



iBRoad2EPC perspectives #2

Public authorities views on the integration potential

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EXECUTIVE SUMMARY

This document details the updated and re-assessed national guides for the iBRoad2EPC integration potential into the individual national framework in the six pilot countries of the project, i.e., Bulgaria, Greece, Poland, Portugal, Romania, and Spain. The individual elements of the initially drafted national guides, as presented in the project's report "Initial national guides" [1] have been re-examined and finalised in collaboration with the so-called National Advisory Committees (NACs - consisting of key actors/stakeholders involved in the national frameworks regarding Energy Performance Certificates and Renovation Passports) of the project and public authorities to ensure that adaptation to the specific country conditions is achieved. The aim was to make iBRoad2EPC a high-quality and usable tool for deep-staged renovation completely adapted to the national needs and circumstances and in line with the national Long-Term Renovation Strategies (LTRSs) or future National Building Renovation Plans (NBRPs) according to Article 3 of the recast EPBD (2024/1275) [2]. The procedure followed aimed to seek opportunities for creating interlinkage between the broader national frameworks in the 6 implementing countries to support the renovation target using iBRoad2EPC as the intermediary.

The core of this report remains the analysis of national integration potential in the form of six dedicated chapters, one for each of the pilot countries, in which the final implementation guide is presented. The guides are the result of locating and assessing the necessary changes in procedures and frameworks to embed the iBRoad2EPC into each country's EPC scheme, policies and overall framework, taking into account the lessons learned during the pilot testing phase and the feedback received from stakeholders.

The structure of the guides remains congruent to the initial report with the addition of an introductory section outlining each country's collaboration with the NACs and key insights from the consultation with public authorities. After that, as was the case with the initial national guides, each country section includes an updated overview of the national energy targets and priorities, the legislative framework regarding EPCs and Renovation Passports, the national building stock characteristics, and the EPC issuing specific procedures/peculiarities.

The finalised iBRoad2EPC vision is then presented for which both the views of the national partners and those of the members of the NACs are considered, along with the conclusions derived from public authorities' consultation during the roundtable discussions that took place after the field test. Moreover, the section includes estimations for the finally proposed cost and effort, the proposed modules to actually fit the national context and needs, the already achieved and the envisaged interlinkages with other tools and software, and the training procedures that are required in order for energy auditors to use the iBRoad2EPC tools in practice.

Each country section concludes with the presentation of an action plan developed by project partners in collaboration with the NAC members and public authorities. The action plans are considered important as they set the basis of the implementation at the national level after the duration of the iBRoad2EPC project. 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. Finally, the last section of the report consists of a summary of the key conclusions and recommendations regarding barriers and facilitators for enhancing integration in each pilot country.

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ABBREVIATIONS

AGKK	Bulgarian Geodesy, Cartography and Cadastre Agency
CEEB	Central Register of Emissivity of Buildings
COAC	Colegio de Arquitectos de Cataluña (Architects Association of Catalonia - Spain)
COAVN	Colegio Oficial de Arquitectos Vasco Navarro (Architects Association of Basque Country and Navarre - Spain)
CRES	Center for Renewable Energy Sources and Saving (Greece)
CSCAE	Consejo Superior de Colegios de Arquitectos de España (Architects Association of Spain)
DBI	Digital Building Identity
DBL	Digital Building Logbook
DIY	Do It Yourself
EC	European Commission
EEOS	Energy Efficiency Obligation Schemes
EPB	Energy Performance of Buildings
EPBD	Energy Performance of Buildings Directive
ESCO	Energy Service Company
EU	European Union
EVE	Ente Vasco de la Energía (Basque Energy Body)
EPC	Energy Performance Certificate
ICAEN	Instituto Catalán de Energía (Catalonian Energy Institute - Spain)
IDAE	Instituto para la Diversificación y Ahorro de la Energía (Energy Saving and Diversification Agency - Spain)
IECP	Integrated Energy and Climate Plan
IEQ	Indoor Environmental Quality
INECP	Integrated National Energy and Climate Plan
LCA	Life-cycle Assessment
LEE	Libro del edificio existente (Existing Building Logbook - Spain)
LTRS	Long-Term Renovation Strategy
MEPI	Measured Energy Performance Indicator
MEPS	Minimum Energy Performance Standards
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 - Spain)
MS	Member States
NAC	National Advisory Committee
NBDR	National Buildings Digital Registry (Romania)
NBRP	National Building Renovation Plan
NECP	National Energy and Climate Plan
NRRP	National Recovery and Resilience Plan
PEC	Primary Energy Consumption

RES	Renewable Energy Sources
RCCTE	Regulation of Thermal Behaviour Characteristics in Buildings (Portugal)
SEDA	Sustainable Energy Development Agency
SRI	Smart Readiness Indicator
TCG	Technical Chamber of Greece

INTRODUCTION

To achieve the ambitious goals and climate targets set by the European Union (EU), a significant reduction should be made in the building sector greenhouse gas emissions, which contributes around a third of EU emissions. The strengthened European Performance of Buildings Directive (Directive (EU) 2024/1275 EPBD recast Directive) [2] has been published in the Official Journal of the European Union and entered into force on 28 May 2024 with a foreseen obligation for Member States to incorporate its requirements into their national laws until 29 May 2026.

The Directive is a cornerstone of the EU's efforts to transition away from fossil fuels by doubling the rate of energy efficiency improvements and tripling renewable energy capacity by 2030, in line with the the “Fit for 55” package [3] which foresees a reduction in greenhouse gas emissions by at least 55% by 2030. Along with a unified approach to EPC scales, the recast EPBD introduced and modified many provisions such as an updated standard for new buildings, including a whole life carbon emissions approach, the establishment of Minimum Energy Performance Standards (MEPs) to renovate the worst-performing non-residential buildings along with a mandatory trajectory for the progressive renovation of the residential segment, strong national building renovation plans and provisions to decarbonise heating and cooling, improved Energy Performance Certificates, a EU framework for the uptake of Renovation Passports (RPs), a stronger role for one-stop shops, a more strategic and impactful financial framework and a focus on the social fairness of all provisions, both for mandatory requirements and incentives [4].

According to Article 2 of the 2024 recast EPBD, a Renovation Passport is defined as a tailored roadmap for the deep renovation of a specific building in a maximum number of steps that will significantly improve its energy performance. It is also foreseen that Renovation Passports 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.

The Horizon 2020 iBRoad2EPC project built on the results of the iBRoad project (2017-2020) and proposes a modular approach for a Renovation Passport which offers in its core/Basic module staged deep renovation advice, along with optional additional add-on modules such as the Investment Cost module, Energy Demand module, Indoor Environmental Quality module (IEQ), Smart Readiness Indicator module (SRI) and Measured Energy Performance Indicator module (MEPI). The aim was to bridge EPCs with Renovation Passports by improving EPC 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 developed and finalised iBRoad2EPC concept and methodology is described in detail in the report titled “iBRoad2EPC in depth” [5] available at the project’s website¹. Its flexible and modular nature allowed for extensive adaptations to fit the specific needs and market maturity in the six pilot countries in which it was tested (Bulgaria, Greece, Poland, Portugal, Romania and Spain). The process of adaptation to the specific requirements of implementing countries concerns both functional and visual elements such as specific target building types, customer groups, energy performance scales, prefabricated text blocks for renovation advice, targets, notes to avoid lock-in effects, indicators, images and the format of iBRoad2EPC. The context, target groups and methodology for country specific adaptation is described in the report titled “Specification for the iBRoad2EPC software tools” [6] which can serve as a model for other countries that intend to implement iBRoad2EPC at a later stage.

¹ <https://ibroad2epc.eu/>

Overview of iBRoad2EPC

iBRoad2EPC is an energy consultation tool for building owners, issued by building professionals. It outlines an initial renovation strategy on how a building can become climate neutral in the long term. The strategy can include a full renovation in one step, but also a renovation in several steps. The long-term perspective means that the individual renovation steps build on each other, with building component connections and even future renovation obligations being considered and, where necessary, prepared in advance. iBRoad2EPC follows a modular approach that enables adaptation to the different requirements in implementing Member States (Figure 1).

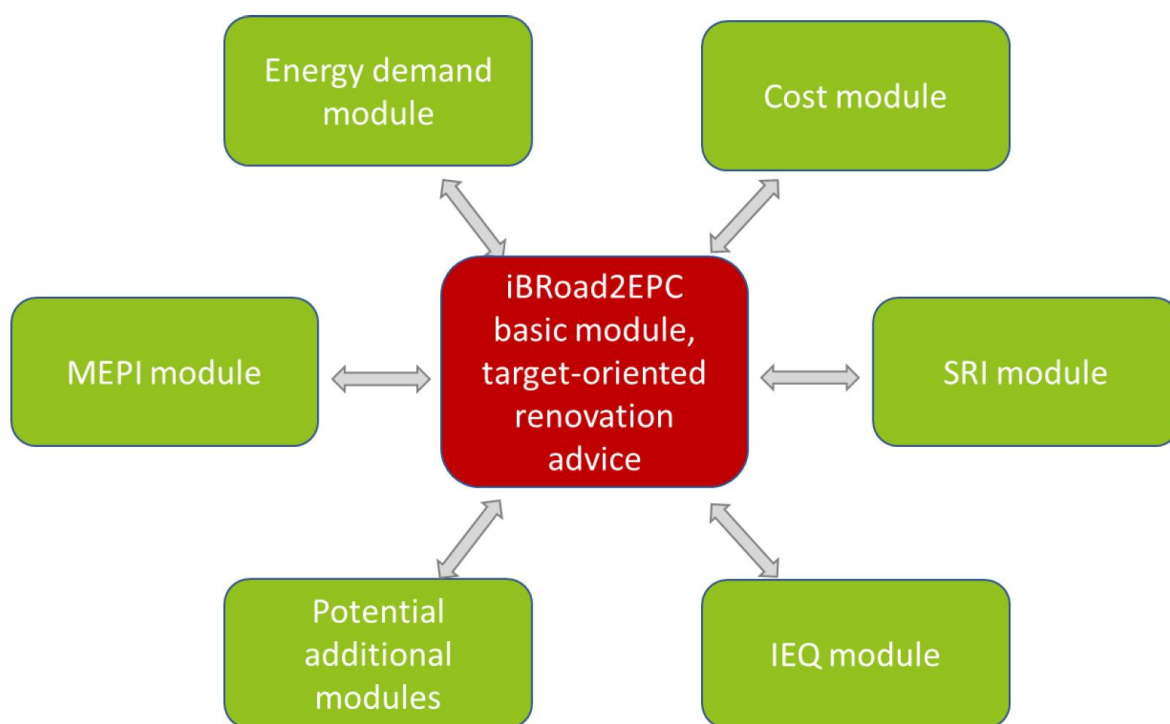


Figure 1: The modular structure of iBRoad2EPC makes it flexible and expandable

A Basic module comprises the general renovation plan and related advice. The unified core features include the output of indispensable technical information for building owners and, in addition, a unifying methodology and layout as well as a uniform software infrastructure to issue the iBRoad2EPC. The Basic Module can be complemented flexibly with additional modules. The additional modules provide extra information on energy demand, investment cost, smart readiness (SRI) and indoor environmental quality (IEQ).

The added value of iBRoad2EPC lies in the improvement of the renovation recommendations that are included in EPCs by incorporating Renovation Passport elements, along with the outline of an individual long-term renovation strategy considering the following key points:

- step-by-step renovations that gradually lead to a meaningful whole,
- avoidance of mistakes through early preparation of later renovation measures,
- alignment with overarching national building targets,
- future requirements and obligations (e.g., ban of fossil fuels, minimum energy performance standards) in order to prepare the building and fulfil all legal requirements.

More information on the iBRoad2EPC concept is available at the project report “Conceptualising iBRoad2EPC” [7] and “iBRoad2EPC in depth” [5].

OBJECTIVES OF THIS REPORT

iBRoad2EPC was tested in Bulgaria, Greece, Poland, Portugal, Romania, and Spain. The initial national guides [1] of iBRoad2EPC provided the necessary framework to support the national adaptation and pilot testing of the iBRoad2EPC, and the updated national guides included in this report will support the actual adoption of the proposed model in the six pilot countries. The collaboration with the National Advisory Committees (NACs) was crucial for the drafting and updating of all elements of the guides in the six pilot countries.

After the completion of the field testing, it was examined how end users perceived the concept, processing tool, graphic design and consultancy content of iBRoad2EPC. Additional consultation meetings with the authorities/NACs were organised in the six pilot countries to locate and assess the necessary changes in procedures and frameworks to embed the iBRoad2EPC into each country's EPC scheme, policies and overall framework, incorporating the lessons learned from the field test. During Roundtables (which featured a group of participants larger than the NACs), more than 230 stakeholders provided insights on the integration potential of iBRoad2EPC, the additional value it offers for energy experts and building owners and the quality/user-friendliness of its interface and outputs. The detailed minutes/proceedings of these roundtable discussions are available at the project's report "Stakeholders views on iBRoad2EPC adoption".

The individual elements of the initial guides have been re-examined and finalised taking into account the lessons learned from the field test, the feedback received from building owners and energy auditors, the technical advancements and progress regarding interoperability with other national platforms and software (national buildings registry, EPC databases, EPC calculation software, etc.) as well as the views of public authorities during the NAC meetings and stakeholders' roundtable discussions that took place in the context of iBRoad2EPC evaluation.

The current report represents the second -and updated- version of the national guides (final national guides) which complete the recommendations needed in the national frameworks to integrate the iBRoad2EPC in each pilot country's legislative, procedural, financial and market situation. The aim is for these guides to serve the development of the national framework for the future adoption of iBRoad2EPC into the national context as a Renovation Passport in line with the provisions of Article 12 of the 2024 recast EPBD.

METHODOLOGY

The first version of the national guides (initial national guides) focused on the preparation for pilot testing, whereas the second -and updated- version of the national guides (final national guides- current report) have incorporated the field-testing experience and stakeholders' feedback and finalise the policy recommendations needed in the national framework to integrate the iBRoad2EPC in the country's legislative, procedural, financial and market situation after the end of the project duration.

In the "Initial national guides" report, there is an introductory part on the iBRoad2EPC concept and key features, issuing procedure and interface, the training toolkit, as well as the outputs and illustrations of the final document that is received by the building owners. This part is considered out of scope in this report, which focuses on the integration potential in each pilot country. The published "iBRoad2EPC in depth" [5] and "Training toolkit" [8] reports available at the project's website² provide extensive information related to these topics.

The final national guides have been developed in close collaboration with the NACs to update, re-assess and replace the initial national guides, and comprise:

- An overview of the collaboration with the NAC in each country along with a summary and key insights of the final consultation meeting regarding the integration potential.
- A brief overview of the current national situation regarding EPCs and Renovation Passports. 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 "EPCs - Energy Performance Certificates & LTRs - Long-Term Renovation Strategies" [9], and "Conceptualising iBRoad2EPC" [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 methodology for the development of the national guides followed the concept of an integrated management cycle (Figure 2) which encompasses five steps: stakeholders mapping, baseline assessment and consultation, set action plan and define indicators, implement actions and evaluation and monitoring. The cycle represented 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. More information on the methodology used to create the initial national guides can be found in the respective section of the "Initial national guides" [1] report.

² <https://ibroad2epc.eu/>

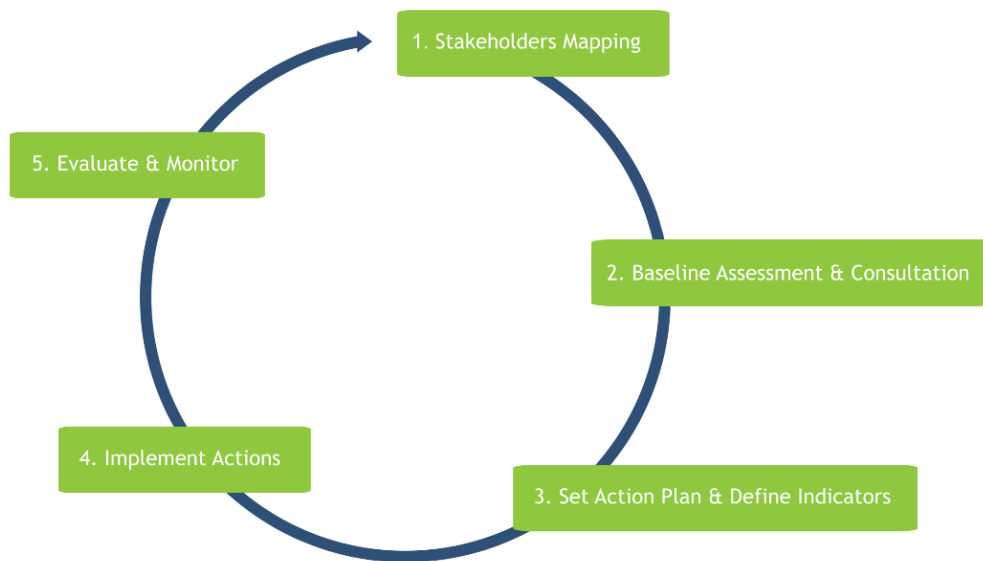


Figure 2: 5 steps of the management cycle that can be repeated to promote informed policy-making

The final guides have resulted from the fourth and fifth steps of the management cycle which refer to the national testing and evaluation phases of iBRoad2EPC, respectively. A critical part of the iBRoad2EPC methodology was the testing of the tool in 57 buildings (public, multi-family, etc.) in the six pilot countries. An evaluation process followed, regarding the field test results, along with the collection of feedback from national stakeholders, and its utilisation for the re-assessment of the national integration potential of iBRoad2EPC.

The final 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.

FINAL NATIONAL GUIDES

Bulgaria

National overview

Some key information on the national targets and priorities, the EPCs and Renovation Passports 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” [7].

National targets and priorities

The Bulgarian LTRS [10] 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 mentioned in the initial National Energy and Climate Plan (NECP, published in 2020) for the period 2021-2030, with the target to achieve savings in 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. A draft of the updated Bulgarian NECP was presented for public consultation in June 2024, however, no updated numbers regarding building renovations are included in the document, leaving this issue unclear until 2025, when the National Building Renovation Plan (NBRP) will be developed as per the 2014 recast EPBD requirements.

Due to the unstable political situation in Bulgaria³ public priorities on EPCs and Renovation Passports 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 (NRRP) 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 in Bulgaria on EPCs and Renovation Passports 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).

³ Since April 2021, only two regular governments have been established, lasting only 6 and 9 months respectively.

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 - SEDA (an executive agency of the Ministry of Energy) is responsible for the accreditation of energy auditors and the quality control of EPCs.

Currently, technical building passports for existing buildings are not mandatory, as the initial obligation to provide such detailed documents (including, besides the EPC, structural assessments and recommendations) by 2024 was abolished by the authorities due to the high costs for the homeowners. Additionally, the requirement to provide an EPC in the case of sale/lease of a building/part of a building, although in theory regulated by law, is not applied in practice, as there is no mechanism to monitor compliance. This has raised multiple concerns over the practical implementation of the EPBD, even at European Commission level.

Building stock characteristics

A detailed review of the national building stock is presented in Chapter 1 of the national LTRS. 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.

In the residential sector, the LTRS states that there is a total of 2.060.745 residential buildings in Bulgaria. The total number of housing units in these buildings is 3.887.149, with a total useful area of 283.833.436 m². The total number of occupied residential buildings is 1.505.945 (76% of all residential buildings). These comprise 3.345.819 housing units with a useful floor area of 248.286.757 m². The total number of occupied housing units is 2.666.733, making for a ratio of vacant housing units to the total number of housing units of 31% (26% in cities and 43% in villages, reaching 100% in completely depopulated areas). The share of vacant housing units in occupied residential buildings exceeds 20%. 91% of the non-renovated buildings in the country are classified to energy classes E, F and G 18% belong to energy class G (with primary energy consumption > 435 kWh/m² per year), 34% belong to energy class F (with primary energy consumption in the range of 364 kWh/m² per year up to 435 kWh/m² per year) and 39% belong to energy class E (with primary energy consumption in the range of 291 kWh/m² per year up to 363 kWh/m²). More than 90% of all residential buildings occupied throughout the year in Bulgaria are single-family houses with a useful floor area of less than 50% of the total area of the building. Multi-family residential buildings have a share of less than 5% of the total number of residential buildings occupied throughout the year, but their useful floor area is approximately equal to that of single-family houses, as more than half of the Bulgarian population occupies such buildings. Regarding multi-family residential buildings, more than 96% of the dwellings are owned by the individual residents, so that a major effort is needed to convince and unite all the owners to invest together to issue an EPC (or a Renovation Passport) for the whole building. For single-family houses, the main challenge is the excessive cost and low perceived value of the EPC.

Information about non-residential buildings is collected by various institutions to enable the provision of administrative services and for other purposes. Data structure and distribution across the various categories is uneven. The Geodesy, Cartography and Cadastre Agency (AGKK) maintains a large dataset that covers 89,56% of Bulgaria's territory. The table below sets out an overview of the data on the non-residential building stock.

Building category	Total area (m ²)
Childcare establishments (kindergartens and crèches)	2.371.438
Other, incl. retirement homes, homes for orphaned and abandoned children, student dormitories, car repair centres	18.470.987
Healthcare establishments (hospitals, polyclinics, etc.)	9.685.995
Retail and wholesale outlets (supermarkets and shopping malls)	10.519.029
Education (schools, colleges and universities)	8.927.599
Public service buildings	14.878.947
Sport halls and facilities	1.793.216
Buildings of cultural and art institutions	2.296.810
Buildings in the transport sector (train stations, ports and airports)	2.803.990
Hotels and restaurants	18.898.840
Not classified	14.276.437
Total	104.923.286

Table 1: Overview of the Bulgarian non-residential building stock

Information on the energy performance of buildings is mainly available from Energy Performance Certificates and there are no other official sources of information. There are differences in the volume of buildings certified in different categories. For this reason, the overview largely comprises categories for which large samples of certified buildings are available, notably administrative buildings, the buildings of educational establishments and scientific organisations and the buildings of childcare establishments.

The distribution of administrative buildings in terms of their energy class is more even compared to that of buildings belonging to other categories. One of the reasons for even distribution by year of construction is that 20% of the buildings have been constructed after 1999, which is when more stringent energy efficiency requirements were introduced. A total of 48,5% of administrative buildings are below the minimum energy consumption class (currently energy class C for all existing buildings constructed before 2010), with an additional 28,4% belonging to energy classes E, F, or G. A relatively high share of buildings (more than 27%) has been certified as energy class B.

The category of educational buildings comprises schools, colleges and universities. Most of them are below the minimum energy efficiency class (74% of the buildings), with 54,5% belonging to energy classes E, F or G. The situation in the segment of childcare establishments is similar to that of the educational institutions. A total of 65,5% of childcare buildings do not satisfy the minimum requirements for the energy efficiency class, and 49,5% belong to energy classes E, F or G. Relatively few (less than 10%) of the buildings of educational institutions and childcare establishments belong to energy class B.

The data provided in Table 1 (for both residential and non-residential buildings) is currently used to develop the strategic and planning documents by policymakers. It also clearly shows the need to provide additional measures and tools to stimulate and streamline the renovation market, among which the iBRoad2EPC toolset could play a major role.

EPC framework

Regarding current legislation stemming from the EPBD requirements, all buildings in use with a total floor area of over 250 m² are subject to a mandatory energy audit. This detailed energy audit is the only possible way to receive an EPC. However, this regulation is not entirely enforced in practice, especially in the residential sector, as there are no functioning compliance mechanisms and political will to impose penalties. The regulation also requires that the owners of any certified building must implement the measures prescribed by the energy audit within three years from the date of acceptance, which, even if also not applied coherently in practice, remains one of the main reasons for the reluctance of building owners to undergo an audit and issue an EPC for their building.

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. Issuing of an EPC goes with a detailed energy audit of the building and completion of a set of documents by the energy auditors which requires a lot of time. 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 SEDA, extremely high compared with common EU practice. Due to the fact that it requires at least one week of work, including an on-site visit from an accredited auditor, 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 led 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 m², 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 completely on the assessor's knowledge and their data collection skills, no specialised certification /EPC training courses had been held for a period of approximately 10 years by any of the seven licensed universities before finally the training courses were restarted in 2023.

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, iBRoad2EPC should not pose a high additional cost and effort above that (Figure 3). The recent update of the EPC framework and calculation methodology has led to an increase in the time needed for the audit and the use of additional, often self-made, calculation tools which is expected to lead to a further increase of the EPC prices. In this context, 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 that are included in the iBRoad2EPC) that will be available for the auditors to use as a base for the energy audit and EPC procedure.

In addition, iBRoad2EPC can assist in the development of detailed descriptions for the recommended energy saving measures that normally are very briefly mentioned in the EPC. The fields to detail the measures in the mandatory energy audit summary EXCEL file may exist, but there is no specific requirement about the level of detail required. Usually, a detailed description of the measures proposed is presented in the energy audit report. If detailed measure descriptions are available in iBRoad2EPC, then it will be redundant to provide also a long energy audit report. All the technical data for the building is included in the summary Excel file, so the control on the energy auditing and certification can be done based on the excel file, the EPC, a saved file/files from the energy modelling software and the Renovation Passport. All the important information for the building owner itself is already present in the EPC. In the case of iBRoad2EPC adoption by the Bulgarian authorities, this approach would effectively save time and efforts for the energy auditors leading to a decrease in the price of the full auditing service.

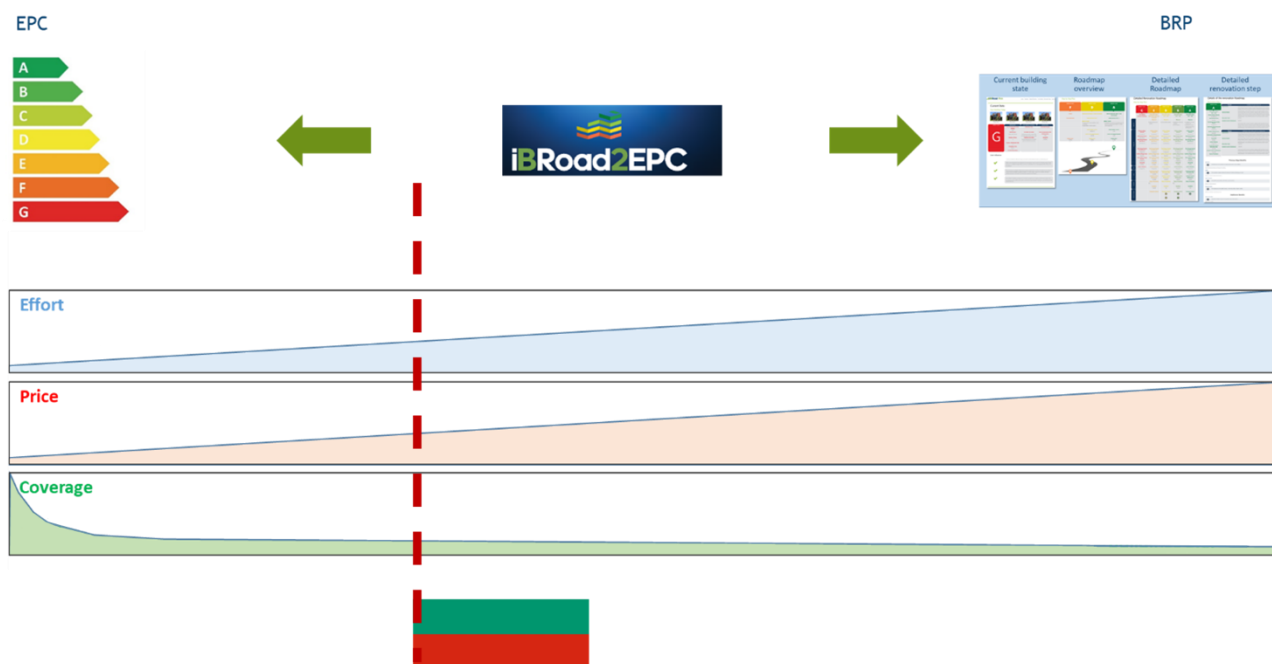


Figure 3: The Bulgarian iBRoad2EPC is conceptually placed towards the EPC end of the EPC- Renovation Passport spectrum.

Proposed modules

For Bulgaria, most of the proposed modules of the iBRoad2EPC modular concept are considered necessary. This can again be 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. The MEPI module on the other hand, is not proposed to be implemented in the country, since measured energy performance is already present in a comprehensive way in the energy audit. The Energy Demand module will become relevant no later than 2026, when the regulated energy market for the households will be abolished. A useful future addition to iBRoad2EPC for Bulgaria would be a module on electric mobility.

Interlinkages and automation

The connection of the iBRoad2EPC Assistant to the EPC database maintained by SEDA is considered particularly useful. By establishing a connection to the database, the iBRoad2EPC Assistant enables accurate and up-to-date data retrieval and storage, improving the efficiency and effectiveness of the iBRoad2EPC issuing procedure. More specifically, the interconnection of iBRoad2EPC with the existing EPC procedure in Bulgaria has been implemented and tested during the iBRoad2EPC national adaptation and roll-out as follows:

As part of the EPC issuing process, all Bulgarian auditors have to fill out a specific Excel file with fixed parameters, including type of content, dimensions and range of possible values. When the auditor starts creating a new enhanced EPC using the iBRoad2EPC Assistant, they are given the possibility to upload this Excel file. This allows 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 extracts the energy saving measures that the auditors have defined as those to be implemented as soon as possible, and adds them to the ASAP step of iBRoad2EPC. However, a specific note is added, mentioning that the auditor should check the measure again and has the option to select a different variant if the most probable match was not the correct one. In this regard, the time-defined steps of iBRoad2EPC are particularly relevant in the Bulgarian case, because EPC recipients anyway have to implement the recommended measures in a defined period of time. Thus, the integration of the iBRoad2EPC Assistant in the typical auditing procedure and the automation of the processes provides the only feasible opportunity

for actual market implementation, given the already very demanding and time-consuming EPC issuing procedure in the country.

Trigger points

The recent amendment of the EPBD sets very ambitious renovation targets for both public and residential buildings. For public buildings, the pledged minimum criteria for existing buildings, coming into force gradually in steps of several years, is an outstanding incentive for staged renovation and the only tool currently available and ready to use in the country to achieve this is iBRoad2EPC. The picture is similar for residential buildings, for which the use of staged renovation is again one of the most suitable approaches, especially as regards cost-efficiency and optimal use of both public resources and private capital.

In this context, the integration of iBRoad2EPC in the Bulgarian national framework should be linked with the development of the National Building Renovation Plan (NBRP), which will replace the Long-Term Renovation Strategy (LTRS) and will become an integral part of the National Energy and Climate Plan (NECP). Thus, the transposition of the EPBD recast, combined with the potential change of the calculation software, present an important opportunity for the possible uptake of iBRoad2EPC in the country.

Another trigger point for implementation is introduced by the upcoming Taxonomy regulation requirements, which require all financing institutions to expand their portfolio of projects with excellent energy performance. Given the fact that the database of EPCs covers a negligible part of the residential buildings, while the real estate market continues to be booming, a stronger demand for an affordable methodology for defining the performance levels of the buildings is already evidenced in the discussions with the representatives of the commercial banks in Bulgaria. This, combined with the efforts of the professional chambers to amend the methodology for assessment of the energy performance of the buildings, could potentially lead to an opportunity to integrate iBRoad2EPC in the EPC issuing procedures.

Considering the past practices, it is assumed that iBRoad2EPC could be initially used on a voluntary basis within future dedicated financing instruments for retrofitting of both public and residential buildings, which would facilitate its integration to the national framework by covering the costs for the energy audits, respectively for issuing of EPCs. However, this is an ambitious goal that should be supported by concrete governmental decisions as soon as the policy crisis in Bulgaria is over and a permanent Government is established.

Training procedures

Until recently, there were serious problems with training and certification courses for EPCs in the country, as they had not been conducted for nearly 12 years. Following the reinstatement of EPC training and certification courses in 2023, iBRoad2EPC was partially integrated during the test phase to the curriculum of one of the course providers. However, in the end it was not included in the mandatory topics, because this would necessitate a regulation change and significant extension of the already long and expensive Energy Auditor course. Thus, the integration of the iBRoad2EPC training material requires a change of the regulations, which has to be initiated by the Ministry of Regional Development and Public Works. This could happen following an update of the methodology and software for energy auditing, or in the case that the EPC issuing procedure is separated from the energy auditing process, which is considered a possibility considering the low percentage of issued EPCs in the country that has already raised concerns at European Commission level.

The integration of iBRoad2EPC training was also discussed within the World Bank's technical assistance project on improvement of the software and training for energy auditors and fits very well with their recommendations for national legislation improvement. This is an argument pro integration of iBRoad2EPC training into national training schemes for energy auditors and EPC issuers. The availability of ambitious renovation support programmes for all types of buildings is also a key factor, so policy advocacy in this direction should be a continuous effort.

Action plan for the national implementation of iBRoad2EPC

Nine (9) priorities have been identified for iBRoad2EPC implementation in Bulgaria, which are presented in Figure 4.



Figure 4: Priorities identified for the Bulgarian Action Plan

The Bulgarian Action Plan for the national implementation is presented in the following overview. The Priorities are grouped in Table 2 per Aim served.

Priority	Aim served	Relevant stakeholder	Proposed actions	Timeframe	Indicators
P1: Simplify the EPC issuing procedure and documentation	A1. Increase market penetration of iBRoad2EPC/ create demand	Ministry of Regional Development and Public Works	Discussions at specialised forums	2024-2025	4 consultation forums
P2: Emphasise innovative elements beyond energy with practical value		National Sustainable Energy Development Agency	Apply for financing and execute pilot projects for iBRoad2EPC application	2024-2025	4 specialised articles
P3: Secure funds to cover the cost of iBRoad2EPC		Technical university - Sofia	Advocate on improvement of the national support programmes and quality assurance mechanisms	2024-2025	5-7 pilot implementations
P4: Promote financing schemes based on iBRoad2EPC		Chamber of Energy Auditors	Support development of dedicated financing schemes based on EPCs	Cont.	5+ meetings with financing institutions
P5: Create the right control mechanisms		Chamber of Engineers in Investment Design		Cont.	Official positions on all relevant documents
		Individual auditors, financing bodies and ESCOs			
P6: Ensure adequate exposure to the public via media channels	A2. Increase the number of deep renovations	Ministry of Regional Development and Public Works	Produce information materials about the added value of EPCs and the multiple benefits of renovation	2024-2025	3-5 publications/ appearances on the topic
P4: Promote financing schemes based on iBRoad2EPC		National Sustainable Energy Development Agency	Ensure media publication and appearances of experts	2024-2025	10-15 web and social media publications
P8: Ensure sufficient capacity to carry out deep renovations		Academia	Advocate on the resuming of certification courses	Cont.	Official positions and declarations on each occasion
		Chamber of Energy Auditors	Produce information materials about the added value of EPCs and the multiple benefits of renovation	Cont.	Support to development of training curricula
P2: Emphasise innovative elements beyond energy with practical value		Chamber of Engineers in Investment Design		2024-2025	4 specialised articles
		Individual auditors, financing bodies and ESCOs			
		Media			
P9: Ensure adequate exposure to potential replicators and partners	A3. Promote synergies between iBRoad2EPC and other projects	Representatives from other projects	Participate in dissemination conferences and joint events	2024-2026	At least 10 participations at topical events
		Financing institutions	Support development of dedicated	Cont.	5+ meetings with financing institutions

Priority	Aim served	Relevant stakeholder	Proposed actions	Timeframe	Indicators
P4: Promote financing schemes based on iBRoad2EPC			financing schemes based on EPCs Apply for financing and execute pilot projects for iBRoad2EPC application	2024-2025	5-7 pilot implementations
P9: Ensure adequate exposure to potential replicators and partners	A4. Ensure stakeholder involvement	Ministry of Regional Development and Public Works	Participate in dissemination conferences and joint events	2024-2026	At least 10 participations at topical events
P6: Ensure adequate exposure to the public via media channels		National Sustainable Energy Development Agency	Produce information materials about the added value of EPCs and the multiple benefits of renovation	2024-2025	3-5 publications/ appearances on the topic
		Academia Chamber of Energy Auditors Chamber of Engineers in Investment Design Individual auditors, financing bodies and ESCOs Media Representatives from other projects	Promote examples and case studies presenting the benefits	2024-2025	3-5 case studies for the use of iBRoad2EPC tools

Table 2: Bulgarian Action Plan for the national implementation of iBRoad2EPC

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 Renovation Passports, 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” [7].

National targets and priorities

According to the Greek LTRS [11], 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 CO₂ emissions in buildings will be reduced by 100% by 2050 compared to 2005, under the most ambitious scenario. The Greek NECP is expected to be updated very soon, as it is currently under public consultation until 16 September 2024. It foresees renewed targets to reduce primary and final energy consumption in the Greek building stock and emphasises the exemplary role of the public buildings. Specifically, it foresees an annual reduction of 1,9% in final energy consumption in the buildings sector, compared to 2021 levels.

The energy upgrade of buildings in the form of building renovations is included in the National Recovery and Resilience Plan (NRRP) [12] 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 though Renovation Passports are mentioned in article 2A of L. 4122/2013 regarding the Greek Long-Term Renovation Strategy (LTRS) [11], 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) - expected to be updated
- the National Energy and Climate Plan (NECP) (ΦΕΚ Β' 4893/31-12-2019) - also to be updated soon
- 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 [11], 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 a nearly Zero Energy Building 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 Renovation Passport integration.

EPCs are mandatory for renting most types of buildings/building units, unless they are independent buildings with an area of less than 50 m², 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 m² ranges from 50 to 150 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/m² (including VAT) is foreseen for the EPC (275 euros for an 80 m² 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/m² = 395 euros, depending on its final form and the time required for its completion (Figure 5). For public buildings or buildings with more than 1000 m² of useful area, the pricing scheme could differentiate. During the testing phase in Greece, the

compensation of 0,34 euros per m² was considered sufficient by most auditors who participated in the field test and issued iBRoad2EPCs for (mainly large) public buildings.

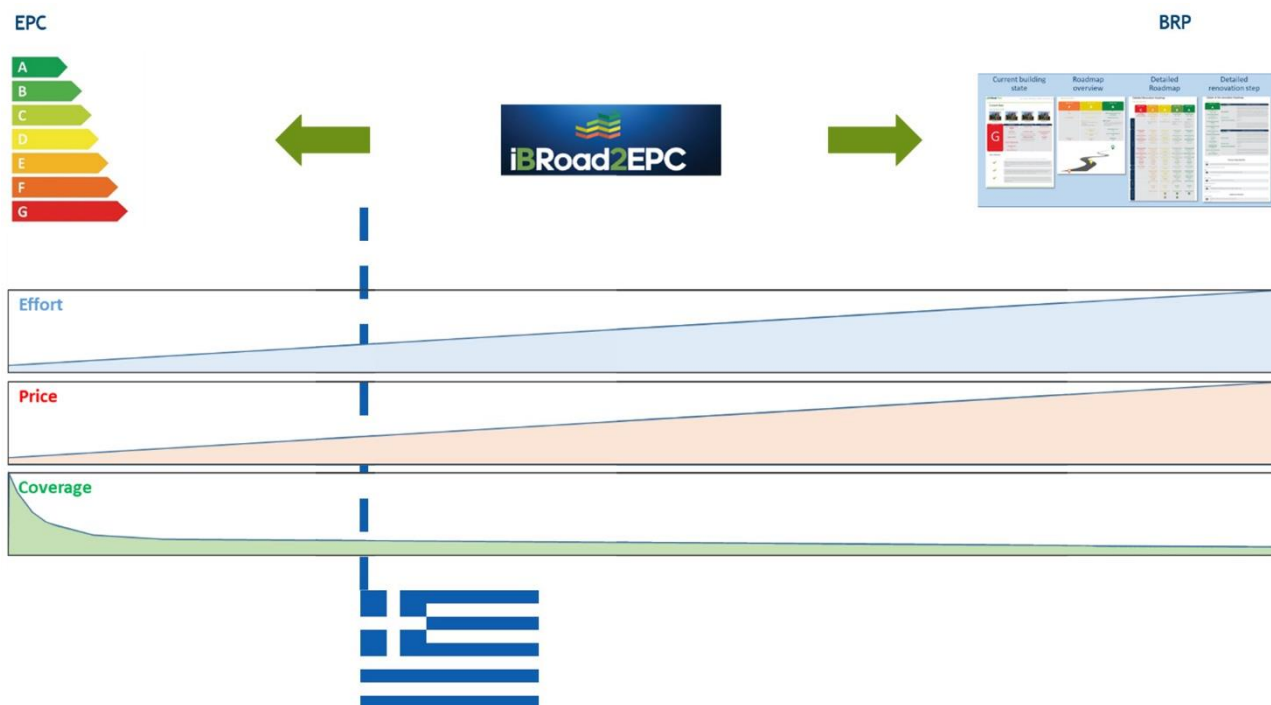


Figure 5: The Greek iBRoad2EPC is conceptually placed towards the EPC end of the EPC-Renovation Passport spectrum

In case of participation at national energy upgrade schemes such as the “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), 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 was not considered necessary by auditors and stakeholders. 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. Additional modules which could be developed beyond the project duration include: a Water Efficiency module 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. The API for this interconnection has already been developed in the duration of the project, and the connections with CRES have been established.

Other interconnections with iBRoad2EPC to be investigated 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. For a mandatory iBRoad2EPC, there needs to be a funding scheme in place to support the additional cost for building owners.

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 Renovation Passports, 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 Renovation Passports, 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 implementation of iBRoad2EPC

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 Figure 6, include: the creation of a comprehensive tool for building energy upgrade embedded in the EPC scheme & ensure sufficient capacity to carry out deep renovations; the integration of iBRoad2EPC in the national energy efficiency schemes; provisions to ensure the integration of the iBRoad2EPC with the existing databases/tools; actions to secure funds to cover the cost of iBRoad2EPC; ensure proper iBRoad2EPC support after the end of the project and make the concept of iBRoad2EPC future-proof.

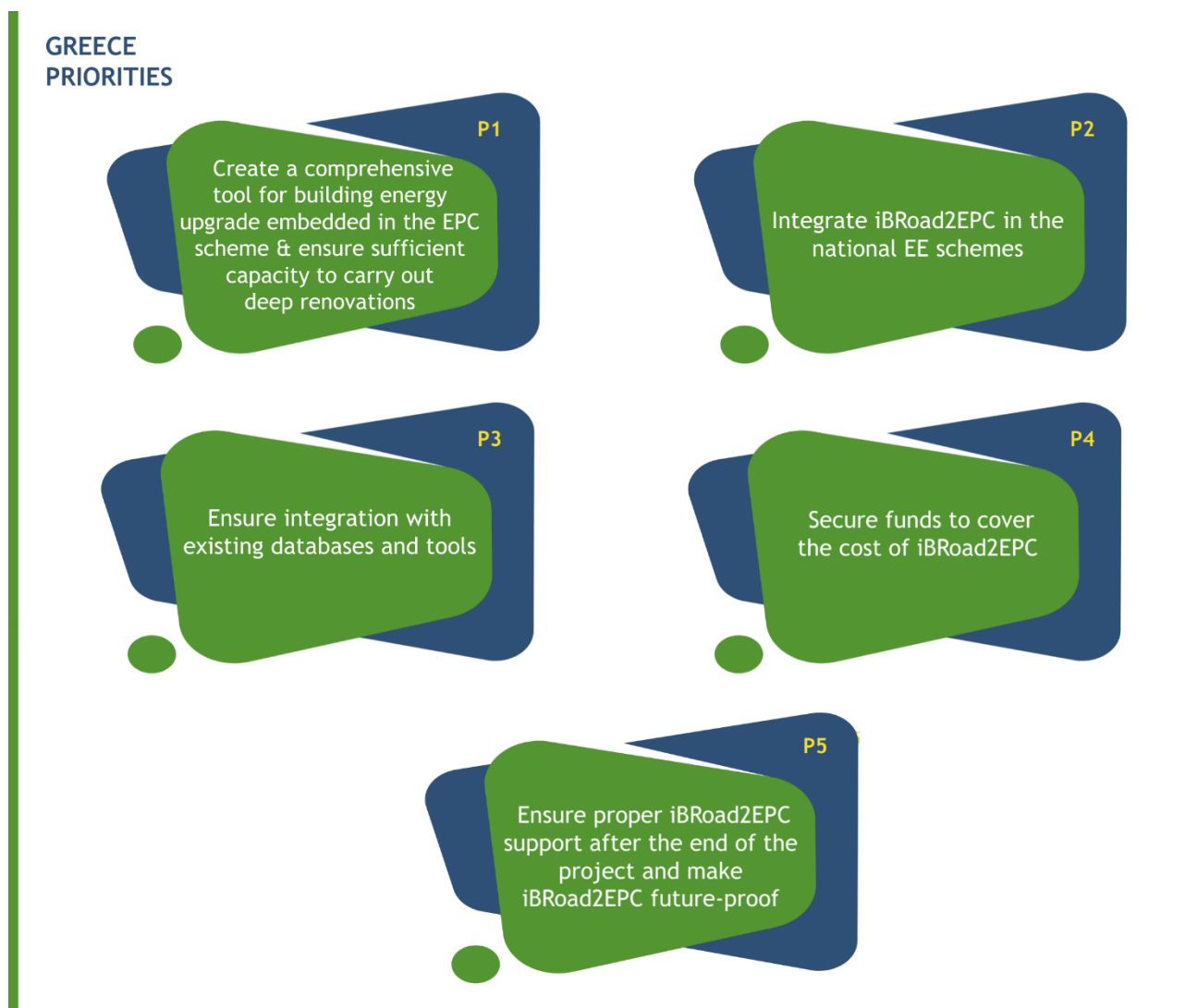


Figure 6: Priorities identified for the Greek Action Plan

The Greek Action Plan for the national implementation of iBRoad2EPC is presented in Table 3.

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	Ministry of Environment and Energy CRES Energy Inspectors Technical Chamber of Greece	Test iBRoad2EPC’s compatibility with existing tools/databases	2025	Number of iBRoad2EPC/ buildings tested	
	A3. Promote future-proof benefits and advancements of deep renovation		Organise training sessions for experts, info days for relevant stakeholders and bilateral communication with parties responsible for the EPC scheme	Continuous	Feedback from energy experts Number of experts completing the trainings	
	A5. Build trust on the importance of informed renovations and the iBRoad2EPC/ create demand		Gather feedback from stakeholders	2024 and following integration	Number of Roundtable discussions	
			Media/dissemination campaign of iBRoad2EPC - link with the market via OSS integration	2025-2026	Number of publications	
P2: Integrate iBRoad2EPC in the national energy efficiency schemes	A1. Increase the number of deep renovations	Ministry of Environment and Energy CRES Energy Inspectors Ministry of the Economy and Finance Technical Chamber of Greece	Identify relevant fields/documents of energy efficiency schemes templates/ documents (“SAVING” and “ELECTRA” programmes) to embed iBRoad2EPC	2024 and following national schemes developments	Number of documents/ fields embedded in iBRoad2EPC	
	A2. Increase public awareness for deep renovation					
	A5. Build trust on the importance of informed renovations and the iBRoad2EPC/ create demand		Stakeholder communication sessions to gather feedback on the integration potential of iBRoad2EPC in national schemes	2024-2025	Number of sessions organised	
	A6. Increase the percentage of private funding for energy renovation projects					
P3: Ensure integration with existing databases/ tools	A3. Promote future-proof benefits and advancements of deep renovation	Ministry of Environment and Energy CRES Energy Inspectors Technical Chamber of Greece	Ensure maximum compatibility/ flexibility of iBRoad2EPC formats/layouts with national layout	2025	Number of iBRoad2EPC features automatically drawn from existing sources	
	A4. Ensure iBRoad2EPC consistency with future national and European targets (NBRP, NECP, EPBD etc.)		Test iBRoad2EPC’s compatibility with existing tools/databases (DBI, Buildingcert, Cadastre, TEE KENAK)	2025-2026		
	A5. Build trust on the importance of informed renovations and the iBRoad2EPC/ create demand					
P4: Secure funds to cover the cost of iBRoad2EPC	A1. Increase the number of deep renovations	Ministry of Environment and Energy CRES	Identification of possible funding sources to cover for iBRoad2EPC additional cost	Continuous	Number of financial instruments established	

Priority	Aim served	Relevant stakeholder	Proposed actions	Timeframe	Indicators
	A2. Increase public awareness of deep renovation	Energy Inspectors Ministry of the Economy and Finance	Info sessions/ bilateral communications with banks for embedding iBRoad2EPC in the business plans they receive for green loans	Continuous	Available budget in euros for iBRoad2EPC
	A5. Build trust on the importance of informed renovations and the iBRoad2EPC/ create demand	Technical Chamber of Greece ESCOs Association of building owners Financing Institutions	Embed iBRoad2EPC in OSSs and promote via online marketplaces	2025-2026	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	Ministry of Environment and Energy CRES Energy Inspectors Technical Chamber of Greece Association of building owners	Ensure adaptation capacity/ iBRoad2EPC flexibility for changing national context	Continuous	Number of roundtables organised after changes in national context
	A4. Ensure iBRoad2EPC consistency with future national and European targets (NBRP, NECP, EPBD etc.)		Media/ dissemination campaign of iBRoad2EPC - link with the market via OSS integration	2025-2026	Number of publications
	A5. Build trust on the importance of informed renovations and the iBRoad2EPC/ create demand		Establish an iBRoad2EPC support mechanism (website-hotline-e-mail support) to be available after the end of the project	2024-2025	Support mechanism options and availability
	A6. Increase the percentage of private funding for energy renovation projects				

Table 3: Greek Action Plan for the national implementation of iBRoad2EPC

Poland

National overview

Some key information on the national targets and priorities, the legislative framework regarding EPCs and Renovation Passports, 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” [7].

National targets and priorities

The Polish LTRS draft mentions strategic targets for the decarbonisation of the building stock covering a complete phase-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/m² and by 2035 buildings with an annual primary energy consumption greater than 230 kWh/m² will be renovated. Consequently, this means that in 2045 the annual primary energy consumption of all buildings will be less than 150 kWh/m². Based on this scenario, by 2050, 65% of the buildings will consume annually no more than 50 kWh/m², and 24% will consume between 50 and 90 kWh/m². Buildings that cannot be extensively modernised (the remaining 11%) will have an annual primary energy consumption between 90 and 150 kWh/m². 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 [13]. However, it refers to performance indicators for the implementation of the LTRS. Poland sets a target value for CO₂ emissions from fossil fuel combustion in residential, commercial, and stationary sources in agriculture of equal to or less than 35 MtCO₂ by 2030 in comparison to the 2018 baseline of 52 MtCO₂.

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 be in compliance with the requirements related to the revision of the EPBD and the goals set in NBRP, the reduction of greenhouse gas emissions and the advancement of building cataloguing/registration procedures in order to effectively manage the building stock.

Legislative framework

Renovation Passports (RPs) are not yet presented in the national legislative framework, but they are mentioned 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 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 m² 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 on-site visit is not officially required for the issuance of an EPC in Poland means that building owners often purchase EPCs online, and the auditor does not have accurate data on the building. This reduces the quality of the EPCs issued and means difficulties in determining 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.

Currently the EPCs database is available to the public, but contains only the address, the index of annual demand for usable energy (EU), the index of annual demand for final energy (EK), the index of annual demand for non-renewable primary energy (EP), the share of renewable energy sources in the annual demand for final energy, and the unit volume of CO₂ emissions. There is no possibility to see the whole EPC.

Enforcement and quality control of EPCs by the ministry is limited, auditors are checked when there is suspicion of creating false EPCs due to suspicious activity (e.g., creating 30 EPCs in one day) or a request is made for an auditor to be checked by a buyer. Such a person loses the ability to issue certificates and is removed from the list of authorised persons. This lack of control over the EPCs submitted into the database causes data inconsistency, for example, different apartments in the same building often have very different results.

The biggest element contributing to the low competence of EPC's issuers is the lack of training courses and examination requirements for aspiring auditors. Requirements for those applying to be registered as energy auditors are as follows:

- full legal capacity
 - no conviction by final judgment for a crime against property, credibility of documents, economic turnover, money and securities, or a fiscal crime
 - having a construction license
- or
- completion of:
 - higher education completed with the professional title of engineer, architect engineer, landscape architect engineer, fire engineer, master's degree in architecture, master's degree in landscape architecture, master's degree in fire engineering, or master's degree in engineering, or

- higher education studies other than those listed above and postgraduate studies, the programme of which takes into account issues related to energy performance of buildings, performance of energy audits of buildings, energy-efficient construction and renewable energy sources.

It follows that those who graduated 20 years ago and obtained an entry in the database do not need to supplement their knowledge, they have the same right to create EPCs as those fresh out of college, with knowledge about new, passive technologies and RES.

Also, since being an EPC issuer is not well paid, there is a lack of certified energy experts. 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.

At the moment, the available programmes supporting energy efficiency in Poland are:

- “Czyste Powietrze” (Clean Air) - subsidising comprehensive thermal modernisation of buildings and replacement of old and inefficient solid fuel heat sources with modern heat sources that meet the highest standards.
- “Ciepłe Mieszkanie” (Warm Housing) - improving air quality and reducing dust and greenhouse gas emissions by replacing heat sources and improving energy efficiency in premises located in multi-family residential buildings.
- *Ulga Termomodernizacyjna* (Thermal modernisation tax credit) - the credit consists of a deduction from the tax assessment basis of expenses incurred for the implementation of a thermal modernisation project in a single-family residential building.
- “Stop Smog” - replacement or elimination of high-emission heat sources with low-emission ones, thermal modernisation of single-family residential buildings, connection to a district heating or gas network.
- “Moje ciepło” (My Heat) - Support for the purchase and installation of heat pumps for new single-family buildings.

Most of the programmes rely on subsidies, but these are awarded only after owners have incurred the costs, making it difficult to proceed with thermal upgrades. Additional impediments are the rather complicated procedures and lack of advertising campaigns.

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 Renovation Passport 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. Following the completion of the field test and related evaluation, it appears that for recipients to be interested in iBRoad2EPC the issuance cost should not exceed the cost of the EPC, which means a less detailed document (Figure 7). This is particularly influenced by the lack of possible state funding.

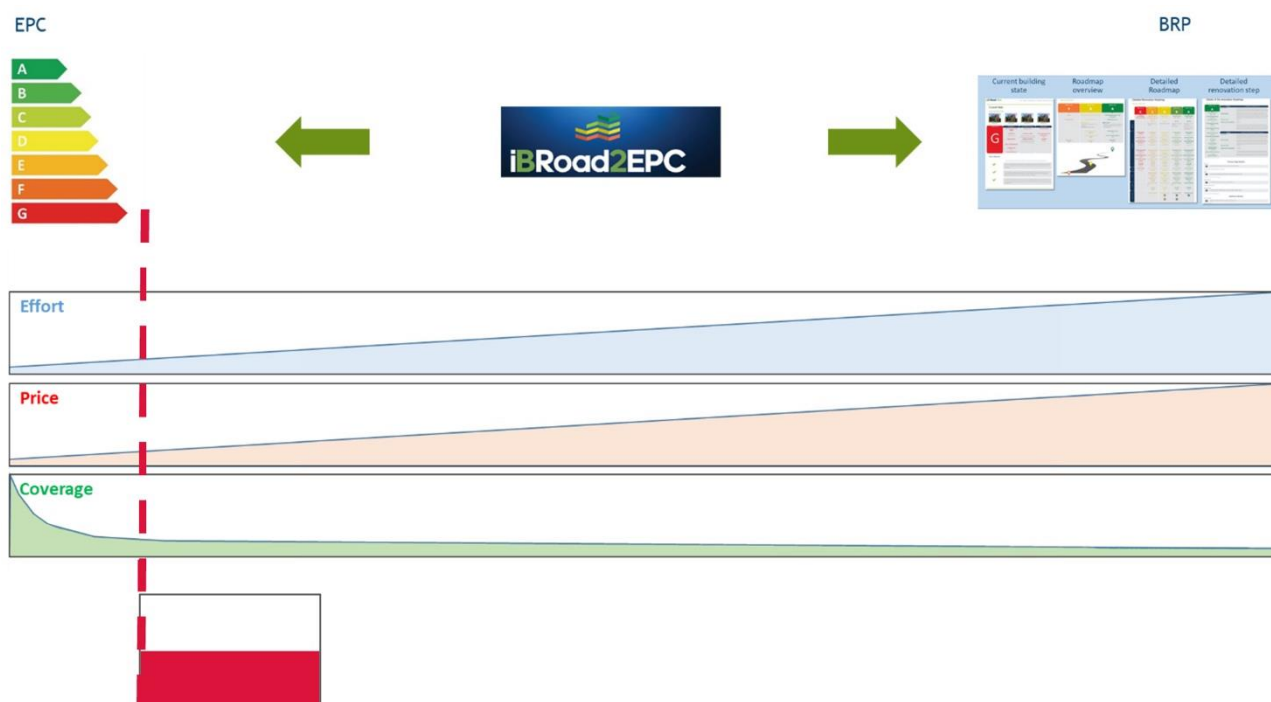


Figure 7: The Polish iBRoad2EPC is conceptually placed near the EPC end of the EPC-Renovation Passport spectrum

Proposed modules

It was originally assumed that the most important iBRoad2EPC modules for Poland would be (in addition to the Basic module) the Energy Demand module, the Investment Cost module and the SRI module. This changed after the field test, with many people in the surveys indicating that the SRI module seems redundant, difficult to understand and calculate, and that the IEQ module seems more useful. However, the Polish NAC recommended that the proposed modules should still be implemented together to make iBRoad2EPC a holistic, comprehensive tool in the country.

From the survey results, the best rated module for the country is the Investment Cost module, as it would complement the EPC very well because Poland lacks recommendations for energy efficiency measures in the EPC. Thus, this would be a breakthrough for the country; crucial for assessing financial feasibility, managing risks, ensuring affordability, promoting sustainability and driving economic growth. Another important module is the one determining energy demand; managing and reducing energy demand in buildings is crucial to achieving energy efficiency, cost savings, environmental sustainability and overall well-being. It plays a key role in addressing the challenges of climate change, resource depletion and energy security, while improving quality of life.

The IEQ module was also rated positively, with respondents believing that it helps draw attention to the quality of the indoor environment, which is overlooked in Poland. Regarding SRI, the ministry is trying to make the SRI calculation mandatory in the EPC, but the work has been currently put on hold. The Measured Energy Performance Indicator was introduced after the tests in Poland had been completed, so it has not been thoroughly tested by auditors. Yet, auditors noted that obtaining real data may be a problem, at least in multi-family buildings, where it would be necessary to receive energy consumption invoices for each apartment.

Interlinkages and automation

The Polish EPC database is available for general use, but as mentioned above, its usefulness is very limited. 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 tools, including software managed by 3rd parties or even Excel and upload data into the above-mentioned EPC database manually.

During the meeting with the Ministry, information was received that the EPC's current database will be rebuilt or a new one will be created from scratch, which provides opportunities in the future to create XML

data connection between the database and iBRoad2EPC and automate the upload of data from certificates. 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, (c) the possibility of uploading the Excel file for EPC calculation into iBRoad2EPC and reading its contents automatically, and (d) trying to establish a connection with the updated database.

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 integrated EPC - 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.

Another possible trigger point arose during the stakeholders meeting - iBRoad2EPC could be used as a tool to support thermal modernisation programmes. The building owner would receive an action plan, and the departments responsible for the programmes could, based on the renovation plan, confirm the achievement of the relevant goals.

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. It is possible in the future to introduce courses and exams for auditors by the Ministry; it would then be feasible to combine the knowledge and training for the EPC with that of iBRoad2EPC.

Action plan for the national implementation of iBRoad2EPC

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 and NBRP 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 8.

POLAND
PRIORITIES



Figure 8: Priorities identified for the Polish Action Plan

The Polish Action Plan for the national implementation 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	A mention of iBRoad2EPC in the NBRP (MRiT), creating a joint information campaign (ZAE, FPE), creating a research programme on building energy efficiency (NCBR)	2024 and continuous	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, NBRP, NECP, EPBD etc.), Create demand for iBRoad2EPC, focus on gaps that this tool can fill in	MRiT	Proposing changes in legislation (MRiT)	2024 and continuous	Creating better 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 the creation of a grant programme, grants based on the submitted EPCs and iBRoad2EPCs (BGK, MRiT)	2024-2025	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 the 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)	2024-2026	Public campaigns informing about thermo-modernisation and iBRoad2EPC

Table 4: Polish Action Plan for the national implementation of iBRoad2EPC

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” [7]. The below sections provide a summary of key information on the national targets and priorities, the legislative framework regarding EPCs and Renovation Passports, the building stock characteristics and the EPC framework.

National targets and priorities

The Portuguese LTRS [14] 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 and 55% by 2030, between 65 and 75% by 2040, and between 85 and 90% by 2050 compared to 2005 levels [15]. The objectives of the Portuguese LTRS for the next three decades, with respect to 2018, are:

- Renovate a building area of 363.680.501 m² by 2030, 635.637.685 m² by 2040, and 747.953.071 m² 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 m² 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 [14].

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 Long-Term National Strategy to Combat Energy Poverty, published in January 2024. 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 National Building Renovation Plan (NRRP). New budget lines, target buildings and application periods are expected soon.

ADENE, the Portuguese Energy Agency will have very specific roles in these important initiatives and strategies, such as:

1. Technical and operational support to the Energy Poverty Observatory foreseen in the Long-Term National Strategy to Combat Energy Poverty.
2. Technical and operational support on the LTRS coordination group which is responsible for the monitoring, supervision and overall coordination.
3. Design and implementation of 50 physical building renovation one-stop-shops, until 2025, under the Recovery and Resilience Plan.
4. Technical and operational support to public financing schemes and relation to EPC system.
5. Technical support to the EPBD transposition.

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 n.º 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 n.º 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 renovation passport and an evaluation of legislative requirements, alongside with adaptation to new EPBD requirements and new features (IEQ). In the fourth version of the EPC scheme regulation (“SCE 4.0”) Renovation Passports will play a pivotal role. Renovation Passports 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)” [14]). Alongside, the official monitoring reports on the LTRS also detail the role of iBRoad2EPC in testing and integrating into the national framework building Renovation Passport features [16].

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 and 93% of the building stock built before the 1st version of the EPBD in 2006. [17]. There are roughly 3,5 million buildings, of which 87% are single-family dwellings, 6 million dwellings, of which 2,9 million [18] are in multi-family buildings, and less than 18% of buildings or units with energy class A or A+ [19].

In Portugal, the buildings sector consumes 33% of final energy consumption and emits 5,4% and 18% of total GHG emissions (scope 1 and scope 2, respectively) and 63% of energy consumption comes from renewable energy sources.

The main barriers regarding energy efficiency upgrades in Portugal are the high renovation costs and the multiple investment difficulties (social, legal, bureaucratic), 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 ($A \geq 250 \text{ m}^2$).

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 4.0”). 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 9). The placement of iBRoad2EPC in the EPC-Renovation Passport spectrum took into account 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.

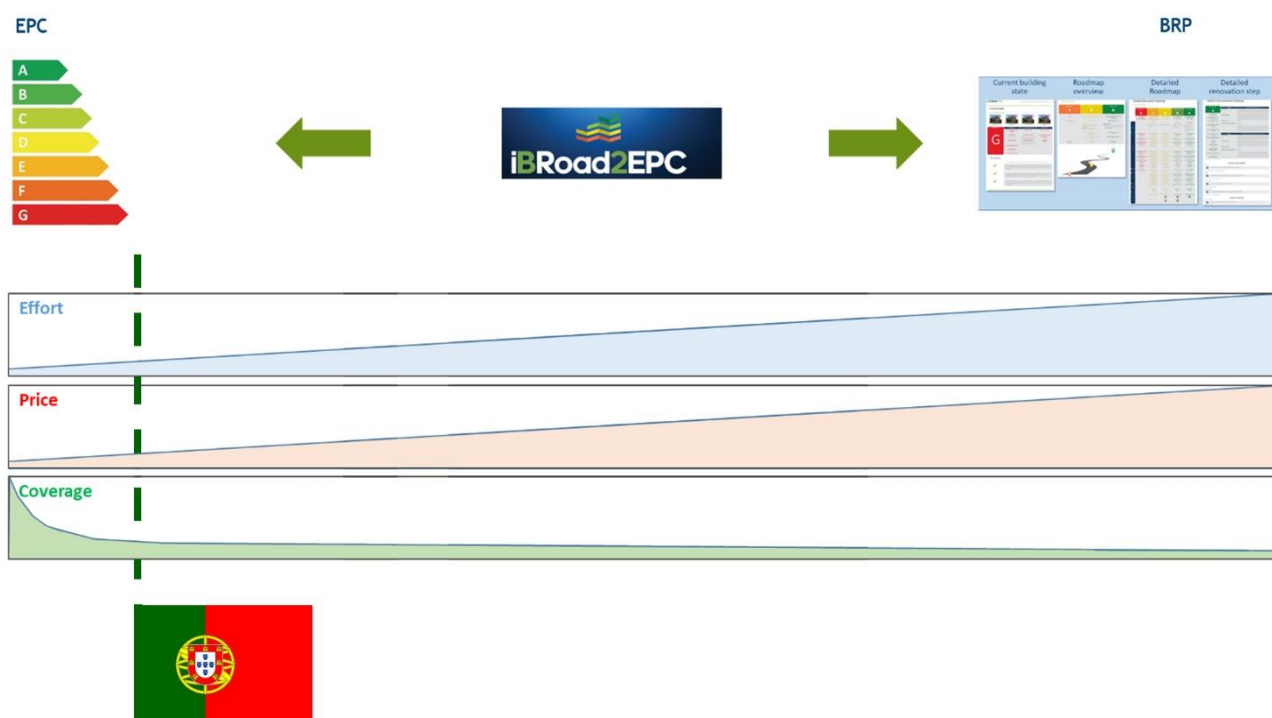


Figure 9: The Portuguese iBRoad2EPC is conceptually placed near the EPC end of the EPC-Renovation Passport spectrum

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 second call on 2023, 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 of the iBRoad2EPC concept 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+

platform⁴ [21], an AQUA+⁵ [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 revealed that external tools such as the SRI and IEQ could use improvements in terms of ease of use and adaptation to national context. Several updates and adaptations have been successfully delivered after this feedback but there was not enough time for extensive testing of the updated tools.

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.

Overall, there are three tools to which iBRoad2EPC could be coupled in Portugal: (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, an XML interlinkage with the official EPC software was developed and tested during and after the field test, following extensive requests from stakeholders and auditors. In practical terms it meant that the iBRoad2EPC Assistant can be fed automatically with information existing in the EPC system, using existing software and data mapping reducing the amount of additional effort for issuing an iBRoad2EPC. This includes additional conversion/calculation on the iBRoad2EPC Assistant to ensure coherence of data but with no direct intervention from the auditor. It was also possible to map improvement measures between the EPC database categorisation and the iBRoad2EPC database namings which means it is possible to import improvement measures already identified in the EPC and also related data such as description, costs and energy savings, among others.

Concerning the casA+ platform, there are various options to integrate iBRoad2EPC which are currently being 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. This has already been conceptualised during the project duration.
- 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.

There is a wide range of possibilities, but the actual implementation needs to be coordinated with EPBD transposition process to ensure consistency. Various integration approaches have been explored, with a

⁴ “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.

⁵ AQUA+ is a simple, agile, and voluntary system for evaluating and rating the water efficiency of buildings, developed by ADENE.

focus on aligning with the EPBD requisites and integrating with other platforms. With the iBRoad2EPC API, integration with external software is possible, reducing the need to navigate multiple platforms and ensuring a unified graphic design. Future steps could include developing and testing API integrations with platforms like the SCE portal and casA+.

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 Renovation Passport framework in the country, and that makes iBRoad2EPC very relevant for future implementation. 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. Given the high possibility of the Renovation Passport maintaining its voluntary profile in Portugal, an especially relevant trigger point would be the access to public funding if the RP is a mandatory requisite to ensure coherent renovation interventions. This actually follows previous experiences where the EPC is issued, even if not legally mandatory, but it is required for access to funding.

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. All iBRoad2EPC training and dissemination events already used and tested the Academia ADENE infrastructure which is a common entry point for energy assessors.

Action plan for the national implementation of iBRoad2EPC

In order for the iBRoad2EPC vision to be realised in Portugal, five (5) priorities have been set, as presented in Figure 10. 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.

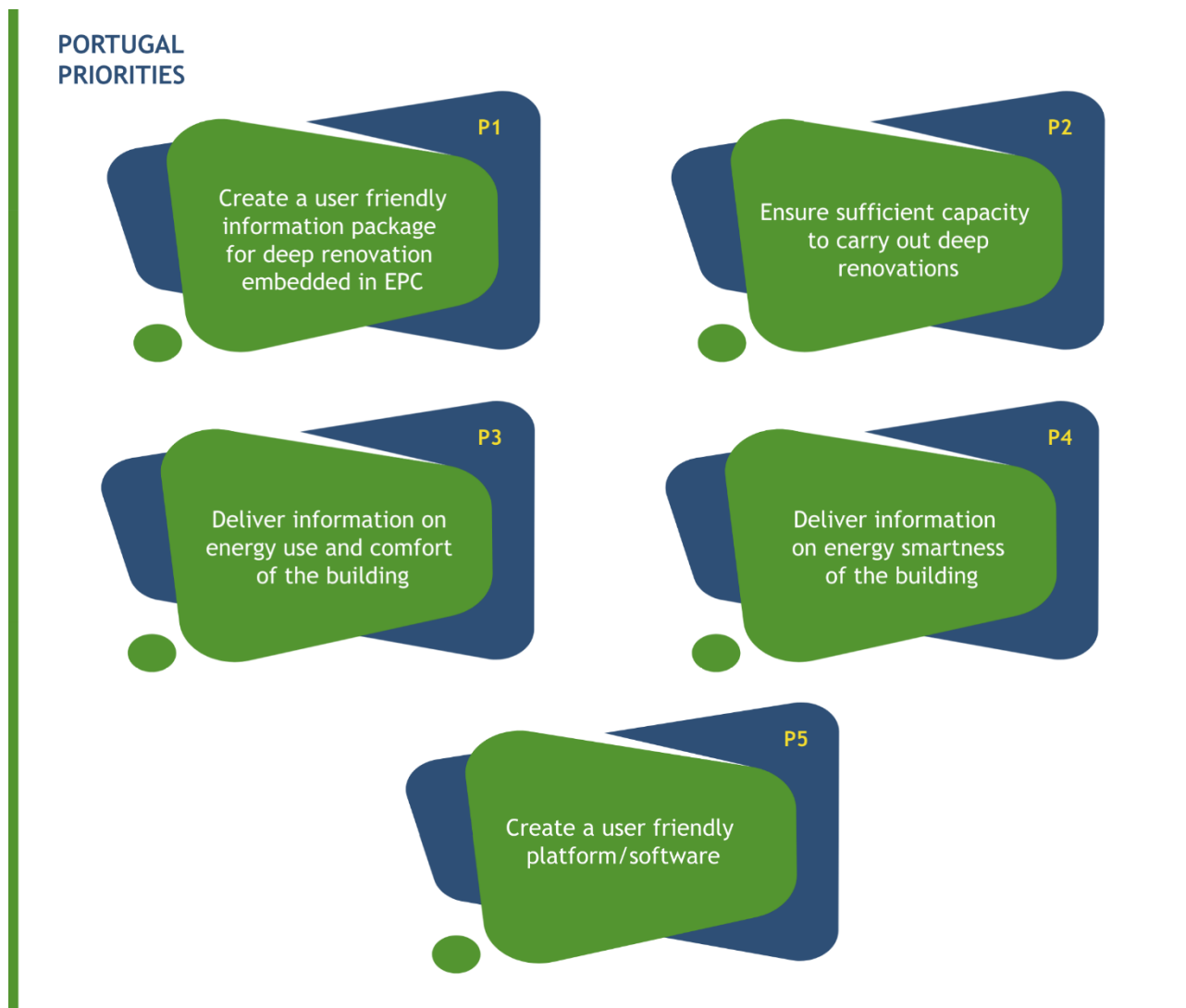


Figure 10: Priorities identified for the Portuguese Action Plan

The priorities above are part of the Portuguese Action Plan for the national implementation which is presented in the following overview (Table 5).

Priority	Aim served	Relevant stakeholder	Proposed actions	Timeframe	Indicators
P1: Create a user friendly information package for deep renovation embedded in EPC	A1. Increase public awareness for deep renovation	DGEG DECO ANPQ Building owners	Test Renovation Passport's features with the iBRoad2EPC tool.	Completed-follow up	Number of EPCs/ buildings tested
	A2. Integration between EPC and Renovation Passport		Integrate EPC tools into iBRoad2EPC and facilitate interlinkage	2024 - follow up	Number of features integrated in iBRoad2EPC (ex: XML integration)
	A3. Increase the number of deep renovations		Adapt tested features to new version of Portuguese EPC	2026	Number of relevant users targeted
	A4. Increase market penetration of iBRoad2EPC/ create demand		Integrate Renovation Passport's features into the new version of the EPC	2026	Number of final users aware of new scheme
			Media/dissemination campaign of new EPC format with Renovation Passport (together with the new EPC format)	2026	
P2: Ensure sufficient capacity to carry out deep renovations	A1. Increase public awareness for deep renovation	ANPQ CPCI/AICCO PN	Test Renovation Passport's features with the iBRoad2EPC tool.	Completed - follow up	Number of EPCs/ buildings tested
	A3. Increase the number of deep renovations		Deliver training modules to relevant stakeholders - focus on auditors/experts	Completed - follow up	Number of people trained in the new EPC/Renovation Passport features
	A4. Increase market penetration of iBRoad2EPC/ create demand		Embedd Renovation Passport, DBL and new EPC features into casA+ platform - boost online one stop shop concept and link offer and demand - exploit existing ADENE ACADEMIA infrastructure/ resources	2024-2026	Number of registrations in the casA+ portal
	A5. Ensure consistency with LTRS goals				Number of renovations/intervention made via casA+ portal

Priority	Aim served	Relevant stakeholder	Proposed actions	Timeframe	Indicators
P3: Deliver information on energy use and comfort of the building	A1. Increase public awareness for deep renovation	ADENE DGEG LNEC	Build 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	Completed - follow up	Number of indicators related to IEQ embedded in iBRoad2EPC
	A5. Ensure consistency with LTRS goals		Test embedded IEQ features	Completed - follow up	
	A6. Prepare for EPBD challenges/ transposition		Evaluate NBRP goals and adapt the tool	2025	
P4: Deliver information on energy smartness of the building	A1. Increase public awareness for deep renovation	ADENE DGEG LNEC	Build SRI features and embed in iBRoad2EPC modules / explore Synergies with SRI2MARKET LIFE project	Completed - follow up	Number of indicators related to SRI embedded in iBRoad2EPC Number of SRI evaluations made (look for synergies with SRI2MARKET project) - over 30 SRI assessments made via iBRoad2EPC
	A5. Ensure consistency with LTRS goals		Test embedded SRI features	Completed - follow up	
	A6. Prepare for EPBD challenges/ transposition				
P5: Create a user friendly platform/software	A1. Increase public awareness for deep renovation	ADENE ANPQ DECO	Ensure maximum compatibility/flexibility of iBRoad2EPC formats/layouts with national layout - to be done within the NAC	Completed - follow up	Number of features successfully embedded/fit for national scheme
	A4. Increase market penetration of iBRoad2EPC/ create demand		Embed iBRoad2EPC modules/learnings in new EPC scheme	2024-2026	

Table 5: Portuguese Action Plan for the national implementation of iBRoad2EPC

Romania

National overview

Key information on the national targets and priorities, the legislative framework regarding EPCs and Renovation Passports, 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” [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 m² (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 (World Bank 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 publicly 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 types 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, while the revised methodological framework entered 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. The National Buildings Digital Registry (NBDR) is under development (terms of reference for public procurement defined) under the NRRP and the EPC database should be functional when the first version of the NBDR will be available.

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 Renovation Passport with regards to its additional cost and effort (Figure 11). The placement of iBRoad2EPC in the EPC-Renovation Passport spectrum is difficult to assess, even after the testing phase of the project, but could be closer to the EPC if the validation of existing commercial EPC software tools will be clarified (either by regulating the procedure of validation or by approving an official calculation engine for the issue of EPC) and use of tools like iBRoad2EPC would be included or connected to the NBDR.

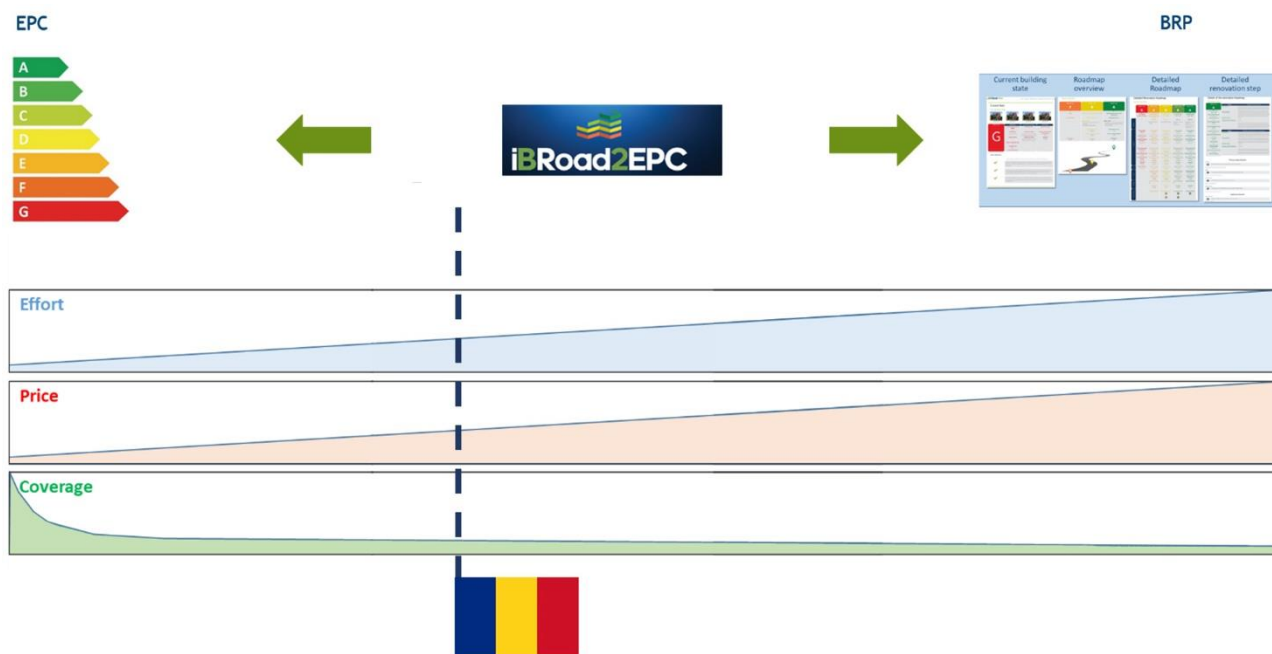


Figure 11: The Romanian iBRoad2EPC is conceptually placed towards the EPC end of the EPC-Renovation Passport spectrum

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 (some of them are supported by XLS spreadsheets, but the calculations need to be automated, while for the Cost module to ensure the link with national energy audit methodology) and

correlated with national practices. 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).

The field tests in Romania showed a good evaluation on the iBRoad2EPC layout/format, graphics and features. All the developed modules are considered useful and possible to implement, except the measured energy assessment (for which reliable information is not likely to be found in practice).

The implementation of iBRoad2EPC in the EPC scheme is considered feasible, but mostly if this will be required by the relevant technical regulations. The energy auditors for buildings (the experts issuing the EPC and performing the energy audit of existing buildings) would use the iBRoad2EPC if it would be mandatory or if it would be included as an add-on tool (or embedded) in the existing EPC software. The implementation of the iBRoad2EPC as an add-on to the existing EPC could double the costs of a normal EPC.

Interlinkages and automation

There are various options considered for iBRoad2EPC integration in Romania, 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 an estimated launch of public procurement in September 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. This would require the revision of the recently approved EPB calculation methodology.

Moreover, the EPC database structure has been developed and will be included in the development of NBDR and could be used as a starting point for the Renovation Passport 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 issuers.

All these options were discussed with NAC members and EPC software providers, but no final decision was possible to take. The embedding of iBRoad2EPC in existing commercial software tools is possible, but the practical way to do it depends on the availability of the developed Assistant (could be connected through the API or by specific XML defined in each software), so the discussion is still open. On the other hand, there is the opportunity offered by the development of the National Buildings Digital Registry (NBDR): the iBRoad2EPC is mentioned in the terms of reference as best practice and the use of the iBRoad2EPC Assistant is probably to be explored in the implementation of the NBDR (public procurement process to be launched in September 2024, development estimated to start at the end of 2024).

Trigger points

It is proposed that iBRoad2EPC features the same trigger points as the Romanian EPC, serving as a pathway to the national Renovation Passport. 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.

The roadmap included in the iBRoad2EPC could be used for dedicated staged financing for staged renovations. Banks could be interested to develop dedicated renovation loan products for deep staged renovations, and iBRoad2EPC could be used to facilitate the disbursement of staged financing for specific renovation steps for an agreed deep energy renovation plan.

An important trigger could be offered by the Article 6 of the Energy Efficiency Directive (2023/1791/EU) on obligations to renovate a minimum of 3% of the stock of public buildings. In this context the existence of a renovation plan for existing public buildings (e.g., roadmap developed by the iBRoad2EPC Assistant) would facilitate the prioritisation of annual funding, opening the possibility of energy renovation funding for a larger number of buildings for which certain renovation milestones are implemented. This would also help operationalise and streamline the public building inventory (now extended from central government buildings to all public buildings).

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 should be targeted to already certified EPC issuers, ideally with the presence of not more than 10-15 participants in each training session. If provided as mandatory, iBRoad2EPC training could be included also for the certification training (for new energy auditors for buildings).

Action plan for the national implementation of iBRoad2EPC

For the realisation of the national implementation 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 12.

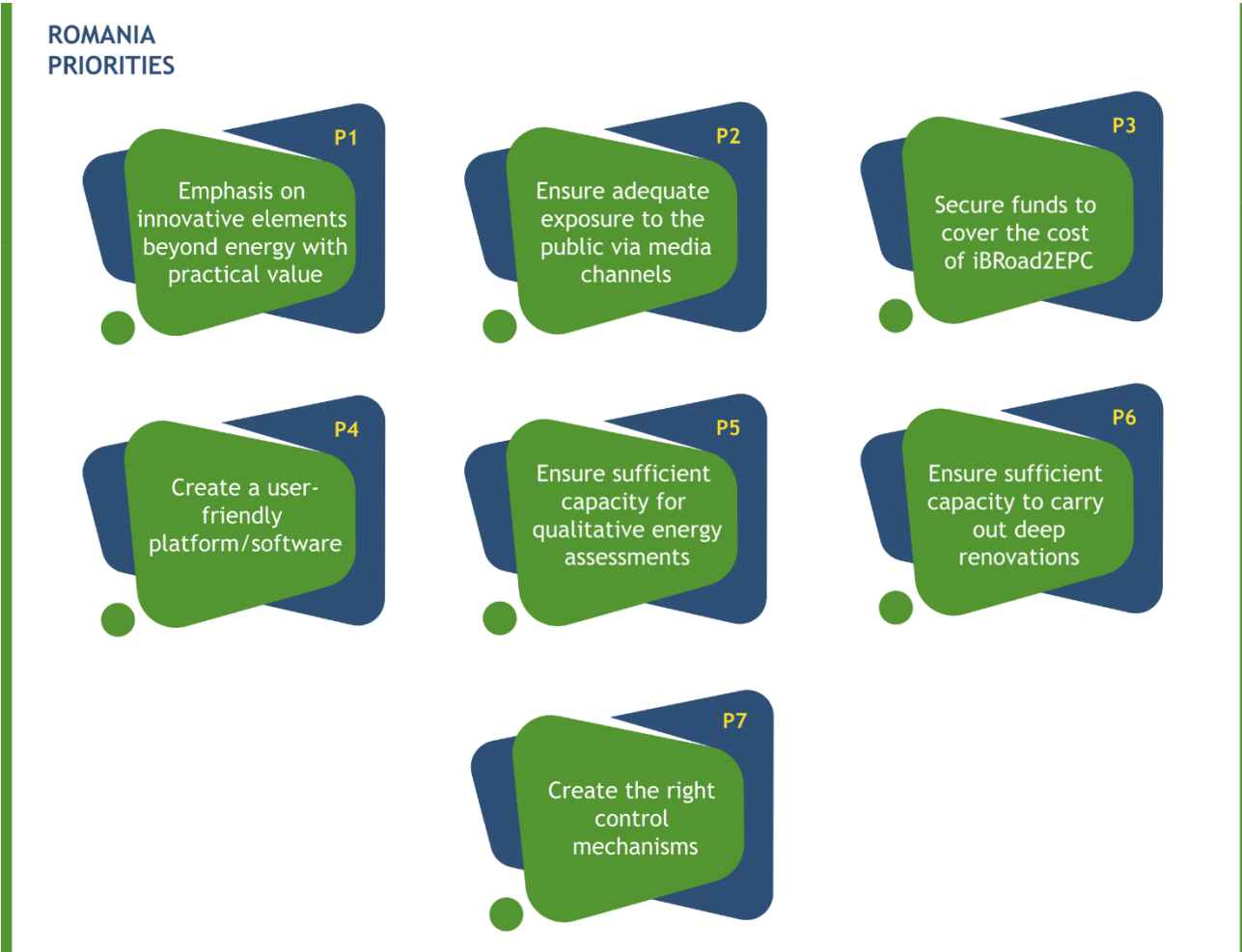


Figure 12: Priorities identified for the Romanian Action Plan

The above priorities are also included in the Romanian Action Plan for the National roll-out which is presented in Table 6.

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	2024-2025	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	2024-2025	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.	2025-2026 (to be continued after the first functional version of DBR is available)	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 Embed iBRoad2EPC modules/learnings in new EPC scheme and Digital Buildings Register design	2024-2025 2025 (after the first functional version of DBR is available)	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	2025-2026	Number of people trained in the new EPC/Renovation Passport 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 A6. Ensure consistency with LTRS goals	MDLPA, NAC members, BUS4RoBOOST (Life project)	Test Renovation Passport's features with the iBRoad2EPC tool. Deliver training modules to relevant stakeholders - focus on auditors/experts Embed new EPC features into DBR platform - boost online one stop shop concept and link offer and demand	2024 - follow up 2025 2025 (after the first functional version of DBR is available)	Number of EPC / buildings tested Number of people trained in the new EPC/Renovation Passport features Number of registrations in the DBR

Priority	Aim served	Relevant stakeholder	Proposed actions	Timeframe	Indicators
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	2024-2025 (to be continued in the next revision of national EPC regulation)	Revised compliance procedures for EPCs

Table 6: Romanian Action Plan for the national implementation of iBRoad2EPC

Spain

National overview

Some key information on the national targets and priorities, the legislative framework regarding EPCs and Renovation Passports, 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” [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
N° 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
N° 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
N° 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

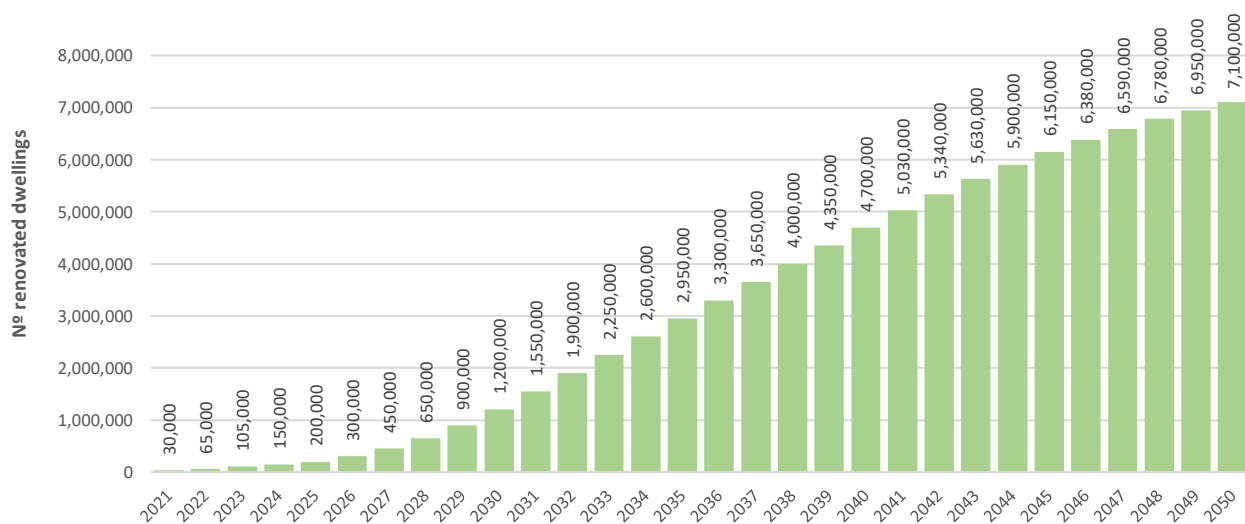


Figure 13: Renovation pathway for the residential sector in the LTRS 2020 (2021-2050).

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 CO₂ 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 National 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 "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

Renovation Passports 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 Renovation Passport idea through the Libro del Edificio Existente". The following regulation documents are relevant to the Renovation Passports 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 Insitutut 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 Renovation Passports 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 m²;
- 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 m² intended for public use (like hospitals, commercial, restaurants, religious sites, etc.);
- 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.

The national context can be summarised in the next figure (Figure 14):

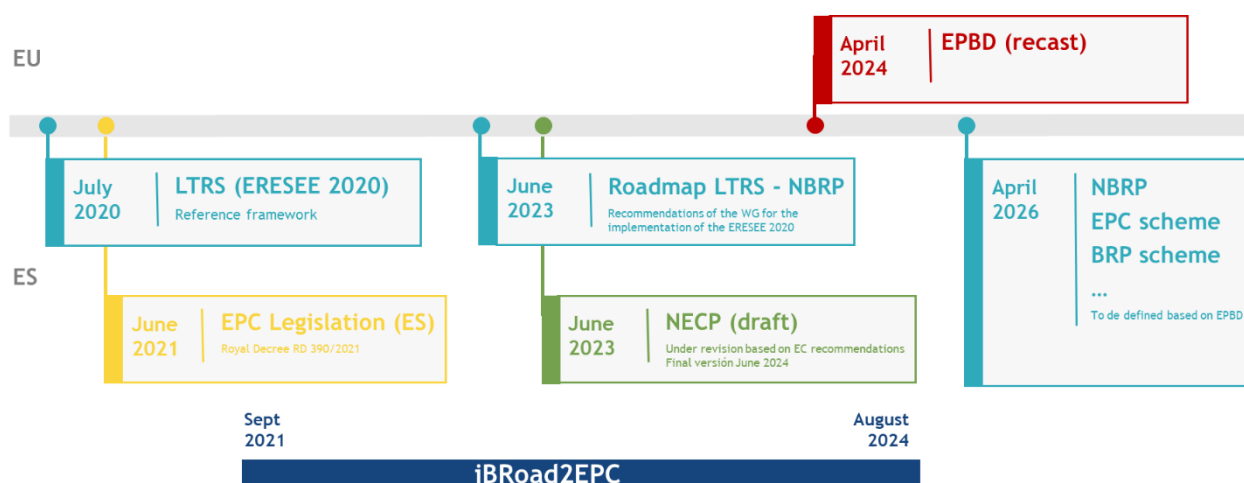


Figure 14: Spanish national context overview

iBRoad2EPC vision

Proposed cost and effort

At an initial stage of the project, because of the low perceived value the EPC has in the country, it was proposed that, in Spain, iBRoad2EPC would 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 was proposed that the Spanish iBRoad2EPC be closest to the Renovation Passport concept of the EPC-Renovation Passport spectrum presented in Figure 15.

However, after the field test and based on the NAC feedback, the final proposed vision is to place iBRoad2EPC closer to the EPC, in the sense of providing a tool that requires less effort and cost to be delivered, with a special focus on facilitating user understanding of the results.

The NAC recognised the added value of the Assistant in introducing the long-term targets and staged approach of the Renovation Passport, as well as the initial idea of the project to converge and link both instruments.

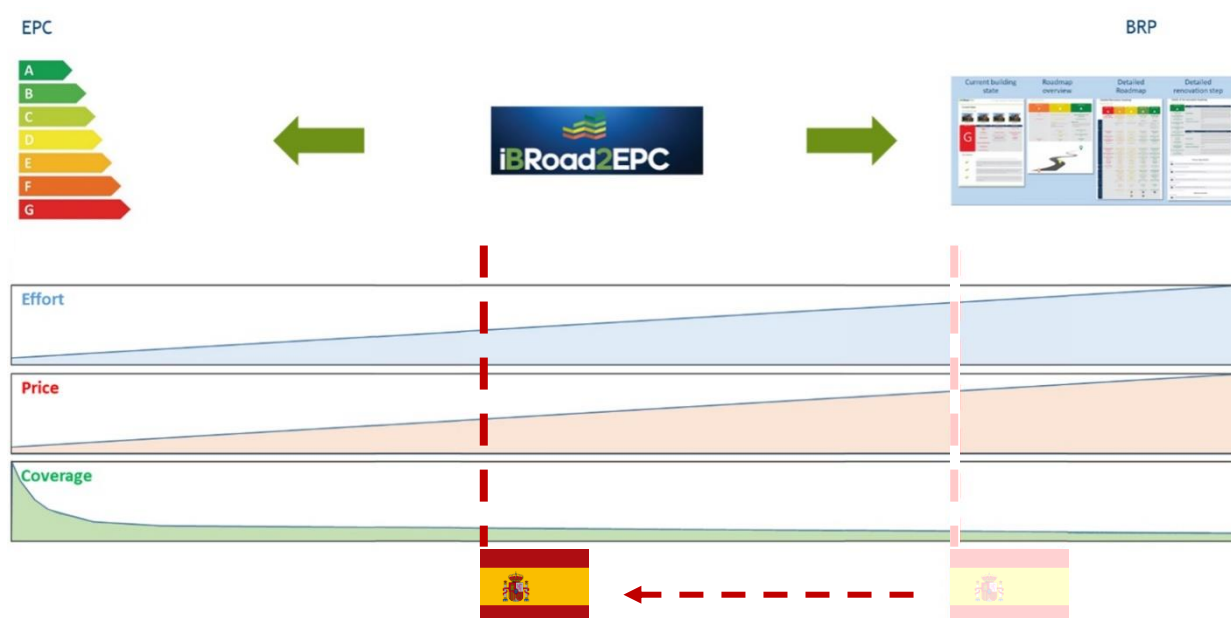


Figure 15: The Spanish iBRoad2EPC is conceptually placed towards the Renovation Passport end of the EPC-Renovation Passport spectrum

Proposed modules

The approach for Spain considers all the modules developed in the iBRoad2EPC concept important. The SRI and IEQ modules were considered more complex by the auditors that carried out the pilot phase and therefore should be optional in the national modular approach. Regarding the Cost module, stakeholders raised a concern when defining the long-term approach, due to the uncertainty in consumption user profiles and energy prices.

Based on the flexibility of the Assistant to introduce new modules in the long-term, some suggestions were made by the NAC members as well as by the auditors:

- NAC members suggested introducing an additional module of **Acoustic rating/certification** (similar to the EPC) since acoustic comfort is already highly developed at regulatory level.
- Auditors suggested to introduce an additional module of **Accessibility and Comfort**, as both elements are considered as triggers for renovation in the residential sector, especially in multi-family apartments that are the majority of the national residential stock.

- 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.

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 16):

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).

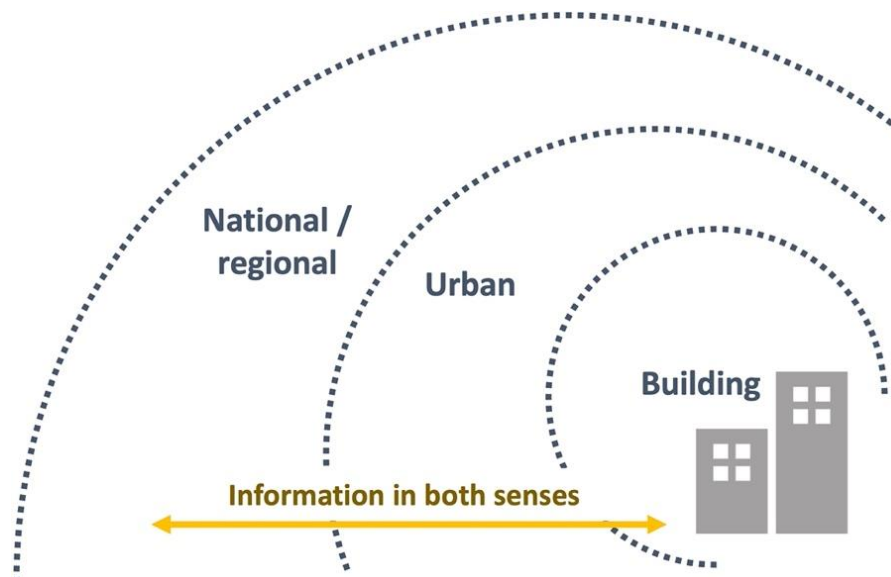


Figure 16: iBRoad2EPC integration in Spain should range across different scales, from the building to the urban and national level of instruments and information. (Source: CICLICA).

An overview of the Overall vision for the new integrated instruments can be found in Figure 17. The integration of iBRoad2EPC in these 3 levels is aligned with the approach described in the approved version of the EPBD recast, that already mentions these building (Renovation Passport and Digital Building Logbook) and national (Building Database, Renovation Plan) level instruments to be developed through the transposition of the directive by each Member State.

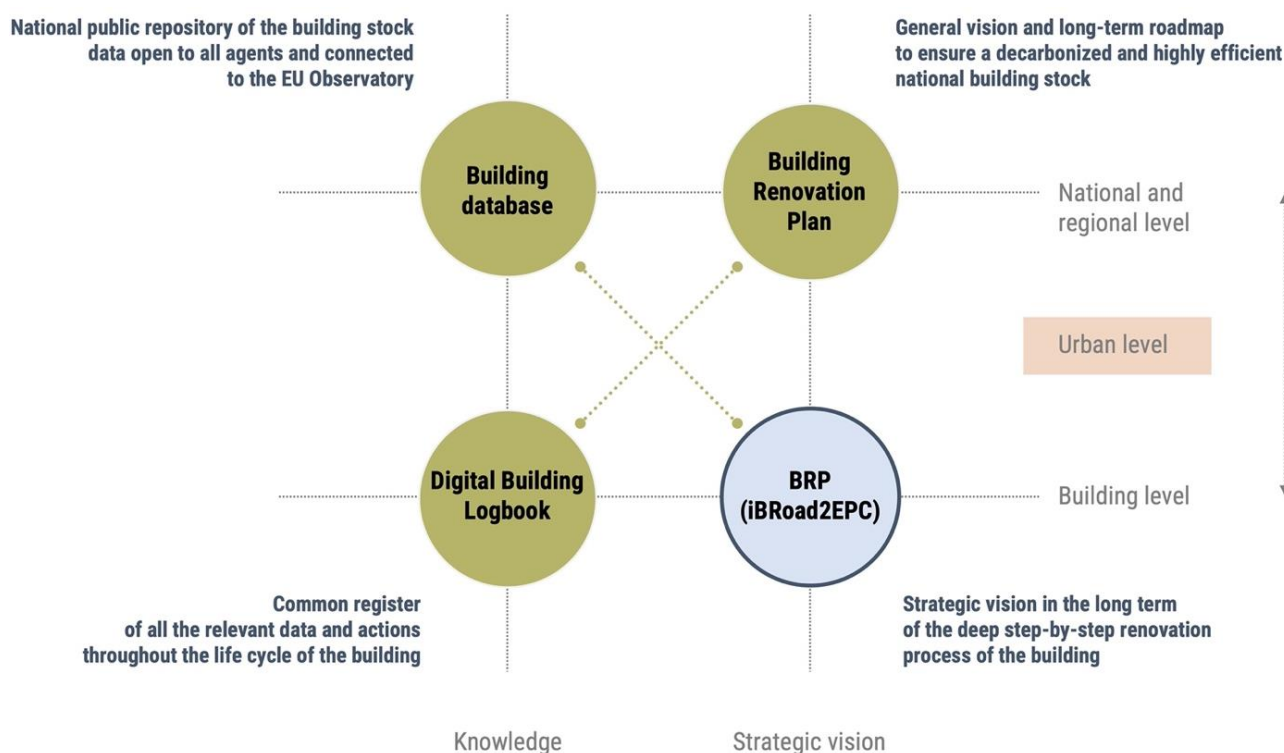


Figure 17: Proposed placement of iBRoad2EPC into the Spanish DBL, Renovation Passport instruments ecosystem (source: CICLICA)

Concerning data management, the main suggestion from the NAC members was to couple the Assistant with some of the official EPC software through the XML file, as it is a common and standardised format. Therefore, the iRoad2EPC XML integration approach was preferred, as this would allow to avoid double manual filling of relevant information, a critical point for iRoad2EPC 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.

After this initial analysis, the interlinkage was developed within the Assistant and tested in a second phase. The results of this pilot testing are shown hereunder:

- *Step 0. Project details.* The XML interlinkage shows that 50% of the mandatory fields to be defined in the Assistant can be introduced automatically. Figure 18: Analysis of common fields between the Spanish EPC XML file and the iRoad2EPC Assistant; tab “project details”. Fields that can be automatically filled are shown in green, and those that require manual input in red shows the automatically filled fields in green, and those that require manual introduction in red.
- *Step 1. Current state.* The XML interlinkage shows that 83% of the mandatory fields to be defined in the Assistant can be introduced automatically. Only the energy costs require manual introduction (Figure 19).
- *Step 2. Renovation steps.* The XML interlinkage shows that 55% of the mandatory fields to be defined in the Assistant can be introduced automatically. Only the renovation costs and the energy costs require manual introduction (Figure 20).

The learnings from the XML testing show overall very positive feedback, as the upload of the XML file in the Assistant for each renovation step is easy and useful. However, there is also a shortcoming as it is not possible to introduce renovation costs due to the operation of the EPC software and the Assistant. In the EPC software, for each renovation step (1, 2, 3, etc.) we have to produce a new EPC (and a new XML). So, in the operation of the EPC software, each renovation step corresponds to an “improved” current state of the building, and, thus, no renovations are introduced in the EPC software.

This is an opportunity (recommendation) to include in the EPC software tools the staged approach and make them operational with the future national Renovation Passport.

The screenshot shows the 'project details' tab of the iBRoad2EPC Assistant. The form is divided into several sections. The top section includes 'Name *' (CUADRILLA DE VITORIA Nº34), 'Client number', 'Building type *' (Residential building), 'Building sub type *' (Residential building), 'Country *', 'Climate zone *' (D1), 'Environment *', 'Current energy class *' (G), and 'Tenure status *'. The middle section includes 'Building constructed in *' (1971), 'Heating system constructed in', 'Cooling system constructed in', 'Project trigger *', 'Project receiver *', and 'Recommendations addressed to *'. The bottom section includes 'EPC Certificate *' with a file selection button. Fields with green borders and checkmarks (Name, Building type, Building sub type, Climate zone, Current energy class, Building constructed in) are automatically filled. Fields with red borders (Environment, Tenure status, Project trigger, Project receiver, Recommendations addressed to, EPC Certificate) require manual input.

Figure 18: Analysis of common fields between the Spanish EPC XML file and the iBRoad2EPC Assistant; tab “project details”. Fields that can be automatically filled are shown in green, and those that require manual input in red.

The screenshot shows the 'current state' tab of the iBRoad2EPC Assistant. The form is titled 'Project: CUADRILLA DE VITORIA Nº34: edit step for Current state'. It includes an 'Upload xml file' section with a file selection button. The 'Energy' section is divided into 'Energy sources' and 'Final energy demand'. Under 'Energy sources', there is a dropdown menu with 'Gasóleo' selected. Under 'Final energy demand', there is a text input field with '184' and a unit 'kWh/m²a'. Below this, there is a 'GHG emissions' section with a text input field with '90' and a unit 'kg/m²'. At the bottom, there is an 'Energy costs' section with a text input field with '0' and a unit '€/a'. A 'Submit' button is located at the bottom right. Fields with green borders and checkmarks (Final energy demand, GHG emissions) are automatically filled. Fields with red borders (Energy costs) require manual input.

Figure 19: Analysis of common fields between the Spanish EPC XML file and the iBRoad2EPC Assistant; tab “current state”. Fields that can be automatically filled are shown in green, and those that require manual input in red.

Project: CUADRILLA DE VITORIA N°34: edit step for 2025 ✕

Upload xml file
 Ningún archivo seleccionado

Target year
 ✓

☐ ASAP

Energy class
 ✓

Renovation costs

Maintenance costs	Energy related costs	Funding
0,0 ✓ €	0,0 ✓ €	0,0 ✓ €

Energy

Energy sources
 1. ▼

Final energy demand
 ✓ kWh/m²a

GHG emissions
 ✓ kg/m²

Energy costs
 ✓ €/a

Figure 20: Analysis of common fields between the Spanish EPC XML file and the iBRoad2EPC Assistant; tab “renovation steps”. Fields that can be automatically filled are shown in green, those requiring manual input in red.

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 Renovation Passport in the country.

Within the new version of the EPBD recast, one of the main triggers for the Renovation Passport in residential buildings was finally discarded, the Minimum Energy Performance Standards (MEPS). This would have been a clear opportunity to introduce a mandatory scheme of renovation passports for residential buildings, linked to the improvements in energy rating.

On the other hand, the EPBD proposes 2 possible triggers:

- The long-term goals: Member States should establish a national trajectory for the progressive renovation of the residential building stock in line with the national roadmap and the 2030, 2040 and 2050 targets contained in the Member State’s NBRP.

- The Long-term renovation contracts: Member States may introduce mechanisms that allow the establishment of long-term renovation contracts over the various stages of staged renovation, to access new and more effective incentives.

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. 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 implementation of iBRoad2EPC

There are five (5) priorities identified for Spain to support the national implementation of iBRoad2EPC 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 21.

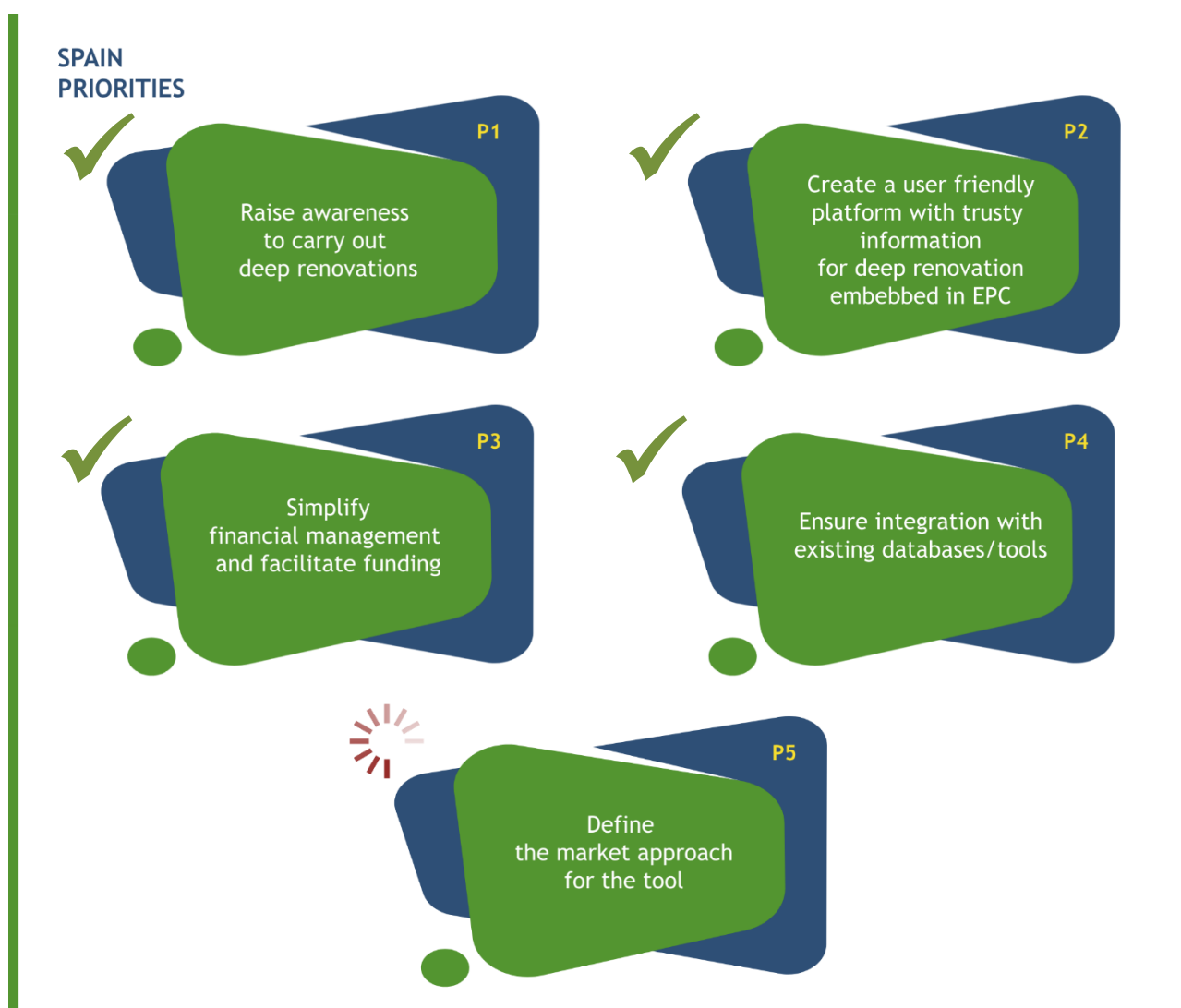


Figure 21: Priorities identified for the Spanish Action Plan

During the lifetime of the project, four out of five priorities were totally fulfilled, so the initial expectations are considered to be covered: these are Priorities 1, 2, 3 and 4. Regarding Priority 5 that was not totally covered, it should be noted that the initial definition of the exploitation of the tool was linked to the approval of the EPBD, that had a delayed of a few years. This fact implied that some of the planned actions could not be implemented.

However, based on the feedback from the NAC meetings and the National roundtable, the Assistant has attracted interest at a key moment such as the transposition of the EPBD, so its exploitation may still have way to go over the next 2 years.

Hereunder (Figure 22) is the relation among Priorities - Aims - Proposed Actions:

Relation Priorities - Aims - Proposed Actions



- A2. Increase public awareness for deep or staged renovations
- A3. Increase the engagement of neighbours in the renovation process
- A4. Build trust in energy planning tools (EPC, BRP, DBL)
- A5. Improve energy habits

- ✓ Offer a **centralized 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**

Relation Priorities - Aims - Proposed Actions



- A2. Increase public awareness for deep or staged renovations
- A3. Increase the engagement of neighbours in the renovation process
- A4. Build trust in energy planning tools (EPC, BRP, DBL)

- ✓ **Testing BRP's features** with the iBRoad2EPC tool.
- ✓ **Include resulting data after each action**, feeding back into the following steps/phases/actions
- ✓ **Organize 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** (Out of scope. MS, April 2026)
- ☀ **Media/dissemination campaign** of the new iBRoad2EPC

Relation Priorities - Aims - Proposed Actions



- A1. Increase the number of deep or staged renovations
- A2. Increase public awareness for deep or staged renovations
- A3. Increase the engagement of neighbours in the renovation process
- A6. Increase market penetration of iBRoad2EPC

- ✓ **Simplify the information and access to subsidies** and/or specific funding programs (NGEU)
- ✗ **Adapt funding programs to deep staged renovation**, distributed over time (Out of scope. MS, April 2026)
- ✗ **Facilitate the entrance of private capital and promote specific offers to renovation** (soft loans or green mortgages) (Out of scope. MS, April 2026)

Relation Priorities - Aims - Proposed Actions



- A7. Promote synergies between iBRoad2EPC and other initiatives
- A8. Upgrade the quality of the Assistant
- A9. Offer synergistic vision
- A10. Ensure consistency with future national and European goals (LTRS, EPBD, etc.)

- ✓ Connect iBRoad2EPC with existing tools/databases (DBL, Cadaster, LEE)
- ✓ Provide automated data schemes to be integrated in the iBRoad2EPC
- ✓ Provide information of long-term goals defined in public strategies
- ✓ Ensure maximum compatibility/flexibility of iBRoad2EPC formats/layouts
- ✗ Embed iBRoad2EPC modules/learnings in EPC scheme (Out of scope. MS, April 2026)
- ✓ Avoid conflict of interest with ongoing tools and certifying agents

Relation Priorities - Aims - Proposed Actions



- A6. Increase market penetration of iBRoad2EPC
- A7. Promote synergies between iBRoad2EPC and other initiatives
- A8. Upgrade the quality of the Assistant

- ☀ 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 ...
- ☀ The tool must both create demand and satisfy it in the short and long term
- ☀ NAC business plan suggestion is to give the tool a free use, retain resulting data and exploit them

Figure 22: Relation among Priorities - Aims - Proposed Actions for the Spanish Action Plan

The Spanish Action Plan for the national implementation, as developed for the initial national guide and updated following the actions that have already taken place during the project duration, is presented in Table 7.

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	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.	Completed - follow up	Nº of buildings tested
	A2. Increase public awareness for deep or staged renovation			Completed - follow up	Capacity of the Assistant to interact
	A3. Increase the engagement of neighbours in the renovation process			2024 - follow-up	Nº of integrations in existing local models
	A4. Build trust in energy planning tools (EPC, Renovation Passport, DBL)			Completed - follow up	Nº of features successfully embedded
	A5. Improve energy habits			Completed - follow up	Nº of users targeted
P2: Create a user friendly platform with trusty information for deep renovation embedded in EPC	A1. Increase the number of deep or staged renovations	Building owners Renovation Agent IDAE EPC software providers Media	Test Renovation Passport'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 Integrate Renovation Passport's features in the new version of the EPC Media/dissemination campaign of iBRoad2EPC	Completed - follow up	Nº of buildings tested
	A2. Increase public awareness for deep or staged renovation			Completed - follow up	Nº of features integrated
	A3. Increase the engagement of neighbours in the renovation process			Completed - follow up	Nº of experts targeted
	A4. Build trust in energy planning tools (EPC, Renovation Passport, DBL)			2024 - follow-up	Nº of features integrated
				2024 - follow-up	Nº of appearances of iBRoad2EPC
P3: Simplify financial management and facilitate funding	A1. Increase the number of deep or staged renovations	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. Facilitate the entrance of private capital and promote specific offers to renovation (soft loans or green mortgages)	Completed - follow up	Nº of buildings tested
	A2. Increase public awareness for deep or staged renovation			2024 - follow-up	-
	A3. Increase the engagement of neighbours in the renovation process			2024 - follow-up	-
	A6. Increase market penetration of iBRoad2EPC				

Priority	Aim served	Relevant stakeholder	Proposed actions	Timeframe	Indicators
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)	Completed - follow up	N° of existing tools compatible
			Provide automated data schemes to be integrated in the iBRoad2EPC (EPC, energy, cadastre, urban planning, building stock)	Completed - follow up	Capacity to integrate automated data
			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	Completed - follow up	N° of policies integrated
			Ensure maximum compatibility/ flexibility of iBRoad2EPC formats/layouts with national layout - to be done within the NAC meetings	Completed - follow up	N° of iBRoad2EPC features automatically drawn from existing sources
			Embbd iBRoad2ECP modules/learnings in EPC scheme	Completed - follow up	N° of features embeded
			Avoid conflict of interest with ongoing tools and certifying agents	Completed - follow up	-
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	GBCE CICLICA	Manage resulting data to produce other data tailored for specific stakeholders, and sell these “second row” data, could be marketable	2024 - follow-up	
			Include a specific budget for maintaining and exploiting resulting data in the long term	2024 - follow-up	
			Define interested stakeholder: facility managers, real estate managers or neighbourhood managers	2024 - follow-up	
			The tool must both create demand and satisfy it in the short and long term; it is probably more efficient to enter the market following EPC than opening Renovation Passport	2024 - follow-up	
			NAC business plan suggestion is to give the tool a free use, retain resulting data and exploit them	2024 - follow-up	

Table 7: Spanish Action Plan for the national implementation of iBRoad2EPC

CONCLUSION AND RECOMMENDATIONS

The report presented the final national guides for the successful implementation of the iBRoad2EPC concept and methodology in the six pilot countries, Bulgaria, Greece, Poland, Portugal, Romania, and Spain, with a special focus on public authorities' views regarding the integration potential, and also incorporating the lessons learned from the field-test and NAC consultation meetings.

As demonstrated by the varying pilot country approaches, the six countries feature different technical, socio-economical and market conditions, including different EPC and Renovation Passport frameworks, national targets, legislation, building stock characteristics and data, financial programmes, and renovation activity. These differences in market conditions have been critical for the development and adaptation of the iBRoad2EPC concept. Moreover, IT implementation and interlinkage approaches in each pilot country have been explored and established during and after the field test, to ensure maximum integration with existing tools and platforms. Substantial progress has been made, especially in Bulgaria, Greece, Portugal and Spain with Excel, API and XML integrations.

Each of the six pilot countries has defined a proposed national approach for the implementation of iBRoad2EPC, specifying its proposed nature (voluntary or mandatory), modules, cost (additional to the EPC), interlinkages & automations as well as training procedures. In general, iBRoad2EPC is considered a useful and already operational example of a Renovation Passport in line with the 2024 recast EPBD requirements. All iBRoad2EPC modules are considered valuable, with the exception of the MEPI module, and its modular nature makes it successfully advantageous and flexible in order to fit the differing national market contexts as well as the building owners' needs, with a manageable cost.

Each of the pilot countries has also recognised a set of priorities, connected to specific aims in order to formulate its national Action Plan for the implementation of iBRoad2EPC. Despite the differences in the technical, socio-economical and market conditions, there is quite a similar number of priorities between countries. 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, as is the provision to ensure sufficient capacity to carry out deep renovations. On the other hand, different needs have been described by the pilot countries in terms of the preferred modules to be implemented.

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 Final National Guides presented in this report serve as a starting point for the actual implementation of iBRoad2EPC as a comprehensive Renovation Passport to fulfil the 2024 recast EPBD requirements in the six implementing countries, paving the path also for other countries outside the project consortium to follow.

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