iBRoad2EPC

Integrating Building Renovation Passports
into Energy Performance Certification schemes
for a decarbonised building stock

Accelerating deep renovation in the EU with Renovation Passports

EU roadmap proposing concrete measures to maximise the uptake of iBRoad2EPC schemes

BPIE – Buildings Performance Institute Europe

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EXECUTIVE SUMMARY

The current rate of renovation to enhance the energy efficiency of buildings in the European Union is only 1%, which is significantly below the 3% threshold necessary to achieve the Union's climate neutrality objectives. The Renovation Wave strategy posits that energy performance certificates (EPCs) and building renovation passports serve as pivotal information tools, capable of triggering and accelerating the process of deep renovation. The 2024 Energy Performance of Buildings Directive (EPBD) recast introduces significant and stringent provisions for EPCs and establishes a framework for renovation passports as an additional voluntary tool to provide a clear roadmap for staged deep renovations. A renovation passport provides a structured methodology for staged deep renovations, enabling property owners and investors to plan interventions in a timely and effective manner and avoid potential lock-ins. The EPBD also recognises the potential for synergies between renovation passports and EPCs, encouraging their joint preparation and issuance.

In accordance with Article 12 of the EPBD, which requires transposition of the EPBD into national law by **29 May 2026**, Member States are required to put in place a renovation passport scheme by that date, based on the common framework set out in Annex VIII of the EPBD.

The iBRoad2EPC project, funded by the EU's Horizon 2020 programme, has developed a flexible, adaptable and modular model renovation passport. It also provides a set of solutions that can be immediately applied to the transposition and/or implementation of a number of EU policy instruments, including the EPBD, the Energy Efficiency Directive (EED) and the Renewable Energy Directive (RED).

The present iBRoad2EPC EU roadmap provides guidance to policymakers on how to optimally prepare the ground and maximise the use of iBRoad2EPC to accelerate deep renovation in the EU**.** The main actions are summarised as follows:

1 Carry out baseline assessment and consultation

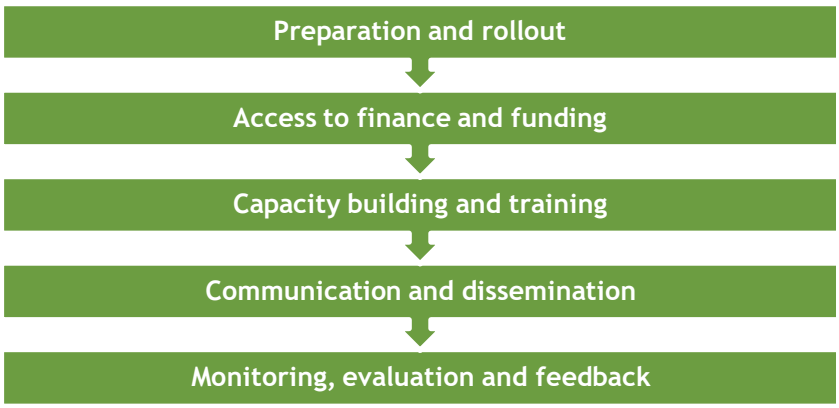
- Identify, engage and consult key stakeholders, and assign responsibilities.
- Understand the EU policy context, transposition deadlines for key directives such as EPBD, EED, RED and submission deadlines for national building renovation plans to better harmonise different policy instruments for greater impact.

2 Set the scene for transposition

- Identify and define the key national priorities and enablers for the implementation of the renovation passport scheme, **based on the experience of six iBRoad2EPC pilot countries.**
- Each Member State will need to find the enablers of its own regulatory ecosystem including priorities that follow each other in a sensible timeline.

3 Set action plan for implementation

- Draw up an action plan for the implementation of the **iBRoad2EPC renovation passport** for each stage of the policy cycle shown below.



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ABBREVIATIONS

API	Application programming interface
BRP	Building renovation passport
EC	European Commission
EED	Energy Efficiency Directive
EPBD	Energy Performance of Buildings Directive
ESCOs	Energy service companies
EPC	Energy performance certificate
EU	European Union
GWP	Global warming potential
IEQ	Indoor environmental quality
LTRS	Long-term renovation strategy
MEPI	Measured energy performance indicator
MEPS	Minimum energy performance standards
NBRP	National building renovation plan
NECP	National energy and climate plan
RED	Renewable Energy Directive
SMEs	Small and medium-sized enterprises
SRI	Smart Readiness Indicator

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INTRODUCTION

Where does the EU currently stand on deep renovations?

As part of Europe's commitment to the 1.5°C Paris Agreement target, the EU Renovation Wave strategy aims to accelerate deep renovation in the EU-27. Around 75% of the building stock in the EU is considered energy inefficient according to current building standards and is in urgent need of large-scale renovation [1]. Renovation not only helps to meet climate and energy targets but also improves living standards for the 15% of the EU population living with issues such as leaking roofs, damp walls, and rotten window frames or floors. It can also support the 9.3% of EU citizens who struggle to keep their homes adequately warm during cold periods [1]. However, the current rate of renovation to improve the energy performance of buildings is only 1%, while the rate of deep renovation, which improves energy performance by at least 60%, is only 0.2% [1]. This is well short of the 3% required to meet the EU's climate neutrality targets [2].

The Renovation Wave strategy aims to achieve 'faster and deeper' renovation in the EU's buildings. In this context, the strategy identifies energy performance certificates (EPCs) as pivotal information tools. The recommendations presented in EPCs are the first step towards buildings' better energy performance. However, Member States differ in their approach to providing and presenting the recommendations [3], [4]. For example, several countries, such as Austria and Denmark, include high-quality and energy-efficient options for renovation recommendations in their national or certified calculation tools. In other countries, such as Germany and Greece, the tools do not automatically provide recommendations; doing so is up to the EPC assessors. Several countries lack frameworks or guidelines for providing recommendations. In many cases, Member States mandate only recommendations based on cost-effectiveness as per the guidelines of the Energy Performance of Buildings Directive (EPBD), which may result in sub-optimal solutions. Furthermore, due to the varying qualifications and training of EPC assessors between the Member States, their recommendations may not necessarily include high quality and energy-efficient options [5].

Recognising the potential and impact of better renovation recommendations, the EPBD from 2018 already recognises building renovation passports (BRPs) as a complementary tool to the EPC. Also, the Renovation Wave strategy mentions BRPs to provide a customised plan for renovating a specific building in steps with the aim of significantly improving its energy performance, called 'staged deep renovation'. The 2024 EPBD recast introduces BRPs more extensively as *renovation passports* in Article 12. Renovation passports provide information on the number of renovation measures, details of individual measures and the best sequence of measures, and potential sources of funding to support and implement the measures. They may also provide comprehensive and detailed information on energy and cost savings.

What to expect from this roadmap

This roadmap report is designed as an implementation guide for EU renovation policies. It is based on the experiences of the iBRoad2EPC project under the Horizon 2020 research and innovation programme which has been running for three years in six EU countries (Bulgaria, Greece, Poland, Portugal, Romania and Spain) and a detailed analysis of the various EU directives, such as EPBD, EED and RED.

The iBRoad2EPC product is a renovation passport in the sense of Article 12 of the EPBD recast. It is designed to facilitate the connection between renovation passports and EPCs. Combining EPCs with certain elements of a renovation passport, particularly the step-by-step renovation guidance, iBRoad2EPC includes the benefits of both these instruments. The iBRoad2EPC methodology includes a modular approach to ensure good integration with the current national EPC schemes. This is set to become a powerful instrument suitable for adoption by national markets, triggering demand for energy efficiency in existing buildings and being used as a decision-support tool in real estate transactions.

In this roadmap, we first explain the importance of deep renovation in Europe and the role and development of information tools, such as EPCs and renovation passports, in achieving this. This leads to the second half of the report, where we briefly explain the concept and application of iBRoad2EPC and its broader role in promoting the long-term decarbonisation of the EU building stock (see Figure 1). For this, we provide a detailed analysis of how iBRoad2EPC can support and facilitate the implementation of each article of the EPBD and its requirements for the renovation passports in Annex VIII, as well as the Renovation Wave strategy, EED and RED. This analysis informs the concrete actions to maximise the uptake of iBRoad2EPC to achieve the EU's decarbonisation goals.

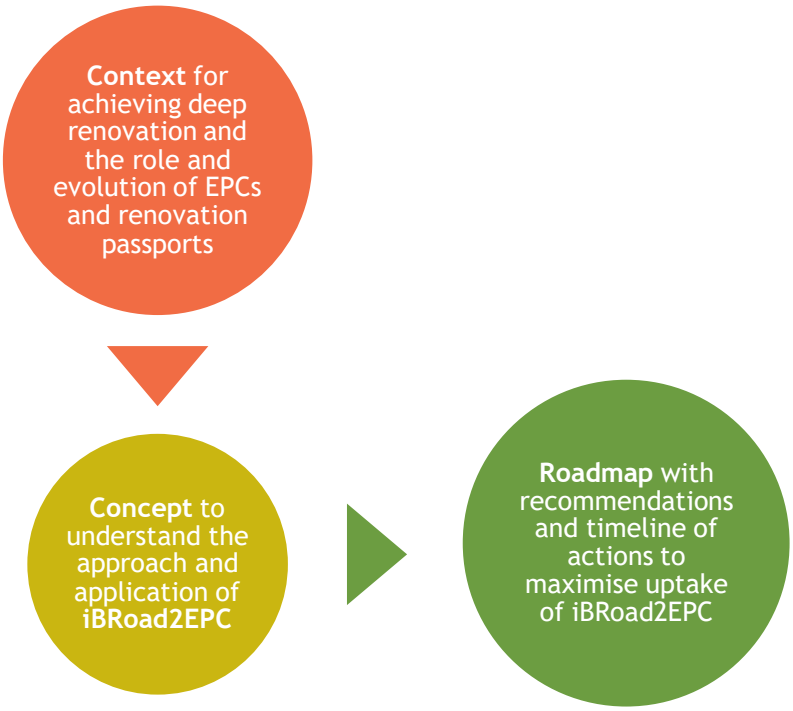


Figure 1: Report structure

Who is the roadmap intended for?

The roadmap is designed as an implementation guide for EU renovation policies. It targets EU policymakers responsible for developing guidance material for the transposition and implementation of the updated EU policy framework in Member States, particularly the recast EPBD. It also addresses national stakeholders such as policymakers and energy agencies developing and updating their EPC schemes and renovation passport frameworks. The iBRoad2EPC project has shown that a diverse range of stakeholders are involved at national level, including different ministries, energy agencies, energy auditor bodies, technical universities, financing bodies, training institutions and building owners [6].

How to use the roadmap

This roadmap proposes concrete measures to accelerate deep renovation in the EU by maximising the use of iBRoad2EPC. More specifically, it provides a step-by-step guide for how to roll out a renovation passport scheme at Member State level, taking the iBRoad2EPC approach and learning from the experiences of the six pilot countries. Based on the analysis of the role of EPCs and renovation passports in the Renovation Wave, EPBD recast, EED and RED, it provides recommendations for improving their implementation or amending the regulatory framework to promote deep renovation, and how to best use iBRoad2EPC for this purpose. Those searching for inspiration and concrete action ideas around implementing renovation passports can use this document and benefit from the three years of experience in operationalising the iBRoad2EPC renovation passport in different Member States with varying regulatory conditions.

CONTEXT – ACHIEVING DEEP RENOVATION IN THE EU

Evolution of energy performance certificates and renovation passports in the EPBD

EPCs are a key tool for assessing and presenting the energy performance of buildings. They have been recognised in the EU policy framework since the first EPBD in 2002 with an expanded scope in the subsequent recasts. Renovation passports are first mentioned in the EPBD 2010 (recast) in 2018 and introduced as a tailored roadmap for the deep renovation of a specific building in the 2024 EPBD recast. The following table shows the evolution of EPCs and renovation passports in the EU policy framework (EPBD).

2002

Directive (EU) 2002/91/EC

Energy performance certificates (EPCs) are first introduced as a tool to promote transparency and information regarding the energy performance of a building under Article 7 in the EPBD in 2002 (2002/91/EC) **[7]**.

EPCs empower prospective owners and tenants of the buildings to compare and assess the energy performance of the building and create market demand for energy efficiency. EPCs should include recommendations for the cost-effective improvement of the energy performance. Additionally, EPCs may include recommended and current indoor temperatures and, when appropriate, other relevant climatic factors.

Article 11 states that EPCs can be issued independently by qualified and/or accredited experts.

2010

Directive (EU) 2010/31/EU

2010 EPBD recast covers EPCs under Article 11 and mandates additional requirements [8]. In addition to recommendations, EPCs should include:

- measures carried out in connection with a major renovation of the building envelope or technical building system(s)
- measures for individual building elements independent of a major renovation of the building envelope or technical building system(s)
- an indication as to where the owner or tenant can receive more detailed information
- the steps to be taken to implement the recommendations.

EPCs may include:

- the annual energy consumption for non-residential buildings
- the percentage of energy from renewable sources in the total energy consumption
- an estimate for the range of payback periods or cost benefits over its economic lifecycle
- related information, such as energy audits, financial or other incentives, and financing possibilities.

Other articles relevant for EPCs:

- Article 12 covers the conditions for the issue of EPCs. It is now an obligation to issue an EPC at renting and sale point.
- Article 13 states how to display the EPC.
- Article 17 states that EPCs can be issued independently by qualified and/or accredited experts.
- Article 18 provides the requirements for independent (quality) control of EPCs
- Article 20 requires Member States to provide information on EPCs

2018

Directive (EU) 2018/844

Building renovation passports (BRPs) are mentioned for the first time in 2018 under Article 2a as an example of an optional scheme under the long-term renovation strategy, to stimulate cost-effective deep renovation of buildings, including staged deep renovation, and to support targeted cost-effective measures and renovation [9].

Under Article 19, the Commission 'shall evaluate' the Directive by 1 January 2026 at the latest, and assess the need for further improvement of EPCs. Article 19a required the Commission to conclude a feasibility study clarifying the possibilities and timeline to introduce an optional BRP that complements the EPC. This study was eventually published in May 2020 **[10]**.

EPC provisions under Articles 11, 12, 13, 17, 18 and 20 remain the same. Other relevant articles on EPCs include:

1. Under Article 8, Member States must ensure that any modifications to the technical building systems that alter the overall energy performance of the building are documented and provided to the building owner for the purpose of issuing EPCs.
2. According to Article 10, Member States can link financial measures for renovation to EPCs and use them as a tool for verification of energy performance improvement before and after renovation. It further encourages the use of EPC databases to gather measured or calculated energy consumption of the buildings

2024

Directive (EU) 2024/1275

The 2024 EPBD recast introduces significant and **stringent provisions for EPCs and introduces**, under Article 12, **a framework for *renovation passports* as an additional voluntary tool** to provide a clear roadmap for staged deep renovations [11].

Article 12 introduces renovation passports based on a common framework as given in Annex VIII which spells out requirements.

Article 19 covers EPCs. It sets out obligations such as complying with a new template (set out in Annex V) which requires EPCs to display information such as the lifecycle global warming potential (GWP) on their first page; developing a common visual identity; expanding the detail of recommendations; and ensuring the quality and reliability of EPCs.

Article 20 covers the issuing of an EPC, for example ensuring that digital EPCs are available under certain conditions.

Article 21 covers display of EPCs, for example non-residential buildings with an EPC need to display it prominently.

Article 22 covers databases for EPCs, to ensure coherence and consistency of information and better integration with other databases.

Article 27 covers the independent control system for EPCs, in line with Annex VI.

Towards deep renovation in the EU through iBRoad2EPC

Several EU-funded projects, known as the Next-Generation EPC cluster, aim to improve the quality, reliability and usability of EPC schemes and develop related concepts such as BRPs [12]. iBRoad2EPC is one such project, which has developed a model renovation passport that facilitates the connection between renovation passports and EPCs.

iBRoad2EPC aims to align existing EPCs with a renovation passport and prioritise the long-term goal of decarbonisation

- Incorporates renovation recommendations over a long-term horizon in a specific sequence to avoid lock-in effects
- Ensures that each measure implemented is part of a comprehensive renovation strategy
- Meets future regulatory requirements, e.g. mandatory minimum energy performance standards (MEPS), the phase-out of fossil fuels, mortgage portfolio standards and the EU taxonomy regulation
- Presents renovation recommendations in a way that is easily understood by the end user, taking into account their needs
- Makes the renovation passport affordable and accessible to more building owners for wide-scale implementation
- Introduces additional indicators, e.g., indoor environmental quality, smart readiness, etc. into current certification schemes
- Caters for the development of automatic interlinkages with other instruments, e.g., EPC or national databases for the energy performance of buildings, EPC calculation software, logbooks, cadastre, one-stop shops etc.

This report aims to show how the transposition and implementation of the EU policy framework, and in particular the 2024 EPBD recast, can be facilitated by the ready-to-use tools developed within iBRoad2EPC and the lessons learned from the project.

CONCEPT – UNDERSTANDING AND APPLYING IBROAD2EPC

iBRoad2EPC is a ready-to-use flexible, adaptable, modular and expandable model renovation passport. It is designed to be optionally integrated into existing EPC schemes.

Insights in this report stem from three years of project experience, testing and learning. In order to better understand how the iBRoad2EPC approach can be used to implement recent EU policies (e.g. EPBD) and how it can best be used to trigger deep renovation, it is essential to explain its characteristics and examine its readiness for integration into existing EPC schemes and frameworks. This chapter therefore focuses on the iBRoad2EPC concept and the back-end tool behind it, the iBRoad2EPC Assistant.

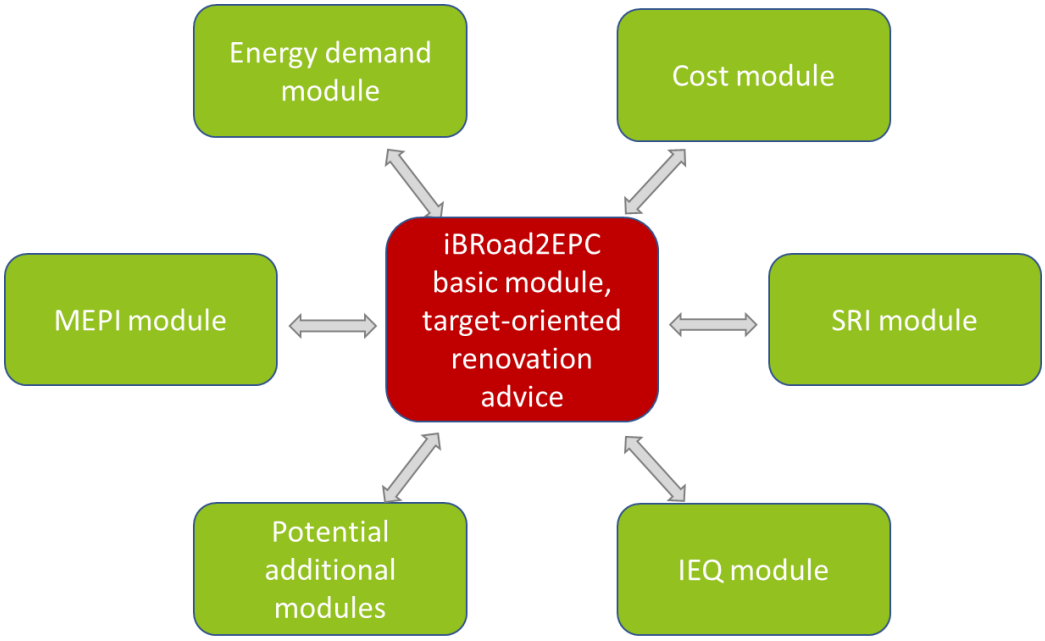


Figure 2: The modular structure of iBRoad2EPC makes it flexible and expandable

The iBRoad2EPC approach

The iBRoad2EPC project, funded by the EU's Horizon 2020 programme (2021-2024), aims to support the decarbonisation of the EU building stock by bridging the gap between EPCs and renovation passports. This integration improves EPCs' effectiveness in supporting staged energy renovations, offering a tailored, step-by-step renovation journey. The project has developed and tested adaptable, modular components to meet the diverse needs of EU Member States. By combining the strengths of EPCs and renovation passports into a single flexible tool, it enhances renovation advice and motivates building owners towards energy-efficient renovations. It consists of a basic module, which incorporates the staged renovation advice as an output that is essential for all users, and additional on-demand modules covering energy demand, cost, smart readiness (SRI), indoor environmental quality (IEQ), measured energy performance (MEPI) and other indicators/modules that can be added where needed (see Figure 2).

The iBRoad2EPC basic module aims to provide essential technical information for building owners, which includes:

- Sequencing improvement measures with notes to prevent lock-in effects.
- Ensuring each implemented measure aligns with a comprehensive renovation strategy.
- Complying with current and future regulatory requirements, such as MEPS and EU taxonomy regulations.
- Presenting recommendations in an easily understandable manner from the end-users' perspective.

For a more detailed overview of the characteristics of the other modules, see the report *"Extending the iBRoad Building Renovation Passport II".*

The iBRoad2EPC Assistant

The iBRoad2EPC Assistant is an online back-end tool that can be used by energy experts to create the iBRoad2EPC output, guided through data entry and editing processes. The tool produces standardised online, but printable, output documents for easier navigation and updates compared to paper formats. Customers receive their iBRoad2EPC as an additional page including a URL or QR code in their enhanced EPC. All data in the basic module of the iBRoad2EPC, including renovation measures, climate zones, energy classes, colour codes, lock-in avoidance information, etc., is country specific, i.e., specifically adapted to each pilot country. The Assistant currently supports single-family, multi-family and various types of public buildings, so certain aspects of the user interface change depending on the building type. The renovation measures (and related information) are thus specific for the chosen building type, country and climatic zone.

The iBRoad2EPC is facilitated by the iBRoad2EPC Assistant, an online tool designed to streamline several key objectives [13]:

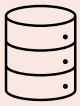
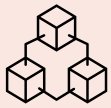
- Creating uniform iBRoad2EPC designs
- Generating online versions of the iBRoad2EPC
- Producing printable pages to supplement EPCs with iBRoad2EPC information
- Offering user-friendly guidance for energy auditors
- Simplifying the assignment of renovation measures
- Providing clear prefabricated content selection
- Allowing easy customisation of default texts
- Supporting easy expansion with additional modules.

The iBRoad2EPC Assistant is a standalone web application with user-friendly input features, including dropdown menus and prefabricated text fields. It comprises components such as an application programming interface (API), standard front-end, database and output structures, offering both basic and optional additional modules (see Table 1). The Assistant can be accessed online or via an API, allowing integration with third-party software, such as EPC software [13]. It can also use XML interfaces in some Member States to import basic EPC data, reducing input requirements. A sample output from the iBRoad2EPC can be found in Annex I. Further details on the iBRoad2EPC Assistant tool and the modules are available in the project deliverables:

- *iBRoad2EPC in depth*
- *Report on the adaptation to multifamily and public buildings*
- *Report on expanding indicators (IEQ, smartness, ...)*
- *API v2.0 (fine-tuned, based on the pilot case feedback), Logbook and Roadmap final versions*[1]

[1] To be made available on the project website shortly.

Table 1: Structure of iBRoad2EPC Assistant [13]

 **Standard front end**	The standard iBRoad2EPC front end has been developed as the default input interface for the Assistant tool, ensuring all necessary data to issue an iBRoad2EPC can be entered. While this front end may be replaced when iBRoad2EPC is integrated into individual software tools in implementing countries, such tools must incorporate fields for all required data. The Assistant tool includes pages for configuring basic settings, such as country information, accredited issuers and projects. The language of the Assistant can be adjusted to match implementing countries, with both the tool and output results translated into the national language. Currently, language options are English, Bulgarian, Greek, Romanian, Polish, Portuguese and Spanish, with access limited to administrators.
 **Databases**	The iBRoad2EPC includes data from various sources, including MEPS, renovation measures, national obligations and milestones from national long-term renovation strategies, etc. Each database is translated into the relevant language and populated with country-specific data. The texts, default values and graphics within the databases can be easily customised to suit implementing countries, eliminating the need for structural changes. The report on adaptation requirements for countries outlines the details of the structure, content and country-specific adaptations of these databases.
 **Output**	The iBRoad2EPC Assistant is used to generate the iBRoad2EPC output. The iBRoad2EPC can be delivered in two formats: • A digital (online) version • A printable page that can be appended to the EPC and directs to the online version. The printable page enables the distribution of a hard copy alongside a paper EPC, acting as an addendum to the EPC. It can also be publicly displayed in buildings where a paper EPC is required. The online iBRoad2EPC offers enhanced functionalities, including user-friendly guidance, links to external resources like authorities or funding schemes, and context-sensitive assistance. It also allows for gamification elements to increase recipient engagement and encourage active interaction with the iBRoad2EPC.
 **Modules**	The iBRoad2EPC basic module includes features to align existing EPCs with a decarbonisation roadmap, emphasising the long-term goal of decarbonisation outlined in the iBRoad2EPC vision statement. Additional modules can be integrated seamlessly, providing flexibility and independence. Additional modules already developed and tested as part of the iBRoad2EPC project include investment cost, energy demand, smart readiness, indoor environmental quality and measured energy performance. Other modules, such as whole-life carbon, life-cycle assessment or water efficiency, may be developed and incorporated in future, beyond the scope of the iBRoad2EPC project.
 **APIs**	The iBRoad2EPC Assistant serves as a back-end tool that compiles and transmits data for specific buildings upon request. It can integrate with various platforms or front ends, including existing tools in Member States like EPC software or EPC registers. iBRoad2EPC provides various options that allow for such automated interlinkages to be built, including client API, XML and excel integrations. A standardised front end is provided for data entry independently from external software. The Assistant employs a versatile API and databases to streamline data retrieval, reducing the need for time-consuming parameter calls. It optimises data transmission to maintain advice quality while enabling the receiving end to manage parameter extraction effectively. Communication occurs via a 'RESTful API', which efficiently retrieves information by breaking down requests into modular nodes. Domain models define data structures for aggregation, providing accessible resources in the back end for third-party communication.

iBRoad2EPC application to support national transposition of EU policies for renovation

The transposition and implementation in Member States of the recast EPBD, in particular, could be facilitated by the outcomes and practical action points of the iBRoad2EPC project. We conducted a detailed analysis of how iBRoad2EPC supports the implementation of the EPBD, EED and RED. The analysis focuses on relevant articles and provisions within these directives and provides recommendations for maximising the benefits of iBRoad2EPC. Specifically, it emphasises the relationship between these provisions and the EPCs, renovation passports and renovation processes. Additionally, the links and relevance to broader policy objectives, such as digitalisation (e.g., digital building logbooks), are discussed. **A detailed analysis can be found in Annex II of this EU roadmap. A summary is provided below to help understand the usefulness of iBRoad2EPC in implementing and furthering the objectives of these directives.**

The analysis shows that iBRoad2EPC complies with several provisions of Article 12 of the EPBD, on renovation passports. In particular, where Member States are interested in integrating EPCs and renovation passports, the iBRoad2EPC provides the conceptual framework, vision and practical tools to be positioned anywhere on the spectrum between EPCs and detailed stand-alone renovation passports. Moreover, it meets 11 out of 14 mandatory requirements and 7 out of 15 optional requirements for renovation passports set out in EPBD Annex VIII. Other requirements of the EPBD are either partially met by the current version of iBRoad2EPC or can be easily integrated due to the modular structure of iBRoad2EPC and its ability to easily connect with other tools and databases though XML, excel or API integration. This analysis highlights the value of the iBRoad2EPC as a model renovation passport for accelerating deep renovation and its ability to provide ready-to-use solutions for the transposition and/or implementation of renovation passports. In addition to EPBD Article 12, iBRoad2EPC can help Member States comply with or fulfil the objectives of various other articles.

Similarly, iBRoad2EPC enhances the ability of public authorities to meet the EED's targets for introducing building renovation passports for public buildings representing at least 3% of the total heated or cooled floor area, helping them to act as role models in improving the energy efficiency of buildings, fulfilling the objectives of Articles 5 and 6. iBRoad2EPC encourages the use and integration of renewable energy, and renewable energy sources can be included as an additional module.

The iBRoad2EPC is a valuable and affordable tool that provides actionable insights on energy efficiency measures, guidance on individual actions, and financial and legal frameworks to accelerate staged deep renovation. This will benefit building owners, public authorities, financial actors and professionals in the construction and energy sectors by facilitating informed decision-making. Especially as Member States enter the implementation phase of the EPBD, iBRoad2EPC can guide the design of effective national renovation passport schemes to help meet decarbonisation targets.

ROADMAP –MAXIMISING THE UPTAKE OF IBROAD2EPC TO ACCELERATE DEEP RENOVATION IN MEMBER STATES

To set the EU on course to implement the Renovation Wave and minimise the building stock's contribution to escalating climate impacts, Member States must revise and strengthen their EPC schemes and develop a clear framework for renovation passports. Here, we present a roadmap (see Figure 3) with clear action suggestions, drawn from learnings of the iBRoad2EPC project, to enable stakeholders to use the iBRoad2EPC tool to support this process. This will support Member States to implement EU policy, particularly the recast EPBD, and accelerate and facilitate the enormous task of renovating and decarbonising the building stock.

Roadmap for the implementation of the iBRoad2EPC renovation passport as part of the EU policy framework, and particularly the EPBD, to accelerate deep renovation in the EU

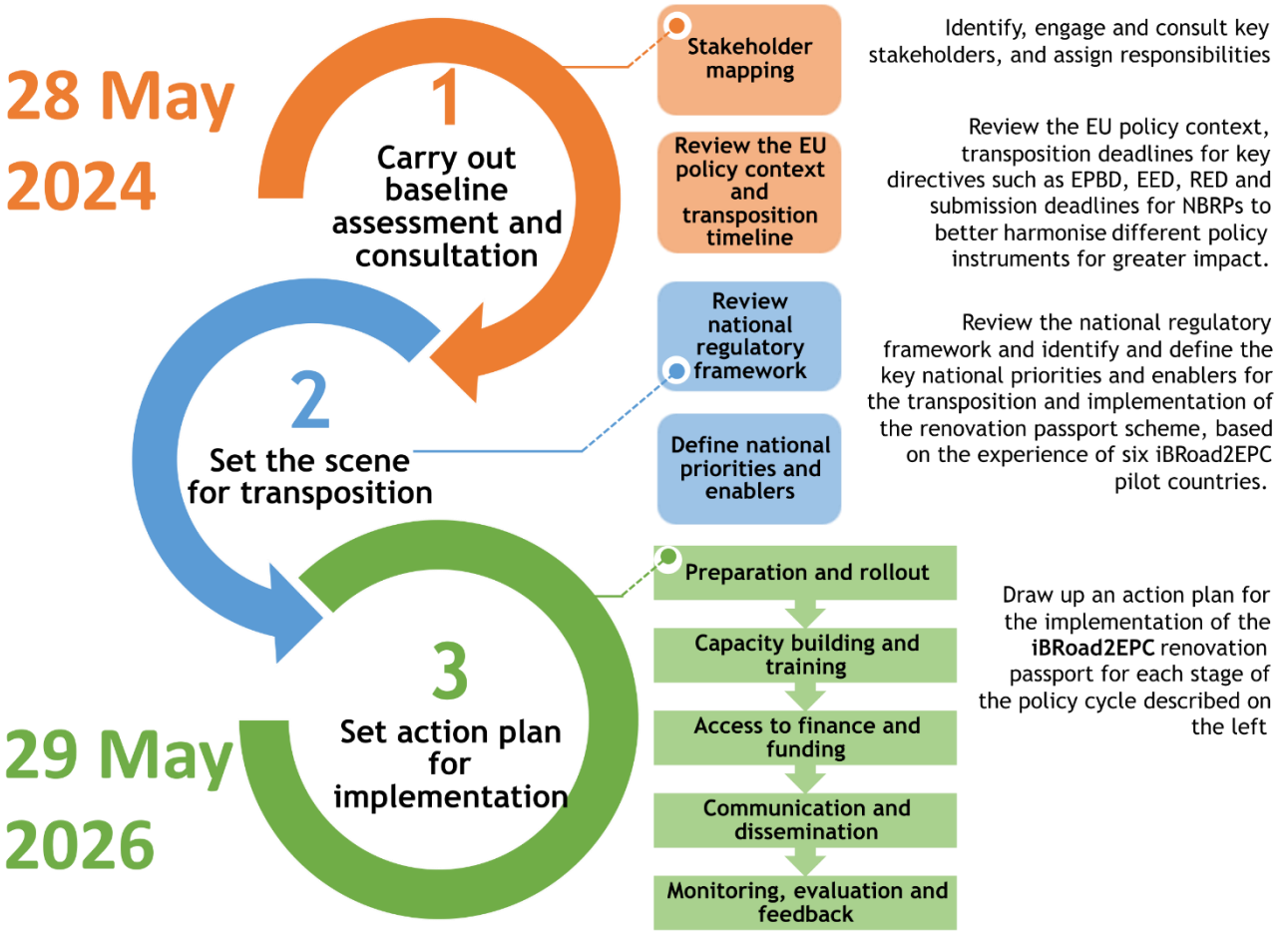


Figure 3: Roadmap to implement iBRoad2EPC to accelerate deep renovation in the EU

Step 1: Carry out baseline assessment and consultation

Stakeholder mapping

The iBRoad2EPC project has shown that stakeholders involved in transposition and implementation at national level are diverse and may include different ministries, energy agencies, energy auditor bodies, technical universities, training institutions, financing bodies and building owners [6]. Each Member State has a different existing structure for the development of energy and building policies and EPC schemes. This will influence the network of actors needed to comply with the EPBD guidelines on EPC and renovation passport schemes. Member States need to map their stakeholders, identify their relative importance,

influence and level of expertise, and engage them at the different stages of transposition and implementation of the EU directives and other related policies.

iBRoad2EPC can inform this process as described in detail in D4.1 *"Initial national guides - iBRoad2EPC and national energy performance certification schemes"*. Final national guides that incorporate experiences from pilot countries will be published shortly on the project website. As a first step, national advisory committees (NACs) were established, consisting of key actors/stakeholders involved in development of the national frameworks for EPCs and renovation passports and the transposition phase. NACs have examined how the iBRoad2EPC could align with the existing national policies or tools related to EPCs and renovation passports, exploring potential synergies. For the six pilot countries, NACs were set up to identify needs, opportunities and challenges for the implementation of iBRoad2EPC. The NAC also served to identify the challenges, barriers and drivers (legal, social, financial) of the current national EPC framework to develop a country-specific vision – for example, whether to integrate the renovation passport with the existing EPC scheme or develop it independently. In addition, NACs reviewed and validated the proposed iBRoad2EPC layout, format, graphics and features. They can also play a crucial role in carrying out other activities outlined in steps 1 and 2 of the roadmap. In addition to the NACs, a parallel stakeholder mapping exercise took place to identify all the stakeholders who would be in carrying out various activities in the implementation phase.

Review the EU policy context and transposition timeline

EU policy provides Member States with a framework to reduce emissions from the built environment and improve people's quality of life. The completion of the Fit for 55 package, the transposition and implementation of the EPBD, EED and RED, and the submission of national energy and climate plans (NECPs) and national building renovation plans (NBRPs) are an opportunity to adapt national regulatory frameworks and to better harmonise different policy instruments for greater impact for people and planet.

Figure 4 illustrates the timeline for the transposition of the directives and the submission of NECPs and NBRPs. These policies are listed for their particular relevance to the iBRoad2EPC project, although other policies may also be relevant. This harmonisation necessitates not only a high level of ambition and a careful reassessment of national contexts, but also creativity in order to integrate all of these new provisions (e.g. MEPS or renovation passports) into existing regulations and implementation structures. The uptake of iBRoad2EPC can support Member States in this process, and facilitate and accelerate deep renovation.

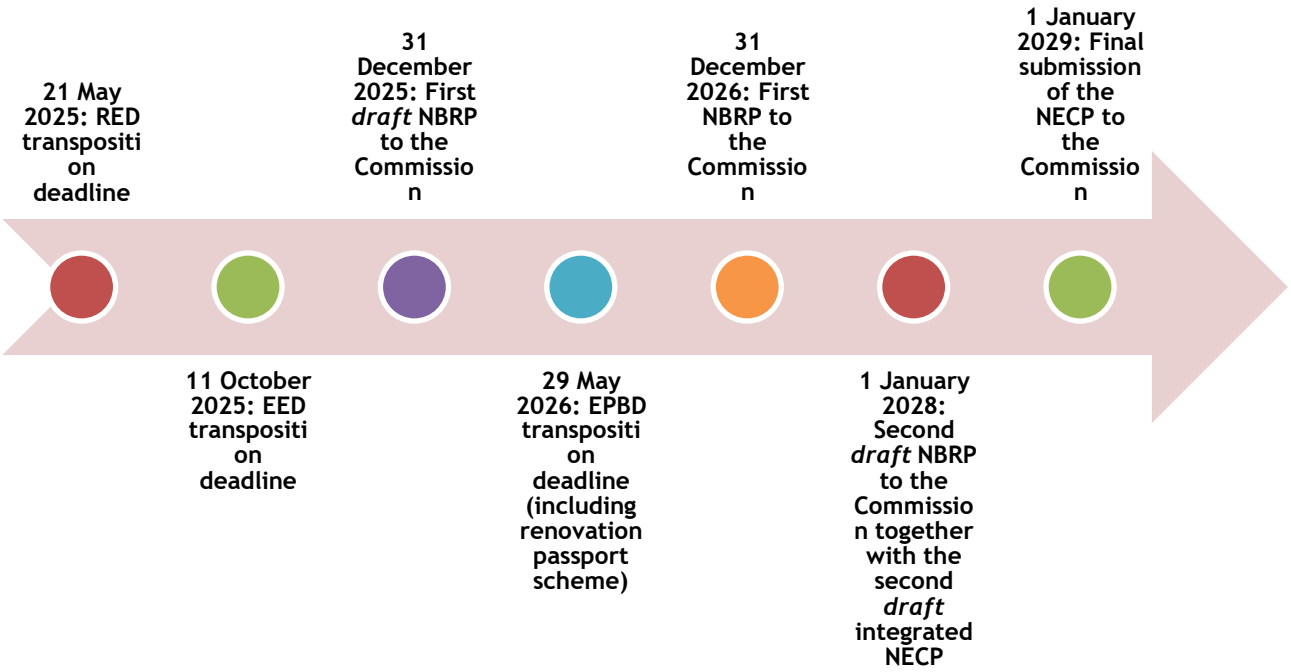


Figure 4: Timeline for transposition of the EED, RED and EPBD

Step 2: Set the scene for transposition

iBRoad2EPC is a flexible renovation passport that Member States can use as a standalone tool or integrate into their existing EPC system. It offers a shortcut to the development of a renovation passport, but Member States need to identify and evaluate the enablers and priorities for action to roll out iBRoad2EPC at national level. The experiences from the six pilot countries can support this process.

Review national regulatory framework

Each Member State will need to identify the enablers in its own regulatory framework, including priorities that follow each other in a meaningful timeline. Taking into account the implementation timeline above and the table below, Member States should carefully assess the current policy and regulatory framework. The aim is to identify existing policies to which new concepts such as the renovation passport could be attached. In particular, Member States should pay attention to their NBRPs, ensuring that the impact on renovation rates, the costs of a more elaborate EPC or an additional passport, training for energy auditors and public authorities and other necessary measures are considered in a comprehensive and coherent way. Financial incentives such as those envisaged in the NBRPs should be revised or designed to integrate and use the impact of iBRoad2EPC to improve their effectiveness.

Define national priorities and enablers

Enablers and priorities from the six iBRoad2EPC partner countries were discussed in the report, *"Initial national guides - iBRoad2EPC and national energy performance certification schemes"*. Table 2 below offers a summary of enablers that emerged and a set of questions that Member States should consider.

Table 2: Priorities and enablers for national roll-out of iBRoad2EPC

Description	Questions
Awareness and information	
National campaigns to promote the benefits of deep renovation and the importance of energy efficiency are crucial. These need to be aimed at increasing public and stakeholder trust in renovation processes and outcomes as well as certification and information tools, mainly EPCs and iBRoad2EPC. This should include clear communication about the value of certification and information schemes. For this, the value of renovation beyond energy efficiency, including health, comfort and smart building features, needs to be emphasised.	What awareness campaigns exist? What information about an iBRoad2EPC renovation passport could be attached? How can information activities be integrated into the establishment of one-stop shops?
Market introduction and training	
There is a need to develop clear strategies for iBRoad2EPC's market introduction and adoption, ensuring capacity for both large-scale certification and renovations. This includes delivering training to stakeholders such as auditors, construction professionals and public authorities, as is being piloted within the iBRoad2EPC project.	What is the current infrastructure to train energy auditors and how can the curricula be extended to incorporate iBRoad2EPC renovation passports? What best practices for training public authorities could be applied to increasing capacity for iBRoad2EPC market introduction?
Issue of EPCs and iBRoad2EPC	
On-site visits are needed to issue both EPCs and iBRoad2EPC; this should be a minimum requirement to ensure quality of input data on the building's condition, materials and systems. This in turn will allow for more tailored renovation advice that avoids lock-in effects. Most importantly, it strengthens communication, awareness raising, exchange and consultation with building users, increasing public trust and reliability.	Can mandatory on-site visits be realised within the current policy framework? What resources and capacities are needed to ensure energy audits happen on-site?
Integration of iBRoad2EPC in EPCs	
iBRoad2EPC envisions an integration with EPCs. There is a strategic market placement for iBRoad2EPC between the EPC and the renovation passport for every Member State based on their existing and envisaged policy framework: iBRoad2EPC can be a mandatory part of the EPC, a voluntary 'light' renovation passport to complement the EPC, a standalone renovation passport, or anything in between.	Does the existing EPC infrastructure allow for an attachment of improved recommendations (hence an iBRoad2EPC)? What form of renovation passport makes most sense? What additional stakeholders need to be involved?
Linkages with EPC databases	
New tools need to be integrated with existing national databases and EPC frameworks to avoid duplication and leverage existing infrastructure. The iBRoad2EPC Assistant draws from a variety of data sources, such as EPC outputs from EPC calculation software as XML or excel files, and is designed to easily connect to existing databases and tools through APIs. It draws on existing national data, such as the list of renovation measures and their key values, LTRSs and NBRPs.	What is the current digital infrastructure (e.g. is there an EPC database)? How can the iBRoad2EPC Assistant be integrated into the existing digital ecosystem?
Tools/platform	
As renovation recommendations are key to the renovation passport, Member States need a tool to enable this. The iBRoad2EPC Assistant is an intuitive, accessible digital platform that provides trustworthy information on deep renovation, embedded in the EPC framework. The iBRoad2EPC Assistant can also be used independently of other tools or software.	What software/platform is currently used to create EPCs? How do users rate it? Can the iBRoad2EPC Assistant be easily connected with the EPC software given its market readiness and usefulness, especially for countries with an EPC database?

Financial incentives	
There is a need to identify and simplify access to financial support and incentive schemes for carrying out deep renovations. This includes securing funds to subsidise the costs of the iBRoad2EPC itself and, most importantly, the cost of implementing its recommendations, especially for those most vulnerable.	In which financial incentive schemes can iBRoad2EPC improve the reliability and quality of intervention measures? What are the sources of funding to cover the costs of the iBRoad2EPC?

Step 3: Set action plan for implementation

From Step 2, we identified several priorities and enablers that Member States need to consider for the national implementation of iBRoad2EPC. Encouragingly, most of these priorities and enablers have found a place in the 2024 EPBD recast, reinforcing the importance of the project findings. In this step, we set out an action plan to show what Member States need to do to implement the various EU directives, in particular the EPBD. The iBRoad2EPC can support them to do this at each stage: preparation and rollout; capacity building and training; access to finance and funding; communication and dissemination; and monitoring, evaluation and feedback (as shown in Figure 4). Annex II of the present EU roadmap provides detailed information on how iBRoad2EPC is relevant to the different articles of the EPBD, EED and RED, in particular a set of recommendations to maximise the uptake and benefits of iBRoad2EPC and a description of how to use it with suggested actions.

Preparation and rollout

By 29 May 2026, Member States must implement an energy performance passport scheme in accordance with the common framework set out in Annex VIII of the EPBD. Renovation passports can be drawn up and issued together with the EPC, in which case the recommendations can be replaced by the passport. Member States should provide a tool for the preparation and updating of the EPC and, as an option, develop a draft simplified EPC for homeowners to quickly prepare energy performance improvement plans. Member States should integrate the renovation passport with other energy-related databases, such as the national building energy performance database and digital building logbooks.

Recommendations

Member States should assess the ease of integrating renovation passports into existing EPC schemes, EPC databases and other energy-related databases.

Member States that have national or mandatory EPC software should integrate the requirements of renovation passports with the EPC software.

In Member States where private software can be used for generating EPCs, Member States should require private software vendors to integrate the requirements of renovation passports with their EPC software.

How to best use iBRoad2EPC to achieve this

iBRoad2EPC's robust and flexible methodology enables renovation passports to be introduced in different ways. There is a strategic market placement for iBRoad2EPC between the EPC and the renovation passport for every Member State based on their existing and envisaged policy framework:

- **Mandatory** as part of the EPC, replacing the renovation recommendations in the EPC if issued together
- **Voluntary** as a 'light' renovation passport alongside the EPC scheme
- A **detailed renovation passport** (voluntary/mandatory)
- Any other variation of the above

The iBRoad2EPC basic and optional modules can fulfil most of the requirements listed in EPBD Annex VIII 1, including a graphical representation of the steps in staged deep renovation; information on MEPS and fossil fuel phase-out; description of the renovation measures for the step; estimation of energy savings, reduction of greenhouse gas emissions and improvement in energy class at each step.

iBRoad2EPC can also fulfil most of the requirements listed in EPBD Annex VIII 2, including a detailed description of the technologies, techniques and materials to be used, and their advantages, disadvantages and costs.

The iBRoad2EPC Assistant is designed to integrate with most existing tools, such as EPC software and databases. The concept, principles and approach behind iBRoad2EPC can therefore be used, among others, to:

- Provide a simple renovation passport tool for homeowners
- Link renovation passport tools to other EPC tools
- Link renovation passport tools to other databases such as digital building logbooks and national building energy performance databases.

Member States can use the iBRoad2EPC Assistant's capabilities to external databases via APIs.

Capacity building and training

Member States should put in place sufficient measures and resources to train stakeholders that are responsible for carrying out the renovation passport scheme, including public authorities, energy (or EPC) assessors and auditors, and construction professionals.

Recommendations

National and regional energy agencies, as well as third-party associations of EPC assessors or energy auditors and training institutions, should conduct capacity-building activities to educate assessors and auditors on the renovation passports, their development, and issuance.

They should also conduct capacity building for construction professionals to help them translate, understand and implement the recommendations in renovation passports.

National and regional energy agencies, or third-party agencies and training institutions, should provide capacity building for public authorities (national, regional or local) to develop effective energy management policies and to use renovation passports to renovate their own buildings to achieve the targets outlined in the EED.

How to best use iBRoad2EPC to achieve this

The iBRoad2EPC project has prepared various training toolkits and support packages for different audiences:

- Training toolkit **and materials for EPC assessors and energy experts**
- Training module for construction professionals (including presentation with notes, exercises, test questions and references)
- **Advisory package for public authorities** (including presentation with notes and references).

Access to finance and funding

Member States should ensure renovation passports are affordable and offer subsidies to vulnerable households seeking to renovate their homes. Financial incentives for energy performance improvements and reduced greenhouse gas emissions in building renovations should be tied to the specific energy savings and improvements targeted or achieved.

Recommendations

Member States should encourage banks and financial institutions to use the renovation passport as a tool to improve access to energy efficiency financing and to link performance improvements to the level of financing.

For example, financing for energy efficiency improvements could be linked to specific criteria, such as improvements in energy consumption, energy class and greenhouse gas emissions, as set out in the

renovation passports. The integration of EPCs and renovation passports with incentive programmes could improve their effectiveness by (1) prescribing clearer guidelines for public administrations on what renovation interventions should be incentivised with priority; (2) tying the exact amount of funds to specific and measurable energy improvements; and (3) providing building owners with clear, reliable and actionable information, making renovations more accessible

How to best use iBRoad2EPC to achieve this

The iBRoad2EPC renovation passport is a valuable and affordable tool that provides actionable insights on energy efficiency measures, guidance on individual actions, and financial and legal frameworks to accelerate staged deep renovation. This will benefit building owners, public authorities, financial actors and professionals in the construction and energy sectors by facilitating informed decision-making. Especially as Member States enter the implementation phase of the EPBD, iBRoad2EPC can guide the design of effective national renovation passport schemes to support the achievement of decarbonisation targets. Member States should consider subsidising iBRoad2EPC under certain conditions and particularly for vulnerable households.

The iBRoad2EPC report "*How to best use financial and non-financial incentives for renovation in implementing markets*" lists various examples of incentives linked with EPCs or improvements in energy performance and offers ways to best use iBRoad2EPC in incentive schemes for renovation.

Communication and dissemination

Members States need to organise information campaigns around EPCs and renovation passports to promote their understanding, visibility and use among various stakeholders, in particular building owners and building managers. Carefully thought-out and targeted information campaigns could also increase public trust in renovation passports and make them a more effective tool to facilitate staged deep renovation.

Recommendations

National and regional energy agencies, utility companies and municipalities should organise renovation campaigns to increase awareness among building owners about the importance, benefits and support systems available for renovation. EPCs and renovation passports should be at the core of these campaigns.

Member States should make use of renovation passports and make their use mandatory in at least some cases – for example, when using public money. Information campaigns should specifically target these cases.

How to best use iBRoad2EPC to achieve this

iBRoad2EPC outputs can support information campaigns. They provide a detailed and simple overview and description of the renovation steps, as well as the corresponding improvements in the energy class. The outputs also provide estimates of costs and payback times, as well as opportunities for financing. To make individual improvements in renovation passports possible, they can be linked with accredited tradespeople and financing institutions. This creates a conducive ecosystem to increase public trust in renovations.

Monitoring, evaluation and feedback

Member States should strengthen the existing independent control systems and quality assurance mechanisms around EPCs and renovation passports in order to increase public confidence in them and use them as a basis for decision-making.

Recommendations

National policy makers should establish key performance indicators to monitor the role and performance of renovation passports in accelerating staged deep renovation.

National and regional authorities should have mechanisms in place to monitor the progress of renovation passports and the rate and depth of renovation.

How to best use iBRoad2EPC to achieve this

iBRoad2EPC can improve the quality and consistency of recommendations in EPCs or renovation passports. The recommendations and building targets in iBRoad2EPC are derived from the LTRS (referred to as the national building renovation plan in the EPBD recast) and are drawn from a central database of recommendations. This minimises the chances of EPC assessors providing suboptimal recommendations.

iBRoad2EPC has the ability to link to external databases (e.g. database of energy performance of buildings, EPC database) through APIs to help monitor the implementation of various recommendations and their timelines. In addition, iBRoad2EPC can generate statistics that can e.g. support in the identification of proposed measures and energy class improvements achieved. These features of iBRoad2EPC can in turn facilitate the monitoring, evaluation and feedback mechanisms of EPC and renovation passport schemes.

Outlook

The EU policy framework has evolved significantly since the start of the iBRoad2EPC project in 2021. Given the uncertainty of the regulatory future of EPCs and renovation passports at that time, iBRoad2EPC was designed with a modular approach and flexibility to be used with any existing EPC scheme or country-specific vision and context. This flexibility is now reflected in the new provisions that allow Member States to decide the extent to which renovation passports and EPC schemes should be linked. As such, the results of the iBRoad2EPC project are highly relevant and provide Member States with a shortcut for their renovation passport design and EPC revision process. This is evident from the detailed analysis in Annex II of this EU policy roadmap, which shows the iBRoad2EPC solution for each relevant article of the recast EPBD.

Stakeholders involved in supporting and guiding EU countries can also benefit from the various findings and proposed actions. In particular, Steps 2 and 3 of the policy roadmap raise awareness of possible pathways for transposition and implementation and the conditions for their success.

For questions and remarks, please contact the iBRoad2EPC consortium: contact@ibroad2epc.eu

References

[1] European Commission, “A Renovation Wave for Europe - greening our buildings, creating jobs, improving lives,” Brussels, 2020.

[2] BPIE (Buildings Performance Institute Europe), “On the way to a climate-neutral Europe,” 2030, [Online]. Available: https://www.bpie.eu/wp-content/uploads/2020/12/On-the-way-to-a-climate-neutral-Europe-_Final.pdf

[3] S. Gokarakonda, M. Venjakob and S. Thomas, “D2.1 Report on local EPC situation and cross-country comparison matrix QualDeEPC H2020 project,” 2020. [Online]. Available: www.qualdeepc.eu

[4] I. E. Maia, L. Kranzl, E. Özer, I. Imamovic, J. Volt and V. Dorizas, “EPCs – Energy Performance Certificates & LTRSs – Long-Term Renovation Strategies,” 2022. [Online]. Available: https://ibroad2epc.eu/portfolio-items/epcs-energy-performance-certi%ef%ac%81cates-ltrss-long-term-renovation-strategies

[5] R. Fragoso and C. S. Monteiro, “(CT5) Certification and Training Status in 2022,” 2023. [Online]. Available: https://epbd-ca.eu/wp-content/uploads/2023/11/CT5-Certification-and-Training-Status-in-2022-with-annex.pdf

[6] E. Touloupaki and A. Corovessi, “Initial national guides - iBRoad2EPC and national energy performance certification schemes of roll-out countries,” 2023.

[7] European Commission, *Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002 on the energy performance of buildings*, 2002.

[8] European Commission, *Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings (recast)*, 2010.

[9] European Commission, *Consolidated text: Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings (recast)*, 2018.

[10] BPIE and INIVE, “Technical study on the possible introduction of optional building renovation passports,” Publications Office of the European Union, Brussels, 2020. doi: 10.2833/760324.

[11] European Commission, *Directive (EU) 2024/1275 of the European Parliament and of the Council of 24 April 2024 on the Energy Performance of Buildings (recast)*, 2024.

[12] European Energy Innovation, “Next Generation Energy Performance Certificates cluster.” [Online]. Available: https://europeanenergyinnovation.eu/Latest-Research/Autumn-2022/Next-Generation-Energy-Performance-Certificates-cluster

[13] P. Mellwig, J. Lawrenz and S. Walter, “iBRoad2EPC in depth,” 2023. [Online]. Available: https://ibroad2epc.eu/portfolio-items/ibroad2epc-in-depth

ANNEX I. SAMPLE OUTPUT FROM IBROAD2EPC

The screenshot below shows what iBRoad2EPC looks like. It indicates time steps and what needs to be done when. These time indications are synchronised with the national LTRS or, in future, NBRP and thus national targets. Which parts of the building the suggested measures apply to is highlighted in green. This iBRoad2EPC is currently attached as QR code in the issued EPC.

iBRoad2EPC: overview page

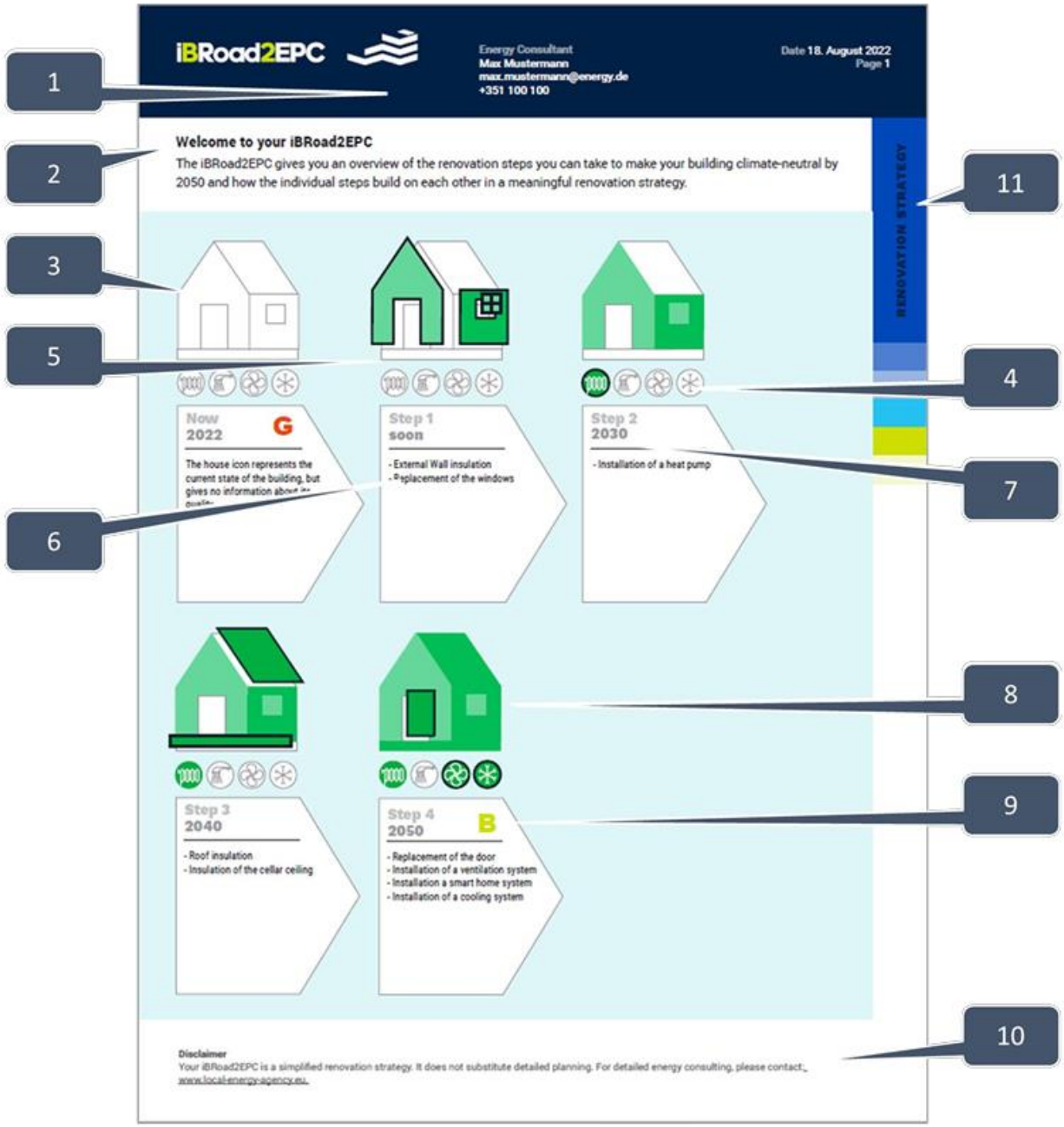


Figure 5: iBRoad2EPC overview page

1. Header with the contact details of the issuer.
2. Welcome text and brief introduction to iBRoad2EPC.
3. Each house symbol represents one renovation step, from the current building state to the target one.
4. Icons represent the technical building equipment, such as heating, cooling, domestic hot water and ventilation systems.
5. Building components or equipment that are to be renovated are highlighted in the respective renovation step.
6. The recommended renovation measures are briefly described. One renovation step can comprise several renovation measures.
7. The year when the renovation step should be implemented is a static preset based on each country's intermediate targets.
8. All completed measures remain green, so that the house becomes greener and greener over time.
9. The target efficiency is shown in the last step.
10. Footer with disclaimer and further information.
11. Tabs to facilitate navigating through the document.

iBRoad2EPC: detail page

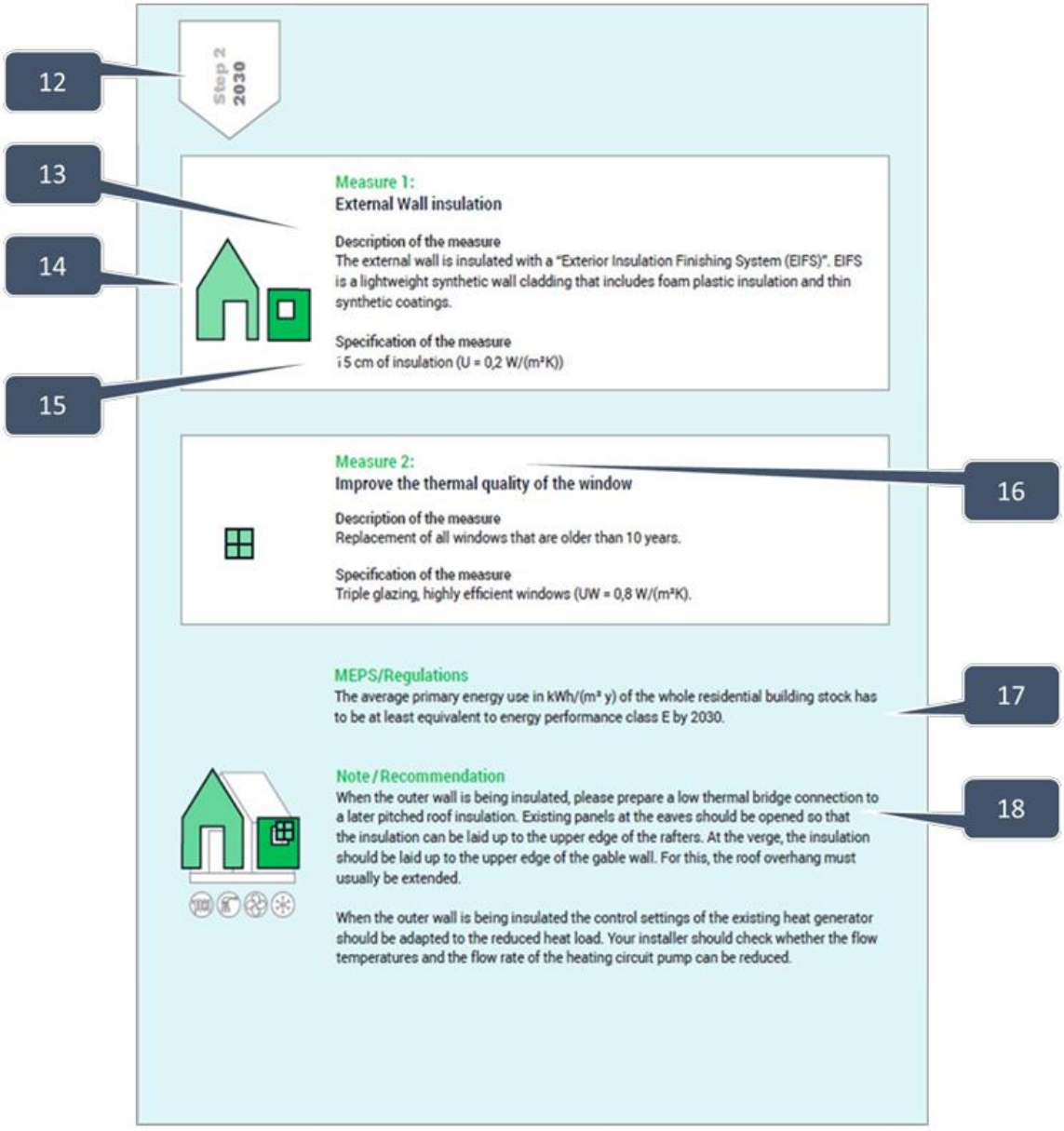


Figure 6: iBRoad2EPC detail page

12. Number and foreseen year of the renovation step.

13. Brief description of the measure.

14. Symbol or icon of the measure repeated from the overview page.

15. Specification of the measure, e.g. insulation thickness or u-value.

16. One renovation step can comprise several renovation measures that will all be displayed in the detail page.

17. Reference to future obligations that are already foreseeable, e.g. MEPS or fossil fuel bans.

18. Recommendation on how to prepare to connect the components to future renovation measures in staged renovations.

iBRoad2EPC: integration of modules

The structure of the iBRoad2EPC enables integration of various modules (see Figure 2 for iBRoad2EPCs modular structure). The following figure (Figure 7) shows the outputs of the energy demand module (e.g., final energy demand, greenhouse gas emissions and energy cots) integrated into the iBRoad2EPC output.

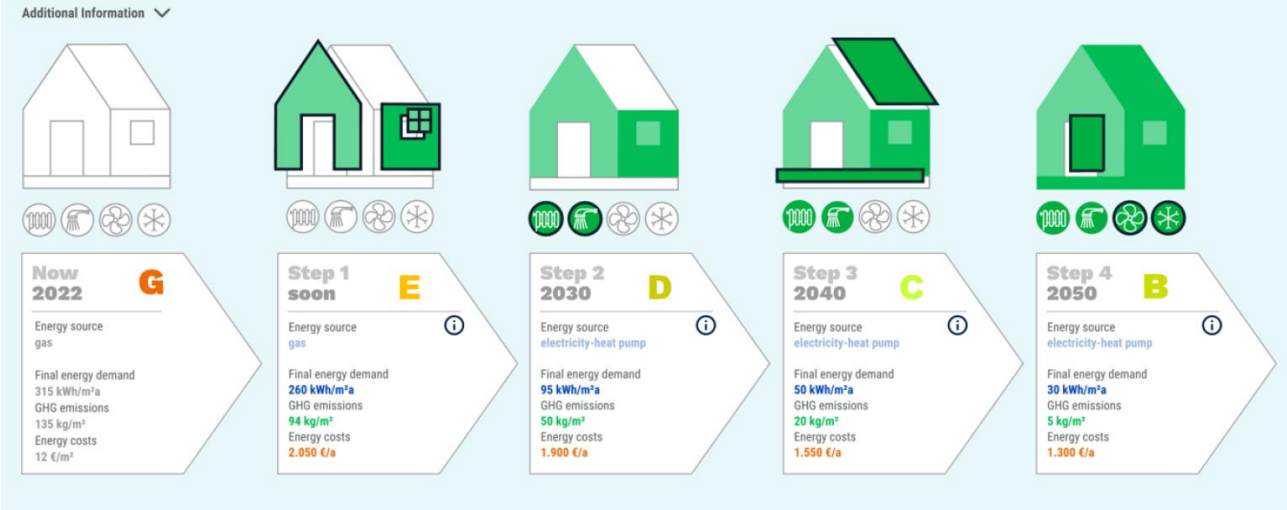


Figure 7: iBRoad2EPC modular structure showing outputs from energy demand module

iBRoad2EPC: output document format

The iBRoad2EPC output is available as an online document, printable upon demand as a PDF. The online version offers several advantages for building owners as it can dynamically display information, be easily updated and be made available on all regular devices.

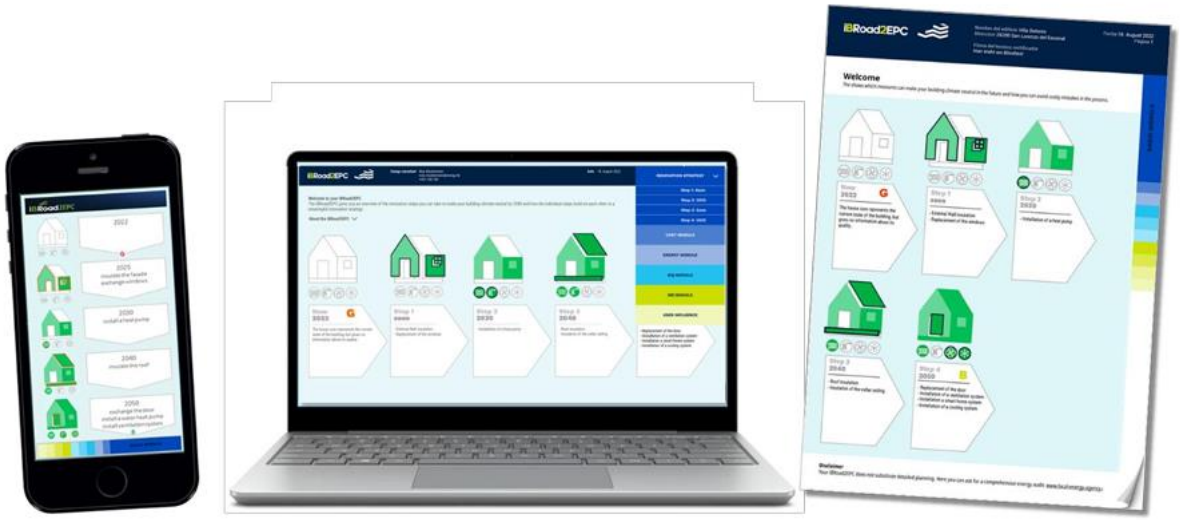


Figure 8: Multiple formats of iBRoad2EPC

ANNEX II – IBROAD2EPC ALIGNMENT WITH EU POLICY

Renovation Wave strategy

The Renovation Wave aims to accelerate the renovation of buildings across the EU. It aims to improve the energy efficiency of existing buildings, reduce greenhouse gas emissions and create jobs in the construction sector. The strategy involves mobilising public and private investment, promoting innovative financing mechanisms and providing technical assistance to support renovation projects. Table 3 outlines how iBRoad2EPC aligns with the objectives of the Renovation Wave strategy.

Table 3: Summary of how iBRoad2EPC aligns with the Renovation Wave strategy

Focus area	Summary of the relevant text	iBRoad2EPC approach
Twin transition; digital building logbooks	**Paragraph 3.1** The Commission plans to launch digital building logbooks, which will merge building-related data from forthcoming renovation passports, smart readiness indicator, Level(s) and EPCs. This integration guarantees data compatibility and cohesion throughout the renovation process.	iBRoad2EPC is by design linked to the iBRoad logbook. The iBRoad2EPC report "*Extending the iBRoad Building Renovation Passport II*" describes the concept of the iBRoad logbook, its data template, functions and benefits, data governance and ownership, and how the link to iBRoad2EPC should be realised. iBRoad2EPC also discusses what needs to be considered and issues to be resolved when linking the logbook to iBRoad2EPC. In addition, linking iBRoad2EPC to any future digital building logbook proposed by the EC is considered possible and could be investigated accordingly.
Nearly zero-energy buildings; EU Taxonomy; deep renovation	**Paragraph 3.2** The Commission intends to use EPCs and nearly zero-energy building standards as the basis for crafting the technical screening criteria for the buildings sector within the EU Taxonomy. Additionally, it is introducing a standard for 'deep renovation' to connect private financing with transparent, measurable and truly environmentally friendly investments.	The output of iBRoad2EPC could be a valuable resource for attracting private sector funding by providing a clear, transparent and measurable roadmap of the building's potential to become a near-zero energy building.
Energy poverty and worst-performing buildings	**Paragraph 4.1** Member States should identify households in energy poverty through their NECPs and LTRSs. Concurrently, the Commission provides a recommendation on energy poverty to help Member States develop effective strategies while also assisting in creating tailored financial options for low-income families and improving access to essential services, energy audits and EPCs.	iBRoad2EPC helps policymakers design different support schemes for different social groups (e.g. policies addressing energy poverty). It ensures that these incentive schemes are designed to be accessible, efficient and attractive to people from low-income households.

Energy Performance of Buildings Directive

The EPBD acknowledges that although one-step deep renovation provides cost-efficiency, reduces emissions and minimises disruption, renovation passports offer a planned approach to staged renovations, allowing owners and investors to plan interventions effectively over time. It introduces a common EU framework for renovation passports as a voluntary tool and provides the requirements for their establishment in Annex VIII. Renovation passports can facilitate informed decision-making and reduce the burden on building owners to implement all renovation measures at the same time. The EPBD further recognises the potential synergies between renovation passports and EPCs and encourages their joint preparation and issuance. For example, on-site visits are mandatory for the issuance of both EPCs and renovation passports. Similarly, when jointly issued, renovation passports should replace the recommendations in the EPCs. EPCs and renovation passports, along with additional assistance instruments such as one-stop shops, facilitate renovation and

access to finance, overcoming barriers. A few important definitions from the 2024 EPBD recast that are relevant to the iBRoad2EPC project are described below in Table 4.

Table 4: iBRoad2EPC relevant definitions from the EPBD

Deep renovation	**"means a renovation in line with the energy efficiency first principle and which focuses on essential building elements, and which transforms a building or building unit (Article 2(20)):** 1. **before 1 January 2030, into a nearly zero-energy building;** 2. **as of 1 January 2030, into a zero-emission building"**
Staged deep renovation	"means a deep renovation carried out in a maximum number of steps, following the steps set out in a renovation passport in accordance with Article 10" (Article 2(21))
Energy performance certificate	"means 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, calculated according to a methodology adopted in accordance with Article 4" (Article 2(30))
Renovation passport	"is a tailored roadmap for the deep renovation of a specific building in a maximum number of steps that will significantly improve its energy performance" (Article 2(19))

This section explores how iBRoad2EPC supports and enhances the implementation of the 2024 EPBD recast to accelerate deep renovation. First, we analyse Article 12 on renovation passports (see Table 5) and the requirements for renovation passports according to EPBD Annex VIII (see

Table 6), which is the focus of iBRoad2EPC. We then analyse all other relevant articles of the EPBD (see Table 7).

Article 12 Renovation passports

Table 5: Summary of how iBRoad2EPC supports the implementation Article 12 on renovation passports

Para N°	EPBD text or summary	Solutions offered by iBRoad2EPC
	Article 12: Renovation passports	
12(1)	"By 29 May 2026, Member States shall introduce a scheme for renovation passports based on the common framework set out in Annex VIII."	iBRoad2EPC presents a model renovation passport that is flexible and adaptable. iBRoad2EPC's basic and optional modules can fulfil most of the requirements listed in Annex VIII, including: - A graphical representation of the steps in staged deep renovation - Information on MEPS, fossil fuel phase-out - Description of the renovation measures for the step - Estimation of energy savings, reduction of greenhouse gas emissions and improvement in energy class at each step. Please refer to Table 6 for details of how iBRoad2EPC can help to meet these requirements.
12(2)	"Renovation passport scheme shall be of voluntary use by owners of buildings and building units, unless the Member State decides to make it mandatory."	The design of iBRoad2EPC allows Member States to decide where exactly they want to place it between an EPC and a renovation passport. Many individual solutions can be realised along this spectrum: iBRoad2EPC can be a mandatory or voluntary component of the EPC, an independent and comprehensive renovation passport, or anything in between. Whether the iBRoad2EPC should be mandatory or voluntary for homeowners must be decided at an early stage of the implementation. The

		possible positioning between EPC and renovation passport depends on this decision.
	"Member States shall take measures to ensure that renovation passports are affordable and shall consider whether to provide financial support to vulnerable households wishing to renovate their buildings."	The design approach of iBRoad2EPC was to provide a tool that is affordable enough to trigger as many deep (nearly zero or zero emissions) renovations as possible in each country context. In this sense, it was conceived as a complement to existing national EPC schemes, issued together with the EPC by a qualified or certified energy expert following an on-site visit. In fact, the user interfaces developed allow the automatic transfer of information from the EPC database or EPC software tool to iBRoad2EPC and vice versa. The result is provided in a digital format that can also be printed as a supplement to the EPC. This enables different go-to-market strategies. The basic version of iBRoad2EPC contains only indispensable information so has only limited extra cost. If renovation passports are introduced as a mandatory part of the EPC, building owners will receive additional information to the EPC they have ordered; the additional cost in this case could either be financed by the state under certain conditions, or should be limited so that building owners can afford and accept it. If voluntary, building owners would decide whether they are willing to pay for the added value, with the possibility of an additional financing scheme to support the market. In any case, iBRoad2EPC could be made affordable for vulnerable households wishing to undertake a staged deep renovation.
12(3)	"Member States may allow for the renovation passport to be drawn up and issued jointly with the energy performance certificate."	iBRoad2EPC provides a reliable and flexible approach for introducing and positioning renovation passports in relation to existing EPCs. This can be achieved by integrating iBRoad2EPC as a mandatory or voluntary component of the EPC, or as an independent and comprehensive renovation passport. By default, iBRoad2EPC is best issued jointly with the EPC, following an on-site visit by an independent expert as a requirement; this will save time, effort and costs and provide high added value to both building owner and energy assessor. However, iBRoad2EPC may also be issued independently from the EPC.
12(4)	"The renovation passport shall be issued in a digital format suitable for printing, by a qualified or certified expert, following an on-site visit."	The iBRoad2EPC Assistant tool produces standardised online (but printable) output documents for easier navigation and updates compared to paper formats. Customers receive their iBRoad2EPC as an additional page including a URL or QR code in their (enhanced) EPC. By default, iBRoad2EPC is best issued jointly with the EPC, following an on-site visit by an independent expert as a requirement. A qualified expert visits the building and uses a checklist to document the building's components and systems, correlating them with the EPC data. They also look at previous refurbishment work.
12(5)	"When the renovation passport is issued, a discussion with the expert referred to in paragraph 4 shall be suggested to the building owner to allow the expert to explain the best steps by which to transform the building into a zero-emission building well before 2050."	According to the iBRoad2EPC approach, experts conduct a detailed interview with the building owners to gather any missing data, ask about their personal preferences and financial capabilities for renovation, and prepare a preliminary roadmap together with the building owner. The iBRoad2EPC approach ensures that the energy efficiency of each renovation measure is based on the LTRS of the specific country, aligning all suggested

		renovation actions with climate objectives. This can be adapted to suit NBRPs as per the 2024 EPBD recast. The system can be adapted to reflect the new objectives and targets defined in the NBRP. Similarly, best steps to transform the building into a zero-emission building based on the national context could be integrated into the iBRoad2EPC approach. To achieve this, the iBRoad2EPC Assistant tool can be linked to the national EPC calculation software or the national EPC database.
12(6)	"Member States shall strive to provide a dedicated digital tool by means of which to prepare and, where appropriate, update the renovation passport. Member States may develop a complementary tool allowing building owners and building managers to simulate a draft simplified renovation passport and for them to update it once a renovation takes place or a building element is replaced."	The iBRoad2EPC Assistant tool is designed to integrate with most existing tools, such as EPC software and databases, to provide building renovation passports. This tool is aimed at EPC assessors and energy auditors. However, the concept, principles and approach behind iBRoad2EPC can be used to provide a simple renovation passport tool for building owners and building managers.
12(7)	"Member States shall ensure that the renovation passport can be uploaded to the national database for the energy performance of buildings set up pursuant to Article 22."	iBRoad2EPC can be easily integrated with the energy performance of buildings database and any other relevant database such as the digital building logbooks through APIs, XML and excel integration.
12(8)	"Member States shall ensure that the building renovation passport is stored in, or can be accessed via, where available, the digital building logbook."	

Table 6: Summary of how iBRoad2EPC supports the implementation EPBD Annex VIII requirements for renovation passports

Annex VIII: Requirements for renovation passports	**How iBRoad2EPC fulfils these requirements**	
	Green = Mostly fulfilled	Light green = Partially fulfilled / future optional module
1. The renovation passport shall include:		
a) Information on the current energy performance of the building	Information on the current energy performance of the building is integrated into the basic module and presented in the iBRoad2EPC output (see Annex I, Figure 5)	
b) A graphical representation or graphical representations of the roadmap and its steps for a staged deep renovation	iBRoad2EPC uses a central graphic to inform building owners what is being renovated and when. It has a modular structure and shows the most important results and facts at a glance. A pictogram of a house shows the renovation measures on the building envelope step by step. It symbolises all building types, including single and multi-family houses, and non-residential buildings. By default, measures for heating, cooling, domestic hot water and ventilation are shown. However, implementing countries may choose to display other technologies. The graphical presentation of iBRoad2EPC clearly shows the icons for the different building components and technologies, the different steps and when they should be carried out, and the performance improvement when they are carried out (see Annex I, Figure 5)	

c) Information on relevant national requirements such as minimum energy performance requirements for buildings, minimum energy performance standards and rules in the Member State on the phase-out of fossil-fuel used in buildings for heating and cooling, including application dates	iBRoad2EPC derives steps, milestones, measures, notes and building targets from national regulations or obligations, e.g., NBRPs, MEPS, etc., details of which are integrated into the basic module renovation advice. Once the iBRoad2EPC issuer has identified the renovation measures, the details of these measures, e.g. insulation thickness, are included automatically. MEPS are also displayed on the 'detail page' where the steps are explained in detail (see Annex I, Figure 6)
d) A succinct explanation on the optimal sequencing of steps	The iBRoad2EPC approach includes improvement measures in a specific sequence to prevent lock-in effects (see iBRoad2EPC detail page in Annex I, Figure 6). Renovation schedules are aligned with national milestones toward climate-neutral building stock and follow a technically sensible order for each building. This approach provides building owners with clear guidance. Sequencing of renovation actions should be tailored to each building by experienced professionals to ensure individual circumstances are considered, as automation could overlook these nuances and diminish the system's value for building owners.
e) **Information about each step, including:**	
i. The name and description of the renovation measures for the step, including relevant options for the technologies, techniques and materials to be used	The name and description of the renovation measures for each step, including relevant options for technologies, techniques and materials to be used, are included in the basic module of iBRoad2EPC (see Annex I, Figure 6).
ii. The estimated energy savings in primary and final energy consumption, in kWh and in percentage improvement compared to the energy consumption prior to the step iii. The estimated reduction of operational greenhouse gas emissions iv. The estimated savings on the energy bill, clearly indicating the assumptions on energy costs used for the calculation v. The estimated energy performance class of the energy performance certificate to be achieved following completion of the step	This information is available in the iBRoad2EPC energy demand module (see Annex I, Figure 7). With the energy demand module, in addition to the basic module, issuers have the option of specifying the new: • Energy demand • Energy efficiency class • Greenhouse gas emissions • Energy costs. iBRoad2EPC does not specifically supply information on savings compared to the previous step, although this is easily achievable.
f) Information about a potential connection to an efficient district heating and cooling system	This feature is currently not available. However, it is possible to introduce it in the future, integrating iBRoad2EPC with geodata. This way, recommendations can be enhanced. For instance, if preferred areas for district heating networks are identified in the database, iBRoad2EPC can suggest future connections to these networks for building owners.
g) The share of individual or collective generation and self-consumption of renewable energy estimated to be achieved after the renovation	Presented only as an outlook for possible future modules.
h) General information on available options for improving construction products' circularity and for reducing their whole lifecycle greenhouse gas emissions, as well as wider benefits related to health and comfort, indoor environmental quality and the	IEQ is considered in iBRoad2EPC, addressing thermal, visual and acoustic comfort, along with indoor air quality. The IEQ score is shown on the IEQ page of iBRoad2EPC for each renovation step, ranging from very poor to excellent. The score is provided for each specific renovation step.

improved adaptive capacity of the building to climate change	Other features are possible as future modules.
i) Information on available funding and relevant weblinks to the sources of such funding	Information on funding is available in the iBRoad2EPC basic module's "Next steps" section. In this section, building owners receive guidance on initiating renovations and contact points, which may include internet links to funding programmes or lists of building experts, depending on the country. References to local energy agencies or suitable tradespeople can also be provided. This information can also be effectively incorporated into the roadmap through the investment cost module (see Annex I, Figure 7).
j) Information on technical advice and advisory services, including contact details and weblinks to one-stop-shops.	Currently not available, but it can be easily integrated into the "Next steps" section of the iBRoad2EPC.
2. The renovation passport may include:	
a) An indicative timing of the steps	The basic module of iBRoad2EPC shows the years in which the renovation measures should be carried out (see Annex I, Figure 5).
b) For each step:	
i. A detailed description of the technologies, techniques and materials to be used, their advantages, disadvantages and costs	A detailed description is given for each step, including a description of the measure, technical specifications and issues to consider when carrying out the renovation measures (see Annex I, Figure 6).
ii. How the energy performance of the building would compare to minimum energy performance requirements for buildings undergoing major renovation, nearly zero-energy building and zero-emission building requirements after completion of the step and how the energy performance of the building elements replaced would compare to minimum energy performance requirements for single building elements [where these exist]	A comparison to minimum energy performance requirements is provided in the detail page.
iii. The estimated costs for carrying out the step	The iBRoad2EPC investment cost module can be used to display renovation costs. The following cost types can be presented for each renovation step: • Total investment costs • Maintenance costs • Energy-related additional costs • Sources of funding.
iv. The estimated pay-back period for the step, with and without any financial support available	Currently not provided. It could be further developed as an optional feature in the investment cost module. However, renovation depth should prioritise achieving a climate-neutral building stock rather than just current economic efficiency. Economic evaluations should focus not only on short payback periods but also on the affordability and reasonableness of the costs.
v. The estimated time needed to carry out the step	Currently not provided, but there is a high potential for future integration. For example, it can be provided in the detail page.

vi.	Where available, the reference values on the lifecycle greenhouse gas emissions for the materials and equipment and a link to the relevant webpage where they can be found	Currently not provided, but there is a high potential for future integration. For example, it can be provided in the detail page.
vii.	The estimated lifetime of measures and the estimated maintenance costs	Estimated maintenance costs are provided in the investment cost module.
c)	Independent modules on:	In general, the iBRoad2EPC structure is modular and additional independent modules can be integrated.
viii.	The typical trades necessary or recommended for carrying out energy renovations (architects, advisors, contractors, suppliers and installers, etc.) or a weblink to the relevant page(s)	Currently not included, but it can be easily added to the "next steps" section.
ix.	A list of relevant architects, advisors, contractors, suppliers or installers in the area, that may include only those fulfilling certain conditions such as matching higher qualification or certification labels or conditions, or a weblink to the relevant page(s)	
x.	The technical conditions needed for an optimal roll-out of low temperature heating	The sequencing of iBRoad2EPC takes into account whether the building is ready for the integration of low temperature heating technologies, such as heat pumps. iBRoad2EPC proposes the future integration with spatially resolved data in a building database. This data can also be used to evaluate other infrastructures, such as electricity distribution networks in areas where a high number of heat pumps are expected.
xi.	How the renovation steps and additional measures could improve the smart readiness of a building	Present in iBRoad2EPC, the SRI module uses the SRI Excel tool from the European Commission and is downloaded automatically in the iBRoad2EPC Assistant. It introduces a specific input mask to the iBRoad2EPC Assistant to interact with this Excel sheet. Upon completing the assessment, results are provided at three levels of detail: (1) the total SRI score, (2) impact scores, and (3) domain scores.
xii.	Technical and safety requirements for materials and works	Currently not available, but they can be easily integrated into the detail page of the iBRoad2EPC.
xiii.	The underlying assumptions behind the calculations provided or a link to the relevant webpage where they can be found	Energy calculations for the iBRoad2EPC are performed using the EPC software specific to each implementing country, not within the iBRoad2EPC Assistant. The complexity of the calculation routines based on underlying standards makes it impractical to include them in the Assistant, as they need to handle various building types and technical equipment. Simplified energy calculation procedures are also excluded to avoid discrepancies with the original EPC software results, which could confuse building owners. Results from the EPC software are transferred to the iBRoad2EPC Assistant manually or through an automated API. This information is currently not shown in the iBRoad2EPC output, but could be displayed in the future, e.g., in the detail page.
d)	Information on how to access a digital version of the renovation passport	The iBRoad2EPC Assistant generates the iBRoad2EPC output form, which can be provided to the recipient either as an online version or as a printable page (see Annex I, Figure 8). The printable page can be attached to the EPC and link to the online version, allowing a hard copy to accompany the paper EPC. In this way,

	iBRoad2EPC serves as an annex to the EPC and can replace the mandatory renovation recommendations within the EPC. It can also be displayed publicly in public buildings. This option is relevant only if a paper version of the EPC is used in the implementing country.
e) Any major renovations made to the building or building unit, as referred to in Article 8(1), and any retrofitting or replacement of a building element that forms part of the building envelope and which has a significant impact on the energy performance of the building envelope, as referred to in Article 8(2), where such information is made available to the expert carrying out the renovation passport	High potential for future integration.
f) Information related to seismic safety, where such information relevant to the building is made available to the expert	High potential for future integration.
g) Upon request of and based on information made available by the current building owner, contain in an attachment additional information, such as the adaptability of spaces to evolving needs and any planned renovations	High potential for future integration.
3. Regarding the status of the building prior to the renovation steps, the renovation passport shall consider, to the extent possible, information contained in the energy performance certificate.	iBRoad2EPC can be easily coupled with existing EPC databases, e.g. via APIs, or EPC outputs in excel or XML format. This allows assessors and owners to understand the existing condition and future goals of the building.
4. Each metric used for estimating the impact of steps shall be based on a set of standard conditions.	Energy calculations for the iBRoad2EPC are performed using the EPC software specific to each implementing country, not within the iBRoad2EPC Assistant.

Remaining articles of the EPBD

Table 7: Summary of how iBRoad2EPC supports the implementation various articles of the EPBD

Para N°	EPBD text or summary	Solutions offered by iBRoad2EPC
	Recital	
(44)	"Long-term renovation contracts are an important instrument by means of which to stimulate staged renovation. Member States may introduce mechanisms that allow the establishment of long-term renovation contracts over the various stages of staged renovation. Where new and more effective incentives become available during the various stages of the renovation, access to those new incentives may be ensured by allowing beneficiaries to switch to new incentives."	iBRoad2EPC supports the establishment of long-term renovation contracts over the various stages of staged renovation based on the renovation advice offered.
	Article 1 Subject matter	
1(1)	"This Directive promotes the **improvement of the energy performance of buildings** and the **reduction of greenhouse gas emissions from buildings within the Union**, with a view to achieving a zero-emission building stock by 2050, taking into account the **outdoor climatic conditions, the local conditions, the**	The vision of iBRoad2EPC is to give renovation a significant push towards zero emissions and trigger mass deep renovation of the EU building stock. This will contribute to the improvement of the energy performance of buildings, while providing for health, comfort, cost-effectiveness and energy security. In doing so, the contents of its databases are specific to the local conditions and national requirements.

	requirements for indoor environmental quality, and cost-effectiveness."	
	Article 2 Definitions	
2(19)	"'Renovation passport' means a tailored roadmap for the deep renovation of a specific building in a maximum number of steps that will significantly improve its energy performance."	The iBRoad2EPC is exactly that: a tailored (though, depending on the modules chosen, simplified) roadmap for the deep renovation of individual buildings over a long-term horizon. It guides the renovation through a specific number of steps defined by trigger points and national milestones and aims at zero emissions or nearly zero emissions level.
	Article 3 National building renovation plans	
3(1)	"Each Member State shall 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."	iBRoad2EPC's stepwise renovation guidance is designed to include strategic targets to be achieved per individual building, already incorporating, among others, milestones for gradually achieving average primary and final energy use and greenhouse gas emission reductions as defined in the national LTRS (or NBRP). This means that iBRoad2EPC recommendations are by design produced in accordance with the LTRS and can be adapted to NRBP objectives (as well as other relevant regulation targets and obligations). The wider the uptake of iBRoad2EPCs, the more buildings will be gradually renovated toward NBRP targets.
3(2a)	"The NBRP should include an overview of the national building stock for different building types, including their share in the national building stock, construction periods and climatic zones, based, as appropriate, on statistical sampling and the national database for energy performance certificates pursuant to Article 22, an overview of market barriers and market failures and an overview of the capacities in the construction, energy efficiency and renewable energy sectors, and of the share of vulnerable households based, as appropriate, on statistical sampling;"	iBRoad2EPCs are produced through the iBRoad2EPC Assistant software which relies on a single database per country, ideally linked to the national EPC database. This enables constant monitoring of whether building renovation planning is consistently progressing toward the NBRP targets. Accordingly, national incentives and other tools can be tailored to encourage progress in the relevant direction, e.g., increase investments in the areas of comparatively greater impact.
	Article 5 Setting of minimum energy performance requirements	
5	"The aim of this article is to ensure that minimum energy performance requirements for buildings or building units are set."	iBRoad2EPC's step-by-step renovation advice already includes, among other things, national thresholds to be achieved by specific dates, directly supporting the achievement of minimum energy performance requirements. iBRoad2EPC integrates all relevant provisions foreseen in national or EU regulations, including MEPS, through its dedicated and country-specific step-by-step renovation advice database as part of the basic module. The database is designed to be flexible and adaptable to changing conditions and can therefore be updated to include revised and more ambitious requirements as foreseen in national legislation. The maximum energy performance thresholds included in this database are differentiated by building type, climate zone and others. iBRoad2EPC can also be used to confirm the compliance of individual buildings before or after renovation, either in combination with the EPC or independently. Particularly when combined with one-stop shops, iBRoad2EPC can provide technical assistance with a

		particular focus on vulnerable households and, where appropriate, people living in social housing.
Article 8 Existing buildings		
8(3)	Member States shall take the necessary measures to ensure that, when buildings undergo major renovation, the energy performance of the building or the renovated part thereof is upgraded in order to meet minimum energy performance requirements as set out in Article 5. Member States shall also address, in relation to buildings undergoing major renovation, the issues of indoor environmental quality, adaptation to climate change, fire safety, risks related to intense seismic activity, the removal of hazardous substances including asbestos and accessibility for persons with disabilities.	iBRoad2EPC provides a roadmap for the staged renovation of existing buildings to meet minimum energy performance requirements and zero-emission targets. It also includes a module for assessing indoor environmental quality and adapts renovation advice accordingly. iBRoad2EPC follows a modular and adaptable approach where different indicators, features and other links can be added. Those features that iBRoad2EPC does not currently cover (fire and seismic safety, climate change adaptation) can be considered for future integration.
Article 9 Minimum energy performance standards for non-residential buildings and trajectories for progressive renovation of the residential building stock		
9(1)	"Member States shall establish minimum energy performance standards for non-residential buildings which ensure that those buildings do not exceed the specified maximum energy performance threshold […] expressed by a numeric indicator of primary or final energy use in kWh/(m^2/y), by the dates specified."	iBRoad2EPC can support the renovation of the worst-performing stock. It can also be used to check compliance for individual buildings before and after renovation, or collectively through aggregated data.
Article 11 Zero-emission buildings		
11	This article provides the definition, thresholds and other provisions related to zero-emission buildings, relating also to renovated buildings. Among these, it also defines that the total annual primary energy use of a zero-emission building must be covered either by energy from renewable sources generated on-site or nearby, energy from renewable sources provided from a renewable energy community, energy from an efficient district heating and cooling system or from carbon-free sources. The aim to reach zero emissions in the case of existing buildings would in most cases require several interventions over time. This can also enable building owners to take advantage of the best options available, at affordable market prices.	iBRoad2EPC enables this approach. It provides advice that is aligned with these thresholds and includes the related energy sources for the total primary energy use of the zero-emission building.
Article 13 Technical building systems		
13(1)	Member States shall, for the purpose of optimising the energy use of technical building systems, set system requirements, using energy-saving technologies, in respect of the overall energy performance, the proper installation, the appropriate dimensioning, adjustment and control and, where appropriate, the hydronic balancing of the technical building systems which are installed in new or existing buildings. This includes requirements for the implementation of adequate indoor environmental quality standards and equipping residential buildings with measuring and control devices for the monitoring and regulation of indoor air quality, the optimisation of energy performance of technical building systems, the	Any type of technology and associated requirements or characteristics (sizing, adjustment and control) can be stored in the iBRoad2EPC country databases of renovation advice and used to draw up relevant measures in a specific sequence. For the time being, at least the prohibition of fossil-fuel-based heating/cooling, requirements/technologies related to indoor environmental quality and renewable energy systems including storage, etc., are already taken into account.

	promotion of energy storage for renewable energy, the switch from fossil-fuel to non-fossil-fuel-based heating and cooling systems, as well as the equipment of non-residential buildings with building automation and control systems.	
	Article 15 Smart readiness of buildings	
15(1)	"[...] The rating shall be based on an assessment of the capabilities of a building or building unit to adapt its operation to the needs of the occupant, in particular concerning indoor environmental quality and the grid and to improve its energy efficiency and overall performance."	iBRoad2EPC currently uses the relevant SRI methodology developed as part of the SRI study commissioned by the European Commission, where energy experts can fill in values in the Excel spreadsheet and upload it to the iBRoad2EPC Assistant. The indicator is then automatically picked up and influences the recommendations. In addition to the SRI methodology developed under the EC contract, the SRI2MARKET methodology has been tested in a number of buildings as part of iBRoad2EPC.
	Article 17 Financial incentives, skills and market barriers	
17(4)	"With due regard to vulnerable households, Member States shall link their financial measures for energy performance improvements and reduced greenhouse gas emissions in the renovation of buildings to the targeted or achieved energy savings and improvements, as determined by one or more of the following criteria [...]"	The integration of EPC and renovation passports with incentive programmes could improve their effectiveness by (1) prescribing clearer guidelines for public administrations on what renovation interventions should be incentivised with priority; (2) tying the exact amount of funds to specific and measurable energy improvements; and (3) providing building owners with clear, reliable and actionable information, making renovations more accessible. iBRoad2EPC includes details on the expected improvements in energy performance following the execution of the measures outlined in the step. Consequently, a Member State might choose, for instance, to either mandate an EPC both before and after renovation or to use a renovation passport. The iBRoad2EPC report "*How to best use financial and non-financial incentives for renovation in implementing markets*" lists various examples where incentives are linked with EPCs or improvements in energy performance.
17(16)	"Member States shall incentivise deep renovation and staged deep renovation with higher financial, fiscal, administrative and technical support. Where it is not technically or economically feasible to transform a building into a zero-emission building, a renovation resulting in at least a 60 % reduction of primary energy use shall be considered to be a deep renovation for the purposes of this paragraph. Member States shall incentivise sizeable programmes that address a high number of buildings, in particular the worst-performing buildings, such as through integrated district renovation programmes, and that result in an overall reduction of at least 30 % of primary energy use, with higher financial, fiscal, administrative and technical support, according to the level of performance achieved."	iBRoad2EPC provides a renovation passport with a staged deep renovation plan that includes the estimated energy performance improvements at each stage. iBRoad2EPC can be used as a tool to identify the worst-performing buildings and the renovation measures required to transform them into zero-emission buildings. In this way, iBRoad2EPC helps to target financial incentives where they are most needed.
	Article 18 One-stop shops for the energy performance of buildings	
18(1)	"Member States shall, in cooperation with competent authorities, and, where appropriate, private stakeholders, ensure the establishment and the operation of technical assistance facilities, including through inclusive one-stop	iBRoad2EPC is an ideal tool to provide information on energy efficiency measures, individual actions, and financial and legal frameworks to market participants, including consumers, community organisations,

	shops for the energy performance of buildings, targeting all actors involved in building renovations, inter alia, home owners and administrative, financial and economic actors, such as SMEs, including microenterprises."	authorities, and professionals in the construction and energy sectors, including links to one-stop shops.
	Article 19 Energy performance certificates	
19(5)	"The energy performance certificate shall include recommendations for the cost-effective improvement of the energy performance and the reduction of operational greenhouse gas emissions and the improvement of indoor environmental quality of a building or building unit, unless the building or building unit already achieves at least energy performance class A."	iBRoad2EPC has a modular structure, in addition to the core basic module that provides step-by-step renovation recommendations. Additional optional modules have been developed for investment costs, energy demand, SRI, IEQ and measured energy performance. Some of these indicators are also required to be displayed on the renovation passport. As iBRoad2EPC uses national EPC calculation software to make these calculations, the adoption of iBRoad2EPC makes it easy to mirror this information from renovation passports in EPCs, e.g. through APIs.
19(6)	"Where Member States provide for a renovation passport to be drawn up and issued jointly with the energy performance certificate pursuant to Article 12(3), the renovation passport shall substitute the recommendations pursuant to paragraph 5 of this Article."	To reduce disturbance, effort and price, and increase their combined benefits, iBRoad2EPC was conceptualised so as to be jointly issued, if desired, with the EPC, following a single on-site visit by a qualified expert. Renovation advice from iBRoad2EPC is then also planned to replace the recommendations in the EPC. The design of iBRoad2EPC allows Member States to decide where exactly they want to place it between EPC and renovation passport. Many individual solutions can be realised along this band width. This can be achieved by integrating iBRoad2EPC as a mandatory or voluntary component of the EPC, as an independent and comprehensive renovation passport or anything else in between. The decision as to whether iBRoad2EPC should be mandatory or voluntary for homeowners must be made at an early stage of the implementation. The possible positioning between EPC and renovation passport depends on this decision. To facilitate the joint issue of EPC and renovation passports, building owners receive their iBRoad2EPC as an additional page including a URL or QR code in their enhanced EPC.
19(14)	"Member States shall make simplified procedures for updating an energy performance certificate available where measures identified in a renovation passport are put in place or where a building digital twin, other certified methods, or data from certified tools determining the energy performance of a building are used."	For each renovation step, the basic iBRoad2EPC module provides information on the renovation measures, estimated energy and cost savings and greenhouse gas emission reductions, improved energy class, etc. iBRoad2EPC uses national EPC calculation software to calculate the energy performance of buildings and determine their energy class. This automatically provides a simplified process for updating EPCs when renovations are carried out.
	Article 22 Databases for the energy performance of buildings	
22(1)	"Each Member State shall set up a national database for the energy performance of buildings which allows data to be gathered on the energy performance of individual buildings and on the overall energy performance of the national building stock. Such databases may consist of a set of interconnected databases. The database shall allow data to be gathered from all relevant sources related to energy performance certificates, inspections, the renovation passport, the smart readiness	The API and the XML and excel integration approach developed in iBRoad2EPC allow interoperability between different forms of existing tools and databases in Member States. These could be national energy performance calculation software, national EPC, building permit, national observatories or other databases, and many more. By default, iBRoad2EPC is linked to the iBRoad logbook, a building logbook developed in the iBRoad project, a predecessor of the iBRoad2EPC project, where it exists. This approach ensures easy central access and automatic transfer of

	indicator and the calculated or metered energy consumption of the buildings covered. In order to populate the database, building typologies may also be gathered. Data may also be gathered and stored on both operational and embodied emissions and life-cycle GWP."	information and, most importantly, coherence and consistency. National and regional authorities should have mechanisms in place to monitor the progress of renovation passports and the rate and depth of renovation.
Article 24 Reports on the inspection of heating systems, ventilation systems and air-conditioning systems		
24(1)	"[...] The inspection report shall contain the result of the inspection performed in accordance with Article 23 and include recommendations for the cost-effective improvement of the energy performance of the inspected system [...] The recommendations shall, where relevant, include the results from the basic assessment of the feasibility to reduce on-site use of fossil fuels."	Recommendations for the phase-out of fossil fuels in heating, ventilation and air-conditioning systems are considered as part of the iBRoad2EPC renovation advice.
Article 25 Independent experts		
	"Member States shall ensure that the energy performance certification of buildings, the establishment of renovation passports, the smart readiness assessment and the inspection of heating systems, ventilation systems and air-conditioning systems are carried out in an independent manner by qualified or certified experts, whether operating in a self-employed capacity or employed by public bodies or private enterprises."	iBRoad2EPC calls for the energy performance certification of buildings, the establishment of renovation passports, the smart readiness assessment and the inspection of heating, ventilation and air-conditioning systems to be carried out by trained and qualified or certified independent experts. For this purpose, it proposes a joint training of energy experts combining the issuance of the EPC and the renovation passport. iBRoad2EPC provides a training toolkit and materials for EPC assessors and energy auditors to understand the concept of staged renovation, renovation passports and how to use iBRoad2EPC to conduct site visits and issue renovation passports. See "iBRoad2EPC's Training toolkit."
Article 26 Certification of building professionals		
26(1)	"Member States shall ensure the appropriate level of competence for building professionals carrying out integrated renovation works in accordance with Article 3 of, and Annex II to, this Directive and with Article 28 of Directive (EU) 2023/17"	To support the upskilling of construction professionals, according to their role in the investment process, for on-site application of the measures and specifications of the renovation passport, the iBRoad2EPC project has developed a set of training material explaining the concept of staged renovation, renovation passports and how to use iBRoad2EPC to carry out deep renovations. See iBRoad2EPC's Training module for construction professionals.
26(2)	"Where appropriate and feasible, Member States shall ensure that certification or equivalent qualification schemes are available for providers of integrated renovation works where this is not covered by Article 18(3) of Directive (EU) 2018/2001 (*Renewable Energy Directive - Article 18 Information and training*) or Article 28 of Directive (EU) 2023/1791 (*Energy Efficiency Directive Article 28 Availability of qualification, accreditation and certification schemes*)."	
Article 27 Independent control system		
27(1)	"Member States shall ensure that independent control systems for energy performance certificates are established in accordance with Annex VI, and that independent control systems for renovation passports, smart readiness indicators and reports on the inspection of heating systems, ventilation systems and air-conditioning systems are established. Member States may establish separate systems for the	iBRoad2EPC proposes a joint control system for the energy performance certificate, renovation passport and smart readiness indicator, though this is not a prerequisite.

	control of energy performance certificates, renovation passports, smart readiness indicators and reports on the inspection of heating systems, ventilation systems and air-conditioning systems."	

Energy Efficiency Directive (EED)

The EED was adopted by the EU to promote energy efficiency within its Member States. The directive sets binding targets for energy efficiency improvements and outlines measures to support these objectives. It promotes energy audits and establishes energy efficiency obligations for energy companies. It encourages the renovation of public buildings to improve their energy performance and recognises the building renovation passport as a tool for this purpose in Article 5. It also emphasises the importance of using the public sector as an agent of change and the availability and usability of data to attract investment in the energy renovation of buildings. Table 8 outlines the way in which iBRoad2EPC can be further used in conjunction with these articles and provisions of the EED.

Table 8: Summary of how iBRoad2EPC supports the implementation of EED

Focus area	EED text or summary	Solutions offered by iBRoad2EPC
	Recital (45)	
ESCOs	Member States must establish an inventory of public buildings, including social housing where applicable, as part of a comprehensive database of energy performance certificates allowing private entities, including energy service companies (ESCOs), to suggest renovation solutions. These proposals can then be compiled by the EU Building Stock Observatory to determine the rate of renovations needed to achieve nearly zero-energy building levels.	iBRoad2EPC produced a list of energy efficiency improvements. Measures for improving energy performance produced by iBRoad2EPC can be aggregated and made available to accredited third parties, including ESCOs.
	Article 4 Energy efficiency targets	
Targets and goal setting	Member States must indicate their national energy efficiency contributions in various sectors, including the construction and buildings sector, in line with the EU's binding final energy consumption. When doing so, they should consider the potential for economic energy savings, changes in the energy mix, and other relevant factors.	The iBRoad2EPC initiative ensures that the energy efficiency of each renovation measure is based on the LTRS of the specific country, aligning all suggested renovation actions with its climate objectives. The system can be adapted to reflect the new objectives and targets defined in the NBRP. To achieve this, the iBRoad2EPC Assistant tool can be linked to the national calculation software or the national database. iBRoad2EPC can therefore be an effective tool to measure and reach the national targets for building sector decarbonisation.

Article 5 Public sector leading on energy efficiency		
Public buildings and social infrastructure	"Member States shall encourage public bodies to improve the energy performance of buildings owned or occupied by public bodies, including by means of the replacement of old and inefficient heaters."	iBRoad2EPC has developed an advisory package for public authorities who are interested in using iBRoad2EPC solutions to trigger deep renovation. The package aims to strengthen capacity building for the design, implementation and monitoring of renovation programmes. With the combination of the advisory package and the iBRoad2EPC Assistant, public authorities will have the necessary capacities to fulfil the targets for renovation passports for the total heated or cooled floor area listed in the EED and help them to act as exemplary in improving energy efficiency in buildings.
Article 6 Exemplary role of public bodies' buildings		
Links with other databases	- The EU Building Stock Observatory can consolidate publicly accessible data on building stock characteristics, renovations, and energy performance. This enhances comprehension of the building sector's energy efficiency through standardised data. The inventory should include at least floor area measurements, annual energy consumption figures (if available), and energy performance certificates issued in compliance with Directive 2010/31/EU (Article 6(5)). - To meet the energy efficiency targets Member States may ensure that a building renovation passport is introduced for public buildings representing at least 3% of the total heated or cooled floor area. These buildings must achieve nearly zero-energy status by 2040 at the latest (Article 6(6a)).	The digital nature and data structure of the iBRoad2EPC facilitates seamless information and data exchange between iBRoad2EPC and other energy-related databases, such as the database for energy performance of buildings and digital building logbooks. The information and statistical data produced by iBRoad2EPC, including the steps for renovation and energy savings, can be aggregated and shared with other public and private entities for research and commercial purposes.
Articles 14 Metering for heating, cooling and domestic hot water; Article 15 Sub-metering and cost allocation for heating, cooling and domestic hot water; Article 16 Remote reading requirement		
Metering and monitoring of energy consumption data	These articles are related to metering, sub-metering and smart meters. Remotely readable meters and sub-meters should be installed at appropriate heat exchange points, such as building complexes or individual buildings, to collect real-time data and provide frequent and enhanced feedback on energy consumption.	The iBRoad2EPC approach potentially enables this by including a measured energy performance indicator as an optional module and providing a method to indicate the energy performance buildings in its energy demand module. Potentially, the iBRoad2EPC could also be updated to be able to capture the data collected by smart meters in the future.
Article 22 Information and awareness raising		
Information and awareness raising	Member States, in collaboration with regional and local authorities where relevant, must guarantee transparent and accessible dissemination of information regarding energy efficiency measures, individual actions, and financial and legal frameworks to all pertinent market participants, including consumers, community organizations, authorities, and professionals involved in construction and energy sectors.	iBRoad2EPC provides information on energy efficiency measures, individual actions, financial and legal frameworks to market participants, including consumers, community organisations, authorities, and professionals in the construction and energy sectors. iBRoad2EPC is an ideal information tool to facilitate information on energy efficiency measures, individual actions, financial and legal frameworks to market participants, including consumers, community organisations, authorities, and professionals in

		the construction and energy sectors, including links to one-stop shops.
Article 28 Availability of qualification, accreditation and certification schemes		
Capacity building of energy assessors and auditors	Member States must ensure the availability of capacity building programmes for professionals involved in energy efficiency, such as energy auditors, energy managers, energy assessors, and providers of integrated renovation works.	iBRoad2EPC provides three forms of capacity building programmes: 1) A training toolkit for energy assessors to create detailed building renovation roadmaps, preferably jointly with EPCs. The toolkit includes presentation materials and training modules for energy/EPC assessors, complete with notes, exercises, test questions and references. See iBRoad2EPC Training toolkit. 2) A training module for construction professionals, explaining the concept of staged renovation, renovation passports and how to use iBRoad2EPC to carry out deep renovations. See iBRoad2EPC's Training module for construction professionals. 3) An advisory package for public authorities to support them in energy planning and renovation of their building stock using iBRoad2EPC (soon to be published). The iBRoad2EPC training and capacity building programmes can be used to train professionals and equip them to deliver integrated renovation works.

Renewable Energy Directive

The Renewable Energy Directive (RED) is a legislative framework established by the European Union to promote the use of renewable energy sources for electricity, heating and cooling. It sets binding targets for EU Member States to increase the share of renewable energy in their overall energy consumption. The directive provides guidelines and support mechanisms to facilitate the deployment of renewable energy technologies, such as wind, solar, biomass and hydroelectric power. Table 9 outlines how iBRoad2EPC aligns or can be further aligned with the RED.

Table 9: Opportunities for aligning iBRoad2EPC with the RED

Focus area	Articles 15 Mainstreaming renewable energy in buildings	iBRoad2EPC approach
Decarbonising heating and cooling	Member States should utilize diverse measures such as energy labels (Regulation EU 2017/1369), energy performance certificates (Directive 2010/31/EU), and relevant Union or national standards to promote the use of renewable heating and cooling systems and equipment and innovative technology, such as smart and renewable-based electrified heating and cooling systems and equipment. They should also provide ample guidance on renewable and energy-efficient options, along with financial incentives to promote the switch to renewable energy solutions and replace outdated heating systems (Article 15a(6)).	The renovation advice in iBRoad2EPC encourages the use and integration of renewable energy for space heating and cooling. In addition, it has a modular approach and building-integrated renewable energy sources, such as solar photovoltaic, can be included as an additional module.

iBRoad2EPC

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