TIMEPAC

Towards Innovative Methods
for Energy Performance Assessment and Certification of Buildings

Deliverable 4.6

# Training activities for Training Scenario 4 – Exploitation of EPC for local, regional and national energy planning

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# Executive summary

This report summarises the training activities carried out as part of the Task 4.6 “Training Scenario 4 – Exploitation of EPC for local, regional and national energy planning”, one of the six scenarios included in Work Package 4 “EPC Standardisation, Training and Capacity Building”. The purpose of these activities is to disseminate the TIMEPAC vision for future scenarios of enhanced Energy Performance Certification (EPC) developed in the Transversal Deployment Scenarios carried out in TIMEPAC Work Package 2.

The training activities included a two-hour webinar and a two-day in-class training. The online webinar, held on March 20, 2024, titled "Exploitation of EPC for local, regional and national energy planning", explored strategies for decarbonisation by exploiting the EPC data to carry out energy performance assessment of the building stock. Additionally, the in-class training sessions on May 29 and 30, 2024, at Politecnico di Torino (Torino – Italy), provided hands-on experience and in-depth training on EPC data analysis and exploitation.

Engagement was notably high, with the online session attracting 192 registered participants and 133 attending live, reflecting the target audience's strong interest, mostly experts on certification in professional practice and administration. The in-class sessions attracted 12 professionals from various backgrounds, enhancing cross-sector collaboration. Feedback from participants was positive, with high satisfaction ratings for both the content and delivery of the training sessions. The exploitation of EPC data to perform statistical analysis aimed at assessing the energy performance of the building stock and at developing renovation plans was widely recognised for its potential to contribute to the decarbonisation of the building stock as foreseen by the recast of the EPDB.

The training activities have successfully disseminated critical knowledge and fostered a collaborative environment among key stakeholders, who also communicated their interest in future webinars and courses. Most participants expressed considerable notice in the practical application of the training insights in their professional activities. Overall, the training activities were well-received, meeting the learning needs of the participants and contributing to the advancement of EPBD objectives through accurate and easy-to-use data analysis methods.

The positive feedback and high engagement levels underscore the importance and effectiveness of these training efforts.

# 1 Introduction

## 1.1 Purpose and target group

The purpose of Task 4.6 "Training activities for Training Scenario 4 – Exploitation of EPC for local, regional and national energy planning" was to deliver the results of the Transversal Deployment Scenarios (TDSs) through training activities to a wide audience, focusing on professionals and stakeholders involved in building performance assessment, energy efficiency, urban planning, and policy-making.

In particular, the focus of the training was to disseminate knowledge and insights gained from the processing of the EPC data by statistical analysis in order to create building archetypes and to perform bottom-up energy modelling of the existing building stock. This approach demonstrates the usefulness of the EPC information to develop renovation plans, even coupled with the information deriving from the building renovation passport applied at a higher territorial scale. Training Scenario 4 delivers the results of Task 2.5 "TDS 5 – Large scale statistical analysis of EPC databases"; in addition, part of the outcomes of Task 2.2 "TDS 2 - Enhancing EPC schemas through operational data integration" and Task 2.3 "TDS 3 – Creating building renovation passports from data repositories" are also considered.

The target group includes experts from various sectors involved in energy performance certification, including:

- Public bodies at municipal, regional, and national levels
- Private sector entities including energy consultancies
- Academic institutions and research centres

The training aimed to equip stakeholders with the knowledge and skills necessary to comply with regulations, adopt sustainable practices, apply accurate methods, and contribute to energy-efficient urban development, in line with the recent recast of the Energy Performance Building Directive (EPBD).

## 1.2 Deliverable structure

The reminder of this report is structured in the following sections:

- Section 2, "Online training activity", provides a comprehensive overview of the webinar conducted on March 20, 2024.
- Section 3, "In-class training activity in Italy", offers a thorough account of the training sessions held on May 29 and 30, 2024.
- Section 4, "Conclusion", presents insights drawn from the training activities.

## 1.3 Contribution of partners

POLITO led Task 4.6 and organised the training activities, on-line and in-class in Torino. The activity of inviting stakeholders to participate in the training has been held by POLITO with the collaboration of Edilclima (EDIC) and Regione Piemonte (RP).

## 1.4 Relations to other project activities

The outputs of the Transversal Deployment Scenarios carried out in WP2 were presented in the training activities organised within this task. The activities have been disseminated through the project website, TIMEPAC Academy platform, and social media channels of TIMEPAC.

# 2 On-line training activity

## 2.1 Introduction

On March 20, 2024, the webinar titled "Exploitation of EPC for local, regional and national energy planning" addressed the topic of the renovation plans for achieving a decarbonised building stock by 2050, as outlined in the recast Energy Performance of Buildings Directive (EPBD), by showing a methodology to exploit the information contained in the EPC databases of the EU countries (Figure 1).

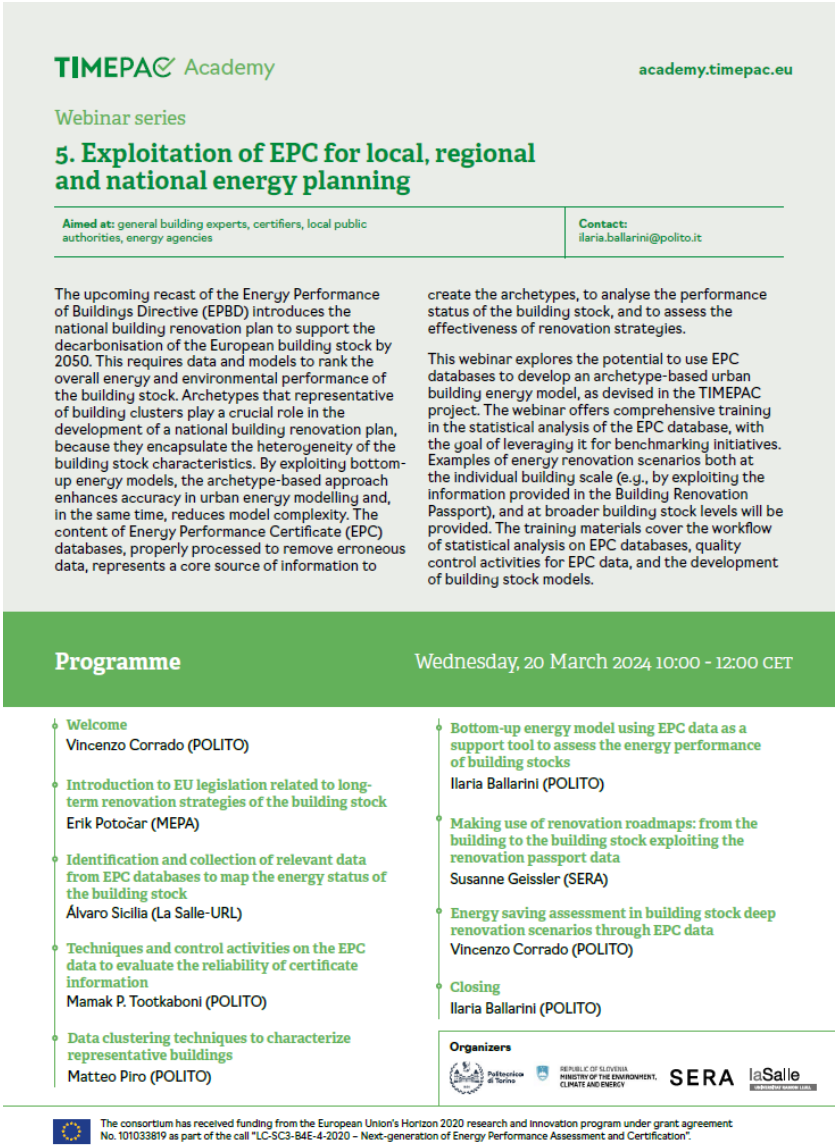


**Figure 1.** Announcement of the webinar on the TIMEPAC Academy website

Archetypes representative of building clusters play a crucial role in the development of a national building renovation plan, because they encapsulate the heterogeneity of the building stock characteristics. By exploiting bottom-up energy models, the archetype-based approach enhances accuracy in urban energy modelling and, at the same time, reduces model complexity. The content of EPC databases, properly processed to remove erroneous data, represents a core source of information to create the archetypes, analyse the building stock's performance status, and assess the effectiveness of renovation strategies.

In this context, the webinar explored the potential to use EPC databases to develop an archetype-based urban building energy model, as devised in the TIMEPAC project (see Deliverable 2.5[1]). The webinar offered comprehensive training in statistical analysis of the EPC database, with the goal of leveraging it for benchmarking initiatives. Examples of energy renovation scenarios both at the individual building scale (e.g., by exploiting the information provided in the Renovation Passport), and at broader building stock levels were provided. The training materials covered the workflow of statistical analysis on EPC databases, quality control activities for EPC data, and the development of building stock models.

The webinar attracted a substantial audience, with 192 participants registered on the TIMEPAC Academy website and 133 attendees connecting to the live. Participants included professionals and stakeholders involved in building performance assessment, energy efficiency, urban planning, and policy-making.

## 2.2 Structure and content

The webinar included the following sessions:

**Session 1: Introduction to EU legislation related to long-term renovation strategies of the building stock**

The session provided an overview of the legislative context and requirements for the deep renovation of the European building stock, which has been included in National Energy and Climate Plans and National Long-Term Renovation Strategies. It also offered an overview of activities conducted in the project Concerted Action EPBD (CA EPBD) framework. This project addresses various elements of EPBD and aims to contribute to the reduction of energy use in European buildings through the exchange of knowledge and best practices.

**Lecturer:** https://academy.timepac.eu/en/lecturers/erik-potocar

**Presentation:** https://academy.timepac.eu/en/lecture-materials/8/34/54

**Recording:** https://academy.timepac.eu/en/lecture-materials/8/34/75

**Session 2: Identification and collection of relevant data from EPC databases to map the energy status of the building stock**

Identifying and collecting relevant data from EPC databases is a crucial step in mapping the energy status of the building stock at various scales. This session covered different types of data available in EPC databases and the techniques used for data extraction. The challenges and limitations associated with using EPC data to map the energy status of the building stock were also addressed, including issues related to data quality, reliability, and the need for data standardisation and harmonisation to facilitate data collection and analysis to develop local, regional and national energy plans.

**Lecturer:** https://academy.timepac.eu/en/lecturers/alvaro-sicilia

**Presentation:** https://academy.timepac.eu/en/lecture-materials/8/35/43

**Recording:** https://academy.timepac.eu/en/lecture-materials/8/35/76

[1] Ilaria Ballarini, Matteo Piro, and Mamak P.Tootkaboni. D2.5 Procedures and services to undertake large-scale statistical analysis of EPCs databases. https://timepac.eu/reports/procedures-and-services-to-undertake-large-scale-statistical-analysis-of-epcs-databases/

**Session 3: Techniques and control activities on the EPC data to evaluate the reliability of certificate information**

This session provided participants with a comprehensive overview of methods, including techniques and control measures, for assessing the accuracy of EPCs. A quantitative procedure for checking the quality of EPC data developed in TIMEPAC was presented, which focused on customised rules and scores to evaluate data reliability. It involved comparing the assigned overall EPC score to a predetermined threshold value, beyond which the certificate is deemed unreliable. The methodology is based on standardised, harmonised, and adaptable rules that can accommodate country-specific variations, ensuring the reproducibility of the process.

**Lecturers:** https://academy.timepac.eu/en/lecturers/mamak-p-tootkaboni

**Presentation:** https://academy.timepac.eu/en/lecture-materials/8/36/44

**Recording:** https://academy.timepac.eu/en/lecture-materials/8/36/77

**Session 4: Data clustering techniques to characterise representative buildings**

In assessing building energy and environmental performance in urban areas, clusters are typically formed by categorising actual or theoretical residential and non-residential buildings based on common characteristics widely recognised by the scientific community. These characteristics encompass various factors such as climatic zones, usage categories, construction periods, size, shape, and key performance indicators. To compile information for creating these clusters, diverse data sources are utilised, including local, regional, or national databases, statistical surveys, and technical standards. Of particular importance is the emphasis placed on EPC databases as the primary source of data for cluster formation.

**Lecturers:** https://academy.timepac.eu/en/lecturers/matteo-piro

**Presentation:** https://academy.timepac.eu/en/lecture-materials/8/37/45

**Recording:** https://academy.timepac.eu/en/lecture-materials/8/37/78

**Session 5: Bottom-up energy model using EPC data as a support tool to assess the energy performance of building stocks**

This session presented some of the most recognised approaches to developing building stock energy models with a focus on the model adopted in TIMEPAC. This model leverages the concept of building typology, which serves as a framework for analysing the energy balance at national or regional scales. This model exploits the EPC database as a supportive instrument to create archetypes to be used in identifying the energy performance of the building stock by means of a bottom-up approach. Statistical analysis is performed to derive the archetypes after the processes of data quality checking and data clustering that were presented in the previous sessions.

**Lecturer:** https://academy.timepac.eu/en/lecturers/ilaria-ballarini

**Presentation:** https://academy.timepac.eu/en/lecture-materials/8/39/46

**Recording:** https://academy.timepac.eu/en/lecture-materials/8/39/79

**Session 6: Creation of a renovation roadmap: from the building scale to the building stock scale exploiting the Renovation Passport data**

The renovation roadmap connects energy efficiency measures with building maintenance, repair, and improvement measures, rather than conducting a deep renovation all at once. The session addressed key aspects such as the advantages of both comprehensive and staged renovations based on a renovation roadmap and the relevant data sources for these approaches. Additionally, strategies for managing the long-term development of costs and technologies were discussed. The

potential utility of the building renovation roadmap was explored as a data source for national building renovation plans when transitioning from individual buildings to the building stock level.

**Lecturer:** https://academy.timepac.eu/en/lecturers/susanne-geissler

**Presentation:** https://academy.timepac.eu/en/lecture-materials/8/40/52

**Recording:** https://academy.timepac.eu/en/lecture-materials/8/40/80

**Session 7: Energy saving assessment in building stock deep renovation scenarios through EPC data**

Accurate modelling of the current energy performance of the building stock is essential to unlock the significant potential for energy savings associated with its refurbishment. This session provided a comprehensive overview of the entire process, which includes: 1. Establishing a knowledge base on the current state of the building stock through statistical analysis of EPC databases; 2. Exploring various refurbishment scenarios, considering efficiency measures and retrofit rates, and 3. Comparing the potential $CO_2$ reductions resulting from these scenarios with climate protection targets. The outline covers the processing of EPC data, which encompasses climate conditions, usage categories, geometric features, envelope thermal characteristics, types of HVAC systems, and energy performance indicators.

**Lecturer:** https://academy.timepac.eu/en/lecturers/vincenzo-corrado

**Presentation:** https://academy.timepac.eu/en/lecture-materials/8/41/53

**Recording:** https://academy.timepac.eu/en/lecture-materials/8/41/81

## 2.3 Quality assurance and feedback from the audience

Quality assurance for this webinar was carried out through a structured questionnaire that included various aspects of the course (see Annex A “Evaluation form for the online training activity”). The questionnaire was completed at the end the session by 18 participants.

The audience's feedback was largely positive. When asked whether their expectations regarding the content and structure of webinar, most respondents indicated that they were fully met. Out of the responses collected, 14 participants expressed that their expectations were "completely" met, while 4 participants felt that their expectations were "partly" met (Figure 2). This feedback reflects a strong overall satisfaction with the webinar, demonstrating its effectiveness in delivering the intended content and meeting the audience's needs.

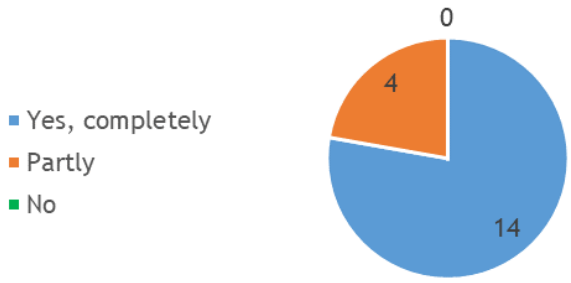


**Figure 2.** Were your expectations regarding the content and implementation method of the Exploitation of EPC for local, regional and national energy planning webinar met?

When asked if they acquired new information, the majority of participants responded positively (Figure 3). Specifically, 13 attendees indicated that they received new information "completely," while 5 participants felt they did so "partly". Nobody responded with "No". This feedback highlights the webinar's success in providing substantial and relevant information to most of its audience, contributing to their understanding of the role of EPCs for understanding the current status of the existing building stocks.

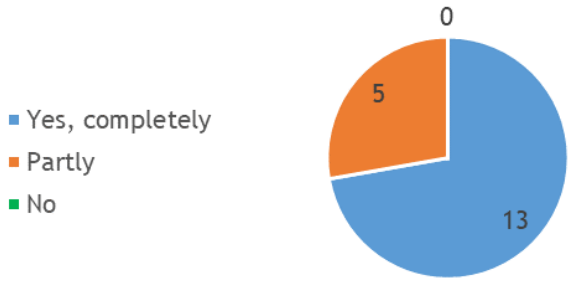


**Figure 3.** Did you acquire new information on how to use EPCs for assessing the status (e.g. energy performance, insulation level, etc.) of the existing building stocks?

The audience responded to whether the enhanced EPC –enriched with reliable data and new indicators– could be a useful instrument for setting-up an effective renovation strategy of the building stock (Figure 4). Out of the feedback collected, 14 participants believed that this enhancement would "completely" help in improving the effectiveness of the renovation, while 4 participants felt it would do it "partly." This positive response underscores the audience's confidence in the potential of the enhanced EPC to boost the renovation of the building stocks, contributing to more efficient energy use and advancing decarbonisation efforts.

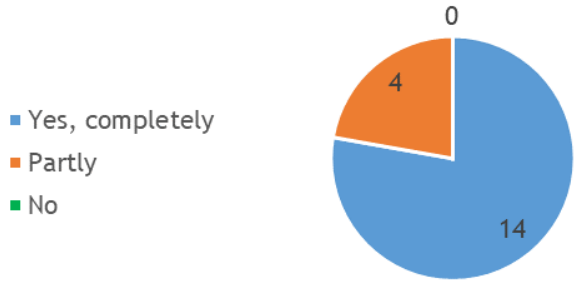


**Figure 4.** Do you think that the enhanced EPC – enriched with reliable data and new indicators – could be a useful instrument for setting-up an effective renovation strategy of the building stock?

The average rating for all sessions was 4.41 out of 5. Specifically, each session was rated as shown in Table 1.

**Table 1.** Session ratings for the on-line training activity

| Session | Rating |
|---|---|
| Introduction to EU legislation related to long-term renovation strategies of the building stock | 4.33 |
| Identification and collection of relevant data from EPC databases to map the energy status of the building stock | 4.39 |
| Techniques and control activities on the EPC data to evaluate the reliability of certificate information | 4.33 |
| Data clustering techniques to characterise representative buildings | 4.33 |
| Bottom-up energy model using EPC data as a support tool to assess the energy performance of building stocks | 4.56 |
| Creation of a renovation roadmap: from the building scale to the building stock scale exploiting the Renovation Passport data | 4.33 |
| Energy saving assessment in building stock deep renovation scenarios through EPC data | 4.61 |
| Average all sessions | 4.41 |

The responses to questions about the TIMEPAC Academy website provided insights into how attendees learned about the webinar, the ease of registration, and their plans for future participation. The majority of responding participants, 12 in total, got to know the webinar through an e-mail from a TIMEPAC partner. Additionally, 4 participants heard about it from a friend, 1 through social media, and 1 from the TIMEPAC website.

Regarding the registration process, almost all responding participants found it user-friendly, with 17 indicating that the registration on the website was easy. Only 1 participant encountered some difficulties with the registration process.

In terms of future engagement, the response was overwhelmingly positive, with 17 participants expressing their intention to participate in other TIMEPAC webinars. Only 1 participant indicated the intention to not attend future webinars. This feedback stresses the effectiveness of e-mail communication from TIMEPAC partners in attracting attendees, the general ease of the registration process, and a strong interest in ongoing engagement with TIMEPAC Academy.

# 3 In-class training activity in Italy

## 3.1 Introduction

The in-class course "Exploitation of EPC for local, regional and national energy planning" was announced in the TIMEPAC Academy in English and Italian (Figure 5).

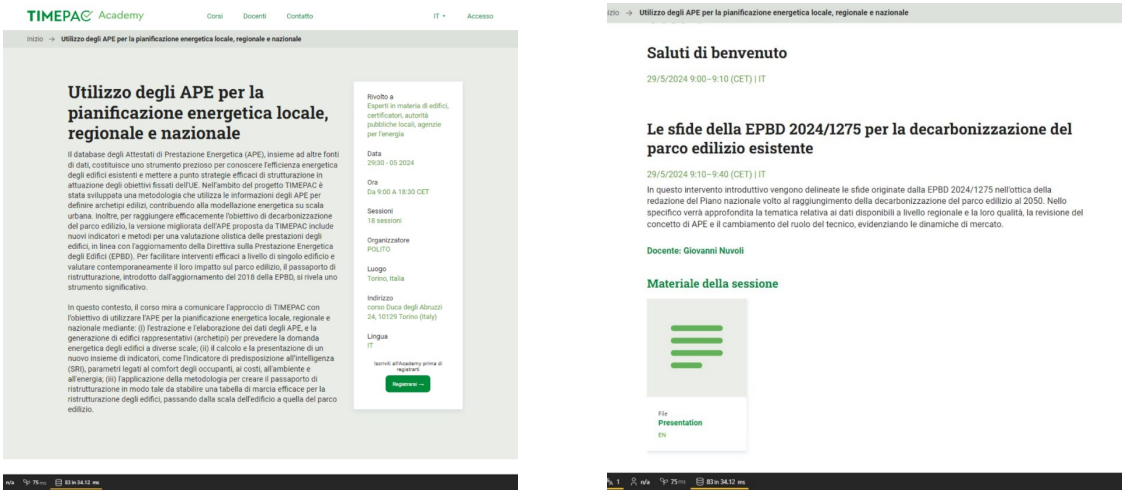


**Figure 5.** Announcement of the in-class course on the TIMEPAC Academy website in Italian language

It was organised into three parts, took place on May 29 (Part 1 in the morning, and Part 2 in the afternoon) and May 30 (Part 3 in the afternoon), 2024, at Politecnico di Torino – Lingotto (May 29) and at Politecnico di Torino - Department of Energy (May 30) (Figures 6 and 7). This course was the follow-up of the webinar on the same topic delivered on March 20, 2024.

**Figure 6.** A snapshot of the first-day of in-class training

**Figure 7.** A snapshot of the second day of in-class training

The purpose of the training was to deepen the concepts introduced in the webinar, providing practical applications and in-depth training. The EPC database, along with other data sources, serves as a valuable tool for understanding the energy efficiency of existing buildings, which is crucial for developing effective energy retrofit strategies and implementing the EU targets. The TIMEPAC project has devised a methodology leveraging EPC information to identify building archetypes, aiding in urban-scale energy modelling. In addition, to effectively reach the forthcoming decarbonisation target, new indicators and methods for holistic building performance assessment are foreseen in the TIMEPAC enhanced EPC, in line with the Energy Performance of Buildings Directive (EPBD) update. To facilitate effective interventions at the building level while also evaluating their broader impact at the building stock level, the Renovation Passport —first introduced in the 2018 recast of the EPBD and then as a tailored roadmap for renovation in the 2024 version— could be a pivotal instrument.

In this context, the training aimed at spreading the TIMEPAC approach to exploit EPCs for local, regional and national energy planning by: (i) extracting and processing EPC data, and generating representative buildings (archetypes) for predicting the building energy demand at different scales; (ii) calculating and presenting a new set of indicators, such as the Smart Readiness Indicator (SRI), parameters related to occupant comfort, costs, environment and energy; and (iii) applying the methodology to create the Renovation Passport in such a way to set up an effective building renovation roadmap moving from the building to the building stock scale. Each of these three main objectives covered one of the three parts of the training.

Overall the course was attended by 12 participants with different profiles (architects, engineers, academics, etc.), representatives of the local orders of architects and engineers, of the public administration (region), and from the private sector (energy consultants, research bodies) (Table 2).

**Table 2.** Organisations participating in the in-class training activity

| Organisations | |
|---|---|
| Order of Engineers of Torino | Order of Architects of Torino |
| iiSBE Italia R&D | Regione Piemonte |
| Politecnico di Torino | Links Foundation |

## 3.2 Structure and content

The in-class activity was structured in the following sessions, spanning over two days and three parts:

**DAY 1 – Part 1 (morning)**

**Session 1: The challenges of the EPBD 2024/1275 for the decarbonisation of the existing building stock**

In this introductory session, the challenges of the new EPBD 2024/1275 were discussed in the view of the redaction of the National Plan addressed to the decarbonisation of the building stock by 2050. Specifically, some topics were deepened, such as the data availability at a regional level and their quality, the revision of the EPC concept, and the change of the technician role, by highlighting the market issues.

**Lecturer:** https://academy.timepac.eu/en/lecturers/giovanni-nuvoli

**Presentation:** https://academy.timepac.eu/en/lecture-materials/15/132/120

**Session 2: Extraction of relevant EPC data for energy large-scale analysis and creation of clusters for archetypes definition**

Understanding energy use at a large scale can support the planning and the design of energy efficiency policies in cities. Energy large-scale analysis can be performed by applying bottom-up models with representative buildings (e.g., archetypes), generally built up from extensive data derived from different sources, including the EPC database. This exercise presented and applied a methodology to extract relevant data in the EPCs and to create clusters of the building stock. It was shown how identifying between two real buildings belonging to the same climatic zone, building use category, and construction period, the one that is the closest to the characteristics of the archetype.

**Lecturers:** https://academy.timepac.eu/en/lecturers/ilaria-ballarini and https://academy.timepac.eu/en/lecturers/matteo-piro

**Presentation:** https://academy.timepac.eu/en/lecture-materials/15/89/121

**Session 3: Application of EPC data quality checking procedure**

The EPC is an essential data source for constructing urban energy analyses. Concentrating on the quality of energy performance certificates and the accuracy of the data they contain is essential. To ensure that the given database contents are correct and beneficial for making proper policy decisions, benchmarking building performance, and energy efficiency upgrades, it is crucial to undertake the quality assessment of the EPC database contents and have energy certifications free of inaccuracies. In this exercise, sample sets of EPC data from the database of Regione Piemonte were provided and appropriate criteria to establish suitable, high-quality data analysis of the EPC data content were shown.

**Lecturer:** https://academy.timepac.eu/en/lecturers/mamak-p-tootkaboni

**Presentation:** https://academy.timepac.eu/en/lecture-materials/15/90/122

**Session 4: Statistical analysis to generate representative buildings (archetypes)**

The building archetypes reflect the most common geometrical characteristics, technical specifications of the building envelope, and technical building system typology, representing the average situation in a market segment. This exercise focused on extracting the most probable data to generate representative buildings for the specific climate zone. The EPC database of Regione

Piemonte was used. The statistical analysis provided the calculation of median and interquartile ranges for selected parameters. The skills and knowledge that were expected at the end of the lectures included the competence to effectively select the KPIs to generate, through statistical analysis, the representative buildings for the specific climate zone.

**Lecturer:** https://academy.timepac.eu/en/lecturers/matteo-piro

**Presentation:** https://academy.timepac.eu/en/lecture-materials/15/91/123

**Session 5: Application of a bottom-up model to predict the building energy demand at different scales**

This exercise aimed to perform an example of applying a bottom-up energy model to predict the energy demand of a building stock. The application was based on the development of an Urban Building Energy Model (UBEM) and adopted a set of reference buildings (archetypes) representative of a subset of the building stock (e.g., residential use) that serve as a basis for analysing the energy balance of the regional building sector (Piemonte). To carry out the exercise, a set of archetypes were taken as an example; their energy intensity was derived from the EPC database, while their frequency in the stock was provided by regional/national data sources (e.g., census).

**Lecturer:** https://academy.timepac.eu/en/lecturers/ilaria-ballarini

**Presentation:** https://academy.timepac.eu/en/lecture-materials/15/92/124

**DAY 1 – Part 2 (afternoon)**

**Session 6: Indicators and methods for the holistic assessment of buildings in the EPDB perspective**

Currently, energy certificates are static energy-related documents, but in the future, according to the enhanced EPC devised in TIMEPAC, they should go beyond the energy field, integrating holistically new Key Performance Indicators (KPIs) from other domains, such as economics, environment, sustainability (e.g., SRI), and social aspects. The review of the EPBD includes new elements to achieve a decarbonised building stock by 2050. Specifically, it points out new requirements for the environment (e.g., the greenhouse gas emission class, the life-cycle Global Warming Potential) and for the Indoor Environmental Quality (IEQ). This exercise provided an overview of methods and indicators in the holistic assessment of an office building-type.

**Lecturer:** https://academy.timepac.eu/en/lecturers/vincenzo-corrado

**Presentation:** https://academy.timepac.eu/en/lecture-materials/15/94/125

**Session 7: Calculation of the SRI deriving potential flexibility measures for existing buildings**

This exercise provided an example of calculating the SRI for an existing office building, which served as a basis for developing energy renovation scenarios with a focus on enhancing building flexibility. Throughout the exercise, participants were guided from data collection to indicator development, both for the building's current state and for the refurbishment scenarios.

**Lecturers:** https://academy.timepac.eu/en/lecturers/alice-gorrino and https://academy.timepac.eu/en/lecturers/alfonso-capozzoli

**Presentation:** https://academy.timepac.eu/en/lecture-materials/15/95/126

**Session 8: Calculation of the enhanced EPC data for future exploitation**

Enhancing EPC schemas through operational data integration would improve the accuracy and reliability of EPC, using data obtained from energy monitoring (e.g., real energy consumption), and from other domains of assessment (IEQ, economics, sustainability, etc.). The exercise addressed the operational data integration and energy model calibration, as to reduce the performance gap between the actual building energy consumption and the standard performance provided by the EPC. Moreover, it also evaluated the integration of a wider set of parameters in the EPC; these consider different evaluation domains, such as indoor environmental quality, Building Automation and Control System (BACS) impact, and cost-effectiveness.

**Lecturer:** https://academy.timepac.eu/en/lecturers/franz-bianco-mauthe-degerfeld

**Presentation:** https://academy.timepac.eu/en/lecture-materials/15/96/127

**DAY 2 – Part 3 (afternoon)**

**Session 9: Transformation of EPC data and other data into Renovation Passport for the deep renovation of the building - case study residential building**

The staged renovation is based on a renovation roadmap that shows the energy-related measures in the correct sequence. This exercise took the audience through the steps of creating a renovation roadmap for deep renovation, based on the EPC and other sources of information such as a Building Information Model. In this context, answers to the following questions are needed: What is the procedure for developing a renovation roadmap? Which tools are available? What are the advantages and disadvantages of the different data sources? How to deal with a lack of data? Is an on-site visit needed? What is the interface with the usual maintenance and repair plan?

**Lecturer:** https://academy.timepac.eu/en/lecturers/alice-gorrino

**Presentation:** https://academy.timepac.eu/en/lecture-materials/15/98/130

**Session 10: Calculation and use of the Renovation Passport to increase the effectiveness of efficiency measures in renovation strategies**

This exercise guided participants through the application of the methodology developed within TIMEPAC project for developing a renovation roadmap for an office building. To this end, tools for assessing the building's current state were provided, along with a procedure for defining energy retrofit scenarios to ensure the achievement of decarbonisation goals by 2025. Insights and challenges were interesting topics for discussion.

**Lecturer:** https://academy.timepac.eu/en/lecturers/alice-gorrino

**Presentation:** https://academy.timepac.eu/en/lecture-materials/15/99/129

**Session 11: Application of recommended energy efficiency measures for the creation of the building stock renovation scenarios**

In order to reach the European goals for decarbonisation, it is of utmost importance to improve the whole building stock, moving from a high pollutant to a zero-emission one. In order to evaluate possible enhancement, the first step is the analysis of the current state of the building stock. Two main groups of energy efficiency measures, related to the envelope and to the technical building systems, were presented as well as the possible influences in the energy and emission reduction. This exercise explained the main phases to define and apply the renovation scenarios for a building stock.

**Lecturer:** https://academy.timepac.eu/en/lecturers/matteo-piro

**Presentation:** https://academy.timepac.eu/en/lecture-materials/15/100/131

## 3.3 Quality assurance and feedback from the audience

Quality assurance for this course was carried out through structured questionnaires that encompassed various aspects of the course (see Annex B "Evaluation form for in-class training"). Each of the three parts of the training was evaluated by a specific questionnaire; the answers were collected for each part separately. Nine participants answered to the questionnaire of Part 1 and Part 2 of the course, while eight participants answered to the questionnaire of Part 3.

The feedback collected from the participants provides insights into their perceptions and experiences with the course. The responses indicate a generally positive reception, with the majority of participants reporting that their expectations were fully met (Figure 8).

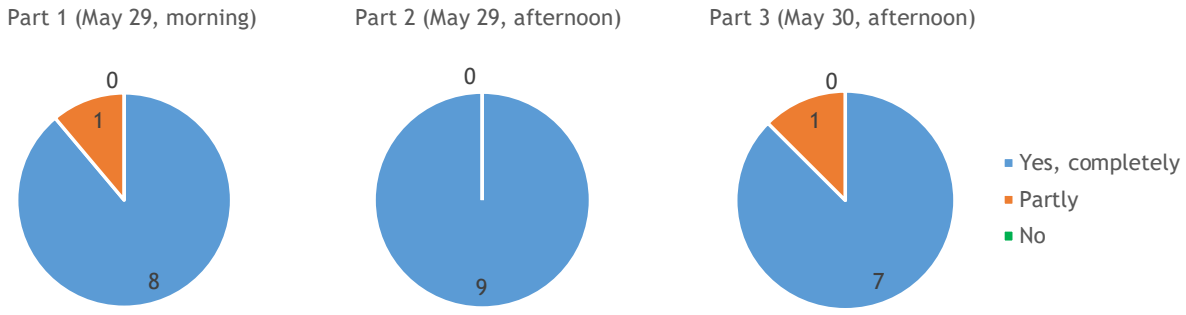


**Figure 8.** Have your expectations been met regarding the content and format of the course?

The average rating for all sessions was 4.65 out of 5. Specifically, each session was rated considering different aspects (i.e., speaker's competence, methods used, usefulness for practice, and presentation contents), as shown in Table 3.

**Table 3.** Session ratings for the in-class training activity

| | | Speaker's competence | Methods used | Usefulness for practice | Presentation contents | *Average* |
|---|---|---|---|---|---|---|
| Session | The challenges of the EPBD 2024/1275 for the decarbonisation of the existing building stock | 4.78 | 4.67 | 4.78 | 4.67 | *4.72* |
| | Extraction of relevant EPC data for energy large-scale analysis and creation of clusters for archetypes definition | 4.67 | 4.44 | 4.11 | 4.56 | *4.44* |
| | Application of EPC data quality checking procedure | 4.67 | 4.11 | 4.33 | 4.33 | *4.36* |
| | Statistical analysis to generate representative buildings (archetypes) | 4.56 | 4.44 | 4.33 | 4.67 | *4.50* |

| | Speaker's competence | Methods used | Usefulness for practice | Presentation contents | *Average* |
|---|---|---|---|---|---|
| Application of a bottom-up model to predict the building energy demand at different scales | 4.78 | 4.67 | 4.33 | 4.56 | *4.58* |
| Indicators and methods for the holistic assessment of buildings in the EPDB perspective | 4.89 | 4.89 | 4.89 | 4.89 | *4.89* |
| Calculation of the SRI deriving potential flexibility measures for existing buildings | 4.89 | 4.89 | 4.89 | 4.67 | *4.83* |
| Calculation of the enhanced EPC data for future exploitation | 5.00 | 4.78 | 4.56 | 4.67 | *4.75* |
| Transformation of EPC data and other data into Renovation Passport for the deep renovation of the building - case study residential building | 4.88 | 4.63 | 4.50 | 4.75 | *4.69* |
| Calculation and use of the Renovation Passport to increase the effectiveness of efficiency measures in renovation strategies | 4.88 | 4.63 | 4.63 | 4.75 | *4.72* |
| Application of recommended energy efficiency measures for the creation of the building stock renovation scenarios | 4.75 | 4.88 | 4.38 | 4.75 | *4.69* |
| | | | | Average all sessions | *4.65* |

The comments received on the questionnaires revealed that the participants appreciated the training and were stimulated by the interaction between the speakers and the audience. Many attendants found the comparison between different stakeholders (professionals, academics, local professional orders…) very useful, expressing hope for collaboration toward the effective decarbonisation of the building stock. In addition, the networking during the lunch break provided an opportunity to share experiences and ideas.

Among the different sessions, some participants highlighted which session they appreciated the most. Several found the session on the new EPBD and its focus on national level transposition, particularly interesting. Others were more interested in the use of EPCs to create building archetypes of the building stock and the application of a bottom-up approach to predict building energy demand at different scales. In this context, some were impressed by how the regional information system that collects EPCs can serve as a valuable database for statistical analysis in energy planning. To improve the quality of EPCs, some participants pointed out the need to incentivise the establishment of controls to reduce errors during the EPCs generation phase.

Concerning the new indicators of the enhanced EPC, the questionnaires reflected interest in the practical examples presented for calculating these indicators, as well as the assessment of the SRI.

Some participants expressed hope for similar courses to be offered in the future. The overall feedback collected reveals that the course was well-received and effectively met the learning needs of the participants.

# 4 Conclusion

The training activities, including the webinar and in-class course, were aimed at providing professionals and stakeholders in building performance assessment, energy efficiency, urban planning, and policy-making, with valuable insights aligned with the goals of the last Energy Performance of Buildings Directive recast.

Feedback from participants of both the webinar and the course on the topic “Exploitation of EPC for local, regional and national energy planning” revealed high levels of satisfaction. The majority indicated that their expectations were met and that they acquired new and relevant information. The webinar ratings averaged 4.41 out of 5, reflecting the effectiveness of the training. This positive response underscores the participant's confidence in the potential of the enhanced EPC to drive building stock renovation, promote energy efficiency and advance decarbonisation efforts. Similarly, the in-class training in Torino obtained positive feedback; the course ratings averaged 4.65 out of 5. Participants from diverse professional backgrounds expressed strong interest in using EPC data for energy analysis of the building stock and for planning renovation scenarios using the archetype approach.

According to the latest EPBD, Member States must develop a national building renovation plan. Its implementation will depend directly on the involvement of public bodies at different levels. Therefore, the participation of different profiles (architects, engineers, academics, etc.), representatives of the local orders of architects and engineers, of the public administration (region), and from the private sector (energy consultants, research bodies) helped enrich the training, strengthen relationships and foster new contacts. Many attendants found the comparison between different stakeholders (professionals, academics, local professional orders…) to be particularly useful and hope for their collaboration in the future for an effective decarbonisation of the building stock.

Most of the participants expressed considerable interest in future webinars and the practical application of the training insights in their professional activities. In this view, besides the sessions dedicated to the analysis carried out on the EPC database, the participants also appreciated the sessions on the SRI assessment and the Renovation Passport. Many participants hope for a replication of similar webinars and courses in the future.

Overall, the training activities were well-received, meeting the learning needs of the participants and contributing to the advancement of EPBD objectives through accurate and easy-to-use data analysis methods. This indicates a strong need for ongoing professional training on subjects related to the implementation of the new Directive.

# Annex A – Evaluation form online training activity

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

Wednesday, March 20, 2024

**- Were your expectations regarding the content and implementation method of the Exploitation of EPC for local, regional and national energy planning webinar met?**

- Yes, completely
- Partly
- No

**- Did you acquire new information on how to use EPCs for assessing the status (e.g. energy performance, insulation level, etc.) of the existing building stocks?**

- Yes, completely
- Partly
- No

**- Do you think that the enhanced EPC – enriched with reliable data and new indicators – could be a useful instrument for setting-up an effective renovation strategy of the building stock?**

- Yes, completely
- Partly
- No

**- We kindly ask you to evaluate all sessions presented at the Exploitation of EPC for local, regional, and national energy planning webinar [1 to 5].**

- Introduction to EU legislation related to long-term renovation strategies of the building stock (Erik Potočar)
- Identification and collection of relevant data from EPC databases to map the energy status of the building stock (Álvaro Sicilia)
- Techniques and control activities on the EPC data to evaluate the reliability of certificate information (Mamak P. Tootkaboni)
- Data clustering techniques to characterise representative buildings (Matteo Piro)
- Bottom-up energy model using EPC data as a support tool to assess the energy performance of building stocks (Ilaria Ballarini)
- Making use of renovation roadmaps: from the building to the building stock exploiting the renovation passport data (Susanne Geissler)
- Energy saving assessment in building stock deep renovation scenarios through EPC data (Vincenzo Corrado)

**- Which session was the most relevant for your professional practice?**

- Introduction to EU legislation related to long-term renovation strategies of the building stock (Erik Potočar)
- Identification and collection of relevant data from EPC databases to map the energy status of the building stock (Álvaro Sicilia)

- Techniques and control activities on the EPC data to evaluate the reliability of certificate information (Mamak P. Tootkaboni)
- Data clustering techniques to characterise representative buildings (Matteo Piro)
- Bottom-up energy model using EPC data as a support tool to assess the energy performance of building stocks (Ilaria Ballarini)
- Making use of renovation roadmaps: from the building to the building stock exploiting the renovation passport data (Susanne Geissler)
- Energy saving assessment in building stock deep renovation scenarios through EPC data (Vincenzo Corrado)

**- Within the EPC data flow—generation, storage, analysis, and exploitation— which stage of this continuous cycle do you consider the most critical for improving building assessment**

- Generation
- Storage
- Analysis
- Exploitation

**- Where did you know about TIMEPAC Academy?**

- e-mail from a TIMEPAC partner
- e-mail from a friend
- TIMEPAC website
- social media
- other

**- Was the registration on the website easy?**

- Yes
- No

**- Would you be interested in getting a digital copy of the TIMEPAC Guidelines to create archetypes of the building stock from EPC data to carry out urban building energy modelling?**

- Yes
- No

**- Are you planning to participate in other TIMEPAC webinars?**

- Yes
- No

**- Final comments and remarks**

# Annex B – Evaluation form in-class training

**Exploitation of EPC for local, regional, and national energy planning.**

Wednesday, May 29 and Thursday, May 30, 2024

**- Were your expectations regarding the contents and the organisation of the *in-class training TIMEPAC* met?**

- Yes, completely
- Partly
- No

**- We kindly ask you to evaluate all the sessions presented in the *in-class training TIMEPAC***

To answer to this point, the following grid has been adopted, considering the evaluation scale from 1 (double sad icon) to 5 (double happy icon):

| | ☹☹ | ☹ | 😐 | ☺ | ☺☺ |
|---|---|---|---|---|---|
| • Speaker's competence | ❑ | ❑ | ❑ | ❑ | ❑ |
| • Methods used | ❑ | ❑ | ❑ | ❑ | ❑ |
| • Usefulness for practice | ❑ | ❑ | ❑ | ❑ | ❑ |
| • Presentation contents | ❑ | ❑ | ❑ | ❑ | ❑ |
| • Presentation length | ❑ Too short | | ❑ Adequate | | ❑ Too long |

Notes (e.g., what is missing in the presentation, what is superfluous, etc.): …….

The evaluation grid has been adopted for each session, in each of the three parts of the course, as follows:

- Part 1:
- Overview of the project (Vincenzo Corrado)
- The challenges of the EPBD 2024/1275 for the decarbonisation of the existing building stock (Giovanni Nuvoli)
- Extraction of relevant EPC data for energy large-scale analysis and creation of clusters for archetypes definition (Ilaria Ballarini and Matteo Piro)
- Application of EPC data quality checking procedure (Mamak P.Tootkaboni)
- Statistical analysis to generate representative buildings (archetypes) (Matteo Piro)
- Application of a bottom-up model to predict the building energy demand at different scales (Ilaria Ballarini)
- Part 2:

- Indicators and methods for the holistic assessment of buildings in the EPDB perspective (Vincenzo Corrado)
- Calculation of the SRI deriving potential flexibility measures for existing buildings (Alfonso Capozzoli and Alice Gorrino)
- Calculation of the enhanced EPC data for future exploitation (Franz Bianco Mauthe Degerfeld)

- Part 3:

- Overview of the project (Alice Gorrino)
- Transformation of EPC data and other data into Renovation Passport for the deep renovation of the building - case study residential building (Alice Gorrino)
- Calculation and use of the Renovation Passport to increase the effectiveness of efficiency measures in renovation strategies (Alice Gorrino)
- Application of recommended energy efficiency measures for the creation of the building stock renovation scenarios (Matteo Piro)

**- We kindly ask you to evaluate all the other aspects of the *in-class training TIMEPAC***

Aspects related to the organisation

| | ☹☹ | ☹ | 😐 | ☺ | ☺☺ |
|---|---|---|---|---|---|
| • Invitation | ❑ | ❑ | ❑ | ❑ | ❑ |
| • Organisation and registration | ❑ | ❑ | ❑ | ❑ | ❑ |
| • Room and equipment | ❑ | ❑ | ❑ | ❑ | ❑ |
| • Coffee break | ❑ | ❑ | ❑ | ❑ | ❑ |
| • Networking | ❑ | ❑ | ❑ | ❑ | ❑ |

Notes: ……

**- I have liked more …**

**- Final remarks**