Demand Side Management Tools

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TOGETHER

The Negotiating Panel Concept: roles and function
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TOGETHER

TOwards a Goal of Efficiency THrough Energy Reduction

The Negotiating Panel Concept: roles and function

D.T2.3.1

PP4 – City of Zagreb

Executive summary

This Guide deals with the concept of Negotiating Panel and aims to give more information on the meaning of the concept itself. The Negotiating Panel is a group of people on a specific object/building who work together in a joint effort to reach the set goals of energy saving, thereby achieving mutual benefit (economic and environmental). The Negotiating Panel Concept is made up of owner, managers and users' representatives (including end users, i.e. occupants), contributing together to the building energy management. The Concept defines roles and operational modalities.

Establishing of 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 a building. The roles and responsibilities of different members of Negotiation Panel are described in this Guide.

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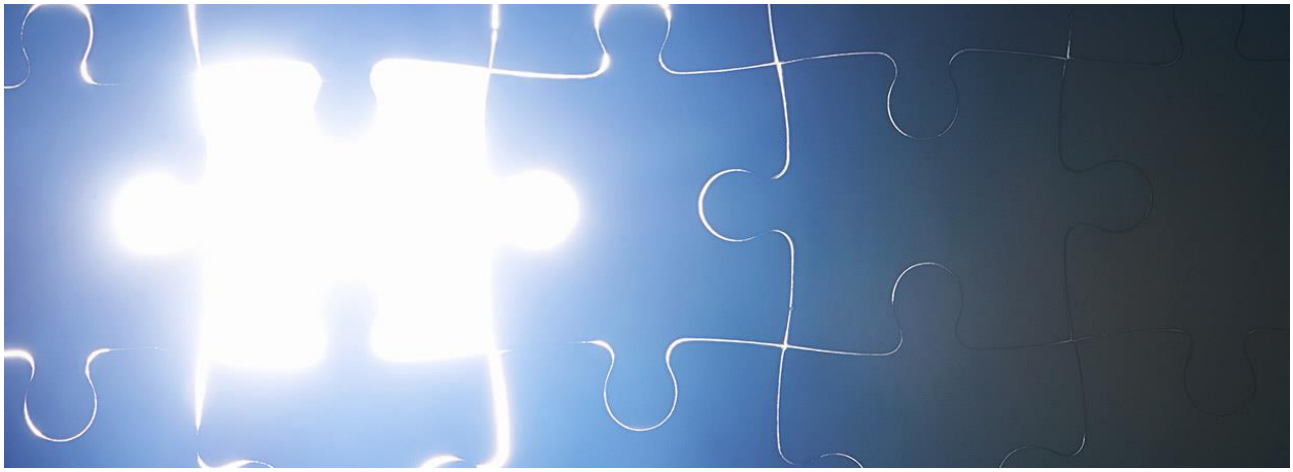
1. Introduction

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. Purposes of the Negotiating Panel Concept: roles and function

In order to fully understand the concept of Negotiating Panel, this Guide starts with explanation of wider goals in energy efficiency that must be understood in order to take appropriate actions. Therefore, the EU policy and legal framework has been briefly described. The three core directives – Energy Efficiency Directive, Energy Performance of Buildings Directive and Renewable Energy Directive – all impose certain obligations to the public sector and promote their "lead-by-example" role in achieving energy savings in their existing building stock. The European Union's Member States are further obliged to transpose these requirements into national legislation. Approaches differ among the Member States, however all of them are taking actions to improve energy efficiency in their public buildings. Buildings are the key in achieving desired energy savings by 2020 and beyond. One of the barriers preventing the higher uptake of the energy efficiency improvement measures is the lack of data and practices of continuous monitoring of energy consumption in the public sector's building stock. Therefore, introduction of comprehensive energy management system in the public sector is crucial step for enabling energy efficiency improvement.

This Guide is comprised so as to give detailed answers to the possible questions arising when introducing energy management in public buildings aimed at providing users' behaviour. After discussing energy policies, laws and regulation that form a framework for energy efficiency in public buildings, energy consumption in buildings will be analysed in order to obtain a general idea on the significance of the building stock in achieving policy targets. The role of energy management systems in buildings will be further explained, with the focus on the roles and responsibilities of different stakeholders, that can be gathered in the Negotiation Panel – formal set-up that will on interactive and informative basis decide on both behavioural and technical measures to be implemented at the building level in order to achieve defined targets.

This Guide is aimed at building owners, managers and users' representatives, who shall, after familiarizing themselves with the deliverable, be capacitated to tackle the issues concerning energy savings in their buildings.

1.3. Use of the Negotiating Panel Concept: roles and function

Energy management system rests on two pillars: 1) organisational structure with clear roles and responsibilities related to energy consumption and energy efficiency in a public building and 2) continuous monitoring of energy consumption and influencing parameters, which enables setting up the targets at building level and definition of technical and behavioural measures that will lead to the reduction of energy consumption.

All members of Negotiation Panel need to be acquainted with the main technical characteristics and systems of a building, and must be familiar with behaviours related to these systems that will lead to energy savings. Therefore, this Guide also describes behavioural aspects of using building's technical systems.

Finally, the Guide provides simple instructions how to establish a Negotiation Panel and how to use the established energy management system in a building to provoke consumer's behaviour change.

It has to be emphasised that, apart from this Guide, the TOGETHER project team has produced other guides that deal in more details with analytical and behavioural demand side management and energy management systems. All these guides should be combined in order to obtain a complete information and instructions how to establish systematic energy management practices within a building, which will in turn provide desired energy savings and other benefits like reduced negative environmental impact, reduced energy bills and increased level of comfort and quality of provided services within a public building.

2. Energy policy, laws and regulations

In order to better understand the energy issues and the connection of energy, environment and economical savings, it is necessary to first take a closer look into the EU and national energy policies, laws and regulations related to energy efficiency in building sector. It is the obligation of the community and individuals to implement these policies, so an overview of the same may prove helpful.

According to the Energy Efficiency Directive (EED; 2012/27/EU) the building sector is the world's largest energy consumer sector, overpassing the transportation sector in terms of final energy consumption. Buildings are crucial to achieving the Union objective of reducing greenhouse gas emissions by 80-95 % by 2050 compared to 1990. The rate of building renovation needs to be increased, as the existing building stock represents the single biggest potential sector for energy savings. Buildings owned by public bodies account for a considerable share of the building stock and have high visibility in public life. Member States should encourage municipalities and other public bodies to adopt integrated and sustainable energy efficiency plans with clear objectives, to involve citizens in their development and implementation and to adequately inform them about their content and progress in achieving objectives. Such plans can yield considerable energy savings, especially if they are implemented by energy management systems(EnMS) that allow the public bodies concerned to better manage their energy consumption. As set in Article 7 EED Member States should achieve new savings each year of 1,5 % of the annual energy consumption from 2014 to 2020. By 30 April 2014, and every three years thereafter, Member States shall submit National Energy Efficiency Action Plans. The National Energy Efficiency Action Plans shall cover significant energy efficiency improvement measures and expected and/or achieved energy savings, including those in the supply, transmission, and distribution of energy as well as energy end-use, in view of achieving the national energy efficiency targets referred to in Article 3(1) respectively Union's 2020 energy consumption has to be no more than 1474 Mtoe of primary energy or no more than 1078 Mtoe of final energy. The Article 5 sets a 3% annual renovation target for public buildings owned and occupied by its central government from the beginning of 2014 onwards. Central government buildings are required to be renovated to meet at least the national minimum energy performance requirements. According to Article 9 Member States shall ensure that, as far as it is technically possible, financially reasonable and proportionate in relation to the potential energy savings, final customers for electricity, natural gas, district heating, district cooling and domestic hot water are provided with competitively priced individual meters that accurately reflect the final customer's actual energy consumption and that provide information on actual time of use. [1]

Conforming to the Energy Performance for Building Directive (EPBD; 2010/31/EU), buildings occupied by public authorities and buildings frequently visited by the public should set an example by showing that environmental and energy considerations are being considered and therefore those buildings should be subject to energy certification on a regular basis. Exchange of experience between cities, towns and other public bodies should be encouraged with respect to the more innovative experiences. Articles 6 and 7 of the EPBD state that the Member State have to take the necessary measures to ensure that new and existing buildings (undergoing major renovation) meet minimum energy performance requirements, taking into account the use of high-efficiency alternative systems (e.g. decentralised energy supply systems based on energy from renewable sources; cogeneration; district or block heating or cooling, particularly where it is based entirely or partially on energy from renewable sources; heat pumps). In line with Article

[1] Directive 2012/27/EU on energy efficiency, October 2012

9 Member States shall ensure that by 31 December 2020, all new buildings are nearly zero-energy buildings (nZEB) after 31 December 2018, new buildings occupied and owned by public authorities are nZEB.[2]

By Article 13 of the Renewable Energy Directive (2009/28/EC) Member States shall ensure that new public buildings, and existing public buildings that are subject to major renovation, at national, regional, and local level fulfil an exemplary role from 1 January 2012 onwards. Member States may, inter alia, allow that obligation to be fulfilled by complying with standards for zero energy housing, or by providing that the roofs of public or mixed private-public buildings are used by third parties for installations that produce energy from renewable source.[3]

According to the revised renewable energy (RES) Directive from November 2016 the role of the consumers has been even more highlighted "consumers are the drivers of the energy transition[4]", thus changing their behaviour could significantly affect energy savings. Customers, respectively consumers are invited to actively participate in the energy management system, demand response (DR) and demand side management (DSM) and thus play a key role in the energy efficiency transition.

The above-mentioned directives are showing a path in which Member States should go and implement the items of the directives into national legislation.

[2] Directive 2010/31/EU on on the energy performance of buildings

[3] Directive 2009/28/EC on renewable energy sources

[4] Technical Memo Renewables: Revised Renewable Energy Directive, EC, November 2016, https://ec.europa.eu/energy/sites/ener/files/documents/technical_memo_renewables.pdf

Box 2.1 - Example from Members States: case - Croatian Energy Management System in the public sector

In December 2012, the Croatian Parliament adopted the Act on Energy Efficiency aligned with EED. Article 21 of the Act sets the duties for the public sector, in particular to: plan energy efficiency measures, manage energy and water consumption in an energy efficient manner, designate legal or natural person responsible for monitoring energy and water consumption, regularly monitor and at least once a month enter data on energy and water consumption in buildings in the national IT system for energy management and periodically, and at least once a year analyse the energy consumption in buildings, and report it to Real Estate Agency.

Regional governments and cities over 35,000 inhabitants are, by the aforementioned Act, obliged to prepare their three-year action plans and annual implementation plans. Three-year plans are made by the representative body, but annual plans are made by an executive body and the procedure is thus simplified. Plans on sustainable development of cities, which most cities already have as Sustainable energy efficiency action plans (SEAP) are complementary to these documents, so that there is already experience in the preparation and implementation of these documents.

The method of energy management, analysis of energy consumption and manner of reporting is prescribed by an ordinance issued by the Minister of Construction.

This Ordinance defines the obligation to the public sector to use the Energy Management Information System (EMIS). The purpose of EMIS is to determine the consumption of energy and water, to determine the place, manner, and amount of consumption in buildings or parts of public buildings and public lighting, reduce energy and water consumption and financial costs for energy and water, reduce the environmental impact through the implementation of energy efficiency measures. The Ordinance set a role for energy consultant/associate as a natural person responsible for the entry, monitoring, analysis and reporting process. The Real Estate Agency conducts regular training of designated persons, energy advisors and energy associates. Although public administration still should have a person responsible for monitoring consumption in buildings that are in their possession, those people will no longer have to enter bills in the EMIS. To improve the accuracy of the entered data, the obligation of entering monthly bills into EMIS now passes to the energy suppliers. People in charge of EMIS still need to control the data in EMIS, use consumption data for a more rational use of energy and, if necessary, enter weekly readings, but herewith their job is made considerably easier.

Connecting EMIS database with external databases store energy and water certainly would result in higher quality, more accurate, more regular data (which allows direct and "Real-time" consumption planning) not relying on manual entry (the error) users. The establishment of such inter-system communication would enable users to focus on itself Cooperation consumption, and thus had better manage consumption of its facilities. Through better management of its facilities allows the national "bottom-up" approach to consumption which is the goal to provide as a more accurate picture of the national energy and water consumption.

More information about Croatian EE Policy and implications for public sector can be found at the web site of Croatian National Energy Efficiency Authority: http://cei.hr/en/ee-policy/

3. Energy consumption in building sector

The total floor area of buildings is around 25 billion m^2 in EU, non-residential buildings represent more than ¼ of the total and are on average 55% more energy intensive than residential buildings (286kWh/m^2 compared to 185 kWh/m^2)[5]. In the EU around 1/3 of the consumption in buildings is for non-residential, however in some countries such as Luxemburg, the Netherlands, Italy, Portugal non-residential consumption in buildings is higher than in other MS and represent around half of the total consumption of buildings. The share of buildings in final consumption according to the last data from ODYSEE databases is represented in Figure 1. As shown, MS as Italy, Lithuania, United Kingdom, Denmark, Poland, Estonia, Hungary, Latvia, and Croatia are above the European average of 40% of final energy consumption in buildings.

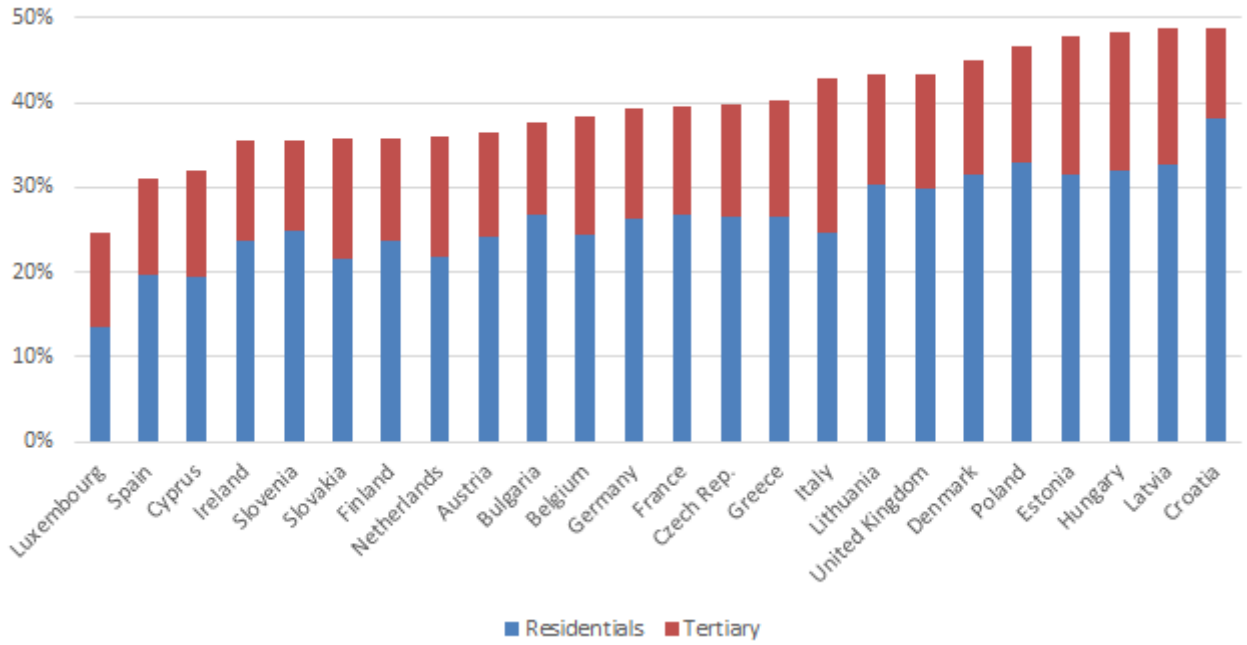


Figure 1: Share of buildings in final consumption (2014), source: ODYSSEE, Enerdata

Trends in the tertiary sector according to ODYSSEE databases show that energy consumption increased rather rapidly until 2008, and has been decreasing since the economic downturn in 2008, by 1.5%/year. On the other hand, electricity consumption has continued growing since 2008 but at lower pace (1.1%/year, against +3%/year before). Figure 2 shows decomposition of energy consumption in tertiary sector according to the fuel type, showing the dominance of electricity in most countries. However, there is no separated data for space heating, water heating, cooking, air conditioning and lighting in non-residential tertiary sector, which points out to one of the essential problems – lack of data gathered through actual monitoring of energy consumption in tertiary building sector.

[5] http://www.odyssee-mure.eu/publications/br/energy-efficiency-trends-policies-buildings.pdf

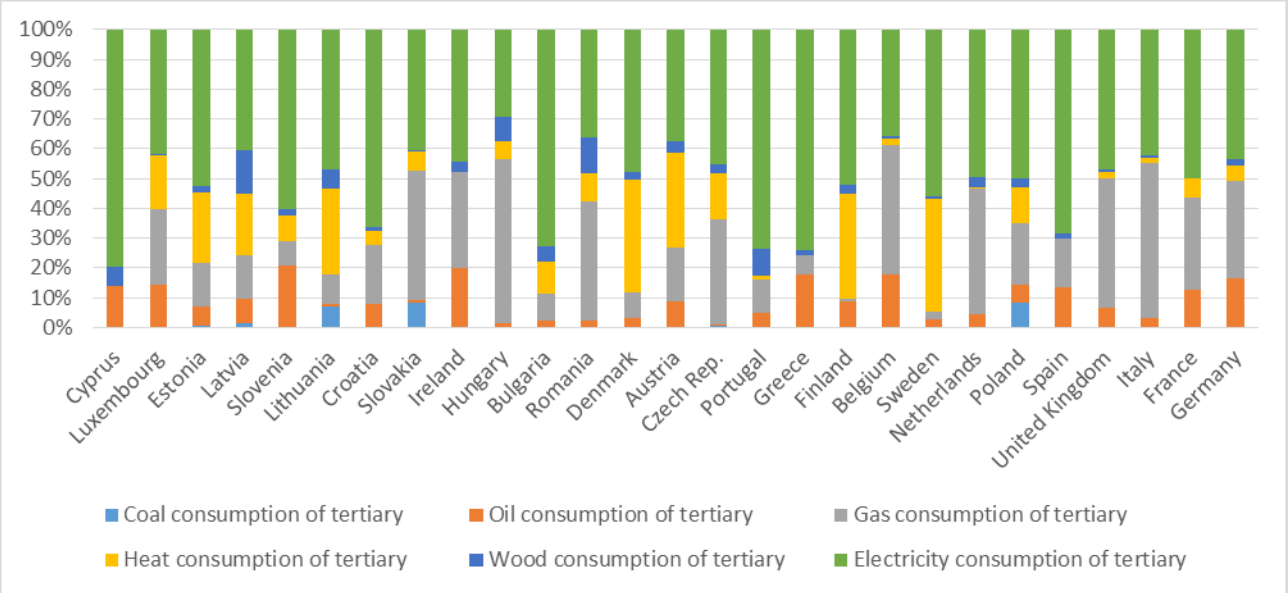


Figure 2. Share in final consuption in tertiary sector (2014), source: ODYSSEE, Enerdata

Is important to underline the lack of data for final energy consumption in non-residential building in the public sector. According to ODYSSEE and Enerdata only data for UK, Germany, the Netherlands, Romania, Sweden, and Denmark are available as shown in the Figure 3. Nevertheless, Italy, Croatia and Cyprus have provided data for electricity consumption in the public sector, but data for final energy consumption are absent.

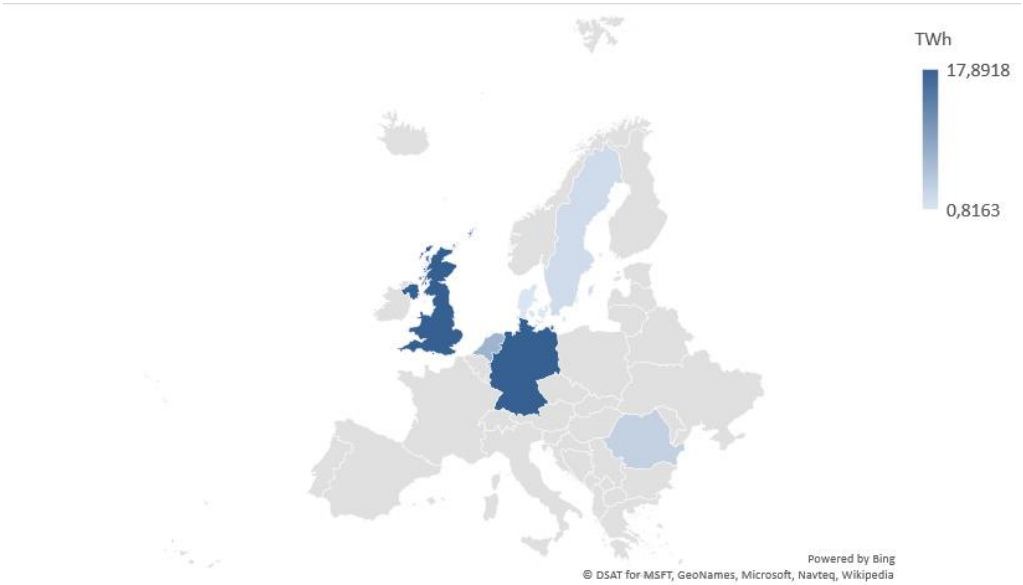


Figure 3: Final consumption of energy in public administration (2014), source: ODYSSEE, Enerdata

There is evident shortage in energy monitoring data in non-residential buildings both from private and public sector. This should be emphasized, especially for the public sector because it is heavily in collision with the main statements of EPBD and EED. Without a monitoring system of energy consumption, which is an essential part of any EnMS, it will not be possible to implement the most appropriate energy efficiency measures and deliver required targets.

4. Energy Management in buildings – a general concept

Energy Management in buildings rests on two pillars as demonstrated in Figure 4 – people and technology, or more detailed on:

- Organisational structure with clear roles and responsibilities (key stakeholders) and
- Comprehensive, all-inclusive Energy Management System that connects building users and technologies, enables monitoring of building energy consumption and relates it to habits, behaviour and maintenance practices within a building.

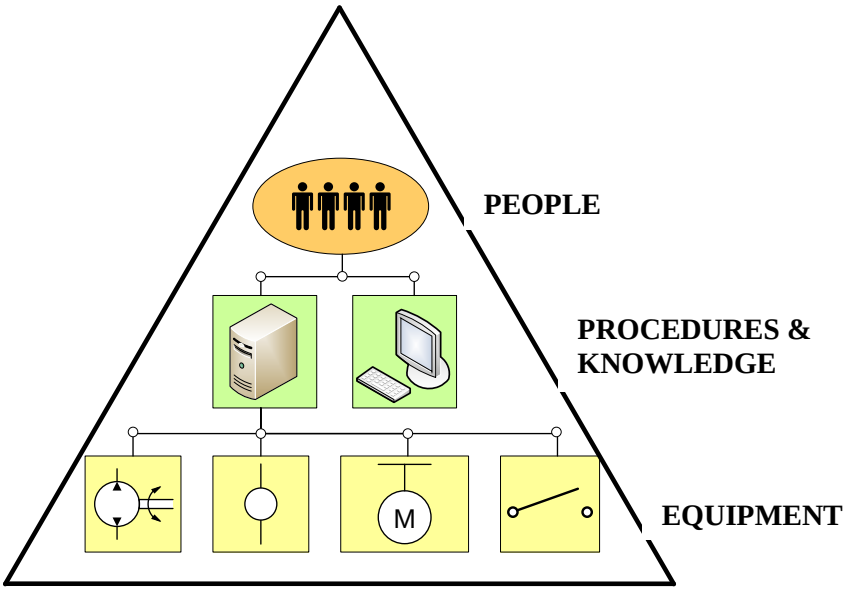


Figure 4: General concept of Energy Management System[6]

As indicated in Figure 4, by placing them at the top of the pyramid, special attention should be given to defining clear roles and responsibilities of key stakeholders (building owners, managers, and users/end users) in the process of energy management in buildings. Without people's consensus, any kind of energy management is impossible. Theirs roles and benefits should be clearly set before imposing any kind of energy management system and technology. It is crucial to set benefit recognition principle of all energy consumers in public buildings. This should be achieved through rising energy consumption awareness and approaching consumers with their actual consumption. In general population, there is mostly a lack of knowledge in reading energy and water consumption data from bills. In most cases, energy consumption data in a public building are "too far away" from an officer who is working in the building and whose energy consumption habits influence the total final consumption. To understand energy consumption, it is important to identify paths of energy consumption. Understanding the topic leads to measures for reducing energy consumption and thus related financial expenses. In developing an energy management

[6] Project "Removing barriers to energy efficiency in Croatia", 2005-2013, UNDP Croatia

concept for public buildings, besides building owners and managers, building users are of crucial importance.

Besides the fact that public buildings should set an exemplary role as standing in EPBD and EED, public building stock in EU is not negligible and non-residential buildings are more energy intensive then residential. It is very important to focus on their consumption expenses highlighting the attention on the amount of public expenditures that could be better relocated in case of reduction of energy consumption in public buildings.

After all interested parties have achieved better knowledge of the topic, a comprehensive approach must be considered in the process of introducing an energy management system in public buildings through a Negation Panel which will bring together representatives of all stakeholders' levels.

Regarding technology, smart metering and demand side management tools enables people to measure savings and manage consumption. People should meet technology, employees responsible for energy monitoring should be educated to use IT tools for monitoring consumption as smart meters for electricity, heating and cooling and water consumption and interpret the obtained data and thus manage consumption. For reducing energy and water consumption the first step is to measure it because without measuring something, you cannot manage it.

As shown from the illustration in Figure 5, building owners, building managers, building users and end-users should be members of the Negotiation Panel. Interests, roles and responsibilities of key stakeholders in the process of energy management will be elaborated in the following chapter.

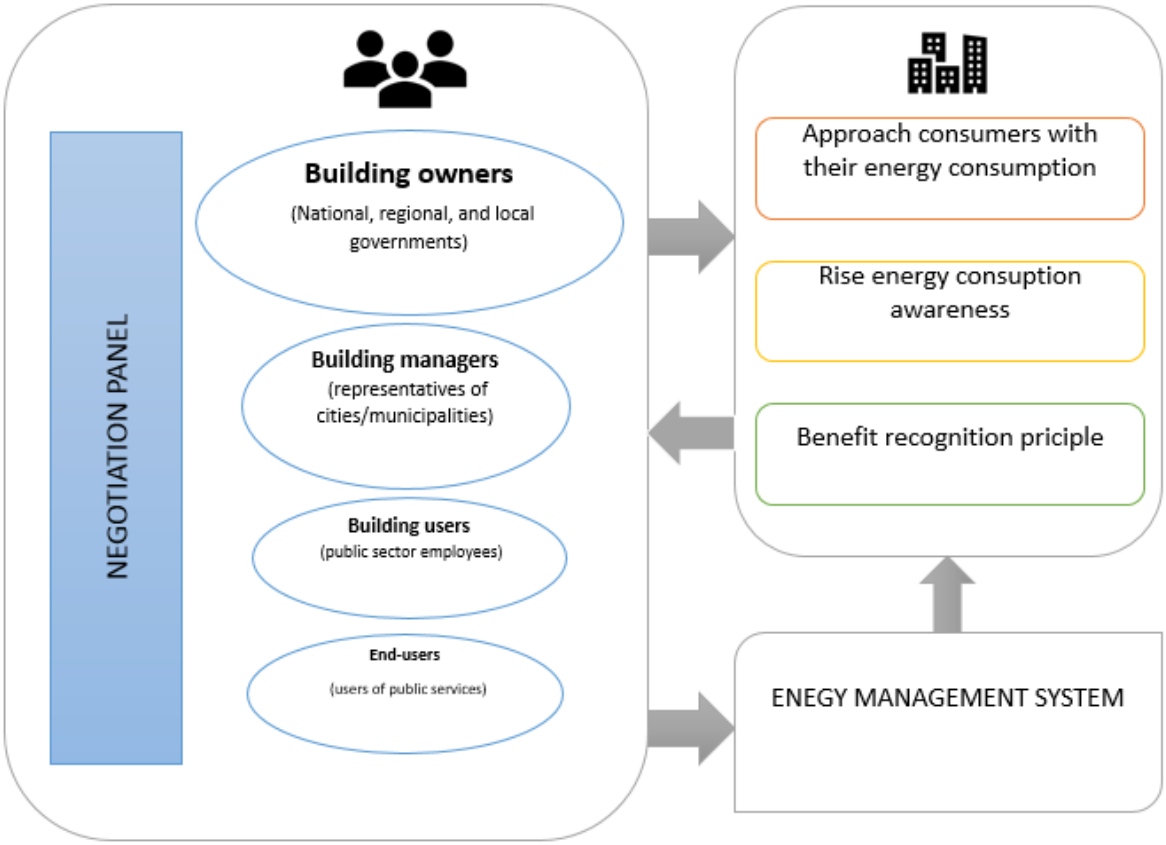


Figure 5. Inclusive energy management system approach

5. Key stakeholders in the Building Energy Management process

The key stakeholders in the building management process include building owners, managers and users/end-users. The said stakeholders have a high responsibility in carrying out energy goals and activities and they must be members of Negotiation Panel that will make decisions on implementation of measures agreed within the Building Alliance. They are “leaders of a change” and their roles are discussed in the subsequent sections.

5.1. Building owners

Building owners are representatives of cities/municipalities, which hold the jurisdiction over a public building. They need to ensure the implementation of the overall city/municipality energy efficiency policy and delivery of desired energy consumption and emission reduction targets.

5.1.1. Interest and motivation

The function of representatives of city/municipalities is to fulfil European and national obligations. According to Article 5 of the EED, 3 % of the total floor area of heated and/or cooled public buildings has to be renovated each year and reports for NEEAPs have to be submitted each year according to the EED showing that 1.5% of energy savings have been achieved. Without showing that energy efficient measures have been achieved in public building stock it is impossible to accomplish European targets. If you cannot measure energy consumption, you cannot manage it and thus achieve energy savings, which should be the main motivation for the representatives to introduce energy management systems.

5.1.2. Role and function

Building owners should be the initiators for energy management system introduction. Since the Building Alliance will lead to some changes in the way of doing business, building owners should carefully consider the way of its introduction. Their first step is to set up a Negotiation Panel and to determine roles and reporting hierarchy. The Negation Panel should include building managers, users and end-users but indisputably the main role should be assigned to a building manager whose responsibilities, role and function will be discussed below.

5.1.3. Responsibility and potential influence on energy use

Building owners should supervise the work of the building managers and the fulfilment of short and long term energy saving targets, but in the same time building owners should emphasize the importance of this kind of projects, demanding regular reports and publishing successes, which contributes to motivation and commitment to the project. The responsibility of building owners is to achieve national and European energy efficiency requirement and to report the accomplished energy savings targets to national bodies responsible for gathering data for annual reports of NEEAPs.

5.2. Building managers

The role of the building manager has gained importance in the past several years, as they need to “know” the building inside out in order to appropriately be able to manage it.

5.2.1. Interest and motivation

Every project should have an owner, a responsible person who oversees the implementation of the project and who will bring it to a successful conclusion. Before setting any kind of energy management system it is important to implement the Building Alliance, which would be the task of a building manager who is also an energy manager. The development of a Building Alliance will set short and long term energy saving targets and their achievement is the task of the building/energy manager. It is in their interest to accomplish results set in a Building Alliance, which will be reported to the building owners.

5.2.2. Role and function

The role and function of the building manager is to monitor, analyse and report energy and water consumption data. In the process of gathering data robust data acquisition should be achieved based on historical data (monthly consumption), data from energy audit (building envelope, existing equipment, and time of usage, etc.) and higher resolution data (real-time or near real-time). Higher resolution data allow building/energy managers to identify consumption dynamics that would not otherwise be observed if only historical data was available. This is the key for performing automated controls schemes, where an action is required in real time, which is the task of building/energy managers. Energy consumption data should be reported monthly to building owners and therefore to the Negation Panel in order to influence energy consumer's behaviour. The achievement of short and long term energy savings targets should be monitored from EMIS and reported to building owners.

5.2.3. Responsibility and potential influence on energy use

Before approaching building owners through EMIS, building/energy managers should be educated about the architectural and technical characteristics of a building, because it is impossible to manage something that you do not comprehend. Once sufficient knowledge is acquired, it is their responsibility to consciously monitor energy consumption and to achieve short and long term energy saving targets set in the Building Alliance. They are the referent persons for energy management and key stakeholders in the Negation Panel, which means that they should daily monitor energy consumption paths and to set alarms and notify others in case of excessive consumption.

5.3. Building users (public-sector employees)

The third key stakeholder refers to the building users. Although they are not directly responsible for the building, they need to be aware of steps being taken and activities carried out in the building. Dominantly, we will deal here with the public-sector employees that are doing their every-day job in the observed building. Their participation in all energy related activities as well as in Negotiation Panel are necessary as their habits and behaviour have significant influence on the building energy use.

5.3.1. Interest and motivation

Public sector employees represent the majority in the hierarchy of stakeholders, hence their behaviour can significantly change the consumption paths. Benefit recognition principle in their case is crucial and does not only refer to reducing bills but to set rewards to those who are more energy efficient conscientious.

The "reward" concept is elaborated in the "EURONET 50/50 MAX project–increasing energy efficiency in public buildings through change of behaviours" funded by IEE program, which actively involves building

users in the energy management process and teaches them sustainable behaviours through practical action setting economic incentive to save energy, both for building users and for local authorities who pay the bills: 50% of the savings achieved thanks to the energy efficiency measures undertaken by the users is returned to them through a financial pay out; another 50% stays within the local authority that pays energy bills. This should set an example because as a result – everybody wins: building users raise their energy awareness, improve their energy habits and receive additional funds; local authorities pay less for energy used in their buildings; local community gets cleaner local environment.

The objective is to familiarize the users with the issue, provide explanations and allow for insight into possible results achieved through behaviour change.

5.3.2. Role and function

It is essential to define the most successful strategies for achieving the goal of permanently influencing the behaviour of building users. This can be achieved through dialogue in the Negation Panel for „soft measures“ and suggestions and official rules concerning energy management. Rules should be very simple, for example activate sleep settings on equipment, avoid the stand-by option, turn-off lights when out of office, avoid overheating of overcooling offices, closing windows etc. Incentives and rewards will simplify behavioural change of building users.

5.3.3. Responsibility and potential influence on energy use

The responsibility of building users is to consciously consume energy and respect the rules set in the Building Alliance. The more building users will adhere to energy consumption rules, the better energy savings targets will be achieved, which is also in interest of all upper ranked in the hierarchy.

5.4. End-users (users of public services)

The end-users are, in most cases, only partially connected or interested in the building they use for specific purpose. They may not be too interested in the detailed functioning of a building, but can nevertheless, if properly instructed, contribute to the energy saving or everyday functioning of a building. Their participation in Negotiation Panel is in some public buildings highly desired (e.g. students and parents in schools), while in other cases this is impossible (e.g. public pools and similar sport objects, administrative offices issuing different documents to various citizens, etc.).

5.4.1. Interest and motivation

As previously mentioned, the participation of some end-user in the Negotiation Panel is impossible but in cases the involvement of students and parents in education buildings is highly recommended. Teachers should involve students in energy efficiency groups with tasks of analysis and evaluation of the school’s energy situation, proposing energy efficiency measures, implementation of proposed measures and organisation of education and information campaign addressed to pupils, teachers, staff, and members of the school’s society. The achievement of the planned results is very important in student’s population, and achievement of “energy savings certificates” should additionally motivated them.

5.4.2. Role and function

In schools, teachers should carry pupils to energy tours through buildings to learn more about energy, energy use in everyday life, energy efficiency, RES, and climate change. For example, exposed posters on

energy savings next to switches should encourage students to turn off lights, measuring temperature, light brightness, and energy consumption from different devices, conducting surveys among other students, teachers and other staff could make them feel as an active part in achieving energy savings.

5.4.3. Responsibility and potential influence on energy use

Since in school's students represent the majority in terms of numbers, their behaviour significantly influences energy consumption. Teachers have the responsibility to educate students about the importance of energy, environmental consciousness, and climate change and how to be more environmentally friendly and save energy with small actions.

5.5. Summary

The Table below summarises the above described diversity of stakeholders, who need to be included in building energy management processes and activities.

Table 1: Stakeholders, who need to be included in building energy management processes and activities

Stakeholder	Interest and motivation	Role and function	Responsibility and influence on energy use
Building owner	• fulfilling European and national obligations • introduction of energy management system in order to measure and prove achievements	• initiators for energy management system introduction • introduction of Building Alliance • setting up Negotiation Panel	• supervising the work of the building managers and the fulfilment of short and long-term energy saving targets • reporting and publishing achievements
Building manager	• an "owner" of the project • successful conclusion of activities and delivery of short and long-term targets set in Building Alliance	• monitoring, analysing and reporting energy and water consumption data to building owners and Negation Panel • reporting achievement of short and long-term energy savings targets • stimulating behavioural change of users and end-users	• monitoring energy consumption • achieving short and long-term energy saving targets set in the Building Alliance • setting alarms of excessive consumption
Building users (employees)	• benefit recognition principle needed to motivate public sector employees	• members of Negotiation Panel • target groups for promotional and	• consciously consume energy and respect the rules set in the Building Alliance

		educational activities	
End-users (users of public service)	• high interest and motivation to achieve results (students) • motivation through inclusion in activities and promotional activities with awards for achievement (through competitions)	• target groups for promotional and educational activities • active participants on energy monitoring and energy saving activities • inclusion in Negotiation Panel if appropriate (e.g. students in schools)	• leaders of change in some cases (e.g. students) • high influence on energy consumption and sustainability of results

6. Energy Management System in Buildings

Energy Management System in a building connects people and technologies and uses ICT solutions to monitor and, in advanced applications, control energy consumption in a building. The information provide feedback to building managers and users about consequences of their energy related behaviour practices. This will further enable building managers to propose corrective actions (and discuss them within Negotiation Panel) both in terms of activities that will target users' behaviour change and technology improvements. In this deliverable, we only focus on users' behaviour. Therefore, the subsequent subchapters will provide a basis for building managers and users to better understand building technologies and their influence on energy consumption and to adjust their behaviour accordingly, thereby improving their buildings' energy performance.

6.1. General guidelines for energy management in buildings

Efficient and sustainable management of the building, all its elements and equipment may be achieved by the following guidelines:

- ✓ allow sunlight heating of premises;
- ✓ close the doors, windows, and other places where heat is lost;
- ✓ regular maintenance of gas and oil installations, pressures, burners, and heat exchangers because unclean heat burners and heat exchangers cause insufficient fuel combustion, and low efficient operation of the whole system;
- ✓ heat exchangers should be scale free, because little ticker layer of soil reduces heat transfer, consumes more fuel and the space will be heated less;
- ✓ radiators must be cleaned frequently to ensure that impurities don't prevent heat transfer;
- ✓ prevent furniture, curtains, or other coverage of heating devices because in this way heat transfer is reduced;
- ✓ maximise the use of daylight for illuminating premises;
- ✓ switch off the lights in the premises when people are out;
- ✓ regularly cleaning lightbulbs, pendants, and lamps, impurities absorb more than 50% of light;
- ✓ use table lamps and lamp where the illumination is needed most;
- ✓ rationalise the use of water;
- ✓ frequently clean and replace filters in air conditions to prevent that device becomes a pollutant;
- ✓ close the doors and windows if cooling is on, when ventilating turn cooling off;
- ✓ setting rationally the desired temperature in the premise;

- ✓ all the premises in the building must be regularly cleaned and ventilate (it also applies to the premises that are not used daily);
- ✓ equipment in premises and installation elements should be used according to the intended purpose, rationally and economically;
- ✓ regular audits and services of the installed equipment in order to eliminate shortcomings on time.

6.2. Architectural and construction elements

General safety and functionality of construction elements of the building are a prerequisite for achieving the set energy savings. A basic information about use and behaviour related to these elements is given here.

Airing of building space

Ventilation must be done before and after using the premises in the related working day. If the modality of using the premises changes or climate condition require so, the premises should be ventilated during the working hours repeatedly, for ingress of fresh air. To ensure complete functionality of the thermal envelope of a building, preserving physical characteristics of the external envelope and preventing uncontrollable water vapour condensation in premises is important to ensure thoroughly 10 minutes' ventilation 2-3 times per day opening all windows completely to have air exchanges and maintain necessary hygienic conditions. The ventilation should perform by opening the lower parts of the window for the ingress of fresh air, and upper parts for the outlet of hot air, if it is technically possible. After major physical activities, ventilation of premises must be done as quickly as possible by opening all elements, but taking care about the draft.

Use of windows and shadings in relation to heat and light gains

Natural light represents a valuable factor for quality improvement of working and living spaces. Daylight illuminates the environment of working and living places and is our contact with all that surround us. To make full use of daylight windows should be frequently cleaned, putting pots of plants and other objects near the windows and dark curtains should be avoided, tables should be positioned to maximise the daylight use. Sun protection elements reduce heat radiation inside the space, their proper use can avoid additional costs for cooling in summer and for heating in winter.

Besides increasing comfort, lifting, and lowering shutters depending on the season can lead to considerable energy savings. By lowering shutters, temperature in the room can decrease for 8*C, which directly reduces electrical energy consumption for cooling. In winter, lowering shutters allows heat retention inside the room which reduces consumption for heating.

6.3. Heating, cooling and ventilation

Heating, cooling and ventilation systems in a specific object allow the users to rationally manage and regulate the temperature in the building, thus creating a comfortable atmosphere. Installations of these systems need to be used in an efficient manner, together with the other architectural and installation elements for regulating the microclimate of the rooms. User behaviour practices in relation to use of heating valves, adjusting heating and cooling temperature are stressed hereafter as well as need for regular control and maintenance of these systems.

Radiator heating

During the heating season, heating represents majority of final consumption thus significant savings can be achieved with devices for heating control. It is important to know how to use the devices because in this way efficiency and functionality is increased. Heating elements should be placed so they can release heat unimpeded without blocking them with other objects or furniture. For enabling heat release, radiators should be regularly cleaned and ventilated to ensure good circulation of hot water; this way, saving of 3-5% can be achieved.

Thermostatic valves

Quality and rational use of energy is not possible without installation of thermostatic valves on heating elements. Thermostatic valves enable temperature control inside the premise according to use, people, and personal will of workers.

Boiler room

The work of the boiler room is mainly automatized with regular supervision of a qualified person. For efficient and correct work of the boil room it is necessary to:

- ✓ follow factory instructions and use authorized service personnel for handling and maintenance of boilers and burners;
- ✓ clean heat exchangers once a year;
- ✓ perform pressure control of water pipelines on the pressure of 6 bars every 5 years;
- ✓ perform services of gas boiler and circulating pump once a year;
- ✓ replace safety valve and measuring instrument (manometers and thermometers) every 3 years;
- ✓ visually inspect boiler room and electric command panel every 3 months;
- ✓ visually inspect and test gas leakage of electromagnetic valve once in 3 months and replace after 5 years;
- ✓ replace HV electrodes on the burner one a year;
- ✓ inspect the burner fan and remove dust from air intake once a year;
- ✓ inspect pressure switches every 3 months and replace them after 2 years;
- ✓ clean impurities catchers every 6 months;
- ✓ visually inspect pipelines and armature every 3 months;
- ✓ regular clean a chimney;
- ✓ maintain fire warning and extinguishing equipment;
- ✓ lead a boiler room diary.

Solar collectors

For making solar collectors perform their function the following instructions should be used:

- ✓ monitor the pollution and impurities on glass and clean it regularly in morning hours when they are cool;
- ✓ checking glass, sealings, quality of liquid, and construction correctness regularly;
- ✓ replace the liquid every 2 years and wash away sludge and dirt;
- ✓ hot water tanks should be cleaned from scale;
- ✓ keep the thermostat of mixer or sanitary water at the maximum of 50°C;
- ✓ keeping the pressure in the installation not lower than 1,5 bars;
- ✓ check freezing protection and pumps;
- ✓ ventilate the system;
- ✓ inspect overpressure in expansion room;
- ✓ visual check of collectors, check of automation, security valves;
- ✓ disinfection of hot water in collectors (with temperature above 70°C).

Air conditioning control

Temperature difference between inner and outer temperature should be not higher than 6°C. Apart the fact that it consumes much more energy, having the higher difference is also harmful for the health. In summertime, optimal temperature of inner space is 5°C lower then outer. Decreasing temperature for 1°C, increases energy consumption by 5%.

6.4. Lighting and other electric appliancies

A valid choice of electrical appliances and equipment as well as rational and responsible behaviour of the users allows for achieving significant savings of energy.

When purchasing electrical appliances, energy efficiency classes must be considered thus buying more energy efficient devices is an imperative in the public sector. Energy consumption difference between class A and D ranges between 30 and 45%. It is also important to consider the actual needs avoiding buying power oversized devices. The use of modern lighting devices instead of incandescent light bulbs and cleaning luminaries at least twice a year can increase energy savings significantly.

Indoor and outdoor lighting should be turn on when needed, depending on the daylight illumination (light switch timers should be turned on and off depending on daylight illumination and season). Artificial lighting should be applied only when daylight illumination is insufficient. Lights should be turned off when leaving the room.

Switch clock for water pumps has to be set to work during working time. Reducing water consumption, decreases electrical energy consumption for driving the pumps.

Larger electrical appliances should mostly be used during low tariffs periods, if working hours allows it, and should be plug off when not in use. Avoiding "stand by" mode is also important because in this mode energy is consumed. Computers must be turned off when not in use, if not possible, at least turning off the monitor.

The key task of employees is turning off appliances when not using them.

6.5. Smart metering and monitoring of energy consumption

By introducing smart metering for monitoring energy consumption in buildings and the reports created thereby, it shall be easier to continuously monitor the energy consumption and analyse consumption per object/group of objects. This is the basis of systematic energy management. **Studies have shown that monitoring consumption and costs has the highest impact on behaviour change, education, and motivation for end users. Without approaching consumers with their actual consumption in real time it is impossible to achieve savings. With real time monitoring consumption systems users have a direct approach with consumption trends and costs which is the first step for behaviour change.** The framework for enabling behaviour change will be further discussed in the chapter regarding the Negotiation Panel Concept.

6.6. Benefits of systematic energy management

The benefits of using such a system include: energy savings, cost reduction, better comfort for users, reduction of the CO_2 gas emission etc. The said benefits are important for raising awareness of users and shall improve users' motivation.

According to some case studies, with good demand side management global savings of 40% electrical energy and 10% of HVAC can be achieved. Proportionally by decreasing consumption, cost reduce, which is very important, especially for building owners, to have immediate financial benefit. Meanwhile, by reducing annual consumption for 1.5 % obligations in Article 7 of EED for reducing energy consumption are fulfilled. With consumption, GHG emissions also reduces which is important for achieving 2020, 2030 and 2050 EU targets.

7. Negotiating Panel Concept

The Negotiating Panel Concept is a relatively new term and therefore needs some explaining. Essentially, it is a group of people on a specific object/building who work together in a joint effort to reach the set goals of energy saving, thereby achieving mutual benefit (economic and environmental). The panel also works on changing the users' behaviour concerning energy savings in a specific building to achieve a more long-term impact.

Building a Negotiation Panel means involving all the participants, giving them the opportunity to participate in the systems development process as representatives of a target user group with the aim to improve the chances of successful systems.

In the Negotiation Panel, all participant are stakeholders. A key stakeholder is any stakeholder who is significantly affected by an organization's actions and/or has considerable influence on those actions, in this case those are building owners, building managers, and building users. External stakeholders are in this case end-users, or to be more specific people who are impacted by an organization's work as service recipients.

In the Negotiation Panel stakeholder's engagement is intended to be an ongoing process of maximizing the involvement of internal and/or external stakeholders to help craft, implement, and adapt strategies to achieve targeted outcomes.

The primary objectives of the Negotiation Panel are:

- Identifying and engaging key (building owners, managers, and users) and external (end-users) stakeholders and creating the necessary structures to carry out specific functions and tasks that are critical to goal attainment and require stakeholder engagement.
- Provide effective coordination, communication, facilitation, and other supportive conditions to achieve maximally effective engagement.
- Fostering a continuous learning environment to help building owners, managers, users and end-users to understand, contribute, implement and adapt strategies to achieve important goals in energy savings.

7.1. Enabling framework and setup of Negotiating Panel

Setting-up of Negotiating Panel within a building must be enabled by some preceding actions that will demonstrate commitment and determination to improve energy efficiency of public buildings. **These enabling activities may be summed in a formal or informal agreement (e.g. Building Alliance concept developed in the framework of the TOGETHER project) involving relevant stakeholders aimed at a common energy saving goal, that can be transformed in management savings to be re-invest for introducing demand side management activities in the terms of a win-win approach.** After the adoption of a new energy strategy for the building, more thoroughly explained in the deliverable covering the Building Alliance, the members of the Negotiation Panel should be focused on areas that have both internal and external reach:

- robust engagement of building owners, managers, users, and end-users in the strategic energy management planning process;

- external reporting on achieved energy saving results by social media, local reports on action plans etc.;

- implementation of the data driven decision making process.

The idea of the Negotiation Panel Concept is to build a common solution to a common problem, thus can be set through the following steps.

1. Identification of stakeholder's problems is the key for better understand them, also identifying in which role they are involved.

2. Informing building owners, managers, users, and end-users about their roles, expectations and responsibilities in the energy management and demand side management process by being open and honest to all of them.

3. Enable interaction in the Negotiation Panel internally and externally (other instructions for comparing results, savings etc.), focus on generating users' needs instead of identifying system requirements because users' needs stimulate creative thinking and all involved need to have open mind to what users express.

4. The iterative process of understanding users' needs and ideas has purpose of increasing the development of team's understanding of the users' situation, building users' knowledge about possible solutions and diverse perspectives and value the design decision throughout the process. Users get empowered since they can follow how their own expressions are being represented in the design, from an immature concept to a fully-fledged IT system.

5. Involving real users with real experience such as a person responsible for equipment maintenance on their everyday practices, in the early stages of the development process - theories and existing knowledge about particular users group shouldn't be ignored or excluded, but supplemented, verified and updated with the users' experience.

6. Influence in user's involvement has two different meanings: users can influence the development if they are involved early in the process, they can have actual influence on the development of new technological solutions instead of merely giving feedback od determined systems; the other one is that the possible influence of every stimulus applied in user involvement processes needs to be considered and discussed in the development team. Having actual influence contributes to empowering users, which in turn creates a positive spiral where the user's motivation to influence increases. To make this possible an open mind in the Negotiation Panel is needed.

7. Building owners, managers, users, and end-users should be inspired to change and developers of technologies for EnMS should be inspired to expand their solution horizon. Members of the Negotiation Panel should be inspired to express themselves in their own terms and talk about their situation and the goals they aim to achieve in everyday life. To inspire developers, members of the Negotiation Panel should be inspired to envisage a desired future state and describe this state, which open up new and better solutions. Creative thinking expands user's boundaries.

8. Creating an open climate in which all members of the Negotiation Panel feel comfortable about revealing their thoughts - encouraging them to open up and illuminate vital aspects about their behaviour becomes possible to design the implementation of EnMS according to the situation.

9. Representation of users' needs should be integrated in the EnMS to increase the chance that the final system will provide an added value. When the EnMS is introduced, it should be integrated in the user's real world context based on the knowledge gained in the interaction process.

10. The final phase implies implementation. One of the focal points for involvement of members of the Negotiation Panel is to implement and test the results in the real-world environment. It is important to keep attention on users in this phase of implementation because people in general have reluctance to change their behaviour, they must be encouraged and reminded to use the implemented system on a regular basis.

7.2. Behaviour Change Approach

One of the main ideas of the project is long-term change of behaviour concerning the energy-related issues. In order to realize the set gaols, **it is necessary to try and change the behaviour of all users (owners, managers, users and end-users) by influencing their set ideas. The User Behaviour Transformation Methodology is shown in Figure 6.** User behaviour transformation methodology consists of preparation, execution and checking.

After thorough examination of EU, national and local policies and their reflections at the local, building level, an energy audit of the public building has to be made in the preparation phase of introducing EnMS, which will provoke behaviour change. Goals have to be set depending on what is possible to achieve and what cost is acceptable for achieving this. It is necessary to define a **Behaviour Toolbox, which should include smart metering (to provide immediate feedback to the users about consequences of their behaviour) and users' involvement instructions**. Humans' actions are generally dependent on the questions that are asked and answered by our sub-conscious mind:

- Is there a problem?
- Do I care?
- Do I know what to do about it?
- Will the solution work?
- What will others think about what I do?

When attempting to change the behaviour of other people we need to use various educational and motivational techniques, that are described in more details in Demand Side Management (DSM) training material, developed under the framework of the TOGETHER project and available as free tool (downloadable on line from the project website).

In the execution phase, smart metering and monitoring energy consumption is of great importance. It will enable users to compare previous and present consumption data. When installing a real time metering device for the first time, it is impossible to have previous real time data, hence historical data from bills will be the first reference. The program of energy consumption monitoring has to be launched officially, involving all the users so that everyone is aware and committed.

In the checking phase, intermediate results analysis and review of progress is needed for performing adjustments and reviewing of goals is needed as well as making of short intermediate reports about the

progress. A final report should be issued stating the results compared to the goals. This is the key for behaviour change in energy consumption.

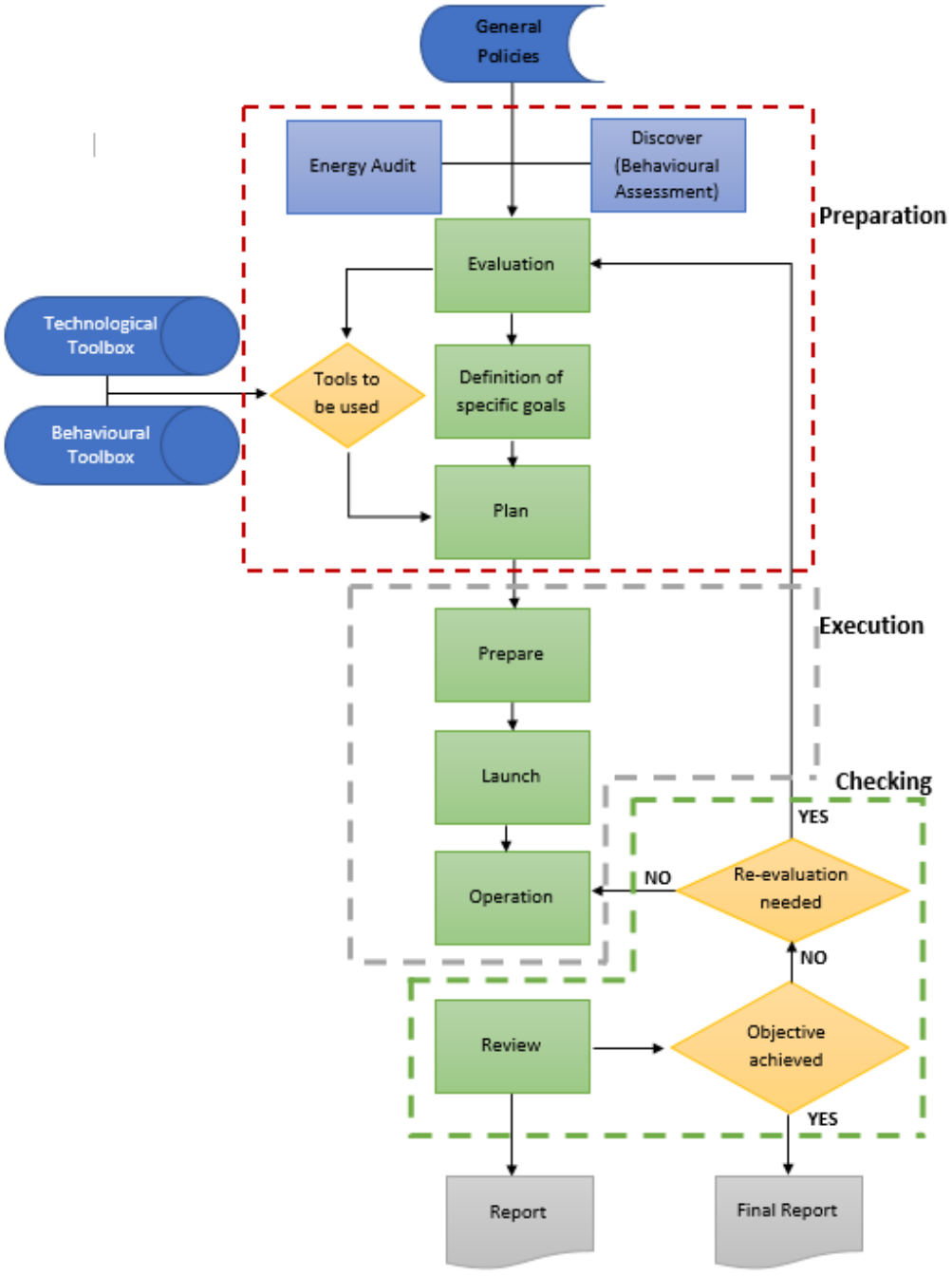


Figure 6. Behaviour Transformation Methodology[7]

[7] Source: "Motivating for Change", Snap Solution Portugal

8. Conclusion

Buildings are in the centre of the EU's energy and climate policy. They are responsible for more than 40% of final energy consumption. As existing European building is likely to stay here for many years to come, it is obvious that determined and coordinated actions are needed at national levels to improve energy efficiency of existing buildings. Public sector has a key role to play, because it has the power to "lead-by-example", i.e. to demonstrate that energy efficiency can be improved and that is has multiple benefits. The share of public buildings in total energy consumption cannot be determined precisely due to lack of data, which only shows that there are no wide-spread practices of detailed and continuous monitoring of energy consumption in the public sector.

Therefore, there is a need to introduce comprehensive energy management systems in public buildings. Only by doing so significant energy savings at no or low costs can be achieved through better understanding of energy consumption patterns and consequential definition of improved operational and maintenance procedures as well as activities that will change stakeholders' behaviour towards more energy efficiency choices.

This Guide provides basic information about such an approach and focuses on roles and responsibilities of different stakeholders that are relevant for energy efficiency improvements at building level. These include building owners, building managers, building users and end-users (users of services provided within a building).

The main message/conclusion of this Guide is that **energy efficiency improvements and energy savings cannot be achieved without people - those who have direct influence on the pattern of energy use in a building (managers and users) but also those that are paying the bills and are responsible for contributing to higher national and EU targets (owners, i.e. local authorities). T**hey all need to be summoned in a formal assembly – Negotiation Panel.

The role of Negotiation Panel is to monitor energy consumption and to agree, on democratic principles and open communication, about measures that will be undertaken in a building in order to reduce its energy consumption. The emphasis is on provoking behavioural changes related to the use of building components and systems, hence the general instructions on energy efficient behaviour has been given in this Guide. Moreover, general instructions on how to approach people and how to provoke change of behaviour are given. The approach includes good preparation of activities in which different educational and motivational methods should be used. In execution phase, it is crucial to introduce people with the results of their behaviour through real time metering and monitoring of energy consumption. This wax, behavioural and analytical part of energy management system are closely connected. Continuous monitoring will reveal deficiencies in implemented activities, will enable re-definition of these activities and will eventually deliver desired results in terms of energy savings.

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Pictures of graphical design

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Glossary

DSM	-	Demand Side Management
EE	-	Energy Efficiency
EnMS	-	Energy Management System
EU	-	European Union

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