PROJECT RURES

D.T2.1.6 Pre-investment report of Energy efficient administrative building in Čakovec Medjimurje region

September, 2018

1. Introduction

Project index number and acronym	CE933 RURES
Responsible partner (PP name and number)	PP9 Medjimurje Energy Agency Ltd, PP10 Regional development agency Medjimurje REDEA
Project website	http://www.interreg-central.eu/RURES
Investment location	Bana Josipa Jelačića 22, 40 000 Čakovec, Croatia
Delivery date	17.9.2018.

2. General description of pilot idea

Please write a short overview and description of the pilot idea, activities, purpose and goals.

Building which will be made more energy efficient through this pilot investment is situated in the ex-military complex in Čakovec. Čakovec is the largest town in Medjimurje county in Croatia with its 17,000 inhabitants (around 30,000 with surrounding settlements) and is considered to be the administrative centre of the County. The ex-military complex was built at the turn of the 19th to the 20th century and it contains several buildings of different size. The building in which the pilot investment is planned to be implemented has around 600 m2 of net floor space area with three floors and according to energy audit is classified as D energy class building. Four public institutions have their offices in the building (Medjimurje Energy Agency Ltd., Regional Development Agency Medjimurje REDEA, MIN Ltd. and Family Center of Social Work Center) which all have a large number of users searching for their services. For the pilot investment itself, in the building described above, it is planned to install solar collector system for hot water and heating support, indoor lighting system reconstruction with LED technology based luminaires and with the addition of motion sensors in the hallways and staircases, installation of smart metering system for all energy sources and replacement of inefficient kitchen appliances with new ones of A+++ energy class. First step in preparing of pilot investment was to hire external experts that made feasibility studies for the planned EE and RES measures. The feasibility study has been developed and the data from the same will also be presented in this report. The second stage of the investment preparation was to hire external experts to develop technical documentation needed for smooth implementation of the pilot investment. This developed technical documentation is used to conduct public procurement for the equipment and installation of the same. It is also used to present technical data within this report. With the implementation of all of the mentioned measures, the building will consume less energy and thus become more energy efficient. Since it is a public building accessible to wide range of users (employees, service users from private sector, political decision makers, natural persons…), the results of this pilot investment will have a wide impact on raising awareness and it will also be used as a best practice example of an energy efficient public building that is using renewable energy sources in the rural area of Medjimurje County.

3. Description of pilot investment

3.1. Technical analysis of the current state

Please describe current state in the area of planned pilot investment (current installed technology, usage regime, mode of use, etc.).

Based on the Energy audit report, current total annual energy consumption of the building is 132,821 kWh, and this number can be divided to energy for heating, 104,363 kWh and electrical energy, 28,458 kWh. Apart from this annual water consumption in the building is 176 m^3. All of this leads to the annual costs of around 7,000.00 euro and the CO_2 emission of 34.90 t.

Currently hot water is prepared by an electrical boiler that is installed in ground floor of the building. Annual consumption of the hot sanitary water is approximately 35 m^3. Hot sanitary water is used in two kitchens situated on ground and first floor of the building. The usage is limited to the working hours of the employees of institutions that have offices in the building, which means mostly between 7 AM and 5 PM. Currently there is no piping for hot water in two toilets that are situated on the ground and first floor of the building, but it is planned to make the piping in the future as a part of building reconstruction.

Currently for the space heating, pyrolytic wood-fired boiler is used which heats water in accumulation tank of 3000 L. In addition, a gas boiler is used for space heating in the transitional period, and can also heat water in accumulation tank of 3000 L.

Indoor lighting system currently consists of 343 luminaires of which 18 are fluo, 14 is incandescent bulb, 311 fluocompact. Total installed power of those luminaires is 9,48 kW with 2.000 average annual working hours of the same. Based on those data the conclusion is that the total annual consumption of indoor lighting is 18.400 kWh which is around 50% of total electrical energy consumption.

Currently there is no installed energy consumption monitoring system in the observed building.

The kitchen appliances currently installed in two kitchens in the building are old and inefficient with tendency to often malfunction. Currently there are two refrigerators, two electric hobs, one dishwasher, one microwave and one electric kettle installed. The power consumption from all of those appliances annually comes to approximately 2,000 kWh.

3.2. Presentation of implementation of planned pilot investment

Please specify technical solutions planned to be installed, goals, target groups and activities of planned investment.

Please describe procedures and working methods that will be used while implementing the pilot installation and additionally through the maintenance of the same.

In Čakovec pilot area, described administrative building, it is planned to install solar collector system for hot water and support to heating. The technology that will be used is vacuum solar collectors with 10 pipes, idle temperature of 286°C and mixture of water and glycol as a system medium. Three of such collectors are planned to be installed on the roof of the observed building. Alongside the collectors, the 200 L accumulation tank with two heating spirals and additional 2.0 kW electrical heater will also be installed. Within this solar system, a solar pump station for water circulation, solar regulation, expansion tank and other fittings needed for the system to function on its own will also be installed.

Apart from heating hot water in the 200 L accumulation tank, solar energy will also be used to support the heating. For this purpose, a reversible valve and plate heat exchanger will be installed. In the plate heat exchanger, the heating water accumulated in an existing accumulation tank of 3000 L will be heated.

Regarding indoor lighting it is planned to install lighting system based on LED technology in all of the rooms in the building using existing fixtures. The types of LED lighting sources that will be used through the course of this action are 10W, G24, 4500K, 850 lm for offices; 6W, G24, 4500K, 485 lm; 6W, E27, 3000K, 485 lm; 18W, G13, 4500K, 1600lm. In the hallways and stairs, it is planned to install motion detectors to control illumination of those parts of the building. Panic lighting system stays the same.

To achieve for the building to be energy efficient it is important to install smart metering system for all energy sources. This is why it is planned to install electric power meter, gas meter, water meter and a calorimeter. First three meters should be installed in consultation with energy and water distributor. It is advised to connect the meters with Information system for energy management (ISGE) so the reading can be automatically uploaded.

Finally, it is planned to replace old and inefficient kitchen appliances with new appliances of A+++ energy class. In two kitchens in the building the following will be installed: 2 refrigerators, 1 electric hob, 2 dishwashers, 2 microwave ovens and 2 electric kettles.

All of the actions described above will contribute to the administrative building to be more energy efficient and sustainable. It will lower energy and water consumption and also reduce the costs of utilities. The building users will live in a healthier environment, especially employees who spend 8 or more hours a day in their offices. Clients and visitors will be able to see how an old, fairly inefficient building can be transformed into an example of good practice when it comes to refurbishment of public buildings.

3.3. Energy and emission analysis

Please include calculations to show reduction of energy consumption and the CO_2 emission achieved by the pilot implementation. Please describe the results.

When installing solar collectors for hot water and heating support it is estimated that the energy savings will be 4,390 kWh annually. This means that the CO_2 emission, regarding this action, will reduce by 1.65 tCO_2 annually.

Installation of energy and water meters does not contribute to energy savings and CO_2 emissions reduction at its own, but if the data gathered will be regularly analysed, numerous potential savings are to be recognised. When implementing those identified saving possibilities, the investment will begin producing energy and CO_2 emission savings.

Indoor lighting system reconstruction with LED technology based luminaires and with the addition of motion sensors in the hallways and staircases it is calculated that the energy savings will be 11,594,5 kWh annually. Total electricity consumption will be reduced from the current 18,393 kWh to 6,798.5 kWh. Reduction of CO_2 emitted will be 4.36 tCO_2 annually.

Replacing old and inefficient kitchen appliances (two refrigerators, one electric hob, one dishwasher, one microwave and one kettle) with new ones of A+++ energy class and by purchase of new kitchen appliances of A+++ energy class (two dishwashers, two microwaves, one electric hob, two refrigerators and two kettles) it is calculated that total electricity consumption will be increased from the current 1,712.9 kWh to 2,419.2 kWh. An increase in total electricity consumption was expected because after the pilot investment there will be one more dishwasher, one more microwave and one more kettle.

Increment of electrical energy consumption will consequently increase annual CO_2 emissions up to 0,27 tons.

***Overview**: After the pilot investment it is calculated that total energy savings will be 15,278.2 kWh annually that leads to 5,74 tCO_2 reduction.*

3.4. Social analysis of pilot investment

Please specify users and potential users, describe impact of the planned installed pilot and benefits for relevant fields (society, environment, economy), stakeholders and RURES project.

The building is being used 5 days a week, usually between 6 AM and 5 PM. There are four organisations that have their offices situated in the building. On the ground floor there is Medjimurje Energy Agency Ltd. with its 6 employees, Centre for Social Welfare's Family Centre with 4 employees and Medjimurje, Investments, Real estate Ltd. with another 5 employees. On the first floor Regional Development Agency Medjimurje REDEA is situated with its 21 employees. Each of these institutions has their clients that come to use the services they provide. It is estimated that apart from the employees, another 20 users come through the building on a daily basis.

All of the above-mentioned users will benefit from the investment since the working conditions in the offices will improve as well as the environmental conditions in all other rooms that are being used. Due to the improved working conditions, employees will be able to concentrate better to the working requirements and thus provide better services to the outside stakeholders. Apart from getting better services, external stakeholders will be able to see and feel the benefits which arise from implementation of energy efficiency measures and be stimulated and encouraged to implement similar measures also in their own offices or other working or living spaces.

Through the implementation of the defined measures, energy consumption and CO_2 emissions will decrease thus providing benefits for the environment on the local level. As the energy consumption lowers, the bills for the utilities will also decrease thus providing the organisations situated in the building financial savings. The building with its implemented energy efficiency measures will become good practice example to other similar public buildings in rural areas and thus provide wider environmental as well as economic impact.

3.5. Building and technical legal requirements

Please specify and describe all of the legal requirements regarding potential building and technical permits.

Investor (Regional development agency Medjimurje REDEA) hired an external expert who developed technical documentation needed for implementation of the pilot investment. The required technical documentation consists of:

1. *Main electrical project*
2. *Main mechanical project*

The documentation was prepared in accordance with all applicable regulations of the Republic of Croatia.

4. Timeframe of investment

Start date (dd.mm.yyyy.)	24/9/2018
End date (dd.mm.yyyy.)	31/3/2019

5. Financial analysis of the pilot investment

Please define the cost of the pilot investment, potential revenues, describe financing method as well as the possibilities of financing similar projects in your region and country. Here you can use the deliverables from WP1 for each specific pilot investment as well as the calculations from point 3.3.

According to the last approved Application form of the RURES project, total value of this investment is 33,000.00 euro. This value can be broken down to four components:

- *Smart-metering system for all energy sources: 15,000.00 euro;*
- *Indoor lighting system based on LED technology: 5,000.00 euro;*
- *Solar collector system for hot water and heating support: 5,000.00 euro;*
- *A+++ kitchen appliances: 8,000.00 euro.*

The public procurement will be defined as the one above national threshold for equipment of 200.000,00 kn (27.000,00 eur) so Croatian national Law on Public Procurement along with all of its subordinate regulations will be followed.

Financing of this investment will be as follows:

- *85% of the investment will be financed through the ERDF i.e. Interreg Central Europe programme – 28,050.00 eur;*
- *15% is financed by the investor i.e. Regional Development Agency Medjimurje REDEA – 4,950.00 eur;*
- *80% of the latter 15% is financed through national Fund for financing the implementation of EU projects on regional and local level – 3,960.00 eur.*

Further to all of the mentioned above, the investor will have to participate in the investment with its own funds only 3% from the total amount of the investment costs, i.e. 990.00 eur.

No revenues are expected to arise from this investment.

There are several financing possibilities for similar projects in Croatia. The simplest one is to invest the money directly from the budget of the local/regional government who owns the building. Nevertheless, such funding is rarely appropriate for municipalities/cities since most of them have limited budgets and usually tend to search for other funding possibilities. Local governments in Croatia also have an access to funding from European Regional Development Fund (ERDF) through Operational programme competitiveness and cohesion. In the past 4 years there were several public calls for enhancing energy efficiency of public buildings which included funding of wide range of different measures (EE and RES related). The funding rates from those public calls were usually between 40% and 80%, depending on the development rate of the funding region. The Environmental Protection and Energy Efficiency Fund is one more option since they sometimes issue calls for financing EE and RES measures for both public and private sector. Financing rates through such calls vary depending on the measure, sector and development of certain region.

Other financing possibilities come from Croatian Bank for Reconstruction and Development (HBOR) and its credit lines. Those credit lines can then be combined with ESI funds or other kind of alternative financing instruments. European Union programmes such as Horizon2020 and territorial cooperation programmes (cross-border cooperation, transnational cooperation, inter-regional programmes) offer another possibility for funding of such actions. Finally, there is one more instrument that can be used for financing of such investments and those are the grants of European Economic Area (EEA) and Norway.

6. SWOT analysis

Strengths	Weaknesses
- Financial savings (savings in electrical energy and heat) - Reduction of greenhouse gasses emission - Higher comfort of stay in the building - Higher energy and lighting efficiency - Reduction of maintenance costs	- Lower utilisation of solar collector on an annual basis (winter months) - High investment costs
Opportunities	**Threats**
- Example of good practice to local and regional authorities both in rural and urban area - An example to citizens how energy refurbishment results not only in energy and financial savings but also in better quality of space usage – encouragement for action	- Poor availability of contractors

7. Transferability of pilot investment

Please describe ways to implement described kind of investment in similar areas/objects. You can link this description to point 3.4.

Refurbishing of public buildings in order for them to become more energy efficient is an activity that is current in most of the European countries. This is especially so in the countries of former Eastern European block (ex-communist countries) where many buildings were built in the 60's and 70's with not much thought on making those building energy efficient. A lot of inhabitants were moving from rural to semi-urban and urban area at that time and there was a necessity for building new, both residential and public buildings (kindergartens, schools, courts, etc.). Apart from that, the fuel for heating was also rather cheap and they gave little thought on the future repercussions on such form of buildings.

In Medjimurje region, where this pilot investment is being implemented, the climate is classified as continental. This sort of climate is characterized by cold winters with significant precipitation and hot and dry summers. This kind of climate is also present in most parts of the Central Europe region so here defined pilot solution can in this context be transferred to any public building in this area. Furthermore, it is necessary in such climate conditions to construct well insulated buildings that can keep the indoor temperature between 19°C and 25°C so that the comfort of the residents stays the same with the energy consumption kept at minimum level.

Following all of the mentioned above, the investment in the measures planned in this project on a public building in Čakovec, can easily be transferred to any other public building in Eastern European block. Apart from the measures planned in this pilot, there are often other investments implemented to enhance energy efficiency of public buildings such as renovation of facades, installation of new highly efficient windows and doors, refurbishment of roofs and so on.

8. Conclusion and further suggestions

Please write a conclusion based on all of the previously described elements of the pilot investment, and also any suggestions you feel necessary.

For the pilot investment, it is planned to install solar collector system for hot water and heating support, indoor lighting system reconstruction with LED technology based luminaires and with the addition of motion sensors in the hallways and staircases, installation of smart metering system for all energy sources and replacement of inefficient kitchen appliances with new ones of A+++ energy class. With the implementation of all of the mentioned measures, the building will consume less energy and thus become more energy efficient. The building users will live in a healthier environment, especially employees who spend 8 or more hours a day in the offices. Clients and visitors will be able to see how an old, fairly inefficient building can be transformed into an example of good practice when it comes to refurbishment of public buildings. The investment in the measures planned in this project on a public building in Čakovec, can easily be transferred to any other public building in Eastern European block.

From all of this, it is apparent how much the planned investment has a wide range of positive impacts on various factors such as energy factor (e.g. lower energy and water consumption, reduce the CO_2 emissions), economic factor (e.g. reduce the costs of utilities), social factor (e.g. a better working environment for employees and an example of good practice for the users and general public) and so on.

The greatest benefit of implementing previously described pilot investment is to further educate the local population and raise awareness of energy efficiency and renewable energy sources.

9. Appendices – project documentation related to pilot investment and all necessary permits in national language

Please enclose a list of all relevant project documentation that had to be produced before the beginning of the pilot investment as well as all permits that were necessary to obtain.

e.g. for Croatian pilot investment:

1. *Main electrical project*
2. *Main mechanical project*