



Towards Innovative Methods
for Energy Performance Assessment and Certification of Buildings

Deliverable 3.1

Report on improved certification with enhanced EPCs

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Executive Summary

This report provides a summary of the activities undertaken in Task 3.1 “Improving certification with enhanced EPCs” of Work Package 3 (WP3) “Verification Scenarios”. The main goal of this work package is to validate the results of the [Transversal Deployment Scenarios \(TDSs\) developed in Work Package 2 \(WP2\)](#), with the involvement of local stakeholders engaged in building certification procedures.

TIMEPAC partners organised workshops in Austria, Croatia, Cyprus, Italy, Slovenia, and Spain with a diverse set of stakeholders, including energy certifiers, energy agencies, and public authorities, among others. A total of 98 participants, 43 of whom represent professional certifiers, consulting companies and regional/local authorities, outside the TIMEPAC consortium, collaborated in the workshops which were carried out from October 2023 to January 2024.

The workshops provided valuable insights, helping to identify the training needs required for participants to contribute to actively enhancing current certification practices in line with the most recent updates of the Energy Performance of Buildings Directive, adopted by the European Council on 12th April 2024.

The workshops conducted across the six countries provided a rich overview of the current building energy performance situation, and the challenges that stakeholders are facing in light of the latest Directive, which is also considered in TIMEPAC’s future scenarios developed in WP2.

One of the main challenges facing stakeholders is how to use building modelling and simulation technologies to improve the quality (more reliable and accurate) and enhance the content (with additional parameters and indicators) of the energy performance certificates (EPCs) in order to ensure interoperability among the applications developed by various software developers and to prevent the loss of information when importing and exporting models between applications. Moreover, despite their importance, energy certificates are susceptible to human error, thus necessitating a delicate equilibrium between their quality and affordability. It is imperative that the cost associated to these certificates is substantial enough to guarantee their reliability and accuracy, thereby safeguarding their integrity in assessing energy efficiency. BIM has many potential benefits, particularly for new construction projects, but its adoption remains limited in some countries, which means that more training is needed.

Regarding the inclusion of sustainable indicators in energy performance certificates, there is concern about the Global Warming Potential (GWP), as it fails to provide clear calculation parameters and available data sets, which would provide crucial information for authorities when certifying standards. Additionally, benchmarks are missing, and tools and databases for calculating KPIs based on a life cycle approach are generally unavailable. Finally, the correlation between high Smart Readiness Indicator (SRI) performance and improved comfort is not consistently demonstrated.

Based on discussions with workshop participants, it was suggested that government entities, educational organizations, industry groups, and professionals collaborate closely. This collaborative effort is crucial for establishing database infrastructure, implementing comprehensive training programs, and facilitating a smooth transition to new standards.

Ultimately, the workshops showed the importance and the effectiveness of training which plays a pivotal role in upholding the integrity of the certification process. Training should provide those involved in building assessment and certification with a more comprehensive perspective on the environmental implications of buildings across their entire lifecycle. Furthermore, it is crucial to disseminate knowledge and information to all parties involved in the assessment process, including property owners, management teams, technical staff, property management agencies, construction firms, and other relevant stakeholders. These insights are especially pertinent to the training initiatives underway in the TIMEPAC Academy.

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).

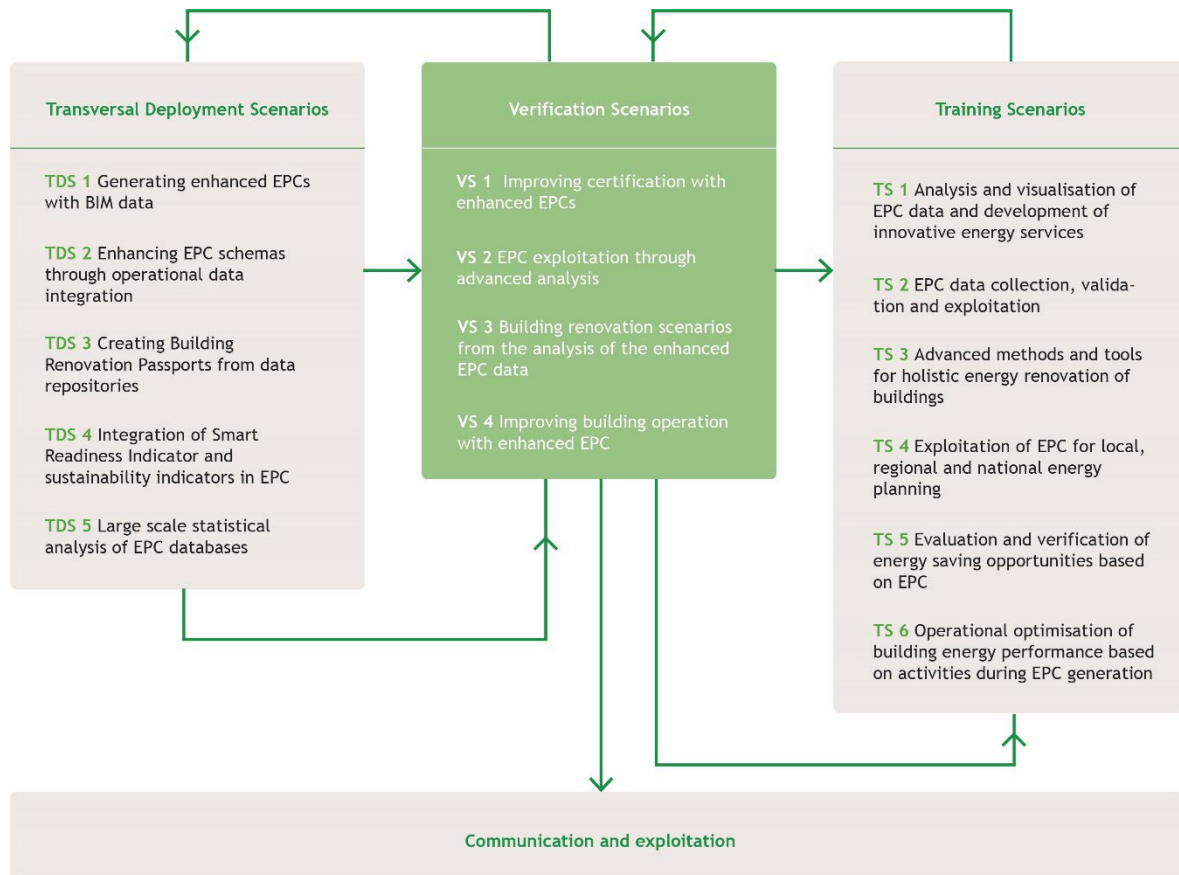


Figure 1. Interconnections between Transversal Deployment Scenarios, Verification Scenarios and Training Scenarios

The work of WP3 was organised into four tasks, 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 organizations arranged a series of Verification Scenarios 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 skill development to be provided through the activities conducted within the TIMEPAC Academy.

This document serves as a report on the implementation of Task 3.1 “Improving certification with enhanced EPCs” which focuses on the interlinking between BIM and certification tools. The workshops for this task were conducted in partner countries during November 2023 in Austria, Croatia, Cyprus, Italy, Slovenia and Spain.

1.1 Purpose and target groups

The aim of Task 3.1 was to verify the procedures envisioned in TDS 1 “Generating enhanced EPCs with BIM data,” and TDS 4 “Integration of Smart Readiness Indicators and sustainability indicators in EPC”. One of the main objectives was to use building modelling and simulation technologies to boost the reliability and precision of the energy performance certificates. At the same time that, new indicators enriching EPCs with extra parameters for a more comprehensive assessment were assessed.

Participants in the workshops for Task 3.2, 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 summary of the collective findings. The summary assists in identifying both the differences among 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 structured 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, organizational 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

ICAEN led Task 3.1, and organised together with FUNITEC two workshops in Catalonia. Project partners in Austria, Croatia, Cyprus, Italy, and Slovenia facilitated the workshops in the respective countries and provided the report afterwards. Regione Piemonte, WP3 leader, has been in charge of coordinating the liaisons across the various workshops, 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 workshops were carried out in parallel with a [survey](#) organised 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 main aim of the Verification Scenario carried out as a part of Task 3.1 “Improving certification with enhanced EPCs” was to verify the procedures developed within Transversal Deployment Scenarios TDS1 “Generating enhanced EPCs with BIM data” and has cross-connections in particular to TDS4 “Integration of Smart Readiness Indicator and sustainability indicators in EPC”.

The objectives of [TDS1 “Generating enhanced EPCs with BIM data”](#) were to develop comprehensive guidelines for evaluating the feasibility of generating EPCs from BIM models to ensure the high quality and reliability of the resulting EPCs, thereby promoting the widespread adoption of BIM for EPC generation. To demonstrate the applicability and value of these guidelines, a thorough validation process was conducted across six partner nations: Austria, Croatia, Cyprus, Italy, Slovenia, and Spain. Thirty BIM models, five from each country, underwent generation and evaluation following the guidelines. The outcomes of the validation exercise illustrated the practicality of the guidelines in real-world contexts and underscored their efficacy in empowering certifiers to confidently produce precise EPCs.

The aim of [TDS4 “Integration of Smart Readiness Indicators and environmental sustainability indicators in EPC”](#) was to investigate, implement and deliver advanced and innovative methods and procedures to generate the enhanced energy performance certificate. To promote the use of the SRI and sustainability indicators, the TIMEPAC “Code of Conduct for Smart Readiness and Sustainability Rating” was created. It represents a set of guidelines, values and principles that are considered fundamental for the successful, professional and transparent calculation of the SRI and selected sustainability indicators. The Code of Conduct was generated based on experiences gained through the implementation of the TDS4 in six countries participating in TIMEPAC.

This Verification Scenario entailed analysing outcomes derived from TDS1 and TDS4 within selected target groups through workshops implemented in six partner countries. The findings derived from the meetings with local stakeholders in the workshops has provided some valuable insights about the training activities to be carried WP4 “EPC Standardisation, Training and Capacity Building”. In particular, the collected input is relevant for the following Training Scenarios (TS):

- TS1 “Analysis and visualisation of EPC data and development of innovative energy services” dedicated to developing innovative energy services that can derive from the enhanced EPC.
- TS2 “EPC data collection, validation and exploitation”, dealing with the data collection process and data extraction from various sources, including the generation of EPC from BIM model.
- TS3 “Advanced methods and tools for holistic energy renovation of buildings”, which focuses on integrating BIM models with simulation tools for improving the assessment of building performance.

Methodology of the workshops

Workshops in each country lasted between two and three hours and were conducted in person. A maximum of 20 attendees per workshop was enforced to ensure maximum efficiency and interactivity. The aim was to gather diverse perspectives from stakeholders representing various sectors to enrich the future scenarios envisioned by TIMEPAC.

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 used to enhance the training materials of WP4.

Key issues driving discussions with stakeholders in the workshops included:

- Advantages and barriers in the implementation of BIM in the EPC generation.
- BIM interoperability with other tools: challenges encountered when creating models in one software and simulating them in a different application.
- Smart Readiness Indicator:
 - Advantages and barriers of the methodology to implement it.
 - Its use in new buildings and building renovation.
 - Its contribution to enhancing EPC.

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 3.1

Country	Dates
Austria (Salzburg)	04.10.2023
Austria (Vienna)	10.10.2023
Austria (Graz)	13.10.2023
Austria (Klagenfurt)	22.01.2024
Cyprus	29.11.2023
Croatia	15.11.2023
Italy	30.10.2023
Slovenia	09.11.2023
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 facilitated 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 4th 2023, Department of Energy Management and Consultancy of the administration of the Province of Salzburg, Günter-Bauer-Straße 1, 5071 Wals-Siezenheim.
- October 10th 2023, at the IG Architektur (architecture collective), Gumpendorferstraße 63B, 1060 Vienna.
- October 13th 2023, Cowork zu Geidorf, Villefortgasse 11, 8010 Graz (Styria).
- January 22nd 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 addressed in this Verification Scenario focused on the challenges associated with the practical implementation of the enhanced EPC with links to data repositories and BIM. The Smart Readiness Indicator and its application in Austria were briefly mentioned but primarily discussed in other events, as specific SRI activities are underway as part of the [Austrian SRI test phase](#).

Crucial questions centred around the future generation of EPCs and the utilization of data from the ZEUS Energy Performance Certificate database. Topics covered monitoring, costs, and benefits for end-users, with an emphasis on distinguishing between new and existing buildings.

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

Regarding the BIM approach:

- The discussion around Building Information Modelling (BIM) and its application in the construction industry highlighted contrasting views. Some argue that BIM is **overly complex**, while others see it as **facilitating faster**, better networked work processes.
- **BIM** also aligns with the principles of the **circular economy**, enabling the easy reuse of components. However, challenges remain, including data management for privacy and public interest concerns.
- Updating BIM models raises questions about responsibility, especially in renovation projects where existing BIM data could simplify the process. However, the automatic generation of BIM models from existing EPC data faces hurdles due to discrepancies between planned and as-built structures. Moreover, the complexity of BIM-based EPC and renovation certificates presents barriers for smaller companies.
- The collected recommendations include developing simpler BIM tools for wider adoption and addressing legal issues surrounding data management and privacy. More information about the current efforts to integrate BIM in the construction industry in Austria can be found at [“BRISE-Vienna Information zum Pilotbetrieb des BIM-basierten Bauverfahrens”](#) and [“BIM-Terminal”](#).

Regarding the sustainability indicators and SRI:

- During the discussions, the topic of SRI was raised. However, most of the participants, aside from the authorities, were not familiar with neither the term nor the concept. From this observation, it can be concluded that more information about it is needed.

3.2 Croatia

Date and location

The workshop took place on 15th November 2023 in the premises of the company EKONERG as EIHP is being refurbished, with the participation of some local key stakeholders (Figure 3).



Figure 3. Snapshots of the workshop in Croatia

Topics addressed

In addition to the TIMEPAC presentation, the sister projects crossCert and EuB SuperHub were also introduced. Participants gained valuable insights into their methodologies and approaches by drawing on the collective knowledge and experiences of the three projects. This exercise not only broadened participants' understanding but also fostered more constructive engagement throughout the workshop.

The workshop aimed to discuss the possible introduction of a new set of indicators and the feasibility of their application in the work of stakeholders. The presentations focused on several aspects:

- BIM as a methodology to generate EPC, increasing coherence between documents of the same building
- SRI structure and functionalities
- Examples of SRI applications in the TIMEPAC project
- Level(s) indicators of sustainability of buildings
- EPC and Renovation Passport, two tools to boost renovation
- EPC and operational data, differences between simulated data and real energy consumption
- data, differences between simulated data and real energy consumption

Stakeholders

The stakeholders participating in the workshop and their profiles are shown in Table 3.

Table 3. Stakeholders attending workshop in Croatia

Stakeholder	Category
HEP ESCO	Energy service company
REGEA	Energy agency
APN	Real estate agency
Energonova	Professional certified
STUDIO M2	Professional certified
Ministry of Physical Planning, Construction and State Assets	Public authority

Outcomes

Regarding analysis and visualisation of EPC data and the development of innovative energy services:

- Building Information Modelling holds potential benefits, particularly for new construction projects, but its adoption remains limited in Croatia, primarily utilized by architects for select new designs.
- Additionally, new indicators like SRI could serve as valuable information tools. However, without access to pertinent information, there is a lack of awareness regarding potential issues, hindering proactive problem-solving efforts.

Regarding the EPC data collection, validation and exploitation:

- **SRI does not consistently lead to improved comfort.** The SRI is acknowledged as an indicator for comfort improvement; however, it faces a similar challenge as EPC in terms of calculated values not always aligning with actual energy consumption.
- **Addressing gaps in skills, datasets, and software is crucial for introducing new sustainability indicators.** Visual presentations of the calculation process to end-users is essential for understanding.
- While BIM aids data validation and collaboration, **cost remains a major hurdle.**
- **Key sustainability indicators** like life cycle Global Warming Potential **lack clear definitions and data**, complicating certification and benchmarking processes. This is crucial for authorities that need to certify the achievement of a standard. There is also a lack of a benchmark.

Finally, the challenge of ensuring interoperability among diverse tools like SRI (that could serve as valuable information tool) is a significant issue that needs to be addressed.

3.3 Cyprus

Dates and locations

The workshop took place at the Oikodomos Education Centre in Nisou Area, Cyprus (Figures 4 and 5), on November 30th, 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 main topics discussed with the workshop participants were:

- How can Building Information Modelling data be effectively utilized to enhance EPCs and provide detailed information about building systems and components?
- What challenges and opportunities arise from integrating operational data into EPCs to improve accuracy and provide real-time information on building energy use and performance?
- In what ways can advanced analysis techniques be applied to identify opportunities for energy savings and optimize building operations based on enhanced EPC data?

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

Regarding energy experts:

- They showed enthusiasm for incorporating SRI into their assessments and reports. They believed that SRI would offer a more accurate vision of building performance and provide clients with techno-economic justifications for adopting energy-efficient measures. This, in turn, would stimulate the market for smart readiness products and services, enhancing the overall energy market.

Regarding end-users:

- They were eager to have a certificate that accurately **reflects their building's attributes** and provides a **reliable benchmark for potential energy upgrades**. They sought assurance that the certificate would accurately represent the value of their property and aid in making informed decisions regarding investment in energy improvements. Furthermore, there was recognition of the importance of accounting for "hidden" benefits like thermal comfort in the decision-making process for potential upgrade investments.

3.4 Italy

Dates and locations

The workshop was held on October 30th, 2023, at the premises of the Polytechnic of Torino (Figure 6). This workshop is implemented by the combined efforts of Regione Piemonte, Edilclima and Politecnico di Torino.



Figure 6. Snapshots of the workshop in Italy

Topics addressed

The workshop began with a keynote address from Alfonso Cappozzoli, who introduced the structure and functionalities of the SRI. After that, presentations were delivered by Vincenzo Corrado on the TIMEPAC project within the framework of the EPBD recast, Valeria Nesci on Level(s) and sustainability indicators, and Alice Gorrino, who provided concrete examples of pilot applications of the SRIs and Level(s) in the TIMEPAC project.

The main aim of the workshop was to generate debate regarding the potential introduction of a new set of indicators and assess their feasibility for stakeholders. The workshop adopted a pragmatic approach, with direct involvement from the invited stakeholders.

The presentations focused on the following topics:

- SRI structure and functionalities.
- Levels method about sustainability indicators.
- Examples of SRI application in TIMEPAC project.

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
AI Engineering	Consulting firm
C2R Consulting	Consulting firm
iiSBE Italia R&D	Research institutions

Stakeholder	Category
Professional Orders of Architects	Professional associations
Politecnico di Torino	Project partner
Edilclima	Project partner
Regione Piemonte	Project partner

Outcomes

The discussion underscored the need to pinpoint gaps when introducing new indicators in building energy performance certification. These gaps could be about skills, data availability, or software requirements. Each indicator needs its own assessment of these gaps, and there should be plans to tackle them effectively, with enough financial support. Unfortunately, this proactive approach seems to be lacking in the professional realm nowadays.

Based on the discussions about EPC data collection, validation, and exploitation, the following conclusions can be drawn:

- Semantic discrepancies exist between guidelines for new indicators and technical norms, requiring resolution or careful consideration.
- Collaboration with building designers and users is essential for a comprehensive sustainability assessment.
- Delays in transposing Directives, norms, and guides on SRIs at the national level hinder professionals' capacity to work effectively.
- Adoption of BACs or BEMS is difficult in the residential sector due to non-technological barriers (economic and cultural), with more success seen in the tertiary sector.
- The correlation between high SRI performance and improved comfort is not consistently demonstrated, echoing issues seen with EPCs.
- Some SRI indicators lack clear definitions and have significant weighting, leading to variability in assessment scores among professionals.
- There is an urgent demand for professional training, yet this alone may not suffice if public bodies fail to conduct thorough inspections.
- Pre-checks by the public sector are deemed as additional benefits.
- Control measures should evolve into consultative services to elevate the overall quality of certifications.
- There is a new wave of indicators coming and not enough information and capacities to provide qualified services. In most of the cases the new methods and indicators are implemented in a formal way as it is only a fulfilment.

Regarding advanced tools for holistic energy renovation:

- Unclear definitions and insufficient data for vital indicators like life cycle Global Warming Potential, pose challenges for certification and benchmarking by authorities.
- The absence of necessary tools and databases for calculating Key Performance Indicators (KPIs) using a Life Cycle approach, impeding comprehensive sustainability assessments.

3.5 Slovenia

Date and location

On November 14th, 2023, a workshop was held in Ljubljana (Figure 7), organised by the Ministry of the Environment, Climate, and Energy (MZI) together with Jožef Stefan Institute (JZI).

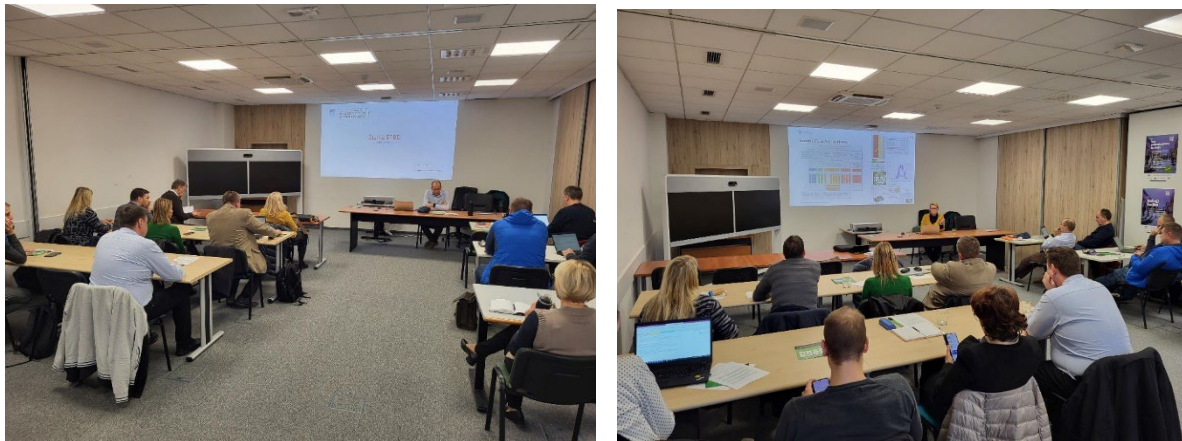


Figure 7. Snapshots of the workshop in Slovenia

Topics addressed

The workshop highlighted several critical aspects of the evolving building energy efficiency landscape, particularly concerning the updated Energy Performance of Buildings Directive (EPBD). Dynamic modelling and the adoption of SRI, among other strategies, will serve as valuable tools to achieve the EPBD's ambitious goal of decarbonising buildings by 2050.

The following topics were discussed with the different stakeholders during the workshop:

- Energy efficiency legislation: The workshop started with an overview of the TIMEPAC project and its relevance to the updated EPBD. This included a discussion on the current state of Slovenian legislation on energy efficiency in buildings and the development of new legislation.
- Use of dynamic methods for calculating energy use in buildings, compared with static models to highlight the advantages. This topic was presented by the University of Ljubljana.
- Relationship between EPC and SRI, presented by the Jožef Stefan Institute.
- Building Renovation Passport. The ZRMK Building and Civil Engineering Institute spoke about sustainable renovation strategies and gave a detailed insight into the Building Passport concept, which is crucial for documenting and guiding energy-efficient renovations.
- Relationship between EPC results and actual energy consumption in buildings, obtained through the process of carrying out energy audits.

The workshop ended with a broad discussion emphasizing the necessity for legislative and governmental backing for energy efficiency in buildings, alongside the creation of a digital platform to streamline data management and accessibility.

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
PETROL	Energy service company
ZEUS ENERGIJA	Professional certified
GOLEA	Energy agency
LEAG	Energy agency
KNAUF INSULATION	Construction company
ZAPS	Professional associations
ZRMK	Research institutions
IJS	Research institutions
UL FS	Research institutions
TELEKOM SLOVENIJE	Energy-related Product Company

Outcomes

Based on the discussions, the following conclusions can be drawn.

Concerning legislative requirements:

- The workshop highlighted several critical aspects of the evolving landscape of building energy efficiency, particularly in the context of the updated **Energy Performance of Buildings Directive**. The workshop served as a valuable platform for discussing the implications of new EPBD standards, the importance of data accessibility for energy audits, and the need for skilled professionals capable of meeting these emerging requirements.

Concerning the enhancement of current EPCs:

- There is an urgent requirement to **establish a comprehensive spatial energy database** to facilitate accurate energy audits, issue Energy Performance Certificates and assess **Smart Readiness Indicator**. This database should not only store data but also ensure easy access and efficient management to drive decision-making and policy development.
- Besides, stakeholders must prepare for more stringent processes in obtaining building Renovation Passports (RPs) and EPCs. Proactive measures, such as familiarizing architects, engineers, and auditors with the new standards well in advance, are crucial for a smooth transition.

Regarding training professionals:

- There is a glaring shortage of qualified professionals capable of meeting the new standards set by the Energy Performance of Buildings Directive. Thus, there is a **pressing need for enhanced training programs tailored for energy professionals** to cover both technical aspects and a deep understanding of EPBD objectives and implications.
- Addressing these challenges requires collaborative efforts from government bodies, educational institutions, industry associations, and professionals to develop database

infrastructure, deliver comprehensive training programs, and ensure seamless adaptation to new standards.

To sum up, the workshop highlighted key obstacles and requirements in the field of enhancing building energy efficiency. It outlined a straightforward direction, highlighting the crucial role of data infrastructure, the demand for competent individuals, and the importance of working together in an adaptable manner. The knowledge acquired from this gathering not only mirrors the present situation but also provides a framework for forthcoming initiatives.

3.6 Spain

Date and location

The workshop took place on October 20th at the headquarters of ICAEN, in Barcelona. The coordinating team ICAEN, alongside Spanish partners CYPE and FUNITEC, carried out the workshop (Figure 8).



Figure 8. Snapshots of the workshop in Spain

Topics addressed

The workshop was divided into two parts:

1. Integration of the energy certificate with the BIM methodology
2. Integration of the Smart Readiness Indicator, Level(s), and the building Renovation Passport with the EPC

Ainhoa Mata, from ICAEN, initiated the workshop with a comprehensive overview, setting the stage for Leandro Madrazo (FUNITEC) to introduce the TIMEPAC project. Subsequently, Álvaro Sicilia (FUNITEC) and Benjamín González (CYPE, online) delved into the enhanced Energy Performance Certificate through Building Information Modelling models. Marta Chàfer (ICAEN) then shared insights on sustainability indicators (Level(s)) and Smart readiness indicators with a Barcelona case study incorporating both indicators.

During the discussion, various factors determining the sustainability of buildings were addressed, considering people, the economy, and the impacts on the environment.

Stakeholders

Seventeen professionals from the construction sector, specializing in energy certification, as well as public administration, participated. Their profiles and organizations are listed in Table 7.

Table 7. Stakeholders attending the workshop in Spain

Stakeholder	Category
JSS	Professional certified
IMHAB	Regional and local public authority
Societat Orgànica	Professional certified
ARCbcn	Professional certified

Stakeholder	Category
Agència de l'Habitatge de Catalunya	Regional and local public authority
Proisotec	Energy auditor
AiguaSol	Energy auditor
Oficina Tècnica de Rehabilitació	Regional and local public authority
ICAEN	Project partner
FUNITEC	Project partner
CYPE	Project partner

Outcomes

The workshop's dynamic format encouraged active participation and generated a wealth of ideas from all attendees. This led to interesting conclusions, which also serve as recommendations.

Concerning BIM, reliability of data and cost of the energy certificate:

- The primary obstacle when utilizing BIM for generating EPCs lies in the lack of **interoperability** among applications developed by various software companies. **Information loss** occurs during the import and export of models between these applications. In response to this challenge, TIMEPAC has developed guidelines that concentrate on open interoperability to facilitate the generation of EPCs from BIM models.
- The data might not always accurately represent reality; it's up to a technician to interpret reality, and this interpretation can be subjective. The data may not always reflect reality; a technician must interpret reality, and this interpretation can be subjective. BIM, properly utilized, **would help prevent inconsistencies** among documents of the same building (energy certificate, technical building inspection, certificate of occupancy, etc).
- The BIM methodology can provide more accurate data for the building assessment and certification, and **minimise discrepancies** among various documents for the same building. However, using **BIM requires more time** and consequently **leads to higher costs** compared to other certification tools. Therefore, it is necessary to strike a **balance between the quality of the energy certificate and its cost**.

With regard to end-users:

- The discussion highlighted the importance of using clear and easily understandable language to raise awareness and inform the public about building rehabilitation efforts and/or energy certificates.
- The proposed methodological changes must consider **citizen engagement**; it is crucial to involve all stakeholders.

Regarding EPCs and databases:

- Authorities must oversee **building databases**, such as energy certificates and building registry entries, ensuring they are transparent, easily accessible, and trustworthy. Simplifying administrative procedures and creating centralized access points are also crucial steps.

- To boot the building's renovation, the administration could create a base simulation of all buildings that are open and can be enriched with specific simulations for each building.
- A **legal governance structure for data is needed**. A singular database presents considerable complexity; instead, fostering communication among diverse databases through APIs, and data spaces, and facilitating data sharing between the public and private sectors appears to be a more viable approach. This includes the implementation of a metadata catalogue encompassing cadastre, consumption data, and other pertinent information.

About financial issues:

- Furthermore, it was observed that a major barrier to rehabilitation efforts is finance. While various mechanisms such as assistance programs, green taxation, and financing options exist to address this challenge, they must be widely disseminated and clearly explained to the public.
- The Barcelona City Council has conducted a comparison between current energy consumption and energy simulations, revealing that actual consumption is lower than calculated. This poses a significant hurdle in achieving a favourable payback for energy improvements. Additionally, in buildings lacking heating and cooling thermal installations, supplementary installations are incorporated, resulting in heightened consumption, although with an accompanying improvement in comfort levels.

With regard to sustainability indicators:

- It was proposed that the building Digital Logbook be a repository to interrelate all these documents SRI and EPCs.
- At the same time, it was indicated that the umbrella under which this set of tools is situated is the European framework Level(s), which establishes the indicators that need to be measured to determine the environmental impacts of a building (energy, life cycle emissions, water, materials...).
- District modelling plays a crucial role in the national building renovation plan. It can utilize archetypes or integrate the Renovation Passport to synchronize planning with an UBEM (Urban Building Energy Model). The RP would provide more detailed information at the building scale.
- According to the draft of the Energy Performance of Buildings Directive, it will be necessary to calculate the building's **global warming potential**. Then, it will be necessary to **know the type and quantity of materials in the building**. The BIM methodology can assist in obtaining this data.
- Moreover, regarding the **SRI indicator**, it was said that it could be highly interesting for the private sector in the **tertiary market**. However, it is not clear whether a **home automation system is more efficient than manual management**.

Changes in the perspective of the energy certificate:

- [The Long-Term Strategy for Energy Renovation in the Building Sector in Spain \(ERESEE\)](#) aims to elevate the annual count of rehabilitated homes from 25,000 to 300,000. Accomplishing this surge necessitates a thorough reconsideration of the administrative framework, particularly in addressing the escalating demands for building permits.
- It is seen that **the importance of the certificate increases** significantly when it becomes necessary for applying for **funding**.

And the need for training:

- The professional sector comprises property management administrations, architecture teams, engineering firms, construction companies, and material suppliers. It was emphasized that **enhancing education** is essential to improve the quality of aspects like energy certificates.

- In Catalonia, a legislative change is foreseen in the definition of certifying technical expert, which would include mandatory training. It is expected that the training will result in an improvement in the quality of the certificates, Moreover, there will be a registry of certifying technical personnel.
- While the energy certificate is commonly utilized, it is frequently regarded as a mere procedural requirement, highlighting the need for **enhanced quality** assurance through increased government oversight and better training for professionals responsible for its execution.
- **Training is key to ensuring the quality of the certificate.** It is essential to train energy advisors, not just technicians who input data into a programme. Training should encompass a broader understanding of the environmental impacts of buildings throughout their lifecycle. It is necessary to form and inform all stakeholders in the process: property owners, management, technical staff, property management, construction companies, and others.

4. Participation

A total of 98 local stakeholders took part in the workshops that took place in the six partner countries.

Table 8 illustrates the distribution of participants across different target groups within each country, offering insights into the diversity among attendees. It is worth noting that the majority across all nations were professional certifiers, with a total of 26 from all countries. This alignment with the primary objectives of the TIMEPAC project underscores its overarching scope and purpose. Spain takes the lead in the category with 7 attendees, closely followed by Italy and Austria, each with 4 attendees.

After professional certifiers the largest target group are consulting companies, with a total of 10 participants. Regional and local authorities showed notable participation with 7 attendees. This prioritization of professional certifiers, consulting companies, and regional/local authorities (43 in total vs 38 project partners) underscores the workshop's focus on engaging key stakeholders involved in building assessment and certification outside the consortium.

Table 8. Workshop participants per country distributed by target groups

	Austria*	Croatia	Cyprus	Italy	Slovenia	Spain	Total
Professionals	4	5	3	4	3	7	26
Energy agencies	1	2	1	-	1	1	6
Consulting companies	2	2	1	2	2	1	10
Construction companies	0	-	-	-	1	-	1
Regional/local authorities	3	-	2	-	-	2	7
Research institutes	1	1	-	2	3	-	7
End users	1	1	1	-	-	-	3
Project partner	2	7	4	10	9	6	38
Total	14	18	12	18	19	17	98

*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 held in Austria, Croatia, Cyprus, Italy, Slovenia, and Spain yielded significant findings and shed light on the training gaps professionals face regarding the challenges posed by the new EPBD.

Analysis and visualisation of BIM and EPC data

In Austria, some argue that **BIM is overly complex**, while others see it as **facilitating faster, better networked work processes**. BIM also aligns with the principles of the circular economy, enabling easy reuse of components. However, challenges remain, including data management for privacy and public interest concerns.

Spain considers that utilizing BIM for EPCs faces **interoperability challenges**, addressed by TIMEPAC's guidelines. Technicians must interpret BIM data subjectively. Balancing cost and quality is crucial for energy certificates. While BIM offers accuracy, it requires more time and higher costs. Nonetheless, it can minimize document inconsistencies for the same building.

Lastly, **BIM holds potential benefits**, particularly for new construction projects, but its adoption remains limited in Croatia, primarily utilized by architects for select new designs

EPC data collection, validation and exploitation (sustainability indicators and SRI)

Italy highlights the importance of clarifying **the existing gaps for the introduction of new indicators** (in terms of skills, datasets and software). The gaps should be identified for each specific indicator and this should be planned and implemented with adequate financing support. This does not appear to be the case in the actual context.

Spain and Italy agreed on **how to approach the SRI methodology**, which is not well defined and has an important weighting. The discretionary nature of their application **can affect the overall scoring**. There are examples where the same building assessed by different professionals reaches different scores, the difference in some cases being quite significant. Italy adds that there are discrepancies in wording and naming (i.e. energy services in EN ISO norms are named as domains in SRI) that need to be solved or taken into due consideration.

Moreover, Spain suggests **utilizing the building Digital Logbook as a central repository for connecting all these documents (SRI, RP, etc)**. Moreover, Spain pointed out that administrations need to manage building databases (energy certificates, building records, etc.) to make them open, accessible, and reliable. It is also necessary to simplify administrative processes and establish single points of access.

Austria, on the other hand, raised the issue of SRI. This led participants, excluding the authorities, to acknowledge the absence of both the term and the methodology. This suggests that there is still a significant gap in terms of information that needs to be addressed.

Italy pointed out, **the significant delays in the transposition phase of Directives, norms and guides on SRIs at the national level**. This inherits the capacity of professionals to perform their activity in due time and with a stable framework.

Slovenia emphasized that there is an **urgent requirement to establish a comprehensive spatial energy database** to facilitate accurate energy audits, issue Energy Performance Certificates, and assess Smart Readiness Indicator. This database should not only store data but also ensure easy access and efficient management to drive decision-making and policy development.

Croatia and Spain indicated **that achieving high ratings in SRI does not always lead to enhanced comfort**, echoing the discrepancies observed in Energy Performance Certificates, where the estimated energy efficiency frequently diverges from real consumption patterns.

Croatia and Spain agree that while Building Information Modelling **aids data validation and collaboration, cost remains a major hurdle**.

Cyprus on the other hand affirmed that energy experts, who are in charge of issuing EPCs, expressed eagerness to SRI in their evaluations and documentation. They were confident that SRI would provide a more precise portrayal of building performance and furnish clients with techno-economic rationales for embracing energy-efficient practices. Consequently, they anticipated that this integration would drive demand for smart readiness products and services, ultimately improving the energy market as a whole. Furthermore, end-users recognized the importance of accounting for "hidden" benefits like thermal comfort in the decision-making process for potential upgrade investments. Ultimately, both professionals and end-users prioritized the benefit of their work or building and the assurance of benefits from potential investments.

In several countries (Croatia, Italy and Spain) **there was a concern focus on the Global Warming Potential, which fails to provide clear definitions for calculation and available data sets.** This is critical for authorities certifying standards. Additionally, benchmarks are missing, and tools and databases for calculating KPIs based on a life cycle approach are generally unavailable.

Advanced methods and tools for holistic energy renovation of buildings

Austria considered that updating BIM models raises questions about responsibility, especially in renovation projects where existing BIM data could simplify the process. However, the automatic generation of BIM models from existing EPC data encounters obstacles due to discrepancies between planned and as-built structures. Moreover, the complexity of BIM-based EPC and renovation certificates presents barriers for smaller companies.

Spain highlights the significance of employing straightforward and easily comprehensible language when increasing awareness and educating the public about building rehabilitation endeavours. Moreover, it was mentioned that one of the **main barriers to rehabilitation is finance.** There are mechanisms to address this issue that need to be disseminated and explained straightforwardly to the public, such as assistance programs, green taxation, financing, etc.

In Slovenia, it was argued that stakeholders have to anticipate stricter procedures when acquiring Building Renovation Passports and Energy Performance Certificates. It is essential, therefore, to take proactive steps, such as ensuring architects, engineers, and auditors are well acquainted with the updated standards beforehand, to facilitate a seamless transition.

Insights for training activities

It recommended that government entities, educational organizations, industry groups, and professionals **work together collaboratively.** This collaboration is needed to build database infrastructure, provide thorough training programs, and ensure a seamless transition to new standards. BIM is not just a tool but a working methodology and there is a need for standardization in sharing data among professionals.

Utilizing the wealth of information gathered from workshops conducted across various countries, along with the invaluable feedback received, comprehensive reports, and thorough analyses conducted, the focal points for the training programme are outlined as follows:

- **When used effectively, BIM could prevent discrepancies** between various documents related to the same building, such as energy certificates, technical building inspections, certificates of occupancy, and others.
- The professional sector includes property management administrations, architecture teams, engineering firms, construction companies, and material companies. Therefore, it is highlighted that **improving education is crucial for enhancing the quality**, for example, of energy certificates.
- The energy certificate, widely used, is **still often seen as a mere formality**, and its quality needs to be improved through more government control and more training for the professionals who carry it out
- There is a significant **lack of skilled** individuals who can meet the updated requirements outlined in the **Energy Performance of Buildings Directive.** Consequently, there is an urgent requirement for improved training initiatives designed specifically for energy

experts. These programs should encompass technical skills as well as a comprehensive comprehension of the goals and consequences of the EPBD.

- **Training** should be more comprehensive, covering the environmental impacts of buildings throughout **the entire life cycle of the building**
- The training will be essential for certifying technicians to carry out their work with the highest quality. This training **will have to be both specific in terms of energy efficiency and sustainability**, and cross-cutting to meet the safety and habitability requirements in both new and existing buildings. However, these requirements are outlined in the [EPBD recast](#):

*“Member States shall address, in relation to **new buildings**, the issues of optimal indoor environmental quality, adaptation to climate change, fire safety, risks related to intense seismic activity and accessibility for persons with disabilities. Member States shall also address carbon removals associated with carbon storage in or on buildings.”*

*“Member States shall address, in relation to buildings undergoing **major renovation**, the issues of indoor environmental quality, adaptation to climate change, fire safety, risks related to intense seismic activity, the removal of hazardous substances including asbestos and accessibility for persons with disabilities.”*

- According to the EPBD, **new parameters** are introduced to measure the sustainability of buildings. Training on these will also be necessary.
 - Whole life-cycle greenhouse gas emissions.
 - The smart readiness indicator
 - Renovation passport.

The widespread use of BIM methodology would contribute to increasing coherence among the various documents of a building, thus improving the quality of building databases.

Final conclusions and recommendations

The EPBD sets an ambitious goal: to decarbonize the building stock by 2050. To achieve this target, energy improvements must be planned implemented and reflected in the energy certificates. Therefore, they become a key piece for climate change mitigation. This fact implies:

- Energy Performance Certificates are **gaining more importance**, and this fact can help change the perception of them as just a mere formality.
- **The quality** of the EPCs **becomes essential** in order to track energy improvement measures in buildings.
- **EPCs databases will allow planning at the local, regional, and national levels.** As indicated by the EPBD, it will be necessary for member states to develop, implement, and monitor national building renovation plans. In these plans, an analysis of the building stock as of 2020 will need to be conducted in order to promote improvement measures and achieve savings for both residential and non-residential buildings established by the directive. This analysis, and the monitoring of implementation of measures, will be carried out using EPC databases or statistical data.

The improvement of the quality of EPCs will be achieved with the participation of the different agents involved in the energy certification process. This means that:

- **Proper technical training is crucial to ensure coherence between the data input into energy certification tools and the resulting outcomes.** Ensuring the correct preparation of certificates stands as the most effective means to enhance the quality of EPC databases, with mandatory training emerging as a promising avenue for quality improvement.

- **Enhanced oversight and inspections of EPCs by competent authorities are imperative**, necessitating a broader and more thorough approach. As outlined in the future EPBD's Annex VI on Independent Control Systems for Energy Performance Certificates:

“Member States shall provide a clear definition of the quality objectives and the level of statistical confidence that the energy performance certificate framework should achieve. The independent control system shall ensure at least 90% of valid issued energy performance certificates with a statistical confidence of 95% for the evaluated period, which shall not exceed one year.”

- **Building owners** commissioning the EPC will increasingly demand quality as they better understand its content and value. Currently, there is a **shifting perception of the EPC**, especially as its results impact eligibility for **grants or tax deductions**. The digital Building Logbook can assist in cross-referencing information from various documents related to the same building and identifying inconsistencies.
- These **entities** will increasingly expect **higher quality standards in the EPCs**. Administrations frequently refer to them (for instance, as part of their review process for grant applications), as do financial institutions (in order to offer loans for rehabilitation projects or better terms if a different energy rating is attained). The revised EPBD highlights:

“The EU Taxonomy (...) classifies environmentally sustainable economic activities across the economy, including for the building sector.”

- These improvements in the quality of energy certificates for buildings will facilitate tracking energy retrofits across the building stock, thereby helping to alleviate the climate emergency we are currently facing.