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Interreg Balkan-Mediterranean PRO-ENERGY

PROJECT

PRO-ENERGY – PROMOTING ENERGY EFFICIENCY IN PUBLIC BUILDINGS OF THE BALKAN MEDITERRANEAN TERRITORY

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Activity:	4.2. Capacity Building for Energy Managers - Training Curricula
Activity Leader:	Department of Electrical and Mechanical Services – Ministry of Transport, Communications and Works
Deliverable:	D4.1.2 Training Curricula

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INTRODUCTION

PRO-ENERGY is a transnational cooperation project, co-financed by the Cooperation Programme "Interreg V-B Balkan Mediterranean 2014-2020", under Priority Axis 2, Specific Objective 2.2 Sustainable Territories. The project aims at promoting Energy Efficiency in public buildings in the Balkan Mediterranean territory and to create a practical framework of modelling and implementing energy investments interventions, through specific ICT monitoring and control systems, as well as through energy performance contracting (EPC). The specific objective of PRO-ENERGY is to reduce by more than 20% the energy spending in public buildings of the participating entities in one year after the implementation of pilot actions.

Based on the above, Work Package 4 (WP 4) "Capacity Building for Energy Managers" capitalizes on knowledge & results of WP3 & includes the identification/selection of trainees (energy managers), the assessment of their training needs, the design & development of training curricula on topics such as energy management process, monitoring, targeting, energy auditing, solution development, regulations& standards, development& management of energy projects, financial tools & techniques with emphasis on energy performance contracting etc., the organisation of training sessions (eLearning, study visits, seminars etc.) & the evaluation of training sessions.

More specifically, Activity 4.2."Training Curricula" aims at developing training curricula on energy related topics on the basis of the thematic areas that were identified following the assessment of the training needs. Such training material will be addressed to the trainees (energy managers) that were identified and selected at previous stage.

1. Scope

As mentioned above, the project aims at promoting Energy Efficiency in public buildings in the Balkan Mediterranean territory and to create a practical framework of modelling and implementing energy investments interventions, through specific ICT monitoring and control systems, as well as through energy performance contracting (EPC). The specific objective of PRO-ENERGY is to reduce by more than 20% the energy spending in public buildings of the participating entities in one year after the implementation of pilot actions.

Against this background, the project addresses the policy & institutional level (Joint Strategy & Action Plan), human resources level (Capacity Building for Energy Managers) & the managerial systems level (open-source ICT Platform & CBA Modeller & Energy Performance Contracting-EPC).

In the frame of the human resources level, this action aims at developing the training curricula on energy related topics on the basis of the thematic areas that were identified following the assessment of the training needs. Such training material will be addressed to the trainees (energy managers) that were identified and selected at previous stage.

Through this activity the project will achieve enhanced capacity of participating territories and other stakeholders and deliver the following results:

- 15 training sessions
- 200 civil servants trained
- 500 stakeholders from all territories trained

2. Methodology for the implementation of the activity

The methodology for the implementation of the action was set by PB4, EMS that is the lead partner for this activity, in collaboration with all other partners. The methodology is common to all project partners. More specifically, on the basis of the results that came up from the web-survey for the identification of trainees and training needs, the coordinator has developed a study guide presenting the main thematic categories for the material that will need to be developed by the partners. Each partner will be contributing to a different thematic as per table that is being presented below.

The Study Guide aims to increase the knowledge, skills, and competencies of trainees on EU-related technical aspects in public buildings, with a particular emphasis on integrating different solutions, selecting the best scenarios, and ensuring effective monitoring and trainee involvement in the proceedings. It is structured in Units and includes a brief introduction, purpose and expected learning outcomes, keywords/key concepts, annotated bibliography, aiming at a more meaningful understanding of the content, terms and concepts of each Unit.

The Study Guide is divided into 6 educational modules presented in the following table:

Units	Topics
Section 1	Legislative framework for energy efficiency
Section 2	Energy efficiency of buildings
Section 3	Energy-saving - Shell thermal insulation - RES
Section 4	Energy behavior
Section 5	Ways to save energy
Section 6	Good practices of energy saving in public buildings

For each module, there is a comprehensive theoretical introduction. For supporting the trainers in the preparation of the respective training sessions, further suggestions are also included regarding:

- list of reference material that helps to address specific issues in more detail.

What is very important for the Study Guide of the PRO ENERGY project is that it provides not only knowledge but also real aspects related to the implementation of energy efficiency

improvements in public buildings, such as the selection of best performance scenarios, overcoming the most typical obstacles or incorporating different types of synergies.

Against this background, it was decided among the partners that the contribution of each under each topic will be as follows:

	Thematic Areas	Partners				
		LB-RE-RUT	PB2-DEA	PB3 - CEA	PB4 - EMS	PB5 - RDA
1	Legislative Framework for energy efficiency		*			*
2	Energy Efficiency of buildings	*				
3	Energy Saving			*		
4	Energy Behaviour	*	*			
5	Ways to save energy					*
6	Good practices			*		

The current deliverable concerns the contribution of the Region of Epirus - Regional Unit of Thesprotia and more specifically with regard to the following Units and Topics:

Units	Topics
Section 2	Energy Efficiency of buildings
Section 4	Energy behavior (in collaboration with Development Agency of Evia, DAE)

On the basis of the above table and with regard to Section 2, the Region of Epirus - Regional Unit of Thesprotia will be developing the training curricula with regard to Energy Efficiency of buildings on the basis also of the recommendations included in the study that was submitted by the coordinator of this activity, PB4.

With regard to Section 4, the Region of Epirus - Regional Unit of Thesprotia will be contributing to this thematic together with the DAE. More specifically, on the basis of the study guide that was developed by PB4, Region of Epirus - Regional Unit of Thesprotia will be contributing to the part referring to Energy efficiency measures and Feedback.
The next sections present the modules in more detail, providing also relevant presentation in a form of an Annex at the end of the current deliverable.

SECTION 2

Energy Efficiency of buildings

1. Section 2: Energy Efficiency of buildings

Today's societies increasingly rely on energy to meet their daily needs. These needs are often met using energy in various forms, such as heat (thermal), light (radiant), motion (kinetic), electrical, chemical, nuclear, and gravitational energy. Energy transformation is the process of converting one form of energy into another (for example, fuel into electricity). During these processes, there are energy losses inherent in the technologies used and the thermodynamic constraints.

Energy use is essential for development, but it has negative effects on the environment - climate change, pollution, depletion of resources, and the destruction of ecosystems. Energy efficiency is important for countries because it mitigates external energy dependence, reduces energy imports and energy costs. It helps reduce the negative environmental impacts associated with energy use, conserving local ecosystems, alleviating energy poverty (lack of access to energy), and increasing the competitiveness of energy-dependent businesses.

Improved energy efficiency across the energy chain, involving energy production, transmission, distribution, and end-use through efficient technologies or behavior or economic change, benefits the environment, improves air quality and public health, reduces greenhouse gas emissions, improves energy efficiency by decreasing reliance on energy imports from outside the EU, lowers energy prices for households and businesses, aids in the alleviation of energy insecurity, contributes to improved productivity, more opportunities, and increased economic growth in the economy, thereby improving citizens' quality of life.

This section includes three modules as being presented in the following table:

Modules	Topics
2.a	Energy Efficiency of buildings: Objectives of the European Union
2.b	Energy Efficiency of buildings: Energy control
2.c	Energy Efficiency of buildings: Energy efficiency measures

The current deliverable presents all three modules.

1.1 Module 2.a. - Objectives of the European Union

The European Union has placed a set of carbon and energy efficiency targets to be achieved by 2020, 2030, and 2050.

Target 2020:

• 20% improvement in energy efficiency - [Energy efficiency Directive (2012/27/EU)], which will lead to a reduction of primary energy by 368 Mtoe.

Target of 2030:

• At least 32.5% improvement in energy efficiency - [Energy efficiency Directive (2018/2002/EU)], which will lead to a reduction of 1 273 Mtoe of primary energy and 956 Mtoe of final energy.

Target of 2050:

• Make the EU a "Neutral Climate" - [A clean planet for all (COM (2018) 773)], which means reducing greenhouse gas emissions by 80-95%.

According to the Directive, at all phases of the power chain, including energy generation, transmission, delivery, and final usage, all EU countries are expected to use energy more effectively.

Construction is the only European energy producer responsible for about 40% of energy demand and around 36% of CO2 emissions in the EU. Therefore, refurbishment of old buildings can lead to considerable energy savings and play a key role in the transition to renewable energy. The economy, particularly the construction industry, is also boosted by investing in energy efficiency. The energy certification of buildings consists of the buildings' evaluation according to their energy efficiency. It allows building owners to know how well their buildings perform and what measures are needed to improve energy efficiency.

Heating and cooling in buildings account for half of EU energy consumption. Households and industry account for much of this energy. Co-generation - the simultaneous production of electricity and heat - is an effective way to increase the efficiency of power stations by producing electricity and useful heat. In a typical power plant, heat is often lost through chimneys. In a co-generation unit, this heat is recovered for use in buildings. Power generation, industrial processes, and waste incineration are some of the activities with great potential for co-generation.

EU energy labels offer a direct and easy indicator of a product's energy quality at the point of sales, enabling consumers to shop for more reliable devices. The EU has introduced regulations to solve this problem, and there is a need for environmentally sustainable

products that help limit electricity and other natural resource consumption while improving overall sustainability.

EU eco-design regulation is an important mechanism for enhancing commodity environmental sustainability by establishing uniform minimum energy efficiency requirements. This reduces the lowest-performing brands from the industry. These regulations are mainly aimed at product manufacturers. Eco-design regulations apply to various products, such as lighting and home appliances, heating and cooling appliances, specific electrical appliances, and other products.

The EU has expanded the availability of public services for energy conservation. However, in order to meet the Energy Union's goals and promote the transition to a renewable energy system, more private financing, especially for energy efficiency initiatives, must be made available. It is expected that an extra € 177 billion a year will be needed to achieve the EU's energy and environment goals for 2030 between 2021 and 2030.

1.1.1. Module aim

By completing this thematic module, trainees will be familiar with key energy concepts and energy-efficient technologies and behaviors. The unit will provide a better understanding of the energy efficiency benefits, the energy management process, its stages and activities, and how energy efficiency can be applied to buildings. During the seminar, European energy efficiency policies and regulations will be presented to trainees. In addition, participants will focus on trends, future needs, and employment opportunities regarding energy efficiency.

1.1.2. Learning outcomes and keywords

Upon completion of the module, trainees are expected to understand, know and apply the following terms and definitions:

- Energy efficiency
- Energy certification of buildings
- EU energy labels
- Co-production
- Ecological design
- Energy efficiency measures (EEMs)
- Energy efficiency action plan
- Project implementation

- Energy transformation
- Energy supply
- Energy cost

Keywords:

Energy efficiency	Energy saving
Energy consumption	Energy control
Energy monitoring systems	Energy use
Energy management	Renewable sources

1.1.3. Teaching material

For the educational needs of this unit, material from the following books will be used:

[Energy efficiency - general]

1. Reference document on best available techniques for energy efficiency (2009), European Commission

2. Erbach Gr, Understanding energy efficiency (2015), European Parliamentary Research Service | Briefing

3. Energy Efficiency Manual (2019), ECOAP Public Energy Efficiency Program Public Administration, (Portuguese)

4. Energy efficiency technologies and benefits - Module 12 (2009), Sustainable Energy Regulation and Policymaking for Africa

5. Energias de Portugal, Practical Guide to Energy Efficiency, 2006, Energy Agency

6. How does saving energy help the environment (2020), Save on energy, accessed 18 June 2020, URL: https://www.saveonenergy.com/learning-center/energy-saving-tips/how-does-saving-energy-help-the-environment/#:~:text=Protect%20the%20air%20and%20prevent, oil% 20or% 20other% 20fossil% 20fuels.

7. The energy conversion chain (2019), Global warming causes, accessed 18 June 2020, URL: https://www.briangwilliams.us/sustainable-energy/the-energy-conversion-chain.html

8. Olende et al, Lighting the way - Toward a sustainable energy future (2007), InterAcademy Council

9. Maldonado E., Energy in the EU Outermost Regions, Renewable Energy, Energy Efficiency | Final Report (2016),

URL:https://ec.europa.eu/regional_policy/sources/policy/themes/outermost-regions/pdf/energy_report_en.pdf

10. Clean Energy for Islands Initiative- European Commission

[European policy]

1. Energy Efficiency - European Commission

2. Directorate - General for Energy, EU energy in figures - Statistical pocketbook (2019), European Commission

3. Our vision for a clean planet for all (2018), European Commission

4. Energy efficiency trends and policies in Portugal (2018), Agenciapara a Energia

Presentations linked to Module 2.a. are being included as an Annex in the current deliverable.

1.2. Module 2.b. - Energy control

Energy is becoming an increasingly expensive cost for organizational structures. Energy use represents not only an economic cost but also an environmental cost, so it is vital for awareness, economic and environmental sustainability through energy efficiency. As environmental problems become more apparent and affect our daily lives, the need for good management of this resource is evident in large and small organizations. Energy management is an ongoing process that understands energy efficiency as a global commitment and uses data to better understand and make decisions about energy use. The ultimate goal of energy management is to ensure that less energy is used to maintain or improve the quality of services. The energy management process usually begins with an energy audit, where energy flows are identified and quantified, and existing energy systems are analyzed. These energy accounting tasks allow the definition of an energy base. Opportunities for improving energy use are identified, and a set of energy efficiency measures are proposed, analyzed, and compared. A planning and organizing process for the selection of technically and economically feasible measures follows. A plan is being drawn up, which takes into account all the necessary resources for the effective implementation of the measures according to a predetermined timetable. The results of the implemented measures are evaluated through a monitoring and verification process in order to be compared with the expected results. New energy efficiency measures can be proposed, analyzed, and implemented in order to meet new requirements and achieve a continuous improvement of energy efficiency.

An energy audit consists of characterizing the amount, where, and how energy is used in a building. When scrutinizing the energy usage conditions of a given installation, the energy controller should be able to provide basic information on detectable deficiencies that allow key areas for energy efficiency improvements to be identified and an energy line to be established/suggest feasible solutions for addressing them, to verify the proper operation of energy systems, for user comfort and compliance with applicable laws.

In energy management, the planning and organizing phase can be summarized by drawing up an energy efficiency action plan, which describes the relevant conclusions reached during the energy audit and includes detailed instructions for implementing energy efficiency measures, which clearly state the entity's objectives and the expected results in their implementation. Establishing a timetable for implementing a measure and a robust verification strategy allows progress to be monitored by comparing actual results with projected results. As the preparation of this plan must involve the input of staff and other stakeholders, it ultimately

represents the entity's commitment to reducing energy consumption and improving energy efficiency.

1.2.1. Module aim

By completing this thematic module, trainees will be familiar with key energy concepts and energy-efficient technologies and behaviors. The unit will provide a better understanding of the energy efficiency benefits, the energy management process, its stages and activities, and how energy efficiency can be applied to buildings. During the seminar, European energy efficiency policies and regulations will be presented to trainees. In addition, participants will focus on trends, future needs, and employment opportunities regarding energy efficiency.

1.2.2. Learning outcomes and keywords

Upon completion of the module, trainees are expected to understand, know and apply the following terms and definitions:

- Energy efficiency
- Energy certification of buildings
- EU energy labels
- Co-production
- Ecological design
- Energy efficiency measures (EEMs)
- Energy efficiency action plan
- Project implementation
- Energy Performance Certificate (EPC)
- Energy Services Company (ESCO)
- Energy cost

Keywords:

Energy efficiency	Energy saving
Energy consumption	Energy control
Energy monitoring systems	Energy use
Energy management	Renewable sources

1.2.3. Teaching material

For the educational needs of this unit, material from the following books will be used:

[Energy management]

1. Guia 2 - Gestão de Energia (2019), ECOAP, (Portuguese)
2. Guidelines for Energy Management (2013), Energy Star
3. Energy Management priorities - a self-assessment tool, Carbon Trust, Energy efficiency, Best practice program
4. The What, Why, and How of Energy Management (2020), Energy Lens, accessed 18 June 2020, URL:https://www.energylens.com/articles/energy-management
5. What Is Energy Management & How Can You Use It? (2019), en-trak.com, accessed 18 June 2020, URL:https://www.en-trak.com/resources/energy-management-explained
6. Pita G., Energy Audit (2013), Téchnico Lisboa
7. Energy Efficiency, Environmental and Energy Study Institute (EESI), accessed 18 June 2020, URL: https://www.eesi.org/topics/energy-efficiency/description
8. Energy Audit Guide for buildings (2001), Finnish Ministry of the Environment, AX Consulting
9. Silva Torres P., (2014), Continuous Improvement Meets Energy Auditing: An Energy Audit Tool for IST, Technical Lisbon
10. Roberts Q., (2019), Getting bang for buck on your industrial energy audit, Efficient See, accessed 18 June 2020, URL: https://www.sageautomation.com/blog/getting-bang-for-buck-on-your-industrial-energy-audit
11. Your quick reference guide to energy auditing - the Australian / New Zealand standard 3598: 2014 (20014), Energy Efficiency Council
12. Purpose of M&V (2020), Efficiency Valuation Organization, accessed 18.June 2020, URL: https://evo-world.org/en/mv/purpose-of-mv

[Energy efficiency and ICT]

1. The role of ICT in Energy Management - Household Sector | 2018, World Energy Council
2. Schippl J., Weinberger N. (2009), Assessing the potential of ICT to increase energy efficiency and fight climate change - key technologies and prospects, STOA Science and Technology Options Assessment, European Parliament
3. Coroama, VC, & Hilty, LM (2009, September). Energy Consumed vs. Energy Saved by ICT-A Closer Look. In EnviroInfo (2) (pp. 347-355)

Presentations linked to Module 1.b. are being included as an Annex in the current deliverable.

1.3. Module 2.c. - Energy efficiency measures

Energy efficiency measures (EEMs) are any measures aimed at reducing energy use without affecting the overall performance of a building or the comfort of its trainees. There are two main types of EEMs: (a) behavior-based, which consists of reducing energy waste through changes in behavior and better planning of equipment operation, and (b) equipment-based, which involves the installation of higher energy efficiency equipment. Proposing energy efficiency measures must make sense both technically and economically. The environmental impact should also be an essential factor in choosing the most effective measures. In the energy efficiency action plan, the measures must be described and justified in great detail. Each measure must have a technical, energy, environmental and economic analysis with the help of actual data or the most reliable estimates possible. The implementation of the project is carried out by applying the proposed energy efficiency measures, including maintenance work and installation of new equipment, either with a complete replacement or with modifications. Implementation difficulty, time, and cost vary considerably depending on the type of energy efficiency measures. Although simple measures can be implemented by the organization, there may be a need for a third party for tasks that require technical expertise or intensive work.

The energy savings are determined through a comparative analysis of the consumption measured before (reference period) and after applying the EEMs (reference period), making appropriate adjustments taking into account possible changes in the operating conditions of the installation. Saving on improvements could fund the development of new phases of the energy efficiency action plan. Using energy monitoring systems or any other automated data collection system is a useful way to monitor energy efficiency measures. Power monitoring systems do not reduce energy consumption but provide equipment operators with helpful information to better adapt and schedule equipment used on time.

Energy efficiency is a relevant topic when addressing the issue of society's needs sustainability. The pervasive nature of energy efficiency issues makes it an excellent platform for innovation and promotes competitiveness. Energy efficiency combined with renewable energy sources represent the two main pillars of a sustainable energy policy. By reducing overall energy consumption and using renewable energy, the negative environmental impact of energy use can be minimized, and the share of renewable energy in final energy increased. Also, the use of renewable energy systems can be an effective way to reduce energy costs in facilities. As energy efficiency measures are often cheaper and easier to implement, priority must be given to renewable energy systems. In addition, if a building uses less energy due to previous energy

efficiency measures applied, it is also accompanied by better and more efficient use of energy produced from renewable sources.

1.3.1. Module aim

By completing this thematic module, trainees will be familiar with key energy concepts and energy-efficient technologies and behaviors. The unit will provide a better understanding of the energy efficiency benefits, the energy management process, its stages and activities, and how energy efficiency can be applied to buildings. During the seminar, European energy efficiency policies and regulations will be presented to trainees. In addition, participants will focus on trends, future needs, and employment opportunities regarding energy efficiency.

1.3.2. Learning outcomes and keywords

Upon completion of the module, trainees are expected to understand, know and apply the following terms and definitions:

- Energy efficiency
- Energy certification of buildings
- EU energy labels
- Co-production
- Energy efficiency measures (EEMs)
- Energy efficiency action plan
- Project implementation
- Energy transformation
- Energy supply
- Energy cost

Keywords:

Energy efficiency	Energy saving
Energy consumption	Energy control
Energy monitoring systems	Energy use
Energy management	Renewable sources

1.3.3. Teaching material

For the educational needs of this unit, material from the following books will be used:

[Energy efficiency and ICT]

1. The role of ICT in Energy Management - Household Sector | 2018, World Energy Council
2. Schippl J., Weinberger N. (2009), Assessing the potential of ICT to increase energy efficiency and fight climate change - key technologies and prospects, STOA Science and Technology Options Assessment, European Parliament
3. Coroama, VC, & Hilty, LM (2009, September). Energy Consumed vs. Energy Saved by ICT-A Closer Look. In EnviroInfo (2) (pp. 347-355)

[Energy management]

1. Guia 2 - Gestão de Energia (2019), ECOAP, (Portuguese)
2. Guidelines for Energy Management (2013), Energy Star
3. Energy Management priorities - a self-assessment tool, Carbon Trust, Energy efficiency, Best practice program
4. The What, Why, and How of Energy Management (2020), Energy Lens, accessed 18 June 2020, URL:https://www.energylens.com/articles/energy-management
5. What Is Energy Management & How Can You Use It? (2019), en-trak.com, accessed 18 June 2020, URL:https://www.en-trak.com/resources/energy-management-explained
6. Pita G., Energy Audit (2013), Téchnico Lisboa
7. Energy Efficiency, Environmental and Energy Study Institute (EESI), accessed 18 June 2020, URL: https://www.eesi.org/topics/energy-efficiency/description
8. Energy Audit Guide for buildings (2001), Finnish Ministry of the Environment, AX Consulting
9. Silva Torres P., (2014), Continuous Improvement Meets Energy Auditing: An Energy Audit Tool for IST, Technical Lisbon
10. Roberts Q., (2019), Getting bang for buck on your industrial energy audit, Efficient See, accessed 18 June 2020, URL: https://www.sageautomation.com/blog/getting-bang-for-buck-on-your-industrial-energy-audit
11. Your quick reference guide to energy auditing - the Australian / New Zealand standard 3598: 2014 (20014), Energy Efficiency Council
12. Purpose of M&V (2020), Efficiency Valuation Organization, accessed 18.June 2020, URL: https://evo-world.org/en/mv/purpose-of-mv

Presentations linked to Module 1.c. are being included as an Annex in the current deliverable.

SECTION 4

Energy behavior

2. Section 4: Energy behavior

The majority of energy-efficient policies adopted (or yet to be introduced) in Europe include technical solutions, but they can also be focused on people changing their actions to reduce energy usage. This section offers a brief overview of the significant factors affecting trainee attitudes and policies. To understand what workers, do and why they do it, behavioral models are needed. Instead of two factors of energy management and static behavior improvement, the interactions between different forces that affect behavior and consumption patterns and the human aspect are dynamic.

They evolve over time, rendering customer behavior and the mechanism of realistic consumption quite irrational and unpredictable. Social science can help us better understand individual and social responses. It has been used to investigate people's attitudes toward energy, energy use, and energy efficiency behavior change initiatives/measures. According to Elizabeth Shove (Shove, 2003), there is an indication that consumption is primarily governed by social norms and is profoundly influenced by cultural and economic factors.

One of the main findings of this study is that we should instead concentrate on the emergence and transformation of collective agreements (social rules) rather than focusing on individual consumption. It is the key to implementing consumption patterns that have varying effects on consumer resources and the environment.

This section includes four modules as being presented in the following table:

Modules	Topics
4.a	Energy efficiency measures
4.b	Feedback
4.c	Feedback measures
4.d	Feedback and goal setting

The current deliverable presents the first two modules, meaning 4.a and 4.b while the first two will be developed by PB2, Development Agency of Evia.

2.1 Module 4.a. - Energy efficiency measures

Many different types of interventions are used in energy efficiency/savings initiatives:

1. Connectivity and commitment:

Knowledge and advancement, education, personal advice, personal commitment, demonstrations, performance metrics, responsibility, action planning, highlighting, prompts, modeling, and feedback.

2. Financial incentives and disincentives:

Incentives, contributions, charges, taxes, bonus schemes, tax disputes, tax refunds, investment funds such as interest-free loans, rewards, and penalties are examples of financial incentives and disincentives.

3. Regulatory:

General legislation and regulations, special exceptions, agreements, and adjustable agreements against dynamic energy pricing.

2.1.1 Module aim

By completing this module, trainees will be able to identify their energy behavior via the presentation of the relevant measures, and whether it could be improved, contributing to their workplace's best possible energy efficiency. Moreover, participating civil servants will learn how they could help/encourage their colleagues towards this energy-saving logic.

2.1.2.Learning outcomes and keywords

Upon completion of the thematic module, trainees are expected to understand, know and apply the following terms and definitions:

- Energy behavior measures
- Energy efficiency measures

Keywords

Energy behavior	Energy consumption level
Energy security	Employee incentive measures

2.1.3. Teaching material

For the educational needs of this section, material from the following books was used:

1. Darby, S., 2006, The effectiveness of feedback on energy consumption - A review for Defra of the literature on metering, billing and direct displays, Environmental Change Institute, University of Oxford.
2. Achieving energy efficiency through behavior change: what does it take? 2013, EEA Technical report, European Environment Agency
3. Shove, E., 2003, 'Converging conventions of comfort, cleanliness and convenience.' In: Journal of Consumer Policy, Vol. 26, No. 4, 12.2003, p. 395–418.
4. Ryan L, and Hilke A., 2012 'Mobilising investment in energy efficiency. Economic instruments for low-energy buildings'. International Energy Agency, at: https://c2e2.unepdtu.org/wp-content/uploads/sites/3/2016/08/iea-mobilising-investment.pdf

2.2. Module 4.b. - Feedback

Feedback is essential for effective learning. Feedback of different sorts can play a vital role in raising awareness of energy and changing trainees' attitudes towards energy consumption. These include direct feedback, indirect feedback, unintended feedback, and energy control (Darby, 2006). For immediate feedback are considered the smart meters, which are of particular interest throughout Europe. Instant feedback covers a number of systems designed to provide frequent or continuous immediate (real-time) access to information on energy consumption.

2.2.1. Module aim

By completing this module, trainees will be able to identify their energy behavior via the presentation of the relevant measures, and whether it could be improved, contributing to their workplace's best possible energy efficiency. Moreover, participating civil servants will learn how they could help/encourage their colleagues towards this energy-saving logic.

2.2.2. Learning outcomes and keywords

Upon completion of the thematic module, trainees are expected to understand, know and apply the following terms and definitions:

- Feedback
- Feedback measures
- Indirect and immediate feedback

Keywords

Energy behavior	Energy consumption level
Energy security	Employee incentive measures

2.2.3. Teaching material

For the educational needs of this section, material from the following books was used:

1. Darby, S., 2006, The effectiveness of feedback on energy consumption - A review for Defra of the literature on metering, billing and direct displays, Environmental Change Institute, University of Oxford.

2. Achieving energy efficiency through behavior change: what does it take? 2013, EEA Technical report, European Environment Agency

3. Shove, E., 2003, 'Converging conventions of comfort, cleanliness and convenience.' In: Journal of Consumer Policy, Vol. 26, No. 4, 12.2003, p. 395–418.

4. Ryan L, and Hilke A., 2012 ‘Mobilising investment in energy efficiency. Economic instruments for low-energy buildings’. International Energy Agency, at: https://c2e2.unepdtu.org/wp-content/uploads/sites/3/2016/08/iea-mobilising-investment.pdf

2.3. Module 4.c. Feedback measures

Employees cannot determine if their energy consumption is excessive in the absence of an appropriate reporting framework. It is essential to know how feedback is provided and whether officials understand information and believe that they can make a difference. The most effective combination of measures appears to include direct and indirect feedback to actively raise employee awareness of energy consumption and keep employees motivated to participate in energy efficiency actions. Direct feedback could include information received via the consumer's computer, via smart meters combined with in-home displays. Indirect feedback could include more informative and frequent bills containing historical and/or comparative information on energy consumption.

Furthermore, the level of energy consumption that existed prior to the implementation of the measure/program may have an impact on its outcome. Policymakers seem to be more concerned with the institution than with the changing consumption habits and behaviors. A problem-solving approach, rather than an instrument-oriented approach, would encourage one to better adjust for the demographic diversity and other biases of the focus population, potentially leading to more efficient behavioral measure adoption. Energy aids' smart cash growth projects are typically motivated by the company's market issues (reducing costs and increasing profits by improving the quality of the energy service provided).

As a result, such programs may disregard genuine opportunities for energy savings. In some instances, the length of the survey, sample size, and personnel profile all substantially impact the feedback measures outcomes. As a result, when implementing national-level policies, all of these considerations must be considered. It is critical to understand the relationship between feedback interventions, demand response systems, and energy management programs in order to minimize future clashes and, effectively, increase energy savings. Feedback initiatives cannot work in isolation from the broader economic environment. When interventions are considered, attention should be paid to the dominant driving force (e.g., energy security challenges, climate change, economic recovery), as well as whether and how these drivers are expected to change the policy in the long term.

Module 4.c. will be developed by the PB2, Development Agency of Evia.

2.4. Module 4.d. Feedback and goal setting

Setting targets is another way to encourage civil servants to conserve energy. This measure is often used on a self-selective basis, which means that workers set and adhere to a particular energy-saving target. This form of dedication can be efficient – in some situations, much more effective than material benefits or compensation for immediate behavioral improvement, resulting in long-term behavioral change (De Young, 1993).

According to research, the target level influenced how well people did in terms of energy use, and an energy-saving target mixed with reviews resulted in higher savings (Becker, 1978). This demonstrates how reviews can assist workers in determining how close they are to meeting their objectives. Setting personal targets for energy conservation can be a powerful tool, mainly when set by the target community and supported by feedback mechanisms.

Against this background, the method of setting SMART goals is a method that is used to help people define and implement intentions. SMART goals are often used in healthcare settings, but they are also used successfully in business and educational settings because they help to create increase a sense of ownership and personal importance when trying to make important changes (Nelis SM, Thom JM, Jones IR, Hindle JV, Clare L., 2018).

Behavioral objectives need to be SMART, that is, specific, measurable, achievable, relevant and time- bound[1].

- *Specific* – clearly defines who or what the focus is and what change is expected.
- *Measurable* – includes an amount or proportion of change that is expected.
- *Achievable* – a change that the individual is capable of making given their needs and preferences, as well as the social norms and expectations.
- *Relevant* – important to your organization and its resources, and what it is trying to achieve
- *Time-bound* – states the time period for achieving the behavioral changes.

Module 4.d. will be developed by the PB2, Development Agency of Evia.

[1] https://sbccimplementationkits.org/

ANNEXES

Module Presentations

SECTION 2

Energy Efficiency of buildings:

Objectives of the European Union

Module 2.a

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Module Aim

- Familiarize with key energy concepts and energy-efficient technologies and behaviors
- Better understanding of the energy efficiency benefits, the energy management process, its stages and activities, and how energy efficiency can be applied to buildings

Learning outcomes and keywords (1/3)

Trainees are expected to understand, know and apply the following terms and definitions:

- Energy efficiency
- Energy certification of buildings
- EU energy labels
- Co-production
- Ecological design
- Energy efficiency measures (EEMs)
- Energy efficiency action plan
- Project implementation

Learning outcomes and keywords (2/3)

Trainees are expected to understand, know and apply the following terms and definitions:

- Energy transformation
- Energy supply
- Energy cost

Learning outcomes and keywords (3/3)

Energy efficiency	**Energy consumption**
Energy monitoring systems	**Energy use**
Energy management	Renewable sources

Energy Efficiency in buildings (1/3)

Energy use in daily needs

Heat (thermal), light (radiant), motion (kinetic), electrical, chemical, nuclear, and gravitational energy

Energy transformation → converting one form of energy into another (fuel into electricity)

Energy Efficiency in buildings (2/3)

Negative effects on the environment

Climate change, pollution, depletion of resources, and the destruction of ecosystems

Energy efficiency

mitigates external energy dependence, reduces energy imports and energy costs

Energy Efficiency in buildings (3/3)

Improved energy efficiency

Efficient technologies/behaviour /economic change

Benefits environment

Improves air quality and public health, reduces greenhouse gas emissions

Objectives of the European Union

European Union

Carbon and energy efficiency targets to be achieved by **2020, 2030, and 2050**

Objectives of the European Union - Target 2020

Energy efficiency Directive (2012/27/EU)

20% improvement in energy efficiency - which will lead to a reduction of primary energy by 368 Mtoe

Objectives of the European Union – Target 2030

Energy efficiency Directive (2018/2002/EU)

At least 32.5% improvement in energy efficiency which will lead to a reduction of 1 273 Mtoe of primary energy and 956 Mtoe of final energy

Objectives of the European Union - Target 2050

A clean planet for all (COM (2018) 773)

Make the EU a "Neutral Climate" - which means reducing greenhouse gas emissions by 80-95%

Objectives of the European Union - Energy efficiency of buildings

Energy efficiency of buildings → buildings' evaluation according to their energy efficiency

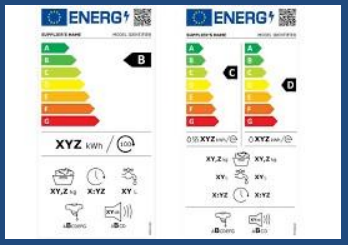
- Construction industry, is boosted by investing in energy efficiency (40% of energy demand and around 36% of CO2 emissions in the EU)
- Allows building owners to know how well their buildings perform and what measures are needed to improve energy efficiency

Objectives of the European Union - EU energy labels

Energy labels → Direct and easy indicator of a product's energy quality at the point of sales, enabling consumers to shop for more reliable devices

EU eco-design regulation

Important mechanism for enhancing commodity environmental sustainability by establishing uniform minimum energy efficiency requirements



Directive 2008/28/EC (1/2)

Eco-design standards for energyconsuming goods

Electrical and mechanical appliances or heating systems

New Energy Label

- Energy efficiency information of the product (color code of seven categories)
- Energy and water consumption
- Performance (intensity, fulfillment, volume level)

Directive 2008/28/EC (2/2)

Ecological design → Improve a product's environmental efficiency (remain its functional properties)

Directive → Establishes terms and conditions for establishing requirements for environmental features of products

Energy-consuming products and those that need to be considered for energy savings are indicated by the label and standard product information on energy consumption → Directive 2010/30/EU

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Energy Efficiency of buildings:

Energy control

Module 2.b

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Module Aim

- Familiarize with key energy concepts and energy-efficient technologies and behaviors
- Better understanding of the energy efficiency benefits, the energy management process, its stages and activities, and how energy efficiency can be applied to buildings

Learning outcomes and keywords (1/3)

Trainees are expected to understand, know and apply the following terms and definitions:

- Energy efficiency
- Energy certification of buildings
- EU energy labels
- Ecological design
- Energy efficiency measures (EEMs)
- Energy efficiency action plan
- Project implementation

Learning outcomes and keywords (2/3)

Trainees are expected to understand, know and apply the following terms and definitions:

- Energy Performance Certificate (EPC)
- Energy Services Company (ESCO)
- Energy cost

Learning outcomes and keywords (3/3)

Energy efficiency	**Energy consumption**
Energy monitoring systems	**Energy use**
Energy management	Renewable sources

Energy Efficiency (1/2)

Energy use in daily needs

Heat (thermal), light (radiant), motion (kinetic), electrical, chemical, nuclear, and gravitational energy

Energy transformation → converting one form of energy into another (fuel into electricity)

Energy Efficiency (2/2)

Negative effects on the environment

Climate change, pollution, depletion of resources, and the destruction of ecosystems

Energy management

Ensures that less energy is used to maintain or improve the quality of services energy dependence, reduces energy imports and energy costs

Energy Management (1/3)

Energy Audit

Identified and quantified energy flows

Existing energy systems are analyzed

- Definition of an energy base
- Opportunities for improving energy use are identified
- Set of energy efficiency measures are proposed, analyzed, and compared

Energy Management (2/3)

Energy Audit

- Planning and organizing process for the selection of technically and economically feasible measures
  - Drawn up of a plan
- Evaluation of results through a monitoring and verification process
  - New energy efficiency measures can be proposed (new requirements)

Energy Management (3/3)

Energy Audit

- Amount, where, and how energy is used in a building
- Energy controller provides basic information on detectable deficiencies (improvements)
- Established/suggest feasible solutions
- Verify the proper operation of energy systems, for user comfort and compliance with applicable laws

Energy Performance Certificate (EPC)

- Registers are the **primary source of information** regarding certified buildings. The share of buildings registers in the EPC database varies across Europe
- Important **instrument** that should contribute to the enhancement of the energy performance of buildings
- Shall include the **energy performance of a building** and the reference values, as well as the recommendations for the cost-optimal or cost-effective improvements of the energy performance of a building or building unit

Energy Service Companies (ESCOs)

Offer energy services which may include implementing energy - efficiency projects (and also renewable energy projects)

- Guarantee energy savings and/or provision of the same level of energy service at lower cost
- The remuneration of ESCOs is directly tied to the energy savings achieved
- Can finance, or assist in arranging financing for the operation of an energy system by providing a savings guarantee

ESCO Energy Service Company

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Energy Efficiency of buildings:

Energy efficiency measures

Module 2.c

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Module Aim

- Familiarize with key energy concepts and energy-efficient technologies and behaviors
- Better understanding of the energy efficiency benefits, the energy management process, its stages and activities, and how energy efficiency can be applied to buildings

Learning outcomes and keywords (1/3)

Trainees are expected to understand, know and apply the following terms and definitions:

- Energy efficiency
- Energy certification of buildings
- EU energy labels
- Co-production
- Ecological design
- Energy efficiency measures (EEMs)
- Energy efficiency action plan
- Project implementation

Learning outcomes and keywords (2/3)

Trainees are expected to understand, know and apply the following terms and definitions:

- Energy Performance Certificate (EPC)
- Energy Services Company (ESCO)
- Energy transformation
- Energy supply
- Energy cost

Learning outcomes and keywords (3/3)

Energy efficiency	**Energy consumption**
Energy monitoring systems	**Energy use**
Energy management	Renewable sources

Energy Efficiency measures

Energy efficiency measures

reduce energy use without affecting the overall performance of a building or the comfort of its trainee

behavior-based

Reduce energy waste through changes in behavior and better planning of equipment operation

equipment-based

Involves the installation of higher energy efficiency equipment

Behaviour based

Connectivity and commitment

- Knowledge and advancement
- Education
- Responsibility
- Personal advice
- Performance metrics
- Action planning
- Modeling and feedback
- Demonstrations
- Personal Commitment

Behaviour based - Social dynamics

Energy consumption activities → Social activities (heat homes, workplace and public spaces)

Social interactions → When, why and how people consume energy

Energy behaviour in the form of peer-effects → Adopt peer-group energy saving behaviours

- Direct interpersonal communication
- Shifting social norms

Community-based initiatives (1/2)

- Could lead to long-term behaviour change
- Groups sharing information
- Part of a wider programme that has clear objectives

Reducing the environmental footprint

Delivering energy savings

Pre-existing relationship between the participants

Share pro-environmental views

Community-based initiatives (2/2)

- Group size → less than 10 people to more than 100 (1,000 in some cases)
- Regular meetings
- Access to reliable information through written material and/or access to a trained expert
- People from the same neighborhood, **workplace** or community of interest such as a faith or a voluntary group → Successful in long -term due to social norms and behaviours

Equipment based

Measures

Appropriate reporting framework

- Direct feedback – smart meters and in home displays
- Indirect feedback – enhanced billing; personal goal setting and feedback;
- Energy audits

Direct feedback

Immediate, from the meter or an associated display monitor

Savings range from 5-15%

- The meter provides a clearly -understood point of reference for **improved billing and for display**
- **Free-standing display**
- **Clearly visible**, within the building

Indirect feedback

Feedback that has been processed in some way before reaching the energy user, normally via billing

Savings have ranged from **0-10%**, but they vary

- Usually more suitable for demonstrating any effect on consumption of changes in space heating
- Historic feedback (comparing with previous recorded periods of consumption)

more effective than comparative or normative (other buildings)

Energy Audits

- Useful tool to provide the information needed to implement energy efficiency measures in a specific environment
- Strengthen the link between energy audits and consumption practices

Be part of a longer-term programme to improve energy management and not just a one-off activity

- Provide information tailored to a specific context and actual consumption
- Delivered by independent experts
- Successful in raising awareness about energy issues

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SECTION 4

Energy behavior

Module 4.a

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Module Aim

- Identify **energy behavior** via the presentation of relevant **measures**, ways to be improved to contribute to workplace's best possible energy efficiency
- Civil servants will learn how they could help/encourage their colleagues towards this **energy-saving logic**

Learning outcomes and keywords (1/2)

Trainees are expected to understand, know and apply the following terms and definitions:

- Energy Efficiency
- Energy behaviour
- Energy Efficiency measures

Learning outcomes and keywords (2/2)

Energy behavior	**Energy consumption level**
Energy security	**Employee incentive measures**

Introduction

Energy-efficient policies

People's changing actions + Technical solutions

Behavioral models

- Energy management
- Static behavior improvement

→ Dynamic Interactions

Energy efficiency measures – Types of interventions

Connectivity and commitment

Connectivity and commitment

- Knowledge and advancement
- Education
- Responsibility
- Personal advice
- Performance metrics
- Action planning
- Modeling and feedback
- Demonstrations
- Personal Commitment

Social dynamics of Energy Behaviour

Energy consumption activities → Social activities (heat homes, workplace and public spaces)

Social interactions → When, why and how people consume energy

Energy behaviour in the form of peer-effects → Adopt peer-group energy saving behaviours

- Direct interpersonal communication
- Shifting social norms

Feedback measures (1/2)

Feedback measures

Appropriate reporting framework

- Direct feedback – smart meters and in home displays
- Indirect feedback – enhanced billing; personal goal setting and feedback;
- Energy audits
- Community-based initiatives

Feedback measures (2/2)

Feedback measures (other)

- Building certification and labelling;
- Public engagement campaigns;
- Financing schemes and subsidies;
- Eco-design

Financial incentives and disincentives

Financial incentives and disincentives

- Contributions
- Incentives
- Charges
- Taxes, Bonus schemes, tax disputes, tax refunds,
- Investment funds such as interest-free loans, rewards
- Penalties are examples of financial incentives and disincentives

Economic instruments to mobilise investment in energy efficiency in buildings

Goal

- Scale-up private investment in low-energy buildings
- Realise the full, economically-efficient energy saving potential as soon as possible

Incentives → encourage potential investors to take action

Deterrents → increase the cost of doing nothing (consumption subsidies/taxes)

Enablers → Facilitate access to finance to invest in energy efficiency

Regulatory Interventions

Regulatory

- General legislation and regulations, special exceptions and
- Agreements
- Adjustable agreements against dynamic energy pricing

Energy efficiency directive (Directive 2012/27/EU)

- Binding measures 20% energy efficiency target by 2020
- EU energy consumption no more than 1483 million tonnes of oil equivalent (Mtoe) of primary energy or 1086 Mtoe of final energy
- EU countries use energy more efficiently at all stages of the energy chain

Measures adopted under Energy Efficiency Directive (1/3)

Policy measures to achieve *energy savings* equivalent to annual reduction of 1.5% in national energy sales
EU countries making *energy efficient renovations* to at least 3% per year of buildings owned and occupied by central governments
National long-term renovation strategies for the *building stock* in each EU country

Measures adopted under Energy Efficiency Directive (2/3)

Mandatory *energy efficiency certificates* accompanying the sale and rental of buildings
The preparation of *National Energy Efficiency Action Plans (NEEAPs)* every three years
Minimum *energy efficiency standards and labelling* for a variety of products such as boilers, household appliances, lighting and televisions (energy label and eco design)
The planned rollout of close to 200 million *smart meters* for electricity and 45 million for *gas* by 2020

Measures adopted under Energy Efficiency Directive (3/3)

Obligation schemes for energy companies to achieve yearly energy savings of 1.5% of annual sales to final consumers
Large companies conducting *energy audits* at least every four years
Protecting the *rights of consumers* to receive easy and free access to data on real-time and historical energy consumption

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Energy behavior

Feedback measures

Module 4.b

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Module Aim

- Identify **energy behavior** via the presentation of the **feedback** and **feedback measures**, ways to be improved to contribute to workplace's best possible energy efficiency
- Civil servants will learn how they could help/encourage their colleagues towards this **energy-saving logic**

Learning outcomes and keywords (1/2)

Trainees are expected to understand, know and apply the following terms and definitions:

- Feedback
- Feedback measures
- Indirect and immediate feedback

Learning outcomes and keywords (2/2)

Energy behavior	Energy consumption level
Energy security	Employee incentive measures

Introduction

Energy-efficient policies

People's changing actions + Technical solutions

Behavioral models

- Energy management
- Static behavior improvement

→ Dynamic Interactions

Types of Feedback

Feedback types (1/3)

- Direct feedback

- Self-meter-reading
- Direct displays
- Interactive feedback via a PC
- Pay-as-you-go/keypad meters
- 'Ambient' devices
- Meter reading with an adviser, as part of energy advice
- Cost plugs or similar devices on appliances

- Indirect feedback

- More frequent bills
- Frequent bills based on readings plus historical feedback
- Frequent bills based on readings plus comparative/normative feedback
- Frequent bills plus disaggregated feedback Frequent bills plus detailed annual or quarterly energy reports

Feedback types (2/3)

- Inadvertent feedback – learning by association

- With the advent of microgeneration, the home becomes a site for generation as well as consumption of power
- Community energy conservation projects such as the Dutch 'Eco-teams'

- Utility-controlled feedback – learning about the customer

- Utility-controlled feedback via smart meters, with a view to better load management.

Feedback types (3/3)

- Energy audits – learning about the 'energy capital' of a building

- Audits may be

• undertaken by a surveyor on the client's initiative
• undertaken as part of a survey for the Home Information Pack
• carried out on an informal basis by the consumer using freely available software, eg carbon calculators

Direct feedback

Immediate, from the meter or an associated display monitor

Savings range from 5-15%

- The meter provides a clearly-understood point of reference for **improved billing and for display**
- **Free-standing display**
- **Clearly visible**, within the building

Indirect feedback

Feedback that has been processed in some way before reaching the energy user, normally via billing

Savings have ranged from **0-10%**, but they vary

- Usually more suitable for demonstrating any effect on consumption of changes in space heating
- Historic feedback (comparing with previous recorded periods of consumption)

more effective than comparative or normative (other buildings)

Disaggregated by end-use (electricity meter) feedback

- Relatively expensive and complicated to supply
- Give the consumer adequate information on different end - uses
- Savings of 10-20% are quoted (North America)

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