



Demand Side Management Tools



D.T3.3.5 Report on PA4 realised by Zagreb in 12 schools and kindergartens included, owned by the City-HR

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 buildings 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



1. Summary description of the pilot action (including investment, if applicable) explaining its experimental nature and demonstration character. The TOGETHER project in Zagreb included the participation of 12 buildings, thereof 6 kindergartens and 6 primary schools. The main aim was to encourage the behaviour change in children (as they were the primary target group), as well as raise their awareness concerning the issues of energy and energy saving. Aside from the children target group, the project activities and the manner of their implementation were designed so as to include the adults (mostly the building staff and teachers, as well as the children's parents) and encourage them to also change their attitude towards the question of energy and energy saving. In order to do so, the City of Zagreb organized and implemented the required training workshops, whereof two were held on site - one in a kindergarten and one in a primary school included in the project. Aside from that, the City of Zagreb also organized three advocacy meetings and eight stakeholder group meetings in order to present the project results. These were organised and conducted with the aid of the external expert, contracted to help the schools and kindergartens implement the project actions. All the objects participating in the project opted for a pilot action that included active participation of children and building staff: at the beginning of the project activities, the schools and kindergartens formed Energy tams, groups of students/children, teachers, principals and caretakers who took it upon themselves to monitor activities implementation in the building as well as to work with other individuals (children and adults alike) and raise their awareness, thereby permanently changing the behaviour of the building users. Some of the activities organized by buildings themselves included as follows: production of films, inclusion of additional topics - such as connection between energy saving and environment protection - into their project activities, organizing eco-patrols, monitoring energy consumption, creating promotional posters, labels, graphs (= awareness raising campaigns), "Big kids teach the small kids" lectures, including the activities in sports events ("Get moving to save energy") etc. The activities also included daily monitoring of energy, water and heating savings achieved, by way of monitoring the dashboards and using the measurement devices - luxmeter, energy consumption meter and thermometer. The pilot actions also included use of the educational game developed for the purposes of the project, Planet defenders, which was received quite well, as it allowed for the topic to be presented to the children in a fun and interactive way.

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

The NUTS region where the trainings were being conducted is HR041, the City of Zagreb, as indicated in the Application form. The pilot buildings are located in different areas of the city and include 6 primary schools and 6 kindergartens.

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

The pilot action was overall a success, insofar as it demanded active participation of the Energy teams, but also other school and kindergarten children. The results of the pilot actions were presented during the advocacy meetings to several stakeholders (including the local, national and regional level and experts in the energy field). The main upside of the pilot actions was the fact that they were comprehensive, but also allowed for the participants to include their own ideas, thereby giving them a feeling of pride, because they could see the direct result of their actions via dashboards with information on the current state of energy, water and heating savings. The Energy teams also had constant support from the partner as well as experts in the field of energy, obtained through the process of public procurement. As the implemented activities are easy to transfer to other schools and don't demand a great investment (save for the acquisitions of dashboards), the possibility of pilot action replication is great.

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

The implementation of the pilot action has shown that the interest of the target groups is great, however there is a danger of gradual decline of interest as the project progresses. For this reason, it is imperative for the participants to be allowed a degree of freedom so that they can suggest own ideas and implement them. There was significant interest from the schools to contact their counterparts in other countries and some even disseminated the project idea not only among the parents of the children attending the schools and kindergartens in the project, but also to other schools and kindergartens not included in the project.

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

STRENGTHS

- Interesting activities
- Possibility of including activities in the school curricula
- Openness and flexibility of the program - it is possible to include additional activities
- The target groups' high level of interest

WEAKNESSES

- The topic may seem complicated to a too young target group
- Lack of didactical toys (expensive)
- Gradual loss of interest, if the Energy team leader is not a referent for the topic

OPPORTUNITIES

- Easy to implement programme
- Expressed interest from other schools and kindergartens, also from other cities
- Replication potential

THREATS

- Lack of support from policy makers
- Low marketing appeal of the topic

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 (reinvestment 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:

Baseline is 2014-2016 and for all pilot buildings is 827.882,00 kWh. Pilot period is September 2017 - August 2018 (one year) and consumption for this period is 822.244,00 kWh

Thermal consumption:

Thermal consumption Baseline is 2014-2016 and for all pilot buildings is 2.559.689,00 kWh. Pilot period is September 2017 - August 2018 (one year) and consumption for this period is 2.652.233,00 kWh

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.

Electricity:

	Building category	Name of the building (optional)	Total net heated	baseline consumption (before the	baseline period (before the pilot action)	consumption after pilot	monitored period after pilot	kWh/m ² after pilot	Baseline calcul
Building 1	Nursery/ Kindergarten	Dječji vrtić Gajnice	890	33116,33333	01.01.2014.-31.12.2016.	30595	01.09.2017.-31.08.2018.	34,3764	bills
Building 2	Nursery/ Kindergarten	Dječji vrtić Zaprude	1560	60222,33333	01.01.2014.-31.12.2016.	60246	01.09.2017.-31.08.2018.	38,61923	bills
Building 3	Nursery/ Kindergarten	Dječji vrtić Cvrčak	1635	41832,66667	01.01.2014.-31.12.2016.	31958	01.09.2017.-31.08.2018.	19,54618	bills
Building 4	Nursery/ Kindergarten	Dječji vrtić Vladimira Nazora	1281	71051,66667	01.01.2014.-31.12.2016.	67170	01.09.2017.-31.08.2018.	52,4356	bills
Building 5	Nursery/ Kindergarten	Dječji vrtić Iskrica	1718	49847	01.01.2014.-31.12.2016.	48447	01.09.2017.-31.08.2018.	28,19965	bills
Building 6	Nursery/ Kindergarten	Dječji vrtić Vjeverica	1031	44745,66667	01.01.2014.-31.12.2016.	55363	01.09.2017.-31.08.2018.	53,69835	bills
Building 7	Primary school	Osnovna škola Gračani	2830	60793	01.01.2014.-31.12.2016.	65229	01.09.2017.-31.08.2018.	23,04912	bills
Building 8	Primary school	Osnovna škola Otona Ivekovića	2137	72958	01.01.2014.-31.12.2016.	72615	01.09.2017.-31.08.2018.	33,97988	bills
Building 9	Primary school	Osnovna škola Većeslava Holjevca	2174	72332,33333	01.01.2014.-31.12.2016.	75626	01.09.2017.-31.08.2018.	34,78657	bills
Building 10	Primary school	Osnovna škola Marije Jurić Zagorke	4246	176715,66667	01.01.2014.-31.12.2016.	169052	01.09.2017.-31.08.2018.	39,81441	bills
Building 11	Primary school	Osnovna škola Grigora Viteza	3882	87764	01.01.2014.-31.12.2016.	93002	01.09.2017.-31.08.2018.	23,95724	bills
Building 12	Primary school	Osnovna škola Ksavera Šandora Gjalskoga	1853	56503,66667	01.01.2014.-31.12.2016.	52941	01.09.2017.-31.08.2018.	28,57043	bills

Heating:

	Building category	Name of the building (optional)	Total net heated floor area [m ²]	baseline consumption (before the pilot action) [kWh]	baseline period (before the pilot action)	consumption after pilot action	monitored period after pilot action	kWh/m ² after pilot	Baseline calculation
Building 1	Nursery/ Kindergarten	Dječji vrtić Gajnice	890	223227,8333	01.01.2014.-31.12.2016.	275962	01.09.2017.-31.08.2018.	310,0697	bills
Building 2	Nursery/ Kindergarten	Dječji vrtić Zaprude	1560	400887,3333	01.01.2014.-31.12.2016.	373446	01.09.2017.-31.08.2018.	239,3885	bills
Building 3	Nursery/ Kindergarten	Dječji vrtić Cvrčak	1635	332240,3333	01.01.2014.-31.12.2016.	362925	01.09.2017.-31.08.2018.	221,9725	bills
Building 4	Nursery/ Kindergarten	Dječji vrtić Vladimira Nazora	1281	259666,6667	01.01.2014.-31.12.2016.	242890	01.09.2017.-31.08.2018.	189,6097	bills
Building 5	Nursery/ Kindergarten	Dječji vrtić Iskrice	1718	381666,6667	01.01.2014.-31.12.2016.	418620	01.09.2017.-31.08.2018.	243,6671	bills
Building 6	Nursery/ Kindergarten	Dječji vrtić Vjeverica	1031	0	01.01.2014.-31.12.2016.	0	01.09.2017.-31.08.2018.	0	bills
Building 7	Primary school	Osnovna škola Gračani	2830	0	01.01.2014.-31.12.2016.	0	01.09.2017.-31.08.2018.	0	bills
Building 8	Primary school	Osnovna škola Otona Ivekovića	2137	0	01.01.2014.-31.12.2016.	0	01.09.2017.-31.08.2018.	0	bills
Building 9	Primary school	Osnovna škola Većeslava Holjevca	2174	407666,6667	01.01.2014.-31.12.2016.	403770	01.09.2017.-31.08.2018.	185,7268	bills
Building 10	Primary school	Osnovna škola Marije Jurić Zagorke	4246	0	01.01.2014.-31.12.2016.	0	01.09.2017.-31.08.2018.	0	bills
Building 11	Primary school	Osnovna škola Grigora Viteza	3882	554333,3333	01.01.2014.-31.12.2016.	574620	01.09.2017.-31.08.2018.	148,0216	bills
Building 12	Primary school	Osnovna škola Ksavera Šandora Gjalskoga	1853	0	01.01.2014.-31.12.2016.	0	01.09.2017.-31.08.2018.	0	bills

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? Yes, we had some issues, it is normal in such systems. Power loss on objects, summer maintenance of the object etc. Since the devices have memory and battery supply there was no data loss. In the testing period we had some incorrectly predefined constants but we solved that as we control data in the energy information system and the error was obvious. The operator remotely corrected the constant.

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? We had experience from previous implementation of the devices, and we tried to correct them with a new contract, such as service of full operational system for 5 year period. We included this, because meters are the property of distributors, while smart meters are ours. So when workers periodically replace the meters, they occasionally do not connect the smart meter back or sometimes may even destroy the pins on the connector, leaving the smart meter unable to collect data from energy meter.

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.

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

Time from September 2017 till December 2018 energy meters metered total energy (electrical, gas and heat) of 3.375.604,00 kWh.

13. How many Building Alliances were signed?

The City of Zagreb owns the pilot-buildings included in the project. The City Office for Education has competence over primary schools and kindergartens. The building maintenance is financed through the City of Zagreb budget. A draft Building Alliance was made, in accordance with the local conditions, however it has been subsequently revealed that it is not possible to execute Building Alliances from the legal aspect, as the City of Zagreb owns the kindergartens and schools, which has been so defined in their statutes.

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*

The changes in user behaviour are difficult to measure by simply referring to the amount of energy saved. This does not give a detailed account of who does what - the caretaker may be the only one paying attention that the heating is lowered when the rooms are empty, while the other building users may not be paying attention to it at all. A more efficient and reliable way of registering changes in user behaviour is through communication, but also measuring the number of participants at events organized by schools/kindergartens. Also, there have occurred situations where, upon arriving at a school/kindergarten, the representatives of the City of Zagreb were greeted by parents of children, stating that their child is now actively paying attention to save energy even in their own home (which may be a bit of a problem during the FIFA World Cup, when the child insists that the TV be turned off, even if the father just popped to the store in half-time).

15. The energy monitoring system installed

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

The City of Zagreb has Energy information system for all the buildings in his property.

This system gathers all data relevant for the analysis i.e. static and dynamic data. Static data are for example, heat area, equipment, state of the art of the object, users, working time, purpose etc, while dynamic data are monthly bills, smart meter data, temperature. We also collect data of energy measures needed for every object, contract for the energy supplier. All this data allows us to analyse, predict, or suggest best energy measures, consumption, calculate energy savings, pinpoint the energy failure or water leakage. The installation of the smart meters on pilot buildings simply added new devices to our big system. This part of the system can monitor consumption on hourly basis, so we can react quickly, we can see the night consumption of the object, verify if there is some deviation from average etc. All data are stored in the system for analysis. An abundant number of historical data allows us to make a better prediction model. The smart monitoring system is made up of 4 major parts:

1. Smart meter connected to the energy meter via impulse pins,
2. signal booster, if necessary
3. Concentrator
4. Router

Smart meter collects the data, booster amplifies the signal, concentrator collects the data from smart meters on the object and router sends the data to the main energy information system for further analysis.

Due to the condition of the energy meters location upon installation, equipment for smart metering must meet the minimum requirements such as increased moisture for water, explosive atmosphere for gas, it must be equipped with 48 h batteries in case of power failure etc.

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 pages and include some pictures in the "GALLERY"

In order to boost energy saving, it has been decided to include every user of the object/building. For that purpose we installed big dashboards for visualisation of the current energy consumption. Also the users can see daily, weekly data consumption so they can react to achieve energy savings and see if the applied measure is working (results in required savings or not). The dashboard is installed in the most frequent place in the building.

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 pages and include some pictures in the "GALLERY"*

As mentioned above, the target groups included younger public, namely children, but also adults (parents, adult building staff etc). Each building has had a Negotiating panel organized, which in most cases included all the adult staff of a building, who were included in discussing project activities and designing how best to suit them to their building. The target groups also included experts in the field of energy, so the project saw the participation of a representative of the Hrvoje Požar Energy Institute (the organization and conducting training sessions), several representatives of the Regional Energy Agency REGEA (the organization and participation in the visit to the Energy centre Bračak - D.C.7.3 Local Workshops with Building Occupants), as well as external expert from the company "Vitar u krmu", procured as additional help for the kindergartens and schools to identify the possible measures for energy saving in their respective buildings. The events Rethink Energy efficiency as first fuel advocacy meetings included participation of representatives from several national and local bodies as well as representatives of schools and kindergartens, which allowed for an exchange of opinions and ideas.

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

The Local supporting structure included the representatives from the relevant City of Zagreb City Office as well as an expert in the field of energy, selected by way of a public procurement procedure. The external expert participated in the production of deliverables D.T3.2.4 - PA4 design for 12

buildings - kindergardens/elementary schools in Zagreb HR, D.T3.3.5 Report on PA4 realised by Zagreb in 12 schools and kindergardens included, owned by the City-HR, D.T3.4.1 Report on the local Supporting Structure and D.T4.1.1 Summary report on stakeholders and target groups involvement. In cooperation with the relevant City Office representatives, the expert also produced detailed analysis of each building participating in the project stating the absolute energy consumption and produced a helpful manual with the suggested technical measures to be included in each building. The manual also included worksheets and control lists for suggested activities.

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 pilot action has shown great success through its implementation in this, and another previous project. Since the topic of energy is quite difficult to present to children, the schools that implemented the project are considering implementing it as one of the school activities.

Indicators related to the energy savings achieved will have a positive impact on the implementation of the TOGETHER project model in other public buildings. Raising the energy teams' level of knowledge and transferring on other stakeholders their conviction that this is a direction towards sustainability, shall lead to increasing the interest for such types of projects, as well as assure the support of policies and public for the implementation of urban projects focusing on climate and 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

The pilot buildings were analyzed regarding the implementation of energy efficient measures (investments).

The Grigor Vitez Elementary School, Kruge 46 is undergoing energy renovation, which includes replacement of carpentry with energy efficient, thermal insulation of walls and roof, balancing the heating system and installation of remote reading of energy consumption. The total investment is EUR 960,000, and 70% is co-financed by EU funds. The expected energy savings are 403.611,00 kWh / a, with a reduction in CO2 emissions of 121.08 tCO2 / a. Works will be completed in 2019.

Elementary school Većeslav Holjevac, is undergoing replacement of carpentry with a more energy efficient one. The total investment is 420.000,00 EUR and is financed from the City of Zagreb budget. The expected energy savings are 320,000.00 kWh / a, with a reduction of CO2 emissions by 90 tCO2 / a. Works will be completed by early 2019.

Technical documentation for the energy renovation of the Primary school Ksaver Šandor Gjalski has been prepared, and the renovation is planned in 2019-2020. The planned investment is 400.000,00 EUR, and it will be financed from the City of Zagreb Budget. The expected energy savings are 350,000.00 kWh / a, with a reduction in CO2 emissions of 105 tCO2 / a.

A comprehensive renovation of 88 buildings owned by the City of Zagreb is planned as part of the Program for Energy Renovation of Public Buildings owned by the City of Zagreb, which has been adopted by the City Assembly in October 2018. It is expected that the implemented measures will achieve energy savings of more than 50% of current energy consumption. Each building in energy renovation shall have smart meters installed and energy savings monitored. The program also includes energy renovation of pilot building from the TOGETHER project: primary school Marija Jurić Zagorka, Štefanovečka cesta 67 (1,880,000 EUR), kindergarten Zapruđe, Baburičina 11 (770,000 EUR), kindergarten Iskrice, Kruga 3 (650,000 EUR) and kindergarten Gajnica, Kerestinečkih žrtava 59 (EUR 330,000). At the moment, technical documentation is being prepared for the above mentioned pilot buildings, and the renovation works are planned in 2020-2021.

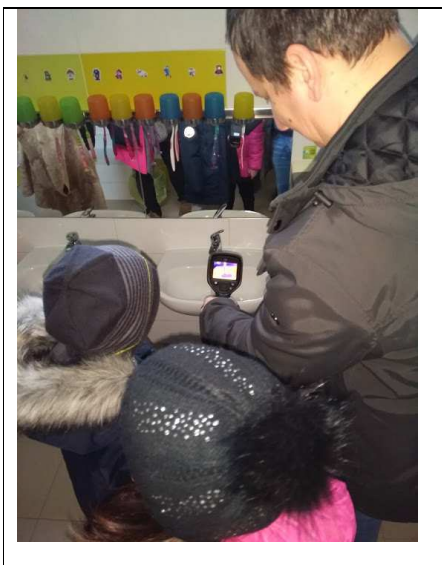
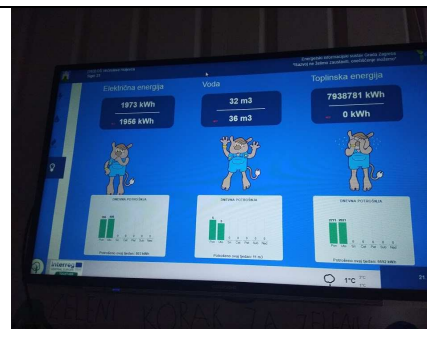
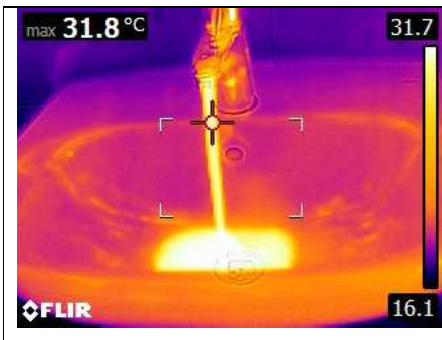
The experience from the TOGETHER project will also be included in the implementation of the Program for Energy Renewal of Public Buildings. The Program itself states: "In order to achieve the projected energy savings, it is important to take into consideration the human factor. User education is an important and indispensable factor in the implementation of energy renovation projects, since each person directly influences the level of energy efficiency achieved by his behavior. In accordance with the measures implemented, each user of the building should follow guidelines on the rational and effective use of the elements, devices, premises and equipment of the building in order to properly maximize the potential of the renovated building. Changing user behavior according to energy consumption is necessary as is also necessary to include all the competent city offices and responsible persons who manage the building in this process. "

21. Full time employee (relevant for INDICATORS). There was no new staff hired for the implementation of project activities.

PHOTO GALLERY

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





MJERILI SMO KOLIKO STRUJE TROŠI MAKETA SUNČEVOG SUSTAVA ...

