



Towards Innovative Methods  
for Energy Performance Assessment and Certification of Buildings

Deliverable 3.3

# Report on building Renovation Passports from enhanced EPC data

Lead Beneficiary: Goriška Local Energy Agency (GOLEA)

Date: 30.04.2024

Version: 1.0

Dissemination level: Public

[www.timepac.eu](http://www.timepac.eu)



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 101033819.

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## Document description

Deliverable No.	3.3
Dissemination level	Public
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Contributors	All consortium members have provided content for this document
Due date of deliverable	30.04.2024
Actual submission date	30.04.2024

Version	Date	Beneficiary	Author
V0.1	7.02.2024	GOLEA	Matej Pahor
V0.2	15.02.2024	GOLEA	Matej Pahor
V0.3	28.02.2024	ICAEN	Marta Chàfer
V0.4	04.03.2024	RP	Silvio De Nigris
V0.5	04.03.2024	SERA	Bettina Sticher
V0.6	02.03.2024	FUNITEC	Leandro Madrazo
V0.7	11.04.2024	CUT	Iosifina Petri (internal review)
V0.8	16.04.2024	GOLEA	Matej Pahor
V0.9	18.04.2024	RP	Silvio De Nigris
V0.10	18.04.2024	GOLEA	Matej Pahor
V1.0	29.04.2024	FUNITEC	Leandro Madrazo, Lisa Kinnear (Proof-reading)

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## Executive Summary

This report provides a summary of the activities undertaken in Task 3.3 “Building Renovation Passports from the analysis of enhanced EPC data” of WP3 “Verification Scenarios”. The primary objective of this work package is to confirm the outputs of the Transversal Deployment Scenarios developed, which were developed in WP2, with local stakeholders involved in building certification processes.

With this purpose, TIMEPAC partners organised workshops with representatives from Austria, Croatia, Cyprus, Italy, Slovenia, and Spain to gather their feedback. Through these workshops, valuable insights were gathered, aiding in the identification of training requirements necessary for participants to actively contribute to the advancement of current certification practices. These efforts align with TIMEPAC's goal to adapt to the latest revisions of the Energy Performance of Buildings Directive.

The findings indicate a pressing need a broader utilization of Building Information Modeling (BIM) in building renovation endeavours. However, significant challenges emerged, notably the absence of a centralized BIM model database and the imperative for designated institutions to oversee data accuracy within these databases. Economic justifications for generating Energy Performance Certificates (EPC) and building Renovation Passports (RP) for low-energy-consumption buildings were also scrutinized.

Attention was drawn to the necessity of implementing enhanced automatic checks for data entry to enhance EPC data quality, considering factors such as occupants' influence and other variables impacting data accuracy. Furthermore, the lack of standardized regulations across countries was underscored, prompting recommendations for streamlining EPC procedures and incorporating advancements in technology and climate considerations, alongside intensified training for EPC issuers.

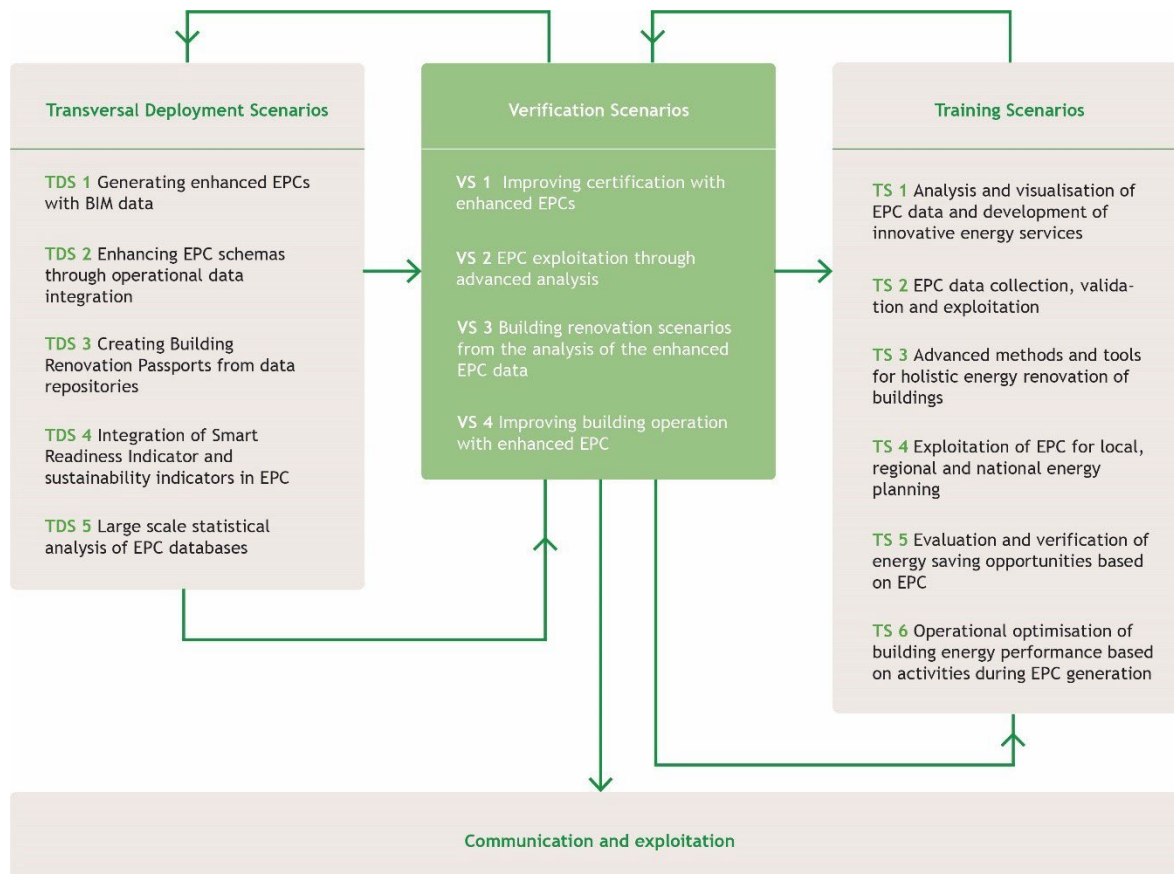
Insights regarding the exploitation of EPC for local, regional, and national energy planning underscored the critical role of enriched EPC data for long-term scenario calculation tools. Suggestions included expanding EPC coverage to non-residential buildings and incorporating additional indicators such as post-scenario CO<sub>2</sub> emissions and investment assessments. There is a clear demand for comprehensive planning tools capable of integrating data and strategic planning across various governance levels.

Workshop insights concerning the evaluation and verification of energy-saving opportunities based on EPC highlighted the importance of calculating savings in BRPs based on actual building usage. Recognizing the challenges of expecting one individual to cover all aspects of the BRP, there is a call for a national training programme to bolster expertise in this area.

In conclusion, the workshops stressed the significance of utilizing real operational data for accurate evaluations of energy-saving opportunities, as well as the need for robust training programs and the development of user-friendly tools to support energy planning activities. Key issues identified from the workshops include the necessity for national-level reforms, improved automatic checks, standardized regulations, and enhanced EPC data utilization. Comprehensive training programmes are deemed essential to address these challenges effectively.

# 1 Introduction

The purpose of WP3 “Verification Scenarios” was to share the visions of enhanced building performance developed in WP2 “Transversal Deployment Scenarios” (TDS) with local actors involved in building performance certification and to provide insights into the knowledge gaps to be fulfilled by the training scenarios to be conducted within WP4 “EPC Standardisation, Training and Capacity Building” (Figure 1).



**Figure 1.** Interconnections between Transversal Deployment Scenarios, Verification Scenarios and Training Scenarios

The work of WP3 was organised around four themes, each one targeting specific audience groups:

- Task 3.1 “Improving certification with enhanced EPCs” - tailored for professional certifiers, energy agencies, and municipalities.
- Task 3.2 “EPC exploitation through advanced analysis” - for professional certifiers and energy agencies.
- Task 3.3 “Building Renovation Passports from the analysis of enhanced EPC data” - aimed at energy agencies and municipalities.
- Task 3.4 “Improving building operation with enhanced EPC” - intended for building managers and end-users.

Within each task, partner organisations arranged a series of workshops with local stakeholders in Austria, Croatia, Cyprus, Italy, Slovenia, and Spain. The purpose of these workshops was to present and discuss the enhanced building performance scenarios, gather feedback from participants, and

identify areas requiring further skills development to finalise the programme of the TIMEPAC Academy carried out within WP4 “EPC Standardisation, Training and Capacity Building”.

This document serves as a report on the implementation of Task 3.3 “Building Renovation Passports from the analysis of enhanced EPC data,” which focuses on devising building renovation scenarios using enhanced EPC data. The workshops for this task were conducted in partner countries.

## 1.1 Purpose and target groups

The aim of Task 3.3 was to verify the procedures envisioned in TDS 3 “Creating building renovation passports from data repositories,” and TDS 5 “Procedures and services to undertake large-scale statistical analysis of EPCs databases.” The objective of TDS3 was to create procedures for tracing the evolution of building renovation using various data sources such as BIM, EPCs, energy audit reports, and operational data, among others. TDS5 aimed to enhance the quality of EPC data, utilize EPCs for energy balance assessments of representative buildings, and provide stakeholders with a reliable methodology for conducting refurbishment scenario analyses on their building stocks.

Participants in the workshops for Task 3.3, organised by partners at their respective locations, were selected based on their level of influence on the addressed topic and their specific skills. This document includes a report of the workshop and a summary of the collective findings. The summary assists in identifying both the differences between countries regarding their current certification procedures and the common barriers and obstacles they face in aligning with the TIMEPAC vision to improve them.

## 1.2 Deliverable structure

The remainder of this report is organised in the following sections:

- Section 2 “Verification Scenario” contains a detailed description of the scenario highlighting its components and illustrating its interconnection with WP2 and WP4.
- Section 3 “Workshops” is divided into six sub-sections, each containing descriptions of workshops conducted in the respective participating countries.
- Section 4 “Participants” includes participant numbers, organisational distribution based on target groups, and the extent of involvement with other concurrent national or European initiatives.
- Section 5 “Findings and conclusions” offers insights drawn from the experiences in the workshops in the various countries.

## 1.3 Contribution of partners

Project partners in Austria, Croatia, Cyprus, Italy, Slovenia and Spain organised the workshops in their respective regions and countries. Regione Piemonte, as WP3 leader, was in charge of coordinating the Work Package, providing guidelines and monitoring the implementation of the tasks.

## 1.4 Relations to other project activities

The work carried out in Task 3.1 serves to interlink the Transversal Deployment Scenarios carried out in WP2 with the training programme to be carried out in WP4. The organization of the workshops was done in parallel with a [survey](#) organized as part of the exploitation plan conducted in WP5 “Communication, Dissemination and Exploitation”. The activities conducted within the workshops have been disseminated through the [project website](#) and social media channels.

## 2 Verification Scenario

The aim of Verification Scenario 3, carried out as part of Task 3.3 “Building Renovation Passports from the analysis of enhanced EPC data”, was to verify the procedures developed within Transversal Deployment Scenarios [TDS 3 “Creating Building Renovation Passports from data repositories”](#) and [TDS5 “Large scale statistical analysis of EPC databases”](#).

The objectives of TDS3 were to analyse the possibilities of using data repositories for creating a Renovation Roadmap which is defined by a sequence of renovation measures to be implemented in steps and to achieve nZEB (nearly zero-energy building) and ZEB (zero-emission building) targets. This involved defining distinct renovation measures that can be tracked through implementation and identifying potential mechanisms, such as enhancing the EPC database or utilizing a BIM database, to trace the implementation of these measures. The analysis of several example buildings in partner countries formed the basis for generating guidelines to generate Renovation Passports from data repositories.

TDS5 primarily focused on the analysis and exploitation of EPC data within the framework of the holistic EPC enhancement of TIMEPAC. One of the objectives of TDS5 was to evaluate and improve the quality of EPC data. This involved utilizing EPCs to perform energy balances of the building stock by defining building archetypes. Furthermore, TDS5 aimed to provide targeted stakeholders with a reliable methodology for conducting refurbishment scenario analyses on their building stocks. In this process, a building stock energy [model tool has been developed and utilized by country partners in TDS5](#). This tool employs datasets from representative buildings to conduct large-scale energy balances and assess the efficacy of energy refurbishment scenarios for the building stock. The tool, designed for performing energy balances on the entire building stock or specific subsets, has proven to be easily applicable with a level of detail and accuracy consistent with the existing data framework. Nevertheless, the tool can be enhanced with additional functionalities based on the stakeholders needs and the requirements of the new Energy Performance of Buildings Directive (EPBD). In the coming years, we will have the capability to conduct extensive energy assessments and evaluate the effectiveness of energy renovation plans for the building stock using building renovation passports. A tool designed for calculating long-term renovation scenarios of the building stock will be able to leverage data from BRP for calibration purposes. By integrating BIM modelling with data from energy audits, smart meters, monitoring systems and additional datasets, we anticipate achieving enhanced precision in assessing crucial energy efficiency indicators.

The findings of TDS3 and TDS5 were discussed in workshops with selected municipalities, energy agencies and consultants of the public sector across participating countries. Building renovation was simulated using outcomes from TDSs, and key indicators were showcased. Moreover, the provided tool intended to offer support in the process of designing building energy renovation plans. The methodology for local building energy renovation plans can address the aspects of the status quo of the building stock, energy building potential identification (technical, economic), investments and planning proposals that will be the basis for the establishment of a long-term strategy for mobilizing investment in the energy efficient renovation of the building stock.

The findings derived from the meetings with local stakeholders in the partner countries has provided some valuable insights about the training activities to be carried WP4 “EPC Standardisation, Training and Capacity Building”. In particular, the input collected in the workshops are relevant for the following Training Scenarios (TS):

- TS2 “EPC data collection, validation, and exploitation”, which focuses on gathering data from the EPC database and exploring its potential use in Renovation Plans.
- TS4 “Exploitation of EPC for local, regional, and national energy planning”, dedicated to investigating the potential for utilizing EPC data to meet climate protection targets in the short, medium, and long term with the usage of BRP and renovation roadmaps.



- TS5 “Evaluation and verification of energy saving opportunities based on EPC”, where enhanced EPC recommendations are utilized to assess buildings' potential energy savings.

### Methodology of the workshops

The workshops organized in each country lasted between two and three hours and were conducted in person. To ensure maximum efficiency and interactivity, a limited number of participants were invited. The objective was to facilitate robust interaction among participants. Specifically, the aim was to include a balanced representation of different stakeholders to collect different perspectives and points of view.

Each workshop's programme was tailored to the specific context in each country. Topics were selected from the Transversal Deployment Scenarios and customized to suit each context. The workshops were conducted in local languages to make them more accessible to target groups, broadening the audience and increasing their overall impact and reach.

To evaluate the workshops' effectiveness, ICAEN conducted post-event surveys among the participants, aiming to gather valuable feedback for the organisers. Furthermore, the insights collected from all participating countries were utilized to enhance the training materials of WP4.

Some of the key issues driving the discussion with stakeholders were the following:

- Could the use of building Renovation Passports (RP) streamline your work processes? If so, how?
- How should the building Renovation Passport be configured and what information should it include, in order to contribute to increasing the renovation rate?
- What is the added value of this document?
- Can you envision incorporating a renovation scenario planning tool into your work? If so, in what capacity?
- Would it be beneficial to include additional indicators in the renovation scenario planning tool?
- Is it the responsibility of the municipality to encourage the renovation of residential buildings?
- How and why should the municipality promote sustainable building renovations?

The following section provides information about the workshop implementation in the six participating countries.

### 3 Workshops

The goal of the workshops was to explain the outcomes of WP2 “Transversal Deployment Scenarios” to interested stakeholders, inviting them to engage in active discussion and debate. The participants were asked to identify barriers related to the implementation of new procedures and to provide insights for overcoming these obstacles.

The format and content of the workshops was structured in a highly flexible manner, allowing for the adaptation of contents to the local context and the invited stakeholders. This flexibility allowed for the combination of various topics into a single workshop or to divide the content into multiple workshops.

In the following table, the workshops carried in each country are listed.

Table 1. Timeline for the implementation of the workshops of the Task 3.3

Country	Dates
Austria (Salzburg)	04.10.2023
Austria (Vienna)	10.10.2023
Austria (Graz)	13.10.2023
Austria (Klagenfurt)	22.01.2024
Croatia	08.11.2023
Cyprus	29.11.2023
Italy	1.12.2023
Slovenia	14.11.2023
Spain	20.10.2023

## 3.1 Austria

### Dates and locations

Because of Austria's federal system, the SERA Institute, as the host, chose to conduct the workshops in various federal states, with each being held in its respective capital city, in order to gather a diverse range of feedback on TIMEPAC results in the most effective manner possible.

SERA organized four workshops to examine the challenges for the practical implementation of a Renovation Passport, including the renovation roadmap and the enhanced EPC with links to data repositories and BIM. All topics included in the Verification Scenarios were addressed in these workshops, albeit with varying depth, depending on the professional background and interests of the audience. At the conclusion of the workshop series, a joint report was produced and made available to all participants.

The workshops were as follows:

- October 4<sup>th</sup> 2023, Department of Energy Management and Consultancy of the administration of the Province of Salzburg, Günter-Bauer-Straße 1, 5071 Wals-Siezenheim.
- October 10<sup>th</sup> 2023, at the IG Architektur (architecture collective), Gumpendorferstraße 63B, 1060 Vienna.
- October 13<sup>th</sup> 2023, Cowork zu Geidorf, Villefortgasse 11, 8010 Graz (Styria).
- January 22<sup>nd</sup> 2024, Kärntner Landesfeuerwehrverband Rosenegger Straße 20, 9020 Klagenfurt (Carinthia), organized with the collaboration of klimaaktiv, the Austrian climate protection initiative, and DI Gerhard Kopeinig (ARCH+MORE ZT GmbH) (Figure 2).

In Graz and Salzburg, participant pictures are unavailable due to privacy policies.



Figure 2. Snapshot of the workshop in Klagenfurt/Carinthia

### Topics addressed

The main topics covered in the workshops related to this Verification Scenario focused on the challenges associated with the practical implementation of the Renovation Passport and strategies for utilizing the EPC database to develop large-scale building renovation plans. Crucial questions addressed during the discussions included the purpose of the Renovation Passport, its creators, and the effective utilization of data from the ZEUS Energy Performance Certificate database.

Additionally, topics covered monitoring, costs, and benefits for end-users.

### Stakeholders

The stakeholders participating in the Austrian workshops and their profiles are shown in Table 2.

Table 2. Stakeholders attending the workshops in Austria

Stakeholder	Category
Manager of the Independent Control System of EPC of the Province of Salzburg	Public authority
Managing director of the Energy Advice Centre of the Province of Salzburg	Energy agency
Energy consultant of the Energy Advice Centre of the Province of Salzburg	Energy agency
Architektur Wildner	Architect
Institute for Sustainable Technologies (AEE - Institut für Nachhaltige Technologien)	Designer, consultant, researcher (company)
Kommunalkredit Public Consulting (KPC)	Financing, public authority
University for Continuing Education (Universität für Weiterbildung Krems)	Property manager, researcher
University for Continuing Education (Universität für Weiterbildung Krems)	Designer, researcher
Real estate management / University of Applied Sciences FH Wien der WKO	Real estate, researcher
AH3 Architekten ZT GmbH	Designer and professional certifier
Austrian Federal Climate Protection Initiative (klimaaktiv)	Governmental climate initiative
Austrian Institute of Constructional Engineering (OIB)	Public authority
Austrian Society for Environment and Technology (ÖGUT)	NGO and agency
Renowave cooperative	Cooperative companies in the building refurbishment sector, agency
RM Regionalmanagement Mittelkärnten GmbH	Public authority
Ressourcen Management Agentur GmbH	Partner of governmental climate initiative
Puterrot GmbH	Consulting company
e+msa EnergieBeratungs GmbH	Consulting company

Stakeholder	Category
Peak energy GmbH	Consulting company
Builders	Designer and professional certifier (company)
AEE Energy services	Professional certifier
Property management	Property manager, end user
Municipality Arnoldstein	Public authority
Carinthian Provincial Government, Departments 11 and 15	Public authority
Engineering offices, technical experts	Professional certifiers and energy advisors
Housing associations	Property manager, end user
Architectural office RESCHETAR e.U.	Designer and professional certifier (company)
ARCH+MORE ZT GmbH	Architectural firm
SERA global GmbH	Project partner

### Outcomes

Key takeaways from the discussion include:

- Energy consulting is the key to determining the data.
- There should be extended training and further education for the training of energy consultants, because the EPCs do not always meet the required quality (monitoring).
- The ZEUS (Central Energy Performance Certificate Environment System) database has not yet been established everywhere, but it is currently used in the Provinces of Salzburg, Styria, Carinthia, Burgenland, Tyrol, Lower Austria. There is no standardised regulation regarding EPC databases in Austria, but rather Province-specific rules.
- Statistical analyses of the EPC database and reference building approach: The ZEUS database contains EPCs created by engineering firms with and without energy consultant training. It contains specific EPCs and those based on default data. The quality therefore varies greatly. A certain level of quality is required for statistical analyses. There are currently no concrete plans to analyse the ZEUS database.
- In general, it is important to simplify the Energy Performance Certificate and not to make it more complicated.
- The calculations in the EPC must better reflect technical and climatic developments, especially in renewable energy technologies and overheating in summer.
- Awarding a prize for high-quality Renovation Roadmaps would be beneficial.
- Different levels of detail for the Renovation Roadmap should be defined (e.g., energy consulting protocol for single-family homes = level of detail 1; property safety inspection in accordance with ÖNORM B 1300 combined with energy audit plus action plan and schedule =

level of detail 2) technical due diligence inspection plus implementation planning of measures and schedule = level 3 detail).

- The figures are also to be given as percentages because they are easier to remember.
- The Renovation Passport makes it easier to obtain subsidies and obtain favourable conditions from banks if it displays the required indicators (e.g. according to EU-Taxonomy Regulation).

## 3.2 Croatia

### Dates and locations

The workshop was organized on the 8<sup>th</sup> of November 2023. It was conducted online to engage stakeholders who were not located in Zagreb and might have encountered difficulties in participating (Figure 3).

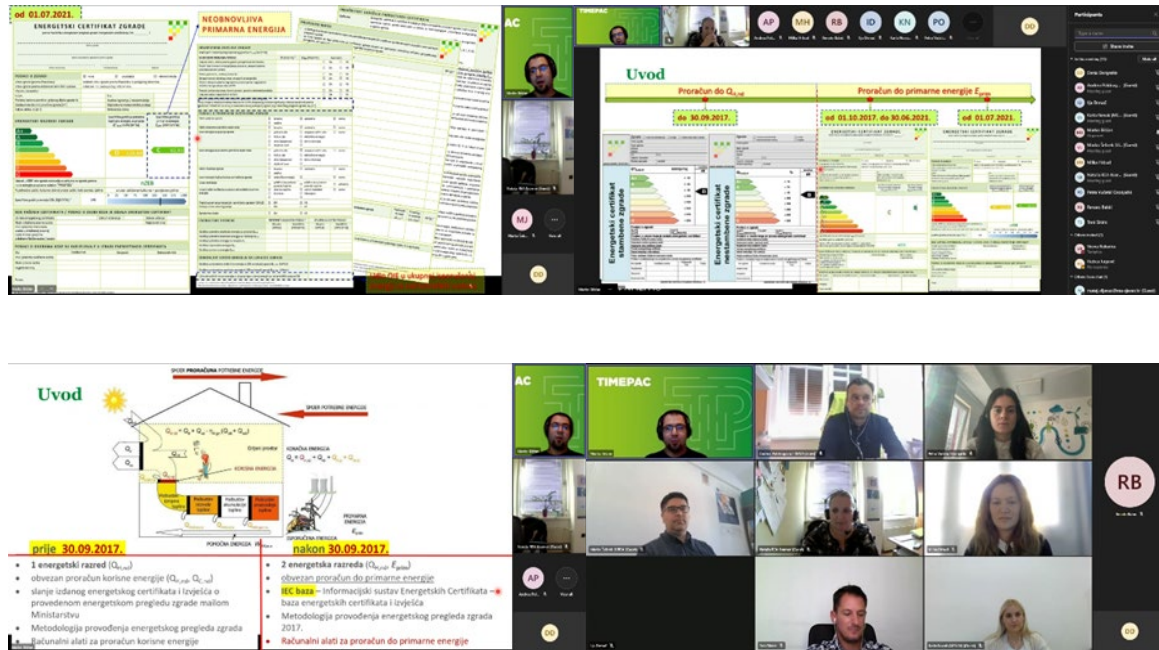


Figure 3. Snapshots of the online session

### Topics addressed

The following topics were addressed during the workshop:

- EPC and building Renovation Passport
- Statistical analysis of the database of energy certificates
- CrossCert project - greater utilization of energy certificates
- Discussion and conclusions

### Stakeholders

The workshop has been organised with the involvement of the stakeholders presented in Table 3:

Table 3. Stakeholders attending online workshop

Stakeholder	Category
REGEA	Regional energy agency
IRENA	Regional energy agency
ZADRA NOVA	Regional and Local public authority (Development agency)
DUNEA	Regional and Local public authority (Development agency)

Stakeholder	Category
REA Sjever	Regional energy agency
MENEA	Regional energy agency
SML	Regional and Local public authority (Development agency)
RAZZ	Regional and Local public authority (Development agency)
PORA	Regional and Local public authority (Development agency)
REA Kvarner	Regional energy agency
RAKAZUP	Regional and Local public authority (Development agency)

### Outcomes

The discussion touched on the following issues:

- It is essential to set up an improved automatic check on the data entry, so that it is possible to avoid typing mistakes and by consequence improve the quality of data.
- The influence of occupants and users is an increasingly important consideration in EPC.
- The data quality of EPC is affected by several issues. They are based on the norms, on the skills of professionals and on the economic value that the certificate has on the market.
- Considering the EPC generation process in Croatia, only certain aspects of EPC could be utilized for energy planning, and the methodology developed by TIMEPAC cannot be integrated. However, participants emphasized that a planning tool of some sort would be immensely beneficial for their work
- EPC data can be used to obtain access to information that is not specifically energy related (i.e. geometry, surfaces).
- Building Renovation Passports can provide the basis for implementation of energy efficiency measures that will give first assumptions on energy savings. However, to achieve more accurate results, real operational data is essential.



### 3.3 Cyprus

#### Date and location

The workshop took place at the Oikodomos Education Centre in Nisou Area, Cyprus (Figures 4 and 5), on November 30<sup>th</sup>, 2023, and was organised by representatives from the Cyprus Energy Agency (CEA) and the Cyprus University of Technology (CUT). This centre provides high-quality education and training programmes specifically designed for professionals in the construction industry. Its goal is to equip participants with the essential skills for career advancement and success. Moreover, the centre is dedicated to certifying workers in Standard Occupational Qualifications..



Figure 4. View of the Oikodomos Education Centre



Figure 5. Snapshots of the workshop in Cyprus

#### Topics addressed

The discussion branched into two primary directions, addressing concerns and needs from both professionals and end-users. The aim was to validate the processes outlined in TIMEPAC by engaging various stakeholders involved in building certification procedures, ensuring their accuracy and effectiveness.

Some of the questions raised included:

- Would the Renovation Passport be useful?
- Would it be beneficial to combine SRIs and sustainability indicators with the EPC?

#### Stakeholders

The stakeholders participating in the workshop and their profiles are shown in Table 4.

Table 4. Stakeholders attending the workshop in Cyprus

Stakeholder	Category
Cyprus Scientific and Technical Chamber (ETEK)	Professional association
The Human Resource Development Authority of Cyprus (HRDA)	Human resources
KNAUF (and other companies/material manufacturers related to energy efficiency upgrades)	Building material producer
Universities in Cyprus (UCY, Frederick etc.)	Academia
VET providers (KES college, Intercollege, UCLAN)	Academia
PASEKSEE (Association of Energy Efficiency Businesses)	Professional association
OEB - Employers and Industrialists Federation	Professional association
KEPA	Productivity centres
ACEEME - Mechanical Engineers	Professional certifiers
SPOLMIK - Civil Engineers	Professional certifiers
Cyprus Architects Association	Professional certifiers
Cyprus University of Technology	Project partner (Academia)
Cyprus Energy Agency	Project partner (Energy Agency)

### Outcomes

The following conclusions can be derived from the discussions:

- Energy experts and advocates for building Renovation Passport were enthusiastic about integrating SRI into their studies and prospective reports. They believe these additions would offer a more comprehensive understanding of building performance and furnish clients with a techno-economic rationale for adopting such measures. However, there were differing views on the extent to which there would be government enforcement of these measures.
- The enhancement of EPC with other indicators is expected to stimulate the market for smart products and readiness services, enriching the energy sector and potentially generating new employment opportunities.
- There were also concerns regarding the capacity of subcontractors and engineers to exploit the new services derived from an enhanced EPC, especially considering Cyprus's status as an island with a relatively small market. Many stakeholders still adhere to traditional practices.
- Users expressed eagerness for accurate and dependable building certificates that provide genuine value for their properties. Such certificates would not only serve as benchmarks for targeted energy upgrades but also empower homeowners to make informed investment decisions. Given that many buildings in Cyprus date back to the 1980s and 1990s and are in need of energy-efficient upgrades, this is particularly relevant. Additionally, considering

factors beyond just energy savings, such as improved thermal comfort, would help in the decision-making process regarding potential upgrade investments.

## 3.4 Italy

### Date and location

The workshop was jointly organized by Regione Piemonte, Edilclima, and Politecnico di Torino and held at the premises of Regione Piemonte (Piazza Piemonte 1, 10127 Torino, Italy) on November 3rd, 2023 (Figure 6). The session was recorded on [video](#).



Figure 6. Snapshots of the workshop in Italy

### Topics addressed

The following topics were addressed during the workshop:

- Renovation Wave and regional policies
- Building archetypes for Urban Building Energy Modelling
- EUB platform SuperHub

### Stakeholders

The stakeholders participating in the workshop and their profiles are shown in Table 5.

Table 5. Stakeholders attending the workshop in Italy

Stakeholder	Category
Municipality of Torino	Regional and Local Public Authority
Municipality of Asti	Regional and Local Public Authority
Municipality of Rivalta	Regional and Local Public Authority
iiSBE Italia R&D	Research institutions

Stakeholder	Category
C2R Consulting	Consulting firm
Ambiente Italia	Consulting firm
ENEA	Research institutions
Politecnico di Torino	Project Partner
EdilClima	Project Partner
Regione Piemonte	Project Partner

### Outcomes

The following conclusions can be derived from the discussions.

About improving the quality of existing EPCs:

- Public administrations' overseeing activities are essential for improving data quality.
- The data quality of EPCs is influenced by several factors, including regulations, the expertise of professionals, and the economic value attributed to the certificate in the market.
- It is essential to establish an automatic data entry check during the generation of the EPC to prevent typing errors and thereby enhance the quality of the data.

With regard to enhancing the information of the current EPCS:

- It is essential to integrate real data in the building performance assessment.
- While defining the current status quo can be challenging, creating scenarios becomes easier when based on solid assumptions established by a clear baseline.
- Creating a robust statistical correlation between energy classes and energy consumption is essential. Past attempts at this were hindered by insufficient sample sizes, resulting in inconclusive outcomes.
- In many cases, municipalities pay fees for their energy contracts based on energy classes, which often do not accurately reflect actual energy usage.
- The influence of occupants and users is increasingly crucial to consider, particularly in the case of heat pumps, where system management plays a pivotal role in efficiency.
- It is important to introduce simplified versions of energy reports that professionals submit to municipalities. Sometimes, incentives are overlooked because accessing them involves daunting workloads for professionals, and they are not actively promoted.
- Artificial Intelligence has been introduced to perform automatic checks or make assumptions, but the software is not yet widely available on the market.
- Making a comparison between real consumption in the EPC mandatory would be beneficial.
- EPC data can offer access to information that is not strictly energy-related, such as geometry and other data.

Concerning the integration of databases and the creation of a national platform:

- Integrating datasets is crucial as it enables the creation of synergies. For example, the EPC database should be integrated as much as possible with the Regional Inventory of heating systems.
- While the Piemonte Region boasts advanced data availability, this is not representative of the average situation at the regional level. The feasibility of establishing a national platform is thus contingent upon data availability at the regional level. Data ownership is fragmented among regional entities, making centralized access challenging.
- Municipalities have already developed methodologies for processing data for planning purposes. Therefore, integrating new practices or methodologies, such as the one developed by TIMEPAC, into ongoing activities could prove challenging.
- Using simplified models (archetypes) based on past energy retrofit investments or interventions as a starting point for developing energy retrofit scenarios could facilitate the process.

And regarding the need of additional training:

- There is a clear need to increase the skills of professionals and certifiers, highlighting the evident requirement for training.
- There is also a pressing need to open the labour market to young workers, as there is a high demand for new professional figures
- There is a lack of integration in the design activity, with engineers, architects, and installers often working in silos rather than collaboratively.

## 3.5 Slovenia

### Date and location

The workshop was held in the premises of Primula conference room (Soška cesta 40, 250 Solkan, Slovenia) on 9th of November 2023 (Figure 7). It was organised through the collaborative efforts of GOLEA, JSI, and MZI.



Figure 7. Snapshots of the workshop in Slovenia

### Topics addressed

The following topics were addressed during the workshop:

- Green Deal, Renovation Wave and regional policies
- Use of building Renovation Passports
- Planning of renovations of local community buildings with usage of the tool for Building renovation scenarios from the analysis of enhanced EPC data
- Challenges and opportunities of the SRI indicator

### Stakeholders

The stakeholders participating in the workshop and their profiles are shown in Table 6.

Table 6. Stakeholders attending the workshop in Slovenia

Stakeholder	Category
City Municipality of Nova Gorica	Regional and local public authority
Municipality of Divača	Regional and local public authority

Stakeholder	Category
Municipality of Ilirska Bistrica	Regional and local public authority
Municipality of Ankaran	Regional and local public authority
Municipality of Ajdovščina	Regional and local public authority
Local energy agency of Gorenjska	Energy agency
Local energy agency Dolenjska-Posavje- Bela Krajina	Energy agency
Local Energy Agency Pomurje	Energy agency
Ministry of the Environment, Climate and Energy MOPE (before named MZI)	Project partner
Goriška Local Energy Agency (GOLEA)	Project partner
Jožef Stefan Institute (JSI)	Project partner

### Outcomes

The following issues were raised during the discussions.

Regarding integration of BIM and EPC:

- If BIM data is to be utilized for generating EPC and RP for buildings nationwide, significant alterations at the national level are imperative in our current building design documentation processes.
- A database of BIM models does not exist, as there are very few of these models.
- It would be essential to designate institutions responsible to ensure the accuracy of data within the databases (BIM database).
- The government must find a way to encourage a more demanding way of producing EPC and BRP based on BIM models. It must also provide a standardized methodology and tools for the preparation of EPC and RP.
- Changes will be needed in the requirements for the creation of building design documentation. The existing documentation is not prepared accurately enough to be used directly for the creation of a BIM model.

With regard to the combination of EPC with other data and their application in the building renovation:

- If the energy audit is poorly executed, it is difficult to produce building renovation roadmap.
- Multiple searches of the same building design documentation are problematic. In the case of using a building logbook, the documentation would be easily accessible.
- It would be necessary to roughly determine for which buildings it would be necessary to make EPC and RP.
- The production of RP and EPC for buildings with lower energy consumption will not be economically justified.



- Other indicators could be considered: CO2 emissions after scenario implementation, investment assessment, etc.

Regarding the creation of national databases:

- A national platform is being developed for the digitization and storage of all documentation.
- Accessibility to public building energy consumption data should be improved.

Concerning the building Renovation Passport:

- The RP must be prepared in conjunction with the preparation of other documentation (energy audit). It would make sense to compare calculated and real energy consumption data.
- It will be necessary to determine the institution that will take care of managing the building logbook. However, only residential buildings have a legally designated building manager. The question is who will take care of the building logbook in other cases (non-residential buildings) and how access will be transferred after the change of ownership of the building.
- Energy agencies, as producers of energy audits, EPCs and other documentation, see great value in using building logbooks. The document's added value lies in the utilization of a building logbook and a detailed explanation of the renovation scenario.
- The tool for calculating long-term scenarios will be more useful when it is based on data from the enhanced EPC which will also include real consumption data. It would make sense to include non-residential buildings in the tool as well. The tool could be used in the evaluation of measures proposed in local energy concepts.
- It makes sense to calculate savings in the building renovation roadmap based on the real use of the building.
- It is difficult to expect that one single expert will be able to cover all the areas that should be covered in the RP.
- While municipalities can promote the refurbishment of residential buildings, it is imperative for the government to provide backing through grant programmes.

## 3.6 Spain

### Date and location

The workshop took place on 17<sup>th</sup> November 2023 at the headquarters of ICAEN, in Barcelona (Figure 8).



Figure 8. Snapshots of the workshop in Spain

### Topics addressed

The following topics were addressed in this workshop:

- Introduction to the TIMEPAC project and presentation of project's objective - proposal of five scenarios for future work with new certificates, aligned with the discussions surrounding the new energy efficiency directive.
- Integration of the building Renovation Passport with the certificate.
- The use of certificates to promote programmes for the rehabilitation of the built environment.
- Large-scale statistical analysis of EPC databases.

### Stakeholders

There were nineteen participants from various sectors, including local administration, research groups, and companies, representing different levels of expertise. Their profiles and organisations are listed in Table 7.

Table 7. Stakeholders attending the workshop in Spain

Stakeholder	Category
Agència de l'Energia de Barcelona	Regional and local public authority
Agència de l'Habitatge de Catalunya	Regional and local public authority
Ajuntament de Rubí	Regional and local public authority
Ciclica	Architects and engineers
Diputació de Barcelona	Regional and local public authority
Green Building Council Spain	Energy certifier

Stakeholder	Category
Institut Català del sol	Regional and local public authority
SUNO	Architects and engineers, specialised in urban simulation
Consell Comarcal Baix Llobregat	Regional and local public authority
ICAEN	Project partner
FUNITEC	Project partner

### Outcomes

The following issues were discussed in the workshop.

Regarding the improvement of the data contained in the certificates:

- Competent bodies and professional associations must actively promote the improvement of certificate quality.
- Energy efficiency certificates, based on normative conditions, often do not accurately reflect user behaviour, resulting in incomparable results to real consumption. Utilizing future climate forecasts in simulations could enhance accuracy.
- Challenges in accessing consumption data hinder effective analysis and decision-making.
- The Barcelona City Council's comparison of current consumption with energy simulations revealed lower actual consumption, complicating the payback period for energy improvements. In buildings lacking heating and cooling thermal installations, additional installations may increase consumption but also enhance comfort.
- The energy efficiency certificate is often poorly understood due to complex indicators, such as non-renewable primary energy, which can confuse users.

About the creation of national databases combining multiple data:

- A legal governance structure for data is imperative. Establishing a single database poses significant complexities; instead, it appears more feasible to facilitate communication among various databases through APIs, data spaces, and shared data initiatives between the public and private sectors. Additionally, implementing a metadata catalogue for categories such as cadastre and consumption data would further enhance data management processes.

With regard to the combination of EPC with other data and their application in the building renovation:

- According to the EPBD draft as of March 14th, 2023, the Renovation Passport comprises several elements: Energy efficiency certificate, Renovation passport, Indicators of readiness for smart applications, Global warming potential over the life cycle, and Indoor environmental quality.

Concerning building rehabilitation and Renovation Passport:

- When discussing the benefits of rehabilitation, it's crucial to address not only energy savings but also comfort and health. These parameters are included in the Renovation Passport.
- To encourage owners to invest in renovation, we should use simpler language, avoiding technical terms like "non-renewable primary energy."

- While the advantages of rehabilitation are well acknowledged, there's still a pressing need for improved communication strategies to effectively persuade individuals to participate in these beneficial practices.

Regarding large-scale renovation programmes:

- Large-scale renovation efforts must encompass various levels: individual apartments, entire buildings, and urban areas.
- The Renovation Passport could interface with urban planning and UBEM (Urban Building Energy Model), offering detailed building-scale information.
- Energy modelling of the urban environment requires the use of models based on reference buildings. In TIMEPAC, a study of reference buildings utilizing certification data has been undertaken.
- Presently, energy efficiency has limited influence on home purchasing or renting decisions. Price and location remain the primary determining factors.
- Implementing local rehabilitation plans can be instrumental in meeting European requirements and decarbonizing the building stock. Examples include a Rehabilitation Guide for municipalities and a Metropolitan Rehabilitation Plan

And the financing of the building renovation:

- In Catalonia, most residential buildings in urban areas consist of multi-family and multi-ownership structures. However, reaching agreements among neighbours can be challenging due to the diverse personal situations of each individual.
- Rehabilitation, particularly focused on the building envelope, proves costly. Presently, investments in this area do not yield sufficient returns through energy savings.
- To qualify for housing rehabilitation grants, including those from the Next Generation funds, significant improvements to both the building envelope and installations are required. However, the high economic cost must be incurred upfront before receiving the grant.
- Relying solely on grants will not be adequate to meet European objectives. One potential solution lies in implementing green taxation measures.
- Grants not only fail to reach the most vulnerable but also overlook the middle class due to overly complicated application processes.
- Awareness of regulations is lacking; for instance, the requirement for an existing building book has been in place since 2015 but has only recently gained attention due to grant programs associated with its implementation.
- Indicators are essential to pinpoint areas where rehabilitation is most needed, particularly in cases of energy poverty.
- Regulations heavily emphasize the building envelope, reflecting a backward-looking approach; however, neglecting considerations for cooling needs could lead to increased energy consumption

## 4 Participation

A total of 105 local stakeholders took part in the workshops organized in the six partner countries (Table 8).

It is worth noting that 42 local and regional administrations and agencies participated. Additionally, there was representation from architects, engineers, technical experts, and consultancies, totalling 24 attendees. In total, 72 external guests were among the 105 participants.

Table 8. Number of workshop participants per country

	Austria*	Croatia	Cyprus	Italy	Slovenia	Spain	Total
Research institutes	1	-	1	3	-	-	5
Local and regional administrations	3	4	-	4	8	7	26
Architects and engineers	2	-	9	-	-	3	14
Technical experts	3	-	2	-	-	-	5
Consultancies	2	-	-	3	-	-	5
Local and regional energy agencies	1	7	-		6	2	16
Green Building Council	-	-	-	-	-	1	1
Project partner	2	3	6	9	7	6	33
<b>Total</b>	<b>14</b>	<b>14</b>	<b>18</b>	<b>19</b>	<b>21</b>	<b>19</b>	<b>105</b>

\*The total number of external participants for the four Austrian workshops is 48 (excluding participating project partners), divided among the four Verification Scenarios for statistical purposes.

## 5 Findings and conclusions

The workshops conducted across Austria, Croatia, Cyprus, Italy, Slovenia and Spain have revealed several critical findings and outcomes with regard to the following topics:

- EPC data collection, validation, and exploitation
- Exploitation of EPC for local, regional, and national energy planning
- Evaluation and verification of energy saving opportunities based on EPC

### EPC data collection, validation, and exploitation

In Slovenia, a national-level shift in building design documentation processes is deemed necessary to effectively utilize BIM data for EPC and BRP creation. The absence of a database of BIM models and the need for designated institutions to ensure data accuracy within BIM databases were emphasized. Additionally, the economic justification for producing EPC and BRP for buildings with lower energy consumption was brought into question. The building Renovation Passport (RP) should be prepared alongside other documentation, particularly energy audits, for a comprehensive understanding.

The feedback from Croatia stressed the importance of improved automatic checks for data entry to enhance data quality. Consideration of occupants' influence and the impact of various factors on the data quality of EPC were highlighted.

Austria highlighted the lack of standardized regulations across provinces and recommended simplifying the EPC while incorporating technical and climatic developments. The importance of extended training and further education for EPC issuers was emphasized.

In Italy, the need for automatic checks on data entry, integration of assessments with real data, and statistical correlation between energy classes and consumptions were underscored. The lack of an integrated approach in design activities, the demand for increased skills among professionals, and the necessity to compare EPC with real consumption were emphasized.

Spain emphasized the need for a legal governance structure for data, suggesting communication with different databases via API and a metadata catalogue. Challenges in accessing consumption data were noted, and the importance of focusing on comfort and health in addition to energy savings during renovations was highlighted.

The Cyprus workshop revealed positive outcomes as Energy Experts and BRP advocates showed enthusiasm for integrating the SRI into their studies. While there's optimism for stimulating the market and creating job opportunities, concerns were raised about government enforcement and the capacity of industry professionals to adapt, given Cyprus's smaller market and lingering adherence to traditional practices.

In conclusion, the collective findings from these workshops underscore the challenges and opportunities in the TS2 EPC data collection and validation processes. Key recommendations include national-level reforms, standardized methodologies, improved training, and considerations for user influence and real data integration to enhance the overall reliability and effectiveness of the EPC and BRP processes.

### Exploitation of EPC for local, regional, and national energy planning

The insights gathered from workshops in Slovenia in connection to exploitation of EPC for local, regional, and national energy planning underscore the importance of enhanced EPC data for effective long-term scenario calculation tools. Recommendations include expanding the tool's applicability to non-residential buildings and incorporating additional indicators like post-scenario CO<sub>2</sub> emissions and investment assessments. While municipalities can promote residential refurbishments, government support through grant programmes is deemed essential.

In Croatia, challenges arise in fully integrating the TIMEPAC-developed methodology into the EPC generation process. However, participants express a clear need for planning tools, and EPC data proves valuable for accessing non-energy-related information, such as building geometry and surfaces. Austrian feedback suggests recognizing high-quality Renovation Roadmaps with awards and defining various levels of detail for these roadmaps. Distinct levels, addressing energy consulting and technical due diligence inspections, are proposed. In Italy the integration of datasets, especially linking the EPC database with regional inventories of heating systems, is considered crucial. However, regional data availability and ownership complexities pose challenges. Municipalities find it challenging to integrate new methodologies such as TIMEPAC into ongoing activities.

In Spain, the need for energy models based on reference buildings is emphasized, but serious errors in 27% of certificates hinder the generation of these references. Energy efficiency does not significantly influence housing decisions, with price and location being more decisive factors. The high cost of rehabilitation, particularly for building envelopes, is not recovered through energy savings. Green taxation is suggested as a solution to meet European objectives, considering that grants alone may not suffice. Grant processes are complicated, and there is a lack of awareness regarding existing regulations. In conclusion, the feedback highlights the need for comprehensive tools, integration of datasets, and strategic planning at various governance levels for effective exploitation of EPC in energy planning. The challenges identified underscore the importance of addressing these issues to enhance the sustainability and energy efficiency of urban environments.

### **Evaluation and verification of energy saving opportunities based on EPC**

Insights gained from workshops in Slovenia, Croatia, Austria, Spain, and Cyprus provide valuable perspectives on - the topic evaluation and verification of energy-saving opportunities using Energy Performance Certificates (EPC). The significance of calculating savings in the Building Renovation Roadmap (BRP) based on real building usage is stressed. Recognizing the challenges of expecting one person to cover all aspects in the BRP, there is a call for a national training programme to enhance expertise. The BRP is acknowledged as a foundational tool for implementing energy efficiency measures, offering initial assumptions on energy savings. However, the feedback emphasized the need for real operational data to ensure more realistic and achievable outcomes. The Renovation Passport is recognized for streamlining processes to obtain subsidies and favourable conditions from banks, aligning with EU-Taxonomy guidelines. Ensuring the relevance of the Renovation Passport for property managers is underlined as essential for reserves planning. Challenges are identified in the understanding of the Energy Performance Certificate, citing complex indicators like non-renewable primary energy. Concerns are raised about the certificate's simulation of normative conditions, making results incomparable to real consumption due to the lack of user behaviour reflection. In conclusion, the workshops underscore the importance of utilizing real operational data for accurate evaluations of energy-saving opportunities.

### **Insights for training activities**

The following issues are worth to be considered in the training activities.

- The need for substantial changes at the national level in building design documentation to use BIM models effectively.
- The need for the government to encourage and provide standardized methodologies and tools for EPC and BRP preparation.
- Emphasis on improved automatic checks and consideration of occupants' influence.
- Integrating assessments with real data for more accurate results.
- Calculating savings in building renovation roadmaps based on the real use of the building.
- Placing greater emphasis to energy audits in training scenarios for more effective and practical skill development.
- Integrating datasets for creating synergies.
- Improving accessibility to public building energy consumption data.

### TIMEPAC D3.3 - Findings and conclusions

- User-friendly data presentation and practical relevance of tools are crucial and understanding complex indicators in the Energy Performance Certificate is nowadays a challenge.
- The need to increase the skills of professionals and certifiers through training (national training programme).