TIMEPAC

Towards Innovative Methods
for Energy Performance Assessment and Certification of Buildings

Deliverable 5.5

Project manual

Lead Beneficiary: European Science Communication Institute gGmbH (ESCI)

Date: 19.12.2024

Version: 1.0

Dissemination level: Public

www.timepac.eu

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

Document description

Deliverable No.	5.5
Dissemination level	Public
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Contributors	All partners
Due date of deliverable	31.10.2024
Actual submission date	19.12.2024

Version	Date	Beneficiary	Author
V1.0	19.12.2024	FUNITEC	Leandro Madrazo

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Executive summary

This document serves as a comprehensive compendium of the project's outcomes, offering valuable resources for a diverse audience, including researchers, public authorities, certification agencies, and professionals engaged in building certification and sustainable development. It encapsulates the collective knowledge and insights generated throughout the project, providing a foundation for advancing energy performance and sustainability in the built environment.

The compendium includes a wide array of materials designed to address different needs and expertise levels. These encompass scientific and technical publications that present research findings, technical reports that document methodologies and results, and training materials aimed at building capacity among professionals and policy makers. Additionally, the collection features practical guidelines and factsheets that distil the knowledge acquired in the Transversal Deployment Scenarios into actionable insights, as well as videos that serve as engaging tools for dissemination and education.

Through this compilation of resources, we seek to promote knowledge sharing and encourage stakeholders to adopt innovative approaches to building energy certification and sustainable development.

1 Scientific and technical publications

Papers, articles and book chapters derived from the work of the project.

Enhancement of current EPC schemas with operational data
Piro, M., Degerfeld, F. B. M., Ballarini, I., & Corrado, V. (2023). The challenges for a holistic, flexible and through-life updated energy performance certificate. Proceedings of the 18th SDEWES Conference, Dubrovnik. Piro, M., Degerfeld, F. B. M., Ballarini, I., & Corrado, V. (2024). The challenges for a holistic, flexible and through-life updated energy performance certificate. *Sustainable Energy Technologies and Assessments*, *69*, 103922. https://doi.org/10.1016/j.seta.2024.103922
One of the strategies proposed by the recently approved version of the Energy Performance of Buildings Directive recast is to provide the Member States with more reliable, accurate, and digitalised Energy Performance Certificates (EPCs), the so-called next-generation or enhanced EPCs. Currently, end-users perceive the EPC as just an administrative obligation for buying or renting a building. The data in the certificates provide limited energy-related information and lack accuracy. Moreover, they cannot account for the continuous changes that occur throughout building lifetime. The overcoming of the EPC limitations is the main objective of the research activity conducted within the framework of Next Generation EPC Horizon2020 cluster. At this regard, the EU-Horizon2020 TIMEPAC project is going to contribute to the enhancement of the entire process of generating, storing, analysing, and exploiting EPCs. The premise is that the building is no longer conceived as a static entity, but as an occupant-centric object, subject to continuous changes. Therefore, the enhanced EPC approach should be holistic, flexible, through-life updatable, and interoperable. In this work, the main methodologies and tools proposed in the TIMEPAC project for the enhancement of the existing EPC schema in terms of EPC generation, exploitation, and data quality are presented and discussed.

EPC and SR
Sučić, B., Jurjević, R., Bišćan, M., & Stegnar, G. (2023). Refining energy efficiency and flexibility strategies using the smart readiness indicator: a comparative case study in Slovenia and Croatia. Proceedings of the 54th International HVAC&R Congress and Exhibition. Belgrade. https://doi.org/10.24094/kghk.023.039
Energy and resource efficiency, combined with renewable energy sources, form the backbone of future sustainable development across all sectors. In this context, reducing energy consumption in buildings and integrating renewable energy sources (REE) into urban environments are vital for achieving a long-term transition to a carbon-neutral society. The European Union (EU) has identified buildings as a key target where improving energy efficiency can have the greatest impact. It has also quantified the significant potential for energy savings associated with investments in infrastructure and equipment. Calculating the Smart Readiness Indicator (SRI)—a measure of a building's ability to adapt its systems in response to external stimuli—requires collecting data from various aspects of the

building's design, use, and operation. During the data collection process, the SRI auditor must extract relevant data from sources such as drawings, logs, predefined readings from supervisory control and data acquisition (SCADA) systems, as well as through communication with energy and/or facility managers, tenants, and building owners.

Accurate interpretation of the SRI results is essential for identifying potential improvements in energy efficiency and flexibility. This paper presents a comparative case study on the application of SRI in Slovenia and Croatia, focusing on measures to enhance energy efficiency and flexibility. Additionally, it aims to provide general elements for a code of conduct in SRI assessments. These elements should serve as quality indicators for clients—building owners, facility managers, building users, etc.—by clarifying what they should expect and require from an SRI auditor to achieve the desired benefits.

Finally, the strengths and weaknesses of the SRI audit process and its role in decision-making, particularly in selecting the optimal energy renovation scenario, are critically examined.

Implementation of the Renovation Passport

Geissler, S., & Hoffmann, M. (2023). Renovierungspass für die Renovierungswelle OIB aktuell - Das Fachmagazin für Baurecht und Technik ISSN 1615-9950

https://www.oib.or.at/node/9725589

https://sera.global/assets/media/OIB-aktuell_Heft-3_2023_Geissler.pdf

The Renovation Passport, as outlined in the European Commission's revised Energy Performance of Buildings Directive (EPBD), serves as a comprehensive guide to help buildings achieve zero emissions by 2050. It is issued by certified experts following an on-site visit and incorporates real energy consumption data. The passport includes a detailed refurbishment roadmap that outlines step-by-step measures for achieving zero-emission status. Additionally, it provides information on the benefits of renovation, such as energy savings, reduced greenhouse gas emissions, improved health and comfort, and enhanced adaptability to climate change, alongside available financial and technical support options.

From the perspective of the property industry, the Renovation Passport aligns with the need for structured and transparent property maintenance planning. It supports long-term strategies for achieving climate-neutral building stock by 2050. Integrating the passport into standard property management practices, as suggested under the Condominium Act 2002, ensures that phased renovations are systematically planned and financed. The passport's validity and relevance must be maintained through regular updates, potentially every five years, after the implementation of each renovation phase. This approach enables adjustments to be made in response to evolving technical, legal, and economic circumstances, ensuring the Renovation Passport remains a robust tool for meeting sustainability goals.

Implementation of the Renovation Passport
Geissler, S., & Hoffmann, M. (2023). Nachhaltige Implementierung der langfristigen Renovierungsstrategie in Bestandsgebäuden. Journal für Facility Management, Issue 25/2023 ISSN 2520-5404 https://journal.ifm.tuwien.ac.at/article/665/galley/695/download/
The European Union focuses on the energetic renovation of existing buildings, while in Austria many property managers struggle with the maintenance and adaptation of existing buildings to the local and technical standard, which in turn represents a decisive criterion in case law for the extent of liability of managers towards clients and third parties. Based on the legal provisions and standards applicable in Austria, the current maintenance and repair process of the existing building stock is outlined and analysed. Subsequently, a strategy for the increased implementation of energy-related refurbishment is derived. It is shown that the long-term renovation strategy in the future must also include the adaptation of essential safety precautions in existing buildings if the goal of increasing the energy-related renovation rate is to be achieved.

Tools and protocols for buildings sustainability assessment and certification
Ballarini, I., Degerfeld, F. B. M., Corrado, V., Piro, M., Sicilia, Á., Sučić, B. (2025). Handbook: Sustainability certifications, labels and tools in the built environment - How to evaluate, certificate and reduce the energy and environmental impacts of buildings. Chapter 4: Tools and protocols for buildings sustainability assessment and certification. Taylor & Francis. *In press*
This chapter includes a thorough analysis of the tools and protocols available for sustainability assessment and certification of buildings. This analysis offers a comprehensive overview of various European and international practices in this field. The first section introduces the Directive 2002/91/EC and further explores the latest regulations, with a primary focus on the evolution of energy certification for buildings. Specifically, the Energy Performance Certificate (EPC) is introduced, which provides essential data on energy consumption analysis, supports buildings energy refurbishment and helps stakeholders in making informed decisions by identifying the most advantageous options. The second section explains into the concept of the circular economy and its relevance to the built environment. The third section deals with the importance of protocols and multi-building tools in promoting long-term sustainability. The analysis emphasizes the significance of utilizing different tools available, including an examination of existing protocols for historic buildings and a comparison of various methodological approaches.

2 Technical reports

Outcomes derived from the project activities which have been published by third parties.

Advancing energy efficiency at the urban scale: perspectives on reliable information in the next-generation Energy Performance Certificates
Article published on the BUILD UP portal, on the work done on the project. Ballarini, I., Corrado, V., & Piro, M. (2024). Advancing energy efficiency at the urban scale: perspectives on reliable information in the next-generation Energy Performance Certificates. https://build-up.ec.europa.eu/en/resources-and-tools/articles/advancing-energy-efficiency-urban-scale-perspectives-reliable

Testing SRI methodology
The case study for the SRI application of a health facility carried out by the Goriška Local Energy Agency and Jožef Stefan Institute in the framework of the TIMEPAC project (see Deliverable 2.4 "Procedures and services for the integration of the SRI and environmental sustainability indicators in existing EPC tools", has been included in the case studies of the EU SRI website https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficient-buildings/smart-readiness-indicator/communication-kit_en https://circabc.europa.eu/ui/group/54384127-eb1d-445e-9b6e-ef5ef14fe429/library/8188251d-6add-443b-927d-a2092996f56c/details?download=true

3 Training materials

Training materials for each session of the webinars delivered through the TIMEPAC Academy are available in the TIMEPAC Community on Zenodo.

TIMEPAC Academy: Webinar 1. EPC data collection, validation and exploitation
https://zenodo.org/records/14168716
In the context of European climate-neutrality and sustainability goals, energy performance certification is expected to become an effective assessment methodology for systematically analyzing and enhancing the energy efficiency of buildings over their successive renovation stages. This webinar aims to explore the synergies between energy performance certification, technical system inspections, and energy auditing. Our objective is to streamline the process of generating EPCs - including their generation from BIM models - by identifying the essential elements for efficient data extraction from various sources, ensuring their accuracy and reliability. We will delve into practical strategies, gathering and validating data, starting at the desktop, with a comprehensive analysis of drawings, inspection reports, and energy audits. This information will be complemented with data obtained during on-site visits, such as renovation status, size, construction materials, and insulation levels. Additionally, we will address the importance of capturing additional information about HVAC systems, lighting, appliances, occupancy rates, and space utilization patterns to assess the actual performance of buildings. The webinar will also feature insights into the TIMEPAC Code of Conduct for Smart Readiness and Sustainability Rating.

TIMEPAC Academy: Webinar 2. Advanced methods and tools for holistic energy renovation of buildings
https://zenodo.org/records/14184575
he upcoming EPBD recast recommends that architects and planners utilize 3D-based modelling and simulation technologies throughout the planning, design, construction, and renovation phases of residential areas to enhance and assess building energy performance. Integrating BIM models with simulation tools can improve the assessment of building performance and support renovation efforts. These digital technologies are particularly beneficial for creating building renovation passports and digital building logbooks, while incorporating smart readiness indicators and life-cycle global warming in building performance simulations. Assessing building performance with these tools enables a more comprehensive evaluation over time and facilitates the transition from one-off certification to continuous performance assessment. This webinar will offer insights into using BIM models to generate EPCs for both new buildings and successive renovation stages throughout their lifespan. Practical cases will demonstrate the capabilities of available technologies.

TIMEPAC Academy: Webinar 3. Analysis and visualisation of EPC data and development of innovative energy services

https://zenodo.org/records/14184594

The upcoming recast of the EPBD includes various measures to facilitate targeted financing for investments in the residential building sector and to gradually introduce minimum energy performance standards for non-residential buildings. Their ultimate aim is to decarbonize the building stock by increasing renovation and improving building energy performance. Moreover, these initiatives should lead to increased reliability, quality, and digitalization of Energy Performance Certificates (EPCs), with energy performance classes being established based on common criteria.

In the context of the TIMEPAC project, EPCs are not perceived as mere paper-based documents; rather, they are envisioned as digital repositories of integrated information. However, the current EPCs predominantly cater for end-users, offering limited and often unreliable technical data. Consequently, the enhanced EPC should serve multiple functions, evolving into a central document accessible to various stakeholders, including end-users, energy certifiers, and local, regional, and national authorities. Thus, the next-generation energy certificate should be tailored to specific audiences and intended purposes.

In this webinar, we will delve into the analysis and visualization of EPC data and its utilization in the development of innovative energy services. Our objective is to equip participants with the knowledge and skills necessary to harness EPC data for the preparation of deep energy renovation projects. Additionally, the webinar will offer insights into monitoring and verifying energy savings, including the potential role of EPCs in this process.

TIMEPAC Academy: Webinar 4. Combining EPC databases with other sources for holistic assessment of the building stock

https://zenodo.org/records/14184598

The upcoming recast of the Energy Performance of Buildings Directive (EPBD) outlines a pathway to achieve a decarbonised building stock by 2050. One of its objectives is that new buildings achieve zero emission status by 2030, compelling Member States to develop national plans for reducing primary energy consumption. In this context, energy performance certificates (EPCs) can play an instrumental role in assessing building performance and implementing large scale rehabilitation programmes.

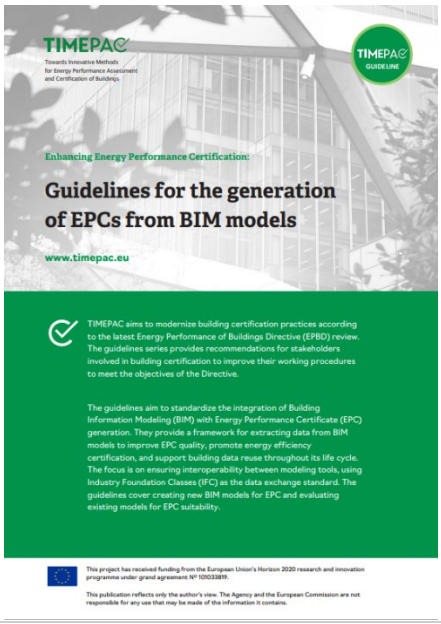
During this webinar, we will explore the potential of utilizing open data from EPCs in Catalonia to enhance their effectiveness as tools for building renovation. We will delve into how the TIMEPAC project has analysed information from this registry, identifying unreliable data and grouping buildings based on characteristics such as climatic zone, use, and year of construction in order create representative archetypes of the building stock. In the absence of data on all buildings, these archetypes serve as a valuable tool to extrapolate their characteristics to the building stock. This enables the assessment of the impact of large-scale rehabilitation measures, ensuring compliance with the EPBD objectives. Additionally, the integration of EPC databases with other sources can facilitate a comprehensive analysis of the built environment, complementing EPC data with information such as population statistics, renewable energy production, transport networks, and public amenities. Insights about this integration will also be provided during the sessions.

TIMEPAC Academy: Webinar 5. Exploitation of EPC for local, regional and national energy planning
https://zenodo.org/records/14184618
The upcoming recast of the Energy Performance of Buildings Directive (EPBD) introduces the national building renovation plan to support the decarbonisation of the European building stock by 2050. This requires data and models to rank the overall energy and environmental performance of the building stock. Archetypes that 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, in the same time, reduces model complexity. The content of Energy Performance Certificate (EPC) databases, properly processed to remove erroneous data, represents a core source of information to create the archetypes, to analyse the performance status of the building stock, and to assess the effectiveness of renovation strategies. This webinar explores the potential to use EPC databases to develop an archetype-based urban building energy model, as devised in the TIMEPAC project. The webinar offers comprehensive training in the 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 Building Renovation Passport), and at broader building stock levels will be provided. The training materials cover the workflow of statistical analysis on EPC databases, quality control activities for EPC data, and the development of building stock models.

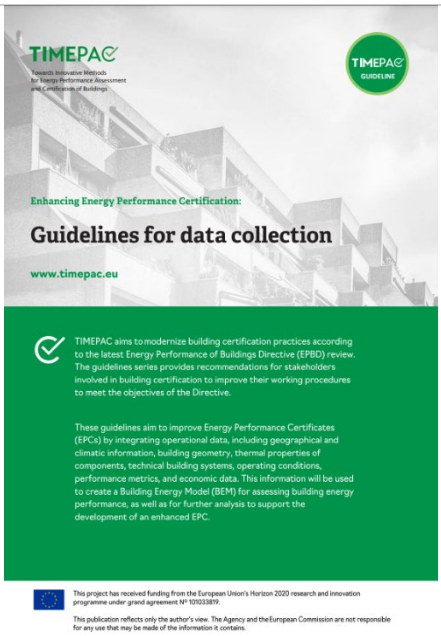
TIMEPAC Academy: Webinar 6. Operational optimisation of building energy performance based on activities during EPC generation
https://zenodo.org/records/14184625
The new EPBD recast aims to increase the rate of renovations of energy-inefficient buildings and improve information on energy performance. Member States shall ensure that energy performance certificates (EPCs) are affordable and issued by independent experts following an on-site visit. In the context of the TIMEPAC project, on-site visit is essential element of the EPC generation process and must be properly planned. During the on-site visit, the certifier should visually inspect the condition of the equipment, systems, and living/working spaces. During this webinar, we will explore how to combine the on-site visit with re-commissioning activities. Our goal is to empower participants with the necessary knowledge and skills to provide cost-effective optimization advice based on activities during EPC generation. Re-commissioning (Re-Co) is the expression used to describe an energy-system operation-optimization service in existing buildings. It focuses on improving the overall performance of a building by investigating and improving how systems operate together. It consists of a rapid energy audit of the buildings, focused on a check and re-set of the energy system's operating parameters. Even though they might give rise to some additional costs, Re-Co services can be carried out successfully and be a cost-effective part of the EPC-generation process because they will generate additional benefits for the owners and building users. The webinar will also provide insights into the monitoring and targeting techniques and comparing the existing with the expected performance.

4 Guidelines

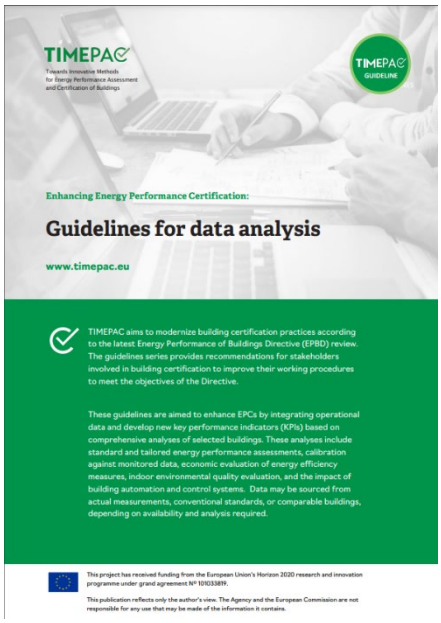
These guidelines summarize the outcomes of the Transversal Deployment Scenarios developed during the project, as documented in the Work Package 2 deliverables available at https://timepac.eu/reports/. The annexed documents from these reports were refined and published as guidelines for professionals in the field of energy performance certification, providing advanced procedures to improve current practices.

Guidelines for the generation of EPCs from BIM models	
https://timepac.eu/wp-content/uploads/2024/11/TIMEPAC_GUIDELINES_EPC_BIM.pdf	
TIMEPAC aims to modernize building certification practices according to the latest Energy Performance of Buildings Directive (EPBD) review. The guidelines series provides recommendations for stakeholders involved in building certification to improve their working procedures to meet the objectives of the Directive. The guidelines aim to standardize the integration of Building Information Modeling (BIM) with Energy Performance Certificate (EPC) generation. They provide a framework for extracting data from BIM models to improve EPC quality, promote energy efficiency certification, and support building data reuse throughout its life cycle. The focus is on ensuring interoperability between modeling tools, using Industry Foundation Classes (IFC) as the data exchange standard. The guidelines cover creating new BIM models for EPC and evaluating existing models for EPC suitability.	

Guidelines for data collection
https://timepac.eu/wp-content/uploads/2024/12/TIMEPAC_GUIDELINES_DATA-COLLECTION_rev_CLEAN.pdf
TIMEPAC aims to modernize building certification practices according to the latest Energy Performance of Buildings Directive (EPBD) review. The guidelines series provides recommendations for stakeholders involved in building certification to improve their working procedures to meet the objectives of the Directive. These guidelines aim to improve Energy Performance Certificates (EPCs) by integrating operational data, including geographical and climatic information, building geometry, thermal properties of components, technical building systems, operating conditions, performance metrics, and economic data. This information will be used to create a Building Energy Model (BEM) for assessing building energy performance, as well as for further analysis to support the development of an enhanced EPC.



Guidelines for data analysis
https://timepac.eu/wp-content/uploads/2024/11/TIMEPAC_GUIDELINES_DATA-ANALYSIS.pdf
TIMEPAC aims to modernize building certification practices according to the latest Energy Performance of Buildings Directive (EPBD) review. The guidelines series provides recommendations for stakeholders involved in building certification to improve their working procedures to meet the objectives of the Directive. These guidelines are aimed to enhance EPCs by integrating operational data and develop new key performance indicators (KPIs) based on comprehensive analyses of selected buildings. These analyses include standard and tailored energy performance assessments, calibration against monitored data, economic evaluation of energy efficiency measures, indoor environmental quality evaluation, and the impact of building automation and control systems. Data may be sourced from actual measurements, conventional standards, or comparable buildings, depending on availability and analysis required.



Guidelines for creating Renovation Passports from data repositories	
https://timepac.eu/wp-content/uploads/2024/11/TIMEPAC_GUIDELINES_RENOVATION_PASSPORTS.pdf	
TIMEPAC aims to modernize building certification practices according to the latest Energy Performance of Buildings Directive (EPBD) review. The guidelines series provides recommendations for stakeholders involved in building certification to improve their working procedures to meet the objectives of the Directive. The guideline aims to provide building owners, property managers, and stakeholders with a clear framework for enhancing energy efficiency in buildings over time. It aligns individual renovation efforts with national and EU targets, such as achieving nearly Zero-Energy Building (nZEB) and Zero-Energy Building (ZEB) standards. It helps stakeholders understand the necessary processes, data requirements, tools, and responsibilities, while offering access to crucial legal, financial, and technical resources for effective renovation implementation. Ultimately, the guideline ensures that each renovation phase is well-documented, financially viable, and compliant with evolving regulations. It is designed as a standalone document that can be easily translated into national languages for stakeholder discussions and used in designing Renovation Passport schemes	

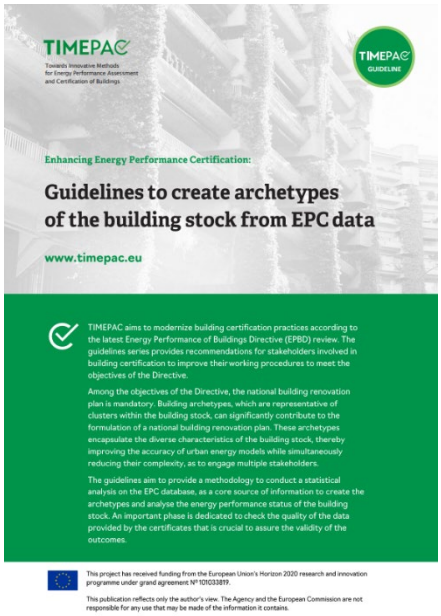
Guidelines to create archetypes of the building stock from EPC data

https://timepac.eu/wp-content/uploads/2024/12/TIMEPAC_GUIDELINES_ARCHETYPES_rev_CLEAN.pdf

TIMEPAC aims to modernize building certification practices according to the latest Energy Performance of Buildings Directive (EPBD) review. The guidelines series provides recommendations for stakeholders involved in building certification to improve their working procedures to meet the objectives of the Directive.

Among the objectives of the Directive, the national building renovation plan is mandatory. Building archetypes, which are representative of clusters within the building stock, can significantly contribute to the formulation of a national building renovation plan. These archetypes encapsulate the diverse characteristics of the building stock, thereby improving the accuracy of urban energy models while simultaneously reducing their complexity, as to engage multiple stakeholders.

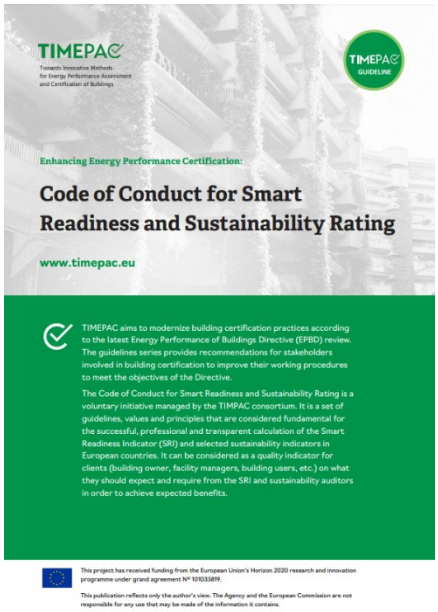
The guidelines provide a methodology to conduct a statistical analysis on the EPC database, as a core source of information to create the archetypes and analyse the energy performance status of the building stock.



Code of Conduct for Smart Readiness and Sustainability Rating

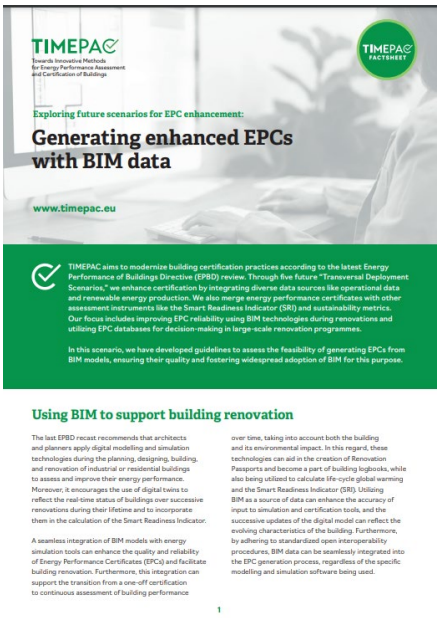
https://timepac.eu/wp-content/uploads/2024/11/TIMEPAC_Code_of_Conduct.pdf

TIMEPAC aims to modernize building certification practices according to the latest Energy Performance of Buildings Directive (EPBD) review. The guidelines series provides recommendations for stakeholders involved in building certification to improve their working procedures to meet the objectives of the Directive. The Code of Conduct for Smart Readiness and Sustainability Rating is a voluntary initiative managed by the TIMPAC consortium. It is a set of guidelines, values and principles that are considered fundamental for the successful, professional and transparent calculation of the Smart Readiness Indicator (SRI) and selected sustainability indicators in European countries. It can be considered as a quality indicator for clients (building owner, facility managers, building users, etc.) on what they should expect and require from the SRI and sustainability auditors in order to achieve expected benefits.



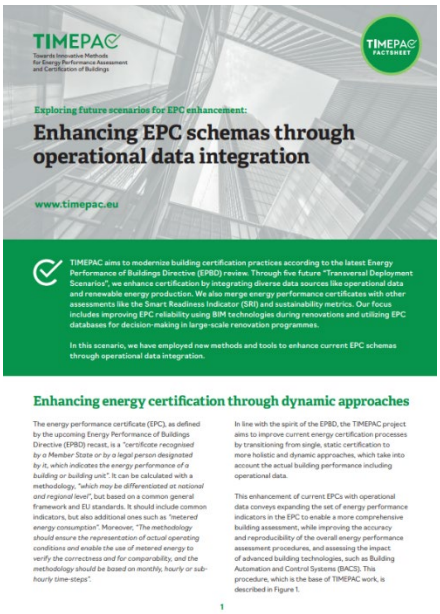
5 Factsheets

The TIMEPAC factsheets present a concise overview of the five Transversal Deployment Scenarios, detailing the various stages of the EPC workflow—generation, storage, analysis, and exploitation. These scenarios engage diverse stakeholders, including research groups, energy agencies, and ESCOS, and incorporate a range of resources such as data, tools, and methods. Designed for these audiences, the factsheets provide a quick and accessible summary of the work conducted within the scenarios, acting as a gateway to the more comprehensive guidelines and reports.

Generating enhanced EPCs with BIM data	
https://timepac.eu/wp-content/uploads/2024/05/2024-05-03-TIMEPAC_Factsheet_TDS1.pdf	
	TIMEPAC aims to modernize building certification practices according to the latest Energy Performance of Buildings Directive (EPBD) review. Through five future "Transversal Deployment Scenarios," we enhance certification by integrating diverse data sources like operational data and renewable energy production. We also merge energy performance certificates with other assessment instruments like the Smart Readiness Indicator (SRI) and sustainability metrics. Our focus includes improving EPC reliability using BIM technologies during renovations and utilizing EPC databases for decision-making in large-scale renovation programmes. In this scenario, we have developed guidelines to assess the feasibility of generating EPCs from BIM models, ensuring their quality and fostering widespread adoption of BIM for this purpose.

Enhancing EPC schemas through operational data integration

https://timepac.eu/wp-content/uploads/2024/05/2024-05-06-TIMEPAC_Factsheet_TDS2v2.pdf


TIMEPAC
Towards Innovative Methods for Energy Performance Assessment and Certification of Buildings
TIMEPAC FACTSHEET
Exploring future scenarios for EPC enhancement:
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In this scenario, we have employed new methods and tools to enhance current EPC schemas through operational data integration.
Enhancing energy certification through dynamic approaches
The energy performance certificate (EPC), as defined by the upcoming Energy Performance of Buildings Directive (EPBD) recast, is a "certificate recognised by a Member State or by a legal person designated by it, which indicates the energy performance of a building or building unit". It can be calculated with a methodology, "which may be differentiated at national and regional level", but based on a common general framework and EU standards. It should include common indicators, but also additional ones such as "metered energy consumption". Moreover, "The methodology should ensure the representation of actual operating conditions and enable the use of metered energy to verify the correctness and for comparability, and the methodology should be based on monthly, hourly or sub-hourly time-steps".
In line with the spirit of the EPBD, the TIMEPAC project aims to improve current energy certification processes by transitioning from single, static certification to more holistic and dynamic approaches, which take into account the actual building performance including operational data.
This enhancement of current EPCs with operational data conveys expanding the set of energy performance indicators in the EPC to enable a more comprehensive building assessment, while improving the accuracy and reproducibility of the overall energy performance assessment procedures, and assessing the impact of advanced building technologies, such as Building Automation and Control Systems (BACS). This procedure, which is the base of TIMEPAC work, is described in Figure 1.
1

TIMEPAC aims to modernize building certification practices according to the latest Energy Performance of Buildings Directive (EPBD) review. Through five future "Transversal Deployment Scenarios", we enhance certification by integrating diverse data sources like operational data and renewable energy production. We also merge energy performance certificates with other assessments like the Smart Readiness Indicator (SRI) and sustainability metrics. Our focus includes improving EPC reliability using BIM technologies during renovations and utilizing EPC databases for decision-making in large-scale renovation programmes.

In this scenario, we have employed new methods and tools to enhance current EPC schemas through operational data integration.

Creating building Renovation Passports from data repositories

https://timepac.eu/wp-content/uploads/2024/05/2024-05-03-TIMEPAC_Factsheet_TDS3.pdf


TIMEPAC
Towards Innovative Methods for Energy Performance Assessment and Certification of Buildings
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Exploring future scenarios for EPC enhancement:
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In this scenario we created procedures to trace the evolution of building refurbishment. This involves utilizing different data sources such as BIM, EPC, energy audit reports, and operational data, among others.
The role of data repositories in staged renovation
The building Renovation Passport was introduced by amending Directive (EU) 2018/844, responding to the need of increasing the renovation rate. Ideally, building renovation is done in one go, but often, this is not possible due to a variety of reasons. The alternative approach is the staged renovation which is implemented over a certain period of time. In such a case, it is important to plan individual measures in the correct sequence to avoid lock in effects and thus ensure that the building improvement potential is fully realized. With the recast EPBD 2024 new provisions have been introduced.
Tracking the implementation of renovation measures is important because the up-to-date information about a building is necessary for tracing the transformation of the building stock as a whole, but also for certain services at building level such as real estate valuation or renovations financed by on-bill savings. In this regard, data repositories play an important role because there is the potential to improve data quality and thus acceptance on the market, and to reduce effort for data collection and thus cost.
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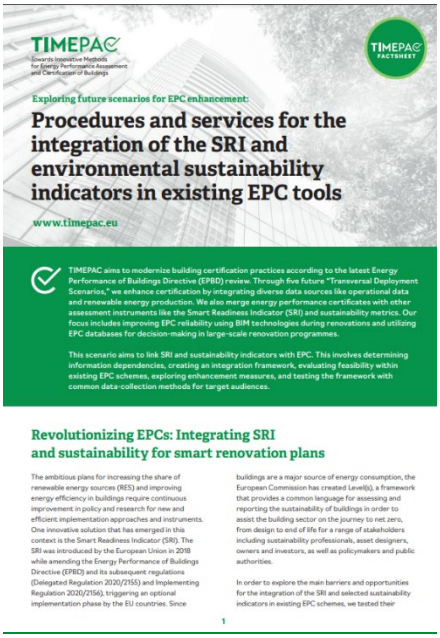
In this scenario we created procedures to trace the evolution of building refurbishment. This involves utilizing different data sources such as BIM, EPC, energy audit reports, and operational data, among others.

Procedures and services for the integration of the SRI and environmental sustainability indicators in existing EPC tools

https://timepac.eu/wp-content/uploads/2024/05/2024-05-06-TIMEPAC_Factsheet_TDS4v2.pdf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This scenario aims to link SRI and sustainability indicators with EPC. This involves determining information dependencies, creating an integration framework, evaluating feasibility within existing EPC schemes, exploring enhancement measures, and testing the framework with common data-collection methods for target audiences.
Revolutionizing EPCs: Integrating SRI and sustainability for smart renovation plans
The ambitious plans for increasing the share of renewable energy sources (RES) and improving energy efficiency in buildings require continuous improvement in policy and research for new and efficient implementation approaches and instruments. One innovative solution that has emerged in this context is the Smart Readiness Indicator (SRI). The SRI was introduced by the European Union in 2018 while amending the Energy Performance of Buildings Directive (EPBD) and its subsequent regulations (Delegated Regulation 2020/2155) and Implementing Regulation 2020/2156), triggering an optional implementation phase by the EU countries. Since buildings are a major source of energy consumption, the European Commission has created Level(s), a framework that provides a common language for assessing and reporting the sustainability of buildings in order to assist the building sector on the journey to net zero, from design to end of life for a range of stakeholders including sustainability professionals, asset designers, owners and investors, as well as policymakers and public authorities.
In order to explore the main barriers and opportunities for the integration of the SRI and selected sustainability indicators in existing EPC schemes, we tested their
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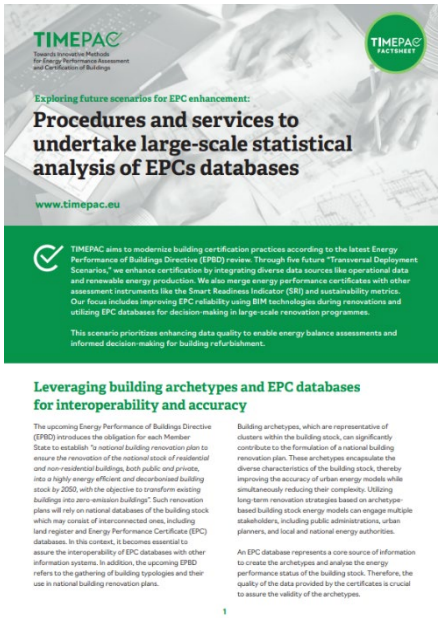
This scenario aims to link SRI and sustainability indicators with EPC. This involves determining information dependencies, creating an integration framework, evaluating feasibility within existing EPC schemes, exploring enhancement measures, and testing the framework with common data-collection methods for target audiences.

Procedures and services to undertake large-scale statistical analysis of EPCs databases

https://timepac.eu/wp-content/uploads/2024/05/2024-05-03-TIMEPAC_Factsheet_TDS5.pdf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This scenario prioritizes enhancing data quality to enable energy balance assessments and informed decision-making for building refurbishment.
Leveraging building archetypes and EPC databases for interoperability and accuracy
The upcoming Energy Performance of Buildings Directive (EPBD) introduces the obligation for each Member State to establish "a national building renovation plan to ensure the renovation of the national stock of residential and non-residential buildings, both public and private, into a highly energy efficient and decarbonised building stock by 2050, with the objective to transform existing buildings into zero-emission buildings". Such renovation plans will rely on national databases of the building stock which may consist of interconnected ones, including land register and Energy Performance Certificate (EPC) databases. In this context, it becomes essential to assure the interoperability of EPC databases with other information systems. In addition, the upcoming EPBD refers to the gathering of building typologies and their use in national building renovation plans. Building archetypes, which are representative of clusters within the building stock, can significantly contribute to the formulation of a national building renovation plan. These archetypes encapsulate the diverse characteristics of the building stock, thereby improving the accuracy of urban energy models while simultaneously reducing their complexity. Utilizing long-term renovation strategies based on archetype-based building stock energy models can engage multiple stakeholders, including public administrations, urban planners, and local and national energy authorities.
An EPC database represents a core source of information to create the archetypes and analyse the energy performance status of the building stock. Therefore, the quality of the data provided by the certificates is crucial to assure the validity of the archetypes.
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This scenario prioritizes enhancing data quality to enable energy balance assessments and informed decision-making for building refurbishment

6 Videos

As outlined in Deliverable 5.4, "Best Practice for Communication Activities," 20 videos have been produced in various formats to highlight and explain TIMEPAC's approach to enhanced Energy Performance Certificates (EPCs). The following section presents a selection of representative videos, including those that have garnered significant public attention.

Energy Performance of Buildings Directive (EPBD) recast. Pau Garcia Audí, Policy Officer, Directorate-General for Energy Efficiency, European Commission
Presentation - https://timepac.eu/wp-content/uploads/2024/10/EPBD-recast-2024-TIMEPAC_PauGarcia_PerPublicar_rev.pdf TIMEPAC International Conference, Barcelona, 5 October 2024
Presentation - https://timepac.eu/wp-content/uploads/2024/10/EPBD-recast-2024-TIMEPAC_PauGarcia_PerPublicar_rev.pdf
Video recording - https://youtu.be/pMeQgJlPbJs?si=XDDUO_2l8_HZcDCD&t=1394

EU Green Deal, Renovation Wave Fit for 55 by 2030 , Repower EU plan drivers for the EPBD revision in 2022 will it affect the use of the set of EPB standards? Jaap HOGELING Chair CEN/TC 371 Energy Performance of Buildings **TIMEPAC International Workshop, Torino, 30 November 2022**
Presentation - https://timepac.eu/wp-content/uploads/2022/12/0.3-Jaap-Hogeling-The-Evolution-of-Building-Energy-Performance-Assessment-and-Certification-Schemes-in-Europe.pdf
Video recording - https://youtu.be/8M3vxUrb18Y?si=fRkbfaDlNP5wV2Ea&t=1278

Introduction to TIMEPAC, Leandro Madrazo **TIMEPAC International Workshop, Vienna, 21 November 2023**
Presentation - https://timepac.eu/wp-content/uploads/2023/12/0.4-Madrazo-Leandro-Introduction.pdf
Video recording - https://youtu.be/5GDkxBM8BgM?feature=shared

An Enhanced Energy Performance Certificate as a Catalyst for Building Renovation in Europe **Promotional video of the TIMEPAC project** **February 2023**
https://www.youtube.com/watch?v=IEQgTeypcbs

Climate Targets 2050: A New Concept to Assess the Energy Consumption of Buildings **Interview with Leandro Madrazo, Project Coordinator** **March 2022**
https://www.youtube.com/watch?v=YPidL4NquZk

Dynamic Energy Certificates to Tackle Climate Change **Interview with Susanne Geissler, SERA Global** **March 2022**
https://www.youtube.com/watch?v=1TeK0Jiy0ss

TIMEPAC Academy Webinar 1: EPC Data Collection, Validation and Exploitation **March 2024**
https://www.youtube.com/watch?v=KJ39sgLL6eo