Demand Side Management Tools

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TOGETHER

DSM tools for the engagement of the building users
D.T2.3.3

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TOGETHER

TOwards a Goal of Efficiency THrough Energy Reduction

DSM tools for the engagement of the building users

D.T2.3.3

LP – Province of Treviso

Executive summary

This deliverable describes in detail the original set of innovative communication tools and contents targeting building users that the TOGETHER consortium has committed to release, under the coordination of the Lead Partner, to promote the experimentation of DSM (Demand Side Management) within the 85 pilot buildings of the project, also in combination with other technical or regulatory measures such as energy audits, smart meter installations, and EPIC (Energy Performance Integrated Contracts).

In the official application form, the promise was to release “easy to apply techniques as Apps, Storytelling, edutainment, gamification [and] social networking, according to building users’ age and attitudes”. In fulfilment of that promise, the present deliverable has considered a broader diversification of tools, not only in dependence of the building occupants’ age characteristics, but also of the functional nature of the buildings - e.g. institutional, educational, etc. Additionally, a framework for the contextual design of the presented DSM tools has been proposed, based on the formula Potential * Acceptance = Result (originally introduced by the IEA – International Energy Agency) and on a long list (by construction, non-exhaustive) of possible behavioural changes that the various DSM tools are supposed to achieve. Finally, a time bound process for the evaluation and approval of the tool proposals by the partners of the consortium has been foreseen and formalised.

As per agreements made during the month of March between the Lead Partner and the Partner in charge of D.T2.2.3 “Set of subsidies and incentives integrated with Demand Side Management”, no state of the art analysis of the DSM tools is provided in the present Deliverable, as the originally planned contribution in that regard (as per the TOC issued in December 2016) has been moved to that other Deliverable.

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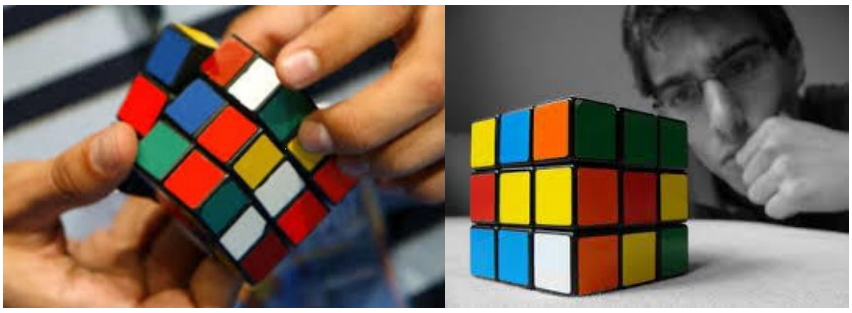
1. Introduction

The Project TOGETHER offers a transnational capacity building platform, where partners with different levels of knowledge can strengthen their competences together, thus reducing their disparities and promoting actions on both the supply and demand side, in the context of planning EE in public buildings. The main goal of the project is improving energy efficiency and energy saving in public buildings by changing behaviour of building users and promoting energy efficiency measures.

This document provides common guidelines to the partners for drafting their respective pilot project implementation plans and developing the presentation of their Pilot Actions in their pilot buildings clusters with a common framework and visual identity.

This tool is contextualized within the framework of the second objective of the project TOGETHER: if the first project objective “To increase energy efficiency and secure investments thanks to improved multidisciplinary in-house staff skills and thanks to an Alliance system with more engaged and motivated buildings users” calls for the observation and learning of possible tools to be combined together for achieving energy efficiency in public buildings, the second one “To produce and test the most appropriate combinations of technical, financial and Demand Side Management tools for the improvement of the energy performance of public infrastructures” calls for the practical and concrete implementation of the possible identified measures.



1.1. Project TOGETHER

The three main objectives of the project TOGETHER consist in:

1. Increasing public buildings energy efficiency and securing investments, through the improved multidisciplinary in-house staff capacity building of Public Administrations and the establishment of a system of alliances with more engaged and motivated building users;
2. Producing and pilot testing the most appropriate combinations of technical, financial and Demand Side Management tools for the improvement of the energy performance of public infrastructures, currently in the 8 regional Pilot Actions involving a total of 85 buildings;
3. Codifying the project outcomes into a comprehensive policy package for a large-scale implementation, bringing local buildings governance practices to the centre of ambitious energy saving policies.

In its inception, TOGETHER plans the organization of an interdisciplinary "Training of Trainers" course for building owners, managers and public decision makers that integrates the traditional technical inputs on energy management and buildings retrofitting with targeted contributions from behavioural science, economics and psychology, aiming to engage the end users in the building energy performance goals.

The "Training of Trainers" course is completed by the provision of an Integrated Smart Toolkit, including:

1. Guidelines for implementing the innovative EPIC (Energy Performance Integrated Contract) scheme, combining technological devices and behavioural-based components;
2. A set of exemplary models of Energy Management Systems in schools, institutional and other type of buildings;
3. An innovative Building Alliance concept among building owners/managers/users who cooperate within a Negotiating Panel to achieve energy savings to be reinvested through a Reinvestment Action Plan.

Additionally, and by the project's end, the Partners will jointly elaborate a Transnational Strategy and Mainstreaming Programme, including policy/strategic and operational recommendations for an appropriate follow-up and a sustainable take-up of the project outputs.

1.2. Extended description of the DSM tools for the engagement of the building users

TOGETHER Deliverable D.T2.3.3 "DSM tools for the engagement of the building users" issued by the Lead Partner and approved by all other participants, proposes and outlines a set of innovative communication tools and contents to win the engagement of the end users of the approx. 85 buildings involved in the project pilots.

In the official application form, the promise was to release "easy to apply techniques as Apps, Storytelling, edutainment, gamification [and] social networking, according to building users' age and attitudes". In fulfilment of that promise, the present deliverable has considered a broader diversification of tools, not only in dependence of the building occupants' age characteristics, but also of the functional nature of the buildings - e.g. institutional, educational, etc. Additionally, a framework for the contextual design of the presented DSM tools has been proposed, based on the formula Potential * Acceptance = Result (originally introduced by the IEA – International Energy Agency) and on a long list - by construction, non-exhaustive - of the behavioural changes that the various DSM tools are supposed to achieve. Finally, a time bound process for the evaluation and approval of the tool proposals by the partners of the consortium has been foreseen and formalised.

1.3. Structure of the DSM tools for the engagement of the building users

The structure of the Deliverable is composed of the following chapters:

Chapter 1 (Concept and Framework) first defines what is meant by DSM (Demand Side Management) in energy efficiency; then proposes a contextual design framework for the specific set of original and innovative communication tools and contents targeting building users that the TOGETHER consortium has committed to release.

Chapter 2 (Behavioural changes to be promoted) provides a non-exhaustive list of the behavioural changes that the various DSM tools are supposed to achieve, in combination with other technical or regulatory

measures such as energy audits, smart meter installations, and EPIC (Energy Performance Integrated Contracts).

Chapter 3 (Toolset) provides a collection of descriptions and how-to's for the key DSM tools identified as suitable for implementation within the (approx.) 85 public buildings involved in the TOGETHER pilots, in association with the list of behavioural changes and in dependence of a preliminary assessment of building users' ages, roles and attitudes, as well as of the functional nature of the buildings themselves - e.g. institutional, educational, etc.

Chapter 4 (Tools approval process and Relevance Matrix) introduces a time bound process for the evaluation and approval of the tool proposals by the partners of the consortium in order to associate the use of one or more of the proposed DSM tools with each of the TOGETHER buildings – in order to develop proofs-of-concept and/or validate the potential of those tools - in the context of the planned pilot actions.

This Deliverable is completed by a Glossary of Terms – covering all the key concepts used all along this document, such as Demand Side Management, the Jevons Paradox and the Hawthorne Mechanism – which finds correspondence and additional information within other Deliverables produced during the project.

2. Concept and Framework

What we mean by DSM (Demand Side Management) in energy efficiency; and our contextual design framework (borrowed from IEA).

Demand for any commodity, including electricity, water and fuel, can be modified by the purposeful action of its providers on the market (through price modifications) and of the government (through changes in regulation and taxation). However, there is evidence in quite a few countries – including, but not limited to, USA and Europe - that other forms of incentives than financial ones or other sets of rules than governmental ones can indeed influence individual and collective consumption. Demand Side Management (DSM), also known as Energy Demand Management or Demand Side Response, is a collection of tools and methods for creating new incentives (other than financial) and new rules (other than governmental) driving behavioural changes in the patterns of individual and collective energy consumption of energy. Originally adopted in the field of electricity, nowadays DSM is applied widely to public utilities including water, gas as well as other fuels.

The companion deliverable to the present one, namely D.T2.2.3 "Set of subsidies and incentives integrated with Demand Side Management", first defines what is meant by Demand Side Management in energy efficiency projects according to selected, relevant experience from the US and Europe; then it proposes a systematisation of the most popular/widely used DSM tools within the following categories: a) information delivery tools; b) simulation, education and training tools; c) instant feedback tools; d) edutainment and gamification tools; e) financial and economic incentives; f) competition based and social networking tools. To the extent that IT systems are developed in support of the goals of those tools, it is commonplace to speak about Persuasive Technology (see definition in the Glossary). A critical analysis is provided in Deliverable D.T2.2.3 for each of the above categories, putting emphasis on key behavioural effects such as the Jevons Paradox, the Hawthorne Mechanism and others.

Another collection of evidence and information on DSM has been gathered in relation to the "Training of Trainers" course for building owners, managers and public decision makers, which was held in Krakow on 20-23 February 2017. The presentations made by the trainers and other supporting material have been made available at the following URL:
http://www.interreg-central.eu/Content.Node/TOGETHER/Transnational-training-material.html

Finally, in the context of the TOGETHER project library, available online at the following URL: http://www.pnec.org.pl/en/together-library several items concerning Analytical DSM as well as Behavioural DSM have been published and are freely accessible for download. Besides providing definitions for these two branches of DSM, Navigant Research (see References) estimates Behavioural and Analytical Demand Side Management spending worldwide to reach $2.5 billion in 2024.

In the following, we pave the ground for the communication tools and contents targeting building users that the TOGETHER consortium has committed to release, and that will be presented in more detailed in section 3 below. Particularly we introduce a pragmatic approach centred on three contextual design goals, borrowed from the DSM (Demand Side Management) concept: Promoting the Acceptance, Understanding the Potential and Monitoring the Results. We will show why and how these design goals are interdependent and contend that a balanced approach to energy efficiency game design should fulfil them all.

Operationally, we propose to adopt to the simple formula first introduced by IEA when elaborating on DSM programs for energy efficiency:

$$Potential * Acceptance = Result \qquad (1)$$

What the formula says is that potential per se is not the only issue. Another problem is how to get sufficient acceptance of energy efficiency measures by the building users. Any huge number multiplied with zero will be zero! (Zonta, 2016)

Successful DSM programs therefore need to work on three distinct aspects: Promoting the Acceptance of proposed measures, Understanding the Potential of a large-scale DSM deployment and Monitoring the Results of behavioural change in terms of improved energy efficiency of buildings. We see these as self-reinforcing aspects, as the following graph displays (see Fig.1):

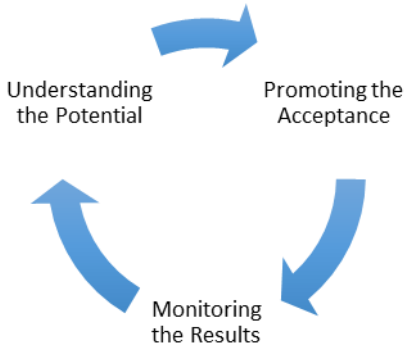


Figure 1: The self-reinforcing DSM cycle (inspired by IEA)

Intuitively, offering the possibility to monitor the results of their engagement (e.g. via smart metering systems or the unravelling of the electricity bills) enables more users to understand the potential of behavioural change for an improved energy efficiency of existing buildings.

In turn, a wider and deeper knowledge of the mechanisms by which DSM can determine a sensible improvement of the current situation favours a broader acceptance of the behavioural prescriptions to be implemented.

Finally, with the full and convinced engagement of all the building occupants (including occasional visitors and the people in charge of e.g. cleaning or periodic maintenance services or dairy supplies), the chances become much higher to reach the most ambitious targets of improvement and to keep them stable across time.

In our opinion, the formula introduced above should act as a sort of framing condition for any serious game or gamified program in the domain of energy efficiency. Unless the designers took the above into account, by contributing to one or more of the stated principles in a concrete manner, one could reasonably question the usefulness (even beyond the effectiveness itself) of the persuasive technology systems developed in accordance with their ideas.

To conclude this Section, we would like to prevent a possible objection concerning the excessive simplicity of the three proposed principles. In fact, our aim is to invoke a return to simplicity, so to speak, in the design of DSM tools, giving priority to their added value in generating the desired behavioural changes and ensuring they are there to stay.

3. Behavioural changes to be promoted

A non-exhaustive list of the behavioural changes possibly targeted by the various DSM tools.

Starting from the IEA formula presented at the end of the previous section means that we recommend adopting the perspective of Contextual Design (see Glossary), which can be seen as a viable alternative to engineering and feature driven models of creating new persuasive technology systems.

In particular, our approach is based on the collection (from existing literature) of a list of behavioural changes that can be possibly targeted by the various DSM tools proposed in the following section. The list is non-exhaustive, both because of its construction, as one cannot figure out all the possible behavioural changes that may possibly occur within a building community, and because it is expected that every Negotiating Panel in charge of a building (and of its related pilot) will feel free to add, delete or adjust the initial list in accordance with the specific purposes of the pilot itself.

In addition, it has to be considered that most of the available evidence does not refer to energy efficiency in public buildings, but to residential buildings (private homes), with the exception of (CIRCE, 2015) and a few other works (summarized in Murtagh et al., 2013 – henceforth M&A, 2013). It is also due to this aspect that we have foreseen a joint session of revision and integration of the initial list of behavioural changes provided herein, which will involve all TOGETHER partners. This review session is part of the broader evaluation and approval process outlined in the following section 4 of the present Deliverable.

In the following table, we make the following high-level classification of the competence of the behavioural changes, which may incur in the context of the pilots:

- **Group O:** Behavioural changes of competence for the Owner of the building.
- **Group M:** Behavioural changes of competence for the Manager of the building (mostly pertaining to small-value investments in maintenance or cleaning aspects and to zero-cost measures to improve energy efficiency in the use of equipment and appliances for lighting, heating and cooling).
- **Group U:** Behavioural changes of competence for the User of the building.

Then we have numbered the items in each Group starting from 1 onwards.

Another relevant distinction concerns the typology of buildings involved in the pilots, as follows:

- **Type G:** Gyms and other sports facilities
- **Type I:** Institutional buildings and offices in general
- **Type S:** Schools and educational buildings in general

Finally we use one (*), two (**) or three stars (***) to characterize the Consumption Reduction Potential (CRP) for the equipment or appliance under consideration, one star being low (up to 10% reduction), two stars being medium (between 10% and 20%), and three stars high (above 20% reduction). Note: these savings refer to the application of individual behavioural changes, not including their cumulative or self-reinforcing effects.

The source of the information displayed in each row is reported in the last column of the following table.

Table 1: Behavioural changes listed by various level classification of theirs competencies

ID	Type	Behavioral change description	CRP	Source
M1	G, I, S	Clean windows periodically to allow a good penetration of natural light in the building	*	CIRCE, 2015
M2	G, I, S	Improve insulation of roller shutter box, which is often a significant point of air leakage	*	CIRCE, 2015
M3	G, I, S	Install a sealed roller tape guide, removing the thermal bridges due to air infiltrations in its openings	*	CIRCE, 2015
M4	G, I, S	Do periodic maintenance of room surfaces to keep their reflection coefficient high over time	*	CIRCE, 2015
M5	G, I, S	Upgrade and maintain the filters of the HVAC system clean from dust reducing the efficiency of the coils	**	CIRCE, 2015
M6	G, I, S	Adjust the temperature of the thermostat so that it stays below 21°C in winter and above 25°C in summer	**	CIRCE, 2015
M7	G, I, S	Use free-cooling to renew the inside air of a room, to avoid starting up the compressor of the cooling system	**	CIRCE, 2015
M8	G, I, S	Replace the refrigerant fluids in heating and cooling equipment with new ones based on natural compounds	*	CIRCE, 2015
M9	G, I, S	Add or repair boilers insulation to protect people from contact with hot surfaces and keep water hot for long	*	CIRCE, 2015
M10	G, I, S	Install a regulatory system to keep temperature stable of the heating and cooling equipment	*	CIRCE, 2015
M11	G, I, S	Clean the radiator surfaces from accumulated dust, acting like a layer of insulation	*	CIRCE, 2015
M12	G, I, S	Purge radiators at the beginning of the heating season from the air trapped in the system	*	CIRCE, 2015
M13	G, I, S	Lower the domestic hot water temperature set-point at 60° C	*	CIRCE, 2015

M14	G, I, S	Fix the dripping taps in public restrooms to prevent leakages and save water	*	CIRCE, 2015
M15	G, I, S	Clean the domestic hot water tank and heat transfer surfaces to avoid sediments	*	CIRCE, 2015
M16	I, S	Combine general lighting with task lighting allowing to concentrate light only where and when it is needed	*	CIRCE, 2015
M17	G, I, S	Regularly clean and maintain lamps and luminaires to increase visual comfort of users and energy savings	*	CIRCE, 2015
M18	G, I, S	Reduce the number of lamps where lighting levels are acceptable and measured as such via a light meter	*	CIRCE, 2015
M19	G, I, S	Reduce the number of luminaires where lighting levels are acceptable and measured as such via a light meter	*	CIRCE, 2015
M20	I, S	Exploit natural light orientation of the workplaces to reduce the need for artificial light and avoid glare	*	CIRCE, 2015
M21	G, I, S	Move the furniture or objects that block the natural light to the center of the room	*	CIRCE, 2015
M22	I, S	Remove any furniture from the front of HVAC terminal units in order to increase their performance	*	CIRCE, 2015
M23	I, S	Foresee different lighting scenarios for the same room depending on the activities done therein	*	CIRCE, 2015
M24	I, S	Place floor lamps and hanging lamps in room corners to exploit reflection of light into the walls	*	CIRCE, 2015
M25	I, S	Deploy multiple power strips with switch in all rooms and/or programmable plugs	*	CIRCE, 2015
M26	S	Repair refrigerator door seals to prevent cool from escaping from the inside	*	CIRCE, 2015
M27	I, S	Deploy solar chargers to charge mobile phones or other portable devices	*	CIRCE, 2015
M28	G, I, S	Use paper towels to dry hands in restrooms instead of electric dryers	*	CIRCE, 2015

M29	I, S	Remove refrigerators from places next to heat sources (including other appliances)	*	CIRCE, 2015
M30	I, S	Install coffee machines with thermal jugs and vacuum insulation to keep coffee warm for long	***	CIRCE, 2015
M31	I, S	Regularly inspect and maintain the elevator system, to foresee breakdowns and prevent malfunctions	**	CIRCE, 2015
M32	I, S	Compress the work schedule to reduce the number of hours of lighting / heating / air conditioning	**	CIRCE, 2015
M33	I	Allow employees to work from home every now and then (e.g. on alternate days or for specific tasks)	**	CIRCE, 2015
M34	I, S	Share with the building occupants the details of the energy bills paid	*	M&A, 2013
M35	I, S	Instruct the building occupants on the functioning and use of the thermostats to control heating	*	M&A, 2013
M36	I, S	Inform the building occupants on the benefits of turning idle devices off before leaving the room	*	M&A, 2013
M37		Insert description here		
M38		Insert description here		
O1	G, I, S	Use silicone, putty or draught excluder to reduce air infiltrations through windows and doors	***	CIRCE, 2015
O2	G, I, S	Seal air leaks located in all cavities present in the building	*	CIRCE, 2015
O3	G, I, S	Inspect regularly wood and aluminum window frames to spot cracks exposing to moisture or decomposition	*	CIRCE, 2015
O4	G, I, S	Add a low emissivity window film to reinforce thermal insulation of glass	*	CIRCE, 2015
O5	G, I, S	Add a solar control window film decreasing the amount of energy that passes through the glass	*	CIRCE, 2015
O6	G, I, S	Put silver foil behind radiators to avoid heating the wall and reflecting heat back into the room	*	CIRCE, 2015
O7	G, I, S	Add or repair HVAC distribution system (ducts &	**	CIRCE,

		pipes) insulation, to reduce losses in distribution		2015
O8	G, I, S	Verify the correct operation of the ventilation system's timers and controls	**	CIRCE, 2015
O9	G, I, S	Analyze the combustion and maintenance of heating boilers	*	CIRCE, 2015
O10	G, I, S	Place the condenser unit in a ventilated area without solar radiation	*	CIRCE, 2015
O11	G, I, S	Install a programmable thermostat	*	CIRCE, 2015
O12	G, I, S	Use ceiling fans instead of air conditioning when possible	*	CIRCE, 2015
O13	G, I, S	Relocate thermostats to appropriate areas	*	CIRCE, 2015
O14	G, I, S	Clean heat exchangers of chillers	*	CIRCE, 2015
O15	G, I, S	Install dampers on flue gas ducts	*	CIRCE, 2015
O16	G, I, S	Install motion sensors for HVAC systems	*	CIRCE, 2015
O17	G, I, S	Install humidity sensors	*	CIRCE, 2015
O18	G, I, S	Install an efficient destratification fan system	*	CIRCE, 2015
O19	G, I, S	Install thermostatic radiator valves	***	CIRCE, 2015
O20	G, I, S	Install a radiator booster	*	CIRCE, 2015
O21	G, I, S	Add or repair domestic hot water storage tank insulation	*	CIRCE, 2015
O22	G, I, S	Add or repair domestic hot water distribution systems	*	CIRCE, 2015
O23	G, I, S	Maintain and inspect domestic hot water electric pumps	*	CIRCE, 2015

O24	G, I, S	Install a timer for the domestic hot water recirculation pump	*	CIRCE, 2015
O25	G, I, S	Install a timer for the domestic hot water boiler	*	CIRCE, 2015
O26	G, I, S	Install mixing valves in the outlet of the DHW tank	*	CIRCE, 2015
O27	G, I, S	Install taps with flow reduction (faucet aerator)	*	CIRCE, 2015
O28	G, I, S	Add or repair water heaters insulation	*	CIRCE, 2015
O29	G	Install low-flow showerheads	*	CIRCE, 2015
O30	G, I, S	Install thermostatic taps	*	CIRCE, 2015
O31	G, I, S	Install motion sensor faucets	*	CIRCE, 2015
O32	I, S	Change to accent lighting where possible	*	CIRCE, 2015
O33	G, I, S	Foresee lighting zoning through manual switches	*	CIRCE, 2015
O34	I, S	Optimize interior security lighting	*	CIRCE, 2015
O35		Insert description here		
O36		Insert description here		
U1	G, I, S	Close windows and doors when HVAC systems are operating	*	CIRCE, 2015
U2	G, I, S	Manage properly the opening of windows and doors for natural ventilation	*	CIRCE, 2015
U3	I, S	Use external solar shading correctly	*	CIRCE, 2015
U4	I, S	Use internal solar shading correctly	*	CIRCE, 2015
U5	I, S	Turn off the air conditioning system at least 20	**	CIRCE,

		minutes before leaving the room		2015
U6	I, S	Avoid using personal heaters in air-conditioned spaces	*	CIRCE, 2015
U7	G, S	Turn off kitchen and bath fans immediately after use	*	CIRCE, 2015
U8	G, S	Use shower instead of bath	*	CIRCE, 2015
U9	G, S	Limit shower length to 5-7 minutes	*	CIRCE, 2015
U10	G, I, S	Disconnect the domestic hot water tank in case it is not working for more than three days	*	CIRCE, 2015
U11	I, S	Wash hands with cold water instead of warm water	*	CIRCE, 2015
U12	I, S	Turn off lighting in unused rooms or zones, esp. on Friday afternoons	**	CIRCE, 2015
U13	I, S	Turn off the luminaires close to windows when there is enough daylighting	*	CIRCE, 2015
U14	I, S	Set the energy saving mode of the electrical equipment	**	CIRCE, 2015
U15	I, S	Turn off the screen of the monitor	**	CIRCE, 2015
U16	I, S	Adjust the brightness of the TV or monitor screen to a medium level	**	CIRCE, 2015
U17	I, S	Choose dark colors for the background images of the desktop screen	**	CIRCE, 2015
U18	I, S	Use the (black) non animated screensaver after a few minutes of screen inactivity.	**	CIRCE, 2015
U19	I, S	Possibly do photocopying and printing works at double-side and in draft quality mode	**	CIRCE, 2015
U20	I, S	Organize multiple printing or photocopying jobs to avoid switching the equipment on & off	**	CIRCE, 2015
U21	I, S	Avoid printing documents which can be used in digital form or transcript manually the contents of web pages and emails with little information on	*	CIRCE, 2015

U22	I, S	Turn off TV, radio, computers and other appliances if nobody uses them	**	CIRCE, 2015
U23	S	Set the economic program of the washing machine	**	CIRCE, 2015
U24	S	Set the economic program of the dishwasher	**	CIRCE, 2015
U25	S	Set the economic program of the electric oven	**	CIRCE, 2015
U26	S	Set appropriate temperatures for the refrigerator and freezer	**	CIRCE, 2015
U27	I, S	Unplug battery chargers when their use is not required	*	CIRCE, 2015
U28	I, S	Reduce the number of personal printers and replace them with a common networking one	**	CIRCE, 2015
U29	S	Use a dishwasher instead of washing dishes by hand if the domestic hot water system is electric	*	CIRCE, 2015
U30	S	Use pressure cookers for daily cooking	*	CIRCE, 2015
U31	S	Use a toaster oven or microwave instead of the oven	*	CIRCE, 2015
U32	I, S	Turn off all stand-alone electronic devices at the end of the day	*	CIRCE, 2015
U33	S	Air dry dishes instead of using the dishwasher's drying cycle	*	CIRCE, 2015
U34	S	Wash only full loads of dishes and clothes	*	CIRCE, 2015
U35	S	Turn off the oven or electric cooker before finishing the cook of a meal	*	CIRCE, 2015
U36	S	Air dry clothes instead of using the washing machine's drying cycle	*	CIRCE, 2015
U37	S	Regularly defrost manual defrost refrigerators and freezers	*	CIRCE, 2015
U38	S	Decalcify (e.g. with vinegar or citric acid) the dishwasher, washing machine & other appliances	*	CIRCE, 2015

		which use water.		
U39	S	Cover liquids and wrap foods stored in the refrigerator to reduce the release of vapors that add to the compressor workload	*	CIRCE, 2015
U40	S	Match the size of the pan to the heating element	*	CIRCE, 2015
U41	S	Use a covered kettle or pan or electric kettle to boil water instead of an electric or gas cooker	*	CIRCE, 2015
U42	S	Use the washing machine with cold water	*	CIRCE, 2015
U43	S	Clean the backside of the fridge once a year	*	CIRCE, 2015
U44	S	When cooking on the range, use pot lids to help food cook faster	*	CIRCE, 2015
U45	S	Iron efficiently: first, accumulate large batches of clothes, start by those needing cooler temperatures, then iron clothes needing higher temperatures and finally turn off the iron and use the stored heat energy to complete the ironing. Remember to turn off the iron if ironing is stopped.	*	CIRCE, 2015
U46	S	Defrost food naturally instead of using the microwave oven	*	CIRCE, 2015
U47	S	Disconnect the fridge in case it is not working for long times	*	CIRCE, 2015
U48	S	Disconnect the vending machine in case it is not working for long time (e.g. during holiday)	**	TREVISO
U49	S	Dry your hair naturally or with a towel instead of using hair dryer	*	CIRCE, 2015
U50	I	Do not call more than one lift If there are several with distinct call buttons, to prevent useless rides	**	CIRCE, 2015
U51	I, S	Use stairs instead of lifts whenever possible	**	CIRCE, 2015
U52	I, S	Wear adequate clothing to the season and to the actual temperature in the building	**	CIRCE, 2015

U53	G, I, S	Do not turn the air conditioning system on when the windows are open	**	M&A, 2013
U54		Insert description here		
U55		Insert description here		

4. Toolset

In the TOGETHER application form, the promise has been to release an undefined number of "easy to apply techniques as Apps, Storytelling, edutainment, gamification [and] social networking, according to building users' age and attitudes".

In fulfilment of that promise, this section now provides an initial collection of DSM tools potentially identified as suitable for implementation within the 85 pilot buildings, in association with the list of behavioural changes presented in the previous section and in dependence of a preliminary assessment of the building users' ages, roles and attitudes, as well as the functional nature of the buildings - e.g. institutional, educational, etc.

The following table lists the proposed DSM tools, which will be validated and possibly integrated by the partners using the process described in the next section 4. We structure the list of tools starting from the three concepts of the formula Potential * Acceptance = Result (originally introduced by the IEA – International Energy Agency).

Table 2: An initial collection of DSM tools potentially identified as suitable for implementation within the 85 pilot buildings

IEA Concept	Tool category	Building type(s)	Target users	Proposed DSM tools
Understanding the potential of a large-scale DSM deployment	Information delivery tools	G, I, S	Adults	Public Display of Energy Audits
			Teen-agers	Experimental design and preparation of templates
			Children	Simplified messaging
	Edutainment and gamification tools		Adults	Origami and slogans
			Teen-agers	The EURONET 50/50 MAX
			Children	Methodology and e-Pack
Promoting the acceptance of proposed behavioural change measures	Simulation, education and training tools	G, I, S	Adults	Training of Trainers
			Teen-agers	Discovering the energy efficiency labels of appliances
			Children	
	Financial and economic incentives		Adults	The 50/50 sharing concept
			Teen-agers	The Great Power Bingo!
			Children	

Monitoring the results in terms of improved energy efficiency of the building	Instant feedback tools	G, I, S	Adults	ENERCLOUD software
			Teen-agers	Energy consumption analyser (ECAS) mobile app
			Children	
	Competition based and social networking tools		Adults	GooseChase mobile app
			Teen-agers	
			Children	

Following are short descriptions of the proposed DSM tools.

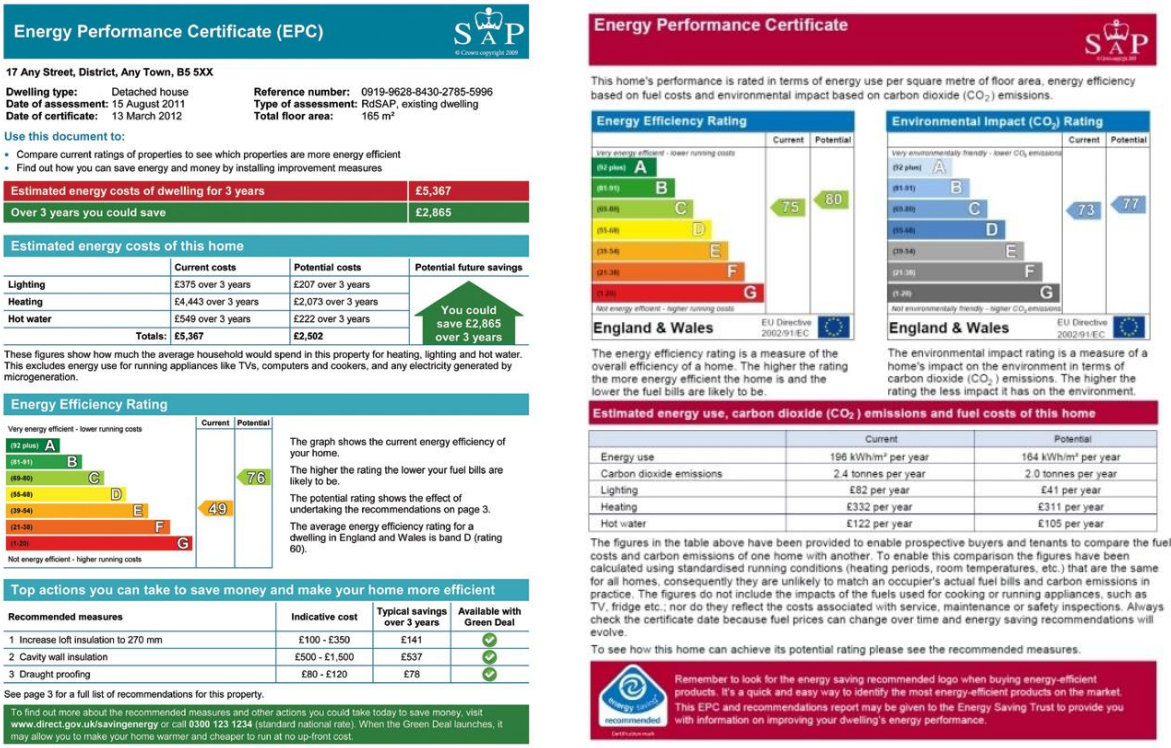
4.1. Public display of Energy audits

In all TOGETHER pilots, energy audits are being held of the participating buildings. These are supposed to contain recommendations for improving the energy performance of the building – including technical measures that may be implemented at zero or very low cost and organizational improvements, including the active participation of users by adopting a set of behavioral changes.

To the purpose of spreading awareness about the current situation and the prospective targets of improvement, we propose to create nice infographics mirroring the structure of the Energy Performance Certificates (EPCs) that the UK Government has revamped in 2012 to improve their informative power.

The look and feel of the resulting tool would be similar to this example[1]:

[1] Source: http://www.justepc.co.uk/ and http://www.gatehouseestates.co.uk/godmanchester-huntingdon-epc/



Energy Performance Certificate (EPC)

SAP

17 Any Street, District, Any Town, B5 5XX

Dwelling type: Detached house
Date of assessment: 15 August 2011
Date of certificate: 13 March 2012
Reference number: 0919-9628-8430-2785-5996
Type of assessment: RdSAP, existing dwelling
Total floor area: 165 m²

Use this document to:

- Compare current ratings of properties to see which properties are more energy efficient
- Find out how you can save energy and money by installing improvement measures

Estimated energy costs of dwelling for 3 years	**£5,367**
Over 3 years you could save	**£2,865**

Estimated energy costs of this home

	Current costs	Potential costs	Potential future savings
Lighting	£375 over 3 years	£207 over 3 years	You could save £2,865 over 3 years
Heating	£4,443 over 3 years	£2,073 over 3 years	
Hot water	£549 over 3 years	£222 over 3 years	
Totals:	**£5,367**	**£2,502**	

These figures show how much the average household would spend in this property for heating, lighting and hot water. This excludes energy use for running appliances like TVs, computers and cookers, and any electricity generated by microgeneration.

Energy Efficiency Rating

	Current	Potential
Very energy efficient - lower running costs		
(92 plus) A		
(81-91) B		76
(69-80) C		
(55-68) D		
(39-54) E	49	
(21-38) F		
(1-20) G		
Not energy efficient - higher running costs		

The graph shows the current energy efficiency of your home.

The higher the rating the lower your fuel bills are likely to be.

The potential rating shows the effect of undertaking the recommendations on page 3.

The average energy efficiency rating for a dwelling in England and Wales is band D (rating 60).

Top actions you can take to save money and make your home more efficient

Recommended measures	Indicative cost	Typical savings over 3 years	Available with Green Deal
1 Increase loft insulation to 270 mm	£100 - £350	£141	✓
2 Cavity wall insulation	£500 - £1,500	£537	✓
3 Draught proofing	£80 - £120	£78	✓

See page 3 for a full list of recommendations for this property.

To find out more about the recommended measures and other actions you could take today to save money, visit **www.direct.gov.uk/savingenergy** or call **0300 123 1234** (standard national rate). When the Green Deal launches, it may allow you to make your home warmer and cheaper to run at no up-front cost.

Energy Performance Certificate

SAP

This home's performance is rated in terms of energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO_2) emissions.

Energy Efficiency Rating

	Current	Potential
Very energy efficient - lower running costs		
(92 plus) A		
(81-91) B		
(69-80) C	75	80
(55-68) D		
(39-54) E		
(21-38) F		
(1-20) G		
Not energy efficient - higher running costs		
England & Wales	EU Directive 2002/91/EC	

The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating

	Current	Potential
Very environmentally friendly - lower CO_2 emissions		
(92 plus) A		
(81-91) B		
(69-80) C	73	77
(55-68) D		
(39-54) E		
(21-38) F		
(1-20) G		
Not environmentally friendly - higher CO_2 emissions		
England & Wales	EU Directive 2002/91/EC	

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

Estimated energy use, carbon dioxide (CO_2) emissions and fuel costs of this home

	Current	Potential
Energy use	196 kWh/m² per year	164 kWh/m² per year
Carbon dioxide emissions	2.4 tonnes per year	2.0 tonnes per year
Lighting	£82 per year	£41 per year
Heating	£332 per year	£311 per year
Hot water	£122 per year	£105 per year

The figures in the table above have been provided to enable prospective buyers and tenants to compare the fuel costs and carbon emissions of one home with another. To enable this comparison the figures have been calculated using standardised running conditions (heating periods, room temperatures, etc.) that are the same for all homes, consequently they are unlikely to match an occupier's actual fuel bills and carbon emissions in practice. The figures do not include the impacts of the fuels used for cooking or running appliances, such as TV, fridge etc.; nor do they reflect the costs associated with service, maintenance or safety inspections. Always check the certificate date because fuel prices can change over time and energy saving recommendations will evolve.

To see how this home can achieve its potential rating please see the recommended measures.

Remember to look for the energy saving recommended logo when buying energy-efficient products. It's a quick and easy way to identify the most energy-efficient products on the market. This EPC and recommendations report may be given to the Energy Saving Trust to provide you with information on improving your dwelling's energy performance.

Figure 2: Examples of Energy Performance Certificates

The pilot installation of the above tool should comply with the following process:

- First, the TOGETHER partners should validate the tool, considering it appropriate to at least one building/pilot.
- Then, the LP should release the template with the graphical format of the project.
- Then, the individual partner should fill in the template with contents appropriate to the pilot building.
- The resulting DSM should be printed (in a few copies) and put on public display in such areas of the building as: close to coffee/vending machines, waiting rooms etc.

A variant of the above is to make the template available in electronic version only and put it on public display through maxi screens.

4.2. Experimental design and preparation of templates

In most TOGETHER pilots, school buildings exist that form an integral part of the pilots. These can host kindergartens, primary or secondary schools. Depending on the age of the pupils and the availability of inspired teaching staff, the preparation of templates and/or public displays can be realized in a participatory manner, involving (some of) the students themselves.

The pilot installation of the above tool should comply with the following process:

- First, the TOGETHER partners should validate the tool, considering it appropriate to at least one building/pilot.
- Then, the LP should release a set of dedicated guidelines for the design and preparation of templates during school work.
- Then, the individual partner should fill in the template with contents appropriate to the pilot building.

A variant of the above is to confer the preparation of the templates to the school classes themselves.

4.3. Simplified messaging

For the lowest age classes, simplified messages can be designed as fit to the purpose, and put on display like proxies of more descriptive presentations of the school building's energy performance.

The pilot installation of this tool should resemble the previous one, already described, in full.

4.4. TOGETHER Origami and associated slogans

Among the different communication tools of the TOGETHER project, a set of origami with associated slogans has been produced. The following table summarizes them – quoting the sources of the respective origami instructions, while the slogans have been ideated for the purpose within the project and are therefore original.

Table 3: A set of origami with associated slogans

Origami Subject	*Associated Slogan*	*Source URL*
Window	Heat loss through leaky windows can be responsible for up to 25% of electric bills.	[2]
"A" letter	Even the Empire State Building has moved from Energy Class B to A – which translated into greatly improved market value.	[3]
House	Buildings are responsible for 40% of energy consumption and 36% of CO_2 emissions in the European Union.	[4]
Candle	Lighting consists of about 10% of a building's energy bill.	[5]
Man	People are the most effective contributors to energy efficiency of the buildings they live or work in.	[6]
Star	There is so much lighting in our cities that we can hardly see the stars.	[7]
Piano	A concerto of technical and behavioural change measures: new music for the buildings energy performance.	[8]
Building	Most building retrofits realise energy savings up to 20%, typically with a 3-5 year payback.	[9]
Wallet	Energy efficiency saves you money. Period.	[10]
TV set	"Idle load electricity"— wasted by appliances in sleep mode —can account for 10 to 20 percent of power consumption in a building.	[11]
Box	A toolbox for energy efficiency. Yours is the choice.	[12]

[2] Source: http://origami-amazing.blogspot.it/2014/12/window.html
[3] Source: http://origami-amazing.blogspot.it/2015/01/alphabet-a.html
[4] Source: http://origami-amazing.blogspot.it/2011/10/house-of-conner.html
[5] Source: http://en.origami-club.com/easy/other/candle2/candle2/index.html
[6] Source: http://www.origami-make.org/origami-face-changer.php
[7] Source: https://it.pinterest.com/pin/177047829074688591
[8] Source: http://origami-amazing.blogspot.it/2014/12/piano.html
[9] Source: http://en.origami-club.com/nature/build/build/index.html
[10] Source: https://it.pinterest.com/pin/571112796471000069/
[11] Source: http://3.bp.blogspot.com/-P4Klw4_XJlE/VGy3mtNgh9I/AAAAAAAAA4o/zBm1GF8PPpk/s1600/tv.gif
[12] Source: https://s-media-cache-ak0.pinimg.com/originals/e4/2b/e0/e42be097288b967a5b812c29911a0622.gif

The above tool has already been validated by the TOGETHER partners during an earlier stage of the project. Therefore, its pilot implementation can follow a slightly different process than the other tools proposed, namely:

- The LP will share the original files with both the original origami instructions (in A4 format) and the slogans (in A3 format or larger sized).
- Each slogan should be translated in the native languages of project's pilot sites.
- The individual partners are free to use the tool for communication purposes (e.g. by sending the origami instructions in attachment to dedicated e-mails to local stakeholders or putting the slogans on display in public rooms of the various pilot buildings).

4.5. The EURONET 50/50 MAX project methodology and e-pack[13]

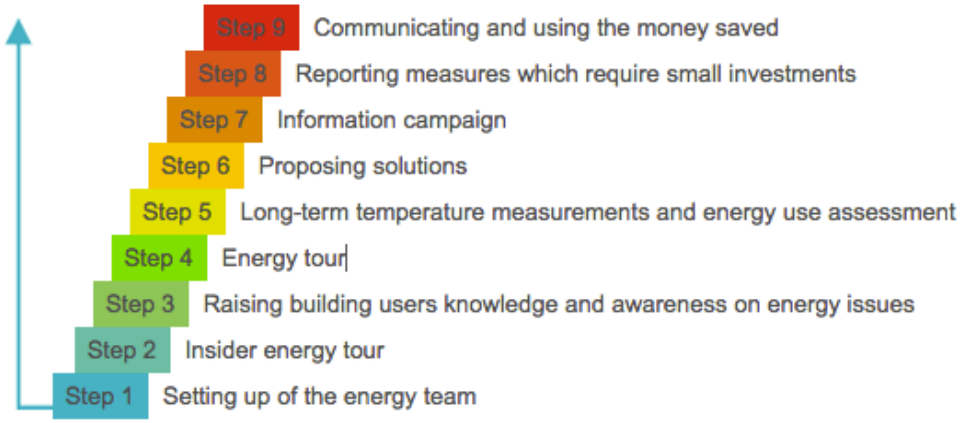


Figure 3: 9-step methodology of EURONET 50/50 MAX

The EU funded project named EURONET 50/50 MAX ideated and successfully deployed a 9-step methodology to actively involve pupils in the energy efficiency management of the school building and teach them how to behave in a more environmentally friendly way through practical actions.

This 9-step methodology, originally implemented within said project in 525 primary and secondary schools from 13 EU countries, can be summarized as follows:

1. **SETTING UP AN ENERGY TEAM**

Consisting of a group of pupils (one class or representatives of different classes), one or two interested teachers and the school caretaker. Its task is to explore the current energy situation of the school and to propose and implement energy saving measures. The team will also organize an information & education campaign addressed to the rest of the school community.

2. **ORGANISING AN INSIDER ENERGY TOUR**

[13] Source: http://www.euronet50-50max.eu/en/about-euronet-50-50-max/the-50-50-methodology-9-steps-towards-energy-savings

Before starting to work with the pupils, the director together with involved teachers and the school caretaker should take part in a so called "Insider energy tour" aiming to do an initial assessment of the energy characteristics of the school building (including assessment of the heating system, technical state of the building, etc.) and to identify the elements, to which pupils' attention should be drawn.

3. RAISING THE PUPILS' KNOWLEDGE AND AWARENESS ON ENERGY ISSUES

A set of training sessions (during regular classes and additional meetings if possible) about such topics as: forms of energy, using energy in everyday life and its impact on the environment, greenhouse effect, climate change and climate protection, energy saving, energy efficiency, use of renewable energy sources. The aim is to raise knowledge and awareness of issues related to climate and energy, as well as to make pupils aware that there are opportunities to do something about climate change and that their individual actions do matter.

4. PUPILS' ENERGY TOUR

This time the energy tour is made by the energy team. Supported by the teachers and the school caretaker, the pupils inspect the whole school building and evaluate different aspects influencing the energy consumption in the school, including: technical state of the building, heating system, lighting, use of electronic equipment, use of water.

All school rooms should be checked: class rooms, corridors, staircases, gyms, toilets, the teacher's room, storage rooms, etc.

5. LONG-TERM TEMPERATURE MEASUREMENTS AND ENERGY USE ASSESSMENT

This step is managed by the energy team, with the twin aim of:

- Drawing up a long-term temperature profile of the school by measuring temperatures in all school rooms for two weeks and checking if they correspond to the established standards.
- Assessing energy use based on observing how other pupils, teachers and other school building users' behaviour influences the energy consumption in the school. Special attention should be paid to such behaviour as: methods of airing the rooms, methods of regulating the heating, the use of electrical and electronic equipment, etc. Surveys can be made among other pupils (outside the energy team) regarding their opinions about temperatures and air quality in the school, habits concerning the use of electrical and electronic equipment and other energy-related issues.

6. PROPOSING SOLUTIONS

At this step the energy team discusses its findings and develops proposals for solutions, both small investments and behavioural changes, the implementation of which may reduce energy consumption at school. The team also identifies proposal "target groups", as well as ways to approach them with the energy-saving message.

7. INFORMATION CAMPAIGN

At this step the energy team shares what was learned during project implementation with the rest of the school, as well as their proposals on what all building users can do to save energy. The team may use different communication channels, including: posters and bulletin board displays, presentations in class and at school events, organization of an Energy Saving Day, creation of a dedicated website, etc.

8. REPORTING MEASURES WHICH REQUIRE SMALL INVESTMENTS

Although the main aim of the 50/50 methodology are energy savings that can be achieved by changing the behaviours of building users, the energy team can also identify the need and propose the implementation of small investments, asking for the financial support of the building owner and/or external sponsors.

9. COMMUNICATING AND USING THE MONEY SAVED

Involving the pupils in the decision on how to use the money saved is a very important part of the methodology. By so doing they will really feel that their actions have positive and measurable results. Therefore, after each year of implementation it is required to calculate how much energy, CO2 and money was saved, inform the school community of the financial inflows derived from the methodology implementation and discuss with the pupils what shall be done with those gains.

To promote the transferability of this methodology, the EURONET 50/50 MAX project has developed an e-Pack including a set of methodological and educational material & tools.

Therefore, to promote the pilot installation of the above tool the following process may be adopted:

- First, the TOGETHER partners should validate the tool, considering it appropriate to at least one building/pilot.
- Then, the LP should liaise with PNEC (the TOGETHER partner being also involved in the EURONET 50/50 MAX project) to define the contents of the e-Pack to be used in the new project context.
- Of course, each individual partner will be free of readapting the e-pack contents as appropriate to the pilot case.

4.6. Training of Trainers

The Training of Trainers process is well consolidated and widely adopted in the state of the art. CEDEFOP[14] defines it in very wide terms, covering:

a) "professional" as well as "occasional" teachers or trainers, the latter being defined as experts in a given field who accompany trainees in their own work environments;
b) a wide range of skills, including knowledge specific to the (general, technical or scientific) field in question, as well as more generic (e.g. educational, psychological and sociological skills; management skills; familiarity with the world of work; up to knowledge of training schemes and target audiences);
c) both the methodologies of training courses (i.e. related to their design, organization and implementation) and the contents of training activities (i.e. imparting knowledge, know-how and skills).

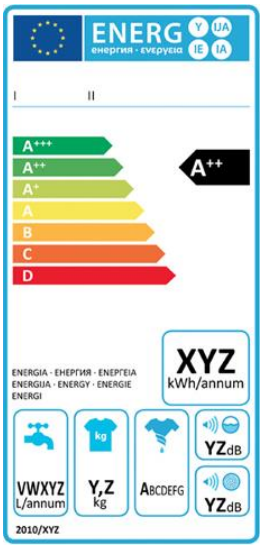
The essence of the Training of Trainers process is to integrate coaching and mentoring with training and technical assistance to learners. In the TOGETHER project planning, a dedicated action line has been foreseen to that end, which has been articulated in three distinct moments:

[14] Source: http://www.cedefop.europa.eu/EN/publications/13125.aspx

- A common, residential, Training of Trainers course restricted to project partners, lasting 4 days and dealing with various aspects related to Demand Side Management (including technical, legal, financial and behavioral issues). This was held in Krakow, Poland, in February 2017.
- A series of local training courses, individually organized at each partner site, with the participation of both attendees to the former course and of additional experts as trainers, coaches and mentors, and a twin eye on both contents and methodologies for the realization of the following step.
- The practical implementation of training principles at each individual pilot site, in ways that can be varying from place to place but globally respond to the logic of transferring thematic knowledge (domain related skills) and expertise (coordination capacities) to the building stakeholders and users.

The pilot installation of this tool is ongoing, and its results will be reported in another ~~Deliverable~~ Activity of the project, namely A.T3.3 Pilot Implementation & assessment of the achieved energy savings based on energy monitoring system.

4.7. Discovering the energy efficiency labels of appliances



Energy Star is an international standard programme for energy efficient consumer products originated in the United States in 1992 and adopted in most Western countries such as Australia, Canada, Japan, New Zealand, Taiwan, and the EU.

Devices carrying the Energy Star blue mark, such as computer products and peripherals, kitchen appliances, refrigerators and dryers, generally use 20–30% less energy than the average level required by law[15]. The EU Directive 92/75/EC, replaced by Directive 2010/30/EU, in operation since 31st July 2011, has established an energy consumption labelling scheme for white goods, light bulbs and other heterogeneous products, based on a set of energy efficiency classes ranging from A to G, A being the most energy efficient, G the least efficient. Since 2010, in an attempt to keep up with advances in energy efficiency, A+, A++ and A+++ grades were introduced and a new type of label exists that makes use of pictograms rather than words, as shown in the picture[16]. The (now closed) EU funded project COME ON LABELS (see http://www.come-on-labels.eu/about-the-project/welcome-eu) has produced a dedicated website to store and distribute information on energy labelling of household appliances. The web application http://eepf-energylabelgenerator.eu/ enables the creation of tailor-made energy labels for relevant products in high resolution pdf format.

Depending on the age of participants, the discovery process can be done at different levels: finding out which appliances bear which labels, understanding the meaning of the pictograms on each label, displaying larger sized labels in the areas where each appliance is located.

The pilot installation of the above tool should comply with the following process:

[15] Source: https://en.wikipedia.org/wiki/Energy_Star

[16] Source: https://en.wikipedia.org/wiki/European_Union_energy_label

- First, the TOGETHER partners should validate the tool, considering it appropriate to at least one building/pilot.
- Then, the LP should release a set of guidelines for the design and preparation of tailor-made energy labels during school work.
- The labels could be printed on stickers and placed on either a map of the building or the individual appliances.

The contribution of active teachers is essential to the success of the above tool, esp. if implemented in kindergartens and primary schools.

4.8. The 50/50 benefit sharing concept

The 50/50 sharing concept is a cornerstone of TOGETHER, and consists in equally sharing the financial inflows resulting from energy efficiency gains between the owners and users of a building.

To some extent, it derives from the (already mentioned) EURONET 50/50 MAX project, but its implementation will be more in focus of the TOGETHER pilots, thanks to the parallel development of the Building Alliance concept, for which see Deliverable D.T2.3.1 "The negotiating panel concept - roles and function".

The pilot installation of the above tool should therefore comply with the process outlined in that deliverable.

4.9. The Great Power Bingo!

Figure 4: Power bingo interface

This game is particularly suitable for young kids, but can also be adapted to teen agers and probably adults – in dependence of the complexity of the challenges.

How it works: Every player will receive a bingo card with the usual random numbers displayed on it. Each number (from 1 to 70 in the example displayed, but this may be changed accordingly) is associated to a certain behaviour that one intends to promote in the target population. The player can mark a number on the card only after checking that someone else, not depending on his/her will or orders, has accomplished a specific task holding that number (for instance, 51 is turning the light off when leaving the room, 54 is closing a window left open with the heating on, etc.).

Each behaviour must be recorded (date, time, person) in order for the mark to be valid. Players win every time they can mark a straight line of five numbers either horizontally, vertically or diagonally. The global target is to cover all the numbers on the card.

There will be a raffle periodically (e.g. every month) for the assignment of low category prizes to those who have marked one or more lines of 5 and for the extraction of the free number, which may be different from month to month. Whoever completes the card first will be the winner of the bingo game.

The pilot installation of the above tool should comply with the following process:

- First, the TOGETHER partners should validate the tool, considering it appropriate to at least one building/pilot.
- Then, the LP should release a baseline set of playing cards and guidelines for the design and preparation of the game during schoolwork. Ideally, the final set of cards should be produced after knowing the exact number of targeted behaviours associated to each of them, in order to generate an appropriate randomization.

Note: Better would be to sell the card at a modest prize (say €1) in order to communicate the message that "there are no free meals" and induce a more attentive consideration of what people are doing and why. This decision however depends also, on whether there would be money prizes at the end of the competition or not. In the latter case, one has to consider that there could be some tax issues, depending on the country legislation.

4.10. ENERCLOUD software (source: Città Metropolitana di Torino)

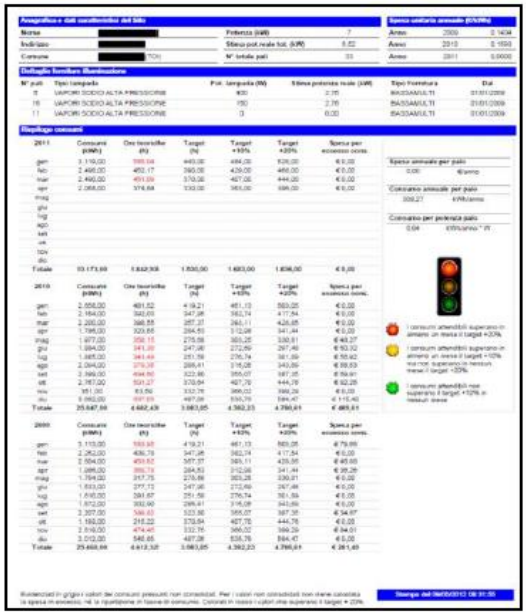


Figure 5: ENERGCLOUD interface

ENERCLOUD, now evolved as ENERCLOUD+, originally developed by the Province of Turin, which has become in the meantime a Metropolitan City, is a web based Cloud computing software that enables the monitoring and evaluation of the thermal/electric energy consumption of public buildings and of the electricity consumption of public lighting systems, using data from energy bills. ENERCLOUD enables to compare consumption and expenditures with target values, identifying abnormal values and potential improvement areas. The software translates electrical and thermal consumptions into an energy performance index (kWh/m^2) displaying via a "traffic light" if the building/facility is in line or not with the target value.

All Covenant of Mayors signatory municipalities of the province of Turin use ENERCLOUD as a key tool for the energy management of their public buildings and facilities. The tool can be made available to other public sector organizations on request.[17]

The pilot installation of the above tool should comply with the following process:

- First, the TOGETHER partners should validate the tool, considering it appropriate to at least one building/pilot.
- Then, the LP should contact the Province of Turin officially to get a release of the software for reproduction and use within the buildings of the programme.

[17] Source: http://www.sistemapiemonte.it/cms/pa/ambiente/servizi/874-enercloud

- Then, the individual partner should get acquainted with the software and make the best use of it within the pilot building(s).

Naturally, there can be other similar solutions developed at partner level in TOGETHER, which may be good substitutes for the above. A final decision should be taken within the consortium in the above respect.

4.11. The Energy Consumption Analyzer (ECAS) app (only for Android)

ECAS has been developed by an Austrian developer as a free and open source software, with translations available in all of the native languages of TOGETHER partners[18].

How it works: ECAS helps to keep track of energy consumption of any building. Users can add meters for gas, electricity, or water to the database and record the current meter readings from time to time.

Readings can be color-coded and comments may be added to remember special situations, which may explain unusual energy usage. A regular reading interval is not required, readings can be taken whenever it is convenient.

ECAS takes advantage of Google's backup and restore service, so the database is automatically stored in a safe place in case the device is reset or lost. On the other hand, ECAS does not track changes of energy cost over time. Whatever costs are set in the meter definition are used for the entire set of readings. Changing the cost factor for a meter immediately changes the readings for the energy cost of that meter. Finally, the product is not supported for iOS or Microsoft devices.

Beside the convenience of being available in many different languages, the rationale of using this tool is that it allows unsystematic collections and updates of meter readings, which is the most likely usage scenario in all the pilot buildings. As a side benefit, users can consider gas and water consumption jointly with electricity, so as to get a unitary view of the current status of the building's energy efficiency across time. In the case of pilots located in schools, the benefit of using this tool is evident from the fact that the pupils could be periodically invited to check and monitor the impact of their activities in the pilot by directly addressing the information made centrally available in the database of meter readings. Finally, a global advantage for the project coming from a generalized use of the tool would be that the progress gained in terms of energy reduction during pilot implementations could also be measured at regular intervals.

Nevertheless, it is possible that some TOGETHER partners are in possession of their own systems and applications, already expressed in native languages. Therefore, we consider this as an illustrative example, which can and should be improved by alternative solutions the implementation of which should keep the monitoring purposes of the tool alive.

[18] Source: http://ecas.netzheimat.at/

As a result, the pilot installation of the proposed tool should follow the process outlined here below:

- First, the TOGETHER partners should validate the tool, considering it appropriate to at least one building/pilot.
- Then, the LP should offer professional advice and intermediation with the team of developers, in case any problems should arise during the preparation of the pilots.
- Should all or most of the partners adhere to the use of this application, a set of dates should be agreed upon for the collection of meter readings in all the pilot sites participating in the deployment of this tool.

4.12. The GooseChase app (for Android and iOS)

GooseChase has been created to simplify the organization of and participation in a scavenger hunt. The app and its related service are delivered by a Canadian company[19].

How it works: The customer uses the GooseChase website to first create a challenge, by giving it a name, a picture and a description. One can also set how long the game will run and whether there is a password to join. Each GooseChase challenge includes a list of missions for the participants to complete. One can design missions from scratch. Every mission has a name, a description, value in points and an optional link to provide extra information. It is possible to add GPS coordinates to the mission locations.

Participants get access to the challenge by searching for the name of the game within the app. They select a mission from the list and follow the instructions to receive the allotted points. They are also invited to provide real-time feeds of their activities, in order to get more points and go up in the ranking. But they are also incentivized to look at what the others are doing, because this also gives them some extra points.

It is possible to form teams or play individually. Submissions are possible of texts, photos and videos, which can be sorted out and reviewed by the organizers in case scores have to be assigned after evaluation. At the end of the game, all scavenger hunt submissions can be downloaded at once by the customer.

The rationale of using the scavenger hunt analogy is to give incentives to report back on the actual behavioral performance of participants in the “game”, as well as on the level of awareness of the results obtained on the fly. For instance, behaviors to be incentivized may include the daily inspection of the information available on energy consumption (by smart meters, big displays, or other sources that the general public may get access to), which will be proven by taking a picture and uploading it to the system. Or it is possible that the last person to turn the light off in a room will take a picture of the room itself to demonstrate achievement.

[19] Source: https://www.goosechase.com/terms-of-service/

The pilot installation of the above tool should comply with the following process:

- First, the TOGETHER partners should validate the tool, considering it appropriate to at least one building/pilot. Note that it is possible to download the app for free and use it experimentally for a maximum number of 5 teams of 5 people each.
- Then, the LP should interact with each pilot to co-define a list of behaviors and actions that should be incentivized by the real-life implementation of the pilot. It is at that time that a paying license should be bought. The professional license allows a maximum number of 20 teams of 5 people each, but it is also possible to get an enterprise license, with discounts for bulk purchases done by not for profit organizations.
- Generally speaking, it would be recommended that each partner site developed their own customization of the challenge. However, as there are possible gains from reciprocal learning, this activity should be realized in coordination by all interested people and organizations.

5. Tools approval and Relevance Matrix

The list of DSM tools provided in the previous section is both non-exhaustive and non-prescriptive. Non-exhaustive, because there may well be alternative options for each proposed tool, and the TOGETHER partners are cordially encourage to suggest more. Non-prescriptive, because partners are left free to decide whether each of these tools can have any chance of being adopted in the context of their pilots or not.

In the latter respect, it has to be kept in mind that the TOGETHER Application Form does not specify a minimum number of DSM tools to be provided to / used within each pilot.

To facilitate the selection process, we introduce the following workflow and three empty table templates.

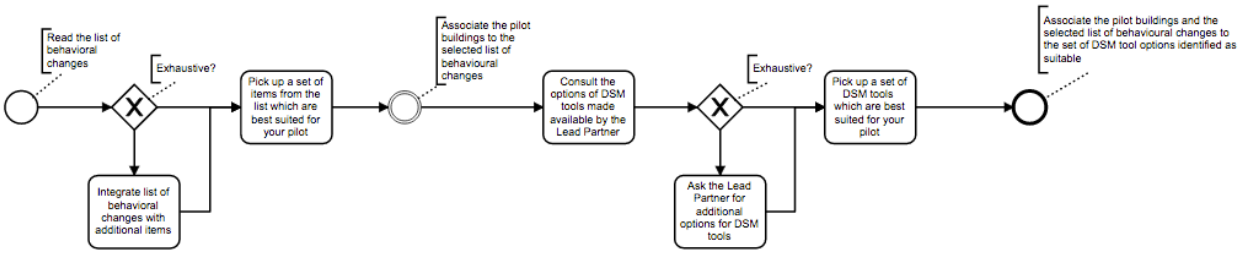


Figure 6: Proposed tool selection workflow

As can be seen, the selection of the preferred DSM tool(s) does not occur per se, in a top down manner, but follows the identification of the list of behavioural changes that are most appropriate to the individual pilot(s).

To that end, all partners are kindly requested, first of all, to read and possibly integrate the list provided in Section 2, taking decisions on which ones are most appropriate to each pilot building.

As a result of this initial part of the workflow, we expect to see a shorter list than the one currently in Section 2, because most of the items will have been dropped from there (and perhaps some new ones will have been added). On the other hand, this table should be repeating itself as many times as the number of pilot buildings, and the chances are be high that different contents will appear on different tables, depending on the specificities of each pilot building.

A possible template for the table we are talking about is the following:

Table 4: A template for List of targeted behavioural changes with proper motivation

BUILDING TYPE / NAME / LOCATION		
List of targeted behavioral changes		**Motivation**
ID#	Description (borrowed from Section 2 list – with extra items added if required)	This can be filled in to the extent it is relevant (e.g. a recommendation from the energy audit)
…	…	…
…	…	…
…	…	…
…	…	…

Ideally, this process of identification of the target behavioural changes should not be done by the partners alone, but in a public context, as open and transparent as it can be made, with the active engagement of all stakeholders and users of the building in focus.

Examples of these public contexts could be: the local energy teams or the pilot's steering committees that each partner should already have created for each building at this stage of the TOGETHER project, or even broader and more inclusive situations such as technical workshops or side events to training for trainers sessions.

Once the list of targeted behavioural changes has been defined, the following task as per the above workflow, will be to associate a number of DSM tools to each building and to each (set of) targets. Generally speaking, all or none of the proposed tools can be used in any pilot. This is why the first and most immediate requirement for each partner will be to consider whether the proposed solutions are satisfactory or not.

These can be done by putting a tick (√) close to each proposed DSM tool and explaining the motivation for its rejection:

Table 5: Checklist of DSM tools used in pilot actions

Tool	**[ ] Yes**	**[ ] No**	**Motivation**
Public Display of Energy Audits			
Experimental Design and Preparation of Templates			
Simplified Messaging			
TOGETHER Origami and Slogans			
The EURONET 50/50 Max Methodology and e-Pack			
Training of Trainers			
Discovering the Energy Efficiency Labels of Appliances			
The 50/50 Sharing Concept			
The Great Power Bingo!			
ENERCLOUD Software			
Energy Consumption Analyzer (ECAS) mobile app			
The GooseChase mobile app			

Again, it is strongly recommended that each partner should not fill in the above table alone, but involving in a very proactive manner all the key stakeholders and users of each pilot building.

Once done with the above task, an interaction is expected between each single partner and the LP to make a clarification of what has been reported in the table above. After this interaction, and particularly in the case that very few or none of the above tools are deemed acceptable due to objective and sharable reasons, the LP will be called again to provide an additional set of proposals that more directly meet the requirements of each pilot site.

However, at the end of this loop, we can speculate that every partner should be satisfied with the list of tools provided. Therefore, the final task for each partner (also including the LP) will be to match the list of (meanwhile identified and selected as key) DSM tools with the buildings where the pilot actions will take place, and the targeted behavioural changes agreed as explained above.

We call this final table, the template of which is reproduced below, "Relevance Matrix", which is the most important output of the whole process. Starting from that matrix, each partner and the TOGETHER project will gain precious information on the shaping of each pilot, the tools being implemented, and the behaviours to be monitored.

Table 6: A possible template for the Relevant Matrix

BUILDING TYPE / NAME / LOCATION			
List of targeted behavioral changes		**Tools to be used to tackle these changes**	**Motivation**
ID#	Description (borrowed from Section 2 list – with extra items added if required)	Name and short description (borrowed from Section 3)	This can be filled in to the extent it is relevant (e.g. to qualify or limit the extent of adoption)
…	…		…
…	…		…
…	…		…
…	…		…

Although a 1:1 association between behavioral changes and DSM tools is possible, at the end of the day it is quite likely that very few tools will be deployed to meet a high number of targets, therefore it will also be possible to cluster the latter in association with each specific tool.

6. Conclusion

This deliverable proposes an original set of innovative communication tools and contents targeting building users that the TOGETHER consortium such as other possible partnerships could use in the framework of their public buildings, in order to secure energy savings through and active engagement of the building users.

This tool has mapped some of the possible and available solutions that can be easily adopted and adapted at local level as they are low costs initiatives, that call in any case for an intensive “human” work for the creation of the enabling conditions that can guarantee the “acceptance” of all the buildings’ player in planning soft measures for the energy efficiency to be combined with financial, technical and procedural measures.

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- http://www.wns.com/solutions/industries-we-serve/utilities-and-energy

Glossary

Term	Definition	Source
Analytical DSM	Finding opportunities for energy savings through equipment monitoring and data analytics.	Navigant Research
Behavioural DSM	Educating consumers and encouraging individual participation to achieve energy savings.	Navigant Research
Building Alliance	A formal or informal agreement involving all the major stakeholders of a public building (owner, manager, users, visitors, etc.) aimed at a common energy saving goal.	Rephrased from several parts of the TOGETHER application form
Contextual Design	A user-centred design process including ethnographic methods for gathering data relevant to the product via field studies, rationalizing workflows, and designing human-computer interfaces. Contextual design can be seen as an alternative to engineering and feature driven models of creating new systems.	Wikipedia
Demand Side Management (DSM)	The modification of consumer demand for energy through various methods such as financial incentives and education.	Quoted from p. 51 of the TOGETHER application form
DSM tools	Communication techniques and contents targeting building users (including Apps, Storytelling, edutainment, gamification and social networking) according to their age and attitudes.	Adapted from p. 72 of the TOGETHER application form
Edutainment	Content designed both to educate and to entertain.	Wikipedia
EPIC (Energy Performance Integrated Contract)	An innovative contractual scheme for the energy management of public buildings, which combines the installation of smart meters and other technological devices with the promotion of behavioural changes within building users and shares resulting gains between the contracting parties.	Expanded from p. 51 and other parts of the TOGETHER application form
Gamification	Application of game-design elements and game principles in non-game contexts.	Wikipedia
Hawthorne Effect	Also referred to as the observer effect, is a type of reactivity in which individuals modify an aspect of their behaviour in response to their awareness of being	Wikipedia

	observed.	
Jevons Paradox	It occurs when technological progress increases the efficiency with which a resource is used (reducing the amount necessary for any one use), but the rate of consumption of that resource rises because of increasing demand.	Wikipedia
Negotiating Panel	A delegation of all the key stakeholders of a public building, who regularly meet to draft the text [and monitor the development?] of a Building Alliance.	Extrapolated from various sections of the TOGETHER application form
Persuasive technology	Technology that is designed to change attitudes or behaviours of the users through persuasion and social influence, but not through coercion.	Wikipedia
Reinvestment Action Plan	A follow-up plan to the pilot actions realised in a partner region, instantiating the commitment to reinvest (at least 20% of) the economic and financial gains achieved by the building owners from the energy efficiency improvements.	Expanded from p. 81 and other parts of the TOGETHER application form
Serious Game	A game designed for a primary purpose other than pure entertainment.	Wikipedia
Social networking	The creation and maintenance of personal and business relationships especially online.	Merriam-Webster Dictionary
Storytelling	The social and cultural activity of sharing stories, often with improvisation, theatrics, or embellishment.	Wikipedia

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