ePANACEA
Smart European Energy Performance Assessment & Certification

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Compendium of Testing and Demonstration Board (TDB) Meetings

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EASt – Energy Agency of Styria

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EXECUTIVE SUMMARY

After 10 years of track record, the current EPCs schemes across the EU face several challenges which have led to not fully accomplish their initial objectives: lack of accuracy, a gap between theoretical and real consumption patterns, absence of proper protocols for inclusion of smart and novel technologies, little convergence across EU schemes, lack of trust in the market and very little user awareness related to energy efficiency.

The objective of the ePANACEA project is to develop a holistic methodology for energy performance assessment and certification of buildings that can overcome the above-mentioned challenges. The vision is ePANACEA becoming a relevant instrument in the European energy transition through the building sector. ePANACEA comprises the creation of a prototype (the Smart Energy Performance Assessment Platform - SEPAP) making use of the most advanced techniques in dynamic and automated simulation modelling, big data analysis and machine learning, inverse modelling or the estimation of potential energy savings and economic viability check.

A relevant part of the project is to have a fluent dialogue with European policy makers, certification bodies, end-users and other stakeholders through two types of participatory actions: on the one hand a feedback loop with policy makers will be carried out through the so called Regional Exploitation Boards (REBs) covering EU-27+Norway+UK, and the dialogue with the end-users will be established by means of specific thematic workshops. Thanks to these participatory actions we will ensure that ePANACEA approach is aligned with and meets the needs of national public bodies, end-users and other stakeholders with a view to test the acceptance and to validate the methodology developed.

ePANACEA will demonstrate and validate reliability, accuracy, user-friendliness and cost-effectiveness of the methodology through 15 case studies in 5 European countries.

This document is a compendium of background information about ePANACEA's methodology, the composition and objectives of the various boards, as well as of the outcomes from the meetings established between members of ePANACEA's Testing and Demonstration Board (TDB). The document will be updated after each TDB meeting.

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1. DESCRIPTION OF THE TESTING AND DEMONSTRATION BOARD

ePANACEA's methodology aims to contribute to the harmonisation of energy performance assessment and certification of buildings across the European Union, enhancing market trust and user friendliness in terms of clarity and accuracy of the information provided. ePANACEA explores several innovation approaches to assess the energy performance of buildings in a modular way, making it suitable for all possible typologies and cases of different complexity:

- Assessment method 1 deals with Smart & performance data-driven building energy performance assessment.
- Assessment method 2 will provide a simplified method based on monthly calculation interval.
- Assessment method 3 will demonstrate the advanced & automated simulation modelling (based on dynamic and calibrated simulation).

All these three assessment methods will be demonstrated and validated in five European pilot countries through 15 real case studies. A wide network of European building owners and managers that have expressed their commitment on providing necessary data for demonstration activities has been established. These demonstration actions pave the way for an efficient roll out of the methodology across the EU.

With these specific objectives **the Testing and Demonstration Board (TDB**) formed by technical partners and national/regional energy agencies of the ePANACEA consortium will allow the validation of the methodology in the five pilot countries from both technical (including cost-effectiveness) and political point of view, through the dialogue with national/regional energy agencies from the five pilot countries (most of them members of the project consortium).

As shown in Figure 1, the TDB consists of five pilot countries, led by national responsible partners:

- ✓ Austria: **EASt** (overall lead) and **TUW**
- ✓ Belgium: **VITO**
- ✓ Greece: **CRES**
- ✓ Spain: **CENER** and **IDAE**
- ✓ Finland: **VTT**

In detail, the leading institutions of the TDB are:

- ✓ **Energy Agency of Styria (EASt)**
  - The Energy Agency of Styria founded 1982 (formerly: LEV – Landes Energie Verein) is the regional energy agency of the Province of Styria, Austria. The mission of the Agency is to increase energy efficiency and use of renewable, domestic sources of energy in the interest of the Climate and Energy Strategy of the Province of Styria. Additionally, EASt manages the Official EPC database of Styria (ZEUS database).
- ✓ **Technical University of Vienna (TUW)** – *supporting EASt*
  - The Energy Economics Group (EEG) is within the Institute for Energy Systems and Electric Drives at Vienna University of Technology (Austria). EEG has managed and carried out many international as well as national research projects funded by the European Commission, national governments, public and private clients in several fields of research, especially focusing on renewable and new energy systems.
- ✓ **National Renewable Energy Center (CENER)**
  - The National Renewable Energy Centre (CENER) is a technology centre, specialised in applied research and in the development and promotion of renewable energies in Spain.
- ✓ **Instituto para la Diversificación y Ahorro de la Energía (IDAE) –** *supporting CENER*
  - IDAE is the Spanish National Energy Agency and contributes to fulfilling Spain's objectives and commitments regarding improvements in energy efficiency, renewable energy and other low carbon cost technologies. This constitutes the strategic framework of its activities.
- ✓ **Technical Research Centre of Finland (VTT)**
  - VTT Technical Research Centre of Finland Ltd is a state owned and controlled non-profit limited liability company established by law and operating under the ownership steering of the Finnish Ministry of Employment and the Economy.
- ✓ **Centre for Renewable Energy Sources and Saving (CRES)**
  - CRES (founded in September 1987) is a public entity supervised by the Ministry of Environment and Energy in Greece and is active in the fields of Renewable Energy Sources (RE) and Energy Efficiency (EE). Its primary aim is to promote technological applications in the RE/EE fields both at a national and international level.
- ✓ **VLAAMSE INSTELLING VOOR TECHNOLOGISCH ONDERZOEK (VITO)**
  - VITO is a leading independent research organisation in the area of cleantech and sustainable development located in Flanders, Belgium. It provides knowledge and technological innovations that facilitate the transition to a more sustainable society. By cooperation, expansion and development of expertise VITO can make smarter use of existing sustainable solutions and develop new technologies.

The mentioned partners are responsible for preparation, conducting and reporting the testing, evaluation and validation of the ePANACEA methodology through the case studies in five pilot countries.

All three innovative assessment methods, developed in ePANACEA will be tested in each pilot country, using the innovative SMART ENERGY PERFORMANCE ASSESSMENT PLATFORM (SEPAP). Developing and using the SEPAP will enable the testing and validation of the ePANACEA methodology, will demonstrate the possibility of convergence of Energy Performance Certificate (EPC) procedures and cloud-based storage of related data. Overall objective of the testing is to validate the decision matrix (accuracy and uncertainty analysis for each method) developed within ePANACEA.

As shown in Figure 1, the national responsible members of the TDB also act as the main interface between the project and the members of the 5 Regional Exploitation Boards (REBs). The REBs aim to establish a fluent dialogue with different European stakeholders, with special focus on national/regional policy makers and certification bodies, which are directly involved in the implementation of the different EPC schemes and are responsible for energy regulations development in their own regions/countries. Regular communication and feedback transfer from and to REBs will be maintained during the project duration and guaranteed by the TDB members. These REBs will include at least 3 face-to-face meetings and 2 survey campaigns for each of them, allowing building a feedback loop with key stakeholders (i.e., a bi-directional knowledge transfer). A special "members only" section of the ePANACEA website will be developed in support of stakeholders' engagement in the context of REBs. Invited stakeholders will be provided with their unique usernames and passwords or be able to self-register or join via their social media profiles.

Participants recruitment for user perception workshops and feedback surveys on EPC methodology is carried out by using the contacts with building owners from possible case studies (described in chapter 2.

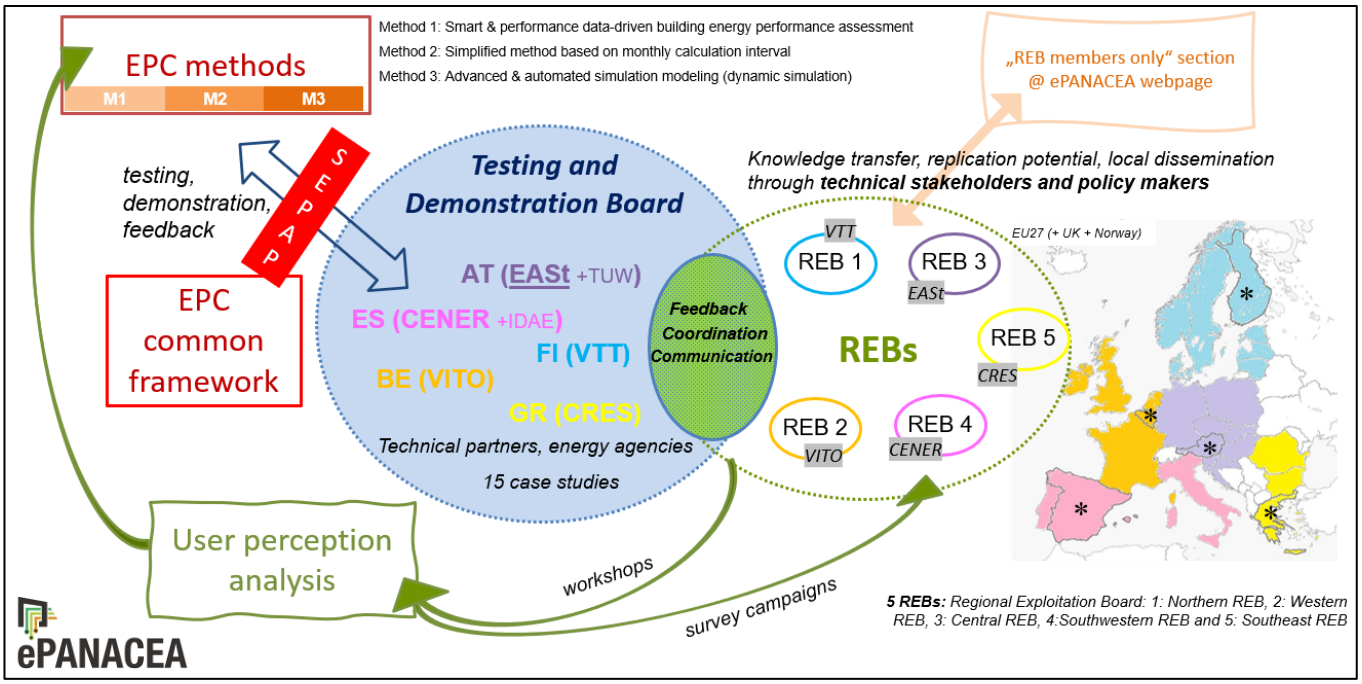

Figure 1: Overview connections between Testing and Demonstration Board and other project activities.

2. THE TESTING PROCESS

The following chapter gives an overview on how the testing of the developed methodology will be performed by the TDB. It describes the EPC methodology development, the SEPAP and the testing phases as well as the already obtained building pool of possible case studies.

2.1. THE METHODOLOGY

The holistic, accurate, flexible and modular methodology for building energy performance assessment and certification developed under ePANACEA PROJECT is based on three assessment methods(Figure 2) plus the decision matrix:

- ✓ **M1: Assessment method 1:** Smart & performance data-driven energy performance assessment
- ✓ **M2: Assessment method 2:** Simplified method based on monthly calculation (ISO 52016) interval and its calibration
- ✓ **M3: Assessment method 3:** Advanced & automated simulation modelling based on hourly calculation (ISO 52017) and its calibration

The vision for the methodology (modular and flexible) development is the evolution of the three assessment methods from less to more complex, according to the building and/or assessment requirements, e.g., innovative energy assessment with compliance of accuracy and standard requirements, integration of smart and novel technologies or use of real measured data.

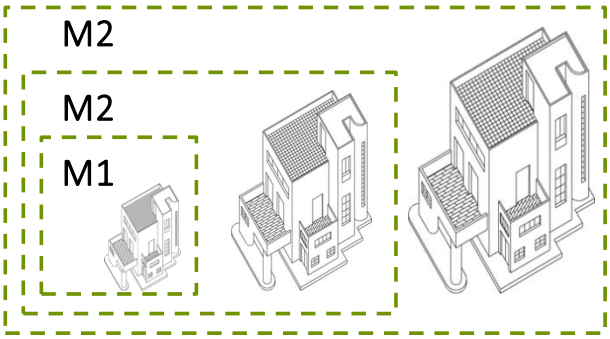

Figure 2: ePANACEA's three assessment methods.

Each assessment method can include some techniques from a lower complexity level. Synergies between the three assessment methods will be exploited:

- ✓ Use of monitoring data
- ✓ Data acquisition
- ✓ Advanced user behaviour modelling
- ✓ Sensitivity analysis
- ✓ Semi-automated calibration based on machine learning techniques
- ✓ Inclusion of novel and smart technologies

The objective of the TDB is to test these three assessment methods on 15 different cases in five pilot countries. The analysis of accuracy and uncertainty of each assessment method will enable the development of a decision matrix for the selection on the most suitable assessment method according to the specific building characteristics and the required accuracy level.

2.2. SMART ENERGY PERFORMANCE ASSESSMENT PLATFORM

The SEPAP (Smart Energy Performance Assessment Platform) will be a cloud platform to build a common framework for the energy performance assessment and certification in Europe, implementing the three assessment methods described above. Additionally, the TDB will validate the three assessment methods through the SEPAP. The platform will be user-friendly and multi-lingual and will have a support and user assistance module. The platform will implement the decision matrix in order to allow the technician to automatically choose between the three assessments methods, according to certain building types and characteristics (e.g., heating/cooling demand, complexity of technical systems, on-site electricity generation, etc.). The SEPAP will be the tool for implementation of artificial intelligence and machine learning techniques, which will coordinate the calibration of the building model according to the possibilities of each methodology. In this way, the platform will learn from the adjustments that technicians have to make to the model so that it replicates reality. Over time, the platform will be able to self-calibrate.

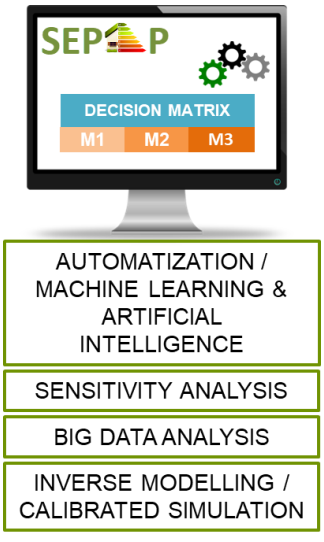

Figure 3: Schematic overview of ePANACEA's SEPAP

2.3. THE PHASES OF TESTING

As already mentioned, the ePANACEA methodology will be demonstrated and validated in five European pilot countries through 15 real case studies. A wide network of European building owners and managers that have expressed their commitment on providing necessary data for demonstration activities has been established. These demonstration actions pave the way for an efficient roll-out of the methodology across the EU.

The demonstration of the energy assessment and certification methodology is organised in three phases as displayed in Figure 4 :

Figure 4: The phases of testing the ePANACEA methodology.

The first phase covers the case study preparation. In this phase, 15 buildings will be chosen from a pre-selected group of buildings (see Table 1). Twenty-one (21) building owners and managers already expressed their commitment on providing the necessary data for testing and validation activities covering approx. 7.000 different buildings (see Table 2). The TDB will select the appropriate case study buildings guided by the methodology requirements concerning data and/or technology availability (e.g., measured data, RES on-site, BACS, etc.). The activity will be developed in close cooperation with the owners, managers and building end users and, where relevant, energy providers or other stakeholders. The case studies include 15 buildings covering a wide range of external characteristics such as climate zones, country specific cultural, social and economic characteristics as well as different data availability.

The second phase builds on phase one and delivers a detailed plan for the steps in the testing and validation of the methodology for each case study. The plan will consist of the activity schedule, descriptions of selected case studies, milestones and expected outcomes. Within this task, progress of the building energy assessment and certification methodology will be continuously monitored.

The third phase implements data collection as well as the testing and validation of the ePANACEA energy assessment and certification methodology. The focus is on the validation of the methodology in real conditions, identification of the bottlenecks during the testing phase and improvement of the assessment methodology. Based on the outcomes of the demonstration activities, the methodology will be updated accordingly. In addition, this will provide feedback to the SEPAP comprising the validation of the decision matrix. Demonstration and validation activities will also include cost analysis, assessment time consumed, and expertise of the technicians needed to perform each module on a specific building type.

The results of the testing phases will be summarised in the Evaluation report of ePANACEA methodology. It will draw up a cross analysis from a qualitative and a quantitative point of view with respect to the existing EPC schemes in each pilot country, and from a qualitative point of view on an international level, comparing the outcomes of the national results. Additionally, the results will be reviewed in close cooperation with the targeted stakeholders.

2.4. THE CASE STUDIES

Testing with real case studies ensures the practical feasibility of the ePANACEA methodology. All three ePANACEA assessment levels will be tested on 15 buildings (3 per pilot country).

As already mentioned, the selection of the case buildings will be done in close collaboration with the ePANACEA methodology requirements as well as with the building owners. Furthermore, the key stakeholders will be informed on further requirements and activities where their input is expected, e.g., in exploring user perceptions or methodology development.

Table 1 gives an overview of the already collected Letters of Intent (LOI) from building owners during the last months.

Table 1: Overview on already collected Letters of Intent (LOIs) from building owners

Pilot country	Numbers of LOIs already received	Short description of available building stock
Austria	8	public educational buildings, residential buildings, apartment blocks, offices, single family houses, public administrative buildings
Belgium	3	residential buildings, large dwellings, office buildings
Greece	6	office buildings, public administrative buildings, public educational buildings, municipal buildings
Spain	2	public buildings, including residential, office, educational buildings and hospitals
Finland	2	public buildings including non-residential buildings, office buildings, educational buildings
Total	**21**	**Approx. 7.000 different buildings**

Together, the buildings presented in Table 1 represent a building stock of more than several thousand buildings and utilisation units. The relevant building owners already expressed their commitment on providing the necessary data. The diversity of building characteristics in terms of climate conditions, size, building type, energy aspects, renewables on site, data availability etc., is shown in Table 2.

Table 2: Overview on buildings and their characteristics, available for ePANACEA testing processes.

Building characteristics		Pilot Country				
		AT	BE	GR	ES	FI
Climate	Atlantic		x		x	
	Mediterranean			x		
	Continental	x				
	Boreal					x
	Alpine	x				
Size	<500 m²	x	x	x		
	500-2.000 m²	x	x	x	x	
	>2.000 m²		x	x	x	x
Type	Single-family houses	x	x			
	Multi-family apartments	x	x		x	
	Offices	x	x	x	x	x
	Educational buildings	x		x	x	x
Energy needs	Heating (& Domestic Hot Water)	x	x	x	x	x
	Heating (& Domestic Hot Water) & Cooling	x	x	x	x	
HVAC	Low complexity	x	x		x	
	Medium complexity	x	x	x		x
	High complexity		x	x	x	
RES on site	No	x	x	x	x	x
	Yes	x	x	x	x	
BACS	Low complexity	x	x	x	x	
	Medium complexity	x	x			x
	High complexity	x	x		x	
Data availability	Low	x	x			
	Medium	x	x	x		
	High	x	x	x		x
	Very high		x		x	

***HVAC**: low complexity - covering heating and domestic hot water demand with only one system (e.g., individual boilers or central heating boiler), high complexity - covering heating, cooling and domestic hot water demand with a mix of different technologies with different fuels; **Data availability**: low - design data, medium - design data, utility bills, weather data, high - design data, utility bills, weather data, short-term measurements, very high - design data, utility bills, weather data, short-term measurements, smart meters data; **RES on site**: Renewable energy sources on site; **BACS**: Building automation and control system*

3. THE TESTING AND DEMONSTRATION BOARD MEETINGS

In order to ensure a fluent dialogue and continuous progress in the testing activities, the TDB will meet several times (whether online or during personal meetings). The main conclusions and next steps of each meeting are shortly presented in this section.

This section will be updated after each TDB meeting.

3.1. CONCLUSIONS FROM THE FIRST TESTING AND DEMONSTRATION BOARD MEETING

The first meeting of the TDB took place online on 23 June 2020 and a second one followed on 15 July 2020. The main objective of these online meetings was to generate a common picture among the TDB members about their tasks in terms of validating the ePANACEA methodology and about the REBs. The national responsible partners from the TDB act as main interface between ePANACEA and the 5 REBs.

Decisions were made on the next steps, upcoming activities, necessary functionalities of the TDB & REB members only section at the ePANACEA webpage, the first REB meeting and how to approach existing institutions which already signed a LOI for being REB members. Additionally, a framework for the content of the first REB meeting as well as organisational questions were discussed and clarified.

The main conclusion from these first meetings were:

- Organise periodical online meetings from September in order to ensure the progress of the activities
- Organise the first REB meeting by the end of 2020, include back up plan for online meeting due to the corona crisis
- TDB will contact possible REB members to inform them about ePANACEA
- Necessary functionalities for the "TDB (& REB) only" section on the ePANACEA website, such as access control and user password, exchange of documents, calendar with milestones, FAQ and library section

The main activities to be undertaken in the next months include:

1. Gathering relevant data from possible case studies and therefore which data should be gathered
2. How should the data be collected (e.g., templates, web private area, other)
3. Selection criteria approach (definition of key variables)
4. Agreement on timeline (deadline for data gathering, deadline for definition of the selection criteria, deadline for the final selection of cases, etc.).

4. LIST OF TABLES

5. LIST OF FIGURES

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