended
2	Grapieny				
3	Plaster of lime cement				
4	weber. M707/ adhesive substance				
5	styrotherm plus 70 insulating material Neopor				

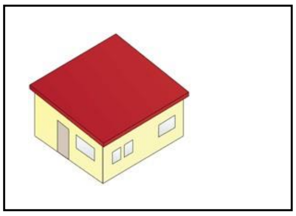
3.1.2. Roof

Type of roof:

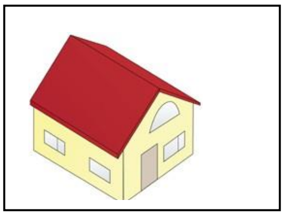
☐ Flat roof



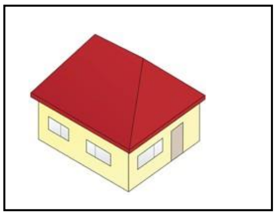
☐ Pent roof



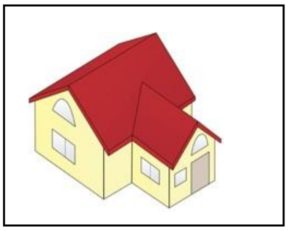
☐ Gable roof



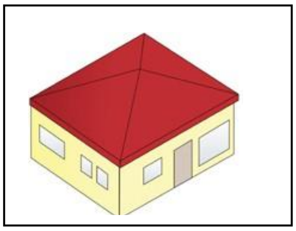
☐ Hip roof



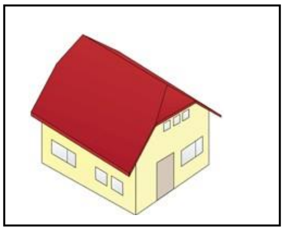
☒ Multi-hip roof



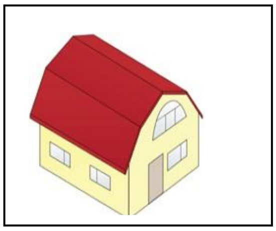
☐ Tented roof



☐ Half-hipped roof



☐ Mansard roof



[5] If there are more U coefficients than one in your country, exchange all of them with the division, what they mean (e.g. recommended, required etc.)

Roof slope [°]**:** no data **in direction:** no data
Roof total surface area [m²]: no data
Envelope material (different layers):

No.	Material	Thickness [m]	Thermal conductivity [W/mK]	Heat transfer coefficient for roof [W/m²K]	Defined heat transfer coefficient for roof (according to the norm, national regulations) [W/m²K]
1					

3.1.3. Ground floor

Floor total surface area [m²]: no data
Envelope material (different layers):

No.	Material	Thickness [m]	Thermal conductivity [W/mK]	Heat transfer coefficient for floor [W/m²K]	Defined heat transfer coefficient for floor (according to the norm, national regulations) [W/m²K]
1	PVC			0,10	0,45 required/ 0,3 recommended
2	Thick concrete (2100)				
3	Asphalt bands, and cardboard				

3.1.4. Basement ceiling (if the building has a basement)

Total surface area [m²]:
Envelope material (different layers):

No.	Material	Thickness [m]	Thermal conductivity [W/mK]	Heat transfer coefficient for floor [W/m²K]	Defined heat transfer coefficient for floor (according to the norm, national regulations) [W/m²K]
1	PVC			0,10	1,05 required/ 0,7 recommended
2	Thick concrete (2100)				
3	Asphalt bands, and cardboard				

<u>**Basement**</u>
Is the basement heated ? ☐ **Yes** ☐ **No**
Basement walls total surface area [m²]:

Envelope material (different layers):

No.	Material	Thickness [m]	Thermal conductivity [W/mK]	Heat transfer coefficient for external wall [W/m²K]	Defined heat transfer coefficient for external wall (according to the norm, national regulations) [W/m²K]
1					

3.1.5. Windows

Type:
☐ single window, single glazed
☐ combined window, double glazed
☐ combined window, three panes
☐ single-frame window, double low-emission glass, argon chamber
☐ single-frame window, three glass panes, two (external) glasses are made of ordinary glass, and the inner glass of low-emission glass, the chambers between the glasses are filled with argon
☐ single-frame window, three glass panes, all glasses are made of low-emission glass, the chambers between the glasses are filled with argon
☒ other (what ?) ....wooden double window closed with a bolt..

Shading (sun protection):
☐ curtains
☐ roller shutters
☐ wooden shutters
☐ internal blinds
☐ awnings
☐ other (what ?) ....

Material (PVC, wood, aluminum, wood-aluminum): wood
Number of windows: 152
Windows total surface area [m^2]: 371,3216
Diffusers in windows (YES or NO):
Heat transfer coefficient [W/m^2K]:
Defined heat transfer coefficient (according to the norm, national regulations) [W/m^2K]: 1,5 requested/1,2 recommended

3.1.6. Doors

Material (wood, aluminum, PVC etc.): wood
Number of doors:
Doors total surface area [m^2]:
Heat transfer coefficient [W/m^2K]:
Defined heat transfer coefficient (according to the norm, national regulations) [W/m^2K]: 3,5 requested/2,3 recommended

3.2. Energy systems data

High efficiency of energy systems and the type of energy source determines its consumption. Also important is the issue of installed control and control systems that help ensure optimal thermal conditions. Energy parameters characterizing the building:
Total non renewable primary energy demand [GJ/year or kWh/year]: 3 408 GJ/year
Energy consumption (heating) [GJ/year or kWh/year]: 3 241 GJ/year
Efficiency of the heating system [%]:
Energy consumption (hot water preparation) [GJ/year or kWh/year]:
Efficiency of the hot water preparation system [%]:
Energy consumption (cooling) [GJ/year or kWh/year]:
Type of energy source (gas boiler, coal boiler, electricity, municipal heating network, biomass boiler, cogeneration, RES etc.): gas boiler
Regulation and control of systems in the building:
☐ thermostatic valves
☐ heat dividers
☐ motion sensors
☐ electricity meters
☐ water meters
☐ other (what ?)……………………………………………………………………………………………………
Annual fuel consumption [kg or m^3 or kWh or GJ]:
Electricity consumption [kWh/year]: 46 389,26
Ordered power [MW]:
Lighting type (traditional incandescent lamps; halogen bulbs; fluorescent lamps; LED lamps):
Power of light bulbs [W]:
Number of lighting points:
Ventilation type (according to the table 1): no data

Building energy profile

The energy consumption in construction is distinguished by three types of energy - primary energy (EP), final energy (EK) and utility energy (EU). Primary energy refers to the energy contained in sources, including fuels and carriers, necessary to cover the final energy demand, taking into account the efficiency of the entire chain of acquisition, conversion and transport to the end user. A concept that is important from the point of view of a sustainable development strategy. The ratio of non-renewable primary energy inputs to the generation and delivery of an energy or energy carrier for technical systems is the difference between primary energy and final energy. The final energy is heat and auxiliary energy, which must be delivered to the boundary of the heating system (building) with a given efficiency in order to cover the energy demand for heating and ventilation of rooms. A concept that is important from the point of view of the building's user who incurs costs related to the operation of the building. The efficiency of the system is a conversion of final energy into utility energy. The utility energy concerns energy for heating and ventilation as well as for preparing domestic hot water, regardless of the type and efficiency of the heating device. A concept that is important from the designer's point of view, characterizing thermal insulation and building tightness. The concepts are presented below.

$$EU \xrightarrow{\eta} EK \xrightarrow{w_i} EP$$

Annual demand for non renewable primary energy EP [kWh/m²/year]

Non renewable primary energy demand for heating	Non renewable primary energy demand for cooling	Non renewable primary energy demand for ventilation	Non renewable primary energy demand for preparation of hot water	Non renewable primary energy demand for electricity	Sum (1+2+3+4+5)
1	2	3	4	5	6
1113,17	No data	No data	No data	156,42	1269,59

Annual final energy demand EK [kWh/m²/year]

Final energy demand for heating	Final energy demand for cooling	Final energy demand for ventilation	Final energy demand for preparation of hot water	Final energy demand for electricity	Sum (1+2+3+4+5)
1	2	3	4	5	6
1011,97	No data	No data	No data	52,14	1064,11

Annual utility energy demand EU [kWh/m²/year]

Utility energy demand for heating	Utility energy demand for cooling	Utility energy demand for ventilation	Utility energy demand for preparation of hot water	Utility energy demand for electricity	Sum (1+2+3+4)
1	2	3	4	5	6
No data	No data	No data	No data		No data

Energy class of the building (according to the table 2): no data

The EU indicator is a building quality indicator. In general, the smaller the EU, the less energy we lose through the outer baffles of the building. It refers to the energy which is consumed and goes from the building's heating system to the individual rooms, and the heat loss (through penetration and ventilation) to the environment. The EU indicator value in the table below includes only heating/cooling.

Electricity price [in your own currency: CZK or EUR or HRK or HUF or PLN]

Fixed fee [per MW-month]: no data
Variable fee [per kWh]: no data
Subscription [per month]: no data

Energy (heating) price [in your own currency: CZK or EUR or HRK or HUF or PLN]

Fixed fee [per MW-month]: no data
Variable fee [per GJ]: no data
Subscription [per month]: no data

Summary and evaluation of the energy building status

The external walls, ground floor and basement ceiling meet the technical requirements in terms of the value of heat transfer coefficient. The building's energy system includes the heating system and the power system. In total, the building uses annually 946 667 kWh, 95% of which is for heating.

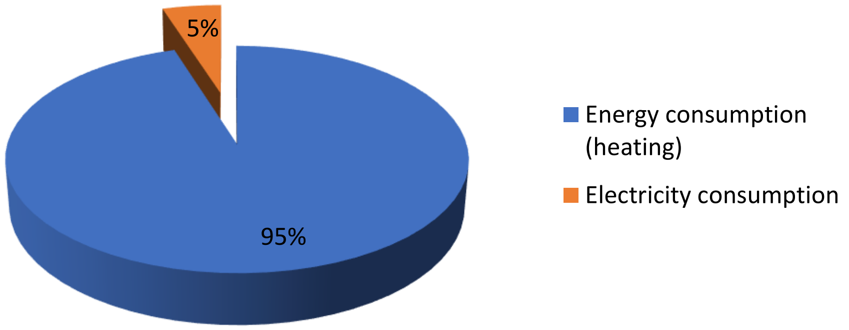


Figure 10: Energy consumption balance of the building for the PA8 – Zacler Skola.

PILOT ACTION - **PA8. Testing the project platform in PL/CZ cross-border regions (PL/CZ) - Zakladni Umelecka Skola**

2. Description of the PA building(s)

The description of the building provides basic building and administrative information. It allows to determine the location and the prevailing geographical conditions, the surroundings of the building. In addition, construction data is an example for similar construction solutions.

Type of building: Elementary Art School in Žacléř
Owner / investor: Město Žacléř
Year of construction: around 1930
Year of use (if different from year of construction): -
Gross building area [m^2]: 1 736,5
Building volume [m^3]: 4020
Building envelope total surface area [m^2]: 873
Shape factor (A/V ratio) [m^{-1}]: 0,432
The shape factor A/V is the ratio of the total surface area of all external walls (including windows and doors), roofs, floors on the ground or ceilings over the unheated basement, ceilings above the crossings, separating the heated part of the building from outside air to the volume of the heated part of the building, increased by the volume of heated rooms in the utility attic or in the basement and reduced by the volume of separate staircases, elevator shafts, open recesses, loggias and galleries.
It is best if the building shape factor is as low as possible. This means that the building should be as compact as possible, similar in shape to a sphere or cube, that is, solids characterized by the lowest A/V ratio. Considering energy consumption, a building with a high A/V ratio "consumes" more energy.
Typology (number of floors): 2
Number of building users:
Location: Nádražní 308, Žacleř 1,PSČ 542 01

Available technical documentation: ◉ **Yes** ○ **No**

Energy audit Year: 2005

Technical inventory of the building Year: 2007

Figure 11: Photo of building available for the PA8 (source: Energetický audit 2005).

3. Energy PA building(s) profile

Collecting energy data allows to determine the energy profile of the building. It provides information on the insulation of external partitions and the condition of energy systems (heating/cooling, ventilation, electricity, hot water preparation) in buildings.

3.1. External partitions

The technical and construction status of the building envelope influences significantly the heat loss to the environment. The used construction and thermal insulation material is important. In order to improve standards, a norm, regulation is established for each partition in each country. For existing buildings in the case of low insulation, it is recommended to carry out thermo-modernization.

3.1.1. External walls

Walls total surface area [m^2]:

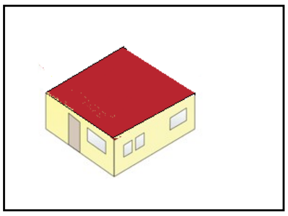
Envelope material (different layers):

No.	Material	Thickness [m]	Thermal conductivity [W/mK]	Heat transfer coefficient for external wall [W/m²K]	Defined heat transfer coefficient for external wall (according to the norm, national regulations) [W/m²K][6]
1	full brick fired	0,65		1,17	0,3 required/0,25 recommended

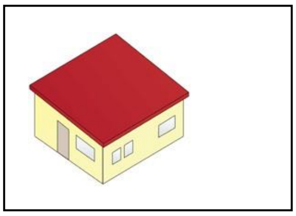
3.1.2. Roof

Type of roof:

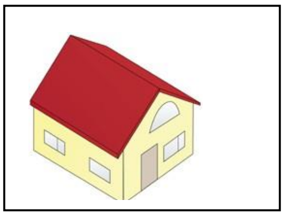
☐ Flat roof



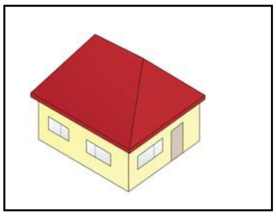
☐ Pent roof



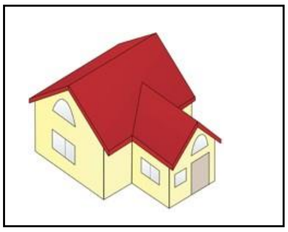
☐ Gable roof



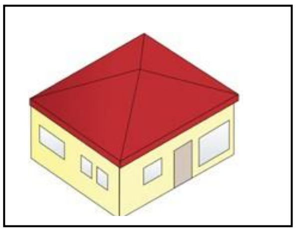
☐ Hip roof



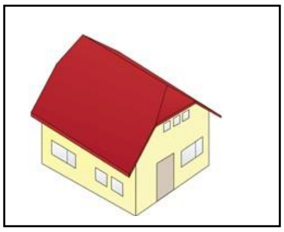
☐ Multi-hip roof



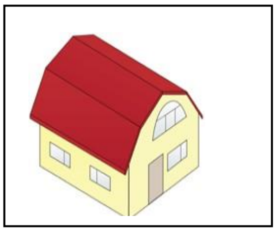
☐ Tented roof



☐ Half-hipped roof



☒ Mansard roof



Roof slope [°]**:** no data **in direction:** no data
Roof total surface area [m²]: 814
Envelope material (different layers):

No.	Material	Thickness [m]	Thermal conductivity [W/mK]	Heat transfer coefficient for roof [W/m²K]	Defined heat transfer coefficient for roof (according to the norm, national regulations) [W/m²K]
1	Gont				0,3 required/0,2 recommended
2	desk ORSIL				

Thermo-modernization (if carried out)
Year: 1996
Applied thermal insulation material: desk ORSIL
Thickness [cm]:
Thermal conductivity [W/mK]:

[6] If there are more U coefficients than one in your country, exchange all of them with the division, what they mean (e.g. recommended, required etc.)

3.1.3. Ground floor

Floor total surface area [m^2]:
Envelope material (different layers):

No.	Material	Thickness [m]	Thermal conductivity [W/mK]	Heat transfer coefficient for floor [W/m²K]	Defined heat transfer coefficient for floor (according to the norm, national regulations) [W/m²K]
1	steel beams			1,3	0,45 required/ 0,3 recommended
2	brick				

3.1.4. Basement ceiling (if the building has a basement)

Total surface area [m^2]:
Envelope material (different layers):

No.	Material	Thickness [m]	Thermal conductivity [W/mK]	Heat transfer coefficient for floor [W/m²K]	Defined heat transfer coefficient for floor (according to the norm, national regulations) [W/m²K]
1	steel beams				
2	brick				

Basement
Is the basement heated ? ☐ **Yes** ☐ **No**
Basement walls total surface area [m^2]:
Envelope material (different layers):

No.	Material	Thickness [m]	Thermal conductivity [W/mK]	Heat transfer coefficient for external wall [W/m²K]	Defined heat transfer coefficient for external wall (according to the norm, national regulations) [W/m²K]
1					

3.1.5. Windows

Type:
☒ single window, single glazed
☐ combined window, double glazed
☐ combined window, three panes
☐ single-frame window, double low-emission glass, argon chamber
☐ single-frame window, three glass panes, two (external) glasses are made of ordinary glass, and the inner glass of low-emission glass, the chambers between the glasses are filled with argon
☐ single-frame window, three glass panes, all glasses are made of low-emission glass, the chambers between the glasses are filled with argon
☒ other (what ?) …………………double window, single glazed ……………………………………………………………………

Shading (sun protection):
☐ curtains

☐ roller shutters
☐ wooden shutters
☐ internal blinds
☐ awnings
☐ other (what ?) ……

Material (PVC, wood, aluminum, wood-aluminum): wood
Number of windows: 278
Windows total surface area [m^2]:
Diffusers in windows (YES or NO):
Heat transfer coefficient [W/m^2K]: 2,7
Defined heat transfer coefficient (according to the norm, national regulations) [W/m^2K]: 1,5 requested/1,2 recommended

3.1.6. Doors

Material (wood, aluminum, PVC etc.): wood and glass
Number of doors:
Doors total surface area [m^2]:
Heat transfer coefficient [W/m^2K]: 5
Defined heat transfer coefficient (according to the norm, national regulations) [W/m^2K]: 3,5 requested/2,3 recommended

3.2. Energy systems data

High efficiency of energy systems and the type of energy source determines its consumption. Also important is the issue of installed control and control systems that help ensure optimal thermal conditions.
Energy parameters characterizing the building:
Total non renewable primary energy demand [GJ/year or kWh/year]:
Energy consumption (heating) [GJ/year or kWh/year]: 737,01 GJ/year
Efficiency of the heating system [%]: 85
Energy consumption (hot water preparation) [GJ/year or kWh/year]:
Efficiency of the hot water preparation system [%]:
Energy consumption (cooling) [GJ/year or kWh/year]:
Type of energy source (gas boiler, coal boiler, electricity, municipal heating network, biomass boiler, cogeneration, RES etc.): gas boiler
Regulation and control of systems in the building:
☐ thermostatic valves
☐ heat dividers
☐ motion sensors
☐ electricity meters
☐ water meters
☐ other (what ?)………………………………………………………………………………………………………
Annual fuel consumption [kg or m^3 or kWh or GJ]: 21 645 m^3
Electricity consumption [kWh/year]: 6 700
Ordered power [MW]:
Lighting type (traditional incandescent lamps; halogen bulbs; fluorescent lamps; LED lamps):
Power of light bulbs [W]:

Number of lighting points:
Ventilation type (according to the table 1): natural ventilation

Building energy profile

The energy consumption in construction is distinguished by three types of energy - primary energy (EP), final energy (EK) and utility energy (EU). Primary energy refers to the energy contained in sources, including fuels and carriers, necessary to cover the final energy demand, taking into account the efficiency of the entire chain of acquisition, conversion and transport to the end user. A concept that is important from the point of view of a sustainable development strategy. The ratio of non-renewable primary energy inputs to the generation and delivery of an energy or energy carrier for technical systems is the difference between primary energy and final energy. The final energy is heat and auxiliary energy, which must be delivered to the boundary of the heating system (building) with a given efficiency in order to cover the energy demand for heating and ventilation of rooms. A concept that is important from the point of view of the building's user who incurs costs related to the operation of the building. The efficiency of the system is a conversion of final energy into utility energy. The utility energy concerns energy for heating and ventilation as well as for preparing domestic hot water, regardless of the type and efficiency of the heating device. A concept that is important from the designer's point of view, characterizing thermal insulation and building tightness. The concepts are presented below.

$$EU \xrightarrow{\eta} EK \xrightarrow{w_i} EP$$

Annual demand for non renewable primary energy EP [kWh/m²/year]

Non renewable primary energy demand for heating	Non renewable primary energy demand for cooling	Non renewable primary energy demand for ventilation	Non renewable primary energy demand for preparation of hot water	Non renewable primary energy demand for electricity	Sum (1+2+3+4+5)
1	**2**	**3**	**4**	**5**	**6**
117,8961	-	-	-	3,86	121,7561

Annual final energy demand EK [kWh/m²/year]

Final energy demand for heating	Final energy demand for cooling	Final energy demand for ventilation	Final energy demand for preparation of hot water	Final energy demand for electricity	Sum (1+2+3+4+5)
1	**2**	**3**	**4**	**5**	**6**
129,6857	-	-	-	11,58	141,2657

Annual utility energy demand EU [kWh/m²/year]

Utility energy demand for heating	Utility energy demand for cooling	Utility energy demand for ventilation	Utility energy demand for preparation of hot water	Utility energy demand for electricity	Sum (1+2+3+4)
1	**2**	**3**	**4**	**5**	**6**
110,2329	-	-	-		110,2329

Energy class of the building (according to the table 2): D average energy-intensive building

The EU indicator is a building quality indicator. In general, the smaller the EU, the less energy we lose through the outer baffles of the building. It refers to the energy which is consumed and goes from the building's heating system to the individual rooms, and the heat loss (through penetration and ventilation) to the environment. The EU indicator value in the table below includes only heating/cooling.

Electricity price [in your own currency: CZK or EUR or HRK or HUF or PLN]
Fixed fee [per MW-month]:
Variable fee [per kWh]:
Subscription [per month]:

Energy (heating) price [in your own currency: CZK or EUR or HRK or HUF or PLN]
Fixed fee [per MW-month]:
Variable fee [per GJ]:
Subscription [per month]:

Summary and evaluation of the energy building status
The external partitions do not meet the technical requirements in terms of the value of heat transfer coefficient. The building's energy system includes the heating system and the power system. The efficiency of the heating system is high (85%). In total, the building uses annually 211 425 kWh, 97% of which is for heating.
The ventilation is done through windows and ventilation ducts.

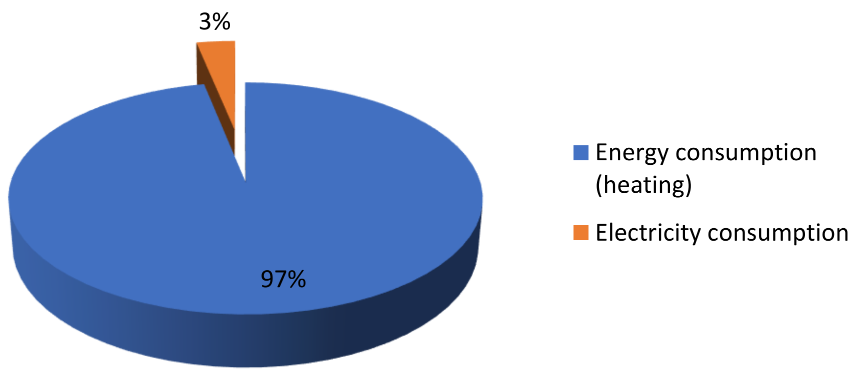


Figure 12: Energy consumption balance of the building for the PA8 – Zakladni Umelecka Skola.

4. Definition of the required resources to run the project activities

This chapter describes the measures and activities that were implemented to start the work in the appropriate order and assign a time schedule.These are only preparatory activities.
The steps that were taken in order to carry out activities without funds are presented in the appropriate order.

PA 8			
No.	Preparatory work	Preparatory work description	Time schedule
1	Data collection	Based on the technical documentation delivered by local authorities as well as	01.2018-12.2018

		owners of the building the data are being selected	
2	Meetings	with the: - local authorities from Poland and Czech Republic - building managers in the selected public buildings	01.2018-12.2018
3	Field survey	study trips to selected public buildings to check the technical conditions	01.2018-12.2018

Table 3: Time schedule of preparatory activities in the PA8.

Table 4 shows the time periods for the period of activity preparation, implementation of activities and subsequent monitoring and evaluation of results. All works must take place before April 2020.

	2018												2019												2020				
Month	Jan	Feb	Mar	April	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	April	May
Project month	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
PA8																													

Table 4: PA8 Activities plan.

start of WPT3 | PA preparations | PA implementation | PA monitoring/evaluation | end of PA | end of WPT3

Explanation:

PA preparations – A set of activities that are used to initiate the activities, such ascollecting data and information, and other administrative work.

PA implementation – A set of activities like implementation of the OnePlace platform, promotional activities.

PA monitoring/evaluation – Checking whether the expected results are received.

5. Definition of problems in the implementation of PA

Each activity may encounter barriers of administrative, organizational or substantive nature. Therefore, it is important to define possible problems that may arise during in energy efficiency.

Problems (with expected delays):

1. Lack of staff in institutions implementing investments or OnePlace – lack of staff may cause delays in implementation and problems with transferring knowledge about OnePlace to other employees;
2. Personnel changes in municipalities and managing institutions – there is no person responsible for the OnePlace platform and the danger of "take with them the knowledge" by outgoing employees;
3. Lack of interest in trainings – the municipalities and managing institutions may not have the time or will to attend trainings and / or conferences.

6. Conclusions

Energy data and administrative description of the building are valuable and necessary information when developing energy audits and conducting activities aimed at improving energy efficiency.