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CENTRAL EUROPE
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BOOSTEE-CE

DELIVERABLE T3.3.1

D.T3.3.1 – Pilot actions preparation **05/2020**

D.T3.3.1: Pilot actions preparation

A.T3.3 Preparation and procurement of pilot actions

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Authors		
	Name (organization)	**Name, e-mail**
WP leader	Mazovia Energy Agency (MAE), PP5	Aleksandra Luks, a.luks@mae.com.pl
Contributing participants	Tolna County Development Agency (TCDA), PP6	Balázs Kiss, kiss.balazs@tolnamegye.hu

1. Introduction and aims

This deliverable is a kind of pre-investment report, which contains all information and data about buildings that allow for a description of the condition of the buildings and the pilot action.
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 to investment for the PA. This document describes activities as part of the tasks undertaken for each pilot action.

PILOT ACTION - **PA4. Application of OnePlace for improving EE in public buildings in Tolna (HU)**

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: Cultural centre
Owner / investor: Municipality of Tolna
Year of construction: 1870
Year of use (if different from year of construction):
Gross building area [m^2]: 1671,92
Building volume [m^3]: 17826,6
Building envelope total surface area [m^2]: 5817,3
Shape factor (A/V ratio) [m^{-1}]: 0,326
Typology (number of floors): 4
Number of building users: 8 employees and 50-800 visitors per day
Location: H-7130, Tolna, Bajcsy-Zsilinszky u. 73/A

Available technical documentation: ○ **Yes** ○ **No**
Gas plan Year: 2006

Figure 1: Example of photos available for the PA4.

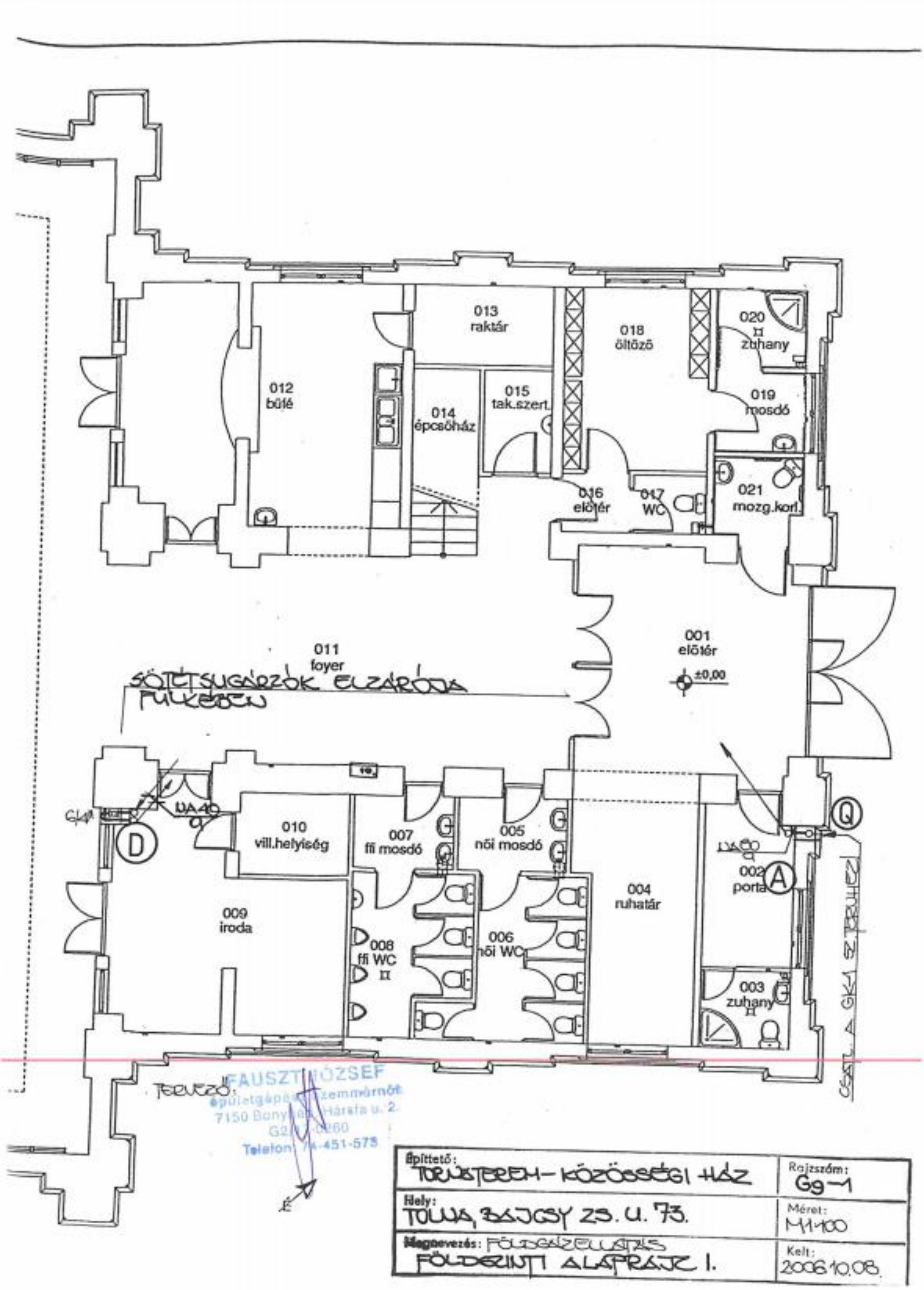


Figure 2: Example of technical drawings, floor plans available for the PA4.

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]: 1492,5
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]
WALL 1					
1	small solid clay bricks	0,45	0,72	0,83	0,24
2	polystyrene foam	0,03	0,04		
3	cement plaster	0,015	0,93		
WALL 2					
1	small solid clay bricks	0,6	0,72	0,74	0,24
2	polystyrene foam	0,03	0,04		
3	cement plaster	0,015	0,93		

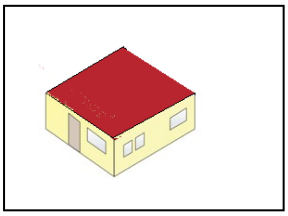
Thermo-modernization (if carried out)
Year: 2006
Applied thermal insulation material: polystyrene foam
Thickness [cm]: 3
Thermal conductivity [W/mK]: 0,04

[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.)

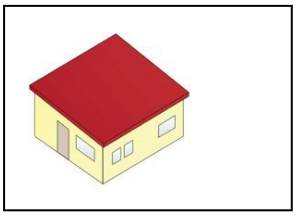
3.1.2. Roof

Type of roof:

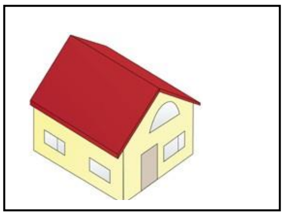
☐ Flat roof



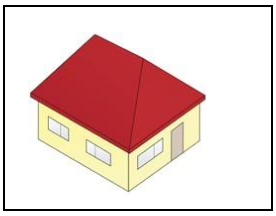
☐ Pent roof



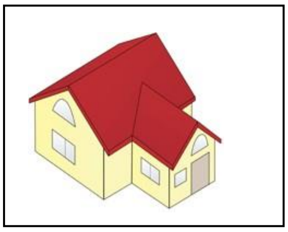
☒ Gable roof



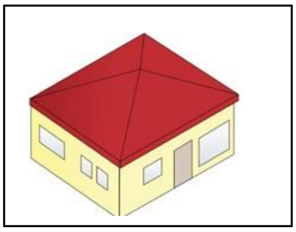
☐ Hip roof



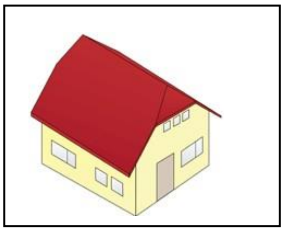
☐ Multi-hip roof



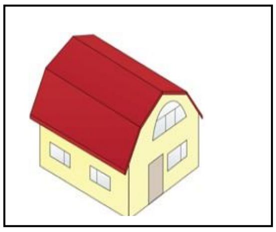
☐ Tented roof



☐ Half-hipped roof



☐ Mansard roof



Roof slope [°]**: 22 in direction: SE**
Roof total surface area [m^2]: 2371,8
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	Austrotherm AT-N100	0,05	0,037	0,33	0,17
2	Austrotherm AT-N100	0,05	0,037		
3	HDPE vapor barrier film	0,0008	0,1		
4	perpendicular to pine fibers. 1	0,025	0,13		

Thermo-modernization (if carried out)
Year: 2006
Applied thermal insulation material: Austrotherm AT-N100
Thickness [cm]: 10
Thermal conductivity [W/mK]: 0,037

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	concrete	0,08	1,280	0,62	0,3
2	Polyethylene film	0,00002	0,170		
3	Austrotherm AT-L2	0,04	0,044		
4	Villox O-V 4 S/K	0,004	0,120		
5	Villox O-V 4 S/K	0,004	0,120		
6	ferro-concrete	0,08	1,550		
7	gravel filling	0,15	0,350		

3.1.4. 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

Material (PVC, wood, aluminum, wood-aluminum): textile
Number of windows: no data
Windows total surface area [m²]: 201,3
Diffusers in windows (YES or NO): NO
Heat transfer coefficient [W/m²K]: 1,4
Defined heat transfer coefficient (according to the norm, national regulations) [W/m²K]: 1,15

3.1.5. Doors

Material (wood, aluminum, PVC etc.): wood

Number of doors: 2
Doors total surface area [m^2]: 80
Heat transfer coefficient [W/m^2K]: 1,6-1,8
Defined heat transfer coefficient (according to the norm, national regulations) [W/m^2K]: 1,15

3.2. Systems energy 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 [kWh/year]: 270 064
Energy consumption (heating + domestic hot water preparation) [GJ/year]: 900,307
Efficiency of the heating system [%]: no data
Energy consumption (cooling) [GJ/year or kWh/year]: N/A
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:

- [x] 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]: 19979
Ordered power [MW]: no data
Lighting type (traditional incandescent lamps; halogen bulbs; fluorescent lamps; LED lamps): fluorescent lamps
Power of light bulbs [W]: -
Number of lighting points:
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 ventilation with heat recovery	operates on the principle of mechanical ventilation extended by a recuperator 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 lighting	Sum (1+2+3+4+5)
1	**2**	**3**	**4**	**5**	**6**
400,11	0	0	11,40	15,00	426,51

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 lighting	Sum (1+2+3+4+5)
1	**2**	**3**	**4**	**5**	**6**
no data	no data	no data	no data	no data	no data

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 lighting	Sum (1+2+3+4+5)
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): 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.

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]: N/A
Variable fee [per kWh]: 23,26 HUF
Subscription [per month]: N/A

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

Fixed fee [per MW-month]: N/A
Variable fee [per m3]: 144,69
Subscription [per month]: N/A

Summary and evaluation of the energy building status

The overall condition of the building is poor. The external partitions such as external walls, floor, windows and doors do not meet the technical requirements in terms of the value of heat transfer coefficient.
The building's energy system includes only the heating system, the hot water preparation system and the power system. The building uses annually 270 066,28 kWh, 93% of which is for heating. The energy class classifies it as an energy-consuming building.
The building is not equipped with cooling systems and ventilation is done through windows and ventilation ducts.

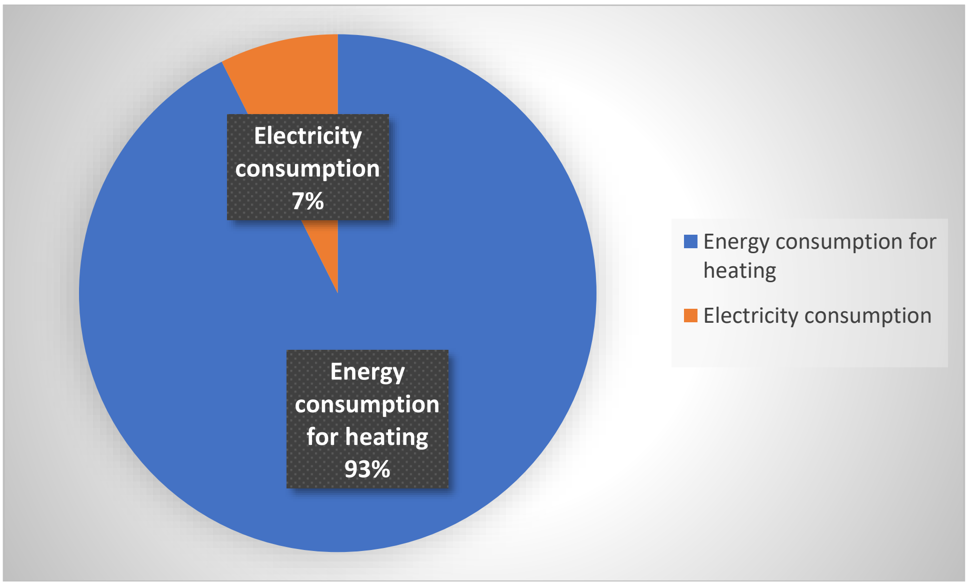


Figure 3: Energy consumption balance of the building for the PA4.

PILOT ACTION - **PA4. Application of OnePlace for improving EE in public buildings in Tolna (HU)**

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 Tolna
Year of construction: 1906
Year of use (if different from year of construction):
Gross building area [m^2]: 1328,8
Building volume [m^3]: 5248,8
Building envelope total surface area [m^2]: 2542,6
Shape factor (A/V ratio) [m^{-1}]: 0,484
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:
Location: H-7130 Tolna, Hősök tere 1

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

Gas network Year: 2009
Electrical network Year: 2009
Misc. plans Year: 2009
PV system Year: 2015

Figure 4: Example of photos available for the PA4.

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):

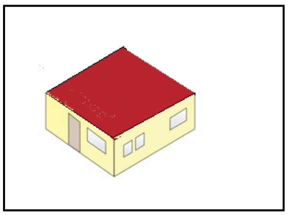
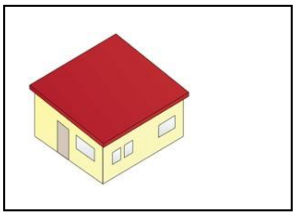
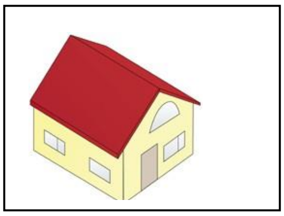
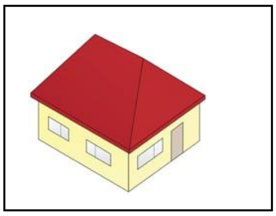
No.	Material	Thickness [m]	Thermal conductivity [W/mK]	Heat transfer coefficient for external wall [W/m^{2}K]	Defined heat transfer coefficient for external wall (according to the norm, national regulations) [W/m^{2}K][2]
			WALL 1		
1	small size clay bricks	0,65	0,72	1,2	0,24
2	cement plaster	0,01	0,93		

[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.)

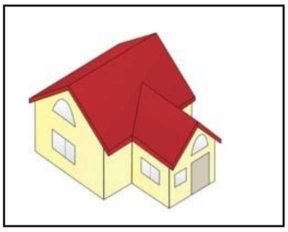
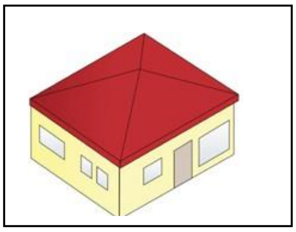
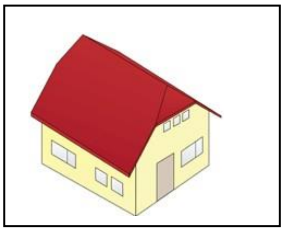
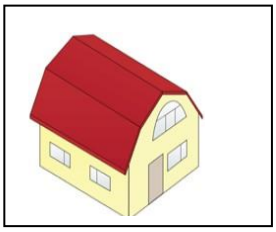
3.1.2. Roof

Type of roof:

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

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

Roof slope [°]: **-** **in direction:** Wybierz element.
Roof total surface area [m^2]: 664,40
Envelope material (different layers):

No.	Material	Thickness [m]	Thermal conductivity [W/mK]	Heat transfer coefficient for roof [W/m^{2}K]	Defined heat transfer coefficient for roof (according to the norm, national regulations) [W/m^{2}K]
1	pine layer	0,025	0,13	0,18	0,17
2	closed air layer	0,2			
3	pine layer	0,025	0,13		
4	filling	0,1	0,58		
5	HDPE vapor barrier	0,0008	0,1		
6	rockwool insulation	0,2	0,039		

Thermo-modernization (if carried out)
Year: 2009
Applied thermal insulation material: rockwool
Thickness [cm]: 20
Thermal conductivity [W/mK]: 0,039

3.1.3. Ground floor

Floor total surface area [m^2]: 521,00
Envelope material (different layers):

No.	Material	Thickness	Thermal conductivity	Heat transfer coefficient for	Defined heat transfer coefficient for floor (according

		[m]	[W/mK]	floor [W/m²K]	to the norm, national regulations) [W/m²K]
1	sand replenishment	0,15	0,58	1,2	0,3
2	gravel filling	0,1	0,35		
3	ferro-concrete	0,25	1,55		

3.1.4. Basement ceiling

Total surface area [m²]: 143,4
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	small size solid clay bricks	0,12	0,72	1,26	0,26
2	filling	0,1	0,58		
3	ferro-concrete	0,25	1,55		

<u>**Basement**</u>

Is the basement heated ? ◯ **Yes** ◉ **No**
Basement walls total surface area [m²]: 143,4

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
Material (PVC, wood, aluminum, wood-aluminum): wood

Number of windows: appr. 70
Windows total surface area [m^2]: 266,4
Diffusers in windows (YES or NO): NO
Heat transfer coefficient [W/m^{2}K]: 1,3
Defined heat transfer coefficient (according to the norm, national regulations) [W/m^{2}K]: 1,15

Thermo-modernization (if carried out)
Year: 2009
Type of windows: wood windows
Material: wood
Number of windows (if all windows are not replaced on the new ones):
Windows total surface area [m^2]: 266,4
Diffusers in windows (YES or NO): NO
Heat transfer coefficient [W/m^{2}K]: 1,3

3.1.6. Doors

Material (wood, aluminum, PVC etc.): wood
Number of doors: 7
Doors total surface area [m^2]: 46,8
Heat transfer coefficient [W/m^{2}K]: 7 - 6,4 (old doors on the front) – 1,35
Defined heat transfer coefficient (according to the norm, national regulations) [W/m^{2}K]: 1,15

3.2. Systems energy 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 [kWh/year]: 187 400
Energy consumption (heating) [kWh/year]: 178 816,61
Efficiency of the heating system [%]: 92
Energy consumption (hot water preparation) [kWh/year]: 34 389,34
Efficiency of the hot water preparation system [%]: 85
Energy consumption (cooling) [GJ/year or kWh/year]: 0
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 [GJ]: 637,42
Electricity consumption [kWh/year]: 10350
Ordered power [MW]: N/A
Lighting type (traditional incandescent lamps; halogen bulbs; fluorescent lamps; LED lamps): various
Power of light bulbs [W]:

Number of lighting points:
Ventilation type (according to the table 1): Mechanical 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 ventilation with heat recovery	operates on the principle of mechanical ventilation extended by a recuperator 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 3: 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 lighting	Sum (1+2+3+4+5-solar gains)
1	**2**	**3**	**4**	**5**	**6**
134,57	0		25,88	27,50	141,03

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 lighting	Sum (1+2+3+4+5)
1	**2**	**3**	**4**	**5**	**6**
no data	no data	no data	no data	no data	no data

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 lighting	Sum (1+2+3+4+5)
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): average energy efficient 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.

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 4: 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]: 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 overall condition of the building is poor. The external partitions such as external walls, floor, windows and doors 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 building uses annually 223 555,95 kWh, 80% of which is for heating. The energy class classifies it as an average energy efficient building.

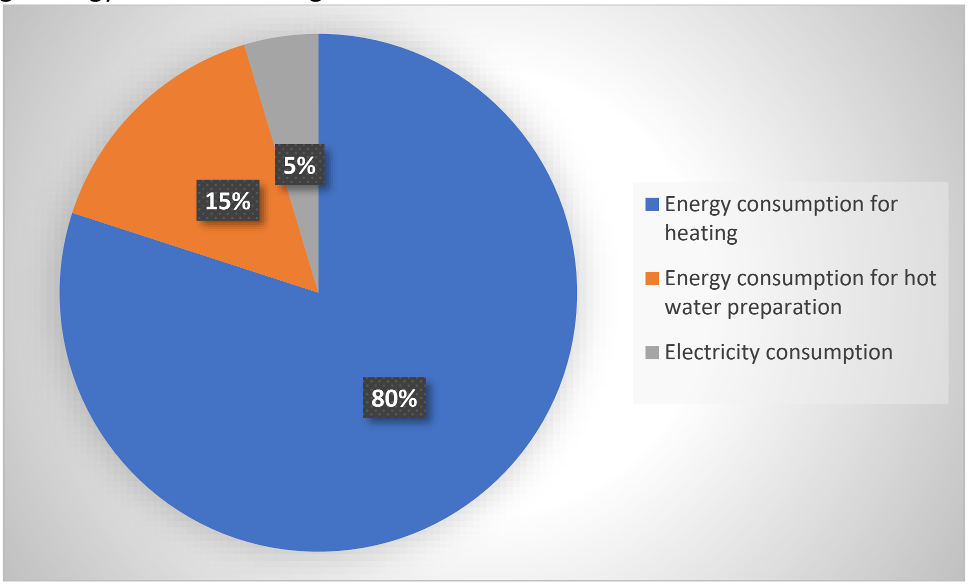


Figure 5: Energy consumption balance of the building for the PA4.

PILOT ACTION - **PA4. Application of OnePlace for improving EE in public buildings in Tolna (HU)**

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: Sports Hall
Owner / investor: Municipality of Tolna
Year of construction: 1987
Year of use (if different from year of construction):
Gross building area [m^2]: 2316,64
Building volume [m^3]: 13926,60
Building envelope total surface area [m^2]: 5969,6
Shape factor (A/V ratio) [m^{-1}]: 0,429
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): 1
Number of building users:
Location: H-7130 Tolna, Sport utca 15/A

Available technical documentation: ◉ **Yes** ○ **No**
Electric network Year: 1987


Figure 6: Example of photos available for the PA4.

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]: 1089,3
Envelope material (different layers):

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

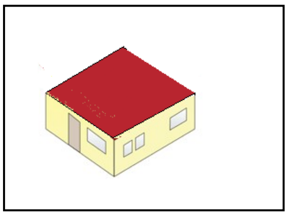
				[W/m²K]	national regulations) [W/m²K][3]
WALL 1					
1	cement plaster	0,015	0,93	0,93	0,24
2	POROTHERM 30	0,3	0,249		
3	cement plaster	0,015	0,93		
WALL 2					
1	cement plaster	0,015	0,93	0,47	0,24
2	POROTHERM 30	0,3	0,249		
3	cement plaster	0,015	0,93		
4	Austrotherm AT-H80	0,05	0,038		
5	cement plaster	0,015	0,99		

Thermo-modernization (if carried out)
Year: 2013
Applied thermal insulation material: Austrotherm AT-H80
Thickness [cm]: 5 cm
Thermal conductivity [W/mK]: 0,038

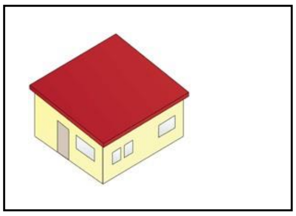
3.1.2. Roof

Type of roof:

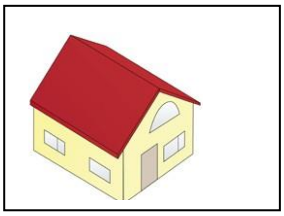
☒ Flat roof



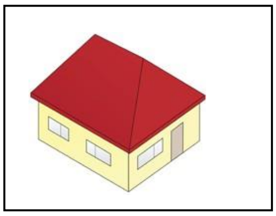
☐ Pent roof



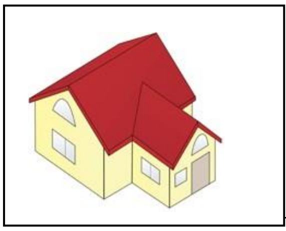
☐ Gable roof



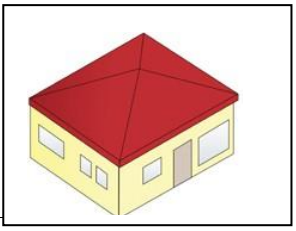
☐ Hip roof



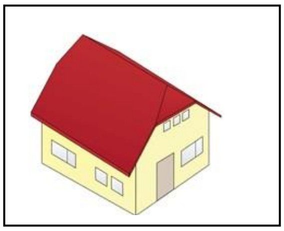
☐ Multi-hip roof



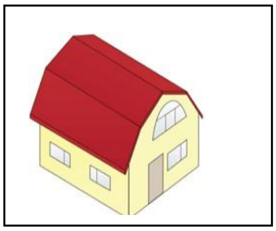
☐ Tented roof



☐ Half-hipped roof



☐ Mansard roof



[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.)

Roof total surface area [m^2]: 2316,60
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	Steel trapezoidal plate without seal	0,0007	58,1	0,42	0,17
2	PE folia	0,0002	0,17		
3	Sloping AT-N100	0,1	0,037		
4	Villox O-V 4 S/K	0,004	0,12		

Thermo-modernization (if carried out)
Year: 2013
Applied thermal insulation material: Austrotherm AT-N100
Thickness [cm]: 10
Thermal conductivity [W/mK]: 0,037

3.1.3. Ground floor

Floor total surface area [m^2]: 2316,60
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	gravel filling	0,15	0,35	1,45	0,3
2	ferro-concrete	0,2	1,55		

3.1.4. 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

Material (PVC, wood, aluminum, wood-aluminum): wood, PVC
Number of windows:
Windows total surface area [m^2]: 220,1
Diffusers in windows (YES or NO):
Heat transfer coefficient [W/m^2K]: 3,5 – 1,51
Defined heat transfer coefficient (according to the norm, national regulations) [W/m^2K]: 1,15

Thermo-modernization (if carried out)
Year: 2013
Type of windows:
Material: PVC
Number of windows (if all windows are not replaced on the new ones):
Windows total surface area [m^2]: 214,1
Diffusers in windows (YES or NO): NO
Heat transfer coefficient [W/m^2K]: 1,51

3.1.5. Doors

Material (wood, aluminum, PVC etc.): wood; metal; plastic
Number of doors: 5
Doors total surface area [m^2]: 27,2
Heat transfer coefficient [W/m^2K]: 3,2 – 4,9 – 1,7
Defined heat transfer coefficient (according to the norm, national regulations) [W/m^2K]: 1,45 - 1,4 - 1,15

Thermo-modernization (if carried out)
Year: 2013
Material: plastic
Number of doors (if all doors are not replaced on the new ones): 2
Doors total surface area [m^2]: 7,3
Heat transfer coefficient [W/m^2K]: 1,7

3.2. Systems energy 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 [kWh/year]: 338 507,4
Energy consumption (heating) [GJ/year]: 800,311
Efficiency of the heating system [%]: n.a.
Energy consumption (hot water preparation) [GJ/year or kWh/year]: n.a.

Efficiency of the hot water preparation system [%]: n.a.
Energy consumption (cooling) [GJ/year or kWh/year]: n.a.
Type of energy source (gas boiler, coal boiler, electricity, municipal heating network, biomass boiler, cogeneration, RES etc.): biomass boiler (wood pellet)
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]: roughly 60 tonnes of pellets and 6000 $m^3$of natural gas
Electricity consumption [kWh/year]: 24736
Ordered power [MW]: n.a.
Lighting type (traditional incandescent lamps; halogen bulbs; fluorescent lamps; LED lamps): various, fluorescent in the arena
Power of light bulbs [W]:
Number of lighting points:
Ventilation type (according to the table 1): mechanical 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 ventilation with heat recovery	operates on the principle of mechanical ventilation extended by a recuperator 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 5: 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 lighting	Sum (1+2+3+4+5)
1	**2**	**3**	**4**	**5**	**6**
110,99	0		20,13	15,00	146,12

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 lighting	Sum (1+2+3+4+5)
1	**2**	**3**	**4**	**5**	**6**
no data	no data	no data	no data	no data	no data

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 lighting	Sum (1+2+3+4+5)
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): 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.

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

<u>Electricity price [in your own currency: CZK or EUR or HRK or HUF or PLN]</u>
Fixed fee [per MW - month]: n.a.
Variable fee [per kWh]: 14,4 HUF
Subscription [per month]:n.a.

<u>Energy (heating) price [in your own currency: CZK or EUR or HRK or HUF or PLN]</u>
Fixed fee [per MW-month]: n.a.
Variable fee [per GJ]: 3081 HUF
Subscription [per month]: n.a.

<u>Summary and evaluation of the energy building status</u>
The overall condition of the building is poor. The external partitions such as external walls, floor, windows and doors 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 building uses annually 247 044,60 kWh, 90% of which is for heating. The energy class classifies it as an average energy-intensive building.

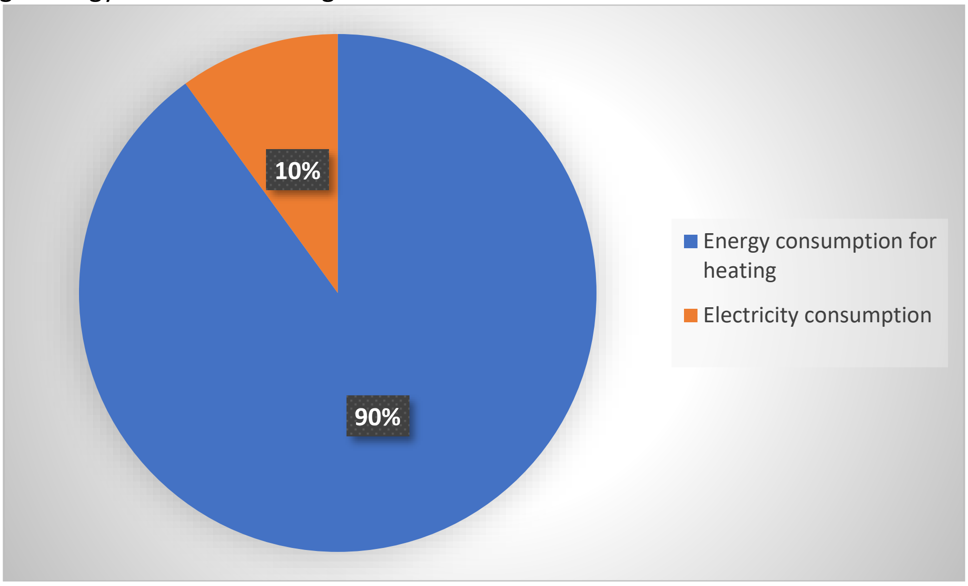


Figure 7: Energy consumption balance of the building for the PA4.

4. Definition of the required resources to run the investment

This chapter describes the measures and activities that were implemented to start the investment in the appropriate order and assign a time schedule and costs. These are only preparatory activities to undertake investment.

The steps that were taken in order to prepare an investment or to carry out other activities are presented in the appropriate order.

PA 4						
No.	Preparatory	Preparatory work	Time schedule	Cost	Market	Selected

	work	description	(from……to……)	(EUR)	research	external expert
1	Meeting with the building owners	Investment description and preliminary list of metering points	2017 November – 2018 November	n.a.	DONE	
2	Energy audit	The energy audits were necessary to provide data regarding the PA buildings as the Municipality had no detailed information about pilot buildings	2020 March - April	3000	DONE	Energy-Profit Kft.
3	Procurement of the contractor	Three-bid procurement to select external contractor to install the smart meters, create the software background and the display of metering data in public space	2020 March	0	DONE	Ökogázprojekt Kft.
4	Verification of smart metering system with external contractor	Meeting with the Municipality staff and the contractor to further refine the metering system in the PA buildings	2020 March	0	DONE	

Table 7: Time schedule and cost estimate of preparatory activities in the PA4.

Table 8 shows the time periods for the investment preparation period, implementation of activities and subsequent monitoring and evaluation of results.

	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
PA4																													

Table 8: PA4 Activities plan.

start of WPT3	PA preparations	PA implementation	PA monitoring/evaluation

Explanation:

PA preparations – A set of activities that are used to initiate the right investment, such as the selection of experts, contractors, collecting data and information, and other administrative work.

PA implementation – A set of activities like installation of equipment, systems, 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 investment may encounter barriers of a financial, administrative, organizational or substantive nature. Therefore, it is important to define possible problems that may arise when investing in energy efficiency.

Problems (with expected delays):

1. The most prevalent problem faced by TCDA was the procurement of the PA investment due to unforeseen administrative and financial constraints. These issues were identified in the beginning were expected to only cause a half-year delay, but ultimately TCDA was able to deliver the PA only by the end of the project.

6. Conclusions

Energy data and administrative description of the building are valuable and necessary information when developing energy audits and conducting investments aimed at improving energy efficiency. Subsequent implementation of pilot project areas will be based on the presented data and will be described in the next reports D.T.3.1.5 and D.T.3.2.2.