



Conceptualising iBRoad2EPC

How Energy Performance Certificates (EPCs) can be upgraded
with Building Renovation Passport (BRP) elements



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EXECUTIVE SUMMARY

The European Union (EU) has set ambitious goals of cutting its net greenhouse gas emissions by at least 55% by 2030 and becoming climate neutral by 2050. To achieve these obligations and climate targets, significant emissions reductions are needed in the building sector, which contributes to around a third of all EU emissions. The energy performance certificate (EPC) is one of the EU's main instruments that can facilitate the long-term decarbonisation of the building stock. The EPC is an established instrument that can inform, motivate and incite building owners to undertake energy renovation. To fulfil this role, however, several challenges need to be addressed and only a few countries have explored the full potential of EPCs.

There is an increasing reliance on EPC data for tracking the progress and the implementation of renovation policies and funding. Yet the uneven quality and reliability of national EPC schemes, coupled with the lack of public trust in the generic list of recommendations may hinder the goal of the EPC to encourage additional investments in energy efficiency. EPCs offer a huge opportunity if integrated with building renovation passport (BRP) elements. According to the definition in the Energy Performance of Buildings Directive (EPBD) recast, the renovation passport is “a document that provides a tailored roadmap for the renovation of a specific building in several steps that will significantly improve its energy performance.” The EPBD recast introduces the requirement for Member States to establish by the end of 2024 a voluntary scheme for renovation passports based on a common framework that will be developed by the Commission [1].

iBRoad2EPC is positioned as the bridge between existing EPC schemes and (future) BRPs that take a further step to offer an individual and step-by-step renovation journey over time. This report investigates the maturity and market potential of the six iBRoad2EPC implementing counties (Bulgaria, Greece, Poland, Portugal, Romania, Spain). By joining the two instruments, EPCs can become a powerful tool that can trigger deep and staged energy renovation and pave the way for the later implementation of comprehensive BRPs.







iBRoad2EPC aims to form the bridge between EPCs and the BRP

The status quo analysis of EPC sets the background and boundaries of the iBRoad2EPC concept. The main findings of the analysis are summarised below:

- on-site visits are not a requirement in all Member States to issue an EPC for existing buildings, making it difficult to provide tailored recommendations and to ensure quality of input data;
- quality control and verification processes are at different stages of implementation, ranging from random checks of EPCs to verification checks before the EPCs are being issued;
- in most implementing countries the assessor issuing an EPC is a qualified engineer; however, even though qualifications are an important aspect of quality assurance, training programmes for energy auditing are not mandatory across all Member States;
- EPC databases have a great potential use for benchmarking, tracking and quality assurance, but they are not freely and publicly accessible in all implementing countries;

- Digital Building Logbooks (DBLs) are data repositories that can store different types of building data during different life phases of the building. They are available in only a few countries (e.g. Portugal and Spain) and are being established in others. The DBL can be bundled with BRP, while linking EPC databases with DBLs would improve market transparency and information availability, reduce costs and risk, as well as enable more effective policymaking;
- EPC recommendations are not required in all Member States. Usually they are derived from a predefined list (e.g. Portugal, Bulgaria and Romania) and also indicate the cost of the suggested renovation measures;
- Innovative indicators, such as indoor environmental quality (IEQ) and smart readiness indicator (SRI), for the great majority of the countries are either not covered or covered to a very basic degree (e.g. Greece).
- Overall, the public trust and reliability of EPCs remains limited. Based on a survey¹ of the iBRoad² project, only 18% of Polish and 17% of the Bulgarian respondents would trust the EPC for advice on renovation measures, while approximately half (47%) of Portuguese respondents would rely on the EPC for renovation advice.

| Country | On-site visit and inspection requirements | Qualification requirements of EPC assessors | Public acceptance of EPCs | EPC recommendations |
|---|--|--|---|--|
| Bulgaria  | Mandatory for all existing buildings; the EPC is the result of an on-site energy audit of the building | Only qualified and accredited energy certifiers can issue EPCs | EPC quality varies significantly; limited quality assurance in place. Very low recognition and social acceptance | EPC recommendations are derived from a predefined list and are linked to deep renovation objectives |
| Greece  | Required for all buildings. The energy auditor collects information based on a site visit and double checks information provided by the owner. | EPC assessors are licensed engineers or engineering graduates | There is varying quality, EPCs are considered an administrative burden rather than a helpful tool for building owners and tenants | The EPC does not include a predefined list of recommendations, the energy assessor is responsible for preparing renovation recommendations |
| Portugal  | Required for all buildings | Qualified EPC assessors must have an architecture or engineering degree, and at least five years of experience in the energy efficiency of buildings | The public trusts EPCs and building owners would rely on them for renovation advice | A list of recommendations of potential measures can be selected by the energy assessor from a predefined list and the expert can add specific recommendations beyond the predefined list |
| Romania  | Required for all buildings | EPC experts are certified/accredited after an 80 hours training course | EPCs are usually inexpensive and of low quality which limits the public trust | EPC includes only standardised and generic recommendations for energy performance improvement. |

¹ <http://ibroad-project.eu/wp-content/uploads/2018/04/iBRoad-Understanding-potential-user-needs.pdf>

² <https://ibroad-project.eu/>



| | | | | |
|---|---|--|---|---|
| Poland  | On-site inspection is not required | A qualified expert must have completed higher education and obtained a technical title (e.g. engineer, architect etc.). Other building experience can also be enough to obtain a certification | EPC data is not reliable due to lack of quality control and there is a low public trust of EPCs | Recommendations are not required, the auditor may give general recommendations, but in most cases the field in EPC is left blank. |
| Spain  | The auditor must make at least one site visit | The prerequisite is to have an academic degree of engineering or architecture | The EPC is seen as an administrative tick-box, that brings no value neither to the property nor owner | Recommendations indicate the required cost for the suggested renovation measures. |

Table 1: Overview of existing EPC market conditions per country³

The analysis found several barriers towards the implementation of BRPs, including the lack of financial support and public awareness. On the other hand, various recent developments can drive the uptake of BRPs. These include references to BRPs in key national strategy documents, such as the long-term renovation strategies (LTRS) and the recovery and resilience plans (RRP).

The analysis of the current EPC market explores the maturity level and potential of the existing schemes to set the foundation of iBRoad2EPC and BRPs. iBRoad2EPC is suggested to comprise a basic module around which additional functions (modules) can be built. The iBRoad2EPC concept thereby provides the opportunity for staged upgrades of the national EPC approaches based on market developments and particular needs. The modular approach is also justified by the intention to increase market coverage, encourage deep renovations, and the implicit synergies/trade-offs between coverage, thoroughness and resources needed.

The basic module requires an on-site visit and uses renovation recommendations from a predefined list, though these are editable so that the auditor can specify the type and order of renovations for the specific building to avoid lock-ins in staged renovations. The advanced version expands the basic module with additional functions (modules) such as IEQ, SRI, energy demand and cost. It further offers the possibility to link to an EPC database, BRP, DBL and other instruments or databases. The more modules are chosen, the more iBRoad2EPC comes closer to a comprehensive BRP.

³ The overview of the EPC market conditions was based on desktop research and inputs collected from country experts

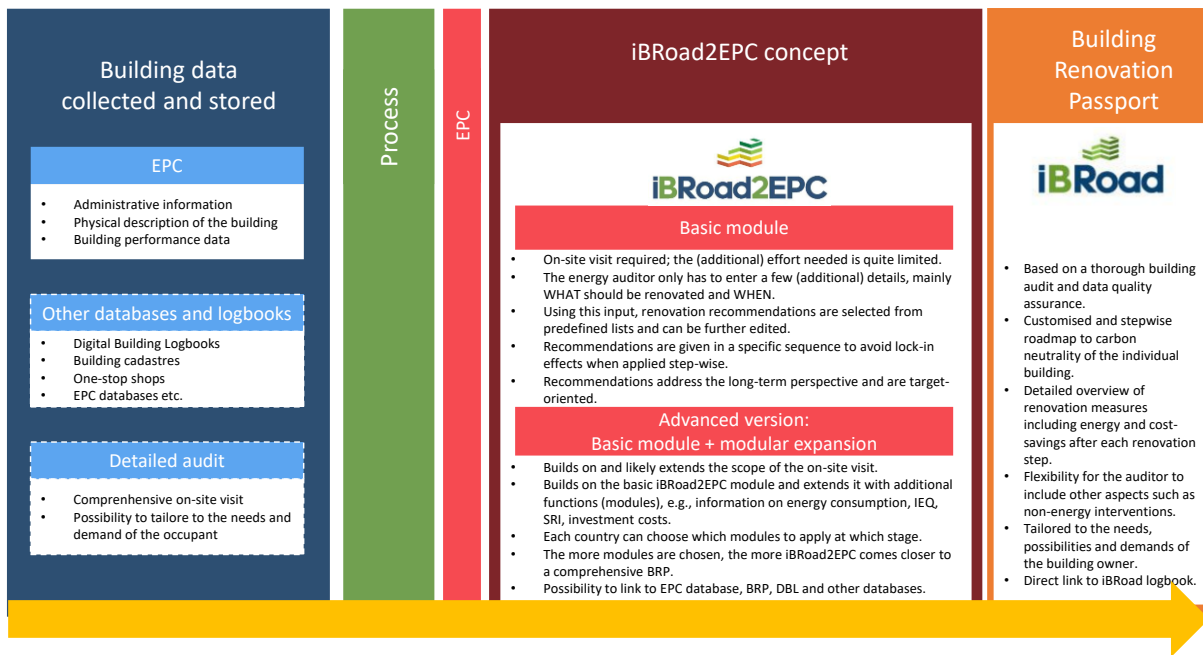


Figure 1: Conceptualisation of iBRoad2EPC in the context of EPC evolution and related instruments

iBRoad2EPC focuses on the long-term decarbonisation objective. It aims to contribute to quality assurance of EPCs, and improve their effectiveness, reliability and usefulness. It further aims to develop the next generation of EPCs that will support EU ambitions and improve conditions of building occupants. At the same time iBRoad2EPC aims at upgrading data gathering and storage approaches. This will help to further improve EPC recommendations, allowing either a staged or a one-step renovation towards a zero-carbon objective.

iBRoad2EPC is a response to the market barrier of the lack of knowledge about which renovation measures to implement and in which order. To develop a reliable and publicly recognised product, it is crucial to promote next-generation EPCs that integrate BRP elements through the right channels and in a language that building owners can understand.

The report concludes with general recommendations and success ingredients: (1) stakeholder engagement of policymakers, EPC issuers, building owners, potential data providers, etc.; (2) innovative elements beyond energy, e.g. Indoor Environmental Quality (IEQ); (3) secure funds and investment capacity; (4) creation of demand combined with quality control mechanisms and awareness raising campaign on the benefits of deep renovation.

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GLOSSARY

BIM - Building Information Modelling

BRP - Building Renovation Passport

DBI - Digital Building Identity

DBL - Digital Building Logbook

EPC - Energy Performance Certificate

EPBD - Energy Performance of Buildings Directive

EU - European Union

IAQ - Indoor Air Quality

iBRoad - The H2020 Individual Building Renovation Roadmap project

iBRoad2EPC - The H2020 Integrating Building Renovation Passports into Energy Performance Certification Schemes for a Decarbonised Building Stock project

IEQ - Indoor Environmental Quality

LCA - Life Cycle Assessment

LTRS - Long Term Renovation Strategies

NACs - National Advisory Committees

MEPS - Minimum Energy Performance Standards

NBRP - National Building Renovation Plan

RRP - Recovery Resilience Plan

SRI - Smart Readiness Indicator

WLC - Whole Life Carbon

ZEB - Zero Energy Building

INTRODUCTION

The European Union aims to become climate neutral by 2050 and cut its net greenhouse gas emissions by at least 55% by 2030 (compared to 1990 levels). To achieve these objectives, greenhouse gas emissions must be drastically cut across all sectors. Mitigation in the construction and building sector plays a key role, but current policies need to be improved to drive the transformation of the sector. The recast of the EPBD proposal published on 15 December 2021 sets a definition of ‘zero-emissions buildings’ for new buildings and renovations as of 2030.

To support the energy and climate targets set by the EU, there is a need to align the EU building stock with climate-neutrality goals. To do this, the EU must fully exploit existing policy instruments including energy performance certificates (EPCs) and long-term renovation strategies (LTRS).

iBRoad2EPC aims to contribute to the establishment of the next generation of EPCs, making them fit for supporting the deep renovation of European buildings. This will be achieved by upgrading EPC schemes with the integration of elements from the building renovation passport (BRP) - which has been conceptualised and successfully tested within the iBRoad project. In particular, this includes tailored recommendations for deep renovation. The project also offers a ready-to-use framework (including software, training and surrounding policy instruments) for the adoption of upgraded EPCs across Europe.

This report investigates the maturity and potential of the market in the six iBRoad2EPC implementing countries (Bulgaria, Greece, Poland, Portugal, Romania, Spain) to expand their EPCs through the integration of BRP elements, such as customised recommendations for staged deep renovations. The review will highlight how ready each country is to implement iBRoad2EPC and will be used to determine the boundaries for the adaptation, national roll-out and testing of the iBRoad2EPC in the pilot countries. The ultimate goal of this report is to set out the concept of iBRoad2EPC.

The report starts with an overview of the key concepts and policy measures relevant for iBRoad2EPC. It is hereby highlighted that iBRoad2EPC should not be seen as a standalone instrument, but rather as an instrument that brings clarity and realises the synergies with existing EPCs and, where possible, with other connected initiatives such as EPC databases, digital building logbooks (DBLs) and BRPs.

The report also provides an analysis of the status quo of the EPC market in the six implementing countries. The areas analysed include the EPC methodology (covering the on-site visit, the calculation method and software), quality assurance (including quality control and requirements concerning the professional qualification of EPC experts) and databases (including EPC databases, digital building logbooks and other relevant databases). The scope of EPC recommendations is also briefly explored while a reference to innovative EPC elements is given.

The second part of the status quo gives more detailed country-specific findings highlighting drivers and barriers, and stating reflections of the role of the iBRoad2EPC, taking into account the country-specific trends.

The last chapter sets out the key principles of the iBRoad2EPC concept.

From iBRoad to iBRoad2EPC

The iBRoad⁴ project (2017-2020) developed, tested and delivered a model for the BRP, supporting single-family homeowners with personalised advice to facilitate stepwise deep renovation of their buildings.

The iBRoad2EPC project builds on the achievements of iBRoad, broadens the scope of the concept and adapts it to national EPC schemes, to prepare the roll-out of next-generation EPCs in Bulgaria, Greece,

⁴ <https://ibroad-project.eu>

Poland, Portugal, Romania and Spain. The aim is to establish the next-generation EPCs that will support the decarbonisation targets of the EU⁵.

⁵ <https://ibroad-project.eu/news/the-ibroad-tools-structure-2/>

METHODOLOGY

To investigate the maturity and potential of the EPC market to integrate BRP elements, BPIE initially completed desk-based research to review available literature. Country-specific inputs were then collected from the six iBRoad2EPC implementing countries through the iBRoad2EPC country leaders (BG: EnEffect, ES: GBCe, GR: INZEB, PL: KAPE, PT: ADENE, RO: URBAN-INCERC) with input from the virtual roundtable held within each of the six national advisory committees (NACs). These consist of a committed handful of key national actors responsible for or directly involved in the implementation of national or regional EPCs and relevant frameworks (e.g. EPC implementing authority, certification body, training body, etc.) in each implementing country.

CENTRAL CONCEPTS AND RELEVANT EU PROVISIONS

The decarbonisation of the European building stock needs a considerable push to achieve climate-neutrality by 2050 as the pace of the transformation remains slow, with a deep renovation rate at a trivial 0.2%. Over the years, the EPBD has employed several policy tools such as EPCs and LTRS to reduce energy use and carbon emissions from the building stock. New measures are also on the way as announced in the recast EPBD, including Minimum Energy Performance Standards (MEPS), BRPs and DBLs. To achieve its climate goals, the EU must utilise all available policy instruments, both existing ones and those which are still in the pipeline. This section maps the links and synergies between iBRoad2EPC and relevant EU-level strategies, highlighting the need for more alignment between various policy and information tools.

EPBD recast proposal and the policy landscape

The European Commission published a full recast proposal of the EPBD in December 2021 [1]. The comprehensive recast touches upon many existing requirements and introduces a series of new provisions. The recast aims to accelerate the renovation of the worst-performing 15% of EU buildings and sets out MEPS for both residential and non-residential buildings. In due course, every building would need to achieve at least a Class E on a revised A-G scale of EPCs. The implementation of MEPS will highly depend on effective national renovation plans (NBRPs) and individual building renovation passports (BRPs). Several elements introduced by the EPBD recast proposal are being discussed in this report, including NBRPs, EPCs and BRPs.

The implementation of the above policy measures will undoubtedly highlight the potential and need for an instrument like iBRoad2EPC as a tool to deliver the information and guidance that enable property owners to improve their properties and reduce emissions. Next to the new policy requirements in the pipeline, financing and support measures are also increasingly available in the form of EU programmes such as NextGenerationEU⁶ and REPowerEU.⁷ They aim to provide financial support for affordable, secure and sustainable energy, which will enable markets to successfully take up instruments such as iBRoad2EPC.

At a glance: key concepts and policy measures relevant for iBRoad2EPC

iBRoad2EPC builds on a number of existing and planned policies, information and awareness-raising tools. Extending the scope of EPCs and implementing iBRoad2EPC modules will require improving how building data is collected, managed and stored. iBRoad2EPC should not be promoted as a standalone instrument, but rather should be integrated with similar existing initiatives such as EPCs, DBLs, NBRP and BRPs.

⁶ NextGenerationEU was started as a recovery plan to mitigate the adverse effects of the COVID-19 pandemic. https://ec.europa.eu/info/strategy/recovery-plan-europe_en

⁷ RePowerEU was started to quickly reduce the region's fossil fuel dependency on Russia, following the Russian invasion of Ukraine. https://ec.europa.eu/commission/presscorner/detail/en/ip_22_1511

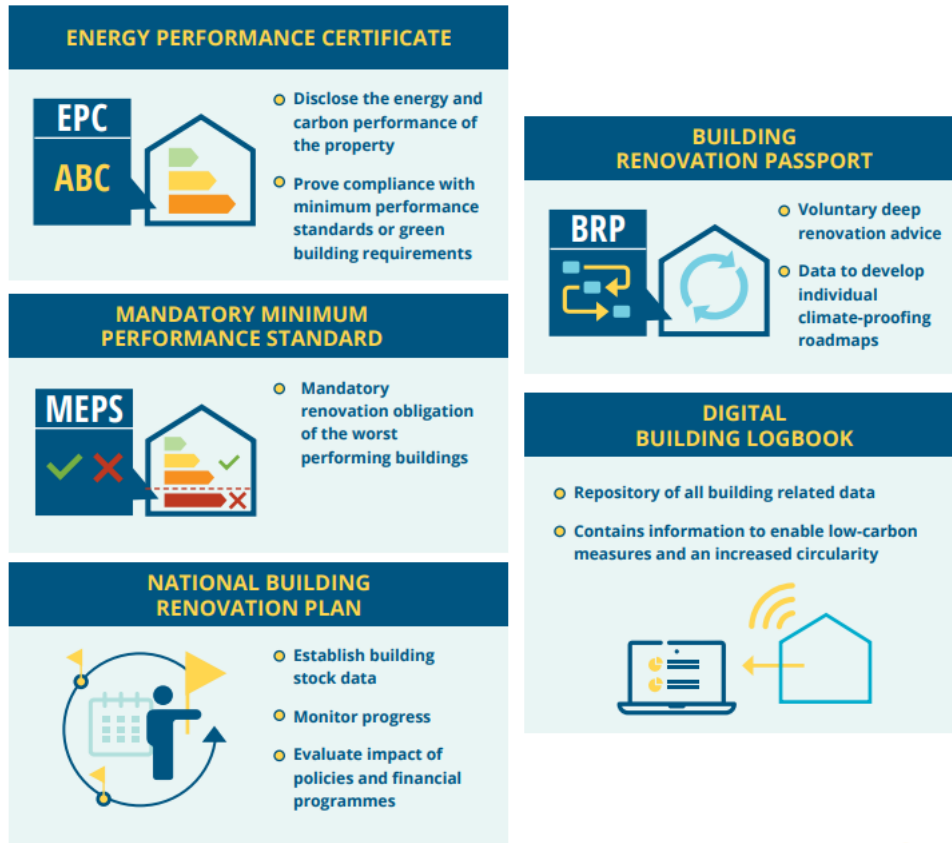


Figure 2: EPBD provisions that can be utilised by the iBRoad2EPC and support the integration of BRP elements into EPC schemes (Source: BPIE, [2])

Energy performance certificates

iBRoad2EPC builds upon existing datasets as a baseline. EPCs are the most widely used documents stating the energy performance of buildings, however they currently lack the ability to trigger and support renovations in practice. EPCs are an important data source that can save time during physical home surveys and reduce the cost of producing BRPs. Increasingly, preferential financing is relying on an EPC rating and MEPS, if introduced, are likely to be linked to a building achieving a specific EPC rating.

By now, national EPC schemes have been implemented in all Member States, although approaches differ significantly. These different approaches resulted in a broad variety of certificates that differ in their scope, reliability and the information they provide. Despite the improvements over time, such as the introduction of independent quality control of EPCs and non-compliance penalties, important shortcomings still prevail.

There is a general agreement over the need for significant improvement of EPCs if they are to guide decarbonisation policies and to have financial incentives tied to them. Good practice examples of national EPC schemes illustrate that more and higher quality data on the building stock could be collected if EPC schemes were improved, empowering policymakers to monitor the impact of policies and financial support schemes. In turn, this can allow policymakers to improve policies, assuming EPC schemes are well implemented and supported by effective compliance mechanisms. Only in this way will EPCs improve market transparency, contribute to increased value differentiation and support the transition to an energy-efficient real estate sector [3].

A much-welcomed comprehensive overhaul of the EPC framework is foreseen in the EPBD recast with a view to increasing the quality and availability of EPCs. This includes “greater harmonisation, the inclusion of

additional information and more stringent provisions on availability and accessibility of databases.”⁸ Considering that negotiations are still ongoing at EU level, Member States may consider the option to ensure that all EPCs are aligned with an EU-wide common template starting in 2026, including several indicators⁹ such as primary energy use, operational energy use and the share of renewable energy generation. The energy classes, currently determined nationally, are expected to be harmonised so that labels have the same meaning across the EU. The A-rating can represent emission-free buildings, whereas the G-rating can correspond to the national 15% worst-performing buildings [4]. If properly implemented, the recast would significantly simplify the introduction of iBRoad2EPC.

Building renovation passports

Building renovation passports are proposed by the recast for the first time in the form of voluntary tools that identify future renovations and plan the best timing and scope for interventions. The European Commission aims to develop, by the end of 2023, a common EU framework that will guide the rollout of renovation passports in Member States. A building renovation passport is defined as “a document that provides a tailored roadmap for the renovation of a specific building in several steps that will significantly improve its energy performance” [4].

This definition is similar to the definition already developed and tested by the iBRoad project, the forerunner of iBRoad2EPC. The individual building renovation roadmap (i.e. the iBRoad-Plan) is a bespoke and sequenced renovation roadmap tailored to specific needs and with the potential of being fully integrated with the logbook, supply chain and funding sources. It provides a robust, complete and tailored long-term plan of renovation measures to be taken at specific points in time considering building owners’ individual needs and possibilities, while indicating the expected investments and energy performance level reached after each measure. The iBRoad-Plan was tested, among others, in iBRoad2EPC implementing countries Bulgaria, Poland and Portugal, and 79% of the homeowners who tested it reported that the tool enables and motivates them to realise concrete renovation measures in the near future [8].

The building renovation passport is produced following an on-site visit by a qualified expert. The passport suggests a sequence of renovation works aiming to transform the building to a ZEB by 2050 at the latest. It further includes expected benefits and potential financial and technical support.

Key features:

- based on a thorough building audit and data quality assurance
- detailed overview of renovation measures over time, avoiding lock-ins and indicating costs and savings after each renovation measure with the end goal of achieving a zero-emissions building standard
- flexibility for the auditor to include other aspects such as non-energy interventions.
- tailored to the needs and demands of the building users.

The EPBD recast recognises BRP as a key instrument to deliver renovations. The introduction of BRPs reflects the need for better guidance and support for property owners throughout their energy renovation journey. Crucially, the effective use of BRPs can also help to raise the quality of works, including encouraging better coordination between well-trained and accredited professionals, reducing the risk of cost and time overruns.

National building renovation plans

The proposed recast of the EPBD replaces LTRS with NBRP. NBRPs must include an ambitious vision for the building stock in 2050 and there will be unambiguous mandatory templates national governments must

⁸ European Commission (2021) [Inception Impact Assessment](#)

⁹ The EPBD Annex V proposes nine indicators that should be included on the first page of the EPC. In addition, there are several optional indicators (mostly going beyond the energy performance and including health, smart readiness and life-cycle data).

follow, as well as a better governance system. The central aim to achieve a decarbonised and highly energy efficient building stock remains, which means existing buildings are expected to become zero-emission [4]. NBRPs should become the basic guiding principle for the implementation of iBRoad2EPC at national level. In this respect, iBRoad2EPC's specific long-term vision must be aligned with the carbon-neutrality goals defined by the proposed EPBD recast as well as the actions and intermediary steps set out in the NBRPs. The experience with current LTRS is that they have not yet provided clarity and detailed information on what should happen on the individual building level¹⁰ and therefore this remains a critical gap that NBRPs will need to fill.

Digital building logbooks

According to the Renovation Wave Strategy, the Digital Building Logbook (DBL) will integrate all building related data provided by the upcoming Building Renovation Passports, Smart Readiness Indicators, Level(s) and EPCs to ensure compatibility and integration of data throughout the renovation journey¹¹.

The recast EPBD positively references DBLs as part of the effort to improve publicly available building energy performance data. Logbooks aim to facilitate interoperability and data exchange between the national database for energy performance of buildings and various other administrative databases.

The DBL can accelerate and maximise the impact of building policies to address climate change. Granular performance and maintenance data availability in addition to the EPC could provide a robust and reliable indication of energy performance and reduce performance gaps.

iBRoad2EPC is a potentially useful tool to increase data consistency and transparency, improving the quality of data collected, but the tool would also benefit from the integration of disparate existing data sources, collecting and storing data in a standardised format, and a robust governance process to ensure quality and data control. Linking iBRoad2EPC and DBLs through a common EU semantic data model and data management could transform iBRoad2EPC into a dynamic tool bringing additional benefits to the owner.

DBLs and iBRoad2EPC have at least three potential touchpoints:

- *Data input* - the DBL can act as a gateway connecting various data silos and data scattered across the building value chain and lifecycle. This makes the DBL an extremely useful data source for measuring real performance but also, further upstream, to inform LTRS, decarbonisation pathways and targets at the building stock level
- *Interface and display* - the DBL can act as a simple and user-friendly dashboard hosting the EPC, the iBRoad2EPC, key data about the property, scheduled maintenance and forthcoming improvement measures, real-time energy performance, comfort considerations and much more
- *Connection to funding sources, qualified professionals and renovation contractors* - the DBL can enable building owners to access suitable sources of public and private financing, as well as trusted stakeholders along the renovation value chain.

¹⁰ <https://www.bpie.eu/publication/the-road-to-climate-neutrality-are-national-long-term-renovation-strategies-fit-for-2050>

¹¹ https://ec.europa.eu/energy/sites/ener/files/eu_renovation_wave_strategy.pdf

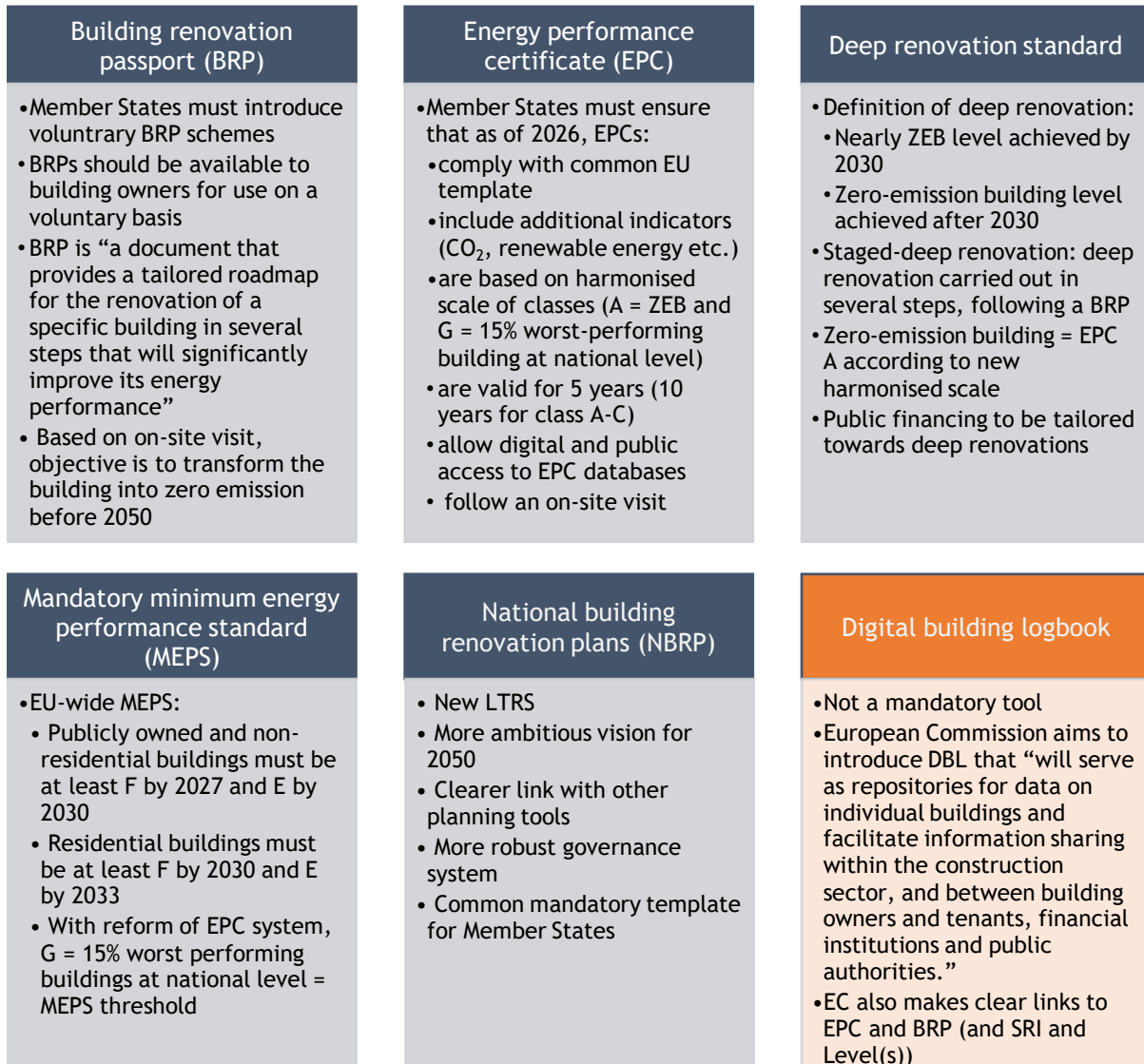


Figure 3: Relevant policy and information tools for the development of iBRoad2EPC

Outlook

Currently, there is a need for more clarity over the scope, purpose and target audience of each of these tools and on how they relate to each other. Mapping synergies and coherent EU-wide approaches could increase learnings and create awareness and market demand. It would also enable interoperability, data consistency and information exchange. These tools offer great potential and can be instrumental in preparing the groundwork for the successful introduction of BRP elements into EPCs. These individual policy measures taken collectively can create trust and contribute to robust data tracking and reporting, which in turn will help expand datasets and enable further refinement of policy tools [2]. Aligning and integrating existing instruments such as EPCs, BRPs, NBRP and DBLs can create multiple opportunities to achieve policy goals, engage building owners on deep renovation and overcome value chain fragmentation.

STATUS QUO ANALYSIS OF EPC SCHEMES

The existing market conditions set the baseline and foundation of iBRoad2EPC. To define the iBRoad2EPC concept, we first need to assess the maturity and potential of the EPC market. This chapter looks into the status quo of different aspects of EPCs, including the methodology, quality assurance regimes, data governance and recommendations included in the certificate. It also explores innovative EPC elements and how these affect public awareness, acceptability and trust.

EPC methodology

This section gives an overview of the EPC issuance process and methodology in the six iBRoad2EPC implementing countries. The main areas examined are the on-site visit, the EPC calculation methodology and the software tools used to support the calculation process.

On-site visit

An on-site visit by a professional increases the reliability of the information collected and the quality of the listed recommendations. Without an on-site visit, it is very difficult to identify tailored recommendations for improvements. Furthermore, an on-site visit may spot irregularities in the EPC data.

Our analysis suggests that none of the implementing countries currently displays a strong auditing culture. Low trust, cost pressures and a lack of awareness about the benefits of deep renovations are limiting the scope and quality of energy audits.

Not all Member States require a physical visit to gather the technical information to issue the EPC for existing buildings. Bulgaria, Greece, Portugal, Spain (as of 2022) and Romania do require an on-site visit, while Poland does not. In Greece, a typical on-site visit for an apartment of 80m² lasts around 30-45 minutes, and more for larger building units or detached buildings. In Portugal, a full visit can take around one hour for a residential dwelling, while the audit of a non-residential building could take 4-8 hours. Travel distance to the property, size of the building and access to building/information can make the length of site visits vary considerably. Overall, the main reason on-site visits are not common is due to time and costs savings, and, importantly, because existing regulations are not mandating it.

A key objective of the iBRoad2EPC is to enhance EPC recommendations by providing tailored advice and a stepwise renovation roadmap - all these require good quality and reliable data. The quality of input data for the calculation process determines the usefulness of the results. In most cases, an on-site visit is a prerequisite for quality input data.

Calculation method

The EPBD (2010/31/EU) gives guidance to Member States with respect to the EPC calculation methodology [5]. Annex I of the EPBD mentions that the energy performance of buildings can be evaluated on the basis of the calculated (asset rating) or actual energy consumption (operational rating).

In Bulgaria, Greece and Romania, the calculation methodology is based on EN ISO 13790 and other complementary European standards. In Romania there is also an alternative calculation method for heating and hot water consumption.

The Polish regulation includes a methodology for calculating energy performance indices for annual demand for non-renewable primary energy, final energy and usable energy.

In Portugal and Greece, the methodologies use data derived from building inspection, drawings and building specifications regarding the primary energy needs and use respectively. The EPC ratings are based on the

comparison of the real building with a virtual building ('reference building' for Greece as well as Spain). In case of Greece, the evaluation methodology is defined by the Greek Regulation for the Energy Performance of Buildings (KENAK). The ratio of primary energy use between the two cases (actual to virtual/reference) gives the EPC rating.

The Spanish EPCs have two ratings based on two indicators (EpnR: Global annual consumption of non-renewable primary energy and CO₂: Global annual CO₂ emissions). These compare the building to the building stock and to a reference building with standard values respectively.

The Bulgarian rating takes into consideration the main building characteristics (e.g. U-values and building systems efficiencies) and compares them against the reference values for 2015 and to the reference values of 1960s-1990s.

In conclusion, standardisation of the calculation methods is a positive trend for the implementation of the iBRoad2EPC concept. However, it is necessary to account for national and regional differences in benchmarking, inputs and outputs, determined by differences in local contexts and policy goals. What is relevant for the iBRoad2EPC concept is that the concept should therefore have a flexible approach to quality assurance and to the level of ambition of the renovation roadmap.

Software

To support the calculation process, most countries make use of a software tool.

Romania uses various alternative tools available on the market and which are based on the current methodology (Mc 001-2006). These commercial software programmes for energy performance calculation are applicable to all building types (AllEnergy, Certificat-energetic.com, Doset-PEC, ALLPLAN, Matrix Energy and TermoExpert). The use of different tools or even distinct versions of the same tool provide inconsistent outcomes.

In Poland, the most frequently used software tools to issue EPCs and to carry out energy audits (beyond EPCs) are provided by private companies (e.g., Audytor OZC, the ArCADia Thermo and the BuildDesk Energy Certificate), while simplified calculation tools for building owners have been developed by manufacturers of building materials.

Bulgaria uses three authorised software tools (EAB, EECalc, Shtrakov) which are not mandatory. In the most commonly used software (EAB, EECalc), the input parameters (e.g. U-value, areas, g-value and other specified inputs to the energy performance calculation) should be calculated in advance, as it is not part of the software.

The Technical Chamber of Greece provides the calculation methodology and official software used to issue the Greek EPCs (TEE KENAK). Other software tools, available from private companies use the same calculation engine as the official software and are widely used by auditors (4M KENAK, easykenak, Energy Certificate CAD).

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 building types (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 apply for its software to be registered in the official list. 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.

The availability of a variety of both public and private software in most of the implementing countries anticipate not only IT challenges but also stakeholder engagement issues for the conceptualisation and market implementation of iBRoad2EPC. For a successful implementation of the iBRoad2EPC concept, public authorities may need to engage and collaborate with private software developers and align towards a single, official assessment tool.

Quality assurance

Quality assurance requirements were not sufficiently taken into account at the introduction of EPCs as part of the first EPBD [6]. Each Member State introduced an independent mechanism for certificates to be issued by qualified experts, but quality control was not foreseen. The EPBD amendment of 2018 (2018/844) states that the independent control systems should be strengthened and compliance checks ought to be put in place [3]. Quality assurance is a challenging task that needs to be embedded into every stage of the certification process and include aspects such as skills, expertise and training requirements of the auditors, as well as the verification of issued certificates.

Quality control

This section explores the independent systems for the quality control of EPCs. Quality controls are in place in all the implementing countries except Poland.

In Greece, quality control is carried out through random checks of EPCs. By law, the randomly selected sample is 5% of the total EPCs issued. Random checks are also conducted on-site, whenever required, depending on desk-check results or in cases of complaints.

Similarly in Romania, the State Inspectorate for Construction (ISC) has been assigned to randomly control 10% of the EPCs and energy audits issued annually. So far, they have covered less than 1% (as reported in trimester ISC reports) of all EPCs. The Romanian Association of Energy Auditors for Buildings signed a voluntary agreement to help ISC in assessing the technical quality of certificates, but this support was rarely requested.

The Portuguese 'Quality Verification Scheme' is structured in two phases. The first is the prevention phase which takes place before the EPC is issued and includes an on-site visit and automatic database control. The second phase is the correction phase, taking place after the EPC has been issued. The latter comprises two types of checks: the summary and detailed verification.

The Ministry of Infrastructure is the responsible authority for the quality assurance of EPCs in Spain. Checks include the validity of the input data, results and recommendations, and are carried out by the competent body of each region directly or by independent agents authorised for this purpose.

The Sustainable Energy Development Agency (SEDA) official registry/database is responsible for control and verification in Bulgaria.

In summary, the Member States are at different stages in implementing the quality control processes for EPCs stipulated by the EPBD. The iBRoad2EPC concept should account for the differences in data quality in the different Member States, as well as for variable reliability of data from sources other than the EPC.

Requirements for EPC experts

This section gives an overview of the skills and training requirements of qualified EPC experts.

Skills and expertise of auditors

Member States have the flexibility to define the qualification needs of an EPC expert. There are a variety of requirements applied at the national level, such as minimum requirements specifying a certain level of education and professional experience, a training programme and/or a mandatory exam [3].

In Greece, Poland, Portugal and Spain, EPC experts must have a degree in engineering or architecture. In addition to that, in Portugal, qualified EPC experts must have at least five years of experience in the energy efficiency of buildings, and to obtain the accreditation, the expert must take a formal exam, managed by the Portuguese energy agency, ADENE. In Poland, other building experience can also be enough to obtain certification and qualified experts are registered in the Ministry's database.

The requirements in Greece are for the EPC assessors to be qualified engineers, members of the Technical Chamber of Greece and graduate engineer or engineers who have acquired equivalent professional

qualifications in the country, and who have the right to sign an Energy Efficiency Study. Graduate engineers have the right to become EPC certifiers one year after obtaining their degree.

The engineering and architecture background of the EPC certifiers in most Member States will be highly relevant if additional inputs, such as IEQ, actual energy consumption or SRI, are required in the proposed iBRoad2EPC approach. Professional qualifications and experience are also essential for producing the tailored recommendations of the iBRoad2EPC.

Training requirements

Most Member States offer training programmes for EPC experts provided by a variety of institutions including third-party bodies and private training organisations. The training curriculum may vary for different types of certifiers and is typically regulated by the government. Typical training modules cover aspects of building physics and technical installations; regulations on the energy performance of buildings; procedures and tools for the assessment of buildings' energy performance; methodology; basics of a cost-effective recommendation for performance improvements; and other related aspects such as on-site renewable energy integration and IEQ [7].

Training of energy certifiers is mandatory in Romania and Bulgaria. EPC experts in Romania are certified/accredited after a mandatory 80-hour training course on topics related to the energy performance of buildings. The accreditation requires the expert to pass two exams and carry out an assessment of a real building. In Bulgaria, a two-week training course and an exam are required. However, training courses have not been organised for the last 7-8 years, which has resulted in a reduced number of trained experts, a fact that can affect the quality of issued EPCs.

No mandatory training takes place in Poland, Spain or Portugal, although the Portuguese energy agency and other entities offer a voluntary regular training plan to improve the qualified experts' skills. In Greece, training and certification of EPC certifiers was initially required but it stopped being mandatory with the application of Law 4409/2016. There is a lack of certified and reliable technicians to promote 'educated' energy renovations.

As previously mentioned, continuous professional development is an important aspect of quality assurance for iBRoad2EPC. Through continuous training, EPC issuers can be educated and informed about the state-of-the-art procedures and tools for assessing a building's energy performance, technical installations and other aspects. This is essential to ensure that properly qualified auditors are available to carry out verifiable audits and provide building owners with trusted advice on how to renovate their buildings.

EPC recommendations

According to the EPBD, EPCs should include "recommendations for the cost-optimal or cost-effective improvement of the energy performance of a building or building unit." The majority of EPC recommendations range from measures such as changing behaviour to improving thermal insulation or changing service systems. The quality of recommendations is important because they can inspire building owners to actually undertake the renovation.

The Greek and Polish EPCs do not include a predefined list of recommendations. The EPC certifier in Greece is responsible for providing recommendations. The most common recommendations relate to the replacement of windows, installation of solar panels, installation of thermal insulation and maintenance of heating and cooling systems. In Poland, recommendations are not required. The auditor may give general recommendations, but in most cases, the relevant field in the EPC is left blank.

The recommendations in Portugal, Bulgaria and Romania are derived from a predefined list. In Bulgaria, the recommendations are linked to the building envelope and the technical building systems, and are combined into packages of measures. The recommendations are not linked to deep renovation objectives. The EPC does, however, indicate the potential cost, energy and CO₂ savings attributed to the individual renovation recommendations. The building owner can access more detailed recommendations in the energy audit report which is an obligatory part of the documentation included with the EPC, but the quality and detail varies

depending on the professional skills, experience and approach of the energy auditor. EPC recommendations in Romania are often generic and do not provide detailed information about the costs and benefits of the potential renovation measures. In Portugal, energy experts can select from a list of recommended measures and add additional guidance.

Most implementing countries (Bulgaria, Greece, Portugal and Spain) provide cost information about the suggested renovation measures, but only Greece and Bulgaria detail the payback period for all suggested renovation measures. In addition to costs, the Portuguese EPC displays the savings on energy bills and the energy class that would be achieved after renovation. This information is presented for each measure and all the measures together. EPCs in Bulgaria and Greece present information on CO₂ emissions.

None of the analysed countries align the suggested renovation measures with the long-term target specified in the LTRS. EPC recommendations are frequently oriented toward the minimum legal requirements and are often low-cost options. Renovations recommendations are not yet consistent with the deep energy renovation objective and the long-term goal of carbon neutrality is not indicated in any of the pilot countries.¹²

In a nutshell, the EPC recommendations vary considerably between Member States, ranging from no recommendations or a generic list to enhanced recommendations with quality checks. The latter represents a first attempt to provide a stepwise renovation roadmap. Building on existing practices, the iBRoad2EPC concept should therefore be flexible and modular, so that the implementing authorities can adjust it to their needs, depending on the current maturity level of the recommendations.

Innovative elements of EPCs

Typically, EPCs in all implementing countries comprise an energy efficiency label that indicates the energy performance level of the building, primary energy use status and CO₂ emissions. Adding new indicators could improve compliance, usability and reliability of EPCs. Innovative approaches to improve EPC data handling and technical aspects can further maximise their value to building owners and end-users.

Increased comfort and indoor environmental quality tend to be more important benefits for occupants than energy savings and could be a potential renovation trigger [3]. IEQ including indoor air quality (IAQ), thermal comfort, lighting and acoustics, has direct effects on health, comfort, wellbeing and productivity of the building occupants. Currently, these aspects are not reported in EPCs in sufficient details. For example, the Greek EPC gives a vague evaluation of the IEQ in which the EPC certifier is requested to check four boxes on the four aspects of IEQ without giving additional information to the building owner on how adequate levels of IEQ are achieved. The evaluation is only a qualitative assessment based on the subjective judgment of the energy expert. IAQ is also indicated in the Portuguese EPC and summer comfort is discussed in the Romanian EPC.

Another innovative element is the SRI. This provides an indication of the capacity of a building to use information and communication technologies and electronic systems to adapt its operation to the occupants' need and improve its overall energy performance [3]. The need for a common EU scheme for rating the smart readiness of buildings is already formalised in the amended EPBD (2018/844, [9]). However, no EU country has yet adopted this as part of its EPC scheme.

Life-cycle assessments (LCA), whole-life carbon (WLC) and circularity are additional important aspects that are currently not covered by any of the implementing countries in their EPC schemes. The ongoing recast of the EPBD will likely introduce disclosure requirements on WLC emissions starting with new constructions. Existing buildings will likely follow at a later stage, as the Renovation Wave objective to at least double the

¹² More details on country-specific recommendations can be found in the iBRoad2EPC report "Summary analysis of EPC's alignment with national long-term renovation strategies"

annual renovation rate makes it clear that the embodied emissions in the materials and components used during renovations will also need to be accounted for and reduced.

Some of these innovative indicators can have flexible approaches, such as the IEQ having a simplified and a more complex method requiring additional inputs and measurements. The addition of the more detailed methods could imply an increase in the price of the EPC. This is another reason for the iBRoad2EPC to adopt a modular approach, adjustable to the needs of the different Member States and on how far they wish to go on these additional features.

Public awareness and reliability

Expert testimonies suggest that, in Romania, EPC credibility is rather low and the recommended measures are rarely treated with interest - most of the time they are not even read. There is generally a low of awareness of energy audits and of the benefits of deep renovation. Furthermore, building owners lack the financial means to carry out renovations. It has been pointed out that benefits of EPC and BRP needs to be communicated in a simple and clear language and by shifting the attention to benefits, rather than the current focus on the investment costs.

The EPC scheme in Spain had, so far, achieved only a limited market impact. Research shows that a large share of Spanish respondents (>80%) believe that EPCs have low or no importance for their choice of house, while many building users are only informed about the EPC during or after contract signing (58%) [10]. This indicates a low awareness of the benefits of deep renovation and a dysfunctional EPC market [10][11].

In Portugal, there is still a lack of awareness among building owners about the benefits of energy efficiency renovation and the EPC is still seen as a formal obligation, rather than a useful information and decision-making tool. The BRP concept is still new and little known [12].

The reliability of the information in EPCs has a major impact on their credibility, acceptance and market uptake. For the vast majority of the pilot countries (Spain, Romania, Greece, Poland and Bulgaria), the reliability of the information in EPCs is poor and public trust is low. In Spain and Greece, public opinion considers EPCs as an administrative burden rather than a helpful tool for building owners and tenants. Due to the variable quality of EPCs in Bulgaria, there is very low recognition and social acceptance: only 9% of building owners would trust EPCs for advice about renovation measures. On the other end, 47% of the Portuguese would trust the EPC for advice about renovation measures, a relatively high share [13].

EPC databases

Each Member State has its own approach to collect EPC data. Data available from different sources makes the comparison between them difficult. Good practice examples offer an important insight into how the value of a database can be maximised.

EPC databases store building certificates in a single database, which can be made publicly available. Most Member States have set up EPC databases which are used for tracking progress on policies regarding renovation and building stock decarbonisation. EPC databases are also used for benchmarking and quality assurance. The source of the data, the way the data is stored and its format is crucial for the iBRoad2EPC implementation.

Bulgaria has a freely accessible database managed by SEDA, while Portugal has a central database managed by its energy agency ADENE. The Portuguese version provides an interface that makes it possible to compare EPC statistics from different regions. Poland, Spain and Romania do not publish the EPCs in a central database but provide information to energy auditors. In Spain, regional governments publish data on their webpages, and in Romania there are plans to establish a national database in the context of the national RRP. In Greece, the EPC database is developed and hosted by CRES, and the Ministry of Environment and Energy makes statistical data publicly available through its website on an annual basis (though the last update was for the year 2020).

BUILDING RENOVATION PASSPORT

Public acceptance

The public view regarding BRPs is essential for the successful uptake of the iBRoad2EPC concept. The trust in the existing EPC schemes can be seen as an important proxy indicator for trust in BRPs.

From the EPC market analysis above, it seems that in most of the implementing countries, there is relatively low trust, recognition and social acceptance of existing EPC schemes. There is also little awareness among building professionals and building owners about BRPs. The exception to this is Portugal, which has a successful EPC scheme with broad coverage. In Greece, key stakeholders seem to be more open to the concept of BRPs and understand the necessity to define reasonable steps towards achieving deep renovation goals in the long term.

Barriers

Barriers to the implementation of BRPs relate to the reliability and trust of EPCs, as mentioned above; lack of awareness about energy efficiency in general and the benefits of deep renovation in particular; the potential additional costs of BRPs; and insufficient financial support for energy renovations in general.

Trust and EPC validity are mentioned as challenging in Bulgaria, Romania, Poland and Spain.

In Greece and Bulgaria, the additional costs of BRPs are also brought up as a barrier. Lack of awareness of the benefits of energy efficiency constitutes a hindrance in most countries, as illustrated by the fact that EPCs are perceived as an administrative burden in Greece and Portugal. In Bulgaria, and most probably also in Romania and other countries in Eastern Europe, the ownership structure and heterogenous socio-economic background of owners of multi-family apartment buildings mount important obstacles to renovation and to issuing of EPCs. In Poland, among others, low quality control due to the large amount of EPC auditors is mentioned as limiting trust in EPC systems, and therefore potentially also BRPs.

Drivers

One of the main benefits of BRPs is that they can ensure that deep renovations are optimised in terms of energy savings, IEQ and carbon emissions reductions [2]. The fact that they are referenced in national policy documents like LTRS and RRP is an opportunity to enhance their implementation, as are conditions requiring an EPC to get access to public funding and targeted information for building owners.

The Spanish, Romanian, Portuguese, Bulgarian and Greek LTRS all mention BRPs as tools with the potential to improve information provision to building owners and to foster deep renovations. Moreover, Spanish, Greek and Polish policymakers have suggested that BRPs could be made a requirement to become eligible for public funding. Generally, the detailed information provided in BRPs is essential to give insights into the order in which renovation works must be implemented and the potential energy savings that can be achieved, and can provide building owners with insights into how much renovation investments will cost.

DIGITAL BUILDING LOGBOOKS

DBLs are data repositories that store various types of building data in a central digital folder. DBLs can store information relevant at different life stages of a building, such as design, operation or end of life. Construction materials, building information models (BIM), building permits, BRPs, EPCs and other data can be stored in DBLs and shared between stakeholders. Depending on the type of data, information stored in the DBL can be updated so the building owners can present up-to-date information to energy auditors, construction professionals, local authorities or potential tenants or buyers. If implemented effectively, DBLs can improve the quality and transferability of building data¹³.

In Portugal and Spain public DBLs are available, whereas DBLs in Romania are offered by the private sector. In Poland, the electronic construction logbook (Elektroniczny dziennik budowy) is being launched in 2022. The DBL is in planning phase in Bulgaria, while in Greece the DBL has recently been established by the government and another logbook is being developed in the context of the EU project X-tendo.

The iBRoad logbook was tested in some of the iBRoad2EPC implementing countries (Portugal, Poland, Bulgaria) and feedback was collected from homeowners and energy auditors. Overall, homeowners' feedback was very positive: 91% liked the idea of a central repository of building-related information, the majority rated the individual logbook features as being 'very useful' to 'rather useful', while 84% would recommend it to family or friends. Energy auditors evaluated the iBRoad logbook as 'very useful' with sufficient existing features and they would recommend it to their colleagues [8].

DBLs play an important role in the iBRoad2EPC concept, as a data exchange enabler. Data from various sources can be used to prefill fields or provide enhanced recommendations. It can also contribute to quality assurance, by realising data checks within and between databases. In addition, DBLs can hold the iBRoad2EPC, can be used to monitor implementation of the recommendations proposed and can send alerts about planned recommendations.

¹³ <https://op.europa.eu/en/publication-detail/-/publication/cac99ee6-06ba-11eb-a511-01aa75ed71a1/language-en>

OTHER DATABASES

The municipal energy information system in Bulgaria (municipalenergy.net) is a voluntary system which collects data from the energy audits of public buildings and energy consumption data. The information can be accessed only by the municipality to which the building belongs. There is still no agreement on how the information from this database can be accessed by a third party. In Greece, the building cadastre, managed by the Ministry of Digital Governance, is a relevant database with some functionalities accessed by the general public and engineers.

These additional databases can be further explored to examine their relevance and potential to be linked to the iBRoad2EPC. Specifically, they should be explored for quality data in relation to building performance, as they can become important information sources for the iBRoad2EPC.

MARKET READINESS ANALYSIS AND POTENTIAL UPTAKE OF IBROAD2EPC

As discussed in the previous chapter, the six implementing countries have different market conditions for the integration of iBRoad2EPC, including different EPC frameworks, available building data, financial programmes and renovation activity. The differences in the market conditions also define the need for an iBRoad2EPC solution and how to best tailor the solution to each market.

This chapter highlights the market readiness and potential for the uptake of iBRoad2EPC in each implementing countries. These findings are visualised in radar charts based on eight main criteria touching upon all topics discussed in the status quo analysis above. The criteria are:

- **EPC process:** how the certification is conducted, whether it requires (i) on-site visit, (ii) types of EPCs, (iii) calculation method and (iv) available software tools
- **EPC quality:** (i) professional qualifications, (ii) availability of EPC experts, (iii) training requirements, (iv) quality assurance and (v) reliability and public trust.
- **EPC status:** (i) market penetration, (ii) validity and (iii) cost.
- **EPC information:** (i) energy, (ii) operational carbon, and innovative elements such as (iii) whole life carbon, (iv) circularity, (v) SRI and (vi) IEQ.
- Skilled professionals
- Long-term targets
- Financial programmes
- Logbooks and databases

Based on the country-specific inputs collected, a preliminary score was given from 1 (worst) to 5 (best) for each sub-characteristic (i,...vi), and an average was then estimated for the main criteria. The inputs was collected from the country leaders and through NAC meetings.

This chapter further highlights the main barriers and drivers and gives the initial assessment on the role and market potential of the iBRoad2EPC in each country.

Bulgaria

With low trust and only 5% of the building floor area covered by valid EPCs, the Bulgarian EPC framework is ripe for improvement. The EPC comes with an audit report and a summary, yet the information presented is rather technical. All EPC data is freely accessible in a central database managed by the energy agency and the EPC price varies widely depending on the quality of the audit and the size of the building. For existing buildings in Bulgaria the prices can range from €2-3/m² but not less than €300 for small buildings, to €0.30-0.50/m² for large buildings. The recommendations are not linked to deep renovation objectives and there is neither reference to the LTRS, nor the country's long-term climate and energy targets.

There are several financial programmes that can be leveraged and linked to the iBRoad2EPC, including grants for multi-family buildings, generous loans for single-family buildings and support for municipalities to renovate their public buildings.¹⁴ A limited number of 'sustainable' financial products are offered by the UniCredit and OBB banks, although these kinds of financial services remain relatively rare in Bulgaria. Financial programmes usually have a very short shelf life. Subsequent programmes will have different rules, and it is unclear when the next programmes will be released.

Figure 4 visualises the overall EPC market analysis for Bulgaria. Given that Bulgaria requires an on-site visit, bases its calculation method on EU standards and offers three authorised software tools to support the calculation method, it receives a high rating in the EPC process. The same procedure was followed to score all eight characteristics shown below based on the EPC market analysis of Bulgaria.

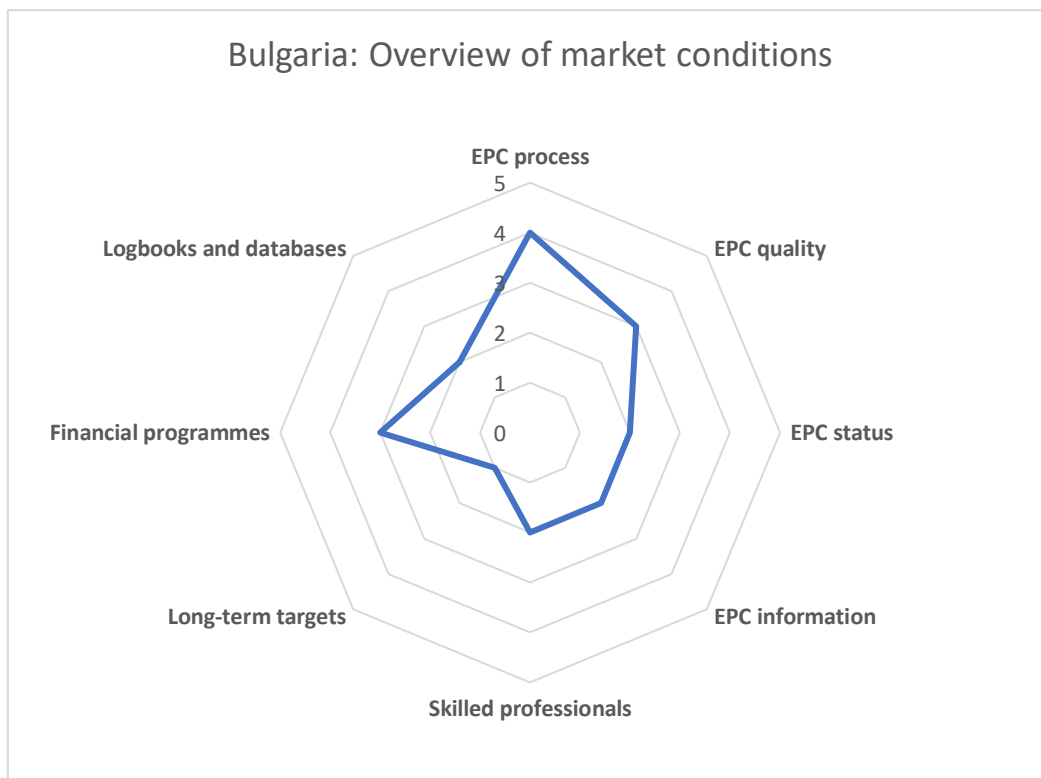


Figure 4: Overview of market conditions - Bulgaria

¹⁴ Recovery and Resilience Plan - 100% grants for renovation of multi-family buildings in the first stage of the plan implementation and 80% grant for the second stage. Urban Development Funds - loans for renovation of single-family houses. Energy Efficiency and Renewable Sources Fund - loan and guarantees for energy efficiency projects in buildings (mainly public buildings). National Trust EcoFund - grants for public buildings.

Drivers:

- Large public interest to increase renovation
- Urgent need to reduce gas dependency

Barriers:

- Lack of trust in energy advice tools - only 26% of owners would trust builders or contractors, whereas 61% would trust family and friends
- High costs
- Competing financial priorities
- Lack of financial support
- Lack of public awareness.

Initial assessment of the role of the iBRoad2EPC

Key elements of the iBRoad2EPC should include a long-term deep renovation target, the costs of each renovation step, the expected cost reduction in energy bills and technical guidance to implement the renovation measures. The document should also stress the benefits of deep renovations and aim to maximise cost-effectiveness of measures, ideally with a return on investment in 5-10 years. Inputs collected from the NAC meetings suggests that iBRoad2EPC could be implemented as an officially recognised additional document either linked to the EPC, or as a standalone tool.

More specifically and related to the content of the document, the first page could contain recommendations based on chronology (what to implement first when taking multiple steps) and reasoning (what are the benefits and costs). A second page could include additional considerations and benefits (e.g. IAQ indicators relevant for health, comfort indicators or SRI), which could also be linked to each renovation step. Taking into account the current EPC context in Bulgaria, the expert view is that *‘in order to ensure market acceptance, iBRoad2EPC would initially rather be cheaper, limited in scope and ambition, than providing a comprehensive and expensive tool.’*

iBRoad2EPC could be linked to the national EPC database, but the EPC database cannot yet cope with many additional data points. iBRoad2EPC can provide easy access to information to owners and other stakeholders. Continuous professional development of energy auditors is important to ensure their skillsets are up-to-date regarding the content of iBRoad2EPC. This would help ensure quality and trust.

The iBRoad2EPC could potentially draw data from the existing ‘technical passports’, containing information about the construction, technical systems, fire safety and other building characteristics. Another data source is the municipal energy information system (municipalenergy.net) which is a voluntary system collecting data from energy audits. Yet another link to an existing platform could be that of ‘energy resumes’ (summaries of the energy audits) generated through an online ‘assistant’ tool managed by SEDA.¹⁵ The latter could add the option to automatically generate the main steps of the building renovation.

According to an initial assessment of the cost of iBRoad2EPC, the tool could cost about 10-30% more than the existing EPCs, depending on its scope and depth, but not less than €100.

¹⁵ Partner information.

Greece

Even though the Greek EPCs are perceived by building owners as an administrative burden rather than a helpful information tool, the EPC calculation methodology seems robust. It is based on EU standards, requires an on-site inspection and involves quality control through random checks of EPCs. For a normal-sized single-family house the price of EPCs ranges from €80-€150. Although Greece has a central registry for EPC certifiers and a central database for EPCs managed by CRES and the Greek Ministry of Environment and Energy, there is no publicly available data on EPCs.

Several existing financial support schemes could be leveraged and linked to the iBRoad2EPC. These include the national energy efficiency renovation scheme for residential buildings EXOIKONOMO, which also covers costs related to obtaining EPCs and logbooks (digital building identity). The ELECTRA programme, which is about to be announced, will address the energy efficiency improvement of public buildings. The iBRoad2EPC could also be supported in the context of public-private partnerships and as part of the services provided by energy service companies (ESCOs) to improve energy efficiency and tackle energy poverty. The overall EPC market analysis of Greece is visualised in Figure 5.



Figure 5: Overview of market conditions - Greece

Drivers:

- Available financial programmes with links to the EPC (EXOIKONOMO programme is the only robust financial scheme, however, it covers only around 50,000-60,000 projects annually)
- Increasing stakeholder interest in step-by-step deep renovations and BRP integration with existing tools and processes.

Barriers:

- Lack of financial support
- Additional costs and time
- Lack of public awareness.

Initial assessment of the role of the iBRoad2EPC

iBRoad2EPC could serve as a comprehensive guide for energy efficiency renovation planning that would add value to the current EPC scheme. The recommendations included in the EPC are not described in detail due to the lack of relevant fields in the EPC template. It is up to the energy auditor to explain the renovation scenarios to the owner, and this rarely happens.

iBRoad2EPC could be linked with the digital logbook called the “digital building identity” (DBI) (which also ensures that the building is fully compliant with regulations) and the EPC database connected with the energy audits portal (www.buildingcert.gr). The iBRoad2EPC could also draw data from the building cadastre, managed by the Ministry of Digital Governance. Currently, these databases are only accessible to professionals (engineers, notaries and EPC certifiers), bar the building cadastre, which offers some functionalities for the general public. iBRoadEPC could serve as a more accessible, digital option for the owner to have access to all building-related data and material.

iBRoad2EPC could be further implemented in all buildings benefitting of the national energy efficiency support schemes as a way to ensure that the proposed measures are the optimal ones. These are in most cases the worst-performing buildings.

The price of an EPC for an apartment of 80m² ranges from €50-150 with an average market price of around €80-100 plus 24% VAT. It is expected that iBRoad2EPC would cost a little more, depending on its final form and the necessary time required for its completion.

Portugal

The Portuguese EPC appears to be more advanced in comparison with the other implementing countries, featuring a relatively high public trust (47% would trust the EPC for renovation advice) and market penetration (more than 2.3 million EPCs issued in the last 14 years). However, EPCs are neither linked to LTRS nor to the country's long-term climate and energy targets. Several financial programmes are available that can reinforce the implementation of iBRoad2EPC. The price range for an EPC is from €135 to €465. Figure 6 visualises an overview of the EPC market conditions in Portugal.

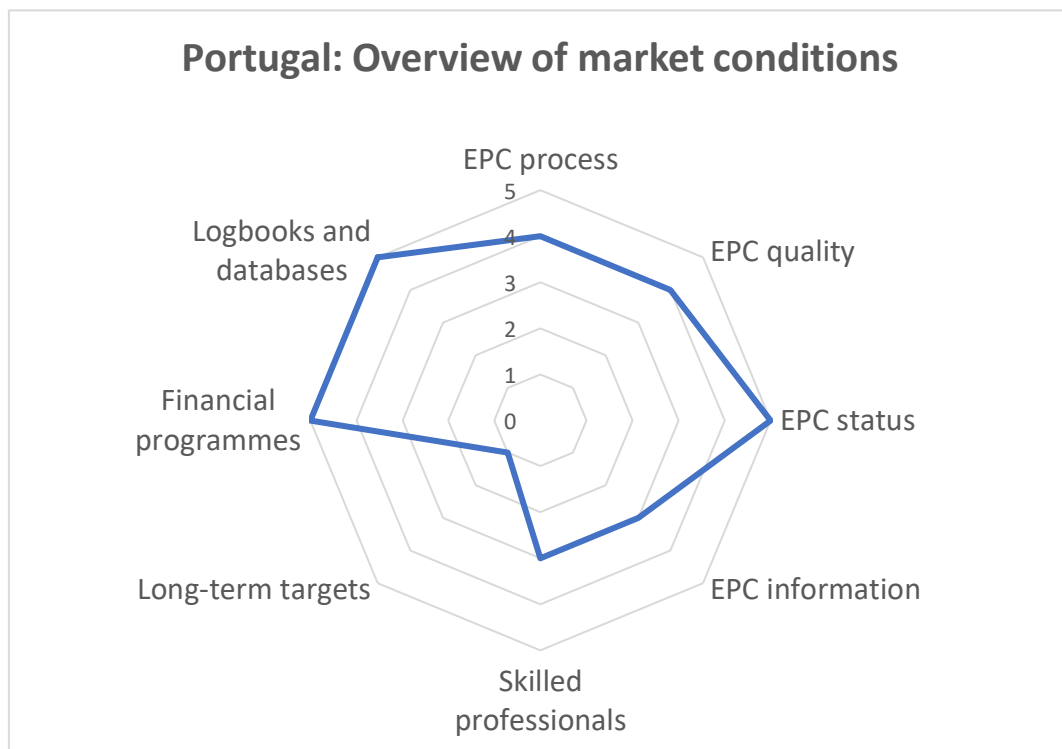


Figure 6: Overview of market conditions - Portugal

Drivers

- In general, Portuguese building owners have trust in contractors, and renovation quality standards are relatively high
- BRPs are mentioned in the national legislation related to the LTRS
- The detailed information provided in EPCs can be good input for targeted renovation works, even deep renovations
- Energy auditors are given full flexibility to identify and suggest optional renovation measures
- Financial Programmes including the More Sustainable Buildings programme (2021-2022), IFFRU (2020-2021) and Vale Eficiência programme support the improvement of energy efficiency and the alleviation of energy poverty

Barriers

- Lack of awareness on the benefits of energy efficiency improvements
- High renovation costs
- Lengthy planning and administrative processes, especially in case of multifamily buildings
- EPCs are still a formal obligation rather than a useful informative tool.
- Renovation passport concept is still rather new and unknown.

Initial assessment of the role of the iBRoad2EPC

Two options are considered to develop and implement iBRoad2EPC. In the first, data exported from the national EPC software is manually inserted by the iBRoad2EPC assistant. Alternatively, automated data exchange can be set up using an application programming interface. Portugal hasn't decided yet on the role and use of the BRP. Preliminary conclusions suggest that the BRP could be, in fact, a version of the EPC specifically tailored to support the identification of renovation measures and their implementation alongside two other version. Other specific EPCs are (1) compliance check at the delivery of new constructions and (2) advertising and awareness purposes.

iBRoad2EPC could contribute to the preliminary development and piloting of the three types of EPCs described above. The iBRoad logbook could be integrated in the central database Portal casA+ developed and managed by ADENE to support residential homeowners. Whether the iBRoad2EPC would be stored in an iBRoad logbook is still a subject of discussion. This way, homeowners could have a track record of the works carried out in the building.

Another option is to integrate the existing building technical file into the iBRoad2EPC or BRP. Several designs for the iBRoad2EPC could be imagined, with versions similar to the iBRoad project, aligned with the national EPC design, or an entirely new design.

The cost of a regular EPC for a residential building is typically €150-250 (with a wider range from €135 to €465 [12]). Since the collection of information is similar to an EPC (despite the need for a lengthier and deeper engagement with the homeowner), the potential cost for a BRP could be similar or a little more than a regular EPC. Harmonisation of technical aspects (thermal, acoustic, indoor air quality, etc.) could help to make processes more agile.

Poland

Public acceptance of EPCs is relatively low with only 11% of building owners would trust the information on an EPC and only 18% would consider the EPC as source of renovation advice. In contrast to most EU Member States, on-site inspection is not required to issue an EPC. Three types of EPCs exist in Poland: for entire buildings, apartments and non-residential buildings. There are several financial programmes that could be linked to iBRoad2EPC including the thermal modernisation and refurbishment fund that combines grants with loans for building owners, financial aid for investors in the energy efficiency field and the “Clean Air, Stop Smog” renovation programme. The price of an EPC ranges from €50 to €100. An overview of the Polish market conditions is shown in Figure 7.



Figure 7: Overview of market conditions - Poland

Drivers

- Predicting energy and cost savings after renovation could incentivise building owners to renovate, as could including visualisations that make the abstract numbers more concrete.

Barriers

- Low awareness and trust in EPC.
- Lack of information about EPCs in general.
- Unattractive EPC design.
- Low public funding for iBRoad2EPC might hinder its implementation.

Initial assessment of the role of the iBRoad2EPC

An electronic construction logbook (Planradar, (Elektroniczny dziennik budowy)) was launched in 2022. According to insights collected from country partners, the logbook will facilitate building management, especially in conjunction with the EPC. BRPs are not yet foreseen in the national legislation, but an energy passport will be included in the government’s “long-term thermo-modernisation strategy” for 2050. Linking

the iBRoad2EPC to the existing EPC database in Poland is not an option because access to the database is very limited.

iBRoad2EPC could be combined with existing financing schemes aimed at energy efficiency renovations. Additional public funding would be beneficial to accelerate the implementation and uptake of the iBRoad2EPC. The state of the current market indicates that iBRoad2EPC should have incremental deployment starting with a simpler and cheaper version of the tool.

According to expert views, iBRoad2EPC should cost 1.5 times more than a normal EPC but the additional cost should be shared by the government. The price should range between €50 and €400, depending on the complexity and size of the building.

Romania

EPCs in Romania are perceived as of substandard quality and there is a low coverage with an unknown number of issued EPCs. There is no publicly available central EPC database, but in the context of the EU RRP, a national building registry will be developed and be operational in the third quarter of 2024. Romanian EPCs have the lowest price among the pilot countries of around €35 per dwelling (€0.10-1.00/m²). Figure 8 shows an overview of the market conditions in Romania.

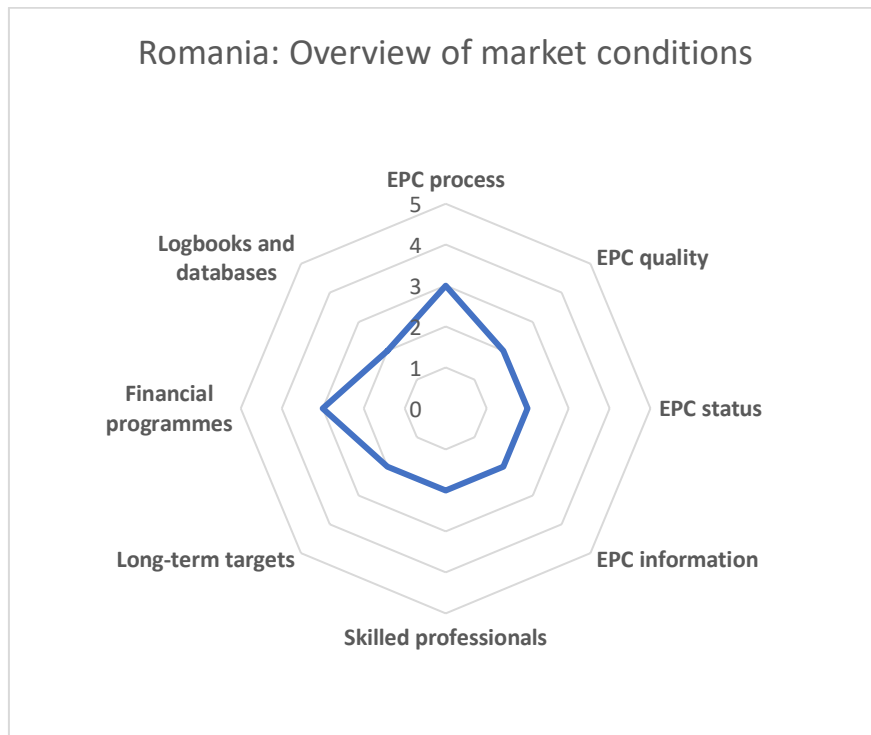


Figure 8: Overview of market conditions - Romania

Drivers

- Policy drivers such as the requirements for the RRP.
- EPCs are mentioned in the Romanian LTRS

Barriers

- Concerns about the validity and reliability of EPCs, which may reduce public trust and trust among experts
- The energy audit methodology, the report template and standard practice are not compatible with the roadmap approach - a revision of the regulation and training of professionals is needed.
- Slow decision-making and limited capacity at technical and administrative level at the Ministry of Development, Public Works and Administration
- Bureaucracy, multi-ownership of buildings and a lack of swift implementation mechanisms
- Low compatibility of developed tools with other databases or platforms (e.g. cadastre, buildings registry)
- Tendency to keep EPC and similar tools as simple as possible (so as not to increase costs).
- Reluctance of professional associations to change and to accept more advanced practices (e.g. more data to collect)
- Limited skills and knowledge of energy auditors.

Initial assessment of the role of the iBRoad2EPC

Several financing schemes are available that support energy efficiency renovations and could be bundled with iBRoad2EPC. iBRoad2EPC should be developed in the context of either new financing schemes or supported by a public grant.

One of the main benefits the iBRoad2EPC could contribute in Romania is the roadmap and link to the building logbook. In addition, programmes like the energy efficiency and smart energy management programme in Romania broaden the scope to include public buildings.

The cost of an EPC for a single-family house ranges in between €35-100. iBRoad2EPC should not amount to significantly higher costs than regular EPCs.

Spain

EPCs in Spain are seen as an administrative task that does not bring value to the property or the building user. Several financial programmes are available in Spain including tax deduction from personal income tax, proportional to the sum invested in energy efficiency renovations. Other support schemes include a special programme aimed at renovation measures in small localities, the building energy rehabilitation programme and the RRP for urban regeneration. The price for an EPC ranges between €50 and €100. The overview of the market conditions in Spain are visualised in Figure 9.

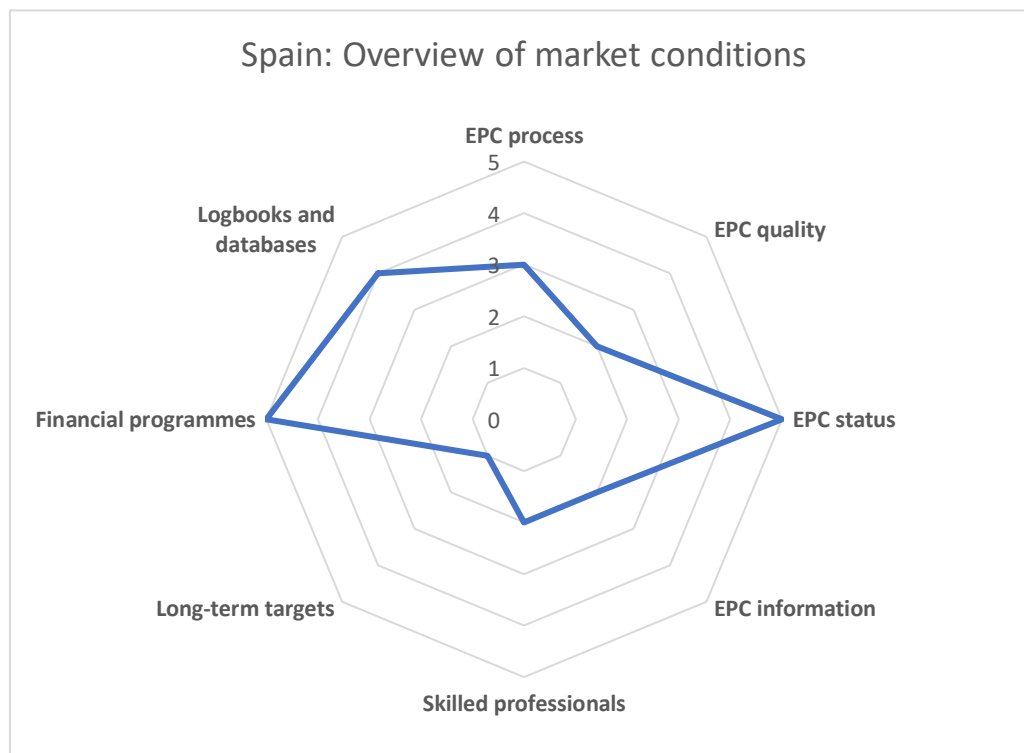


Figure 9: Overview of market conditions - Spain

Drivers

- BRPs are mentioned several times in the Spanish LTRS as a key tool to foster deep renovation - but no steps have been taken to implement them so far
- The LTRS also suggests the integration of EPCs and BRPs (measure 7.7) as well as linking EPCs or BRPs to public funding (measure 4.1) and the existing building logbook (measure 8.4)
- The LTRS data and targets can be used to set the targets of the iBRoad2EPC
- Synergy with the new tool Libro del Edificio Existente (existing building book).

Barriers

- Low trust in EPCs
- Possible overlap with Libro del Edificio Existente, which contains similar information to the BRP (roadmap)
- Limited training of professionals
- Low cost of the EPC and high cost of the BRP
- Limited data accessibility and utility.

Initial assessment of the role of the iBRoad2EPC

A main benefit the iBRoad2EPC could bring to Spain is the individual building decarbonisation roadmap aligned with the LTRS objectives for 2050 of reducing greenhouse gas emissions and ensuring a highly energy efficient and decarbonised building stock. It could further become the appropriate tool to nudge the energy behaviour of the building owners and users.

Financial support on its own would not make the tool successful unless new policies linking access to the funds with the building's decarbonisation roadmap are introduced in Spain. iBRoad2EPC may be integrated with the Libro del Edificio Existente, which has its own financial support programme. Based on the collected feedback from national experts, additional features that could be included in the future could relate to accessibility and climate adaptability, water issues, resilience and circular economy (features aligned with the Level(s) framework).

The iBRoad2EPC should bring clarity to the market and to stakeholders by aligning instruments such as the EPC, DBL and BRP. These tools should be clearly communicated to facilitate understanding of their value and scope. Besides the EPC, the iBRoad2EPC concept should include the existing ITE (technical inspection of buildings), the IEE (assessment of building report) and the cadastre. iBRoad2EPC could propose innovative methods of data aggregation and standardisation. The collaboration between stakeholders and various public agencies will be necessary, so inter-administrative functions and competencies need to be articulated and simplified. Professional bodies should have the possibility to standardise the prices, structure and operability of the EPC, DBL and BRP. In addition, there is a need to improve and reinforce the training programmes for professionals.

The DBL and BRP are seen as part of the drive to digitalise services, serving as an umbrella platform. The online platform should be an instrument for the final user to allow more tailored simulations to reduce energy demand and enable exchange and collaboration between building sector stakeholders. It should address both small owners and big tenants. Spanish experts suggest the iBRoad2EPC should be a consulting document independent from the EPC but closely linked to the EPC and the DBL.

The estimated cost of a BRP is approximately €1,500 though subsidies could bring this amount down to €800. The cost depends on many factors: accessibility to the building and data, size and characteristics of the building, market factors, etc. The cost of the BRP should include a clear breakdown (visit, data gathering, assessment, reporting, and others) translated into the value provided.

Overall country maturity

Overall, in terms of EPC market maturity, Bulgaria, Romania and Poland seem less advanced, receiving a comparable low average score. Of these three countries, Bulgaria had a higher score on the EPC process (4), while Poland had the highest score for logbooks and databases. All three countries have a similar maturity in terms of EPC quality, status, information, skilled professionals, long-term targets and financial programmes.

The Greek and Spanish EPC seems a bit more advanced, receiving a moderate overall score. Both countries had a higher rating overall in comparison to Bulgaria, Romania and Poland. Spain is more advanced in the EPC status, financial programmes and logbooks, while Greece is more mature in the EPC process. From all the iBRoad2EPC implementing countries, Portugal has the most advanced EPCs, receiving the highest scores in most of the categories.

The radar charts give a visual indication of the strengths and areas in need of further improvement. None of the iBRoad2EPC implementing countries feature long-term targets in their current EPCs.

CONCEPTUALISING IBROAD2EPC

The market analysis described above found great variation in EPCs from country to country, based on differences in the political and legal context and in the maturity of the real estate market. Quality control and databases are other important aspects that differ between Member States. Low reliability and trust, which prevent EPCs from fully realising their benefits, were a common theme across all countries except Portugal.

These findings inform the concept of iBRoad2EPC. The intention is to fill market gaps in each country and support building decarbonisation policies. iBRoad2EPC is positioned as the bridge between existing EPC schemes and (future) BRPs that take a further step to present an individual renovation journey over time (i.e. staged deep renovation).



Figure 10: iBRoad2EPC aims to form the bridge between EPCs and the BRP

The proposed iBRoad2EPC concept

The market analysis and stakeholder mapping revealed different levels of market maturity and capacity, which suggests that the iBRoad2EPC concept needs to be adaptable to the different local conditions of the Member States and needs to stay relevant when markets mature, or new building regulations come into effect.

The iBRoad2EPC concept is therefore suggested to comprise a basic module around which additional functions (modules) can be built. The iBRoad2EPC concept thereby provides the opportunity for staged upgrades of the national EPC approaches based on market developments and particular needs. The modular approach is also justified by the intention to increase market coverage, encourage deep renovations, and the implicit synergies/trade-offs between coverage, thoroughness and resources needed.

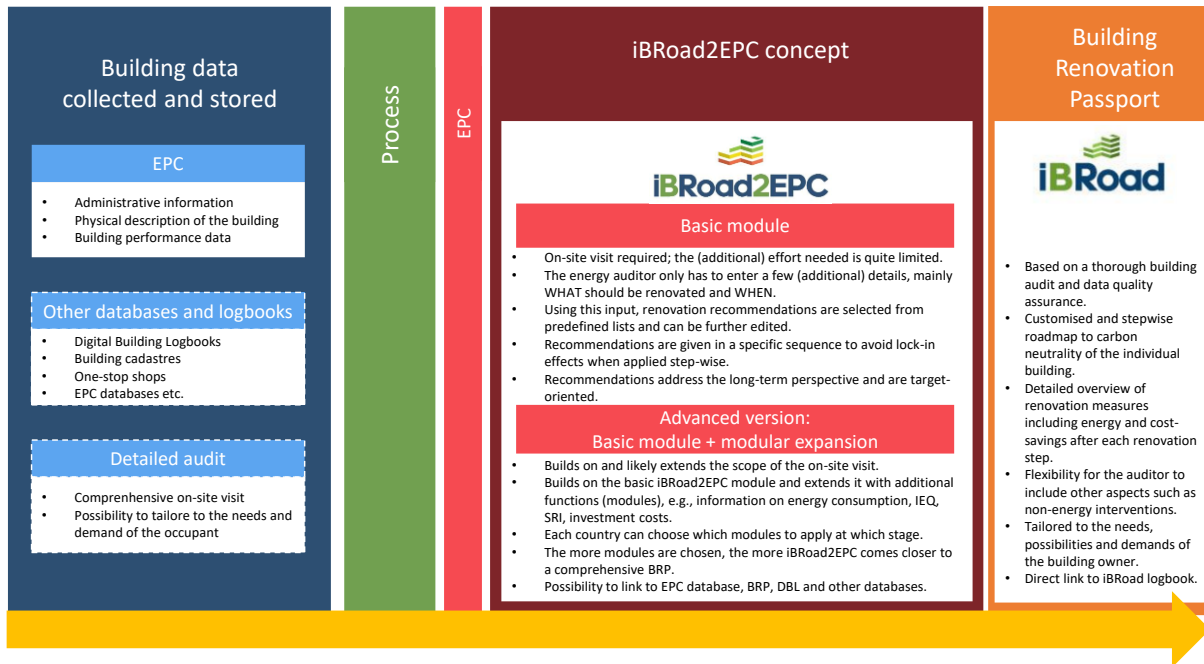


Figure 11: Conceptualisation of iBRoad2EPC in the context of EPC evolution and related instruments

Basic module

The basic module requires an on-site visit and proposes renovation recommendations from a predefined list, which are however editable so that the auditor can specify the type and order of renovations for the specific building and avoid lock-ins in staged renovations. An important feature of the recommendations is that they address the long-term perspective, supporting step-wise renovation which is in line with the national long term decarbonisation and climate targets.

Key features:

- On-site visit required, but the (additional) effort and cost is quite limited
- Basic expert training required
- Developed relying mainly on collected EPC data; the energy auditor only has to enter a few (additional) details, e.g. what specific renovation measures should be applied when
- Renovation recommendations are selected from predefined lists and can be further edited
- Recommendations consist of improvement measures planned over a time range of decades in a specific sequence to avoid lock-in effects when applied step-wise; no provision for indicating individual cost items or performance levels achieved
- Recommendations address the long-term perspective and are target-oriented with an end goal of achieving a zero-emissions building standard.
- Flags requirements to comply with MEPS.
- Does not consider lifestyle aspects.
- Provides opportunity for future extension with additional modules according to Member State needs and market maturity.
- Trigger point for further engagement and action.

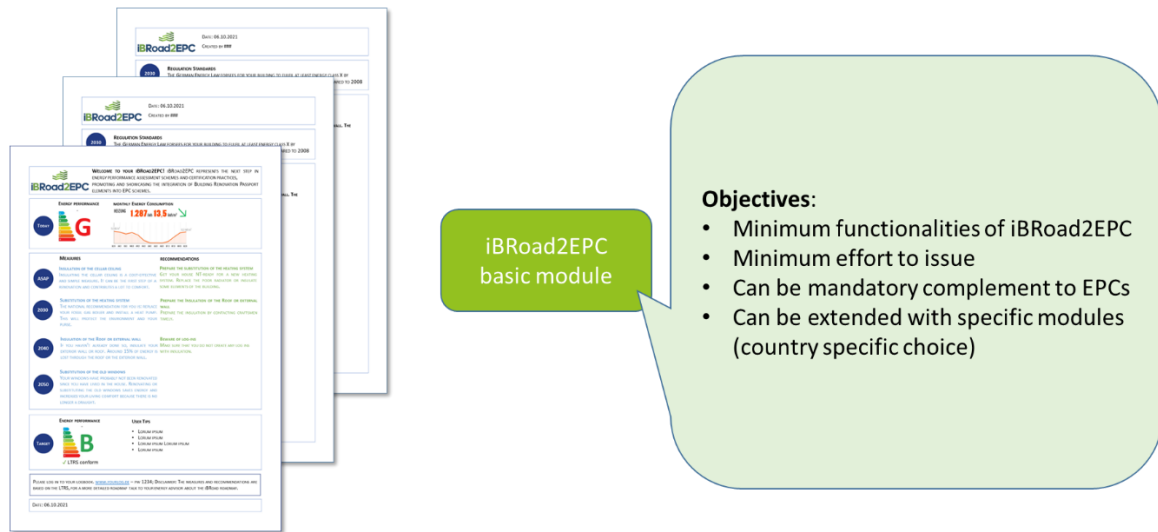


Figure 12: Overview of the basic module

Advanced version: basic module + modular expansion

The advanced version expands the basic module with additional functions (modules) such as Indoor Environmental Quality, Smart Readiness, energy demand or cost module, while it further offers the possibility to link to an EPC database, BRP, DBL and other instruments or databases (Figure 13).

Key features:

- Builds on and likely extends the scope of the EPC on-site visit
- Requires more extensive expert training
- Builds on the basic iBRoad2EPC module and extends it with additional functions (modules), e.g.,
 - energy demand/consumption
 - smart dimension/SRI
 - IEQ
 - funding
 - component assessment
 - investment/cost
 - safety
 - embodied carbon
- Each country can choose which modules to apply at which stage
- The more modules are chosen, the more iBRoad2EPC comes closer to a comprehensive BRP
- Possibility to link to EPC database, BRP, DBL and other instruments or databases
- Can be further tailored according to national renovation strategies as well as local energy infrastructure.

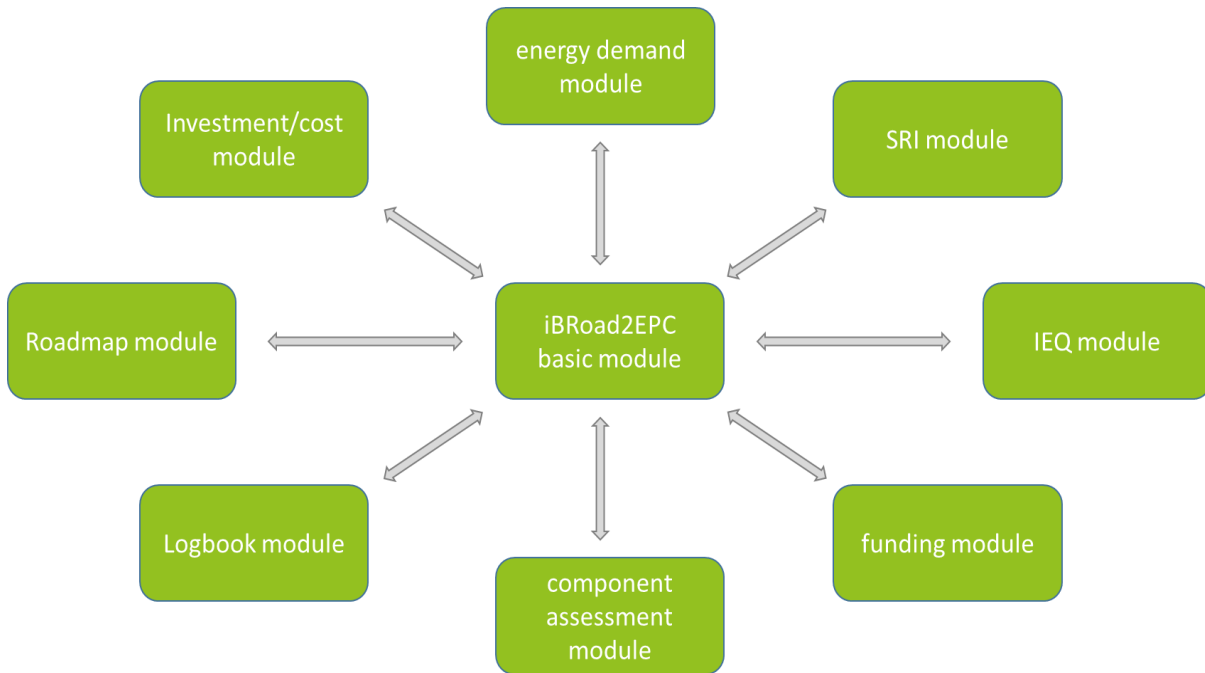


Figure 13: Possible features of the iBRoad2EPC advanced version.

Key principles of the iBRoad2EPC

iBRoad2EPC serves as a link between existing EPCs and future BRPs. It is intended to integrate BRP elements into existing EPC schemes by adapting the BRP concept to fit existing EPC regimes and to improve the list of recommendations. iBRoad2EPC highlights how existing EPC schemes need to be reformed to capture high quality and trusted information that is able to support building owners to take the steps needed to get to zero-emissions buildings.

By creating a more transparent and reliable methodology based on an on-site visit performed by trained and qualified energy experts using the officially established and recognised calculation methodologies, iBRoad2EPC aims at further improving the reliability, usefulness and effectiveness of EPCs. Introducing other BRP elements, such as customised long-term recommendations, IEQ and SRI, it will support the end-user in undertaking more and in-depth renovations and improving the conditions in their building.

iBRoad2EPC will bring existing EPCs closer to a decarbonisation roadmap and introduce a focus on the long-term objective of decarbonisation by:

- Including carbon performance as well as energy use as key metrics before and after renovation
- Including improvement measures in a specific sequence to avoid lock-in effects
- Ensuring that every measure implemented is part of a comprehensive renovation strategy
- Complying with future regulatory and financial requirements, e.g. MEPS, mortgage portfolio standards or the EU taxonomy regulation.
- Considering local energy infrastructure, relevant local initiatives (e.g. plans to install a low-temperature district heating network), the optimisation of smart district networks, as well as regional LTRS.

The recommendations are presented in a way that can easily be understood by the end-user and consider the user's needs. iBRoad2EPC builds on as much available data as possible, including the EPC database and DBLs:

- Renovation measures and tailored advice could go into more depth and be more specific

- Data imported from the logbook or relevant databases (if available) replaces multiple required user inputs and reduces auditing time and costs
- Linking with logbooks can incorporate operational and dynamic data that provides quality assurance and verification and validation of the effectiveness of the implemented renovation measures.

Building data

Data inputs and outputs are the backbone of iBRoad2EPC. Producing robust and bespoke extended EPCs is a data-intensive undertaking. The most relevant information categories include physical building descriptions, operation and maintenance, building performance, smart readiness, comfort and health improvement, and finance. Data collected to produce EPC ratings already captures a wide range of data points aligned with the information categories mentioned above, which makes the integration of EPC databases a priority data source for iBRoad2EPC.

Research shows that almost all EPC databases store information about the building, some energy performance data, and the current EPC rating [3]. Several countries also include information on the potential EPC ratings which, for example, could be reached if the outlined recommendations in the EPC were followed. A small number of Member States give a basic indication of the building's IEQ level. However, data collection methods for information on building renovation currently lack consistency. Overall, EPC data is considered to be insufficient to develop long-term renovation plans. EPCs must become more transparent and reliable in order to build trust and public acceptance. They should be further tailored to the needs of the end-user to enhance their usefulness and attractiveness.

The increasing integration of EPC databases with DBLs offers another major opportunity for improvements to EPCs in the areas of:

- *The user experience and richer datasets* - replacing multiple required user inputs to provide information e.g. about the house construction, floor area, heating system etc. with data imported from the logbook or other databases, e.g. land registry, utility and energy company data
- *Accuracy* - by removing the reliance on user input or modelled data, as well as by verifying the provenance of data inputs. As the logbook is designed as a live and dynamic digital document, it captures inputs as they change over time, with enough historical data to establish a baseline for the current performance of the building and where it could/should be over time
- *The customer journey towards renovation* - by, for example, linking building owners with installers (e.g. via an online marketplace) who can provide the measures recommended in the advice tool. Or by providing information linking to a database of available financing options and financial products.

A detailed on-site audit by an accredited professional will be required to fill data gaps, spot inconsistencies and formulate a forward-looking renovation plan. The on-site visit may be the most important item affecting the cost of building renovation plans, so the integration of logbooks and other sources is essential to save time during physical home surveys and reduce the cost of producing renovation plans.

Data templates and data inputs including the technical/legal aspects related to data exchange and access will be discussed in the forthcoming technical report on the definition of the proposed concept, content and methodology of iBRoad2EPC.

CONCLUSIONS

The EPBD recast will likely impact several policies discussed in this report, such as EPCs, national LTRS and BRPs. Their implementation will create the demand for a reliable and user-friendly tool which can provide information and advice to owners on how to improve their buildings and reduce emissions. BRPs are introduced in the EPBD recast as voluntary tools that identify future renovations and plan the best timing and scope for interventions. To achieve the climate targets, a broad and quick market penetration is needed to support buildings' deep renovation.

Market analysis, however, shows several barriers to the implementation of BRPs, including the lack of financial support and public awareness, as well as high costs. The transition from EPCs to BRPs will therefore require some intermediate steps by Member States as proposed by iBRoad2EPC. The iBRoad2EPC concept is suggested to comprise a basic module around which additional functions (modules) can be built. The basic module requires an on-site visit and utilises renovation recommendations from a predefined list, which are however editable so that the auditor can specify the type and order of renovations for the specific building to avoid lock-ins in staged renovations. This long-term perspective is an important feature of the recommendations, supporting stepwise renovation to a future-proof target state which is in line with the national long-term decarbonisation and climate targets.

The advanced version expands the basic module with additional functions (modules) such as IEQ, SRI, energy demand and cost. It further offers the possibility to link to an EPC database, BRP, DBL and other instruments or databases. The more modules are chosen, the more iBRoad2EPC comes closer to a comprehensive BRP. With this approach, Member States can gradually extend their existing EPC schemes following market developments, needs and possibilities. This modular approach is fully justified by the intention to increase market penetration and deep renovations, as well as by the implicit trade-offs and synergies between coverage, thoroughness and resources needed.

The iBRoad2EPC can become the bridge between existing EPC schemes and future BRPs by providing the opportunity for staged upgrades of the national approaches based on market developments and particular needs. iBRoad2EPC will at all points improve the reliability of existing EPCs and usefulness of their recommendations, enabling a staged renovation approach to zero-emission buildings.

iBRoad2EPC aims to establish the next generation of EPCs, improving their effectiveness, reliability and usefulness and supporting the decarbonisation ambitions of the EU, while improving conditions for the building occupants. To set the foundation of iBRoad2EPC, our analysis of the current EPC market conditions shows the level of maturity and potential of the existing schemes to merge with the BRP. The variations in legal and political contexts, state of the real estate market, EPC methodology, quality assurance, databases and recommendations as well as quality and reliability of EPCs provide both opportunities and challenges for the integration of existing EPC schemes with the BRP.

The extended EPC through the integration of BRP elements, as proposed in iBRoad2EPC, is a response to the market barrier of the lack of knowledge about which renovation measures to implement and in which order and the low awareness on the benefits of deep renovations. To develop a reliable and publicly recognised product, it is crucial to promote next-generation EPCs that integrate BRP elements through the right channels and in a language that building owners can understand.

Recommendations and future actions

Among the main barriers to deep renovation are the lack of knowledge about which measures to implement and in which order, and the low awareness of the benefits renovations generate. iBRoad2EPC aims to tackle these through the expansion of EPCs and the integration of selected elements from the BRP. Based on the European Commission's technical study on the possible introduction of optional BRPs,¹⁶ bundling BRPs with

¹⁶ <https://op.europa.eu/en/publication-detail/-/publication/a38ea088-aead-11ea-bb7a-01aa75ed71a1/language-en>

other supporting instruments (such as the EPC, LTRS and DBL) can have a positive impact on the decision to renovate, the type of measures to implement and the performance level of the selected measures.

In addition, the development of the iBRoad2EPC concept should not leave out key factors that can contribute to its success:

- **Stakeholder involvement:** ensure that key stakeholders (e.g. policymakers, EPC issuers, building owners, potential data providers, etc.) are regularly involved as they can steer and successfully guide local implementation
- **Innovative elements beyond energy:** deep energy renovation should be treated in a holistic manner and the extended EPCs should go beyond energy and CO₂ emissions to provide information related to the IEQ and smart readiness of the building.
- **Secure funds** to test the extended EPC with BRP elements. Investors from the private sector (e.g. banks and institutional investors) could also be interested in funding and testing the concept as an important supporting document for green mortgages and other financial due diligence measures.
- **Build demand** by creating a need, a desire and an obligation. The need could be created by linking the iBRoad2EPC concept with access to energy efficiency financing. The desire can arise after raising awareness of building owners on the main benefits of integrating BRP elements in EPCs, like ensuring that deep renovations are optimised in terms of energy savings and IEQ. Even if the integration of BRP elements in the EPC becomes mandatory (obligation), its success won't be guaranteed unless combined with a proper quality control mechanism and an awareness-raising campaign on the benefits of deep renovation.

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iBRoad2EPC

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