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BOOSTEE-CE

DELIVERABLE T3.1.3

D.T3.1.3 – PA2 in a school complex (primary, comprehensive and polytech) in Judenburg-Lindfeld (AT)

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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	Municipality of Judenburg (JUD), PP10	Helfried Kreiter, h.kreiter@judenburg.at Eva Volkar, e.volkar@judenburg.at Christian Moser, c.moser@judenburg.at
	Energy Agency Upper Styria (EAO), PP11	Gernot Baernthaler, gernot.baernthaler@eao.st

1. Introduction and aims

This deliverable is a kind of investment report that 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 each pilot action.

2. Identification of problem areas

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.
The pilot action is implemented in the school complex Lindfeld in Judenburg. The complex consists of four partly separate buildings which house three schools and a sports hall. The building Lindfeldgasse 5 is a sports hall built in 1970. Lindfeldgasse 7 was built in 1962 and houses the primary school. The buildings Lindfeldgasse 9 and 11 are two wings which are interconnected by an annex and house the comprehensive school as well as the polytechnical school in a part of the building Lindfeldgasse 9. The two main buildings were erected in 1965 and 1966, the annex was refurbished and expanded by one floor in 2004. The windows and the electrical installations of the buildings are new, but the energetic state of the buildings (walls, roofs) corresponds to others of the built period. Only the annex has thermal insulation and a better energy class.
All buildings are supplied with district heating which comes from biomass, namely the waste heat of a nearby pulp and paper mill. In addition to the district heating there is a solar installation on the sports hall for water heating. The heat is distributed from one central transfer station to the different buildings. The distribution network has been expanded and renewed piece by piece over the years and therefore the single components are not perfectly fitted. There is no automatic regulation for the system but regulation is done very diligently by hand by the building manager. Thanks to the janitor's care the distribution of the heat works to a satisfying degree but there is certainly potential for work simplification and, above all, the janitor will retire in some years and with him a lot of knowledge about the heating system will leave, too.

Each investment is the result of the assumptions made therefore the pilot action has defined its own goals, which it will achieve in the perspective of the duration of the BOOSTEE-CE project. The objectives also point to existing problems that need to be minimized or eliminated entirely.
The initial intention for the pilot action was the installation of smart metering to refine the energy monitoring of the building complex and measure the consumption of the separate buildings for a better division of heating costs between the different schools (different cost centres). However, the first detailed audits of the heating distribution and hydraulic system as well as of the regulation and control system have shown that thanks to the energy cost accounting there is already enough data to divide the energy costs. The installation of additional measuring equipment would only cause costs without additional benefit. Therefore, it was concluded that for long term energy saving it was necessary to optimize not only the regulation and control system but also the heating distribution and hydraulic system.

The new plan for the pilot action was thus based on the assumption that the two main tasks were the installation of an automatic regulation and control for the heating system as well as a better fine-tuning and harmonization of the components of the heating system to improve heating distribution and consumption. It was decided that the pilot action in the BOOSTEE-CE project should be the first step in a series of enhancements and comprise the installation of a central automatic regulation and control unit. Specialists were invited to check the system in situ and bring tenders and proposals for the necessary actions. Three tenders were handed in.

Subsequent further inspections of the buildings (thermography) have shown that renewal and upgrading works in the heating system alone will not lead to more energy efficiency as long as the energetic state of the building envelopes is not improved with thermal insulation and new roofs. Therefore, the municipality has decided that a comprehensive refurbishment concept including heating system, façade and roof shall be made. Due to the tense financial situation of the municipality a modular step-by-step approach was considered, with the BOOSTEE-CE pilot action as first step in a series of actions. Further considerations have concluded that the best way to finance this large-scale refurbishment project in the foreseeable future is a contracting solution which covers all necessary works and investments. Preparations are underway.

Although the initially planned measures of the pilot action will thus not be realized in the course of BOOSTEE-CE, the analyses made in the project have spurred the Municipality of Judenburg to pursue a bigger path of action and implement a comprehensive refurbishment project for all buildings of the school complex Lindfeld with the help of a contracting partner. This enterprise will have a considerable effect on the energy efficiency of the buildings and reduce energy consumption and costs for the municipality.

In addition to these technical measures, other important goals in this pilot action are:

1. Staff training about energy efficient use in the building
2. Increasing the comfort of the buildings' use
3. Easier operation of the buildings

3. Research on EE measures for the PA

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.
For detailed energy analysis, three smart meters are available for electricity and one smart meter for heating. For electricity, electronic smart meters are installed from the grid operator Stadtwerke Judenburg for every building part. For heat supply, also a meter is installed for accounting the energy consumption. The data are collected monthly, and then reported to environmental department and integrated into the municipality's energy monitoring. As part of BOOSTEE-CE, the Stadtwerke Judenburg will provide the log file from the smart meters for electricity supply at quarterly hour basis, for more detailed energy analyses of the previous situation as well as benchmarking and controlling the effort after improvements in the energy efficiency.
The heat consumption is spread up to the different building parts by a heat load calculation of the different building parts. The total consumption is metered at the heat transmission station from the district heating.
The smart meters which were installed were financed outside the project by the ESCO's Stadtwerke and kelag.

The intelligent remote energy meters enable automatic data transmission on energy consumption. The owner of the building receives bills for actual energy consumption, not forecasted. In addition, it can monitor energy consumption on an ongoing basis, which in turn will allow to manage this consumption and reduce electricity bills. Control of the level of energy consumption will allow to optimize the level of contracted power, which in turn will generate savings.

The analysis carried out as part of the project showed that further modernization of buildings (in addition to the installation of intelligent energy meters) is needed. Other investments planned at a later time (from ESCO funds) in the school complex of Judenburg Lindfeld:

- Improvement in the hydraulic system of the heating system for better regulation of water flow rates on radiators, and room temperature regulation
- Reconstruction of the hydraulic distribution, pumps and valves
- New smart regulation and control for heating of all building parts
- Partly thermal insulation on outside walls and rooftop
- Replacement of lights by new efficient LED lights

Figure 1: Investment activities photos for the PA2 in Judenburg Lindfeld, heat distribution system before the reconstruction. Source: EAO / Baernthaler

4. OnePlace platform testing

Implementation of the pilot action consists of two aspects:

- technical, i.e. the installation of an automatic regulation and control for the heating system as well as a better fine-tuning and harmonization of the components of the heating system to improve heating distribution and consumption (described in chapter 3);
- social / promotional like staff training about energy efficient use in the building and 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 OnePlace platform was tested by a group of municipal experts, including building and space planers, building managers and energy experts. The platform was presented at the focus group meeting of the e5/European Energy Award team on 2/4/2019 and also tested individually. 11 people gave a feedback to the platform in form of a questionnaire and in discussion.
The 3D EMS tool with its dimensional visualisation of the buildings and the town terrain was received positively. Most people said that they could imagine using the 3D EMS tool and named energy use and energy planning as the most suitable fields of usage, especially to visualize supply areas of district heating, gas and other heating fuels, the distribution of solar energy and PV and to identify areas with potential for refurbishment and expansion of renewable energy sources.
They also saw a potential use by city planners and for architectural competitions. Also, for building management purposes the tool is seen as potentially valuable if it is possible to link more specific building related information to the database and visualisation.
For private users the 3D visualization tool could be of general interest, and more specifically people who intend to purchase building land, buy or hire real estate can better assess the surroundings of the contemplated object (height of neighbouring buildings, shading situation, view).

5. Application of OnePlace platform in PA2

The OnePlace platform has also been tested in the conditions of the pilot action in Judenburg. It has been confirmed that the platform works well and is useful.
Most test persons found the 3D EMS tool useful for the assessment of the energetic performance of public buildings if more specific data about energy consumption for heating and annual energy consumption in general were available. Also, an application for energy accounting is suggested. As an additional benefit information about energy audits, building plans and all basic building data could be displayed. For building management purposes, it would be useful to link information about existing concepts (e.g. fire protection) and impending deadlines for check-ups to the buildings.

6. Conclusions

The activities described in the pilot action in Judenburg represent a good practice. They can serve as a model for carrying out investments aimed at improving the energy efficiency of public buildings with

limited financial resources. Installation of smart metering for electricity and heat consumption is an important part to improve the data quality and basis for energy analysis and definition of measures for energy efficiency.
The case of the Judenburg pilot action is exemplary for many Austrian small and mid-sized towns. Many school buildings were erected in the 1960s and 1970s and have the same energy standard as those in Judenburg. The municipality is also not alone with the tight financial corset and being subject to the restrictions of the Maastricht regulations which narrow municipalities' scope of action for investments.
The pilot action shows that small isolated measures that can be financed at a given moment do not necessarily lead to the successful reduction of energy consumption but it is advisable to take a look at the whole system. Before making improvements in the technical equipment the overall energy consumption should be lowered as much as possible through energetic improvements of the building envelope.
Smart metering and energy monitoring for electricity and heat will provide detailed data, this is important do set energy efficiency targets and measures. Also, energy monitoring and controlling of established measures can be improved by modern smart metering systems. Failures' in technics and rising energy consumption can be recognized in an early stage, to save energy and costs.

Contracting offers a good way for municipalities to put plans for refurbishment in public buildings into action without running up debts and is therefore becoming increasingly popular among Austrian towns. The contracting partner is motivated to achieve high energy savings to lower their costs, and after the end of the contract the investment stays with the building owner, namely the municipality.

In the case of Judenburg, after years of small piece-by-piece measures against the backdrop of scarce financial resources the policymakers have understood the need for a comprehensive renovation of the pilot action buildings and want to use contracting as a way for financing these energy efficiency measures. This is a clear merit of the BOOSTEE-CE project.

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