iBRoad2EPC

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

Initial national guides

iBRoad2EPC and national energy performance certification schemes of roll-out countries

INZEB
INITIALISING ENERGY BALANCE TOWARDS ZERO

INZEB

December 2023

www.ibroad2epc.eu

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement Nº 101033781

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Published in April 2023 by iBRoad2EPC. Updated in December 2023.

All of iBRoad2EPC's reports, analysis and evidence can be accessed from ibroad2epc.eu

EXECUTIVE SUMMARY

This document details the initial national guides for the iBRoad2EPC roll-out in the six pilot countries of the project, Bulgaria, Greece, Poland, Portugal, Romania, and Spain. Prior to the presentation of the roll-outs, a chapter presenting the evolution from the iBRoad project to the iBRoad2EPC concept is included, naming and presenting the concept and its key features, the issuing procedure, and the interface that has been enhanced, the visualisation of the outputs and how the upgraded illustrations look like, while a presentation of the iBRoad2EPC training is also included.

The core of this report is the national roll-outs. Each of the pilot countries has a dedicated chapter in which the development of the national initial roll-out guides is presented. Specifically, each of the chapters includes an overview of the national energy targets and priorities, the legislative framework regarding EPCs and Building Renovation Passports, the national building stock characteristics, and the EPC issuing specific procedures/peculiarities. The iBRoad2EPC vision is then presented for which both the views of the national partners and those of the members of the so-called National Advisory Committees (NACs - consisting of key actors/stakeholders involved in the national frameworks regarding EPCs and BRPs) are considered. Moreover, the section includes provisions and estimations for the proposed cost and effort, the proposed modules that fit the national context and needs, the envisaged interlinkages with other tools and software, and the training procedures that are required in order for the energy auditors to use the iBRoad2EPC tools.

Each country section concludes with the presentation of an action plan developed by project partners in collaboration with the NAC members. The action plans are considered important as they set the basis of the roll-outs at the national level. Each of the six action plans presented in this report includes a list of identified priorities and the aims which they serve. The action plans also present stakeholders that need to be engaged including a proposed timetable for the implementation of the actions. A summary of similarities and differences among the six action plans is included in the last chapter of this report.

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ABBREVIATIONS

EU	European Union
EPC	Energy Performance Certificate
MS	Member States
LTRS	Long Term Renovation Strategy
EBPD	Energy Performance of Buildings Directive
NBRP	National Building Renovation Plan
BRP	Building Renovation Passport
REICs	Real Estate Investment Companies
IEQ	Indoor Environment Quality
SRI	Smart Readiness Indicator
MEPI	Measured Energy Performance Indicator
IECP	Integrated Energy and Climate Plan
PEC	Primary Energy Consumption
SEDA	Sustainable Energy Development Agency
EPB	Energy Performance of Buildings
NECP	National Energy and Climate Plan
NRRP	National Recovery and Resilience Plan
DBI	Digital Building Identity
TCG	Technical Chamber of Greece
EEOS	Energy Efficiency Obligation Schemes
GoI	Group of Interest
CEEB	Central Register of Emissivity of Buildings
DIY	Do It Yourself
NAC	National Advisory Committee
RCCTE	Regulation of Thermal Behaviour Characteristics in Buildings
INECP	Integrated National Energy and Climate Plan
MITECO	Ministerio para la Transición Ecológica y el Reto Demográfico (Spanish Climate Change Office)
MITMA	Ministerio de Transportes, Movilidad y Agenda Urbana (Directorate General for Urban Agenda and Architecture)
IDAE	Instituto para la Diversificación y Ahorro de la Energía (Energy Saving and Diversification Agency)
CSCAE	Consejo Superior de Colegios de Arquitectos de España (Architects Association of Spain)
COAC	Colegio de Arquitectos de Cataluña (Architects Association of Catalonia)
COAVN	Colegio Oficial de Arquitectos Vasco Navarro (Architects Association of Basque Country and Navarre)
EVE	Ente Vasco de la Energía (Basque Energy Body)
ICAEN	Instituto Catalán de Energía (Catalonian Energy Institute)
LEE	Libro del edificio existente (Existing Building Logbook)
CRES	Center for Renewable Energy Sources and Saving (Greece)

INTRODUCTION

The European Union (EU) has set ambitious goals to cut its greenhouse gas emissions by at least 55% by 2030 and become a climate neutral continent by 2050. To achieve these goals and climate targets, a significant reduction should be made in the building sector, which contributes around a third of EU emissions.

The EU Member States (MSs) are obliged to develop Long Term Renovation Strategies (LTRSs) for their building stocks, according to Article 2a of the Energy Performance of Buildings Directive (EBPD), with the objective to set out a trajectory for the decarbonisation of the sector by 2050. The strategies should, among other elements, include an overview of the building stock and actions to stimulate cost-effective deep renovation of buildings. The LTRS should also include a roadmap to 2050, with clear and measurable milestones for 2030 and 2040. The purpose of the LTRS is to steer policies, actions, and financial instruments toward the common target of a building stock that is aligned with a net-zero economy by 2050.

The Energy Performance Certificate (EPC) is an established tool for the facilitation of building energy renovation in all MSs that has received a lot of criticism, while for an effective EU-wide implementation of EPCs, several challenges need to be addressed. The European Commission's proposal for the EPBD recast from the year 2021 suggests new requirements for EPCs and, according to Article 3, the replacement of the LTRSs with National Building Renovation Plans (NBRPs) that will include a more ambitious vision for 2050, clear links to other planning tools, and a mandatory template for MSs [1].

The proposed recast of the Energy Performance of Buildings Directive (EPBD) includes several key new provisions aimed at improving the energy efficiency of buildings in the EU. These provisions include the establishment of Minimum Energy Performance Standards (MEPS), the promotion of Zero-Emissions Buildings (ZEBs), and the requirement for new buildings to report on Global Warming Potential. The proposal also includes measures to better factor in the multiple benefits associated with the optimisation of energy performance, the establishment of a common template for Energy Performance Certificates (EPCs), and the introduction of a common, harmonised EU scheme for rating the smart readiness of buildings. Changes to provisions on Technical Building Systems (TBSs) and the inclusion of inspections of ventilation and air conditioning systems are also welcomed.

A Building Renovation Passport (BRP) is defined as a document – in electronic or paper format – outlining a long-term step-by-step renovation roadmap for a specific building, resulting from an on-site energy audit and fulfilling specific quality criteria and indicators (such as energy consumption, daylight, indoor air quality, health conditions, thermal comfort, acoustic comfort, cost, etc.) [2]. As foreseen by the EPBD, BRPs will provide a clear roadmap for staged renovation over the lifetime of a building, helping owners and investors plan the best timing and scope for interventions [3].

Building Renovation Passports (BRPs) can help meet the ambitious EU energy efficiency targets by providing the necessary information and guidance to enable property owners to improve the energy performance of their properties and contribute to the reduction of GHG emissions. Providing clear, accessible, and affordable information that is bespoke to individual buildings can also deliver benefits along the retrofit supply chain. BRPs can help building owners make informed decisions, find funding, and connect with suppliers and service providers, simplifying the process of building renovations. Construction professionals can access information on the existing construction state of a property and make energy efficiency improvements that complement existing technologies, materials, and components. Real Estate Investment Companies (REICs) and individual property investors can better assess the risks to their portfolios and provide tailored products to customers, while accessing the data needed to develop new products and services. Local authorities can build a better understanding of the local building stock, enabling them to implement effective retrofit programmes at a local level. BRP initiatives are being rolled out in a growing number of European countries (Belgium, France, Germany etc.) [4] and can be designed to support all property tenures.

The Horizon 2020 iBRoad project (2017-2020) developed, tested, and delivered a model for the BRP in the form of a customised renovation plan (iBRoad-Plan), combined with a repository of information (iBRoad-Log) targeted to single-family residential buildings, which supported homeowners with personalised advice to facilitate stepwise deep renovation [5]. The Horizon 2020 project "iBRoad2EPC" builds on the results of

the iBRoad project, aiming to bridge the Building Renovation Passport (BRP) with the Energy Performance Certificate (EPC), and expand, improve, and broaden their format and joint scope to consider additional features, e.g., Indoor Environmental Quality (IEQ) and Smart Readiness Indicator (SRI), and become applicable to multi-family and public buildings. This bridging will make EPCs more useful by improving the recommendations to enable deep renovation (in one or several steps) through roadmap elements, preventing lock-in effects, incorporating national climate and decarbonisation targets and priorities in the proposed renovation steps, promoting synergies with existing tools and databases, etc.

The European building stock can be divided into residential and non-residential buildings. While the main use of residential buildings is housing, non-residential buildings can be used for a variety of purposes. For example, there are offices, educational buildings, hospitals, wholesale, retail, hotels, restaurants and more. Public buildings can be used either as residential buildings (social housing), but mainly are used as public administration offices, hospitals, and other public uses. In the EU27, Switzerland and Norway, the share of residential buildings is 75% (50% being single-family houses and 25% multi-family housing) and that of non-residential buildings is 25% [6]. The quantitative share of public buildings may be relatively small, but they are regularly addressed with specific obligations. All the aforementioned building types require an EPC in certain situations (e.g., buying/selling, renting) and thus also qualify as target groups for the iBRoad2EPC. Therefore, the extension of target building types from iBRoad's single family to iBRoad2EPC's single-family, multi-family, and public buildings was considered critical for the success of the tool.

The iBRoad2EPC project broadens the scope of the iBRoad concept and adapts it to national EPC schemes, to prepare the roll-out of next generation EPCs in Bulgaria, Greece, Poland, Portugal, Romania, and Spain. By adapting iBRoad2EPC to the national EPC schemes, it will reach more buildings than iBRoad; because it can be issued during all trigger occasions when the EPC is issued, it is expected to have a more direct impact and improve the EPC but it will not replace iBRoad. The aim is to improve reliability, usefulness, and effectiveness, thereby establishing the next generation of EPCs that will support Europe's decarbonisation ambitions as reflected in the Renovation Wave Strategy, while improving conditions for building occupants. The concept is flexible and modular, making sure it can be adapted when the markets are even more mature (e.g., more available building data, new financial instruments, increased public needs, etc.), and stays relevant when new building regulations come into effect.

OBJECTIVES OF THIS REPORT

iBRoad2EPC will be tested in the following countries: Bulgaria, Greece, Poland, Portugal, Romania, and Spain. The national guides of iBRoad2EPC aim at providing the necessary framework to initially support the national adaptation of the iBRoad2EPC and the preparation of the relevant pilot testing, and afterwards for the actual adoption of the proposed model in the six pilot countries.

The objective is to seek opportunities for creating interlinkage between iBRoad2EPC and national frameworks in the six pilot countries to support the renovation targets using iBRoad2EPC as the intermediary. The changes that may be needed in EPC characteristics and execution procedures, compliance checking, policy regulations, quality assessment, standards, costs, training, and certification schemes, as well as financing schemes for deep renovation, have been evaluated and discussed, to a different extent for each country. The individual elements of the guides have been examined and defined in collaboration with the National Advisory Committees (NACs) established within the activities of the project, to ensure that adaptation to the specific country conditions and building types is achieved. Interoperability issues with other national platforms (national buildings registry, EPC databases, EPC calculation software, etc.) will be identified and solutions are proposed to facilitate a smooth integration of the iBRoad2EPC to the current national EPC schemes.

The current report represents the first version of the national guides (initial national guides) which focus on the preparation for pilot testing of iBRoad2EPC through the presentation of an initial overview of the relevant contexts (regulatory, policy, market, etc.) in order to define the course of action, whereas the second -and updated- version of the national guides (final national guides) will complete the recommendations needed in the national frameworks to integrate the iBRoad2EPC in each pilot country's legislative, procedural, financial and market situation. At the end, these guides will serve the development of the national framework for the future adoption of iBRoad2EPC into the national context.

This report is structured as follows: chapters 1 and 2 give an introduction and show the objectives of this report. Chapter 3 provides an overview of the proposed iBRoad2EPC concept and tools, including its foreseen technical adaptation possibilities in terms of structure for use in the specific national context of each implementing country. In chapters 4 and 5, the six national guides of the iBRoad2EPC pilot countries (Bulgaria, Greece, Poland, Portugal, Romania, and Spain) are presented along with a summary of the key conclusions for the next steps and the implementation potential of iBRoad2EPC.

FROM EPC TO iBRoad2EPC

Concept and key features

The iBRoad2EPC concept is described in detail in the iBRoad2EPC project report "Conceptualising iBRoad2EPC: how Energy Performance Certificates (EPCs) can be upgraded with Building Renovation Passport (BRP) elements" [7]. Based on market analysis and mapping of stakeholders' needs, which revealed various levels of maturity of the market and capacity building, the iBRoad2EPC concept has been developed to be adaptable to the different local conditions of the Member States. The concept is flexible and modular, making sure it can be adapted when the markets are even more mature (e.g., more available building data, new financial instruments, increased public needs etc.), and stays relevant when new building regulations come into effect.

The implementation of iBRoad2EPC with a modular approach allows maximum flexibility and customisability. Thus, iBRoad2EPC can appear as an annex to the EPC as well as a stand-alone consulting product. The output document is available online. A printable version may be developed in the future. iBRoad2EPC follows a semi-flexible approach, in which a unified core can be complemented with additional modules. The basic content, the general design, and the key features of iBRoad2EPC, however, remain the same, regardless of its flexible adjustments as a complete package.

There are two options concerning the implementation of iBRoad2EPC in each Member State: either the iBRoad2EPC is introduced as a mandatory part of the EPC, or it will represent a voluntary tool. In the first case, building owners would receive additional information to the EPC they ordered; the additional cost in this case could either be financed by the state under certain conditions, or it should be limited so that building owners can afford and accept it. In the second case, building owners would decide if they were willing to pay for the added value, with the possibility of an additional funding scheme to support the market penetration of the tool. The concept for the iBRoad2EPC is to be able to serve both cases to meet the requirements in the respective MSs (Figure 1). The specific cost, effort, and coverage of the EPC and BRP spectrum, as presented below, is only indicative and may vary between the pilot countries.

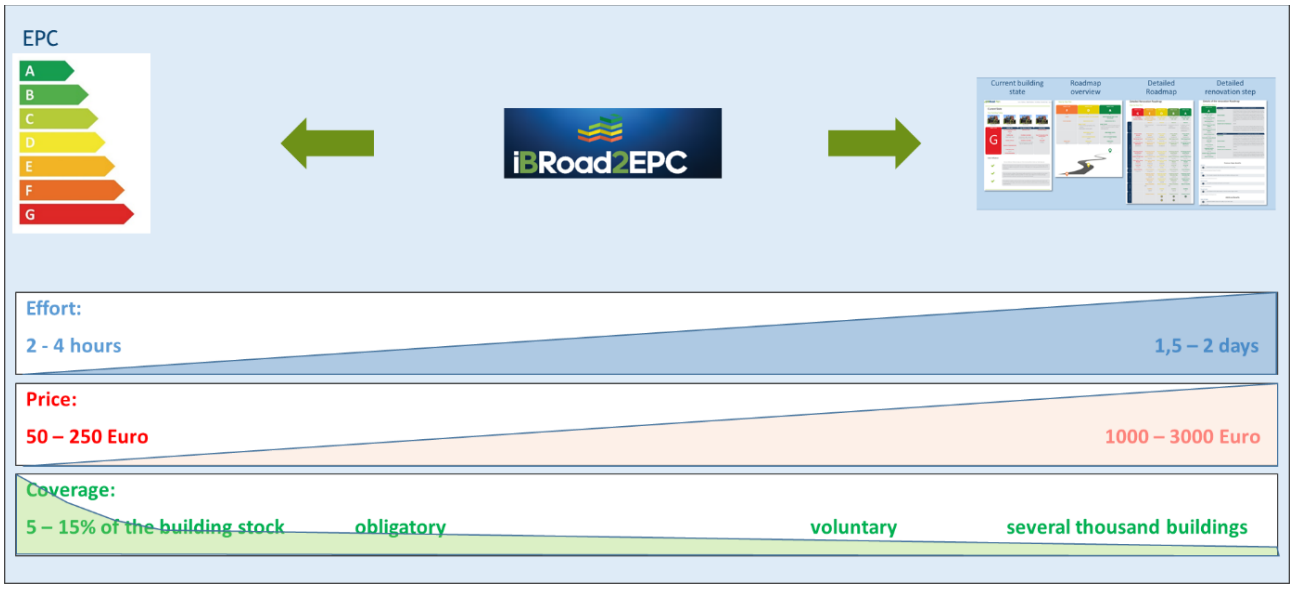

Figure 1: Strategic placement of iBRoad2EPC in relation to the existing EPC and the Building Renovation Passport (BRP) with consequences for effort and cost to issue and market penetration.

The Basic module is the above-mentioned unified core of iBRoad2EPC around which additional modules can be built. It comprises all core features of iBRoad2EPC (e.g., user interface, graphical illustration templates, basic project information and comprehensive renovation advice) and is the indispensable basis for the implementation of iBRoad2EPC. The main function of the Basic module is to provide to building owners the necessary technical information, as well as the target-oriented renovation recommendations that must be

included in every iBRoad2EPC. Additional modules can be integrated freely and independently of each other and extend the functionality of the Basic module. The following modules have been developed as part of the project's activities: i. Investment Cost module, ii. Energy Demand module, iii. Indoor Environmental Quality (IEQ) module, iv. Smart Readiness Indicator (SRI) module, v. Measured Energy Performance Indicator (MEPI) module. The development of other, potentially additional modules falls out of the scope and duration of the iBRoad2EPC project. However, with the core of the tool already in place they could be part of future, country-specific, enhancements.

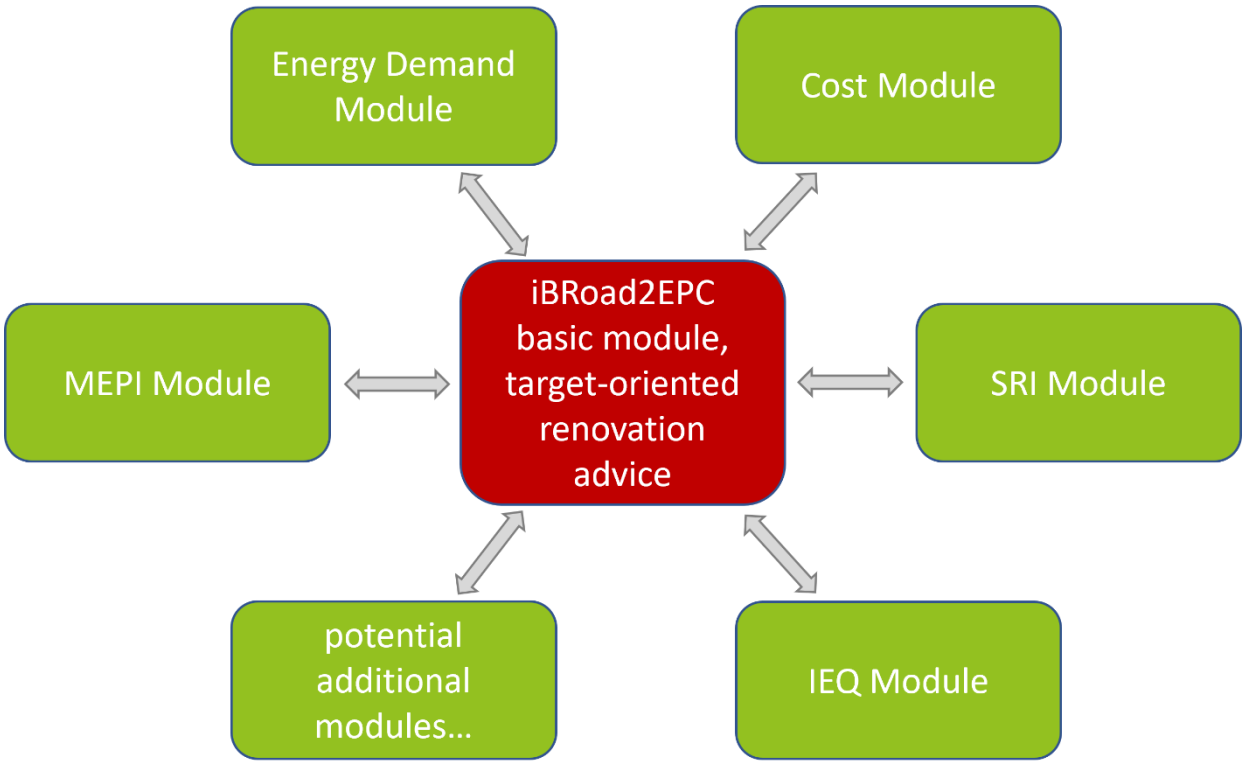

Figure 2: The modular structure of iBRoad2EPC makes it flexible and expandable.

Issuing procedure and interface

The iBRoad2EPC is created with an online tool called the iBRoad2EPC Assistant, similar to the iBRoad Roadmap Assistant developed in the predecessor project iBRoad (2017-2020) that was intended for creating the Renovation Roadmap documents. The iBRoad2EPC Assistant is a web application that serves as an input mask and produces the output documents, and is intended to be used by energy experts. The iBRoad2EPC Assistant can be implemented independently of other tools or software. It is not necessary to link it to the national calculation software or the national database. Rather, a database has been developed as part of the iBRoad2EPC project activities, which contains information on renovation measures, and is integrated in the iBRoad2EPC Assistant, functioning as the central library of the tool. Prefabricated text blocks are cumulated there to be chosen from the tool and displayed in the actual iBRoad2EPC automatically. The database works in a semi-flexible way; it contains text that applies to all as well as text that is country specific.

The structure used in the iBRoad2EPC Assistant allows for a user-friendly input of the building information, supported by dropdown menus and prefabricated text fields and functionalities. The objective of the iBRoad2EPC Assistant is to provide recommendations that are as individual as possible with as few data entries as needed. To this end, the Assistant guides the user through a simple data entry process. The inputs allow filtering the matching text blocks from the database. They are inserted as suggestions in the form. The iBRoad2EPC Assistant provides the issuer a preview of the iBRoad2EPC and allows him/her/it to make changes, e.g., to describe a specific building detail more precisely.

Figure 3 and Figure 4 present some input masks of the iBRoad2EPC Assistant. The tool is still under development at the time of editing this report and may change in terms of functionality and layout until the end of the project.

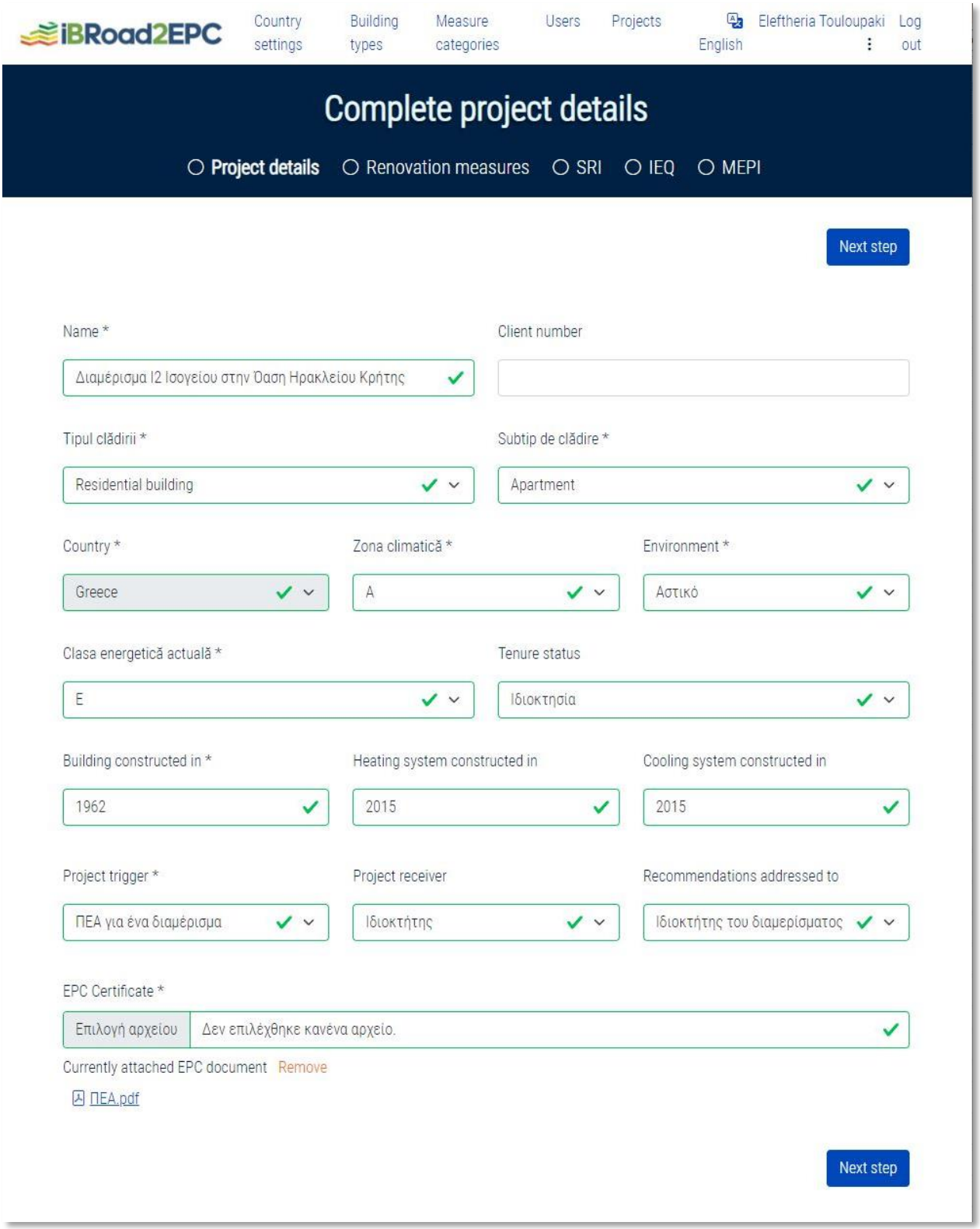

Figure 3: iBRoad2EPC Assistant Standard Front End: input mask for project details.

After all renovation steps have been entered, the iBRoad2EPC Assistant automatically inserts notes to help ensure that deep renovation is achieved at the end without lock-in effects, even if it is carried out in a

stepwise manner. The notes are created automatically but issuers can edit them if necessary. More details on the data input and information needed for issuing the iBRoad2EPC can be found at the "Technical report on the definition of the proposed concept, content and methodology of iBRoad2EPC" [8] and "Handbook for energy auditors" which is part of the iBRoad2EPC toolkit [9], respectively.

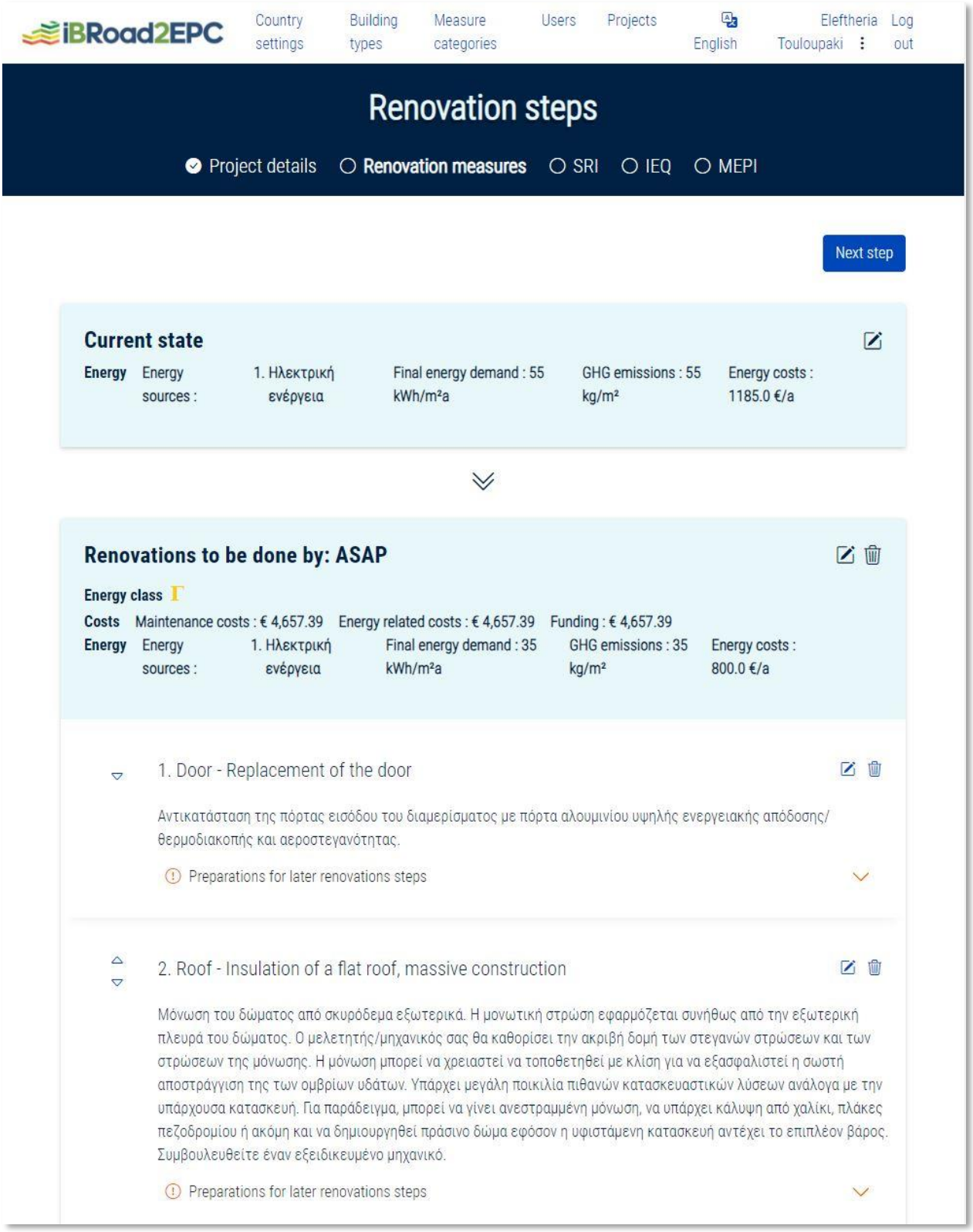

Figure 4: iBRoad2EPC Assistant Standard Front End: mask to assign renovation measures to given dates.

Outputs and illustrations

The contents of iBRoad2EPC will be presented online in a graphical layout. The layout has been prepared in view of offering an attractive, interesting appearance that presents complex technical content in a comprehensive manner, creating a recognisable brand for the whole family of iBRoad/iBRoad2EPC tools.

The output of the central graphic and detail pages of iBRoad2EPC are presented in Figure 5,

Figure 6 and Figure 7 below. Detailed information and other variants on the graphical design of iBRoad2EPC, including how results from additional modules are being displayed in the illustrations, can be found in Chapters 7, 8 and 9 of the "Technical report on the definition of the proposed concept, content and methodology of iBRoad2EPC" [8], mentioned before.

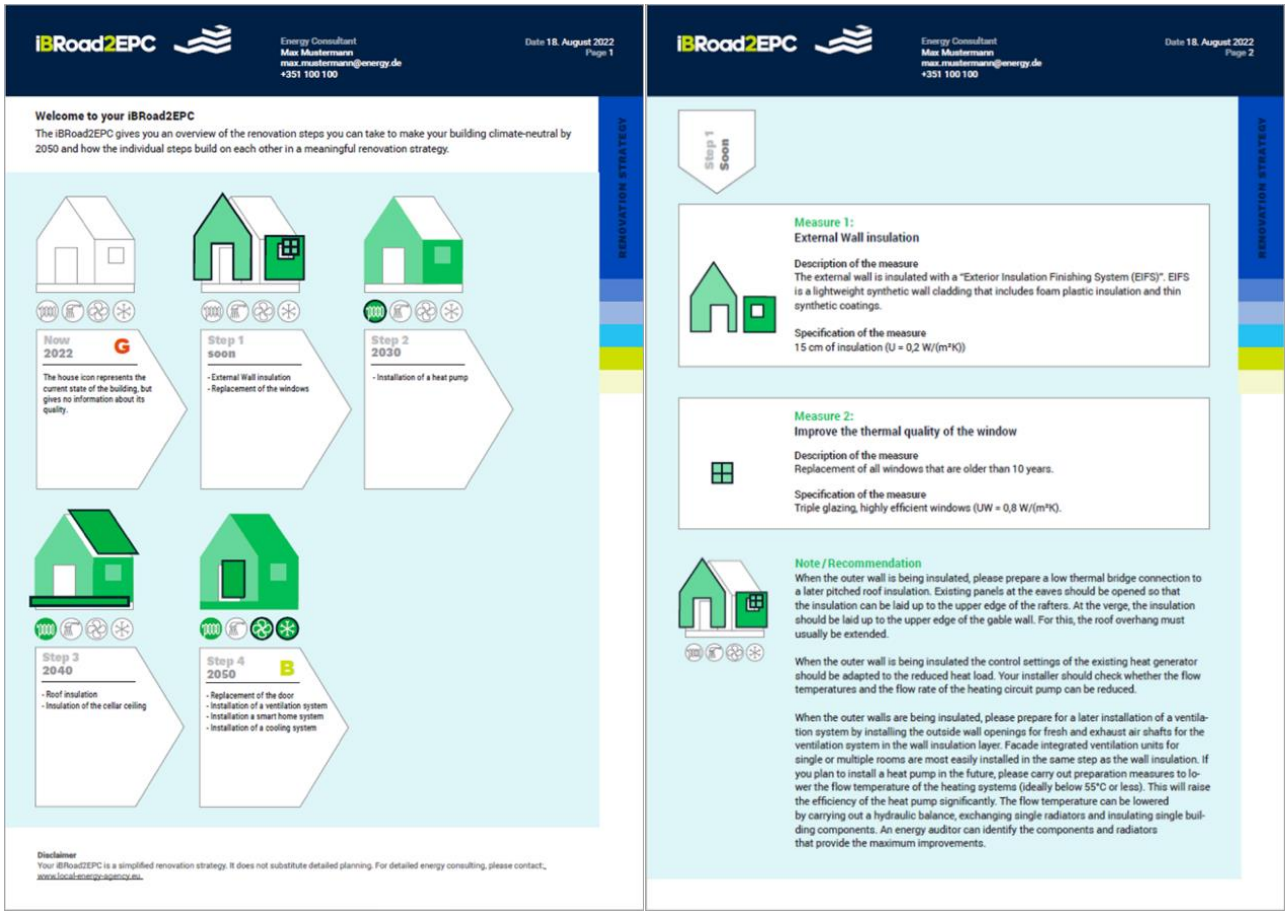

Figure 5: Document frame with central graphic (left) and detail page inserted (right).

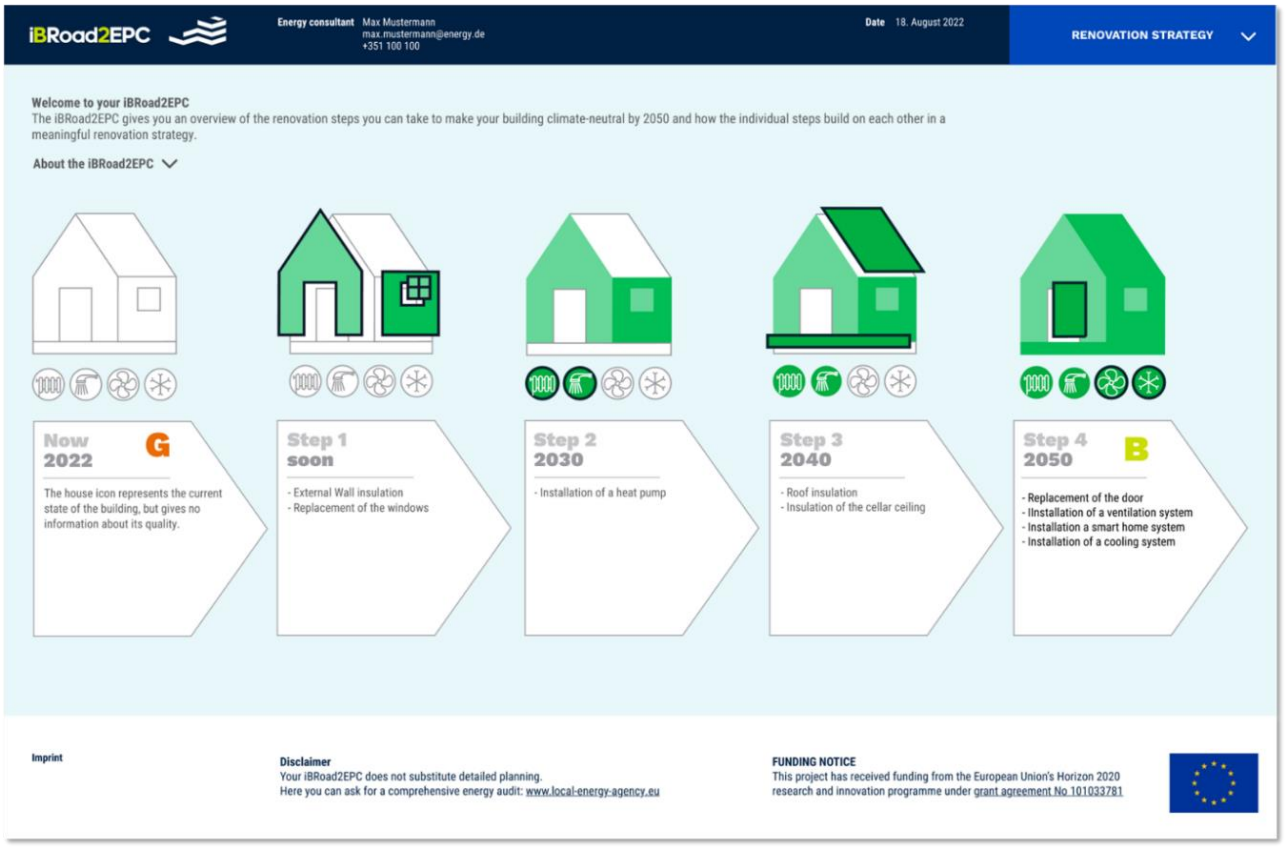

Figure 6: Online version of iBRoad2EPC: central graphic.

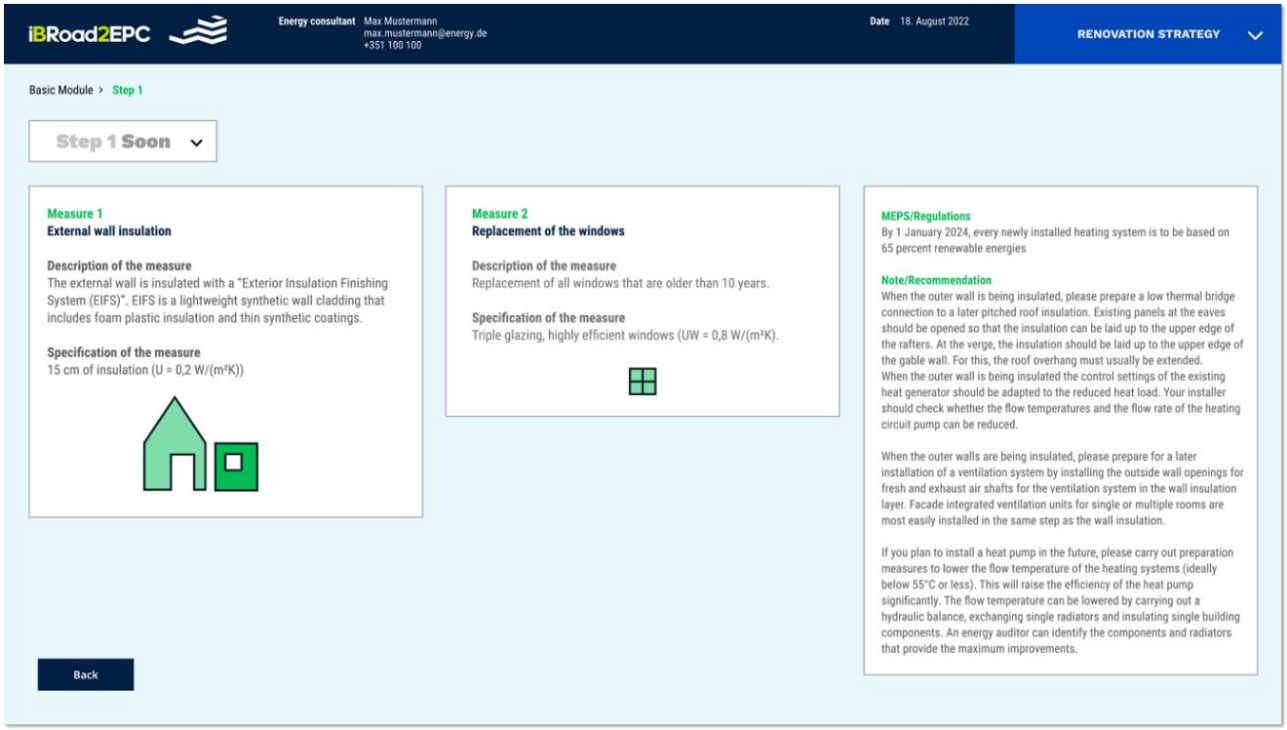

Figure 7: Online version of iBRoad2EPC: detail page.

The iBRoad2EPC training toolkit

A key objective of iBRoad2EPC is to boost the quality of EPCs and renovation works in general, and thereby improve user trust and their ability to undertake building renovation so as to reach a building's decarbonisation targets. For this to be achieved it is, among others, important to enhance EPC auditors' training, whereby experts must first gain sound understanding of the benefits and key principles of long-term planning for renovation. In addition, they must be trained on the use of the tools and methods for the creation of such a strategy.

The iBRoad2EPC training toolkit therefore introduces the iBRoad2EPC approach to EPC recommendations and its focus on the long-term objective of decarbonisation by:

- including target-oriented renovation advice in the form of improvement measures in a specific sequence to avoid lock-in effects;
- ensuring that every measure implemented is part of a comprehensive renovation strategy;
- complying with future regulatory and financial requirements, e.g., mandatory Minimum Energy Performance Standards (MEPS), mortgage portfolio standards or the EU taxonomy regulation, ban on fossil fuel boilers, etc.;
- presenting the recommendations in a way that can easily be understood by the end-user and considers the user's needs.

It thereby describes what iBRoad2EPC is, which added value it provides to building owners, and how renovation strategies can be set up in general. It then guides building professionals/issuers through the five steps of issuing the iBRoad2EPC. In addition, it includes new features and factors, such as the SRI, the IEQ and the MEPI of the buildings.

As already mentioned, iBRoad2EPC follows on its predecessor project, iBRoad, and related outputs. Accordingly, the iBRoad2EPC training toolkit has been developed following the structure of the iBRoad training toolkit (which included a Handbook for energy auditors, presentations for the train-the-trainer and auditors' training seminars, as well as a telephone hotline) [10].

The iBRoad2EPC training toolkit thereby comprises the following parts:

- a Handbook for energy auditors which explains the basic processes and technical details on how to issue an iBRoad2EPC for the building typologies under examination, including guidance and advice on how to assess IEQ, smart readiness and real energy consumption, what principles to respect and how to define the renovation steps in collaboration with the building users;
- presentations for the auditors´ training in which the use of the tools and the implementation procedures are introduced and explained step-by-step;
- a checklist and a blank template to be filled by the auditors/experts during the on-site visit as additional supporting material.

The iBRoad2EPC training toolkit will be available to all interested bodies through the project's website [9].

The intention of the iBRoad2EPC training is for it to become an integral part of the EPC auditor's training in the implementing countries. Pilot country partners were therefore asked to provide information on the EPC training requirements, material, seminars duration, etc., in order to better tailor the iBRoad2EPC training toolkit to the national conditions and combine it with existing EPC issuing procedures. A possible interaction of iBRoad2EPC with other products in the iBRoad family has been considered in its development so that together they form a meaningful whole.

iBRoad2EPC INITIAL NATIONAL GUIDES

The national guides of iBRoad2EPC aim at providing the necessary framework: initially to support the development and national adaptation of the iBRoad2EPC and the preparation of the relevant pilot testing and afterwards for the actual adoption of the proposed model in the pilot countries.

The national guides have been developed in close collaboration with the NACs and comprise:

- A brief overview of the current national situation regarding EPCs and BRPs. Each of the pilot countries features a different context regarding the EPC scheme, building stock characteristics and peculiarities, legislation, and national targets, as well as market maturity status. Therefore, it is important to highlight the specific conditions regarding gaps, needs and priorities that the iBRoad2EPC will need to fit in, and the added value it can offer. For this purpose, the general outcomes of the iBRoad2EPC project reports "Summary analysis of EPCs' alignment with national Long-term renovation strategies" [11], and "Conceptualising iBRoad2EPC: how Energy Performance Certificates (EPCs) can be upgraded with Building Renovation Passport (BRP) elements" [7] have been summarised and are presented in the national overview section of each pilot country.
- The proposed national iBRoad2EPC vision, based on market maturity status, existing frameworks, and upcoming policy priorities, needs and opportunities in relation to, e.g., targeted building typologies, necessary indicators, layout, training and capacity requirements, possible interlinkages with other tools and databases in the country, etc.
- A national Action Plan on how to address legal, social, financial, and other parameters along with the necessary steps, roles, and actions for the successful implementation of the national roll-out. The key policy recommendations for the successful implementation of iBRoad2EPC in the national contexts are being presented in the form of strategic aims, priorities, and actions, including the relevant stakeholders' roles and time-planning.

The first version of the national guides (initial national guides - current report) focuses on the preparation for pilot testing, whereas the second -and updated- version of the national guides (final national guides) will, following the field testing experience and stakeholders' feedback, review the initial assumptions and finalise the policy recommendations needed in the national framework to integrate the iBRoad2EPC in the country's legislative, procedural, financial and market situation. The methodology for the development of the national framework follows the concept of an integrated management cycle which encompasses the steps described below. The cycle (Figure 8) represents a process that promotes a holistic approach to policy making and can be repeated for future developments/adaptations of the iBRoad2EPC concept even after the duration of the project.

The proposed steps of the management cycle are analysed as follows:

Step 1:

For the first step, iBRoad2EPC pilot country partners have carried out an initial assessment of the stakeholders who are relevant to iBRoad2EPC, as members of the NACs or externally, using the "Stakeholder Universe" visual network analysis tool [12]. According to this procedure, the pilot partners initially identified the relative importance of particular stakeholder groups. Then, they created an overview of their expectations towards the project as well as their influence, level of expertise and flexibility to adapt their everyday (business) practices. Finally, they explored the networks that exist between them and could support the implementation and promotion of the project. The result was a comprehensive stakeholder network for each pilot country to map stakeholders' main characteristics to be used in the drafting of the initial iBRoad2EPC national guides.

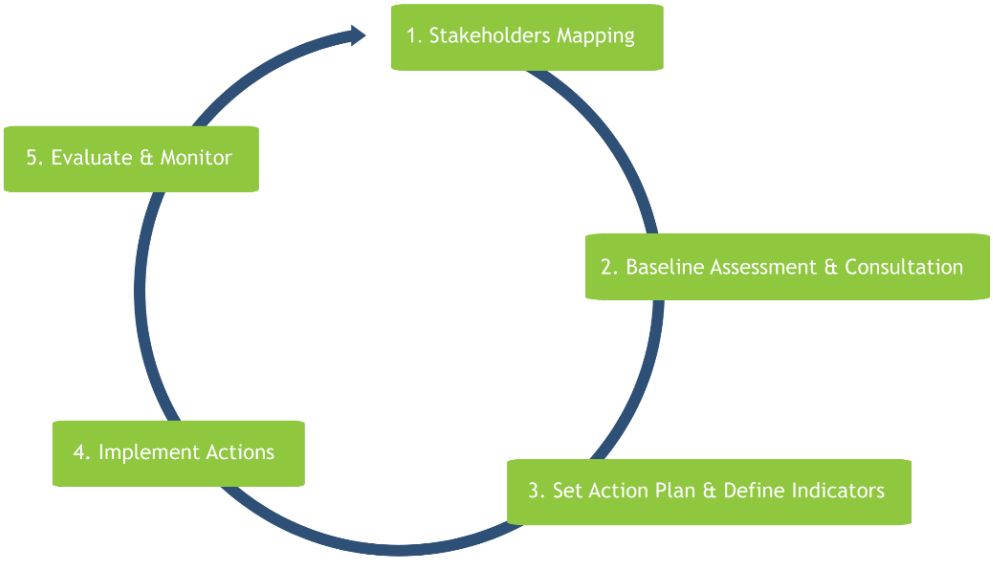

Figure 8: 5 steps of management cycle that can be repeated to promote informed policy-making.

Step 2:

As part of the second step, the main points of the baseline assessment for each pilot country have been re-evaluated in close collaboration with the NACs to identify needs, opportunities as well as challenges to be addressed for the iBRoad2EPC implementation. The identification of challenges, barriers, and drivers (legal, social, financial) of the existing national EPC framework was necessary in the process of formulating a concrete vision for iBRoad2EPC in the country. Moreover, the proposed iBRoad2EPC layout/format, graphics and features for validation and consultation have been presented to the NACs. Finally, pilot country partners considered how the iBRoad2EPC might align with potentially existing national policies or tools concerning EPCs and BRPs, and explored potential synergies by involving relevant stakeholders in the discussions.

Step 3:

After the baseline assessment, the pilot country partners have drafted (with the support and collaboration of the NAC members) an Action Plan for the national roll-out. A concrete vision for the iBRoad2EPC adoption in the country has been formulated by setting the aims and priorities of the Action Plan, as well as the actions and roles of the identified stakeholders with their respective timeframe.

Steps 4 and 5:

The fourth and fifth steps of the management cycle refer to the national testing and evaluation phases of iBRoad2EPC, respectively. A critical part of the iBRoad2EPC methodology is the testing of the tool in approximately 60 buildings (public, multi-family, etc.) in the six pilot countries. An evaluation process will follow, comprising the collection of feedback from national stakeholders, and its utilisation for the re-assessment of the national integration potential of iBRoad2EPC.

The initial national guides of iBRoad2EPC are presented in the following subsections. The country-specific vision of the tool is based on the national situation, as described in other project reports with different scope and focus, along with the consultation/contribution of the NACs.

Bulgaria

National overview

Some key information on the national targets and priorities, the EPCs and BRPs legislative framework, the building stock characteristics and the EPC framework in Bulgaria are presented below. Detailed information on the market analysis and the status quo of the EPC scheme in the country can be found in the iBRoad2EPC report "Conceptualising iBRoad2EPC: how Energy Performance Certificates (EPCs) can be upgraded with Building Renovation Passport (BRP) elements" [7].

National targets and priorities

The Bulgarian LTRS milestone for energy savings is 2,917 GWh/year to be achieved by 2030, which corresponds to a reduction of 6.9% in the total energy consumption of the households and services. The Bulgarian milestones for the renovation of the residential and non-residential building stock are in line with the scenario and additional policies used in the IECP for the period 2021-2030, with the target to achieve savings in the Primary Energy Consumption (PEC) of 27.89% and the final energy consumption of 31.69%. The Bulgarian LTRS mentions that by 2050, 60% of the residential housing stock and nearly 17% of non-residential housing stock will be renovated. The floor area of the renovated buildings will be more than 45 % of the total floor area of the entire housing stock in Bulgaria [13].

Due to the political situation in Bulgaria (without regular government since April 2021), public priorities on EPCs and BRPs have been frozen. However, the LTRS of the country recognises step-by-step renovation as a deep renovation policy.

The Bulgarian National Recovery and Resilience Plan offers renovation schemes for multi-family residential and public buildings at 100% grant rate, and a smaller scheme for industrial buildings at 35-45% grant rate. There is no scheme for single-family buildings.

Legislative framework

In December 2022, new norms, and rules on technical requirements for the energy performance of buildings were promulgated. This complies with the requirement of the Energy Efficiency Act (Article 31(5)) that the energy performance requirements of buildings should be checked and, if necessary, updated every 5 years.

The current laws and regulations on EPCs and BRPs are as follows:

Energy Efficiency Act:

- Ordinance No. E-RD-04-2 of 16 December 2022 of the Ministry of Energy and the Ministry of Regional Development and Public Works on energy efficiency auditing, certification, and assessment of energy savings of buildings (SG No. 102 of 23 December 2022).
- Ordinance No. E-RD-04-1 of 3 January 2018 of the Ministry of Energy and the Ministry of Regional Development and Public Works on the circumstances subject to entry in the registers under the Energy Efficiency Act, the entry and receipt of information from these registers, the conditions, and procedures for the acquisition of qualifications by energy efficiency consultants (SG No. 6 of 16 January 2018).

Spatial Planning Act:

- Ordinance No. RD-02-20-3 of 9 November 2022 of the Ministry of Regional Development and Public Works on technical requirements for the energy performance of buildings. (SG No. 92 of 18 November 2022, amended and supplemented SG 3 of 10 January 2023).

The new regulations are based on the ISO 52000 family of standards. However, they cite a number of other standards that auditors need to be familiar with in order to correctly apply the building energy performance methodology. The authority responsible for the norms and rules on technical requirements for energy performance of buildings is the Ministry of Regional Development and Public Works. However, the Sustainable Energy Development Agency (an executive agency of the Ministry of Energy) is responsible for the accreditation of energy auditors and the quality control of EPCs.

Currently, technical passports for existing buildings are not mandatory and the requirement to provide an EPC in the case of sale/lease of a building/part of a building is regulated by law, but there is no mechanism to monitor compliance.

Building stock characteristics

A detailed review of the national building stock is presented in Chapter 1 of the national LTRS (see Ref. above). Buildings are grouped into two main categories (residential and non-residential), and for each category different cross-sections of statistical data have been prepared, including type of use, type of ownership, year of construction, floor area, energy class, etc.

Regarding multi-family residential buildings, more than 96% of the dwellings are owned by the residents and a major effort is needed to unite all the owners to issue an EPC (or a BRP) for the whole building. For single-family houses, the main challenge is the already excessive cost and low perceived value of the EPC. In public and tertiary buildings, things are more regulated and iBRoad2EPC can be adopted considerably faster. In these buildings, shallow energy efficiency measures have been implemented in the past 5-10 years. Even though reinvesting in these measures may not be economically feasible, using the iBRoad2EPC to identify solutions and approaches for stepwise deep renovation will allow them to reach full potential of energy efficiency in the future.

EPC framework

All buildings in use with a total floor area of over 250 m^2 are subject to a mandatory audit and certification. The owners of any public-services building are bound to implement the measures prescribed by the energy audit for achieving the minimum required energy consumption class within three years from the date of acceptance of the results of the audit.

The Bulgarian EPC is very detailed and uses a tailored approach rather than a standardised one which is common for most other EU countries. In the Bulgarian methodology, default values for the inputs are not provided by the methodology, and the assessors use their experience or actual data collected on site to fill in such inputs. This makes the cost of the EPC, issued on the basis of a full-scale energy audit, with all prerequisites needed for submission to the Sustainable Energy Development Agency [SEDA (executive agency under Ministry of Energy)] extremely high compared with the EU practice. Due to the fact that it requires at least one week of work from a certified auditor and an on-site visit, it cannot be marketed for less than 1.500 euros, even in the case of a single-family building. Furthermore, the update of the Energy Performance of Buildings (EPB) assessment methodology in December 2022 has caused confusion and will lead to additional efforts for the energy auditors and, consequently, an additional increase of the cost of the EPC.

Only accredited energy auditors can issue EPCs. The auditors undergo a two-week full training course and examination procedure and must be of an engineering educational background (architect/civil engineer, HVAC/thermal engineer, or electrical engineer). A physical person is allowed to issue EPCs for buildings smaller than 500 m^2, whereas a legal entity employing more than 3 energy certifiers can issue an EPC for all buildings, regardless of their area. Even though Bulgaria has a very high level of education and experience requirements for energy auditors, which is to be expected since the Bulgarian method relies more on the assessor's knowledge and their data collection skills, no specialised certification /EPC training courses have been held for the past 10 years by any of the 6 licensed universities.

Compliance to the methodology and quality assurance of the energy audits, respectively of the EPCs, as well as the registry, control, inspection, and the authorisation of energy certifiers (energy auditors) is a responsibility of the SEDA. While the audits are usually checked for formal consistency, the reliability of the input data can hardly be traced. An online registry of all audited buildings is available on the SEDA webpage.

iBRoad2EPC vision

Proposed cost and effort

Because the Bulgarian EPC is already quite costly and detailed, it is proposed that iBRoad2EPC does not pose a high additional cost and effort to that (Figure 9). Also, the recent update of the EPC framework and calculation methodology has led to frustration among energy experts that could lead to an increase of the prices of EPCs. The placement of iBRoad2EPC in the EPC-BRP spectrum will be finalised after the testing phase of the project. iBRoad2EPC could serve as a supporting tool to facilitate energy experts in mitigating part of the costs by offering a comprehensive methodology along with a user-friendly toolbox (for example, already developed texts for recommendations will be available for the auditors to use as a base for the energy audit and EPC procedure).

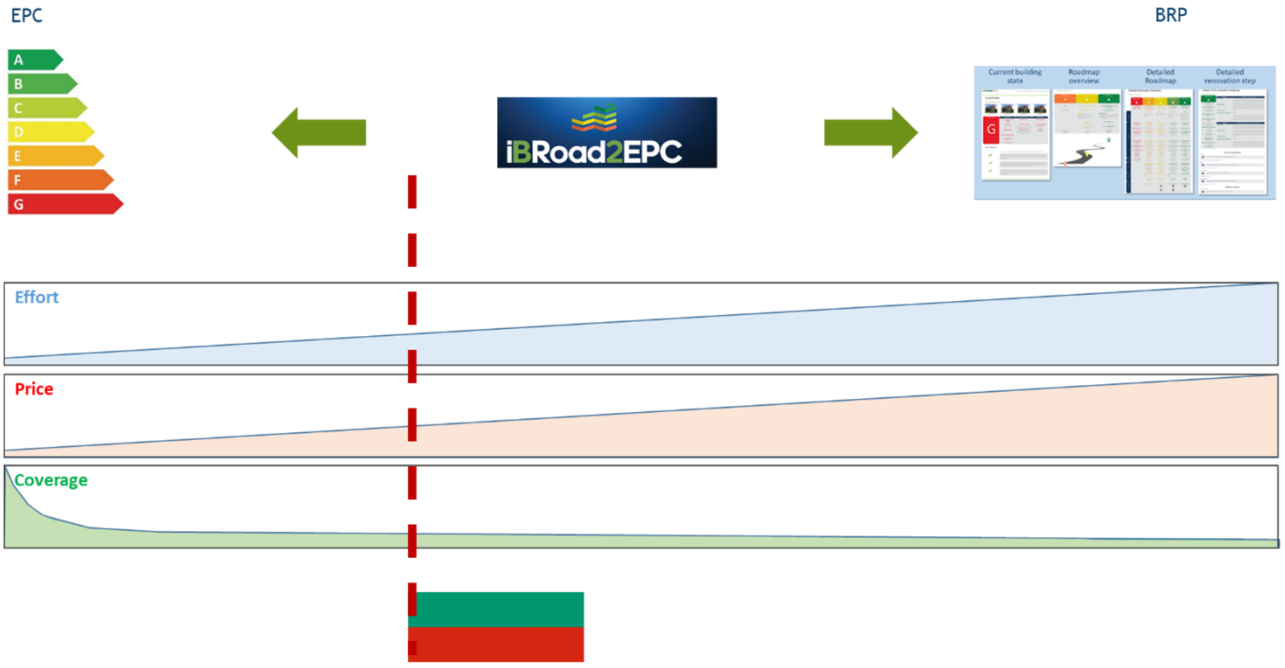

Figure 9: The Bulgarian iBRoad2EPC is conceptually placed towards the EPC end of the EPC-BRP spectrum.

Proposed modules

For Bulgaria, most of the proposed modules presented in Chapter 3.1 are considered necessary. This can be again attributed to the fact that the Bulgarian EPC is technically already quite advanced. Specifically, apart from the Basic module, the Investment Cost module should be adopted immediately, and the SRI and IEQ modules can be added at a later stage, even though they are considered very important. Regarding the MEPI module, it is not proposed to be implemented in the country, since measured energy performance is already present in a comprehensive way in energy audits. The Energy Demand module will become relevant no later than 2026, when the regulated energy market for the households will be abolished. Concerning the possibility of iBRoad2EPC additional modules which could be developed after the duration of the project, a possible module on electric mobility would be a useful addition. After the iBRoad2EPC training and field test in Bulgaria, feedback from energy auditors could lead to the suggestion of specific additional modules for future development after the end of the project.

Interlinkages and automation

Particularly useful would be the connection of the iBRoad2EPC Assistant to the EPC database maintained by SEDA. By establishing a connection to the database, the iBRoad2EPC Assistant would enable accurate and up-to-date data retrieval and storage, improving the efficiency and effectiveness of the iBRoad2EPC issuing procedure.

At the moment, the interconnection of iBRoad2EPC with the existing EPC procedure in Bulgaria is envisaged as follows:

As part of the EPC issuing process, all Bulgarian auditors have to fill out a specific Excel file. When the auditor starts creating a new enhanced EPC using the iBRoad2EPC Assistant, they will be given the possibility to upload this excel file. This would allow iBRoad2EPC to extract and pre-fill all data fields that auditors would normally have to enter manually, jumpstarting the iBRoad2EPC issuing procedure with very little effort and time. Moreover, it will extract the measures that the auditors have entered in the excel file to be implemented as soon as possible and add them to the ASAP step of iBRoad2EPC, adding also a note saying that the auditor should check the measure and maybe select a different variant if the most probable match was not the correct one. The time defined steps of iBRoad2EPC are particularly relevant in the Bulgarian case, because EPC recipients have to implement the recommended measures in a defined period of time.

Trigger points

The integration of iBRoad2EPC in the Bulgarian national framework could be linked with the report on the implementation of the LTRS and the new National Energy Climate Plan (NECP) that will include the updated LTRS. Moreover, the EPBD amendments and the change of the calculation software will affect the possible uptake level of iBRoad2EPC in the country. At this stage, it is assumed that iBRoad2EPC be used on a voluntary basis but connected to existing or future financing instruments, in order to facilitate its integration to the national framework by covering part of the extra cost compared to the (already expensive) EPCs. However, this is an ambitious goal that should be supported at governmental level as soon as the policy crisis in Bulgaria is over and a permanent Government is established.

Training procedures

Even though currently there are still issues with the EPC training and certification courses in the country, when they are resumed, the iBRoad2EPC training module could be integrated into the EPC auditors' training courses that are part of the national accreditation procedure for energy auditors. Also, it could fit into the World Bank consultation on auditors' training that is expected to be organised in the near future.

Action plan for the national roll-out

Nine (9) priorities have been set in Bulgaria, which are presented in the following overview.

Figure 10: Priorities for Bulgaria.

The Bulgarian Action Plan for the National roll-out is presented in the following overview. The Priorities are grouped in the Table per Aim served.

Priority	Aim served	Relevant stakeholder	Proposed actions	Timeframe	Indicators
P1: Simplify the EPC issuing procedure **P2: Emphasise innovative elements beyond energy with practical value** **P3: Secure funds to cover the cost of iBRoad2EPC** **P4: Promote financing schemes based on iBRoad2EPC**	**A1.** Increase market penetration of iBRoad2EPC/ create demand	Ministry of Regional Development and Public Works National Sustainable Energy Development Agency Technical university - Sofia Chamber of Energy Auditors	Discussions in the NAC and specialised forums Produce information materials about the added value of EPCs and the multiple benefits of renovation Apply for financing and execute pilot projects for	2022-2024 2022-2023 2023-2024	3 consultation forums 4 specialised articles 5-7 pilot implementations

Priority	Aim served	Relevant stakeholder	Proposed actions	Timeframe	Indicators
P5: Create the right control mechanisms		Chamber of Engineers in Investment Design Individual auditors, financing bodies and ESCOs	iBRoad2EPC application Advocate on improvement of the national support programmes and quality assurance mechanisms Support development of dedicated financing schemes based on EPCs	Cont. Cont.	Official positions on all relevant documents 3-5 meetings with financing institutions
P6: Ensure adequate exposure to the public via media channels **P7: Create a user-friendly platform/software** **P4: Promote financing schemes based on iBRoad2EPC** **P8: Ensure sufficient capacity to carry out deep renovations** **P2: Emphasise innovative elements beyond energy with practical value**	**A2.** Increase the number of deep renovations	Ministry of Regional Development and Public Works National Sustainable Energy Development Agency Academia Chamber of Energy Auditors Chamber of Engineers in Investment Design Individual auditors, financing bodies and ESCOs Media	Ensure media publication and appearances of experts Launch and promote the iBRoad2EPC platform in Bulgaria Advocate on the resuming of certification courses Produce information materials about the added value of EPCs and the multiple benefits of renovation	2022-2024 2023-2024 Cont. 2022-2024	3-5 publications/ appearances on the topic 10-15 web and social media publications Official positions and declarations on each occasion 4 specialised articles
P9: Ensure adequate exposure to potential replicators and partners **P4: Promote financing schemes based on iBRoad2EPC**	**A3.** Promote synergies between iBRoad2EPC and other projects	Representatives from other projects Financing institutes	Participate in dissemination conferences and joint events Support development of dedicated financing schemes based on EPCs Apply for financing and execute pilot projects for iBRoad2EPC application	Cont. Cont. 2022-2024	At least 10 participations by the end of the project 3-5 meetings with financing institutions 5-7 pilot implementations
P7: Create a user-friendly platform/software	**A4.** Ensure stakeholder involvement throughout the duration and	iBRoad2EPC / EnEffect Media	Adapt the iBRoad2EPC software	2023-2024	Operational platform

Priority	Aim served	Relevant stakeholder	Proposed actions	Timeframe	Indicators
	after the end of the project	Financing bodies	Promote the software through dissemination events and media publications	2023-2024	At least 10 participations by the end of the project
			Develop and promote examples and case studies presenting the benefits	2024	3-5 case studies for the use of iBRoad2EPC tools

Table 1: Bulgarian Action Plan for the National roll-out

Greece

National overview

The following sections include key information on the national targets and priorities for Greece as well as information on the legislative framework regarding EPCs and BRPs, the building stock characteristics and the EPC framework. Detailed information on the market analysis and the status quo of the EPC scheme in the country can be found in the iBRoad2EPC report "Conceptualising iBRoad2EPC: how Energy Performance Certificates (EPCs) can be upgraded with Building Renovation Passport (BRP) elements" [7].

National targets and priorities

According to the Greek LTRS [14], in view of achieving climate neutrality, buildings will need to achieve a reduction of the final energy consumption of 8% by 2030 compared to 2015, a reduction between 20 and 28% by 2040, and a reduction between 28 and 40% by 2050 compared to 2015, setting a clear roadmap for energy savings in buildings. For buildings and building units, the NECP's aim is to achieve energy upgrading ranging from 12 to 15% of the building stock in the period 2021-2030 through targeted policy measures. The Greek LTRS specifies that CO_2 emissions in buildings will be reduced by 100% by 2050 compared to 2005, under the most ambitious scenario.

The energy upgrade of buildings in the form of building renovations is included in the National Recovery and Resilience Plan (NRRP) [15] both as a sub-component and as part of a wider investment in the entire public sector, with a total funding of 4.1 billion euros. Almost 1.3 billion euros are earmarked for investments in energy savings in homes, with an additional 350 million euros available for adaptation and further energy efficiency as part of regeneration plans. Moreover, a separate loan facility will provide almost 1.4 billion euros for energy efficiency and demonstration projects to SMEs or large companies, in addition to 450 million euros in grants.

Among the priorities set by the authorities and/or the public in general are:

- to increase the buildings' renovation rate; actually, national energy efficiency upgrade schemes have been running since 2012, mostly for residential buildings, featuring a very high interest from the general public;
- to alleviate poverty and energy poverty, mostly with subsidy programmes (heating allowance, social solidarity income, housing allowance, social tariff, etc.); and
- to address social affairs (high on the agenda of most local authorities).

Legislative framework

Even through Building Renovation Passports (BRPs) are mentioned in article 2A of L. 4122/2013 regarding the Greek Long Term Renovation Strategy (LTRS) [14], they are not included in the official LTRS document itself. The national regulatory framework regarding EPCs and energy efficiency/renovation of buildings in general includes:

- the Regulation for the Energy Efficiency of Buildings (KENAK) with its accompanying technical guidelines (ΦΕΚ Β' 2367/12-07-2017)
- Building code NOK (Law 4067/2012 ΦΕΚ Α' 79/09-04-2012 as partially altered by more recent regulations)
- the National Long-term renovation strategy (LTRS) (ΦΕΚ Β' 974/12-03-2021)
- the National Energy and Climate Plan (NECP) (ΦΕΚ Β' 4893/31-12-2019)
- the National Recovery and Resilience Plan (NRRP)

Building stock characteristics

Residential buildings in Greece represent the vast majority (95,4%) of the existing building stock [14], with similar distribution among single-housing and multi-housing units. Nevertheless, 55,7% of the residential buildings have been built before 1980, when the first regulation on energy efficiency was published, and therefore are characterised by having no insulation at all. Multi-family buildings are generally owned by a

large number of persons, which makes decision-making procedures for any intervention, including energy efficiency upgrades, very challenging.

Commercial buildings represent a small percentage of the national building stock (4,6%). Also, hotels and buildings used for touristic purposes are present in many areas of the country (many houses are also used as touristic residences).

Regarding public buildings, according to Ministerial Decree Δ6/B/14826/17.06.2008 (B' 1122), there is an obligation for the appointment of an energy manager in every building occupied by public authorities. Moreover, from January 1st, 2021, every building leased and used by public authorities must be nZEB, and from December 31st, 2023, all buildings used by public authorities must score at least energy class B according to their EPC. Any construction work performed on public buildings is subject to a time-consuming procedure of procurement, assignment, and approval before the eventual release of funds, and in many cases their ownership status is unclear.

In many areas of the country there is a need to comply with special rules for the protection of cultural and architectural heritage. Finally, in Greece there is a big number of illegal (without permit or with partial permit) buildings, which have to go through a legislative procedure before proceeding with renovation works.

EPC framework

EPCs in Greece are seen as an administrative burden rather than a helpful tool for building owners, but due to the extensive legal obligations, there is high market penetration. Even though they are usually cheap and low quality, if executed according to the foreseen procedure following an on-site inspection, they contain solid information on renovation recommendations, payoff period, and target ratings after improvement which can be a facilitator for long-term BRP integration.

EPCs are mandatory for renting most types of buildings/building units, unless they are independent buildings with an area of less than 50 m^2, and for selling all types of buildings/building units in the context of the Digital Building Identity (DBI) scheme which includes EPC data. EPCs are also mandatory to be issued for new buildings and for buildings that receive public financing from the national energy upgrade programmes (energy efficiency renovation schemes). From January 1st, 2021, the EPC class of a property must be explicitly mentioned in all real estate advertisements.

The EPCs framework is regulated by the Ministry of Environment and Energy, under the jurisdiction of the Departments of Energy Inspection of Northern and Southern Greece. The Technical Chamber of Greece (TCG) is responsible for the calculation methodology, which follows the EN ISO 13790 standard, and the official EPC calculation software, TEE KENAK.

iBRoad2EPC vision

Proposed cost and effort

The price for an EPC in Greece for an apartment of 80 m^2 ranges from 50 to150 euros, with an average market price between 80 and 100 euros plus 24% VAT. This is already considered expensive by building owners. For the buildings participating in the national energy upgrade scheme, a cost of 75 +2.50 euros/m^2 (including VAT) is foreseen for the EPC (275 euros for an 80 m^2 apartment) which is a fair price for the required work and is completely subsidised. It is proposed that iBRoad2EPC is introduced in the Greek market in a two-fold manner: a basic version with necessary functions and modules, offered at a lower cost to make it more approachable to the vast majority of building owners, and a more advanced/full version with a freely negotiable price between the recipient and the energy expert. The basic version of iBRoad2EPC could cost a little more than the official EPC issuing cost, for example 75 + 4 euros/m^2 = 395 euros, depending on its final form and the necessary time required for its completion (Figure 11).

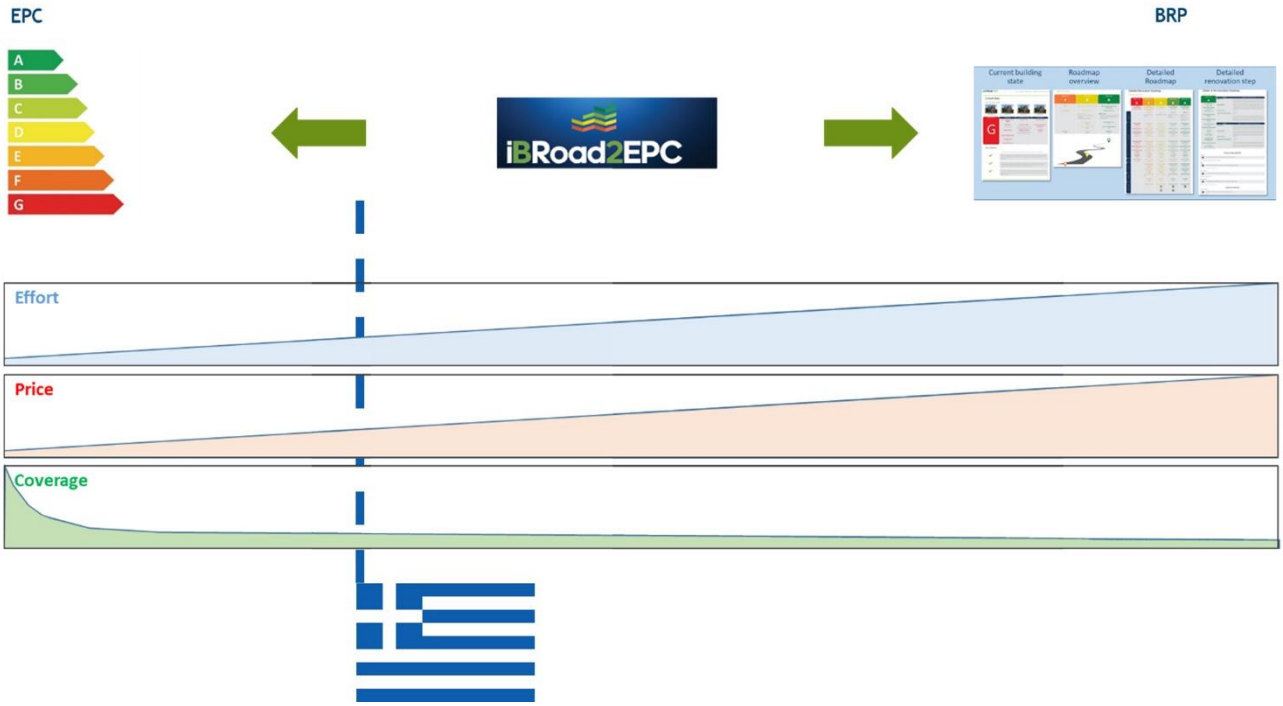

Figure 11: The Greek iBRoad2EPC is conceptually placed towards the EPC end of the EPC-BRP spectrum.

In case of participation at national energy upgrade schemes such as the "I am Saving" programme for residential buildings or the ELECTRA scheme for public buildings, iBRoad2EPC could complement the EPC submitted for the application with the detailed description of the proposed measures. Another financing option for the extra cost would be to promote iBRoad2EPC as part of the "business plan" submitted to banks for financing of renovation works independently from national schemes. One financing option could be through the budget under the National Recovery and Resilient Plan Greece 2.0 since components for building renovation exist and the green/sustainable transition axis is promoting the energy upgrades of high-consuming buildings.

A second financing option could be the Energy Efficiency Obligation Schemes (EEOS) under which energy providers must invest a specific budget for the increase of dwellings' energy efficiency through various actions. According to the EEOS, actions can include targeted programmes to boost the energy efficiency of buildings and appliances, installation of smart energy management systems, information campaigns on good energy management and conservation, etc. Based on the latter, a proposal can be prepared that an action could be the integration of iBRoad2EPC financing.

Proposed modules

For Greece, the following modules of iBRoad2EPC (apart from the basic module which acts as the core of iBRoad2EPC), as presented in Chapter 3.1, are considered especially useful:

- the Energy Demand module (ideally coupled with the EPC results).
- the Investment Cost module (with exogenous calculation until a reliable and updated national price database is established).
- The IEQ module, because of social implications (energy poverty).

The SRI module may not be of critical importance for the present conditions in the country, but it will be needed in the near future. Also, the MEPI module can be a useful addition, but is not considered necessary. In addition, a Logbook module (or other type of link to a Logbook) would be valuable as the owner's repository of all building-related information and data. Regarding the additional iBRoad2EPC modules which could be developed after the end of the project duration, a Water Efficiency module would be considered useful because of water shortage, especially in Greek islands; a RES module because of high solar availability

and obligations already in place and finally, a Summer Heat Protection module because of overheating issues that are prevalent in many Greek regions in the summer months.

Following what is described earlier, it is proposed that the basic iBRoad2EPC version is offered at a low cost, whereas a more advanced version may later comprise all developed modules and be offered at a price that is freely negotiable between the recipient and the energy expert.

Interlinkages and automation

EPC issuers in Greece enter the administrative building data manually on the online EPC platform "Buildingcert", which produces an XML file to be inserted into the national software TEE KENAK or other private software tools that utilise TEE KENAK's calculation engine through an API. After the auditor's work, the final XML file, which includes technical information on the building's components and systems (but not the results of the calculations), is uploaded to the Buildingcert platform which produces the EPC in PDF format using the TEE KENAK calculation engine remotely.

The iBRoad2EPC technical integration strategy currently explored in Greece is based on interlinkage with the EPC platform Buildingcert (managed by CRES) both to retrieve the basic administrative data of the building (address/geographical location, building permits, EPC results and recommendation scenarios, EPC in PDF format, etc.) and (on a later stage) to draw specific parts of the XML file which represent building components and systems to be directly linked with the renovation measures included in the iBRoad2EPC Assistant. These interlinkages would make iBRoad2EPC extremely more user/expert-friendly and marketable compared to a manually managed iBRoad2EPC issuing procedure.

Other platforms in the country that could be interlinked with iBRoad2EPC are the Cadastre, managed by the Ministry of Digital Governance, and the technical/permit platforms regarding Digital Building ID, legalisation documents, building permits, etc., managed by the Technical Chamber of Greece. The connection with a national cost database would aid in making iBRoad2EPC futureproof. An alternative to this would be a comparison feature between different buildings issuing an iBRoad2EPC in the same Climate Zone, to act as a reference basis for energy experts for price calculation.

Trigger points

It is proposed that iBRoad2EPC be a two-fold (basic and advanced version) voluntary addition to the EPC with the same trigger points, i.e., selling, renting a property, and enrolling in public energy upgrade schemes.

Training procedures

Training of EPC issuers is not mandatory by law since 2016, and training providers in Greece have almost stopped to offer training courses on EPC issuing. EPC issuers rely on the Technical guidelines offered by the Technical Chamber of Greece, along with the very few remaining options offered by private training providers. New products and services, such as the BRPs, create the need for upskilling and reskilling the workforce, both white and blue collars as new and connected to the new requirements skills are mandatory to properly deliver the needed works. A curriculum for BRPs, such as iBRoad2EPC, should be offered – upon the approval of the relevant stakeholders – to training centres and incorporate the relevant training modules into the existing training schemes.

Action plan for the national roll-out

For the Greek Action Plan, a set of five (5) priorities have been considered and discussed while the priorities are connected with six (6) aims. Specifically, the priorities for Greece, also presented visually in the following Figure 12, include the creation of a comprehensive tool for building energy upgrade embedded in the EPC scheme/ ensure sufficient capacity to carry out deep renovations and the integration of iBRoad2EPC in the national EE schemes. In addition, provisions should be made to ensure the integration of the iBRoad2EPC with the existing databases/tools while actions are needed to secure funds to cover the cost of iBRoad2EPC. Last, priority should be given to ensure a proper iBRoad2EPC support after the end of the project and make the concept of iBRoad2EPC future-proof.

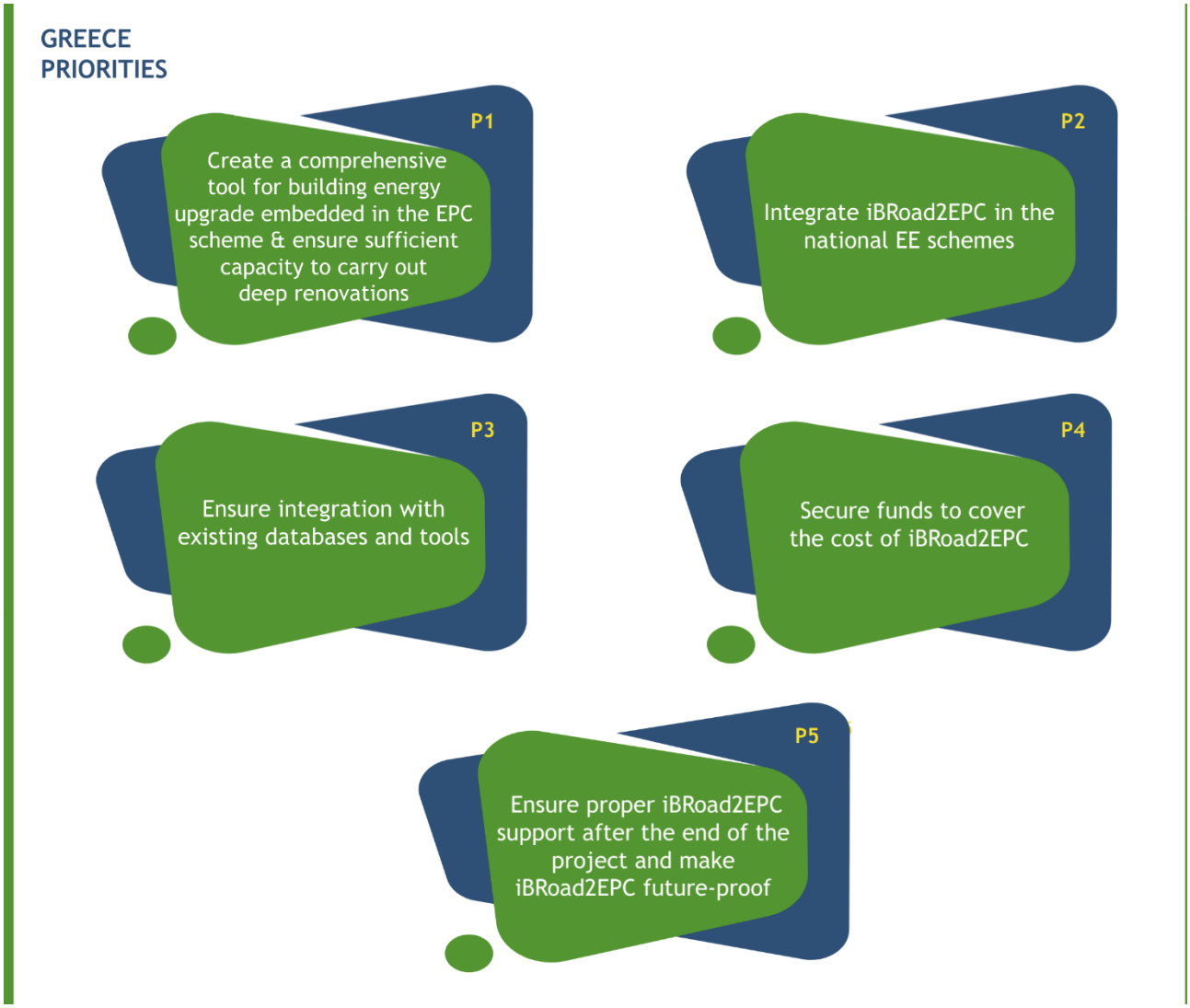

Figure 12: Priorities for Greece.

The Greek roll-out is presented in the following Action Plan for the National roll-out in Table 2.

Priority	Aim served	Relevant stakeholder	Proposed actions	Timeframe	Indicators
P1: Create a comprehensive tool for building energy upgrade embedded in the EPC scheme/ ensure sufficient capacity to carry out deep renovations	**A1.** Increase the number of deep renovations **A3.** Promote future-proof benefits and advancements of deep renovation **A5.** Build trust on the importance of informed renovations and the iBRoad2EPC/ create demand	EPC scheme Group of Interest (GOI) stakeholders	Test iBRoad2EPC's compatibility with existing tools/databases Organise training sessions for experts, info days for relevant stakeholders and bilateral communication with parties responsible for the EPC scheme Gather feedback from stakeholders Media/dissemination campaign of the new iBRoad2EPC - link with the market via OSS integration	2023 (Q1) 2023 (Q2-3) 2023 (Q4) 2024 (Q1)	Number of iBRoad2EPC/ buildings tested Number of experts completing the trainings Number of publications
P2: Integrate iBRoad2EPC in the national EE schemes	**A1.** Increase the number of deep renovations **A2.** Increase public awareness for deep renovation **A5.** Build trust on the importance of informed renovations and the iBRoad2EPC/ create demand **A6.** Increase the percentage of private funding for energy renovation projects	EPC scheme GoI stakeholders EE scheme GoI stakeholders	Identify relevant fields/documents of EE schemes templates/ documents ("I am saving" and "ELECTRA" programmes) to embed iBRoad2EPC Stakeholder communication sessions to gather feedback on the integration potential of iBRoad2EPC in national EE schemes	2023 (Q1-2) 2023 (Q2-3)	Number of documents/ fields embedded in iBRoad2EPC Number of sessions organised
P3: Ensure integration with existing databases/ tools	**A3.** Promote future-proof benefits and advancements of deep renovation **A4.** Ensure iBRoad2EPC consistency with future national and European targets (LTRS, NECP, EPBD etc.) **A5.** Build trust on the importance of informed renovations and the iBRoad2EPC/ create demand	EPC scheme GoI stakeholders	Ensure maximum compatibility/ flexibility of iBRoad2EPC formats/layouts with national layout – to be done within the NAC meetings Test iBRoad2EPC's compatibility with existing tools/databases (DBI, Buildingcert, Cadastre, TEE KENAK)	2023 (Q1-2) 2023 (Q2-3)	Number of iBRoad2EPC features automatically drawn from existing sources

Priority	Aim served	Relevant stakeholder	Proposed actions	Timeframe	Indicators
P4: Secure funds to cover the cost of iBRoad2EPC	**A1.** Increase the number of deep renovations **A2.** Increase public awareness of deep renovation **A5.** Build trust on the importance of informed renovations and the iBRoad2EPC/ create demand	EPC scheme GoI keyholders EE schemes GoI stakeholders EE market GoI stakeholders	Identification of possible funding sources to cover for iBRoad2EPC additional cost – to be done within the NAC meetings Info sessions/ bilateral communications with banks for embedding iBRoad2EPC in the business plans they receive for green loans Embed iBRoad2EPC in OSSs and promote via online marketplaces	2023 (Q1-3) 2023 (Q2-3) 2023 (Q4)	Number of financial instruments established Available budget in euros for iBRoad2EPC Number of iBRoad2EPC/ buildings tested
P5: Ensure proper iBRoad2EPC support after the end of the project/ make iBRoad2EPC future-proof	**A1.** Increase the number of deep renovations **A4.** Ensure iBRoad2EPC consistency with future national and European targets (LTRS, NECP, EPBD etc.) **A5.** Build trust on the importance of informed renovations and the iBRoad2EPC/ create demand **A6.** Increase the percentage of private funding for energy renovation projects	Consumers GoI stakeholders EPC scheme GoI stakeholders	Ensure adaptation capacity/ iBRoad2EPC flexibility for changing national context – to be done within the NAC meetings Media/dissemination campaign of the new iBRoad2EPC - link with the market via OSS integration Establish an iBRoad2EPC support mechanism (website-hotline-e-mail support) to be available after the end of the project	2023 (Q1-2) 2024 (Q1) 2024 (Q1-2)	Number of publications

Table 2: Greek Action Plan for the National roll-out

Poland

National overview

Some key information on the national targets and priorities, the legislative framework regarding EPCs and BRPs, the building stock characteristics and the EPC framework in Poland are presented below. Detailed information on the market analysis and the status quo of the EPC scheme in the country can be found in the iBRoad2EPC report "Conceptualising iBRoad2EPC: how Energy Performance Certificates (EPCs) can be upgraded with Building Renovation Passport (BRP) elements" [7].

National targets and priorities

The Polish LTRS draft mentions strategic targets for the decarbonisation of the building stock covering a complete pphase-out of coal for heating by 2050, phase-out of coal in the residential buildings by 2040, and phase-out of natural gas in both residential and non-residential buildings by 2050.

The fast and deep renovation scenario assumes that by 2027 all buildings with an annual primary energy consumption greater than 330 kWh/m^2 and by 2035 buildings with an annual primary energy consumption greater than 230 kWh/m^2 will be renovated. Consequently, this means that in 2045 the annual primary energy consumption of all buildings will be less than 150 kWh/m^2. Based on this scenario, by 2050, 65% of the buildings will consume annually no more than 50 kWh/m^2, and 24% will consume between 50 and 90 kWh/m^2. Buildings that cannot be extensively modernised (the remaining 11%) will have an annual primary energy consumption between 90 and 150 kWh/m^2. The renovation rate of this scenario is 3%.

The strategy does not include any target dates or percentage reductions in carbon emissions, nor is there an explicit target for fully decarbonising the building sector [16]. However, it refers to performance indicators for the implementation of the LTRS. Poland sets a target value for CO_2 emissions from fossil fuel combustion in residential, commercial, and stationary sources in agriculture of equal to or less than 35 $MtCO_2$ by 2030 in comparison to the 2018 baseline of 52 $MtCO_2$.

Among the priorities set by the authorities and/or the public in general in Poland are the thermomodernisation and energy efficiency upgrade of existing buildings in order to meet EU targets and the goals of the LTRS, the reduction of greenhouse gas emissions and the advancement of building cataloguing/registration procedures in order to effectively manage the building stock.

Legislative framework

Building Renovation Passports (BRPs) are not yet presented in the national legislative framework but the Energy Passport will be included in the government document "Long-term Thermo-modernisation Strategy for Poland in the 2050 perspective". EPC/energy efficiency of buildings related regulations in the country are:

- the Law on Energy Performance of Buildings from 2014 (Ustawa z dnia 29 sierpnia 2014 r. o charakterystyce energetycznej budynków (Dz.U. 2014 poz. 1200 - amended in April 2023)
- the Ordinance on the methodology of building Energy Performance calculations and Energy Performance Certificate from 2015 (Dz.U. 2015 poz. 376 z późn. zm. - amended in April 2023)
- the Construction Law (Dz.U. 1994 nr 89 poz. 414 z późn. zm. - amended in April 2023)
- the Central Register of Emissivity of Buildings (CEEB)
- the act on supporting thermo-modernisation and renovation of buildings (Uchwała nr 91 Rady Ministrów z dnia 22 czerwca 2015)
- Regulation of the Minister of Infrastructure of April 12th, 2002, on technical conditions to be met by buildings and their location (Dz.U. 2022 poz. 1225)

The national legislation on the energy efficiency of buildings is characterised by complexity and lack of transparency among procedures that generally require a high amount of time.

Building stock characteristics

The majority of the buildings in Poland are in poor condition. This fact, combined with the high electricity/heating prices has led to high energy poverty rates. Moreover, the general public is not aware of the multiple benefits of a well-performed energy renovation, resulting in buildings undergoing thermal modernisation insufficiently (DIY renovations without expert advice/counselling) or with unsuitable materials. Commercial buildings are characterised by a frequent change of ownership that hampers long-term programming for renovation, and a lack of shared information. Housing cooperatives, which manage almost 2.8 million multi-family buildings (of the around 7 million residential buildings of the country), undergo a lengthy procedure of municipality approval for energy upgrade works and the distribution of funds must be accepted by every flat owner. Regarding public buildings, buildings that are newly built are preferred for use over renovated ones or historical buildings that require more complex procedures for energy renovation.

EPC framework

The EPC in Poland is currently mandatory for the sale of an apartment/house, for public buildings over 250 m^2 and, after the legislation updates enforced as of April 2023, it is mandatory also for rentals. Under the new regulations, the owner or manager of a building or part of a building will have to provide the tenant with a copy of the EPC and the tenant will not be able to waive the right to receive the document. In addition, EPC data will be mandatory for real-estate advertisements.

The fact that an onsite visit is not officially required for issuing an EPC in Poland hampers the quality of issued EPCs and implies a difficulty in identifying tailored recommendations for improvements. Software tools that are used for EPC issuing (e.g., Audytor OZC, the ArCADia Thermo and the BuildDesk Energy Certificate) are provided by private companies, whereas simpler tools addressed to building owners have been developed by manufacturers of building materials. EPCs in Poland do not feature classes or recommendations, are considered hard to understand and not of great value by building owners.

There is a lack of enforcement and quality control of the EPCs from the ministry and the EPC database is not publicly accessible. Also, since being an EPC issuer is not well paid, there is a lack of certified energy experts and a need for effective training on energy efficiency in general. The fairly high costs of EPCs, coupled with the lack of enforcement by the responsible authorities create resentment from the building owners towards paying for an EPC.

Regarding funding opportunities for energy efficiency interventions, there are no subsidies available, only loans which require complex procedures to obtain.

iBRoad2EPC vision

Proposed cost and effort

In Poland, a cheaper and faster solution is preferred with regards to the iBRoad2EPC proposal, but for those who are interested, it should be possible to issue a more detailed document with more BRP characteristics and a higher cost. The cost of the EPC ranges from about 300 PLN (~65 euros) for a single-family house to more than 1000 PLN (~220 euros) for more complex buildings, and it is proposed that the cost of issuing an iBRoad2EPC should not exceed twice the cost of the EPC (for example: EPC for a single-family house 65 euros + iBRoad2EPC 130 euros) (Figure 13). The placement of iBRoad2EPC in the EPC-BRP spectrum will be finalised after the testing phase of the project. iBRoad2EPC will have to be privately financed, since no national funding is expected in the near future.

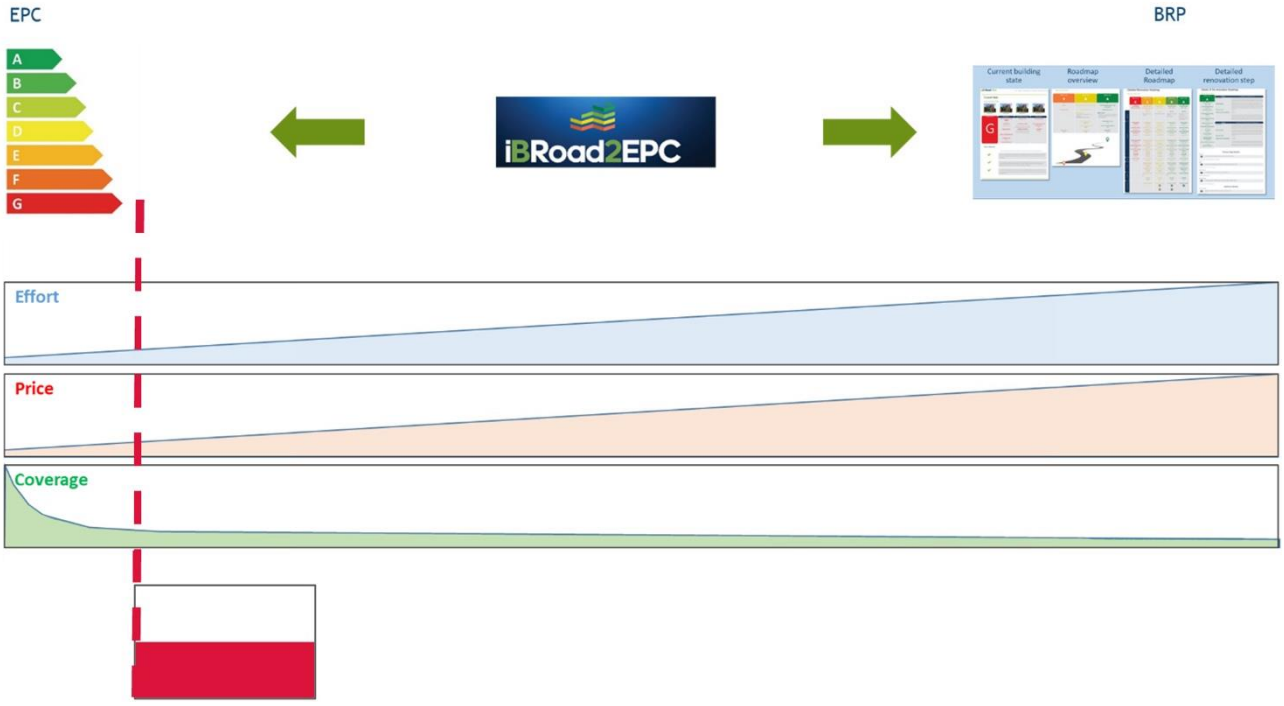

Figure 13: The Polish iBRoad2EPC is conceptually placed near the EPC end of the EPC-BRP spectrum.

Proposed modules

The most important modules of iBRoad2EPC for Poland are (apart from the Basic module) the Energy Demand module, the Investment Cost module and the SRI module. It is, however, advisable by the Polish NAC that the proposed modules be implemented together, as a holistic, comprehensive tool, and not separated to implement, for example, only one. The most important module for the country is the Investment Cost module; since Poland lacks recommendations for energy efficiency measures in the EPC, the Investment Cost module would complement the EPC very well and form a breakthrough for the country. The Energy Demand and SRI modules seem to be equally important; the ministry is trying to make the calculation of the SRI mandatory in the EPCs but there is no specific calculation method mentioned. For the moment, it seems difficult to implement the IEQ, MEPI and additional modules, because of lack of expert training on these matters.

Interlinkages and automation

The Polish EPC database is not available for general use, not even for auditors. The only data available is the "List of buildings whose usable area occupied by the judiciary, prosecutor's office and public administration bodies, exceeds 250 m^2 and in which services are provided to the public"; this includes iformation on the usable area, CO_2 emissions, share of renewable energy sources in annual final energy demand, as well as an index of annual usable/final/primary energy demand of the building. Also, there is neither an XML approach used in the country nor an official software for the issuance of EPCs. Energy experts calculate EPCs with various excel tools and upload data into the above-mentioned EPC database manually, without calculation.

. The following options for integration are currently explored: (a) establishing links with a private software tool which implements the Polish calculation approach, (b) checking which information iBRoad2EPC could contribute to the current EPC database, and (c) the possibility of uploading the excel file for EPC calculation into iBRoad2EPC and reading its contents automatically.

Trigger points

iBRoad2EPC in Poland is proposed to be voluntary. Despite the legal obligation of having an EPC for new buildings, owners in reality do not issue EPCs since there is no enforcement control from the ministry. A mandatory iBRoad2EPC, considering also the fact that Poland does not feature an official software for creating EPCs, seems to be monopolistic. Activities should focus on promoting the benefits of having an EPC and the iBRoad2EPC concept, because only after raising the awareness of owners will there be an opportunity to try to introduce iBRoad2EPC into the legal framework. The iBRoad2EPC may even be proven to be more encouraging to building owners than the EPC itself, because it fills the gap of the lack of recommendations and costs estimation for thermal upgrades. Finally, access to finance and subsidies for energy upgrade interventions based on the iBRoad2EPC is also a possibility that would boost its uptake in Poland.

Training procedures

Due to the lack of training for energy experts, iBRoad2EPC will need to feature its own training course. This will require trainers who are responsible for this and will provide training only for iBRoad2EPC, which may result in a shortage of trainees and high costs. The interest of energy experts will depend on the level of adoption of iBRoad2EPC in the country and its demand from building owners. Therefore, the legal placement of iBRoad2EPC in the national framework is of crucial importance.

Action plan for the national roll-out

iBRoad2EPC's implementation strategy will mainly consist of increasing public awareness of its benefits, showing energy experts that it will be easy to use, improving their knowledge and capabilities, and allowing them to expand their range of services. Also, emphasis will be given to the fact that iBRoad2EPC could help meet the national LTRS goals. For Poland, four (4) priorities have been set. First is to build trust in deep renovations and encourage the use of EPCs. Second is to integrate iBRoad2EPC with the Polish EPC methodology and achieve compatibility with the development plans of the ministry. The third priority is securing funds to cover iBRoad2EPC, and the fourth is to support the iBRoad2EPC after the project ends. The Polish priorities are presented in Figure 14.

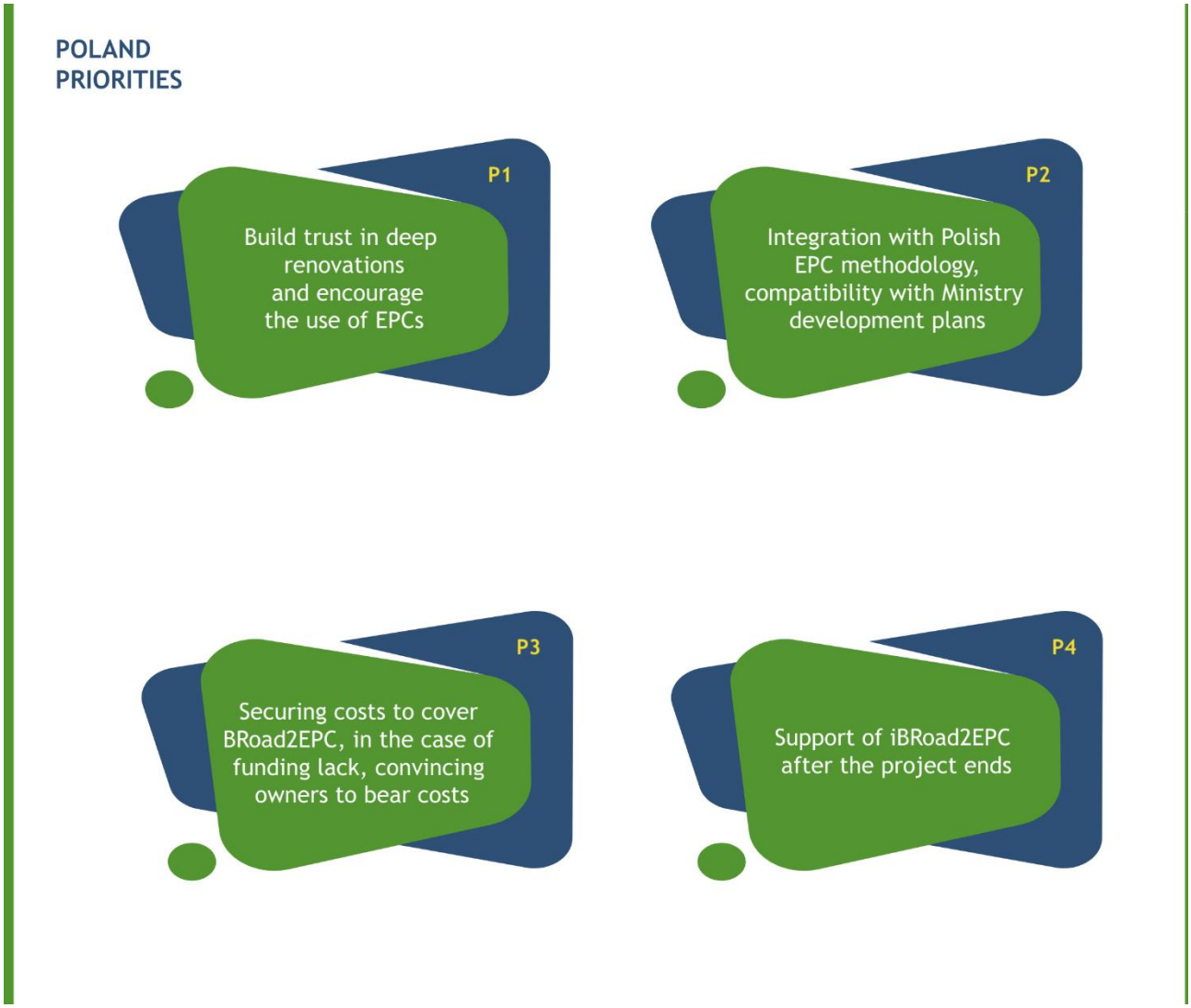

Figure 14: Priorities for Poland.

The Polish Action Plan for the National roll-out is presented in the following overview.

Priority	Aim served	Relevant stakeholder	Proposed actions	Timeframe	Indicators
P1: Build trust in deep renovations and encourage the use of EPCs	**A1.** Increase public awareness for deep renovation, possibility to continue renovations, Convincing building owners to purchase EPCs and showing the benefits of deep renovation, Increase in the number of EPCs generated	MRiT, NCBR, ZAE, FPE	Proposing changes to the LTRS (MRiT), creating a joint information campaign (ZAE, FPE), creating a research programme on building energy efficiency (NCBR)	Starting before the end of project (end of 2023)	Visibly more modernised buildings or being under works
P2: Integration with Polish EPC methodology, compatibility with ministry development plans	**A2.** Controlling and requiring EPCs so that iBRoad2EPC can be issued, Ensure iBRoad2EPC consistency with future national and European targets (LTRS, NECP, EPBD etc.), Create demand for iBRoad2EPC, focus on gaps that this tool can fill in	MRiT	Proposing changes in (MRiT)	Starting before the end of project (beginning of 2024)	Open database, more accessible EPCs to public, Execution of law (fines in a case of absence of EPC)
P3: Securing costs to cover iBRoad2EPC, in case of lack of funding convincing owners to bear costs	**A3.** Funding will enable thermal upgrades to continue despite market problems, Owners' belief that the benefits of owning an iBRoad2EPC outweigh the costs (in case of lack of government funding)	MRiT, BGK	Proposing creation of a grant programme, grants based on the submitted EPCs and iBRoad2EPCs (BGK, MRiT)	Starting before the end of project (mid 2024)	Stable level of thermal upgrades regardless of market situation
P4: Support of iBRoad2EPC after the project ends	**A4.** Raising awareness among homeowners, showcasing thermo-modernisation opportunities via iBRoad2EPC, Attempt to change in law - from optionality to legal requirement	FPE, ZAE, Saint-Gobain, MRiT	Posts by stakeholders on their websites, social media, promoting information (FPE, ZAE, Saint-Gobain), proposing changes in law (MRiT)	After the end of project, to continue bringing awareness of iBRoad2EPC (end of 2024 till 2026)	Public campaigns informing about thermo-modernisation and iBRoad2EPC

Table 3: Polish Action Plan for the National roll-out

Portugal

National overview

Detailed information on the market analysis and the status quo of the EPC scheme in Portugal can be found in iBRoad2EPC report "Conceptualising iBRoad2EPC: how Energy Performance Certificates (EPCs) can be upgraded with Building Renovation Passport (BRP) elements" [7]. The below sections provide a summary of key information on the national targets and priorities, the legislative framework regarding EPCs and BRPs, the building stock characteristics and the EPC framework.

National targets and priorities

The Portuguese LTRS [17] presents several policies and actions aiming to increase the renovation rate and establishes a roadmap of improvement measures as well as indicative milestones for 2030, 2040 and 2050 monitored by a set of progress indicators. The country targets to reduce GHG emissions between 45 and55% by 2030, between 65 and 75% by 2040, and between 85 and 90% by 2050 compared to 2005 levels [18]. The objectives of the Portuguese LTRS for the next three decades, with respect to 2018, are:

- Renovated a building area of 363,680,501 m^2 by 2030, 635,637,685 m^2 by 2040, and 747,953,071 m^2 by 2050.
- Primary energy savings of 11% by 2030, 27% by 2040, and 34% by 2050.
- Reduce the number of discomfort hours by 26% by 2030, 34% by 2040, and 56% by 2050.

The heating energy consumption in the residential sector is expected to be reduced by 26% by 2040 and 50% by 2050, whereas the energy consumption per m^2 in the residential buildings sector is expected to decrease to 20% by 2050, compared to today, with investment in passive measures in the building envelope [17].

Among the priorities of the national government are the EPBD transposition, the increase of the building renovation/refurbishment rate considering the targets of the national LTRS, the increase of comfort levels as well as the reduction of the energy poverty rates, as depicted in the, soon to be published, Long Term National Strategy to Combat Energy Poverty. One of the existing financial schemes for the energy renovation of buildings features a grant of up to 85% of the investment, making it very popular to homeowners. The respective funds for this scheme, supported by the Environmental Fund, now come from the NRRP. New budget lines, target buildings and application periods are expected soon.

Legislative framework

The first Portuguese regulation for the energy performance of buildings (EPB) was introduced in 1990 via the Thermal Performance Buildings Characteristics Regulation (RCCTE) - Decree-law n.º 40/90. It was the initial legal mechanism to establish energy performance requirements for new constructions and significant renovation projects. This regulation was updated in 2006 (Decree-law nº 78,79 and 80/2006), based on the European Directive 2002/91/CE. This new regulation set more stringent demands for the thermal performance of buildings and implemented the Energy Certification System (SCE). In 2010, Directive 2010/31/EU on building energy performance was released, leading to the creation of two revised regulations in Portugal - Residential Buildings Energy Performance Regulation (REH) and Commercial and Service Buildings Energy Performance Regulation (RECS) - along with a revised SCE (Decree-law nº 118/2013). Recently, in 2018, a new directive was introduced for EPB, which amends the previous regulations. Portugal revised its procedures to the new framework and the current legislation was published in December 2020 under the Decree-law n.º 101-D/2020.

There is an ongoing process of upgrading the EPC scheme in the country, including a more user-friendly version, a version of the BRP and a legislative requirements evaluation, alongside with adaptation to new EPBD requirements and new features (IEQ). In the third version of the EPC scheme regulation ("SCE 3.0") BRPs will play a pivotal role. BRPs are also mentioned in the national legislation related to the long-term renovation strategy (LTRS). Specifically, there is a LTRS measure: "Creation of the building renovation passport, as an optional instrument, which complements the energy certificate (in line with the one developed under the European iBRoad project)".

Building stock characteristics

The Portuguese building stock is characterised by a prevalence of residential buildings. A significant proportion (13%) of these buildings dates back to 1945 or earlier, and most (66%) were built before 1990, before energy performance regulations for residential buildings were introduced [19].

The main barriers regarding energy efficiency upgrades in Portugal are the high renovation costs and the multiple investment difficulties (social, legal, bureaucratical), especially in multi-family buildings and buildings with multiple owners. There is an ongoing procedure to map/register all properties in the country, including buildings, to create the National Building Registry. Still, an EPC database is fully functioning and accessible. Some funding schemes have been designed using information that was made available by the national EPC database. Currently, this database holds information on roughly 1.85 million EPCs.

EPC framework

EPCs in Portugal are still largely perceived as a formal obligation rather than a useful informative tool, even though there is high market penetration and 47% of Portuguese would trust renovation advice on an EPC, indicating relative trust in the EPC framework [20]. EPCs are mandatory for new buildings, major renovations, as well as renting or selling most types of buildings. Since 2013, the EPC class of a building must be explicitly mentioned in all real estate advertisements and at the entrance of non-residential buildings ($A \geq 250$ m^2).

The Portuguese EPC has been established 17 years back and almost 2.9 million certificates have been issued in the country, i.e. almost 25% of the country's building stock, by around 2,500 EPC experts. Public and private software tools following the national algorithm and technical standards are available in Portugal for energy performance calculations. Nevertheless, the most common tools are Excel spreadsheets. There is a 'Quality Verification Scheme' that is structured in two phases, which comprises two types of checks, the summary and detailed verification.

In Portugal, EPC experts must have a degree in engineering or architecture and at least five years of experience in the energy efficiency of buildings sector and, to obtain the accreditation, the expert must take a formal examination, managed by the Portuguese Energy Agency, ADENE. There is no mandatory training for EPC issuers in the country, although the Portuguese Energy Agency and other entities offer a voluntary regular training plan to improve the qualified experts' skills.

iBRoad2EPC vision

In the iBRoad2EPC proposal for Portugal, focus should be given on the flexibility and possible compatibility of the tool with the new foreseen version of the national EPC ("SCE 3.0"). Also, due to the high percentage of residential buildings in the country, full implementation potential on the housing stock is considered crucial along with testing iBRoad2EPC for other building types, as well. Moreover, the possibility of having customisable steps for EPC issuers (at least the possibility to edit the year) was mentioned from the Portuguese NAC.

Proposed cost and effort

The Portuguese EPC system is already quite advanced, and with sufficient information on energy efficiency recommendations. Therefore, a high additional cost for issuing an iBRoad2EPC would not be advisable, especially after the new version of the national EPC is approved and considering that the collection of information is similar to an EPC (despite the need for further and deeper interaction with the homeowner) (Figure 15). The placement of iBRoad2EPC in the EPC-BRP spectrum will be finalised after the testing phase of the project. In the country, there are many developed tools facilitating building energy efficiency interventions/building sustainability, and iBRoad2EPC could bring together these different solutions under a unified umbrella, along with the EPC.

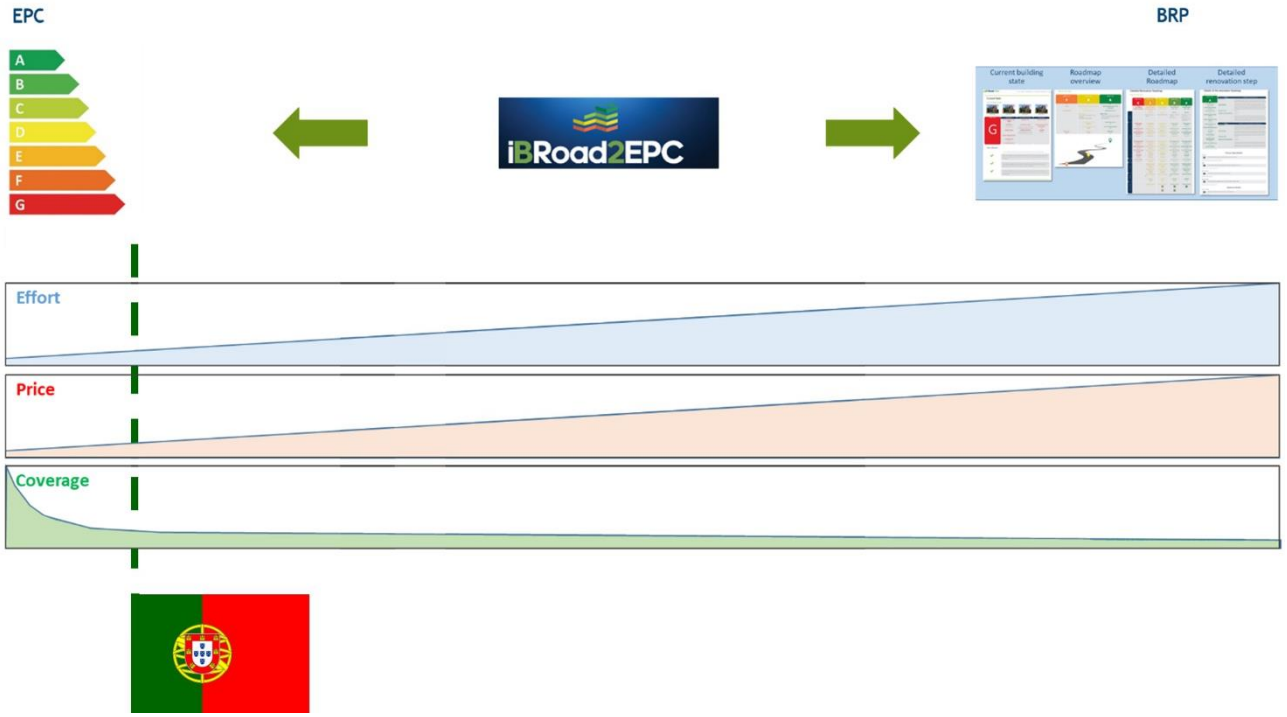

Figure 15: The Portuguese iBRoad2EPC is conceptually placed near the EPC end of the EPC-BRP spectrum.

There are several financial programmes dealing with deep renovation available, that could leverage and be linked to the iBRoad2EPC, such as the "More Sustainable Buildings" programme 2021-2022 and its foreseen revamping for 2023-2024, the Support Programme for Condominiums (2023), other financing to be developed under the Recovery and Resilience Plans on the Energy Efficiency in Buildings component and the IFRRU 2020-2021-EU (a 1,400 million euros financing instrument focusing on urban rehabilitation).

Proposed modules

For Portugal, almost all the proposed modules presented in Chapter 3.1 are considered necessary (Basic, Energy Demand, Cost, SRI and IEQ modules). This can again be attributed to the fact that the Portuguese EPC is already quite advanced. Specifically, apart from the Basic module, the Energy Demand, Cost and IEQ modules were identified by the NAC as the most important ones. Concerning potential additional modules, the following suggestions were made from the NAC: a module linking to the national one-stop-shop casA+ platform[1] [21], an AQUA+[2] [22] module, and a module linking iBRoad2EPC with the water-energy nexus certification tool (which is "linking" EPC and AQUA+). After the iBRoad2EPC training and field test in Portugal, feedback from energy experts could lead to the suggestion of specific additional modules for future development.

Interlinkages and automation

The compatibility of iBRoad2EPC with the soon to be upgraded EPC is considered very important. An automatic link between the EPC and iBRoad2EPC, i.e., the automatic pre-filling of information on the iBRoad2EPC Assistant that is available on the EPC's XML file (general information, energy calculations and measures), was identified as a critical issue for the tool to be fully exploitable in the future, taking advantage of further links between national databases that could arise.

[1] "Portal casA+" is a national one-stop-shop provided by ADENE, with other features such as a digital building logbook (DBL) or renovation measures based on the EPC recommendations, i.e., specific intervention needs, building owners and service providers.
[2] AQUA+ is a simple, agile, and voluntary system for evaluating and rating the water efficiency of buildings, developed by ADENE.

Overall, there are three tools to which iBRoad2EPC could be coupled: (a) the excel EPC calculator, (b) the XML file that is produced for every EPC and (c) the casA+ platform. Mapping the fields between the iBRoad2EPC and the excel EPC calculator was assessed as a rather difficult task. Instead, it is preferable to concretely map the fields between iBRoad2EPC and the XML file and this process is currently ongoing. The aim is to prefill the iBRoad2EPC assistant with as many information as possible.

Concerning the casA+ platform, there are various options to integrate iBRoad2EPC which are currently explored:

- There is already a page where homeowners can order services from energy experts by clicking checkboxes. iBRoad2EPC can be added as an extra service here.
- It is possible to add a dedicated page to explain and promote iBRoad2EPC to homeowners.
- In parallel, a page can be integrated to explain and promote iBRoad2EPC to experts.
- CasA+ already contains a page which shows renovation recommendations that are created automatically and imported via an API. It may be possible to add a box to show iBRoad2EPC recommendations in case an iBRoad2EPC has already been issued for the respective building. Homeowners could be given the option to order a concrete quote from craftsmen by clicking on a checkbox. It is rather unlikely that this can be realised within the project duration, however, it can already be conceptualised.
- iBRoad2EPC can be integrated in the contract with software developers who work on casA+. This is a very concrete measure to showcase the implementation of iBRoad2EPC.
- All relevant funding mechanisms related to building renovation are connected to casA+. Thus, funding information could be integrated in iBRoad2EPC and/or iBRoad2EPC recommendations can be aligned with funding schemes.

Apart from the casA+, other platforms in the country with which iBRoad2EPC could be coupled are the “Ficha Técnica da Habitação“(technical housing Cadastre), and the “Livro de Obra”, (repository of official information related to construction and licensing procedures). Considering that these tools could be parts of a future official Digital Building Logbook (DBL) in the country, such a connection would ensure a futureproof iBRoad2EPC.

For the moment, there is no BRP framework in the country (except the one developed in iBRoad) to couple iBRoad2EPC with. It is critical that the modules developed within iBRoad2EPC are fit for the national EPC scheme in order for the new version of the EPC to adopt the outputs/tools from the project. Finally, links with the building Cadastre and other building registries such as the EU Building Stock Observatory should be examined.

Trigger points

It is proposed that iBRoad2EPC in Portugal be voluntary in principle, but mandatory if used for access to public financing. The trigger points for issuing an iBRoad2EPC should be the same as those of the EPC (renting, selling a property, new buildings, access to financing, etc.). Also, in case of renovation or regular maintenance of building components, even for non-energy related interventions, the occasion should be a trigger for action and for issuing an iBRoad2EPC.

Training procedures

It is proposed that iBRoad2EPC training is offered as an additional training module addressed to certified EPC issuers, integrated into the existing Academia procedures [23] of the Portuguese Energy Agency (ADENE). Available training programmes on energy performance for residential and non-residential buildings, energy management systems and building renovation could serve, among others, as the basic core for the additional iBRoad2EPC training module.

Action plan for the national roll-out

In order for the iBRoad2EPC vision to be realised in Portugal, five (5) priorities have been set as presented in Figure 16. The priorities include: the creation of a user-friendly information package for deep renovation embedded in EPCs, the provision to ensure sufficient capacity to carry out deep renovations and deliver information on energy use and comfort of the building, to deliver information on energy smartness of the buildings, and the creation of a user-friendly platform/software. The priorities are part of the Portuguese Action Plan for the National roll-out which is presented in the following overview.

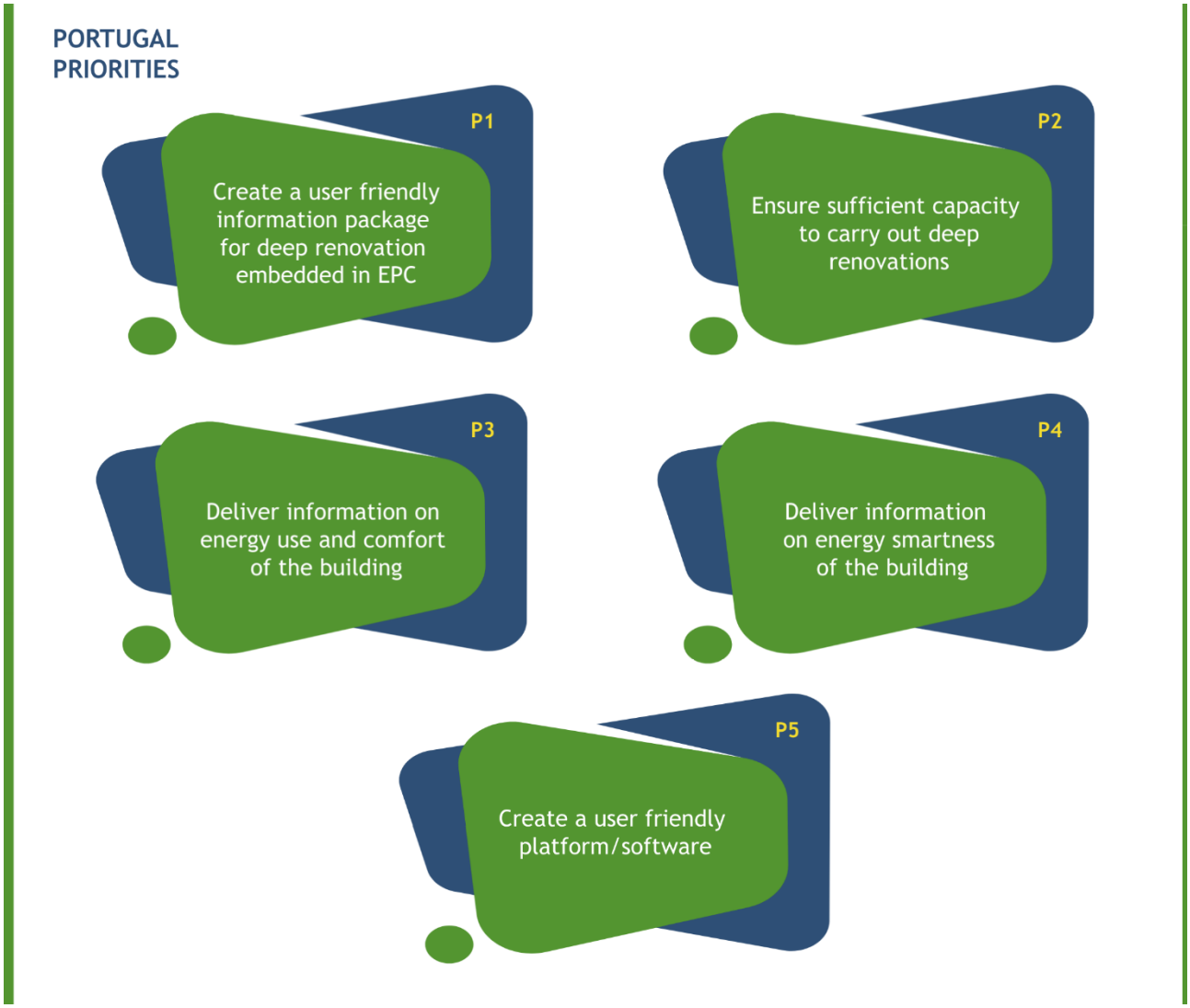

Figure 16: Priorities for Portugal.

The priorities above are part of the Portuguese Action Plan for the National roll-out which is presented in the following overview.

Priority	Aim served	Relevant stakeholder	Proposed actions	Timeframe	Indicators
P1: Create a user friendly information package for deep renovation embebbed in EPC	**A1.** Increase public awareness for deep renovation **A2.** Integration between EPC and BRP **A3.** Increase the number of deep renovations **A4.** Increase market penetration of iBRoad2EPC/ create demand	DGEG DECO ANPQ Building owners	Testing BRP's features with the iBRoad2EPC tool. Adapting tested features to new version of Portuguese EPC Integration of BRP's features in the new version of the EPC Media/dissemination campaign of new EPC format with BRP (possibly together with the new EPC format)	2023 2024 2024 2024	Number of EPCs/ buildings tested Number of relevant users targeted Number of final users aware of new scheme
P2: Ensure sufficient capacity to carry out deep renovations	**A1.** Increase public awareness for deep renovation **A3.** Increase the number of deep renovations **A4.** Increase market penetration of iBRoad2EPC/ create demand **A5.** Ensure consistency with LTRS goals	ANPQ CPCI/AICCOPN	Testing BRP's features with the iBRoad2EPC tool. Deliver training modules to relevant stakeholders – focus on auditors/experts Embedd BRP, DBL and new EPC features into casA+ platform – boost one stop online shop concept and link offer and demand – exploit exisiting ADENE ACADEMIA infrastructure/ resources	2023 2023 2024	Number of EPCs/ buildings tested Number of people trained in the new EPC/BRP features Number of registrations in the casA+ portal Number of renovations/interventi on made via casA+ portal
P3: Deliver information on energy use and comfort of the building	**A1.** Increase public awareness for deep renovation **A5.** Ensure consistency with LTRS goals **A6.** Prepare for EPBD	ADENE DGEG LNEC	Buil IEQ features e.g comfort rating as number of days in discomfort in each season at a "free-floating temperature condition" and embed in iBRoad2EPC modules	2023	Number of indicators related to IEQ embedded in iBRoad2EPC

Priority	Aim served	Relevant stakeholder	Proposed actions	Timeframe	Indicators
	challenges/ transposition		Testing IEQ features embbed	2023	
			Evaluate NBRP goals and a adapt the tool	2024	
P4: Deliver information on energy smartness of the building	**A1.** Increase public awareness for deep renovation **A5.** Ensure consistency with LTRS goals **A6.** Prepare for EPBD challenges/ transposition	ADENE DGEG LNEC	Build SRI features and embed in iBRoad2EPC modules / explore Synergies with SRI2MARKET LIFE project	2023	Number of indicators related to SRI embedded in iBRoad2EPC Number of SRI evaluations made (look for synergies with SRI2MARKET project)
			Testing SRI features embedded	2023	
			Evaluate SRI goals specifically on minimum comfort category requirements (LTRS)	2024	
P5: Create a user friendly platform/software	**A1.** Increase public awareness for deep renovation **A4.** Increase market penetration of iBRoad2EPC/ create demand	ADENE ANPQ DECO	Ensure maximum compatibility/flexibility of iBRoad2EPC formats/layouts with national layout – to be done within the NAC	2023	Number of features successfully embedded/fit for to national scheme
			Embbed iBRoad2ECP modules/learnings in nem EPC scheme	2024/2025	

Table 4: Portuguese Action Plan for the National roll-out.

Romania

National overview

Key information on the national targets and priorities, the legislative framework regarding EPCs and BRPs, the building stock characteristics and the EPC framework in Romania are presented in the below sections while the detailed information on the Romanian market analysis and the status quo of the EPC scheme in the country can be found in the iBRoad2EPC report "Conceptualising iBRoad2EPC: how Energy Performance Certificates (EPCs) can be upgraded with Building Renovation Passport (BRP) elements" [7].

National targets and priorities

The Romanian LTRS is quite ambitious regarding renovation rates, foreseeing an increase from the current (business as usual) 0.5% to 3.39% in 2021-2030, and predicting 3.79% in the period 2031-2040, and 4.33% in the period 2041-2050, according to the recommended scenario. This is anticipated to bring a reduction of the final consumption by 9% in 2030 (0.83 Mtoe), a 24% reduction in GHG emissions (2.34 Mton), a 65% reduction of final consumption in 2050 (6.14 Mtoe) and a 80% cumulative reduction in the period 2021-2050. The Romanian LTRS mentions in particular that the public sector must take the lead to improve energy efficiency by renovating 8.25 million m^2 (26%) of public buildings by 2030.

In addition, according to the Romanian Integrated National Energy and Climate Plan (INECP), the primary energy consumption target is 32.3 Mtoe by 2030 compared to 32.1 Mtoe in 2020.

The Renovation Wave pillar of the National Recovery and Resilience Fund (NRRP) includes calls for renovation projects of multi-family and public buildings, ranging from moderate to deep renovation and integrated interventions, also including the aspect of seismic resilience. The Digital Building Registry is also included in the NRRP, to be delivered until the end of 2024.

The energy renovation of the existing building stock (some energy poverty alleviation measures are provided in existing programmes), is one of the main priorities of national authorities as expressed in the Long-Term Renovation Strategy in the form of ambitious targets. The national LTRS should be correlated with the National Strategy regarding seismic resilience that was recently approved by the Romanian Government.

Apart from the NRRP, other funding sources for building renovation available or under negotiation are the ESIF Regional Programmes (multi-family and public buildings) with guides for the calls for projects under preparation, to be developed and implemented by the eight Regional Development Agencies, as well as the Environmental Fund (single-family and public buildings, PV systems for single-family buildings). Finally, to support capacity building in the design and implementation of building renovation programmes, there is the Technical Assistance Facility to Support Renovation Wave in EU Member States – Romania (WB and DG REGIO).

Building stock characteristics

Multi-family buildings are generally owned by a large number of persons that are apartment owners. Even though it is mandatory to establish owners' associations, these do not seem to function well in reality, stalling the decision process for building works. Public buildings and multi-family buildings that are included in public funded renovation programmes are subject to public procurement procedures in which the tender specifications and involvement of building owners (private multi-family buildings) is challenging, the financial implementation of the renovation projects is performed by the local authority (municipality) with minimum involvement of apartment owners' representatives in the decision-making process.

EPC framework

There are two kinds of EPCs in Romania: the EPC for buildings/building units and the EPC for apartments in condominiums. The first type of EPC also includes a notional building classification (the same building geometry, but in compliance with minimum energy performance requirements), similar to a target rating (limited to the existing building configuration). The EPC format, content and classes have been undergoing revision since 2017, with the revised methodological framework in force starting from 16.02.2023. The new EPC format and classification (diversified per building type) will allow compliance checking with nZEB levels for new buildings.

The EPC is obligatory for new buildings, as well as for selling/buying/renting existing buildings or building units, and is also required for renovation under public funding programmes. Moreover, the EPC class of a property has to be explicitly mentioned in all real estate advertisements, but this is not actually implemented in the market. The new EPC already includes information on renovation recommendations, but no target ratings after improvement. EPCs in Romania are usually cheap and low quality and the general public awareness on their significance is low.

Existing compliance checking procedures have no provisions for technical check (i.e., check of input data, reliability of results). There is a legal obligation for compliance checking of 10% of the number of issued EPCs each year, but the actual number is difficult to estimate because the EPC database is not functional.

Initial training and expertise requirements for the certification of energy auditors for buildings is a positive aspect, but there are no further qualification requirements at re-certification (every 5 years), There is a need for the development of a coherent continuous professional development scheme.

iBRoad2EPC vision

Proposed cost and effort

It is proposed that the Romanian iBRoad2EPC be closest to an EPC than a BRP with regards to its additional cost and effort (Figure 17). The placement of iBRoad2EPC in the EPC-BRP spectrum will be finalised after the testing phase of the project.

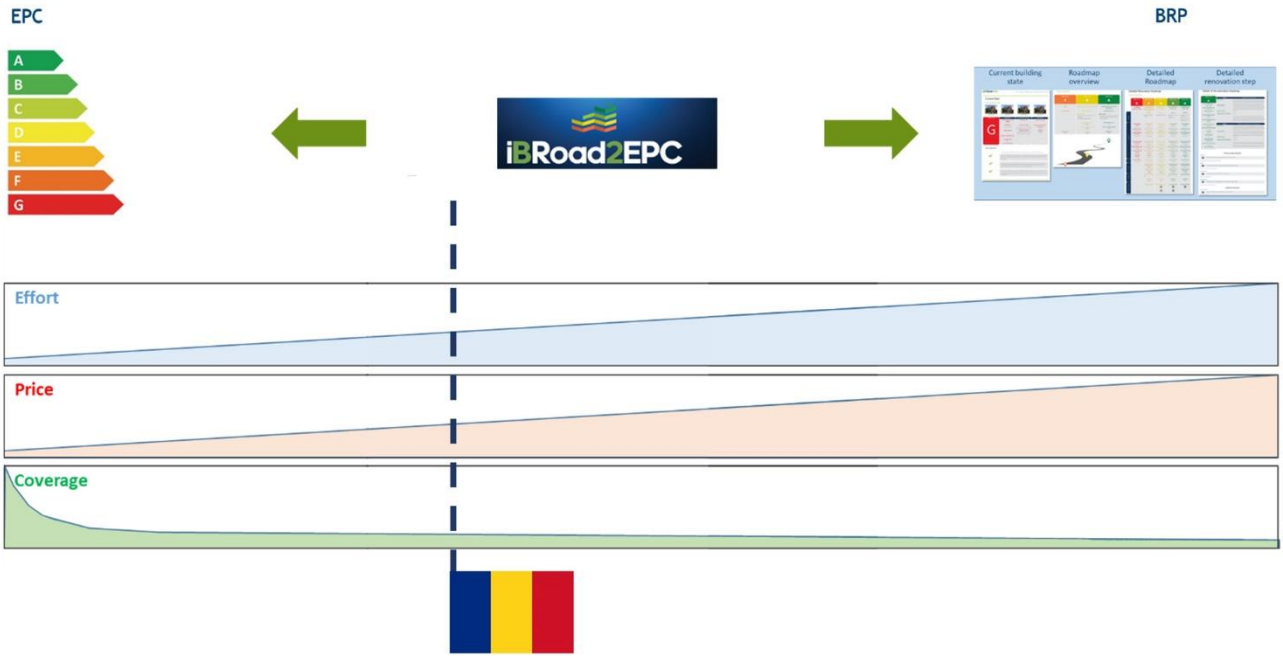

Figure 17: The Romanian iBRoad2EPC is conceptually placed towards the EPC end of the EPC-BRP spectrum.

Proposed modules

Apart from the Basic module, the main necessary module identified for the Romanian case is the Energy Demand module. The Cost, SRI, IEQ and MEPI modules are also considered important but need functional evaluation tools to be applied. Concerning potential additional modules, options such as Water Efficiency, Renewable Energy Resources and Summer Heat Protection modules could be utilised in the future in case of a more extensive iBRoad2EPC integration. RES and summer comfort are already included in the EPC (data on the installed systems, if any, or mentioned in the recommendations list).

Interlinkages and automation

There are various options considered for iBRoad2EPC integration in Poland, but not yet sufficiently mature:

- A national Digital Buildings Registry is currently under development (included as measure in the National Recovery and Resilience Plan - NRRP with a deadline for implementation in December 2024). Once advanced, it would offer great potential for integration with iBRoad2EPC through an API.
- All types of software used to issue an EPC produce an output file (XML or other format) but in a non-standardised form. Three of the commercial software programmes for issuing EPCs (ENERG+, DOSET-PEC, AllEnergy) are currently being aligned with the new EPC methodology and possible integration with at least one of them would be preferable, even though the amount of data extracted from the software and automatically embedded into iBRoad2EPC would be relatively limited.
- Recommendations in the EPC are currently defined in a simplified way and, therefore, a realistic solution would be to try to integrate the whole iBRoad2EPC recommendation measures database into an EPC issuing software; prerequisite is to find a software provider willing to collaborate.

Moreover, the EPC database structure has been developed and could be used as a starting point for the BRP development. Also, data retrieval from the National Cadastre logbook, the digital Building Roadmap and local databases would facilitate iBRoad2EPC integration into the everyday practices of EPC certifiers.

Trigger points

It is proposed that iBRoad2EPC features the same trigger points as the Romanian EPC, serving as a pathway to the national Building Renovation Passport (BRP). It is considered best to introduce iBRoad2EPC as a voluntary annex to the existing EPC, in order to keep the additional costs and effort to a minimum.

Training procedures

iBRoad2EPC training can be introduced as a stand-alone training course or included as an additional module to the specialisation courses organised by the relevant professional associations in the context of continuous training for energy auditors. iBRoad2EPC training courses can be organised in the occasion of the recent update of the calculation methodology legal act (MC001-2022). It will be targeted to already certified EPC issuers, ideally with the presence of not more than 10-15 participants in each training session.

Action plan for the national roll-out

For the realisation of the national roll-out in Romania, seven (7) priorities have been envisaged, namely: the emphasis that should be given on innovative elements beyond energy with practical value for the market and all involved and beneficiary parties, the provision to ensure an adequate exposure to the public via media channels as well as to secure funds that will cover the cost of iBRoad2EPC, and the creation of a user friendly platform/software. In addition to the above, it needs to be ensured that sufficient capacity for qualitative energy assessments will be available and the same applies for the sufficient capacity to carry out deep renovations. Last, proper control mechanisms need to be created. All Romanian priorities are visualised in Figure 18.

Figure 18: Priorities for Romania.

The above priorities are also included in the Romanian Action Plan for the National roll-out which is presented in the following Table 5.

Priority	Aim served	Relevant stakeholder	Proposed actions	Timeframe	Indicators
P1: Emphasis on innovative elements beyond energy with practical value	**A1.** Increase market penetration of iBRoad2EPC/ create demand	MDLPA, NAC members	Discuss about the value of innovative elements within NAC and agree on key features of these elements to be communicated	2023	Factsheet on innovative elements
P2: Ensure adequate exposure to the public via media channels		MDLPA, NAC members, media partners	Present iBRoad2EPC to reference events, Prepare media content	2023-2024	Presentation, Press release
P3: Secure funds to cover the cost of iBRoad2EPC	**A2.** To facilitate iBRoad2EPC adoption. Use envisaged finance for the Digital Buildings Register development (under NRRP).	MDLPA, MIPE, NAC members	Discuss integration of iBRoad2EPC database elements in the Digital Buildings Register (DBR) design.	2023-2024	Number of modules + texts embedded in the DBR structure
P4: Create a user-friendly platform/software	**A3.** Increase public awareness for deep renovation **A1.** Increase market penetration of iBRoad2EPC/ create demand	MDLPA, NAC members, service providers	Ensure maximum compatibility/ flexibility of iBRoad2EPC formats/layouts with national layout – to be done within the NAC Embbed iBRoad2ECP modules/learnings in new EPC scheme and Digital Buildings Register design	2023 2024	Number of features successfully embedded/fit for to national scheme and DBR
P5: Ensure sufficient capacity for qualitative energy assessments	**A4.** To facilitate upskilling of energy auditors for buildings	MDLPA, AAECR, OAER, Universities	Deliver training modules to energy auditors	2023	Number of people trained in the new EPC/BRP features
P6: Ensure sufficient capacity to carry out deep renovations	**A3.** Increase public awareness for deep renovation **A5.** Increase the number of deep renovations **A1.** Increase market penetration of iBRoad2EPC/ create demand	MDLPA, NAC members, BUS4RoBOOST (Life project)	Testing BRP's features with the iBRoad2EPC tool. Deliver training modules to relevant stakeholders – focus on auditors/experts Embedd new EPC features into DBR platform – boost one stop online shop concept and	2023 2023 2024	Number of EPC / buildings tested Number of people trained in the new EPC/BRP features Number of registrations in the DBR

Priority	Aim served	Relevant stakeholder	Proposed actions	Timeframe	Indicators
	A6. Ensure consistency with LTRS goals		link offer and demand		
P7: Create the right control mechanisms	**A6.** Improve the quality of EPCs and raise the trust level in EPC market	MDLPA, ISC, AAECR, OAER	Discuss the improvement of EPC compliance procedures, facilitate the definition of a continuous professional development scheme for energy auditors and other relevant experts	2023-2024	Revised compliance procedures for EPCs

Table 5: Romanian Action Plan for the National roll-out.

Spain

National overview

Some key information on the national targets and priorities, the legislative framework regarding EPCs and BRPs, the building stock characteristics and the EPC framework in Spain are presented below. Detailed information on the market analysis and the status quo of the EPC scheme in the country can be found in the iBRoad2EPC report "Conceptualising iBRoad2EPC: how Energy Performance Certificates (EPCs) can be upgraded with Building Renovation Passport (BRP) elements" [7].

National targets and priorities

The Spanish LTRS identifies 1.2 million dwellings (out of 18.7 million primary residences) that form the priority market for renovation for the next decade (2021-2030) on which policies are focused, increasing 10 times the current renovation rate (from 30,000 to 300,000 dwellings per year) in 2030.

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Nº dwellings	30.000	35.000	40.000	45.000	50.000	100.000	150.000	200.000	250.000	300.000
Cumulative dwellings	**30.000**	**65.000**	**105.000**	**150.000**	**200.000**	**300.000**	**450.000**	**650.000**	**900.000**	**1.200.000**

	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Nº dwellings	350.000	350.000	350.000	350.000	350.000	350.000	350.000	350.000	350.000	350.000
Cumulative dwellings	**1.550.000**	**1.900.000**	**2.250.000**	**2.600.000**	**2.950.000**	**3.300.000**	**3.650.000**	**4.000.000**	**4.350.000**	**4.700.000**

	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Nº dwellings	330.000	310.000	290.000	270.000	250.000	230.000	210.000	190.000	170.000	150.000
Cumulative dwellings	**5.030.000**	**5.340.000**	**5.630.000**	**5.900.000**	**6.150.000**	**6.380.000**	**6.590.000**	**6.780.000**	**6.950.000**	**7.100.000**

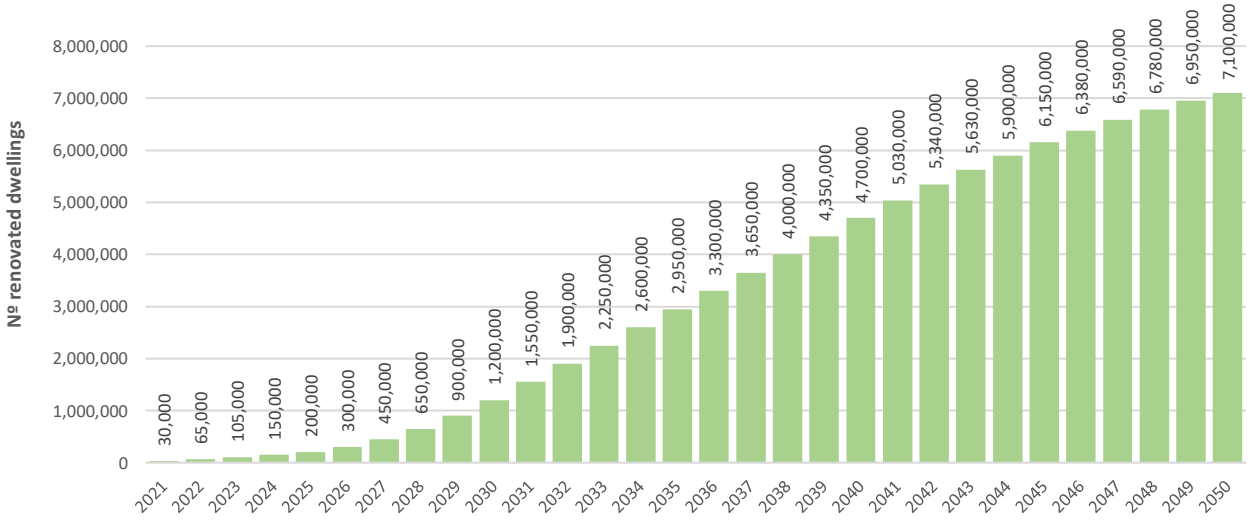

Figure 19: Renovation pathway for the residential sector in the LTRS 2020 (2021-2050).

The Spanish Government also proposes to extend the 3% renovation requirements (in EED art 5) to all public bodies, including autonomous communities and local entities. A large contribution to the projected energy savings is expected from heating in the residential sector as of 2050; the consumption expected from heating would be less than 55% of the 2020 levels.

The objectives for 2050 for the residential sector are a 37% reduction (compared to 2020) of energy use and a 99.8% reduction (compared to 2020 levels) of CO_2 emissions, while for the non-residential sector, a 36%

reduction in energy use compared to 2020. To achieve this, it is estimated that a total investment of 143 billion euros is required.

The Spanish recovery and resilience plan includes a Housing renovation and urban regeneration plan under Component 2. It promotes energy efficiency residential renovations by supporting more than half a million energy efficiency renovations in residential buildings to achieve, on average, a primary energy demand reduction of at least 30%. It has a budget of 3.4 billion euros. Through Line of action 2 (comprehensive renovation programme for buildings) it is possible to finance, independently of the development of the renovation work, the preparation of the "existing building book", a technical document that includes a Diagnosis of the building and an Action Plan, to take advantage of the potential for improvement of the buildings and contribute to the digitisation in the integral management of the buildings (communities of neighbours). The existing building book aims to develop the concept of the "building renovation passport" by incorporating it into an integrated strategy that includes not only energy efficiency, but also other features such as safety of use and accessibility, health and comfort, acoustic comfort, etc.

Legislative framework

BRPs are presented in the Spanish legislative framework only in the national Long Term Renovation Strategy ERESEE 2020 and specifically in PART III. IMPLEMENTATION and Action 8.4. “Analysis of the potential for the development of the BRP idea through the Libro del Edificio Existente”. The following regulation documents are relevant to the BRPs and therefore also for iBRoad2EPC:

- Law of the Building Sector (LOE, 1999) – Legislative framework Libro del Edificio Existente updated by Royal Decree RD 390/2021 (current EPC legislative framework)
- Building Code (CTE, 2006)
- Law of Land and Developments (Ley del Suelo, 2008)
- Regional laws and regulations

The responsible authorities for the policy sector on a national level are the Spanish Climate Change Office (MITECO), the Directorate General for Urban Agenda and Architecture (MITMA) and the Energy saving and diversification Agency (IDAE). Besides specific courses from private companies, training and certification are carried out by the Architects Association of Spain (CSCAE), the Architects Association of Catalonia (COAC) and the Architects Association of Basque Country and Navarre (COAVN). Also, the Architects Chamber is delivering webinars on Libro del Edificio Existente (paper logbook with action plan, for the Recovery Funds). The authorities responsible for the EPC registry are Ente Vasco de la Energia (EVE) for the Basque Country and Insititut Català de l’Energia (ICAEN) for Catalonia.

Building stock characteristics

Regarding the Spanish building stock, 71% of Spanish dwellings are in multi-family buildings, presenting several challenges because of the ownership structure that may hamper the agreement process, the level of engagement, energy habits and lack of environmental awareness. The 17 autonomous regions have the power over housing and land policies. Regarding public buildings, there is an opportunity for BRPs to be applied in schools and others, where the renovation works can be carried out during the summer period.

EPC framework

The Energy Performance Certificate is mandatory for:

- all new buildings;
- existing buildings or parts of buildings to be sold or rented to a new tenant;
- buildings or parts of buildings belonging to or occupied by a public administration with a total useful floor area of more than 250 $m^{2;}$
- buildings or parts of buildings where alterations or extensions are carried out that meet certain conditions;
- buildings or parts of buildings with a total useful floor area of more than 500 m^2 intended for public use (like hospitals, commercial, restaurants, religious sites…);
- buildings that are required to undergo mandatory Technical Building Inspection or equivalent inspection.

The Energy Performance Certificate in Spain is viewed as an administrative task that provides little value to the building or its users, and is considered unreliable. It contains information on energy consumption and measures to improve energy efficiency but does not include information on other sustainability factors (such as IEQ, SRI, LCA, etc.) or long-term goals. An on-site visit is required for its execution.

The Ministry for Ecological Transition and the Demographic Challenge in Spain has an official list of seven tools to deliver an EPC, developed by public or private entities, classified into three groups depending on their target (general procedure for energy certification for planned, completed and existing buildings: HULC, CYPETHERM HE Plus, SG SAVE, TeKton3D TK-CEEP; simplified procedure for the energy certification of existing buildings: CE3, CE3X; simplified procedure for energy certification of residential buildings: CERMA). Any Spanish company can initiate the procedure for its software to be registered in the official list.

The EPC registry, external control and inspection depends on each region, where a competent body is designated to perform these functions. Compliance checking is done by random checks on a small percentage of EPCs issued, carried out by the competent body of each region directly or by independent agents authorised for this purpose.

Auditor training is currently not mandatory by law, and both public and private courses are available. To become an auditor, one needs academic or professional qualifications to manage building projects or prepare EPCs. However, with the new Royal Decree RD 390/2021, competent technicians have been aligned to possess the qualifications required for preparing EPCs.

iBRoad2EPC vision

Proposed cost and effort

Because of the low perceived value the EPC has in the country, it is proposed that, in Spain, iBRoad2EPC does not follow the same path as the EPC; rather, it should put value in its new features and the long-term goals, and provide support to the owners in order to engage them in the renovation process. Therefore, it is proposed that the Spanish iBRoad2EPC be closest to the BRP concept of the EPC-BRP spectrum presented in Figure 20. The proposed effort for issuing an iBRoad2EPC is 1 day, and its estimated cost will be defined after the testing phase of the project.

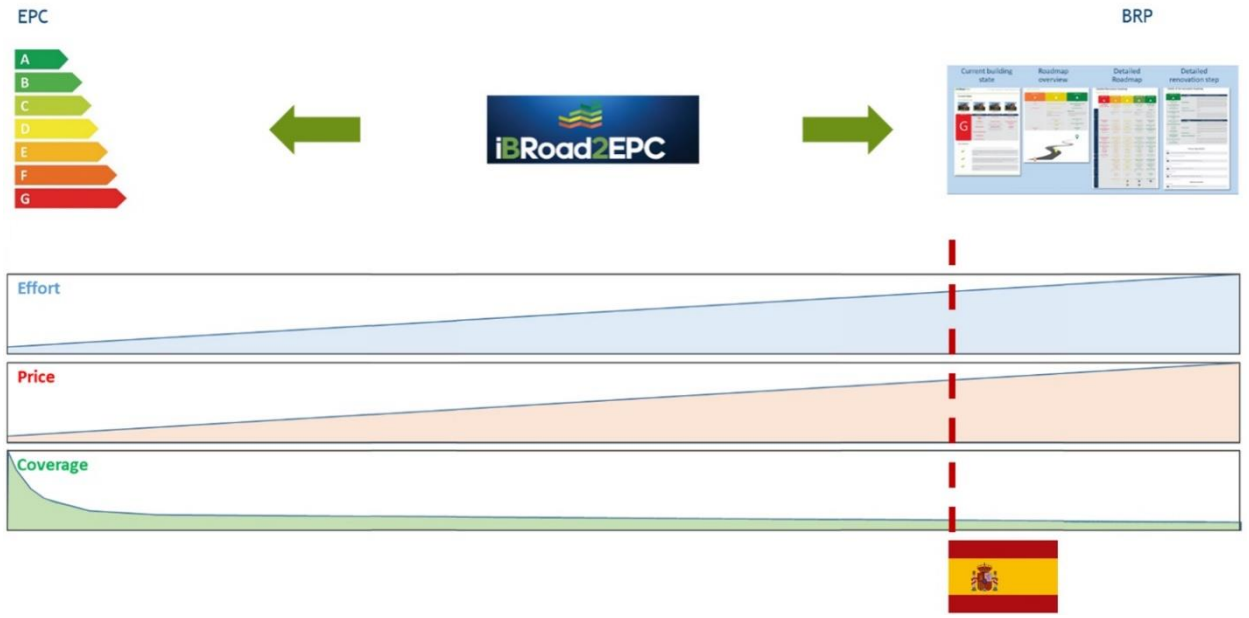

Figure 20: The Spanish iBRoad2EPC is conceptually placed towards the BRP end of the EPC-BRP spectrum.

Proposed modules

It is proposed that the full version of modules as presented in chapter 3.1 is adopted for Spain, since energy certification data of buildings/apartments are already interconnected. A 3D model of the building/apartment would be useful to be integrated in the future, even though this could increase the cost of issuing the iBRoad2EPC. Moreover, an additional module of Acoustic rating/certification (similar to the EPC) is desirable since acoustic comfort is already highly developed at regulatory level. Finally, the ability of iBRoad2EPC for gradual introduction of additional modules in the long-term perspective is essential.

Interlinkages and automation

According to the Spanish NAC consultation, the integration of the iBRoad2EPC Assistant with existing and new instruments should be defined in 3 levels (Figure 21):

1. Link at building level with the Digital Building Logbook (LEE). At the moment, there are several funding schemes due to the Next Generation EU, that require an Existing Building Book (LEE) containing an EPC before and after the upgrade. Moreover, the LEE contains a detailed explanation of the measures to be conducted and, as an option, a step-by-step intervention so iBRoad2EPC could be integrated into those procedures, especially in the residential scheme. Thus, iBRoad2EPC should be developed taking into consideration the LEE. This would help to raise awareness and facilitate the approach with citizens and communities, especially in multi-family buildings where social barriers are very important.
2. Link at urban level with district or municipality level instruments such as the Urban vulnerability Atlas (web application that provides statistical information and allows the analysis of urban vulnerability at census section level in all municipalities in Spain).
3. Link at national and regional level with databases such as the EPC, the Cadastre, the National building renovation plan (via aggregated indicators, renovation goals, MEPs, etc.), funding databases, and urban planning platforms such as the Urban Areas Digital Atlas (web application that offers statistical data that make up a repertoire of 600 indicators from the main sources of information, which makes it possible to approach the territorial reality of urban environments in Spain), the Residential Stock Atlas (web application that offers statistical information and allows the analysis at census section level, and in all the municipalities of Spain- of various variables related to building, and in particular, to buildings predominantly used as dwellings, generating thematic maps of different indicators) and the URBAN3R (web application to promote urban regeneration in Spain and help decision-making for the design of regeneration plans and strategies on an urban scale with data coming from the national LTRS).

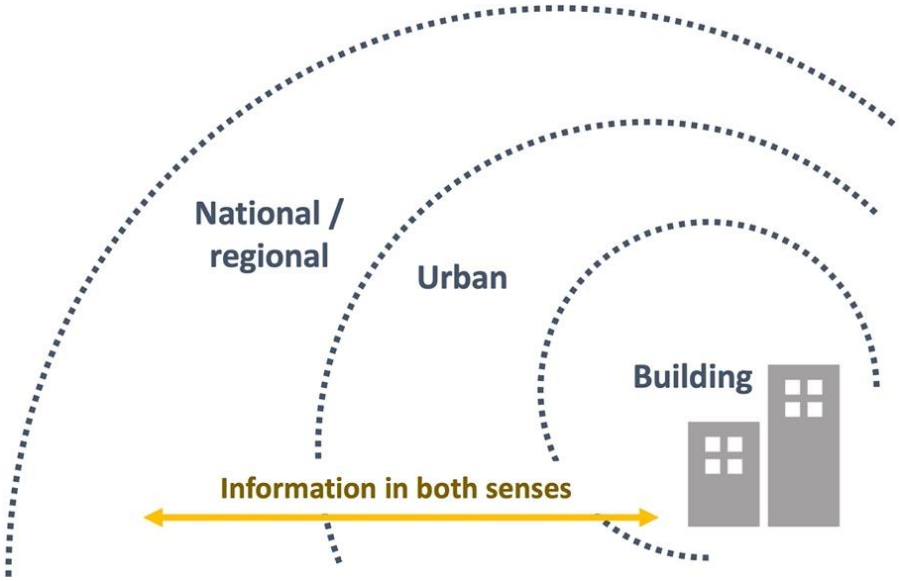

Figure 21: iBRoad2EPC integration in Spain should range across different scales, from the building to the urban and national level of instruments and information. (Source: CICLICA).

An overview of the Overall vision for the new integrated instruments can be found in Figure 22:

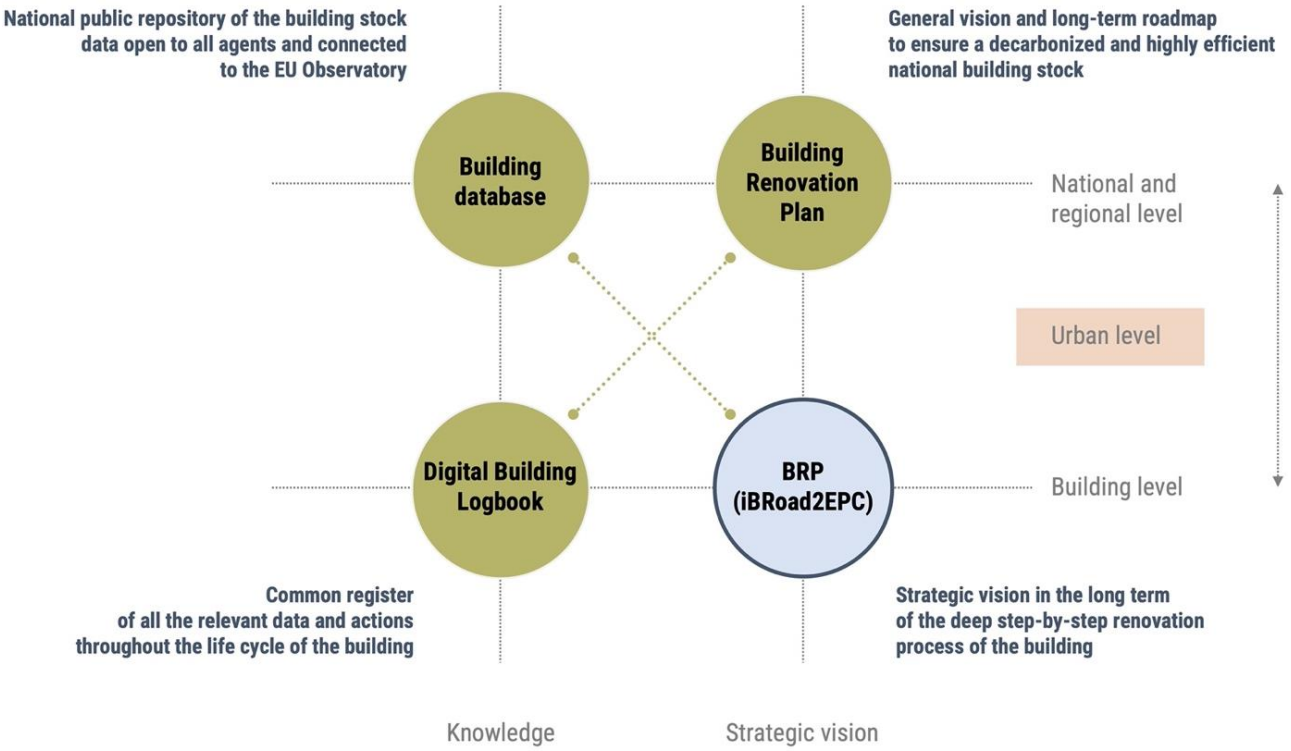

Figure 22: Proposed placement of iBRoad2EPC into the Spanish DBL, BRP instruments ecosystem. (Source: CICLICA).

Concerning data management, it is highly preferrable if data input is automated from other existing databases, such as the EPC, energy, cadaster, urban planning, building stock, etc., and manual entry of data is kept to a minimum. Especially regarding official EPC tools in Spain, the XML file produced by all calculation software is common and standardised. Therefore, the iBRoad2EPC XML integration approach was preferred, as this would allow to avoid double manual filling of relevant information, a critical point for iBRoad2EPC integration/ usability by experts according to Spanish stakeholders.

A first analysis of the common fields between the XML file and the iBRoad2EPC Assistant shows that 33% of the fields in the Assistant are directly present in the XML; this means that 33% of the fields in the Assistant could be uploaded directly via the XML file, reducing effort for the energy experts considerably. In addition, another 24% of the fields in the assistant could be linked to fields in the XML file after some form of programming modification (e.g., adapting the building type or the energy source to the categories of the EPC software). It remains to be evaluated to what extent such programming is feasible. The remaining fields (including project trigger, project receiver or recommendations among others) would then have to be entered manually by the energy expert.

Based on this analysis and further assessment of the potential for programming modifications during iBRoad2EPC, and counting on the opinion of the NAC software provider, the national approach will be further defined.

Finally, some projects with which iBRoad2EPC interoperability would be beneficial are the following:

- The eOpengela project [24]
- The Turnkey project [25]
- The RenovEU project [26]

Trigger points

The iBRoad2EPC in Spain should be voluntary with the same trigger points as the EPC (renting or selling a property. It could be made mandatory in the future if a national framework is defined for the BRP in the country. The long-term goals should be defined in the same way as in the National Building Renovation Plan.

Training procedures

As mentioned before, EPC training is not mandatory in Spain. iBRoad2EPC training material integration can be done through public bodies or private training companies offering modules targeted to Building Renovation Passports (BRPs). Possible alliances could be pursued with training organisations to integrate a specific module of iBRoad2EPC training material as a complement to their programme, ensuring that the additional material poses an added value both for the organisation and the auditors.

Action plan for the national roll-out

There are five (5) priorities identified for Spain to support the national roll-out and include: the increase in awareness raising to carry out deep renovations, the creation of a user friendly platform with reliable information for deep renovation embedded in the EPC scheme, the simplification of the financial management and the facilitation of funding, the definition of the market approach for the promotion of the iBRoad2EPC tool and to ensure the integration with the existing national databases and tools. The priorities are presented in Figure 22.

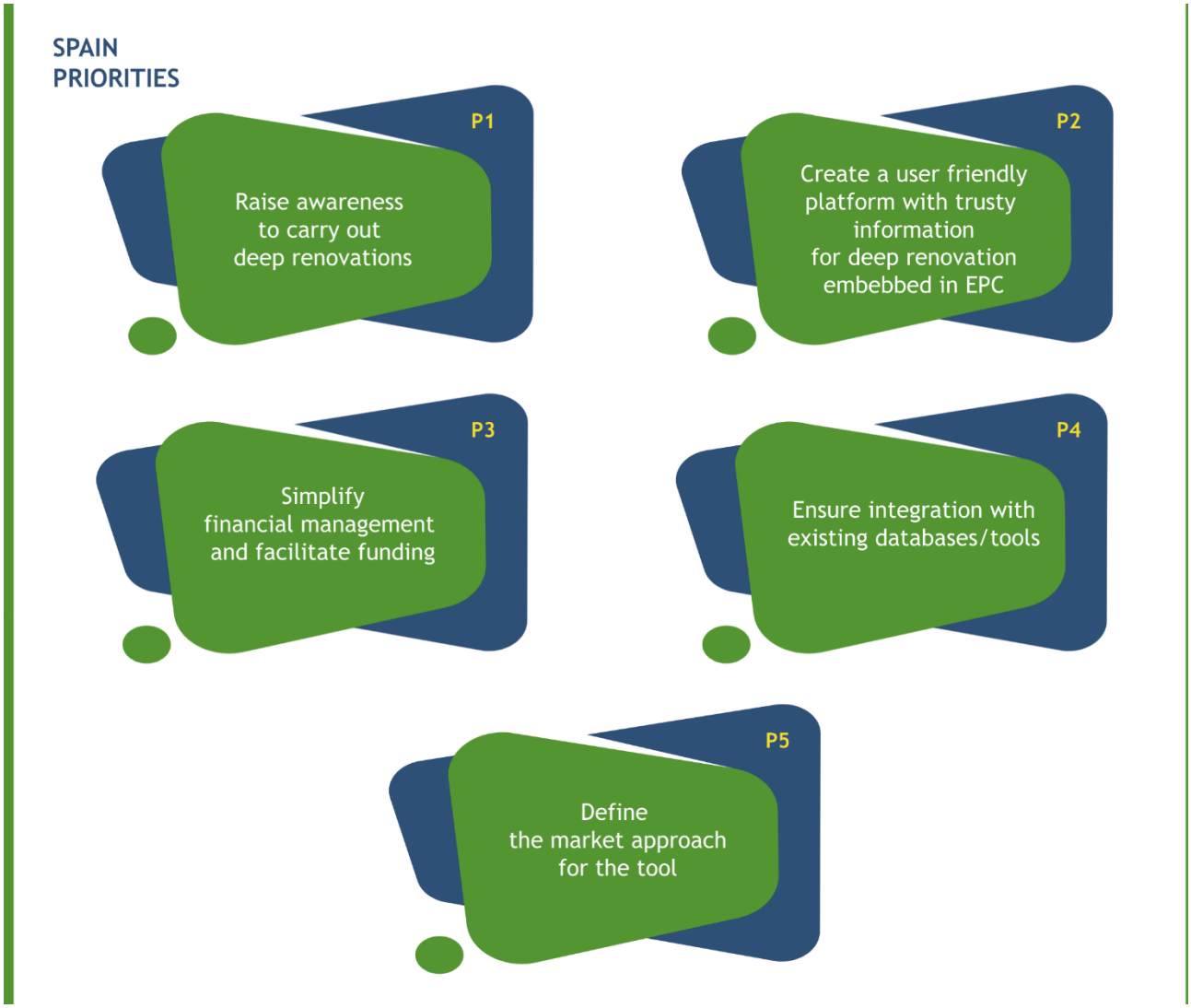

Figure 23: Priorities for Spain.

Table 6 presents the Spanish Action Plan for the National roll-out.

Priority	Aim served	Relevant stakeholder	Proposed actions	Timeframe	Indicators
P1: Raise awareness to carry out deep renovations	**A1**. Increase the number of deep or staged renovations **A2**. Increase public awareness for deep or staged renovation **A3**. Increase the engagement of neighbours in the renovation process **A4**. Build trust in energy planning tools (EPC, BRP, DBL) **A5**. Improve energy habits	Building owners Energy experts Support technicians from OSS or similar IDAE MITECO	Offer a centralised information service and advice on the different aspects involved in renovation, combined with a digital support service throughout the process. Engage users in the creation of their roadmap. Combine the service with local models rooted in the community, like one-stop shops. Integrate different approaches besides the technical view (financial, social) Increase knowledge on energy habits.	2023 (test) 2023 (test) 2024 (follow-up) 2023 (test) 2023 (test)	Nº of buildings tested Capacity of the Assistant to interact Nº of integrations in existing local models Nº of features successfully embedded Nº of users targeted
P2: Create a user friendly platform with trustly information for deep renovation embebbed in EPC	**A1**. Increase the number of deep or staged renovations **A2**. Increase public awareness for deep or staged renovation **A3**. Increase the engagement of neighbours in the renovation process **A4**. Build trust in energy planning tools (EPC, BRP, DBL)	Building owners Renovation Agent IDAE EPC software providers Media	Testing BRP's features with the iBRoad2EPC tool. Include resulting data after each action, feeding back into the following steps/phases/actions Organise training sessions for experts, info days for relevant stakeholders and bilateral communication with parties responsible for the EPC scheme Integration of BRP's features in the new version of the EPC Media/dissemination campaign of the new iBRoad2EPC	2023 (test) 2023 (test) 2023 (test) 2024 (follow-up) 2024 (follow-up)	Nº of buildings tested Nº of features integrated Nº of experts targeted Nº of features integrated Nº of appearances of iBRoad2EPC
P3: Simplify financial management and facilitate funding	**A1**. Increase the number of deep or staged renovations **A2**. Increase public awareness for deep or staged renovation **A3**. Increase the engagement of neighbours in the renovation process **A6**. Increase market penetration of iBRoad2EPC	Financing entities IDAE Renovation Agent	Simplify the information and access to subsidies and/or specific funding programmes (NGEU) Adapt funding programmes to deep staged renovation, distributed over time, giving visibility to the savings achieved that can be used for subsequent interventions.	2023 (test) 2024 (follow-up)	Nº of buildings tested -

Priority	Aim served	Relevant stakeholder	Proposed actions	Timeframe	Indicators
			Facilitate the entrance of private capital and promote specific offers to renovation (soft loans or green mortgages)	2024 (follow-up)	-
P4: Ensure integration with existing databases/ **Tools**	**A7**. Promote synergies between iBRoad2EPC and other initiatives **A8**. Upgrade the quality of the Assitant **A9**. Offer synergistic vision **A10**. Ensure consistency with future national and European goals (LTRS, EPBD, etc.)	National Gov Regional Gov Software developpers	Connect iBRoad2EPC with existing tools/databases (DBL, Cadastre, LEE) Provide automated data schemes to be integrated in the iBRoad2EPC (EPC, energy, cadastre, urban planning, building stock) Provide information of long-term goals defined in public strategies; align the measures, and monitor the degree of implementation; following up results and the assessment of the impacts produced in terms of effectiveness and efficacy Ensure maximum compatibility/ flexibility of iBRoad2EPC formats/layouts with national layout – to be done within the NAC meetings Embbed iBRoad2ECP modules/learnings in EPC scheme Avoid conflict of interest with ongoing tools and certifiying agents	2023 (test) 2023 (test) 2023 (test) 2023 (test) 2023 (test) 2023 (test)	Nº of existing tools compatible Capacity to integrate automated data Nº of policies integrated Nº of iBRoad2EPC features automatically drawn from existing sources Nº of features embebed -
P5: Define the market approach for the tool	**A6**. Increase market penetration of iBRoad2EPC **A7**. Promote synergies between iBRoad2EPC and other initiatives **A8**. Upgrade the quality of the Assistant	Consortium	Manage resulting data to produce other data tailored for specific stakeholders, and sell these "second row" data, could be marketable Include a specific budget for maintaining and exploiting resulting data in the long term Define interested stakeholder: facility managers, real estate managers or neighbourhood managers The tool must both create demand and satisfy it in the short and long term; it is probably more efficient to enter the	2024 (follow-up) 2024 (follow-up) 2024 (follow-up) 2024 (follow-up)	

Priority	Aim served	Relevant stakeholder	Proposed actions	Timeframe	Indicators
			market following EPC than opening BRP NAC business plan suggestion is to give the tool a free use, retain resulting data and exploit them	2024 (follow-up)	

Table 6: Spanish Action Plan for the National roll-out.

CONCLUSIONS

The report presented the initial guides for the national roll-out of the iBRoad2EPC concept in the six pilot countries, Bulgaria, Greece, Poland, Portugal, Romania, and Spain.

As demonstrated by the varying pilot country approaches, regarding iBRoad2EPC implementation presented in chapter 4, the six countries feature different technical, socio-economical and market conditions, including different EPC and BRP frameworks, national targets, legislation, building stock characteristics and data, financial programmes, and renovation activity. These differences in the market conditions have been critical for the development of the iBRoad2EPC concept in order to best tailor the content to each of the markets.

For the development of the national roll-outs, consultation processes have been organised with the NAC members of each country who provided their feedback and insights on various topics, including the ways of embedding iBRoad2EPC in the national schemes, the process of testing the concept, the adaptation to the specific country conditions and building typologies and the interlinkage between the national frameworks to support the renovation targets using iBRoad2EPC as the intermediary. Moreover, IT implementation and interlinkages approach in each pilot country are being explored, to ensure maximum integration with existing tools and platforms. Work is ongoing in promoting the API approach to developers: a list of fields to be implemented in national EPC software is being prepared, so as to demonstrate how much work it would require for developers, explain processes and advantages etc.

The national approaches are summarised below:

For Bulgaria, iBRoad2EPC can act as a voluntary tool to facilitate and simplify the already quite complex procedure of EPC issuing, by providing energy auditors with a list of predefined measures and notes for recommendations. The EPC scheme in the country is technically advanced, and therefore a more advanced version of iBRoad2EPC is preferred, with selected modules being the Basic and Investment Cost module to start with, the SRI and IEQ modules at a later stage, and the Energy Demand module around 2026. At the moment, a link for automatic import of data from the EPC excel file into the iBRoad2EPC Assistant is being explored. Connection of iBRoad2EPC with the EPC database is considered particularly useful, whereas linking it to existing or future financing programmes could increase the uptake level of the tool.

In Greece, because of the low perceived value of the EPC and its recommendations, iBRoad2EPC is proposed to serve as a meaningful renovation roadmap for building owners, or a voluntary addition to the EPC of buildings participating at national energy efficiency schemes. A two-fold approach is proposed with a basic and an advanced version. Apart from the Basic module which acts as the core of iBRoad2EPC, the Energy Demand module (ideally coupled with the EPC results), the Investment Cost module -with exogenous calculation until a reliable and updated national price database is established- and the IEQ module, because of social implications (energy poverty) are considered especially useful. Intercommunication with the EPC database, as well as an EPC producing software, would greatly facilitate its market uptake. The options currently explored for iBRoad2EPC integration in Greece are: (a) interlinkage with the EPC platform Buildingcert (managed by CRES) to retrieve the basic administrative data of the building (address/geographical location, building permits, EPC results and recommendation scenarios, EPC in PDF format, etc.) and (b) interlinkage with the official software TEE KENAK or at least one private software tool for EPC development through an API. These interlinkages would make iBRoad2EPC more user/expert-friendly and marketable.

In Poland, where an on-site visit is not mandatory to issue an EPC and EPC quality is generally considered compromised, iBRoad2EPC could offer a reliable and user-friendly alternative/addition to tailored renovation consultation for building owners. The most important modules of iBRoad2EPC for Poland, apart from the Basic module, are the Energy Demand, the Investment Cost, and the SRI module. It is, however, advisable by the Polish NAC that the proposed modules be implemented together, as a holistic, comprehensive tool. The versatility of the tool in terms of cost and future additional modules is also considered important. The potential for technical integration into the existing framework is currently being examined.

In Portugal, the placement of iBRoad2EPC in the universe of the several already developed tools regarding building sustainability/energy efficiency is the key to its successful market uptake, even on a voluntary basis for general construction/renovation works. Its compatibility with the, soon to be updated, EPC is considered particularly important, considering the quite advanced EPC framework and public awareness in the country. For Portugal, all of the proposed modules, apart from the MEPI one, are considered necessary. This can again be attributed to the fact that the Portuguese EPC is already quite advanced. Overall, there are three tools to which iBRoad2EPC could be coupled: (a) the excel EPC calculator, (b) the XML file that is produced for every EPC and (c) the casA+ platform. Within iBRoad2EPC, work is currently ongoing on concretely mapping the fields between iBRoad2EPC and the XML file in order to enable to prefill the iBRoad2EPC Assistant with as many information as possible. Also, various options to integrate iBRoad2EPC in the casA+ platform are currently being explored.

In Romania, iBRoad2EPC is proposed to serve the pathway towards a national BRP, by introducing it as a voluntary annex to the EPC which will focus on the Energy Demand and keeping costs and efforts to a minimum. SRI, IEQ, MEPI and Investment Cost aspects are also considered important but not necessary. Interconnection with the national Digital Buildings Registry which is currently under development along with at least one commercial software programmes for issuing EPCs (that is aligned with the new updated methodology) and data retrieval from other databases such as the National Cadastre logbook, the digital Building Roadmap and local databases would facilitate iBRoad2EPC integration into the everyday practices of EPC certifiers and therefore its uptake by the national market.

Finally, in Spain, iBRoad2EPC is proposed to be marketed differently than the current EPC of low perceived value. Its introduction in the market as a voluntary, user-friendly BRP with a high added value placed on its new features and the long-term goals for the renovation process would be advantageous. For Spain, it is proposed that the full version of modules as presented in chapter 3.1 should be adopted since energy certification data of buildings and apartments are already interconnected. The integration of iBRoad2EPC with existing and new instruments should be defined in 3 levels: at the building level with the Digital Building Logbook (LEE), at the urban level with district or municipality level instruments such as the Urban vulnerability Atlas and at the national and regional level by linking it with several databases. Also, it is highly preferrable if data input is automated from other existing databases and manual entry is kept to a minimum. Official EPC tools in Spain feature a common and standardised XML file and therefore XML integration is preferred and currently explored, as this would allow to avoid double manual filling of relevant information, a critical point for iBRoad2EPC integration/ usability by experts according to Spanish stakeholders.

Each of the pilot countries has also recognised a set of priorities, connected to specific aims in order to formulate its national Action Plan. Despite the differences in the technical, socio-economical and market conditions, there is quite a similar number of priorities. The integration of iBRoad2EPC with the existing databases and tools is a common priority for Greece and Spain, while the provision to secure funds to cover the cost of the iBRoad2EPC is a common priority in Bulgaria, Greece, Poland, and Portugal. The user friendliness of the iBRoad2EPC tool is a common priority for all countries while the provision to ensure sufficient capacity to carry out deep renovations is also addressed in all countries. On the other hand, different needs have been described by the pilot countries in terms of the preferred modules, as mentioned above.

The above differences and similarities show the versatile nature of iBRoad2EPC and its efficiency to be adapted based on the national needs, priorities, and vision, while serving as a reliable and user-friendly tool. The different needs identified in the six pilot countries effectively shaped the nature and technical characteristics of iBRoad2EPC, to make it valuable and relevant in all national contexts.

The National Initial Guides presented in this report serve as a starting point for the testing phase of the project in each pilot country. Upon the completion of the testing phase which is scheduled to be finalised by the end of January 2024, a more concrete planning will be feasible, also considering the open consultation process with the public authorities and various stakeholders.

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement Nº 101033781