Demand Side Management Tools

Interreg CENTRAL EUROPE TOGETHER

D.T3.3.1 Template for reporting Pilot Actions Results

PA3 related to the public pilot buildings in Slovenia (D.T.3.3.4)

CE51 TOGETHER

Executive summary

This template is delivered for reporting pilot actions with technical description and documentation about the combination/selection and application of the integrated measures applied in pilot buildings. Partners are required to include a presentation of their Pilot Action, providing with an overview of the implemented activities and results achieved. Each partner has to produce this report using information and content collected at local level with the support of the managers/users/negotiating panels of the involved buildings.

It is not requested to included detailed information for each single building involved (a part some specific information about the energy consumption) as detailed information have been already provided in the PILOT CONCEPT DESIGNS. Exemplification, reference to specific context are welcome.

Note for the authors: please provide information in all the requested text boxes. You have to consider that the provided information will serve to prepare other project documents/deliverables such as the final e-book. For that reason, it is important to write clearly to create the conditions that everyone can understand and get the added value you want to share with the "external" audience.

Several content of the current template will be transferred and used for preparing the PILOT FACTSHEET compulsory for the CE programme

DEADLINE FOR SUBMITTING THE FILLED TEMPLATE TO THE LEAD PARTNER: 20 JANUARY 2019

1. Summary description of the pilot action (including investment, if applicable) explaining its experimental nature and demonstration character. Overview of the Pilot Actions implemented, general introduction. Write max 2 pages that introduce your local activities, the target group engagement, results. Please give evidence of the approaches implemented in the different buildings in particular if they are not belonging to the same category (educational, institutional, others) include some pictures in the "GALLERY"

The University of Maribor decided to integrate measures to be tested in 7 public buildings (2 educational buildings and 5 dormitories). Only in four of them SMS was installed, but the consumption of energy was analysed in all buildings as other already had installed systems for measuring.

The character of selected pilot buildings

The pilot building, the Faculty of Energy Technology is in Krško. Being an educational institution, according to permanent employees it has the character of an institutional building, but it has also a public character – students come to the building frequently.

Rest of the six buildings are in Maribor. There are five students' dormitories and one larger building with three faculties, the Faculty of Education, the Faculty of Arts and the Faculty of Mathematics and Natural Sciences.

Student dormitories, which are included as pilot buildings, do not have permanent staff, while students living in these building randomly and as tenants of rooms, so that despite their longer presence or stay in the building, we are talking about a building, which features the character of a public building.

Larger building with three faculties, the Faculty of Education, the Faculty of Arts and the Faculty of Mathematics and Natural Sciences is similarly like FE Krško, that means an educational institution, with permanent employees and so it has the character of an institutional building. And like FE Krško it has also a public character because of students.

With Pilot Action we wanted to trigger the process of change or, better still, for change, by focusing on all users who live and manage buildings, giving them an instant measure of the effectiveness/ineffectiveness of activities undertaken. The first activity to stimulate awareness is, therefore, visualization and immediate and objective evaluation provided, in the case of TOGETHER project, by investments in devices for the real-time detection and monitoring of electricity and heat consumption.

Pilots aim

The core activity of the project is the implementation of behavioural and organisational interventions that could lead to a more aware and rational use of energy by users. The main goal is to achieve energy efficiency in all pilot buildings.

Process for setting up the pilots

The process was the following:

1. Identification of Negotiating Panel members;
2. Implementation of energy audit in all 7 pilot buildings with suggested interventions for improvement of energy efficiency in each building;
3. Design of the Pilot Concept including 7 Pilot Building Action Plans;
4. Installation of SMS system in 4 pilot buildings and training of staff to manage the system;
5. Discussion and identification of problems with members of Negotiating Panels and presentation of prosed solutions;
6. Smart metering and presentation of data at Negotiating Panels;
7. Signing the Statement on considering recommendations of the TOGETHER project.

Behavioural measures and communication with target groups

Behavioural measures and communication were oriented to raise awareness of public buildings' users (managers, employees and end-users – students, visitors) and changing behaviour to achieve more efficient use of energy. Behavioural changes were (are) achieved by:

- Informing and raising awareness of target groups (users) by displaying data on Big screen (LCD) at the traffic places (entrance in building, hallway) with all relevant measured data (temperature, humidity, current energy consumption, current water consumption, …);
- Established TOGETHER Energy Info Point – presenting general data; data on electricity consumption and heating;
- Implementing training on monitoring systems to raise awareness of owners/managers/users of public building on the amount of saved energy from particular behaviour (turning on/off lighting, computers…) - users; the potential for new investments and measures based on the consumed energy per square meter – owners; the possibility for optimization of operational parameters (e.g. heating curve: supply temperature vs. outdoor temperature) – managers;
- Creating and disseminating posters;
- Creating and disseminating labels (10 types for saving energy: electricity, water, heating);
- Creating and disseminating tips on energy efficiency for owners, for managers and users of public buildings translated into Slovene language;
- Organising Negotiating panels where presenting project activities and results, discussed how to raise awareness of owners/managers/users of public buildings and looking for solutions for increase energy efficiency in those buildings;
- Creating graphic/video tools to raise awareness and published then on project website and UM/FE website;
- Implementing Multichannel campaign: (1) uploaded interactive game Planet Defender and Green Encyclopaedia in Slovene language the website http://www.planetdefenders.si/ to be accessible to wider public; (2) Prize Game "Saving Energy TOGETHER).

Although the measures influence the user's behaviour towards efficient use of energy, there is strong impact of human factor, which depends on the user's character, awareness with responsible acting and lifelong education starting from kindergarten. For this reason, one of our measures was elaboration of colouring book distributed in kindergartens. This assures not only short term but also long-term change of user's behaviour in order to increase the energy efficiency.

We informed students in Students dormitories with Data Display (smart TVs) at the entrance in the Dormitories, with labels that inform on smarter use of energy and brochures with tips on efficient use of energy. Also, Students has a representative member in our working group. Employees and their Heads are also cooperated in Project working groups (Negotiating panels) and are deeply aware of the importance on how they can improve Energy Efficiency through their actions and behaviour.

Organisational measures

Regarding organisational interventions, all the Negotiating Panels have considered the possibility of a better organisation to achieve efficient use of energy and possible savings in all pilot buildings and behavioural changes of managers, technical and other staff employed and end users.

Technical measures

The pilots in Slovenia, Maribor and Krško are in line with the approaches planned in the project
According to chapter 3.2 of the D.T2.1.6 Pilot Concept, there are three types of Pilot Actions that can be carried out at the level of an individual building:

- Combination of the day-to-day energy management system with the DSM measures that have been developed: Basic approach.

- Improvement of the already existing measures for the user involvement with new DSM tools: Improvement approach.
- Application of the integrated tools developed in WP T2, including an improved Energy Management System, financial, technical, contractual and DSM tools: Evolutionary approach.

The UM has implemented Evolutionary approach.

Smart metering System

University of Maribor (UM) has installed Smart Metering Systems (SMS) into 4 pilot buildings (Student dormitories 1,2,3 in Maribor and FE Krško). The installed SMS allows users to control and monitor energy efficiency of the building. It allows to archive and analyse data and alarm in case of failure or irrational use of energy. Four of pilot buildings are fully equipped with systems for measuring/monitoring all indicators determining their energy consumption. Each of the building has their own system and it is not combined with others, this assures that system works independent, without potential external interferences. The SMS consists of regulation equipment, smart meters, electric cabinets and fine material.

The SMS allows to measure and display in real time and stores all required parameter on local server, which is used for analyzation of captured information. In buildings, following parameters are acquired:

- Fuel/gas consumption,
- Heat consumption,
- Consumption of energy for domestic hot water preparation,
- Consumption of water and
- Indoor comfort (temperature, humidity and illumination).

For measuring fuel/gas consumption there are used fuel meters, which counts natural gas according to the consumption. These meters were upgraded with Modbus module, which assures communication with Programmable logic controller (PLC). Heat consumption is measured with heat meters, in most cases are used meters of the manufacturer Enercon CF-ECHO II. They have already built-in proper communication ports. Water is monitored via existing water meters, which have been upgraded with incremental encoder, for data transfer. All acquired data is transferred via Modbus protocol to common PLC, which is responsible for data processing. For indoor comfort measurement is used solution of company Wireless Sensor Tags. Wireless Sensor Tags and Kumo Sensors monitor, and record motion events, temperature, humidity and illuminance located in reference premises. Data is transferred via wireless signal to data concentrator, which is connected to internet. This allows to connect the system in SMS.

In other 3 buildings where SMS system was not installed the UM signed an Agreement on access to the existing central controlling system of energy consumption were signed with buildings' managers. With those agreements UM has rights to access to current and past recorder data on energy consumption measurements. The representatives of those pilots also committed themselves to raise awareness among public buildings users on proper use of energy tools developed in the project.

Targets group in buildings

1. Students and visitors of 5 Student' Dormitories – more than 1,000 students targeted through target through group meetings, labels for behavioural changes on energy consumption, by publications on webpages and social media and dissemination other info material;
2. Staff in the Student' Dormitories (Management and Technical staff) – 71 employees, including managers targeted through stakeholders group meetings and Negotiating Panel and as well labels, publication on webpages and social media and other info material;
3. Students and visitors of four Faculties (two buildings) – more than 3,100 students targeted through training, labels on changing behavioural, publication on webpages and social media and other info material;

4. Lecturers, tutors and other employees at Faculties – 380 targeted through training, Negotiating Panels, stakeholder group meetings, labels, publication on webpages and social media and other info material.

Results

- **Improved capacity of managers** of the buildings to engage users in the decision-making process related to efficient use of energy;
- **3 Negotiating panels (by the end of January 12 meetings were implemented)**. It is a group of people in a specific building who work together in jointly strive to reach the set of energy saving goals and mutual benefit (economic and environmental). The Negotiating Panel Concept is made up of representatives of owners, managers and users (including end users, i.e. occupants), contributing together to the energy management of the building. Establishment of a **Negotiation Panel was the first step in introducing full-scale energy management system in a building.** It comprises all relevant stakeholders and envisages open discussion principles to define measures and deliver desired energy saving targets at the level of an individual building;
- By the end of January 2019, **6 Statements on considering recommendations of TOGETHER project** have already been signed.

Leveraged Funds

The Municipality of Maribor, the associated partner of the project, established private-public partnership with company Petrol and with the purpose to improve energy efficiency in public buildings, it signed a contract on energy renovation of 24 public buildings, primary schools, kindergartens, sport objects and building of the municipality. The investment is 12 mio EUR, in this 1.5 mio EUR are financial sources of Maribor Municipality, 4 mio of EU funds, other are private sources. The yearly savings are predicted in the amount of 550.000 EUR.

Additional information

The Social Audit Questionnaire represents the experimental work developed by the Province of Treviso in cooperation with the University of Maribor. This set of questions aims to understand the behavioural attitudes of building users. The data will be processed in accordance with the current legislation and in any case no personal data is required other than one's the sex, class and school of affiliation.

2. Indicate the NUTS (Nomenclature des unités territoriales statistiques) regions concerned by the pilot action

The NUTS are (SI032) Drava Statistical Region and (SI036) Lower Sava Statistical Region.

Pilot Actions was implemented in seven public buildings:

1. SI036 Lower Sava Statistical Region (Spodnjeposavska statistična regija): Faculty of Energy Technology, Krško
2. SI032 Drava Statistical Region (Podravska statistična regija): Student Dormitory Number 1, Maribor
3. SI032 Drava Statistical Region (Podravska statistična regija): Student Dormitory Number 2, Maribor
4. SI032 Drava Statistical Region (Podravska statistična regija): Student Dormitory Number 3, Maribor
5. SI032 Drava Statistical Region (Podravska statistična regija): Student Dormitory Number 4, Maribor
6. SI032 Drava Statistical Region (Podravska statistična regija): Student Dormitory Number 5, Maribor
7. SI032 Drava Statistical Region (Podravska statistična regija): Faculty of Education, Faculty of Arts and Faculty of Mathematics and Natural Sciences, Maribor.

3. Sustainability of the pilot action results and transferability to other territories and stakeholders. Max 2000 spaces

The sustainability of Pilot activities is reflected in the fact that expanded data capture will contribute to better planning and management of devices and installations related to the economical use of energy and other sources. We believe that measurable results will contribute to reducing costs, at the expense of lower energy consumption and resources. It is a motive for such measurement, along with all other measures, to be passed on, as a good practice also to the level of the entire University in Maribor, and later to other institutions, while one is teaching a wider crowd of people to become aware that energy and drinking water goods, that are increasingly limited and valuable to human use, as they also affect other stakeholders that are important for survival on our planet.

The investment in SMS has a significantly positive effect on the environment and climate through the behavioural change expected to occur at the building users facing them with their own energy consumption data. In addition, this gives an opportunity to buildings owners to monitor daily consumption, which can lead to implementation of more advanced energy efficient measures. Practice shows that the introduction and proactive use of SMS can result in up to 15% of savings. Even more, if we combine such system with proper involvement of building users (Behavioural Demand Side Management), additional 5% can be achieved. This can result in reduction of energy demand, consequently reduction of emissions and CO2 impact. In other words, it can be said that implementation of SMS can be the main figure in setting up a sustainable development of public buildings in case of the TOGETHER Project.

4. Lessons learned and added value of transnational cooperation of the pilot action implementation Max 1000 spaces

The knowledge and value added of transnational co-operation is reflected in various approaches to implement pilot actions, which can often also be constrained by local/national regulations. One such example is the extinguishing of lights in buildings, when there is no working time and there is no one in the building, the regulation stipulates that a certain number of lights must on due to the fire.

This example shows that it might be wise to study certain laws, regulations, and regulations in general, as times change. As the project takes place in seven countries, pressure on the non-life law or policy can be exploited, if not directly at least so that it becomes again subject to review. This is certainly one of the positive effects of such co-operation, not to talk about converging attitudes in the field of awareness-raising and education, and the unification of "good" culture.

The installation and application of the SMS primarily contribute to the pilot implementation and to achievement of energy efficiency in the involved buildings. However, the partnership has different dissemination tools through which the results and the lesson learned about SMS are and will be disseminated also at transnational level. Such tools are for instance the newsletters, the library on the project website, Integrated Tools, several international conferences and workshops, where participants get familiar with the usage of such systems. In addition, the partnership plans to publish an article in a specialized magazine explaining the different technical approaches of the partners related to smart metering and the lessons learned from the application of the different metering systems. Yet, the pilot reports will summarize the main experiences gained from the implementation of the investment which will be also disseminated as project results on transnational level motivating municipalities of other countries to invest in the installation of such system in their public buildings.

5. Describe the Strength, Weakness, Opportunities and Threats that you have registered when implementing the pilot activities. Write max 1 page

SWOT:

Strength

- The introduction of pilot activities, tools developed through project, presented to public buildings users, training and other awareness raising activities resulted in behavioural changes in energy consumption;
- Staff employed in pilot buildings and managers better understand the benefits of using SMS and its importance. This is important not only for public building users which are directly involved in efficient use of energy in public buildings, moreover, the behaviour will also be transferred to family members at home, which means care for energy efficiency everywhere.

Weakness

- SMS did not operate all the time in a right way, therefore some data were impossible to monitor and present at LCD. Some pilots locations were omitted for various reasons in terms of monitoring the measurement results or their public display for short time. Smart metering system should be observed in short periods;
- Despite of all activities related to behavioural changes some staff, and other users of public buildings are not incluned and do not care on energy efficiency and energy savings.

Opportunities

- By implementing pilot activities, with focused thinking about energy efficiency, opportunities have also been shown to emerge in higher energy savings and, consequently, lower costs, and such thinking has also stimulated multiple brainwaves in many areas, making it even more effective and more innovative way of handling energy, which on the other side encouraged the creation of new jobs with all the positive things that this fact brings with them.

Threats

- As the greatest threat, we detected the possibility that in the course of the pilot actions despite the efforts at some point in time, the desired effects are still not achieved;
- Although positive effects are measured and detected the decision and policy makers should recognise this and otherwise the good results will be closed with project end;
- Limited time of the project activities. Support team is the “engine” of many events, workgroups, workshops etc. After the end of the Project, the support team will be dissolving, people with a huge knowledge about the Project will possibly go to another, but not necessarily a similar project. This means that if we won’t succeed in the last part of the project, the effort should soon be forgotten;
- Lack of funds for investments in energy renovation of public buildings can endanger further efforts for improvements.

Before pilot implementation
Implementation of the pilot activities and implementation of the energy audit

September 2017- December 2018
Implementation of the pilot and use of the smart meters. The baseline is calculated on the basis of the historical data (if available) or on the basis of the energy audit

January 2019
Reporting and data elaboration

February - April 2019
Elaboration for the Political level (reinvestiment plan And action plan

Follow up: PPs and APS continue to use the smart meters even after the closure of the monitored period

7. Total energy saved (in kWh) within the monitoring period, which is one year (please considered your pilot buildings altogether)

Electric consumption: - 35,56 MWh

Thermal consumption: 143,46 MWh

8. What the baseline refers to? (audit, historical data etc.? You have to indicate what type of data was used. Please, give a short description about the type of data used.

The starting point for measuring the impact of pilot activities is the data obtained in the pilot buildings of the project. Four of the seven objects are selected for "Smart" Metering System (SMS) for measuring quantities such as electricity consumption, thermal energy, lighting, moisture, external and internal temperatures, water consumption and quantities covered by the heating process itself, such as, for example, the temperature of the hot water supply, the pressure in the primary duct, openings of valves and the like. For these four objects, data are provided through various sensors and at a higher level of PLC units, sampled every fifteen minutes and centrally collected in control computers that are compressed into a single SCADA system where processes and data processing can be controlled remotely via a team viewer and are available to all and only interested and qualified users. For purposes on the SCADE level, Petrol has developed its own Eltec DaVi application. We export the data there to MS Excel (CSV) and convert them to the correct format. Then we process them and get information for decision making.

In addition to this "wider" system, our supplier, Petrol also has a TIS (commercial name for the Tango web application), which operates based on energy accounting and data on energy consumption are available on a monthly basis. This system applies to all seven buildings. The data that are needed and required in the project are processed with the MS Excel application, what is still sufficient for our project.

ELECTRICITY								
	total net heated floor area	baseline consumption (before the pilot action)	baseline period (before the pilot action)	consumption after pilot action	monitored period after pilot action	kWh/ m2 after pilot	Baseline calculation	
	m2	kWh/ 2015-2017	start date, end date	kWh/2018	start date, end date		Indicate whether the baseline is calculated by smart meters or bill audit	Indicate add all problems with measurements and collecting data
ŠD1	**2,811.00**	84,038	2015-2017	81,259	2018	28.91	Audit	
ŠD2	**2,413.00**	114,9872	2015-2017	106,192	2018	44.01	Audit	
ŠD3	**3,605.00**	95,112	2015-2017	87,389	2018	24.24	Audit	
FE	**1,275.91**	60,945	2015-2017	62,757	2018	49.19	Audit	
PEF, FNM, FF	**17,226.00**	6580,351	2015-2017	631,019	2018	36.63	Audit	
ŠD4	**4,554.00**	112,392	2015-2017	119,890	2018	26.33	Audit	
ŠD5	**4,213.00**	116,161	2015-2017	110,907	2018	26.32	Audit	

All pilots have remote heating except of the Faculty of Energy Technology that use gas for heating.

HEATING								
	total net heated floor area	baseline consumption (before the pilot action)	baseline period (before the pilot action)	consumption after pilot action	monitored period after pilot action	kWh/ m2 after pilot	Baseline calculation	
	m2	kWh/ 2015-2017	start date, end date	kWh/2018	start date, end date		Indicate whether the baseline is calculated by smart meters or bill audit	Indicate add all problems with measurements and collecting data
ŠD1	**2,811.00**	408,300	2015-2017	450,600	2018	160.30	Audit	
ŠD2	**2,413.00**	154,473	2015-2017	170,300	2018	70.58	Audit	
ŠD3	**3,605.00**	394,900	2015-2017	460,400	2018	127.71	Audit	
FE	**1,275.91**	163,992	2015-2017	143,201	2018	112.23	Audit	
PEF, FNM, FF	**17,226.00**	1.263,677	2015-2017	1.345,380	2018	78.10	Audit	
ŠD4	**4,554.00**	412.623	2015-2017	377,730	2018	82.94	Audit	
ŠD5	**4,213.00**	416,563	2015-2017	410,380	2018	97.41	Audit	

The presented data shows that energy consumption (electricity) increased in 3 pilot buildings and energy consumption (heating) in 4 pilot buildings, despite of installed SMS system and behavioural changes activities, due to the following reasons:

- Faculty of Energy Technology: the consumption of electricity slightly increased while energy for heating decreased for more than 12% compared to average use of energy for heating in years 2015-2017. There is also loss of energy due to poorly sealing windows and appropriate radiators. All behavioural changes activities implemented during the pilots actions cannot have such a big influence on energy efficiency use until this building has complete energy renovation.
- In the pilot building where three faculties are located, there was no savings in the energy, despite of all behavioural changes activities implemented. During the Negotiating Panel meetings, it was agreed that this building need complete energy renovation and we decided that UM project team will advise them in this process and help to prepare energy renovation plan to be prepared for gathering funds for its realisation.
- The electricity consumption decreased in Student Dormitories 1 (for more than 3 %) in Student Dormitories 2 (about 7.5 %) while energy consumption for heating increased for more than 10 % despite of SMS system installed and behavioural changes activities.
- In Student Dormitories 4, where SMS system was not installed, the electricity consumption increased for almost 6,7 % while the energy consumption for heating decreased for almost 8,5 %.

9. Do you have some issues with gathering the consumption data? Have you lost some data? (for various reasons such as the router stopped working, the wrong predefined constants in concentrator, same basic arithmetic issues that programmers did wrong by mistake, etc). How did you solve it?

Problems with data collection have been and will continue to be, even though we can approach it as carefully and precisely as possible. One of them was lateness of the involvement of SCADA in the project. And Vice Versa. Inclusion of the TOGETHER project in SCADA. The fact is, that Petrol (our energy supplier) SCADA did not develop only for the TOGETHER project, but as a supplier of energy cover to a large part of public administration and buildings in Slovenia. And the system lives so every day and it evolves. Thus, we found that SCADA sampling for our project was started just at the beginning of December 2017. And for earlier periods for 4 building, where we introduced SMS, we have available only data from energy accounting. Of course, the case of the other three buildings is even worse, because we have also only available data from energy accounting, which very often are not useful for the project' issues. For these three buildings we tried to acquire the correct data (for year 2018) from the energy supplier, and as the supplier has only aggregate data (granulation one month) it struggles to get data from the distributor. Finally, we received data from energy supplier' energy accounting, but very late. Only four of pilots have installed SMS and the other three do not have, therefore the energy accounting data was used.

10. How have you solved this problem? what are the advices and suggestions that you might stress out so the others that will replicate similar investments could use them?

Measurable results should be obtained. Only based on accurately measured results it is possible to obtain data from which we can extract the information that is the basis for decision making. So, we suggest that at the planning stage, the clear goal is exactly what kind of information we will need. And more time is needed, the data needs to be carefully planned. So, plan what kind of data we will need, how often sampling, foresee hazards, and traps in getting them, anticipate all possible risks, and, finally, whether we can acquire them within the foreseen timeframe. It does not matter if we get the data too late when we should have the information in order to decide. To get the right and accurate data as described, this entails the planning of the entire infrastructure, which can provide such information and, finally, the means so that the infrastructure can also be established. In the case

of restrictions, in the construction of infrastructure, most often due to scant measurements, we are trying to help with a set of knowledge and techniques so that the obtained data is still appropriate. So, under the line - careful planning at the beginning is necessary.

For the needs of the project we need measured quantities at four-time intervals: on weekdays during the open time of the buildings (from 6 am to 10 pm); on weekdays at the close time of the buildings (from 10 pm to 6 am); on Saturdays and on Sundays and Holidays.

In order to separate the measured data for these four-time intervals it is necessary to be sampled at least every hour or more. This is the problem with buildings where we did not introduce SMS (ŠD4, ŠD5 and PEF, FF, FNM building) and in all pilot buildings for earlier periods. We received information about the desired quantities from the energy accounting where we measure quantities only once in a month, what is insufficiently precise. For that reason, we introduced "Method of Determining Unmeasured Values" (short MDUV). The hypothesis is that the deviation (measured/determined) will not be so large to have a significant effect on the determined unmeasured values in buildings.

As already mentioned, we tried to reach some of the missing data, but unsuccessfully, therefore we used the analogy method (MDUV) where it makes sense - in concrete terms - student dormitories have a similar form and purpose of the buildings, if we have detailed data for student dormitories ŠD 1,2,3 will, according to the monthly data set in student dormitories ŠD 4 and 5, try to calculate the necessary information for these two dormitories. A somewhat more difficult task awaits us at the PEF, FF, FNM building, where there are no similar reference objects in form, but only in purpose – FE Krško.

11. Describe the investment costs and indicate what are they

OPEX – Operating Expense costs that are the ongoing costs for running the system
CAPEX – Capital expenditure costs of developing or providing non-consumable parts for the product or system.

Example: purchase of a copier must be deemed Capex, whereas the annual cost for paper, toner, power supply and maintenance represent OPEX. For such more wide-ranging systems as business ones, OPEX might even include the cost of manpower and sites, such as rental and associated services.
When we speak of OPEX (OPerating EXpenditure) costs, we refer to the costs necessary to manage a product, a business or a system, otherwise termed O&M - Operation and Maintenance – costs. OPEX costs.

Major milestones of investment implementation

In the 1st period UM has prepared technical/project documentation about Smart Metering System (SMS) based on of already built-in and equipment that is necessary to implement according to the SMS description. Right in the start of the 2nd period, our legal office prepared agreements for SMS installation in pilot buildings that were signed by all involved parties. In meanwhile, our legal office prepared a procurement documentation according to the national regulations and pre-prepared technical/project documentation. Public procurement was open for 2 weeks, between 14. 7. 2017 and 25. 7. 2017. Petrol company was the only bidder, therefore UM signed contract with them.

Whole investment implementation process was on the company Petrol, because of the signed turn-key contract. In the first phase, that were held in the first week after contract was signed, hardware installation works were completed. The second phase was to establish a communication between the installed parts of SMS for each pilot building, and to connect it with suppliers' server for establishment of the cloud service for the remote access. The third and the most important phase was development of software for requested needs. All works were completed in time, except after a while some minor mistakes were shown, and further corrections were needed.

Investment costs (Total costs and ERDF in EUR) including a break-down of main cost items

The contract of the company being responsible for the smart metering system (SMS) installation included two main tasks:

1. BL5 – thematic equipment (Mechanical, electrical and communication equipment; Services and education (delivery of the material, elaboration of the program, establishment of the system, implementation of energy monitoring, commissioning, education of the client) – total amount of 42,395.94 € with VAT ((ERDF: 36,036.55 €);
2. BL 6 – works for installation the thematic equipment – total amount of 7,490.80 € with VAT (ERDF: 6,367.18 €).

Total investments - contracted amount is 49.886,74 € with VAT (ERDF: 42.403,73 €).

12. Total energy metered from the installation (fully working) to December 2018

Total energy metered from the installation to December 2018 was 4,56 GWh.

13. How many Building Alliances were signed? Please provide information about the involved pilot buildings/institutions that agreed to officially sign a building alliance and give an overview of their terms of reference (e.g. energy reduction goal, % of division of the energy savings etc).
Has been the building alliance internally disseminated and shared with all the buildings players (e.g. teachers, students, janitors etc)
How have you informed all the interested buildings players about the alliance and its aims and conditions? *In case you have not signed the Building Alliance; please describe the reasons and the alternative measures you have adopted.*

We tried to establish Building alliance, but due to obstacles of organisational structure and regulations in the University of Maribor, the heads of the UM and Faculty decided to present a non-binding statement instead of "official" Building Alliance.

6 Statements on considering recommendations of TOGETHER project have already been signed. One of them valid for 5 pilots, Student dormitories, 3 for pilot building where three faculties are located, and 2 were signed by local support structure, Energy Agency for Savinjska, Saleška and Koroška Region, KSSENA and Development Innovation Centre Slovenska Bistrica. We expect by the end of February 2019 that statements for other Pilot buildings and maybe even more from other members of the University of Maribor will be signed. We received positive feedback and inclination to energy efficiency.

14. Describe the unexpected positive events/situations that you have registered during the implementation of the pilot activities. What changes in user behaviour can be experienced and how it was measured? *Please provide information and give examples/specific references*

During the pilots implementation some positive situations have been recorded:

- On the third meeting of the Negotiating Panel with the representatives of the Student' Dormitories (ŠD Maribor), it was discussed about how to add a small part of each other to put Energy Efficiency and Source consumption on a better level. And here is! Two maintenance employees in Students dorms Maribor came to the idea, how to reduce energy consumption in a garage house. They have replaced all classical light bulbs with new, on LED technology based, with built-in motion sensors. The savings were enormous, over 20%.

- It is very important, how to persuade employees to change behaviour and think in innovative way. This case was example of good practise and indicates that we have motivated participants of the working group, both on the management side and the other side - employees.
- By including our associated partners, municipalities in project activities, presented them results of pilots we achieved positive results as the Energy Agency for Savinjska, Saleška and Koroška KSSENA has already signed the Statement on considering recommendations of TOGETHER project and will include them into documents of Velenje and Celje municipalities. We expect that other Energy agencies and municipalities will sign it.
- Also, on the second meeting of Negotiating Panel in building, in which three faculties are located, (the Faculty of Education, the Faculty of Arts and the Faculty of Mathematics and Natural Sciences), it was expressed their interest of UM project team cooperation and advising them in the process of energy renovation and in preparing plan of energy renovation to follow the goal of energy efficiency in this building. With prepared plan and documentation, they can apply to EU (ELENA) and national sources (adequate ministry).

15. The energy monitoring system installed

Please write this part with a simple language that everyone can understand. Write max 2 pages

For the purpose of the project and for exploiting phase after the project, our provider for Energy, company Petrol was invited to solve needs of the project. They incorporate our Pilot Buildings into the existing system SCADA, which they need for managing processes of energy in many public buildings in Slovenia. Remote access to SCADA, visualized screen is ensured any time with TeamViewer software. Also measured energy use is displayed on large dashboard displays on the entrance into some buildings. For more explicit comparison, statistics and comparison to previous use of energy is displayed and rate of energy saving is graphically displayed.

Below is the table with specifications, what is needed for the SCADA system:

Installed sensors	NI-10000, PT100, PT1000, analogue 0 - 10V, current 4 - 20 mA
Interfaces to adjust the signal between sensors and the data capture system	13-bit analog converter, all analog, reverse and digital signals converted to the controller
Communication between sensors and interfaces if the interface for signal adjustment is required	MBUS communication for direct meter reading
Data capture device (e.g. controllers)	platform Siemens Climatix POL638.7, POL965, POL907, As regards hardware, the program was developed by PETROL
Performing a local data store	SQL Server 2016
Execution of remote data storage	Apache Hadoop
Communication between devices for data capture and remote data storage; platforms	TIS client via MQTT
Security of stored data (failures, unauthorized entries, intrusions, privacy protection)	Servers placed in the VM Ware environment, hardwired redundancy of disk fields, access through authorized certificates x.509
Data management (data analytics, real time and delayed forecasting, forecasting)	data analyst, data display in real time, archive display, M & T diagrams, CUSUM
Speed of data transfer in individual communications	TIS allows processing of 250 kbps
Functionality of data platforms (alarms, further activities, feedback loops)	SMS defined events, overdrawing errors, - the following changes, - influence on performance through pre-defeated functions,

16. Describe how the dashboard/data visualisation is operated and what is the feedback that receive the buildings' visitors. *Whom is addressed the dashboard to? habitual visitors or occasional visitors? Please describe the target. Provide information Do it in max 1 page and include some pictures in the "GALLERY"*

Dashboard data visualization is installed in four buildings. In three student dormitories (ŠD1, ŠD2 and ŠD3) in Maribor and the Faculty of Energy in Krško. In student dormitories, large LCD screens (smart TVs) are located at the entrance, and in Krško, on the hallway of the faculty, where there is a great flow of people.

The display shows the current consumption of heat, electricity, outside temperature, interior temperature, brightness and relative air humidity in the building in the form of Dashboards, as well as information on the project, what it is intended for, and the like. As already mentioned, such awareness is primarily intended for occasional visitors who find it difficult to achieve awareness in any other way. Of course, the permanent users of the building walk daily by the Display, and the impressions have the same effects as the first group.

17. Relevant for D.T3.3.10 about the involvement of the target groups
Describe the involvement of relevant Target Groups in the implementation of your Pilot Action
Report on the target groups' involvement in Pilot Actions from the negotiation to its assessment
Please write at Detail what, when, who and how. *Do it in max 1 page and include some pictures in the "GALLERY"*

The list of our target groups includes:

1. Students and visitors of 5 Student' Dormitories – more than 1,000 students targeted through target group meetings and labels for behavioural changes on energy consumption, publication on webpages and social media and other info material;
2. Staff in the Student' Dormitories (Management and Technical staff) – 71 employees, including managers targeted through stakeholders group meetings and Negotiating Panel and as well labels, publication on webpages and social media and other info material;
3. Students and visitors of four Faculties (two buildings) – more than 3,100 students targeted training, labels on changing behavioural, publication on webpages and social media and other info material;
4. Lecturers, tutors and other employees at Faculties – 380 targeted through training, Negotiating Panels, stakeholder group meetings, labels, publication on webpages and social media and other info material.

For successful pilot action implementation, to changes behavioural habits in energy consumption we involved target groups through many events, such as meetings, on site visits, consultations, presentations, workshops:

- 4 Bilateral meetings with external company Petrol d.d. which delivered SMS equipment;
- 12 Target group meetings with 380 participants.

At target group meetings several topics were covered: presentation of the project and its goals, presentation of the pilot activities, energy audits, tools, training with the purpose to increase their interest to change behaviour and find out which other actions were needed to increase energy efficiency and to increase stakeholders support in those activities.

With the purpose to change bad habits in energy consumption UM hired external providers (designer, printing company) to arrange labels, 10 different labels for efficient use of energy (see Galary) and raise awareness on importance of energy efficiency. The labels are in all pilot buildings. UM also

translated tips (all three types) and disseminated them to all pilot buildings to be available to building owners, managers and users.

UM has made available on University webpage and project webpage all training material and tools developed through project and disseminated link to all public buildings' owners, managers, users and end users and wider public.

To raise awareness on the importance of energy efficiency UM also disseminated colouring Activity book for children in Slovene language and interactive game Planet defender also in Slovene language on hired server available to wider public.

18. Relevant for D.T3.4.1 about the SUPPORTING STRUCTURE

Describe your LOCAL SUPPORTING STRUCTURE (how it is composed, who are the members etc)
Describe the actions/decisions realised by the Local Supporting Structure that you have organised for supporting the pilot actions.
Please write max 2 page with completed information or in any case an adequate information
Detail what, when, who and how

The supporting structure is composed by:

1. Project team, 6 employees, 3 full time and 3 part time, that organised all events concerning Together project, such as: meetings, local workshops, training, energy audits, advocacy and other relevant events to reach all goals of the TOGETHER project;
2. 2 members of company PETROL, a supplier of devices that implemented training on monitoring system and, also communicate with UM to resolve problems;
3. 1 External expert in preparing Pilot concept design;
4. 1 external expert to implement Energy Audits for all 7 pilot buildings;
5. External provider that assure the server and thus access to the game Planet Defender to general public in the frame of multi-channel campaign.

The project team is dedicated to organising the availability of monitoring and showing data on energy consumption after the project end. In that action the support of Negotiating Panels members, professors, employed at the University and its faculties (pilot building users), pilot building managers and pilot building users (students) is needed.

19. Expected impact and benefits of the pilot action for the concerned territory and target groups and leverage of additional funds (relevant for INDICATORS)

The expected impact on the territory is that pilot activities cover many people who are familiar with energy efficiency measures. The results of those measures will, as an example of good practice, also affect other similar institutions in the territory to join the activities that enable energy efficiency as they will try to reduce costs devoted to energy products. They will recognise that the introduction of effective data collecting can help them to better plan energy regimes and, consequently, to save energy and other resources (water). Disseminating project results and educating pilot buildings' users will be extended to all users of buildings in this area, which can have a multiplier effect on the wider surroundings, as they could implement acquired knowledge outside the pilot area, for example to indicate the behaviour of informed users at home and in all other buildings. An important role here is also the raising and education of the youngest members of our society, because we know that for the shift in the minds of a wider society, it is necessary to start education from an early age. In this way, we expect that savings and investments will be multiplied in the efforts for efficient use of energy.

20. Describe if any of the involved administrations have invested own resources (e.g. for retrofitting the pilot buildings and or for extending the smart meters system in the involved buildings or in other buildings) already during the pilots implementation. Indicate if any of the involved administrations have taken a commitment to invest own resources. Please give numbers, dates and describe shortly the type of levered investment

For example, we describe problems on the building with three Faculties at the second meeting – Negotiating panel PEF, FF, FNM in Maribor. They listed all the problems they have and what needs to be repaired in the building, such as: replace rest of the windows (some were replaced); new building envelope; in winter time on the north side of the building is too cold inside so they have to additionally heat the rooms with portable heaters; the heating system is worn out; radiators are broken so they cannot regulate the temperature; there are no thermostat valves on the radiators; the boiler, from which the radiators are filled, is defective and because of that last year they lost 1000 l of water each day; they only have two building managers for whole building (it is a big building) who cannot repair all defects on time, etc.

After we introduced them the behaviour change measures, developed during the project they explained that they will have no effect on the energy consumption of the building because of all these defects - for example they cannot close the radiators when they open the windows because there are no thermostat valves; even if they turn appliances off they will not save energy because there are approx. 10 portable heaters turned on, which consume a lot of energy, etc.

Another problem is the fact that there are 3 faculties in one building, and it is hard to solve problems, they do not necessarily want or need the same things and each faculty is trying to solve different problem that affects her.

A big problem is also the acquisition of funds, as this is decided at a higher level, to which they cannot influence (The University of Maribor) has to negotiate on their behalf with the Ministry of Education, Science and Sport (and also for every other faculty – there are 17 faculties); previous tenders for funding refurbishment of public buildings were not including faculties so they could not apply; even if they could apply, they do not have "Investment documentation" which is needed for application.

They need (and they want) a long-term and comprehensive solution. They need help from project team to advise them in this process and in preparing energy renovation plan. Based on this plan they will approach to preparation of Investment documentation to apply to tenders in the future, e.g.: to ELENA - European Local Energy Assistance. UM established further cooperation after project' end to help them in preparation of investment documentation.

After all of this – the answer is - University Maribor will refurbish in this case this building, so we can expect, that they will follow our advices from Together project. But as we can see, that could not be possible in very short time.

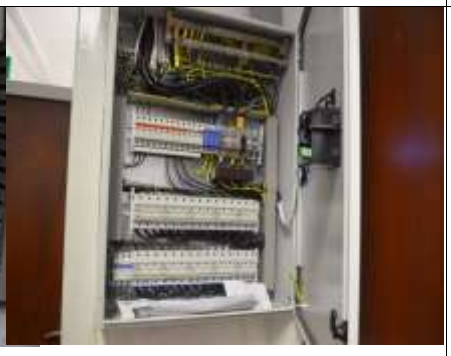
21. Full time employee (relevant for INDICATORS). Indicate if you have hired new staff for the implementation of the pilot actions and if the contract will be renovated after the end of the project

The Faculty of Energy Technology, which is a member of the University of Maribor, employed three people for the implementation of the project TOGETHER: (1) Sonja Gavez; (2) Sedina Sarajlić; (3) Damijan Leban.

The contracts will be renewed if the duration of the project is extended or if they are employed on another project. Other three people, working on the project are permanently employed at the University of Maribor, one of them part time, and perform work on the TOGETHER project as one of the additional work obligations.

PHOTO GALLERY

(please make sure that people included in the pictures have given you their informed consent giving you consent to publish the pictures)




Maribor, Faculty of Mechanical Engineering

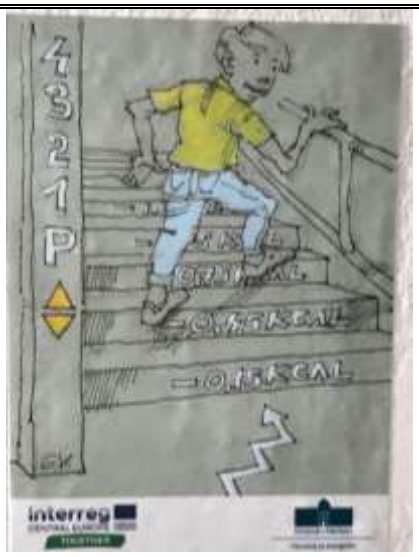

Velenje, Environment Protection College

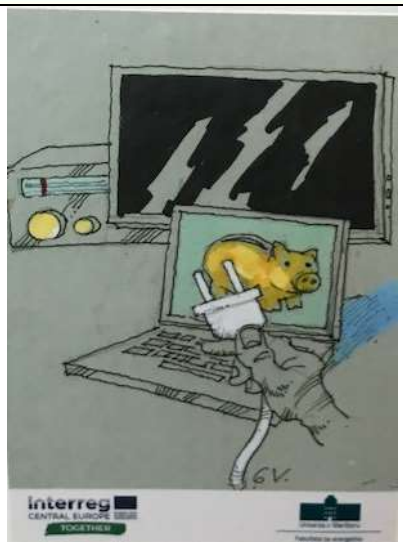

Velenje, Environment Protection College


Maribor, Waldorf kindergarten


Krsko, Faculty of Energy Technology


Velenje, School Centre



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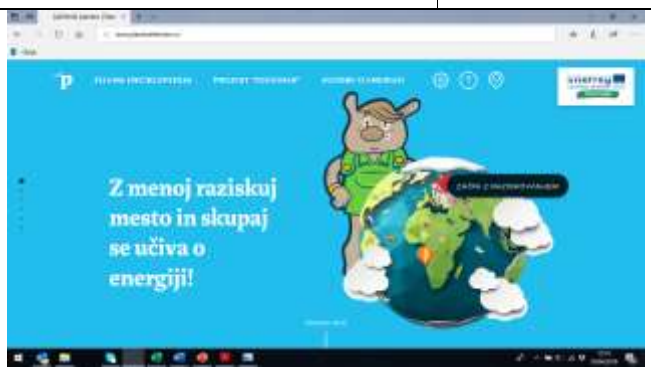
Z menoj raziskuj
mesto in skupaj
se učiva o
energiji!


Zelena
enciklopedija