

DELIVERABLE T3.1.4

**D.T3.1.4 – PA3 with zero-energy public
buildings in Zlin Region (CZ)**

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A.T3.1 Implementation of pilot actions for EE improvement

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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	Energy agency of the Zlín region, PP3	Jan Vidomus, jan.vidomus@eazk.cz Tomas Perutka, tomas.perutka@eazk.cz



1. Introduction and aims

This deliverable is a kind of investment report with a description of technical support and preparatory activities, presenting recommendations for two new investments to improve energy efficiency. It also contains information and data about devices and technology implemented in the pilot action buildings. Analysis of selected measures aimed at improving energy efficiency implemented in pilot actions is aimed at defining the possibilities of how to better manage/monitor energy and use/consume it rationally. This document is also about the testing of the OnePlace platform as a design tool supporting the acquisition and dissemination of knowledge on the improvement of energy efficiency in buildings. The aim of the document is to present investment activities and goals to be achieved as part of the tasks undertaken for the pilot action as well as recommending new EE investments.

2. Recommendations for EE improvement measures

Each project or investment should be preceded by an inventory, analysis of the current state and identification of the biggest problems in the building, which cause its energy and ecological inefficiency. These aspects also affect the financial issue and are a consequence of higher operating costs for facility users.

In the Zlín region were selected 4 secondary schools, one special primary school and hospital Uherske Hradiste. All these buildings are operated by the organisations of the Zlín region. Energy agency of the Zlín region has unique database of energy management of these buildings and due to that EAZK is able to focus on the right potential of decrease of energy consumption.

EAZK above that energy management established measurement of indoor climate in the secondary schools and special primary school, which means CO₂, temperature and humidity measures. EAZK trained all the teachers how to ventilate well. Training of teachers was absolutely necessary for the balance of indoor climate and energy consumption.

Each investment is the result of the assumptions made, therefore the pilot action in the Czech Republic has defined its own goals, which it will achieve in the perspective of the project implementation. The objectives also point to existing problems that need to be minimized or eliminated entirely. The goals in this pilot action are listed below:

1. Reduction of energy demand in the selected buildings in Zlín Region
2. Annual CO₂ equivalent savings
3. Annual cost savings
4. Increasing the comfort of the buildings use and easier operation of the buildings
5. Promoting and disseminating knowledge about energy efficiency measures in buildings
6. Promoting and disseminating knowledge about indoor environment like temperature, humidity and CO₂
7. Promoting and disseminating knowledge about IR camera measurements and its goals

Well-defined goals have allowed the right choice of measures and devices to improve energy efficiency. Analysis and review of available technologies that were used to implement the pilot action will allow for better understanding of what was done, how and why.

The Energy Agency of the Zlín Region (EAZK), which has participated and continues cooperation on monitoring the effects of investment, recommends two methods of improving energy efficiency – energy management and thermo-modernization of the buildings, which bring large financial benefits and energy



savings. Examples of the effects of thermo-modernization improvements and energy monitoring are presented in the table below:

No.	Method of improving energy efficiency	Percentage reduction in energy consumption compared to the previous state
1	Insulation of external building partitions – walls, roof, flat roof	15 – 25 %
2	Windows exchange for tight windows with a lower U-value	10 – 15 %
3	Introduction of cost allocators	about 5 – 10 %
4	Energy monitoring	5 – 7 %

Table 1: Examples of improvements effects. Source: M. Robakiewicz "Metody i środki techniczne termomodernizacji", Warsaw 2016

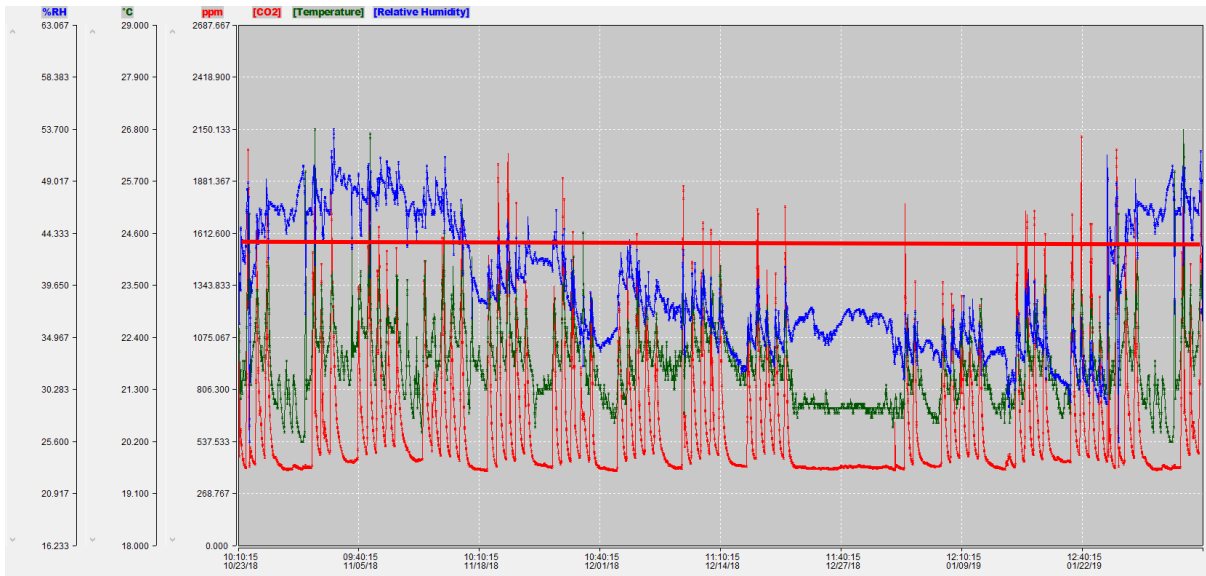
The selected buildings underwent thermal modernization, replacing mainly windows with a heat transfer coefficient $U = 0.9 \text{ W/m}^2\text{K}$, replacing doors with a heat transfer coefficient $U = 1.2 \text{ W/m}^2\text{K}$ and a thermally insulated roof made of mineral wool or EPS ($\lambda = 0.039 \text{ W/m}\cdot\text{K}$) in the minimum thickness of 22 cm. In some schools were possible to insulate walls that are not historical with EPS $\lambda = 0.039 \text{ W/m}\cdot\text{K}$ and 16 cm thickness.

The energy management was established in 2009 and we are able to quantify the decrease of energy were precisely.

In the secondary schools and special primary school were installed measurement of indoor climate which means measure of CO_2 concentration, humidity and temperature. You can see the installation and the outputs from the measurement on the pictures below.



Picture 1: Investment activities photos for the PA3 in Grammar school Holesov. Source: Energy agency of the Zlín region archive



Picture 2: Outputs from the indoor climate measurement. Source: Energy agency of the Zlín region archive

EAZK provided technical support at all stages of its implementation, including the preparatory stage, construction and operation. It assisted in the selection of external experts assessing the optimization of the building's operation. EAZK supported and managed the introduction of energy management in accordance with EN ISO 50001; development of a programming tool necessary for regular assessment of data results, financial analysis and investment management. In addition, the building staff will be trained in energy management skills by EAZK. The agency widely disseminates knowledge acquired during the modernization of very specific historic buildings.

3. Investment preparation activities

This chapter describes the measures and activities that have been implemented to start the investment in the appropriate order and assign a schedule. However, these are not only preparatory activities to undertake investment, but also implementation works and final monitoring of results and energy management.

The steps that have been taken to prepare and implement the investment are presented in the appropriate order.

I. Uherské Hradiště hospital			
No.	Preparatory work description	Schedule	Market research
1	Project documentation for the new building (pavilion of internal medicine) was evaluated by EAZK and, upon these suggestions of EAZK, the outer insulation would be strengthened, more quality materials will be used for the roofing as well as windows, doors and floors will eventually have better energy performance than suggested in original project documentation. Basic energy management was introduced to all hospital buildings and data of energy consumption were collected. There are many taking-off points in the whole area of the	2015-2017	DONE



	hospital (master metered and sub metered) with outputs in different formats. These were consolidated into one database. The data were confronted with invoiced consumption in the form of xls file and this was given to the hospital for further updating. PV potential, co-generation unit and modernisation of present incinerator are being considered in present time.		
2	Investment realisation, technical support in the investment implementation by EAZK .	2017-2019	DONE
3	Introduction of energy management according to EN ISO 50001; developing programming tool needed for regular evaluation of data outputs, financial analysis and management of the investment.	2019-2020	DONE
II. Grammar school in Holešov			
No.	Preparatory work description	Schedule	Market research
1	EAZK prepared application for subsidy from OP Environment related to building reconstruction and improvement of its EE. Public procurement was carried out for the realisation of the investment, however, only one bid was received which exceeded initial estimated costs by 80.000 EUR. At the same time the roofing of the building was found insufficiently effective so that it was decided about the update of the current project documentation. New public procurement is supposed to be prepared by the end of November.	2015-2018	DONE
2	EAZK obtained 7 CO ₂ sensor for measuring the level of CO ₂ in building that are going to be introduced to the school building by the end of the year. Management of the school was trained on inner environment of the classrooms and new building operational rules were developed.	2018	DONE
3	Investment implementation	2018	DONE
4	Existing energy management will be improved by a least monitoring of temperatures, humidity and CO ₂ emissions in particular classrooms being carried out on two weeks basis. The staff personnel will be trained in energy management skills by EAZK.	2018-2020	DONE
III. Secondary pedagogical and social school Kroměříž			
No.	Preparatory work description	Schedule	Market research
1	EAZK prepared application for subsidy from OP Environment related to building reconstruction and improvement of its EE. EAZK carries out complete administration of the project in system MS2014+. On a basis of project documentation EAZK consulted and suggested changes for public procurement according to the rules of OP Environment. The investment was realised between June and September.	2015-2016	DONE
2	EAZK obtained 7 CO ₂ sensor for measuring the level of CO ₂ in building that are going to be introduced to the school building by the end of the year. Management of the school was trained on inner environment of the classrooms and	2016-2017	DONE



	new building operational rules were developed.		
3	Existing energy management will be improved by a least monitoring of temperatures, humidity and CO ₂ emissions in particular classrooms being carried out on two weeks basis. The staff personnel will be trained in energy management skills by EAZK.	2018-2020	DONE
IV. Basic school 1. Máje Kroměříž			
No.	Preparatory work description	Schedule	Market research
1	EAZK prepared application for subsidy from OP Environment related to building reconstruction and improvement of its EE. EAZK carries out complete administration of the project in system MS2014+. On a basis of project documentation EAZK consulted and suggested changes for public procurement according to the rules of OP Environment. The investment was realised between June and September.	2015-2016	DONE
2	EAZK obtained 7 CO ₂ sensor for measuring the level of CO ₂ in building that are going to be introduced to the school building by the end of the year. Management of the school was trained on inner environment of the classrooms and new building operational rules were developed.	2017	DONE
3	Existing energy management will be improved by a least monitoring of temperatures, humidity and CO ₂ emissions in particular classrooms being carried out on two weeks basis. The staff personnel will be trained in energy management skills by EAZK.	2018-2020	DONE
V. Grammar school Valašské Klobouky			
No.	Preparatory work description	Schedule	Market research
1	EAZK prepared application for subsidy from OP Environment related to building reconstruction and improvement of its EE. EAZK carries out complete administration of the project in system MS2014+. On a basis of project documentation EAZK consulted and suggested changes for public procurement according to the rules of OP Environment. The investment was realised between June and September.	2015-2016	DONE
2	EAZK obtained 7 CO ₂ sensor for measuring the level of CO ₂ in building that are going to be introduced to the school building by the end of the year. Management of the school was trained on inner environment of the classrooms and new building operational rules were developed.	2017	DONE
3	Existing energy management will be improved by a least monitoring of temperatures, humidity and CO ₂ emissions in particular classrooms being carried out on two weeks basis. The staff personnel will be trained in energy management skills by EAZK.	2018-2020	DONE
VI. Grammar school Vsetín			
No.	Preparatory work description	Schedule	Market research
1	EAZK prepared application for subsidy from OP Environment	2015-	DONE



	related to building reconstruction and improvement of its EE. EAZK carries out complete administration of the project in system MS2014+. On a basis of project documentation EAZK consulted and suggested changes for public procurement according to the rules of OP Environment. The investment was realised between June and September.	2016	
2	EAZK obtained 7 CO ₂ sensor for measuring the level of CO ₂ in building that are going to be introduced to the school building by the end of the year. Management of the school was trained on inner environment of the classrooms and new building operational rules were developed.	2017	DONE
3	Existing energy management will be improved by a least monitoring of temperatures, humidity and CO ₂ emissions in particular classrooms being carried out on two weeks basis. The staff personnel will be trained in energy management skills by EAZK.	2018-2020	DONE

Table 2: Time schedule of investment.

Table 3 shows the time periods for the investment preparation period, implementation of activities and subsequent monitoring and evaluation of results.

Month	2015											
	Jan	Feb	Mar	April	May	Jun	July	Aug	Sep	Oct	Nov	Dec
I												
II												
III-VI												

Month	2016												2017											
	Jan	Feb	Mar	April	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	April	May	Jun	July	Aug	Sep	Oct	Nov	Dec
I																								
II																								
III-VI																								

BOOSTEE-CE project start

Month	2018												2019												2020				
	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
I																													
II																													
III-VI																													

Table 3: Investment plan.



Preparations

Implementation

Monitoring/evaluation

Explanation:

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.

Implementation – A set of activities like installation of equipment, systems.

Monitoring/evaluation – Checking whether the expected results are received.

4. OnePlace platform testing

Implementation of the pilot action consists of two aspects:

- technical, i.e. energy management system and thermo-modernization of the buildings (described in chapter 2);
- social / promotional like OnePlace platform use.

This chapter is devoted to the promotional aspect and describes the testing and structure of the project platform below.

The OnePlace platform consists 4 different modules: Living Energy Marketplace; 3D Energy Management System; Energy Efficient Cities; Financing Energy Efficiency.

The first one is an online database helping to understand all different kinds of energy efficiency measures, electronic devices and offering qualified contractors who can carry out energy efficiency investments.

The second one is a webGIS system which can navigate a map of an urban environment, select a 3D building of interest and retrieve the energy audit and other cadastral/building information. The 3D Energy Management System aims to harmonize the different data sources in one database and visualize them.

Next module enables the exchange of experience and good practices between regions for public authorities and other public actors.

The last one is an attractive visual presentation of the transnational strategy outcomes (financial road map), examples of best practices and practical steps to use the national and EU-level resources. This module also tries to capture and present the methods of financing energy efficiency investments that will be transferred to the participating regions' Energy Efficiency Roadmaps.

The current content of the OnePlace platform has been tested by project partners and selected stakeholders. The chosen method of reviewing is the questionnaire. This choice was considered optimal and the best. It included a short time to gather feedback and comments.

The survey was conducted in April 2019; altogether 26 responses were collected, partly from the participants of the Focus group meeting held in Zlín on 15.4, partly by other external relevant respondents. Due to the complexity of the 3D Energy Management System (EMS) which is one of the four modules of the BOOSTEE-CE OnePlace platform, the survey was necessary for needs of the users and for further development of the portal. Users mostly think that the portal is easy to use. Respondents prefer Czech language, because of the probably effectiveness and comfortable of the work in the 3DEMS. A key question addressing users was if analysis of the attributes is easy to perform. Most than 95 % think that is quite easy to actively use 3DEMS. All survey correspondents prefer having additional documents attached to the



building like thermal acquisition photo or energy audit document. The most disputative question was 3DEMS training. However, still 57,7 % respondents think that the additional training is necessary.

The recommendations for attributes of the pilot actions was to extend the attributes with the attribute "building energy performance" indicating the energy performance of the building both before and after the renovation, eventually indicating the possible future energy performance of the building suggested in the energy audit

Next recommendations for the filtering were to include the option of filtering the buildings according to the energy performance of buildings. Second opinion was that user will be able to increase to size of the letters for older audience.

5. Application of OnePlace platform in PA3

The OnePlace platform has also been tested in the conditions of the pilot action in Zlin Region. It has been confirmed that the platform works well and is useful.

OnePlace is the only portal that combines LIVING ENERGY MARKETPLACE, ENERGY EFFICIENT CITIES, FINANCING ENERGY EFFICIENCY and 3DEMS. These features are combined in the friendly user way. 3DEMS are the most impressive part of the portal and all visitors can see the real state of the buildings with the all necessary parameters. For example the 3DEMS can be used for the solar installation and right settings of it. Moreover the energy efficiency database is wide and you can find all smart solutions from the whole Europe.

6. Conclusions

The activities described in the pilot action in the Zlín Region represent a good practice. They can serve as a model for carrying out investments aimed at improving energy efficiency consisting of installing energy management system and thermo-modernization works.

The best possible beginning is inside the unique energy management led by EAZK. Due to that is EAZK ready to recommend best solutions and best possible buildings suitable for the donations. Than is absolutely necessary to coordination between all participants in the realization team (Energy agency of the Zlín region, Zlín region, school, build company, supervision). Final step is to continuously measure the indoor climate to prevent any disbalance between indoor climate and energy consumption.

The information from this study will be useful and used for documents D.T3.2.1 and D.T3.2.2.