



Demand Side Management Tools



D.T3.3.8 Report on PA7 realised by Hegyvidek in 9 offices, community and sport centers, swimming pool

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 include 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.



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 PILOTS CLUSTER AND SMART METERS SOLUTIONS

The Municipality of Hegyvidék has been working on a cluster of buildings that are either owned directly used, managed or rented by the Municipality of Hegyvidék, for a total 9 pilot buildings that are:

1. 1 drawing (secondary school), rented from the Municipality
2. 3 kindergardens, owned by the Municipality
3. the headquarter building of the Municipality
4. 2 office buildings, rented from the Municipality
5. 1 sport center and swimming pool, rented from the Municipality
6. 1 cultural center, rented from the Municipality

Pilot Action wanted to trigger this 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 Project TOGETHER, by investments in smart metering devices for the real-time detection and monitoring of electricity, gas and heat consumption and indoor air temperatures.

The pilot buildings have been concretely involved in a project of technological and behavioural experimentation.

If technological experimentation consists on the installation of devices, as well as on relevant training and increased ability to analyze consumption scenarios, behavioural experimentation comprises a series of activities common to all the buildings and for specific activities defined by the individual working group.

THE PROCESS FOR SETTING UP THE PILOTS

Common activities are identifiable in the process of:

1. Establishment of a mixed work group, composed of as many subjects representing the building and sub-categories of users, called **Negotiating Panel**;
2. Implementation of **energy audits** that have suggested a list of necessary interventions to improve energy efficiency in each building;

3. Implementation of a **survey** of issues concerning building use realized by the working group (**also called as social audits**);
4. A series of trainings carried out on the basis of common Together Training Package
5. Verification and analysis by the working group of the results of energy audits and surveys;
6. Acquisition of **skills and knowledge** to leverage the potential of sensors;
7. Identification of **critical points** and definition of an **intervention plan**;
8. Preparation of the so called Building Alliance

Each Negotiating Panel has approved a **Pilot Concept** (meant as a Building Action Plan) preparing the approval of the so-called Building Alliance, for a total of 9 Alliances to be signed by the end of the project.

THE AIM OF THE PILOTS

The **core activity of the project is the implementation of behavioural and organizational interventions that could lead to a more aware and rational use of energy by users.** The main goal is, of course, the achievement of energy savings, but the educational value related to this type of activities was also fundamental, particularly in the education buildings (kindergardens and the drawing school).

The specific activities of each institute reflect the contents of the intervention plan defined by each negotiating panel on the basis of a framework of suggested interventions, to include “nudges” through the process of training, animation and support triggered by Project TOGETHER working group.

BEHAVOURAL MEASURES

The **biggest effort in all the pilot buildings is the implementation of activities addressed to users of buildings to enhance their behaviour towards a more efficient use of energy.**

Depending on the building type and users' composition the activities implemented were:

- peer education and building specific expert advices
- games and educating performances (e.g. puppet shows or activities with the Humphrey booklet in the kindergardens,)
- competitions
- awareness raising activities
- workshops, stands and guerrilla actions
- gentle pushes
- analysis of consumption data (analytical DSM)
- creation of posters and other graphic/video tools to communicate the correct behaviours to adopt
- display of smart metering data in frequently visited halls of each buildings
- other surveys on building use and related consumption (actual and theoretical)

to activate processes of reflection and behavioural change.

Naturally, the technical-scientific complexity of the activities implemented is defined according to the reference target group that, moreover, does not function as passive spectator, but as co-producer of initiatives and material, in the context of a living-lab logic.

Adherence to the project has created favourable conditions for cooperation, triggering collaborative processes.

Although every pilot building has elaborated a tailored plan depending on the features of building and users, the programmes proposed have the following common structure:

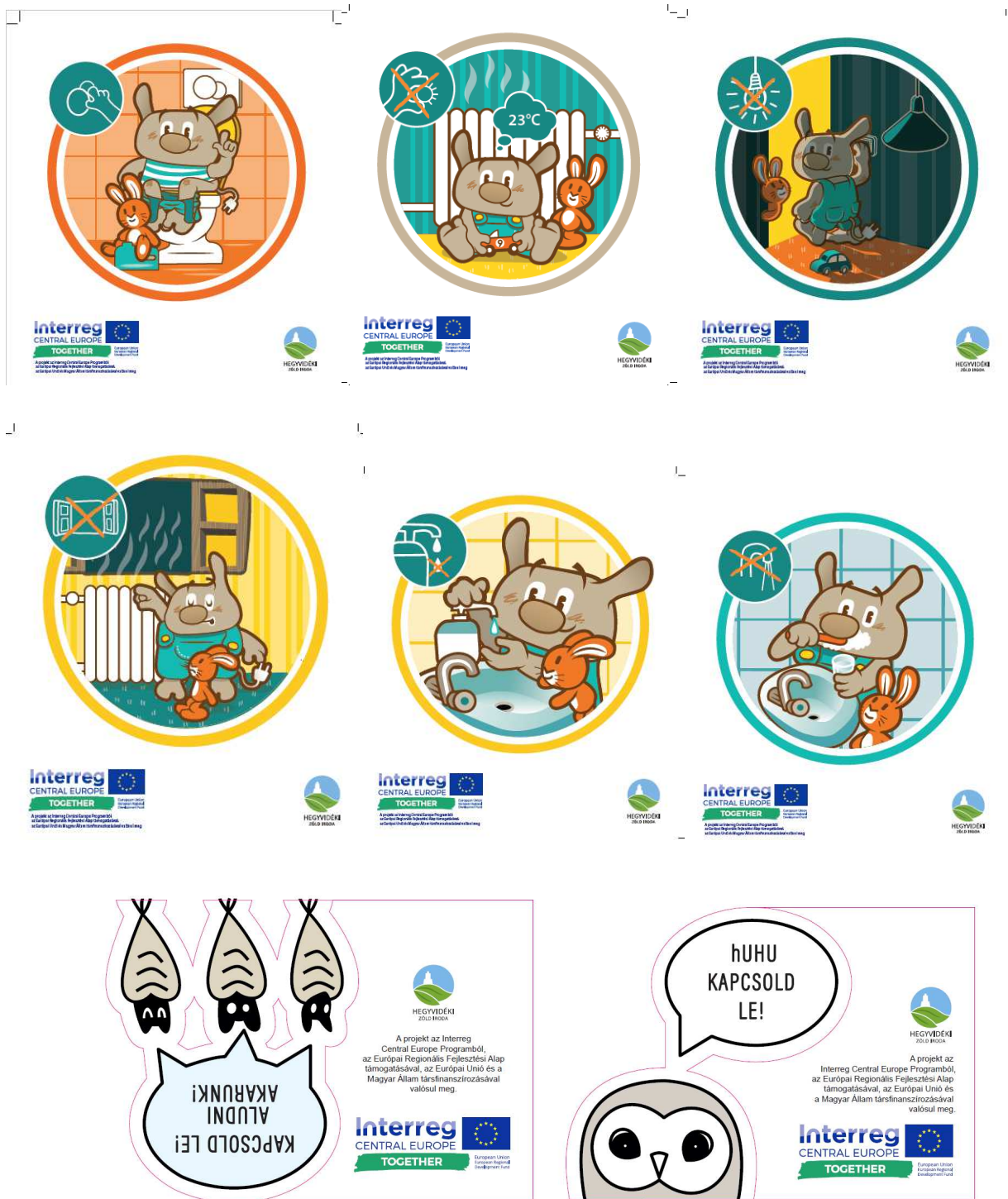
- a preliminary training/learning phase for key building users on energy issues and smart metering;
- a periodic monitoring of consumption (where possible one before and one after the implementation of DSM measures);
- an active involvement by users in the production of communication materials and in peer-to-peer education;
- an energy saving and activity competition between the buildings.

Some specific actions to be highlighted: Energy efficiency competitions were organized between the pilot buildings with the participation of the so called Energy commandoes (group of pilot building users and managers). All 9 pilot buildings involved in Project TOGETHER have been participated in the competition that was concretely aiming at registering energy reduction, monitored through the smart meters. Two competing categories were introduced: to save the most energy during a certain period and to be the most active commando (members whom are taking an active role on maintaining and developing the buildings energy efficiency). Results will be announced in March 2019.

In addition, energy days were organized with the Humphry character in 4 pilot kindergartens facilitated by a contracted enterprise (Europalánta). The dates of the energy days were the following: Táltos Kindergarten - 28 September, 3 October, Normafa Kindergarten - 4th October, Orbánhegyi Kindergarten - 9, 11 October, Kimbi Kindergarten - 12 October 2018. Puppet show with Humphrey character and other creative workshop with children were carried out.

Hegyvidék Municipality organized a local workshop in one of the pilot building, in the Budai Drawing School in the frame of a one week long open event for students. The Together workshop was organized on the 5th of September 2018 during this open event. In the frame of the event, students of the drawing school designed energy efficiency graphics (including Humphrey vignettes and many others) could be applied in stick format in public buildings placing them to different spots. Each graphics was designed for raise awareness and attention of building users for the environment. The best graphics will be applied in the pilot building addressing behavioural change at building users. A selection of the vignettes were distributed not only in the pilot buildings, but also in many other buildings visited by the public, such as other schools, medical centres, etc. Among other disseminating activities (including an energy quiz) a specific distribution action of the graphics will be the so called Info day carried out in all three pilot office buildings to be mentioned will be on 28 February 2019.

In the MOM Sport Centre revision of thermostat settings, info days like a guerrilla action (colouring walls), rationalization in program schedules and in MOM Cultural Centre the presentation of the project video in the lobby on a large screen and also an interactive guerrilla action (colouring walls) can be given as specific examples.





BUILDING SPECIFIC EXPERT ADVICES

All buildings were visited by energy experts to analyze building using habits and technical possibilities and building specific advices have been elaborated and provided to the users. The recommended measures included recommendations on organisational issues (such as reorganisation of cleaning schedule), operational advices based on smart meter data analysis (e.g. revision of thermostate programme) small technical investments (e.g. elimination of unnecessary ventilation openings of boiler rooms). The recommendations have been provided for the building users and the negotiation panels and were presented on workshops and communication events.

THE CONNECTION OF THE PILOTS 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:

1. Combination of the day-to-day energy management system with the DSM measures that have been developed: **BASIC APPROACH**.
2. Improvement of the already existing measures for the user involvement with new DSM tools: **IMPROVEMENT APPROACH**.
3. Application of the integrated tools developed in WP T2, including an improved Energy Management System, financial, technical, contractual and DSM tools: **EVOLUTIONARY APPROACH**.

On the basis of the tools selected by each Negotiating panel, all pilot buildings have implemented the so-called **BASIC approach** as no experience on DSM measures and social energy related activities had been applied so far and thus the introduction of new methods, identification and internalisation of target groups and involved actors were rather challenging.

An important investment worth to be highlighted was the additional support of the Municipality on the smart meter installations to be able to realized a more extended measurement systems with sub-meters. Without this support only main consumptions could have been measured in the pilot buildings, but thanks it further sensors could be installed enabling a more detailed analysis.

RESULTS

- **Improved capacity of managers and key actors** of the buildings to engage the whole chain of the users in the decision-making process related to usage of the spaces and time of usage;
- **9 Negotiating panels**. It is a group of people on a specific object/building who work together in a joint effort to reach the set energy saving goals, thereby achieving 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 is a 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.

- **9 prepared Building Alliances for the 9 buildings**: the effort to reduce the energy consumption is a shared effort. The Building Alliance identifies the common goals and activities in order to achieve energy reductions decided by the Negotiating Panel. The Building Alliance is the result of a co-working approach that has to be adopted by all the project partners since the beginning of the project.

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

HU10 Central Hungary.

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

The sustainability of the pilot actions including the maintenance of the smart meter system is ensured by the Green Office of the Municipality of Hegyvidék who owns and operate the smart meter system and implemented the pilot. In addition, the Municipality plans to install further smart meters into the other public buildings owned by the Municipality. In parallel with the extension of the smart meter system, DSM tools (stickers, posters, energy days, energy competitions) are planned to be applied in other public buildings in the district. Therefore, not only the pilot action results (behavioural change achieved at the pilot building users and managers) will be sustained by the continuous application of the DSM tools in the pilot buildings, but further public buildings of the Municipality will be involved.

Regarding the transferability of the pilot results, the most adaptable DSM tools are the tutorial video, the Humphrey stickers, posters, and the stickers and posters designed by the students of the Budai Drawing School. The graphic of these posters and stickers are electronically available, this way they are re-printable by any other municipalities or organizations in other territories. It is also an adaptable idea to involve the building users into the preparation of the DSM tools which will be applied there. In the case of the Budai Drawing School it worked quite well that the students designed the DSM tools such as stickers and posters, and they were also the target group of these tools.

The different types of events such as the energy days in kindergartens, games organized for the users of the office buildings and the colouring wall tool are also easily adaptable and basically low-cost ones, all raise the attention of the building users for energy efficiency.

Due to the fact that 4 completely different types of public buildings were involved into the project as pilot buildings: office buildings, kindergartens, cultural and sport centres, the Municipality had to and managed to develop a variety of DSM tools can be applied for a wide range of target groups. Therefore, a wide range of organizations can apply these tools selecting from DSM tools for children or adults. The DSM tools developed by Hegyvidék will be disseminated during the local closing event, the project final event and during other local events organized by the Green Office of the Municipality.

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

We can summarize the lessons learned as follows:

- the daily tasks and the many different duties that building actors have to carry out stifle their spirit of innovation and of understanding how the energy management system could be improved;

- the engagement of the end users in energy efficiency programs based on their involvement is demanding and requires a high level of interdisciplinary knowledge to pilot the process;
- some segments of the buildings communities do not accept to be involved as they consider the involvement not as an opportunity but as an additional burden, but fortunately they represented a minority among the pilot buildings;
- The more you are attached to your working place and environment, the more you are available to change your behaviour and at least not to hamper the process of changing.
- Transnational cooperation has a crucial role in the delivery of the local training material in the partners' regions as:
 - it produced a common framework of reference in a much more cost-effective way compared to individual efforts, and it achieved economies of scale;
 - it introduced an interdisciplinary approach to energy efficiency never tested before in all the partners' regions;
 - it helps to make use of wider and more diverse pool of knowledge and experience

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

Strength:

- Kindergartens and the drawing school represent a fertile soil where to invest in programmes based on the engagement of users understood as children and students. Students, specifically smaller children, are truly reactive and positive when there are new challenges and goals. They usually do not need specific awards and concrete acknowledgment of their work and efforts. They just need to be recognisable by their parents when showing a picture, for example. They are happy with a social award, such as a Humphrey poppet or a their work (poster, pictogram) to be hanged out in a public space. Also children are the key to reach their parents.
- In most pilot buildings there are really motivated internal staff who easily understood the aim of the project and the benefit of using smart meters solutions combined with Demand Side Management measures aiming at improving behaviour and the spatial/time usage of the buildings.

Weakness:

- Weak experience of the Hegyvidék in the real use of smart meter technology. The knowledge had to be acquired first and experts had to be found.
- Installation of smart meters were often difficult or impossible due to legal or technical barriers. They need to be regularly monitored to detect errors in time. However it is a very resource demanding work.
- Preliminary activities to be carried out before installation of the sensors have to be carefully performed in order to avoid events that could hamper the installation.

- Public administration officers are sometimes negative in relation to innovation. They are not so open to innovation as it demands time, new procedures, and new way of working and can put their daily work under discussion
- Energy efficiency programmes based on behaviour/organisational changes need to be constantly **enriched by feedback**, ideas and support to guarantee a durable result.
- Slow turn over in the public administration.
- The role of the energy manager is not planned at building level. In most buildings the energy manager is an external person (sub-contractor) and is not motivated to make efforts in order save energy.

Opportunities

- The need to improve energy efficiency in public buildings is more and more increasing with regards to the legal framework and capacity building.
- The Municipality has a clear vision on how to further develop the pilot actions and how to transfer the tested methods onto other buildings.
- TOGETHER project can be the basis of a district level energy management system that would cover all the municipality owned buildings using GIS tools as well.
- **The Green Office of Hegyvidék is the engine of initiating new European projects and follow up actions. Staff is motivated, skilled and more experienced thanks to TOGETHER project.**

Threats

- **Lack of human resources** to replicate in the longer period the practical assistance that was guaranteed by Project TOGETHER. The team that was established will support in a more limited way the pilot buildings, unless further decision is taken;
- **Lack of funds for investing** in the upgrade and enlargement of the local monitoring network;
- The staff members engaged in controlling and checking the smart meters could be removed and/or change office/department, so one threat could be the lack of a good hand-over.

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

Electricity: 17335 kWh

Gas: 27830 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.

For the TOGETHER project Energy Audits were performed in all 9 pilot buildings. For the audits gas and electricity consumptions were collected for three preceding years. In case of electricity data only yearly values were available, while gas data was available on a monthly basis for some of the buildings. The baseline was defined based on the historical data available from the time period 2014-2016.

Baseline correction was made for the yearly electricity consumption, as in the pilot buildings the measurements are not covering a whole year period, thus a part year baseline consumption had to be estimated from the baseline data. According to the smart meter data the kindergartens and the school had similar electricity consumption characteristics, thus the monthly baseline was derived from the whole year smart meter measurement data from Táltos Kindergarten. As for the offices the consumption characteristics of the Municipality building were taken as basis for the Kiss János office buildings, since they have similar demand side.

The gas consumption data also had to be corrected, since it is mostly used for heating in the relevant pilot buildings. In the buildings, where the gas consumption data is collected by smart meters, only yearly baseline period data was available, thus for the comparison an HDD correction has been made based on the external temperature and smart meter data.

Electricity						
	total heated floor area	baseline consumption - corrected for the measurement period	baseline period	consumption after pilot	monitored period after pilot	saved energy
	m ²	kWh/year	start date, end date	kWh/year	start date, end date	%
Böszörményi Office	2360	125756	January 2014, December 2016	110487	January 2018, December 2018	12.1%
Municipality	3407.2	235217	January 2014, December 2016	266290	January 2018, December 2018	-13.2%
Kiss János Office	2499.1	62494	January 2014, December 2016	351816	March 2018, December 2018	-463.0%*
Budai Art School	956.4	22376	January 2014, December 2014	23156	May 2018, December 2018	-3.5%
KIMBI Kindergarten	1292.1	30197	January 2014, December 2016	30366	April 2018, December 2018	-0.6%

Electricity						
	total heated	baseline consumption -	baseline period	consumption after pilot	monitored period after	saved energy
Normafa Kindergarten	834.7	16080	January 2014, December 2016	18929	April 2018, December 2018	-17.7%
Táltos Kindergarten	890.5	16327	January 2014, December 2016	14261	January 2018, December 2018	12.7%
MOM Sport Center	9957.9	2507872	January 2014, December 2016	-	-	-
MOM Cultural Center	3213.8	876560	January 2014, December 2016	-	-	-

In the table negative savings mean higher consumption than the baseline. As mentioned in the description of the baseline definition correction had to be made, since there was no appropriate baseline data for most of the buildings. In case of Bösztörményi Office and Táltos Kindergarten the baseline data was appropriate and no corrections had to be made. In these two buildings 12.1% and 12.7% energy saving was achieved respectively.

As for the Municipality building compared to the baseline consumption a higher consumption was registered. This is due to the fact, that in the building the heating was provided for longer time period by the heat pumps instead of the gas boilers, which resulted in a higher consumption. In the Municipality building electric subsystems were also measured and the data was further assessed. From the total consumption (the sum of the main meter and the PV production) the consumption of the heat pumps, servers and not office related consumptions were subtracted and the mainly office related consumptions were compared for October months of 2017 (before pilot) and 2018 (after pilot). The results of the comparison confirmed, that in the examined time periods both the daytime and nighttime office consumptions were lower after the pilot, which meant a nearly 15% saving.

In case of the *Kiss János Office building** the electricity consumption was more than 4 times *higher* than the measured consumption of the baseline period. This is due to the fact that in the baseline period the building was only partly used since the building was *renovated*. After the renovation the building got new function and also cooling system was installed, which was not present before the renovation. For this reason the results for this building are *not relevant* for the project, however the building can be assessed also after the project is over, since the smart metering system is installed.

For the buildings of Budai Art School, KIMBI Kindergarten and Normafa Kindergarten the baseline data was not sufficient and an appropriate, justified correction is impossible to make, thus these data should also be excluded from the pilot results. However, the project is still ongoing and thus in these buildings a proper evaluation can be made within the project timeframe.

In case of the MOM Sport and MOM Cultural buildings there was no appropriate data for evaluation due to the legal obstructions for smart meter instalment, which has significantly lengthened the instalment period. Obstacles have been overcome and we will receive appropriate data in the future.

Gas						
	total heated floor area	baseline consumption - corrected for the measurement period	baseline period	consumption after pilot	monitored period after pilot	saved energy
	m ²	kWh/year	start date, end date	kWh/year	start date, end date	%
Böszörményi Office	2360	345078	January 2014, December 2016	-	January 2018, December 2018	-
Municipality	3407.2	401241	January 2014, December 2016	-	January 2018, December 2018	-
Kiss János Office	2499.1	297993	January - December; 2014, 2016	-	March 2018, December 2018	-
Budai Art School	956.4	113369	January 2016, December 2016	86715	May 2018, December 2018	23.5%
KIMBI Kindergarten	1292.1	174688	January 2014, December 2016	-	April 2018, December 2018	-
Normafa Kindergarten	834.7	226199	January 2014, December 2016	226773	April 2018, December 2018	-0.3%
Táltos Kindergarten	890.5	131351	January	130175	January	0.9%

			2014, December 2016		2018, December 2018	
MOM Sport Center	9957.9	4227963	January 2014, December 2016	-	-	-
MOM Cultural Center	3213.8	97906	January 2014, December 2016	-	-	-

In case of smart metering of gas consumption there were several obstacles, which made it impossible in most of the buildings to install the smart meters. In case of Budai Art School a significant 23.5% saving was achieved. In Normafa and Táltos kindergartens the late instalment of the metering system didn't make it possible to have a whole year comparison, thus a proper evaluation was not possible to make, however with the corrections made it can be concluded, that no significant savings were achieved.

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?

As in every project which involves measurements there were some errors and problems. The most common issue was that, the measured data was not registered for short time periods and after a few hours a larger consumption value was registered. This issue can be addressed easily, when a longer time period is examined (daily, weekly etc.), since in this case the problem is not even visible. The problem occurs, when hourly data is evaluated, since in this case these peaks can mislead the evaluator. In this case such time periods can be excluded from the examination, which in the end is not a significant problem, since huge amount of data is accumulating over time.

We had issues also with the internet connection, however this didn't cause any problems, since the data is saved also on a local server in every building. In this case when the system was back online the data was automatically transferred to the main server.

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?

Based on the experience from this project the following can be advised:

- It is necessary to fully assess the buildings before installing the smart meters in the building. This assessment is the cornerstone of the smart meter installation, since it helps to identify the relevant measurement points. Based on the budget for the smart meter installation this evaluation can help to select the most important measurement points.
- It is important to have a proper baseline before the installation, so the early measurement data can be evaluated as well and preliminary error notifications can be implemented in the system, so in case of measurement problems an automatic notification can be set. If only yearly historical data is available it is important to start to read meters at least on a monthly basis as soon as possible, but latest at the beginning of the smart meter planning process.
- During the early stage of the smart meter measurement it is an utmost importance to have a trained person, who checks the measured smart meter data and creates in the first period weekly and later monthly reports, which is submitted to the building manager(s) and owner(s). This way early problems of the measurement system can be spotted and fixed. Also in the early stage it is possible to identify user/behavioural patterns, which can be verified by interviews as well.
- If the building is rented from the owner it is important to agree with the renter about the smart meter installation and access to the building and consumption data. It is better to have a written agreement between the partners.
- If the main gas/electricity meters are planned to be measured it is important to start discussion with providers as soon as possible, because they can really prolong the installation process by requiring additional, not foreseen documentation.

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.

The total cost of smart metering system and maintenance was 55.017 EUR. 60% of this total amount was covered by the project and 40% was paid by the Municipality as it's own-contribution.

OPEX (OPerating EXpenditure) costs: 18.608 EUR for testing and running the system in all 9 pilot buildings.

CAPEX (Capital expenditure costs): 36.409 EUR for installing the smart meters and the dashboard.

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

Electric consumption: 739126 kWh (Böszörményi Office, Municipality, Kiss János Office, Budai Art School, KIMBI Kindergarten, Normafa Kindergarten, Táltos Kindergarten).

Gas consumption: 464307 kWh (Budai Art School, Normafa Kindergarten, Táltos Kindergarten)

Thermal consumption: 91970 kWh (Municipality, Kiss János Office)

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?

The signature of the 9 Building Alliances is under progress. The Building Alliance will be signed by the 9 pilot building managers and the Municipality of Hegyvidék and will cover all DSM actions that have been started or will be executed in the future. Given the fact that, based on currently available data, it is difficult to determine the actual amount of energy savings or the amount of money saved, BA does not yet contain any reallocation of saved energy costs. In the future there is intent to partly reallocate the saving costs, so the BA will be reviewed time to time. In this stage the BA will be a kind of “letter of intent”, an agreement between the Municipality and the leaders of the pilot buildings.

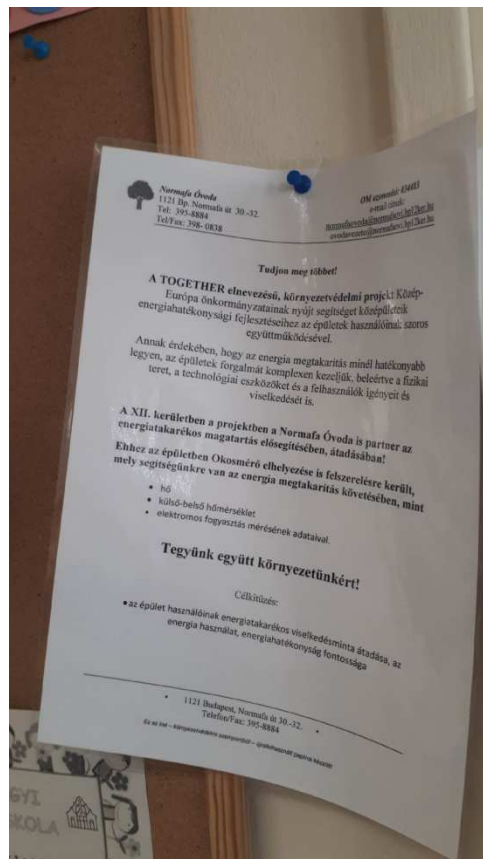
The BA will be disseminated on project events and will be made available for all employees interested in it upon request.

14. Describe the unexpected positive events/situations that you have registered during the implementation of the pilot activities.

During the pilot cases, several events and positive situations have been recorded, the most important ones are as follows:

- 1) The analytical DSM measures (analysis of consumption trends based on the smart meter data) highlighted some failure in operation in nearly all pilot buildings showing a sad picture about general operational practice, but justifying the importance of the project.

- 2) The drawing school ran a competition in the school. The aim of the competition was to prepare posters, logos, leaflets and other materials (including the Humphrey character) to be distributed in their own building and in the other pilot buildings as well. In turn the sport center offered awards to the participating drawing school teams (free entry tickets). Such intensive cooperation between pilot buildings was a surprising positive experience.
- 3) The children in the kindergartens showed a very positive attitude and understanding, above our expectations. It was partly thanks to the highly motivated teachers.
- 4) Decision makers proved to be open minded and became easily motivated to internalise and support the project aims, helping the project team significantly to carry out the work.
- 5) Behavioural changes will be monitored in March using questionnaires, but during the Negotiation Panel meetings several positive changes have already been reported, such as modification of cleaning schedule in the sport center and changes in the roles of the cleaning staff (they must control the light switches), etc. In the Normafa Kindergarten an information sheet has been hanged on the wall about the TOGETHER project to inform parents about the project objectives and methods.
- 6) Some building users showed a special interest on the Dashboard and decided to investigate reasons for unexpected energy use during off-peak periods.



Information sheet handed out in Normafa kindergarten to inform parents about the TOGETHER project and the Dashboard

15. The energy monitoring system installed. Please write this part with a simple language that everyone can understand write max 2 pages

In each of the pilot buildings a complex smart metering system was installed. During the planning period it was important to build an appropriate smart meter system, which applied to the building systems and characteristics and also fits the allocated budget. It was found, that electricity and temperature measurements are the most cost effective, also if the main meters are “readable” by smart meters than the reading of those are also relatively cheap. All other measurement types have additional costs since they require changes in the building systems (e.g. meter instalment).

For the smart meter systems the following hardware is used:

- Temperature and humidity sensors with signal transmitters
- Electricity consumption/production meters (1 and 3 phase direct or alternate current)
- Galvanic isolator for signal reading of electricity and gas meters
- Calorimeters for heating systems
- ICP data collector

Data transmission to the data storage units in the buildings is done via Ethernet/LAN. The data storage units are connected to the internet, where the data are transferred to the central server.

The smart metering system also requires a software, which helps with the data collection, storage and visualization. The software creates a database from the collected data. With the software the data can be visualized with different time intervals (15 mins, hourly, daily, monthly and yearly). The measured data can be grouped by measurement or consumer type. The data can be accessed online without any installed software, and multiple users can log in at one time. The webserver is password protected. The collected data can be exported in XLS, XML, CSV and TXT format, which enables the data evaluation in external softwares e.g. MS Excel.

The smart metering system (hardware and software parts) alone is not able to give feedback to the building visitors/users/occupants, it is only providing information to the building managers. In the project also dashboards were installed in the buildings. The dashboards have access to all measured data, which is collected in the building. This includes the following data:

- temperature
- humidity
- electricity consumption & production

- heat / gas consumption

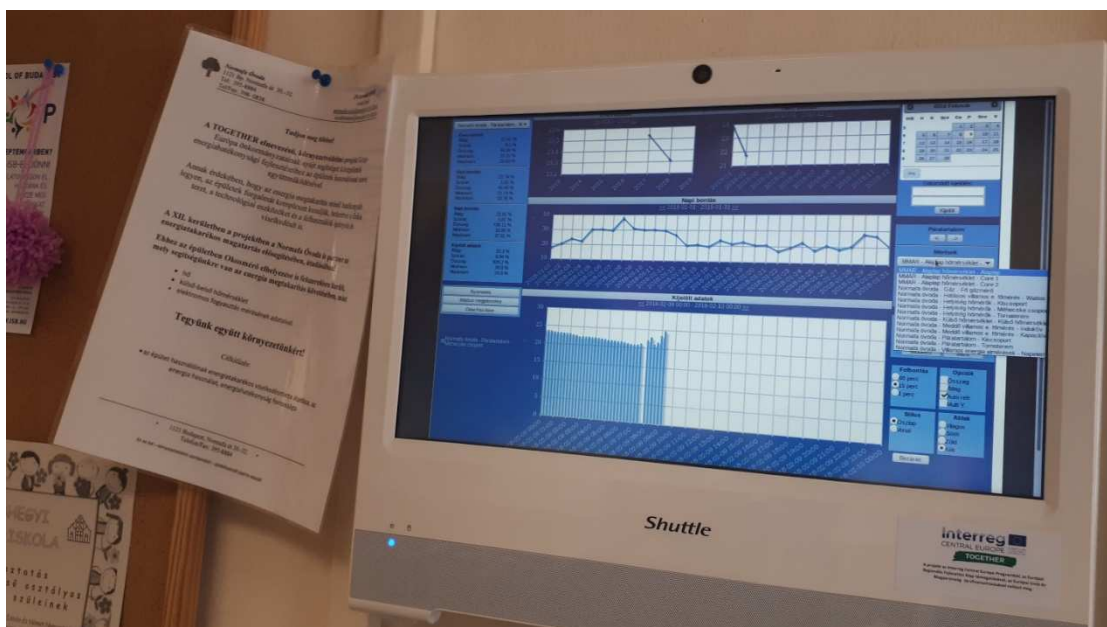
All collected data can be visualized on the dashboards, which includes data comparison for different time intervals: 15 mins, hourly, daily, monthly, yearly.

The dashboards are located close to the entrance of the building, so all personnel and visitors can see them.

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"

Kindergartens: The dashboard is targeting the employees (kindergarten teachers and nurses, janitor) and the parents. The monitors were placed near to the entrance so every visitor can check the buildings energy efficiency. The data has been visualised in a very simple and understandable way so non-professionals can also understand the trends. Most of the kindergarten teachers are interested and they try to evaluate the shown data in their everyday operation. Even so in one of the kindergartens the teachers also put out a short know-how next to the display targeting the parents (see the attached picture).



Cultural Centre and Sport Centre: The dashboard is targeting mainly the building employees and janitors and the general public. In most of the cases in these type of buildings only the building employees can affect the buildings energy efficiency, but the role of the general public is crucial as they can identify or highlight if something is consuming a lot of energy in an ineffective way. That's why the displays has been installed in the common area. The data is visualized the same way as in the

kindergartens so the general public can understand the trends. The building employees feedback were that they thought that the data is useful and they can develop their energy efficient ways further. Also the general public has commented seeing and asking about the display and that also helped the presence of the project.

Office buildings: The dashboard is targeting the office employees, the janitors, cleaners and if relevant the clients. The dashboards show the consumed energy in daily bases in a simple way, where the employees can check how their building is functioning. Changing the daily based operations needs concrete and visible proof, but however there is a need fur further training of the building users to make them aware and understand how they can manage a building in an effective way. The feedback from the office building users are that some of them are really interested so they are the key stakeholders (energy commando participants) to reach out to the rest of the employees.

Drawing School: The dashboard is placed in the middle of the drawing school so every student and teacher can see it. There has been already interesting suggestions - like how to change the heating system - from one of the school teachers, thanks to the dashboard.

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"

First of all, the Municipality has made a small research, that whom might be the building users in all 9 pilot buildings and also who can be the most interested ones. After the Green Office gathered a long list of people they have organised the first stakeholder meeting where they invited the interested persons.

As the pilot buildings had different functionalities the involved target groups were rather diverse as follows

- Kindergartens: building managers, educational staff, janitors, cleaning staff and children
- Drawing school: building managers, educational staff, janitors, cleaning staff and students
- Hegyvidék municipal building: politicians, managers, janitors, cleaning staff, receptionists and clerks
- Two other office buildings: managers, janitors, cleaning staff, receptionists and clerks (one of the office buildings involves a kindergarten as well with target groups described before)
- Cultural and sport centers: managers, janitors, cleaning staff, receptionists and visitors

Target groups can strongly benefit from such DSM and technical investments in terms of opportunities to reduce, and keep under control, energy consumption, and to enhance the opportunity to foresee and therefore prepare the ground for future investments.

After several meetings during that the Municipality raise the participants' awareness about the project and it's goals the so called energy commandos have been established (they are basically the negotiation panel). Their role as key building users are to check if something in the buildings are not working in an energy efficient way and try to get a solution with the help of the external experts. The engagement was recorded through further actions such as:

- **several meetings** in the Municipality with the stakeholders of the pilot buildings, throughout the project implementation;
- **round tables** aiming at collecting ideas for an user-friendly dashboard to be developed;
- **on site visits** during installation of the smart meter devices;
- on site visits aiming at verifying the preliminary conditions for their installations;
- training events, to teach users the soft solutions and also DSM analysis, dashboard data analysis
- **on the job experience** during performance of the energy audit done in the buildings in the very early phase of project implementation;
- **on demand training**: users of pilots buildings have indicated what type of training activities they preferred;
- **engagement in the elaboration of the content of some communication and promotional material**: many students and teachers in the drawing school have been actively involved in the realisation of some communication material or asked to filter and give their opinion as field testers of the communication content and approach;
- **competing**: a senior competition marked TOGETHER was elaborated with the support of experts of the municipalities. The terms of reference were filtered and integrated by them in order to get their stronger commitment to convince schools to subscribe;

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 main supporting structure of the project is the Green Office who is the thematic implementer and coordinator. One colleague is responsible for the smart metering and monitoring system installation from the technical point of view. The communication between stakeholders and supporting

energy commando members and networking belongs to another staff member. The leader of the Green Office is the main decision maker as a thematic expert on this field. The office will maintain the project result and further activities in the future and further extend the project elements to other buildings.

The project manager, the financial manager and the expert of procurement procedures belongs to other departments of the Municipality. These staff all works in the municipality building so these colleagues are the core of the energy commando in this building.

In an external company there is an external manager who supports the administrative part of the project implementation.

The Municipality also has two external thematic experts from the University of Technology of Budapest. They give the most important thematic knowledge to the Green Office whom are facilitating the whole process.

Installing the smart metering system connect to an external company (Pannon Építőműhely) who are really experienced on this field and supports the maintenance of the smart meters and supports data collection and analysis. There is an also an interconnection between them and the other external and internal experts.

Fortunately the Municipality is really lucky with these experts, they are all very experienced and enthusiastic with a great knowledge.

In all nine pilot building there are key energy commando members who can contribute to the whole project with their knowledge of their buildings and can disseminate awareness raising 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)

In terms of benefit, testing the new technical equipment installed, combined with behaviour-based energy efficiency programmes, gave a concrete opportunity to improve the current energy monitoring system that is mainly based on a “passive” payment of monthly bills, without a critical verification of the real consumption and the reasons leading to a specific energy consumption. The leverage effect generated by the project in terms of investments in extending the smart monitoring system as already explained is about 22.000 EUR. The high quality training programmes, combined with the set of tools provided during the project life (e.g. smart meters, energy audit certificates, etc.), have encouraged the decision makers of the Municipality to invest this amount in a larger monitoring system enabling deeper and more detailed technical analysis.

The Green Office could convince decision makers to extend some of the actions to more than 20 municipal buildings. As a first step all these buildings are visited by technical expert to collect

detailed technical information and carry out an energy analysis and develop action plans. Building using habits will also be analysed on a basic level.

Furthermore one new Interreg project proposals have been submitted that can be considered as follow up actions and Municipality searching other opportunities, applications, tenders to extend the results of this project.

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 leverage effect generated by the project in terms of investments in extending the smart monitoring system as already explained is about 22.000 euros. The high quality training programmes, combined with the set of tools provided during the project life (e.g. smart meters, energy audit certificates, etc.), have encouraged the decision makers of the Municipality to invest this amount in an extended monitoring system enabling deeper and more detailed technical analysis. The investment will be paid out in May 2019, but most of the technical development have been already completed.

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

Thanks to the project there are two half time employees working in the Green Office of the Municipality. One of them is responsible for the technical implementation and maintenance of the thematic content of the project, the other is responsible for communication and networking of the stakeholders and also further project development.

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



Hűmér

a Zöld oviban és otthon

Bizonyára már mindenki ismeri Hűmért, a kedves kis trollt. Hűmér messzi troll-birodalomból érkezett, ahol nem törődnek azzal, ha a csapból folyik a víz, égve marad a villány, télen tárva-nyitva vannak az ablakok, nyáron pedig melegít a fűtést. Hűmér nem tudta, hogy ez pazarlás, amivel árt a fának, virágoknak és az embereknek is, viszont Nektek köszönhetően már sejti hogyan kell okosan használni az energiát és így jobban vigyázni a környezetre az óvodában. **Bonaon nv** szüzi Hűmér barátja, aki meg szeretné tanulni a kis trolltól ezeket a módszereket, hogy otthon is spórolhasson az energiával. Segítsétek Bonaont a tanulásban és figyeljetelek otthon is az alábbiakra!

A kisgomb-nagygomb dilemma
A WC lehúzásakor is rengeteg vizet megtakaríthatás, ha okosan használod a kis és nagy nyomógombokat.

Ne pazarold a szappant!
Kézmosásnál elég csak egyszer megnyomnod a szappanadagolót. Épp annyit adagol, amivel kezed tudsz mosni.

Ne folyasd a csapot!
Fogmosás közben használd inkább poharat, és zárd el a csapot! Így sok vizet takaríthatsz meg!

Ha fűtesz, csukd be az ablakot!
Télen, amikor hideg van, és fűtünk a lakásban, csukd be az ablakot, mert a hő kiszökik és magasabb lesz a fűtés száma.

Okosan szabályozd a radiátort!
Ne tekerd föl túl magas hőmérsékletre a radiátort, 20-23 fok is már bőven elég. Ha nincs szükség fűtésre, tekerd le a termosztátot!

Kapcsold le a villanyt!
Ha kimész a szobából, kapcsold le a villanyt, így a villanyszámla sem lesz annyira magas! Napközben használd inkább természetes fényt.










Energy Days in Kindergartens



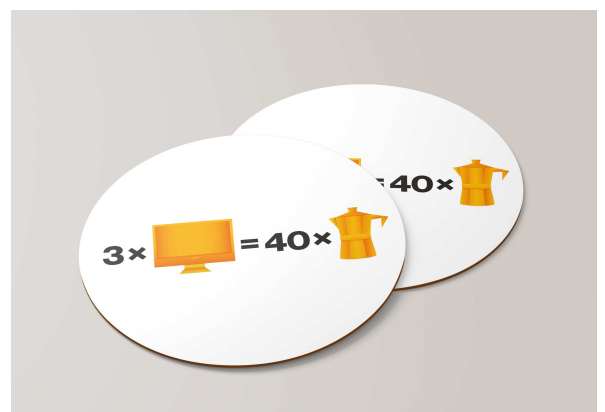
- Energy commando meeting




- Coloring wall in MOM Kult and Sport

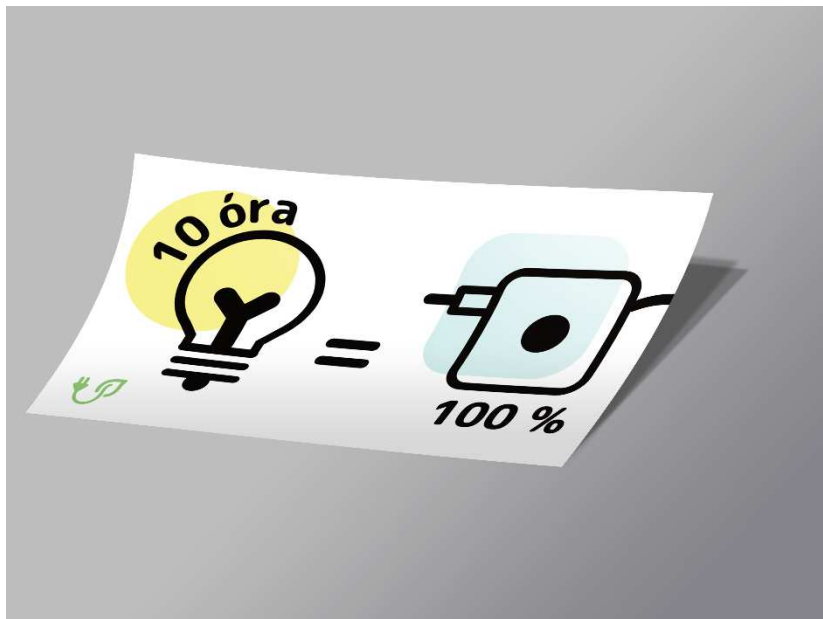


- Smart meter dashboards





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