INTRODUCING BUILDING RENOVATION PASSPORTS IN IRELAND

FEASIBILITY STUDY

Supported by

seai SUSTAINABLE ENERGY AUTHORITY OF IRELAND

IGBC IRISH GREEN BUILDING COUNCIL

LIT LIMERICK INSTITUTE OF TECHNOLOGY

SUMMARY

The objective of this report is to explore the opportunity of introducing Building Renovation Passports (BRPs) in Ireland. A BRP contains a Roadmap and a Logbook. The Roadmap is a masterplan for the deep energy retrofit of a dwelling which sets out the measures step by step. The associated Logbook is a repository of information relating to the fabric and performance of the building which includes a record of previous works. BRPs empower homeowners to undertake deep energy retrofits by providing a set of actions, a sequenced plan and estimated costs. BRPs address the barriers to consumer decision-making by giving homeowners the technical information they need to make informed choices. BRPs also embed long-term climate goals into the short- and medium-term renovation steps.

Based on a review of existing BRP schemes, the iBRoad approach was piloted on twenty single-family dwellings across Ireland between February and August 2020. iBRoad was selected as suiting most of the Irish needs identified. It was also perceived as a way to ensure the passport piloted in Ireland is comparable to other European schemes.

The feedback gathered from auditors and homeowners was used to develop these recommendations.

Piloting Phase
February → August 2020

20 Single-Family Dwellings

KEY LEARNINGS & RECOMMENDATIONS

Building Renovation Passports **could contribute to an increase in Ireland's renovation rate**, both directly and indirectly.

First, the Roadmap can **give homeowners clarity on their renovation perspective and motivate them to implement renovation measures**. It is also useful in increasing homeowners' awareness of energy efficiency and in improving the skills of the occupants in this area.

90% of the homeowners involved in the pilot said they had learnt some or a lot from the Roadmap.

The Roadmap enables and motivates the building owner to realise concrete renovation measures in the near future.

89% of the **Homeowners** taking part in the Irish pilot rather or completely agree with this statement.

78% of the **Auditors** taking part in the Irish pilot rather or completely agree with this statement.

The introduction of the BRPs would ensure homeowners have a record of works for future reference or warranty issues and a clear plan for any further future improvements. The record and evidence of works can be transferred to new occupiers on sale or rent and thereby better reflect the condition of the home and list any necessary work that might still be remaining. By allowing the new owner to take up where the previous owner left off, it should reduce the transactional cost of retrofit where property changes hands. The BRP should be linked to a property and transferred to the new owner when a property is sold.

The BRP would also make it easier for homeowners to ensure that opportunities aren't missed to include energy improvements when repairs and maintenance works are done on their homes.

All the homeowners involved in the pilot affirmed that the Logbook provided them with a long-term possibility to track their building-related information.

Homeowners found it particularly useful to be able to access historic information on the building construction and energy use in one place.

Secondly, auditors identified **a number of co-benefits which further support the business case for BRPs**.

First, the introduction of BRPs, which would track the evolution of individual buildings, would **provide policy decision-makers with invaluable information on Ireland's building stock** (e.g. energy consumption and executed maintenance) and **progress towards carbon targets**. By enabling better monitoring of policy impacts, it would **inform future policy and investment decisions**[1]. For instance, the introduction of a logbook which gathers information on actual energy use, through smart meters or utility bills, could support BER (calculated energy use) improvement over time.

By improving the quality and quantity of data, BRPs will support the development of energy efficient mortgages in Ireland. BRPs could increase quality assurance, which in turn would make it easier for banks to introduce low interest mortgages[2].

The BRPs should **build upon the success of the BER in Ireland and complement it**. To avoid duplication of work and to reduce cost, **the roadmap**, **the logbook and DEAP file should be fully integrated**.

The recommendations for renovation included in the new BER advisory report are a good first step, but need further elaboration. Like the BRP, the new BER advisory report gives information about how each energy saving measure will improve the BER rating, gives indicative costs for each proposed measure and provides a five star scale to indicate how comfort levels would be improved. The additionality that the BRP brings to the new advisory report is that it is based on a detailed onsite visit from an auditor who discusses the needs, future plans and financial flexibility of the building owner in order to develop a timeline that indicates which measure should be taken first thereby avoiding lock in effects. It is hence recommended to include the roadmap in the recommendations section.

To support energy renovation and to reduce cost, the roadmap and the logbook should be **available online**. Auditors should also be able to provide a hardcopy of the roadmap to homeowners.

As previously indicated, the logbook, the roadmap and DEAP file should be connected. These could also be connected to other useful datasets such as utility bills and flooding maps. To ensure quality and consistency, **homeowners should not be able to edit the logbook or the roadmap**. **However**, **they should be able to share the whole documents or relevant parts of it with buyers and building professionals/ construction workers who may need to access and edit part of it**. E.g. to include information on maintenance works performed.

Against this background, **the logical home for the BRP is within SEAI**, **integrated within the DEAP tool**. This would avoid potential conflicts of interest between the various stakeholders (e.g. grant providers, auditors and contractors) and provide a number of potential co-benefits. Firstly, the tool can be linked with other incentives to drive renovation uptake - e.g. grant schemes. Secondly, and as previously mentioned, it would support the delivery of the renovation targets and policy-making. The Logbook in particular could be a way of interpreting the very large amount of data that is being built up by SEAI. Furthermore, by acting as a repository of information, the Logbook will greatly assist BER assessors and building professionals to find the information they need (e.g. levels of External Wall Insulation or agrément certs). Currently much of the data required by the BRP is already being collected into DEAP therefore, if integrated, the process would be considerably streamlined.

[1] http://bpie.eu/wp-content/uploads/2020/05/X-TENDO-REPORT_FINAL_200519_pages.pdf
[2] https://eemap.energyefficientmortgages.eu/

As an interim step and, to undertake further field tests of the next iteration, the BRP could be run by a private organisation for a few years. E.g. a one-stop-shop. This step would allow to further develop the tools for the Irish market.

Besides familiarity with DEAP, **BRP assessors must be able to think long-term (20 year plan) and to develop recommendations to make the property as energy efficient as possible**, **taking into consideration its characteristics (best possible principle)**, **as well as the preferences and financial capabilities of the owner**. BRP assessors should hence have good communication skills and be in a position to estimate the cost of work. Consequently, BRP assessors require extra-training in comparison to existing BER auditors.

As with all other iBRoad pilots across Europe, there **is a mismatch between the cost auditors said they would charge to develop a passport** (€600 to €750) **and what homeowners are willing to pay** ("a low fee"). A number of actions could be taken to address this issue. First, the integration of the BRPs with DEAP file should significantly reduce cost. Project aggregation, i.e. developing the BRP for all houses in a housing estate in one go, could also reduce cost. Secondly, the BRPs could be introduced alongside financial support and/or regulatory stimulus. For instance, it could be a requirement to access grants or additional financial support. This is critical as BPIE's report indicates **BRP tools work most effectively when supported by awareness raising campaigns**, **financial support and regulatory stimulus**.

Given the potential of the BRP to increase the energy renovation rate in Ireland, **it is recommended to pilot it at a larger scale** i.e. on different building types and with a more representative group of homeowners. The BRP was only piloted on 20 single-family homes and most homeowners involved were "early adopters" with high levels of retrofit awareness. A first step in that process would be to better adapt the tools to the Irish context (i.e. applying the same wording as the BER, updating the data sets to Irish calculation standards) and to integrate it with DEAP to simplify its use.

In line with the European Green Deal and the EU Circular Economy Action Plan, it might also be worth exploring how the BRPs could improve buildings' durability, adaptability and circularity.

INTRODUCTION

In late 2018, the IPCC issued a stark warning. It highlighted that limiting global warming to 1.5°C is crucial to avoiding the most catastrophic impacts of climate change. It also clearly established that achieving the goals of the Paris Agreement will require action at an unprecedented pace and scale. The European Union and the Irish Government have both committed to a net-zero economy by 2050, but they cannot meet this target without fully decarbonising the building stock. As 75% of today's buildings will still exist in 2050, and as the bulk of the current building stock was built without significant energy performance requirements[3], retrofit is critical to reach this objective. Yet, the current renovation rate (approx. 1.49%) is too low to meet this goal, and most renovation works taking place are shallow.

The rationale behind Building Renovation Passports

Barriers to deep renovation are perceptual, technical and financial. Many homeowners cannot afford to do everything at once or are limited by the need to continue to live in the house while work is being done. Even when attractive financing options are available, these are not necessarily enough to spur people to overcome the difficulties they perceive with undertaking energy efficiency upgrades. Next to the availability of finance, property owners are often confronted with a lack of awareness about the costs and benefits of renovation, and with a lack of understanding of the process - what to do, where to start, and which measures to implement and in which order. Most homeowners also lack detailed information about their homes, including its current condition, when and how it was built, what subsequent improvements were made and what the potential is to improve comfort and energy efficiency. These perceptual and technical barriers can lead to inaction, delays, or sub-optimal and uncoordinated works.

Building Renovation Passports (BRPs) are masterplans for retrofit and include a record of works. By providing a set of actions, sequence and estimated costs, to inform improvements towards more energy efficient homes, they address the barriers to consumer decision-making. They can also embed the long-term ambition (2050 targets) into the short and medium term steps of renovation, ensuring no opportunity is missed.

Finally, by improving the availability of data, Building Renovation Passports should de-risk renovation investments in energy, and support policy-making.

Building Renovation Passports - Legal Background

Building Renovation Passports are more and more considered as a key solution in Europe to avoid lock-ins and encourage phased ambitious quality retrofit.

The Energy Performance of Buildings Directive (EPBD) from the European union refers to building renovation passports as an example of a measure whereby Member States can support targeted cost-effective renovation and staged deep renovation – Art. 2a.1(c).

Article 19a requires the European Commission, before 2020, to conclude a feasibility study on the possibilities and timeline for introducing an optional Building Renovation Passport. The text of this article gives some hints about the possible content of the passport:

"An optional building renovation passport that is complementary to the energy performance certificates, in order to provide a long-term, step-by-step renovation roadmap for a specific building based on quality criteria, following an energy audit, and outlining relevant measures and renovations that could improve the energy performance."

[3] European Commission, 2019. Comprehensive study of building energy renovation activities and the uptake of nearly zero-energy buildings in the EU: https://ec.europa.eu/energy/studies/comprehensive-study-building-energy-renovation-activities-and-uptake-nearly-zero-energy_en

In its report on "Maximising the energy efficiency potential of the EU building stock", Irish MEP Ciaran Cuffe also calls for the introduction of a "building renovation passport to foster, coordinate and track continued improvements and to monitor renovation depth and energy performance benefits house owners, building operators and tenants".

About the pilot programme

In 2017, the Irish Green Building Council, in conjunction with the Department of Communications, Climate Action and the Environment (DCCAE), organised a comprehensive consultation process, involving close to 200 key stakeholders, to co-design an ambitious national renovation strategy for Ireland. Key recommendations made at the time to facilitate energy renovation included introducing building renovation passports and energy efficient mortgages. The IGBC subsequently worked on the development of energy efficient mortgages as part of the Horizon 2020 funded EeMAP project. It then became clear that to increase predictability of outcomes and generate investors' confidence, energy efficient mortgages' criteria should include the BER, alongside additional quality assurance measures i.e. building performance monitoring, an assessment of the design and construction teams' skills, and building renovation passports.

Based on this learning, the IGBC and Limerick Institute of Technology have been exploring the opportunity of introducing Building Renovation Passports (BRPs) in Ireland. A first step in that process was to review existing schemes in Europe and beyond - see report here. As one of these schemes (iBRoad) fitted most of the identified needs and had been successfully piloted in other European Member States (Bulgaria, Poland and Portugal), the project partners decided to pilot it in Ireland. This was arranged in collaboration with the Horizon 2020 project iBRoad under which the said scheme has been developed. The iBRoad consortium was interested to see iBRoad piloted in additional countries; the scheme has in the meantime been adapted for testing in Greece and Romania. Two of the iBRoad project partners directly supported the pilot testing: ifeu (training) and Blue Planet Academy and Consulting (software).

To gain a better understanding of how Building Renovation Passports could work in Ireland, eleven auditors were recruited to undertake the pilot. The auditors were selected based on their qualifications, their location and the type of residential properties they were ready to audit.

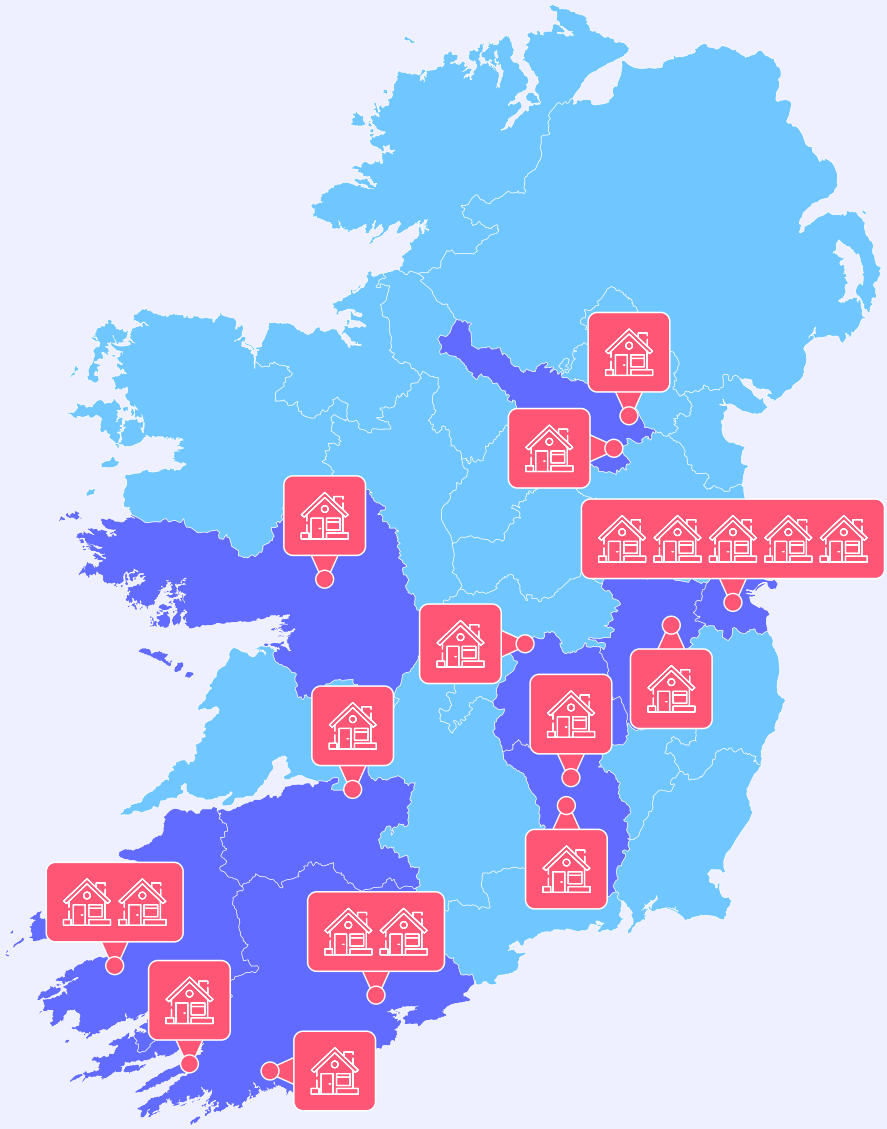
The 11 energy auditors involved in the pilot with trainer Peter Melwig of ifeu and IGBC staff

Training session of the 11 energy auditors

LIST OF ENERGY AUDITORS INVOLVED IN THE BRP PILOT		
Name	**Professional Background**	**Location**
Eoin McGann	Registered domestic BER Assessor	Carlow
Xavier Dubuisson	Sustainable Energy Engineer	Cork
Colm Murray	Architecture Officer with the Heritage Council	Kilkenny
John Kirby	Chartered Arch Tech and passive house designer	Kerry
John Morehead	Architect in private practice	Cork
Aongus O'Dowd	Registered domestic BER Assessor & Technical Heat Pump Assessor	Kildare
Noel Brady	Program manager for Warmer Homes Scheme, Better Energy Communities and Better Energy Homes	Cavan
Darren Duffy	Registered domestic BER Assessor	Dublin
Eddie Power	Registered domestic BER Assessor	Kilkenny
Sean Byrne	Registered domestic BER Assessor	Carlow
Brian Bryne	Registered domestic BER Assessor	Dublin

The auditors tested the iBRoad passport on 20 single-family homes across the country between March and August 2020. As apartments only account for 12% of all dwelling types in Ireland and given the short duration of the pilot, the project partners decided to focus on single-family homes. But, it might be worth exploring the opportunity of testing and introducing BRPs for multi-family units and non-residential buildings in future.

LIST OF SINGLE-FAMILY DWELLINGS USED AS PART OF THE PROJECT	
Building Type	**Location**
1923 Brick	Dublin 4
1978 Hollow Block	Dublin 14
2006 Cavity Wall	Co Galway
1930'S Hollow Brick	Co Dublin
1930'S Mass Concrete	Dublin 4
Pre 1900 Stone Wall	Kilkenny
1978 Cavity Wall	Kilkenny
1949 Mass Concrete Wall	Dublin 5
1982 Cavity Wall	Co Laois
1988 Cavity Wall Limerick	Co Limerick
1997 Cavity Wall Kerry	Co Kerry
1998 Cavity Wall	Co Kildare
1988 Cavity Wall	Cork
1877 Masonry	Co Cavan
1870 Stone Wall	Co Cavan
1900 Solid Stone Wall	Co Cork
2007 Cavity Wall	Co Cork
1790 Solid Stone Wall	Co Cork



Auditors and homeowners taking part in the pilot were required to complete a questionnaire on their experience on completion of each passport. Thirty-six questionnaires were returned to the project partners.

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Report Structure

The aim of this report is to present the key findings of the iBRoad Building Renovation Passport testing phase in Ireland. It is intended to be used as a source of reference by all organisations interested in the development of Building Renovation Passports in Ireland. In particular, it will inform the All Government's Climate Action Plan - Action 45 - Develop a tool to deliver a roadmap to individual homes to achieve BER B2.

The first part of the report reviews the feedback received from auditors and homeowners who took part in this pilot. The second part presents a suggested set of recommendations on the opportunity of introducing BRPs in Ireland, and supporting measures required so that they achieve the desired effect. An example of how a Building Renovation Passport for Ireland could look like and what should be included in it is available in Appendix 1.

KEY LEARNING AUDITORS

About the field test

This pilot enlisted eleven experienced energy auditors to examine a total of 20 single-family houses across the country. The auditors were selected based on their qualifications, their location and the types of residential properties they were ready to audit.

The auditors were trained by Peter Melwig of ifeu, one of the partners of the iBRoad project in January 2020. Once the training was complete, the auditors identified buildings suitable for renovation with owners willing to participate in the field test. The auditors had been requested to identify specific buildings according to their typology[4]. The energy auditors received a small fee for participating in the field test.

The assessments were carried out with an on-site visit. The purpose of the visit was both to collect the technical data to be used for calculating the Roadmap and to learn about the future plans of the building owner and their financial flexibility. After the site visit the auditors created the iBRoad Renovation Roadmap using the Roadmap Assistant. This is one of the iBRoad web tools made available for the piloting, the other being the Logbook. The auditors then shared the Roadmap with the building owners, some emailed the link and others made another visit to talk through the renovation steps. The auditors then added the relevant data to the Logbook and shared the Logbook with the building owner. In certain cases, in response to GDPR concerns, auditors were able to transfer the Logbook using a transfer code to the building owners own account set up on the iBRoad web tools.

The major difficulty experienced by this field test was the Covid-19 restrictions imposed at the time. This resulted in a delay of eight weeks in the field test timeline but also in some cases the auditors were not able to audit the buildings that they had originally intended. For this reason, the span of buildings audited does not have the range of building typologies initially planned. Specifically, this resulted in no timber framed buildings being audited under this pilot. See below for range of building typology tested.

Auditors taking part in this pilot were required to complete a questionnaire on their experience on completion of each passport. Eighteen questionnaires were received, of which two were incomplete. At the end of the testing phase a live online feedback session was organised for the auditors so that they could further report back on their experience of using the tools, to elaborate on the tools' possible benefits and to discuss as a group recommendation for the scheme going forward. Seven of the 11 auditors attended this feedback session.

[4] Based on the typology of Irish dwellings developed as part of the Tabula Episcope project. Read more.

BUILDING TYPOLOGY TESTED

Stone Walls, Pre 1900

Solid Brick Walls, 1900-1929

Mass Concreate Walls, 1930-1949

Hollow Block Walls, 1950-1966

Cavity Walls, 1978-1982

Hollow Block walls, 1978-1982

Cavity Walls, 1983-1993

Cavity Walls, 1994-2004

Cavity Walls, 2005-2010

Source: Irish Building Typology Brochure

On-site Visit

On average the onsite visit lasted one and a half hours with the shortest being 1 hour and the longest 3 hours. Two thirds of building owners already had a long-term perspective on their building before the visit.

Usefulness of the on-site visit

Overwhelmingly the energy auditors found the site visit “very useful” or “rather useful”.

To what extent do you consider your visit to the building as useful?	Very Useful	Rather Useful	Less Useful	Not Useful	Not Done
Information about the current building state	**81%**	13%	6%	0%	0%
Information about possible renovations in the future	**50%**	**50%**	0%	0%	0%
First sketch of a Renovation Roadmap on the blank template	13%	**53%**	20%	0%	13%
Tour of the house	**63%**	38%	0%	0%	0%
Visit as a whole	**69%**	31%	0%	0%	0%

Planning and calculation of renovation steps and measures

To create the Roadmap a range of information needs to be entered into the Roadmap Assistant. The energy auditors needed on average 2 hours to enter the present building state into the DEAP calculation software with some taking 30 minutes and others up to 4 hours.

When creating the renovation steps and calculating them within the calculation software, the auditors took a further 4.4 hours on average. Some took as little as an hour for this step and others longer than a day.

Existence of a BER

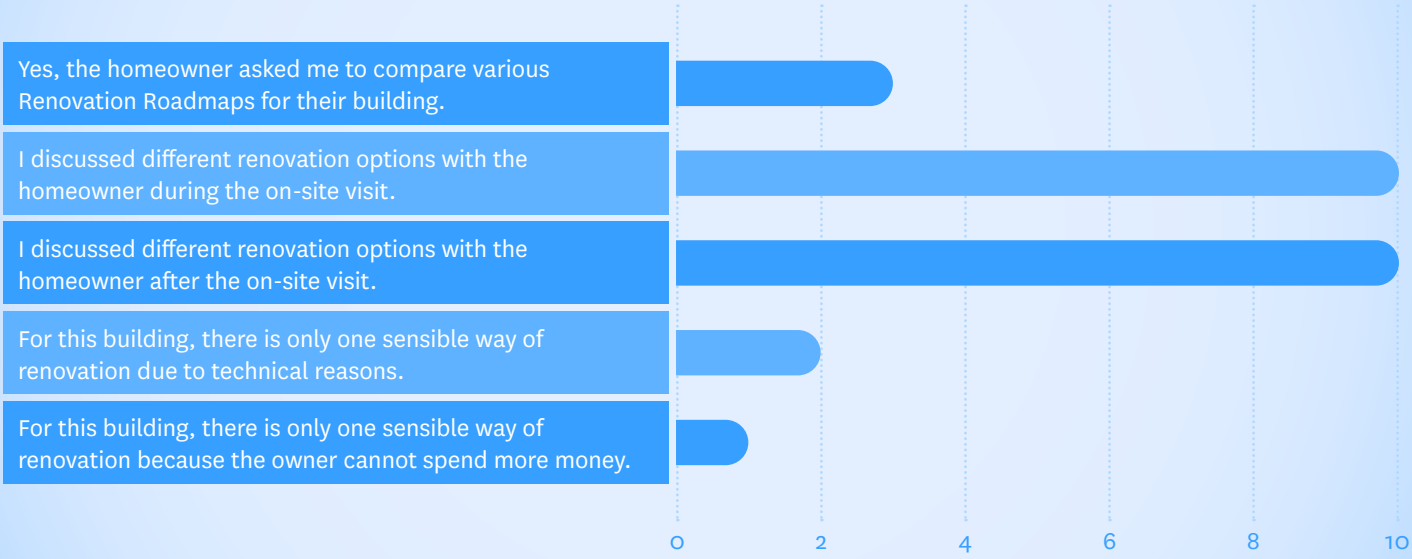
Over three quarters of the dwellings surveyed already had a BER before the iBRoad consultation. This compares with around 33% of the general Irish housing stock which have BER certificates[5]. Hence, the sample of homeowners in this pilot cannot be considered entirely representative of the general population but instead is more representative of “early adopters” of the energy rating system.

Renovation Variants

The iBRoad Roadmap presents just one final renovation variant. During the process there might be several options to discuss with the building owner. The chart below shows how the majority of the auditors took the time to talk about the different renovation options available to the building owner.

[5] https://www.seai.ie/technologies/seai-maps/ber-map/

Have you talked to the building owner about comparing variants to the Renovation Roadmap?



There was a mixed response as to whether it was helpful to have a comparison of variants in the Roadmap. One auditor suggested that too many choices could lead to confusion. Most felt it was useful to have the discussion about variants before the Roadmap was produced.

Roadmap Assistant

The auditors produced the Roadmap with the help of the iBRoad Roadmap Assistant. This is a tool that displays the Roadmap data in a unified format with preconfigured text blocks. The majority (63%) felt they needed some time to get used to the Roadmap Assistant but had no major problems. One commented “creating a new renovation step was straight forward once I figured out that each measure needed to be created separately”. A sizable group (38%) agreed they could work with Roadmap Assistant, but it took a lot of time to understand with one reporting back “I had some trouble saving partially completed renovation steps”. When asked about the specific features of the Roadmap Assistant, a large proportion (63%) thought it hard or very hard to navigate through the website in general with one remarking that the process was “too complex” and “needs to be simplified”.

Usefulness of the Roadmap Assistant features

The auditors were asked about the usefulness of specific features of the Roadmap Assistant and in the main they found the features to be “useful” or “very useful” specifically in relation to the Roadmap overview and the detailed Roadmap.

How useful are the following features of the Roadmap Assistant in your eyes?

	Very Useful	Rather Useful	Less Useful	Not Useful
Roadmap page (overview)	40%	**60%**	0%	0%
Detailed Roadmap	**53%**	47%	0%	0%
Current state of your building - energy rating	**50%**	38%	13%	0%
Current state of your building - advice for user influence	13%	**63%**	19%	6%
Details of renovation steps - description of measures	**50%**	38%	13%	0%
Details of renovation steps - renovation costs	**38%**	**38%**	25%	0%

How useful are the following features of the Roadmap Assistant in your eyes?	Very Useful	Rather Useful	Less Useful	Not Useful
Details of renovation steps - technical details and notes	25%	31%	**38%**	6%
Details of renovation steps - incentives	**50%**	44%	0%	6%
Details of renovation steps - energy demand	**44%**	38%	19%	0%
Details of renovation steps - carbon emissions	**44%**	25%	31%	0%

iBRoad Renovation Roadmap

As part of the field test the auditors created Renovation Roadmaps for the building owners. The auditors were asked to assess the usefulness of a number of aspects of the Roadmap.

Satisfaction with the iBRoad Renovation Roadmap features

A majority was either “rather satisfied” or “completely satisfied” with the features listed although a sizable amount were “less satisfied”.

How satisfied are you with the following features of the iBRoad Renovation Roadmap?	Completely Satisfied	Rather Satisfied	Less Satisfied	Not Satisfied
Comprehensibility of the Renovation Roadmap	13%	**69%**	19%	0%
Graphics / appearance of the Renovation Roadmap	31%	**56%**	13%	0%
Presentation of the present building state	19%	**56%**	19%	6%
Degree of detail of the proposed measures	0%	**56%**	38%	6%
Clarity of the renovation perspective over the next few years	38%	**44%**	19%	0%
Information on the energetic benefits of renovations	**38%**	**38%**	25%	0%
Information on the economic efficiency of renovations	19%	**56%**	25%	0%
Usefulness of the information for you personally	19%	**56%**	19%	6%

Usefulness of the iBRoad Renovation Roadmap features

The auditors were also asked their opinion on the usefulness of certain features of the Roadmap online document. In general, they found the features to be “rather useful” or “very useful”. In particular the “detailed Roadmap” and the “details of the renovation steps – energy demand”.

How useful are the following features of the online document iBRoad Renovation Roadmap for you?	Very Useful	Rather Useful	Less Useful	Not Useful
Roadmap page (overview)	27%	**67%**	7%	0%
Detailed Roadmap	44%	**56%**	0%	0%

How useful are the following features of the online document iBRoad Renovation Roadmap for you?	Very Useful	Rather Useful	Less Useful	Not Useful
Current state of your building - energy rating	20%	**53%**	27%	0%
Current state of your building – hints for user influence	31%	**38%**	19%	13%
Details of renovation steps – description of measures	**44%**	**44%**	13%	0%
Details of renovation steps – renovation costs	31%	**50%**	13%	6%
Details of renovation steps – technical details and notes	25%	**44%**	31%	0%
Details of renovation steps – incentives	38%	**44%**	6%	13%
Details of renovation steps –energy demand	25%	**75%**	0%	0%
Details of renovation steps – carbon emissions	31%	**44%**	25%	0%

General assessment of iBRoad Renovation Roadmap

The auditors were asked for a general assessment of the Renovation Roadmap tool. In the main the response was positive and the auditors either “completely agreed” or “rather agreed” with the statements below. They particularly agreed that the Roadmap is useful and informative for the building owners. One auditor commented “financial planning is key to an orderly renovation roadmap”. Another recognised its usefulness for building professionals “The iBRoad is ideal for Technical Assessors and BER Assessors when it comes to Energy Upgrades, Grant Applications and associated works involved and in particular upgrades with a view to the Heat Pump Grant Process”.

To what extent do you agree with the following statement?	Completely Agree	Rather Agree	Agree Less	Completely Disagree
The iBRoad Renovation Roadmap is useful and informative for the building owner.	**63%**	38%	0%	0%
The iBRoad Renovation Roadmap is easy to understand, clear, and transparent for the building owner.	31%	**44%**	25%	0%
The iBRoad Renovation Roadmap looks appealing to the building owner.	25%	**69%**	6%	0%
The iBRoad Renovation Roadmap takes into account the personal situation of the building owner (such as preferences and financial options).	25%	**44%**	31%	0%
The iBRoad Renovation Roadmap provides the building owner with a long-term renovation strategy for their building.	**56%**	38%	6%	0%
The iBRoad Renovation Roadmap will help the building owner to avoid investing in the wrong things	**63%**	31%	6%	0%
The iBRoad Renovation Roadmap enables and motivates the building owner to realise concrete renovation measures in the near future.	**44%**	**44%**	13%	0%

Preferred presentation of the Renovation Roadmap

When asked what type of presentation they preferred, the auditors responded in the main (75%) that a printed document should accompany the online presentation and be made available to the homeowner. Multiple answers were allowed in this case.

Which way of presentation do you prefer for the iBRoad Renovation Roadmap?

Completeness of the iBRoad Renovation Roadmap

The auditors were asked if the Roadmap contained all the necessary indicators or if they proposed additional indicators. A majority (63%) thought there were sufficient indicators and the others made suggestions for further indicators to be included. For example, they would add:

- Ability to input renewable energy saving separately in renovation steps
- Information about technical risks of renovation measures
- Ability to input air permeability results
- A homeowner comments section for building state e.g. “the house feels cold and damp in current state”
- Airtightness and ventilation and controls for Space and DHW heating

The auditors were asked what other tools or information would be useful for them to create a Roadmap. Their suggestions included:

- Integration with DEAP software as part of the recommendations section
- Ability to take PHPP rather than BER data for energy modelling
- Broad guidance on typical costs for various upgrades e.g. ballpark costs of a new heating system in a 3 bed house or a per m² rate for external insulation.
- Good practice references to national and international renovation standards
- Simplification of data input
- For older buildings, a sense that the character of the buildings is important, and some recognition that it could or should have an impact on decision-making.

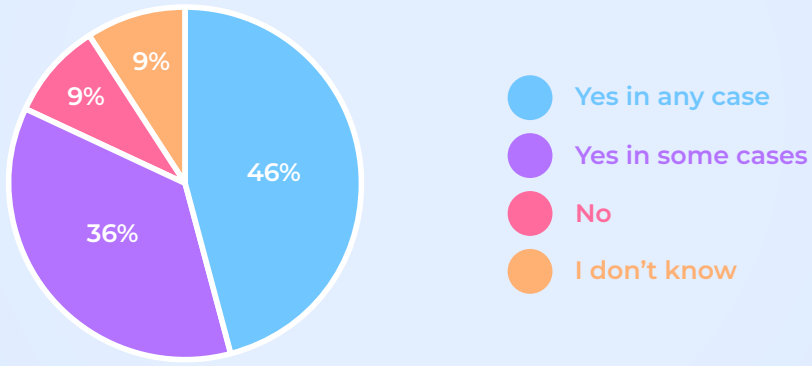
The auditors were asked their ideas about how best to develop the Roadmap further. Their suggestions included:

- Integrate the Roadmap with the Logbook.
- Integrate the Roadmap with DEAP software for easy export and import of data. Also streamline the inputs and match input wording with DEAP.
- Review process and documentation with user in mind e.g. there is a fair bit of repetition with Logbook and Roadmap entries also yellow on grey is difficult to read.
- Facilitate the upload of additional guidance notes and specifications for reference by the homeowner and renovation contractors

Renovation recommendation rate

A clear majority of auditors would recommend the Roadmap to their colleagues. With one responding that “it was a new way of looking at buildings for me, it encouraged getting the steps in the right order rather than what the homeowner or energy assessor thought they should do next.” However, another warned that the “notes on the detailed renovation steps are too standardised and confusing for the homeowner” and felt that he had to explain each step in further detail to the homeowner.

Would you recommend the iBRoad Renovation Roadmap to your colleagues?

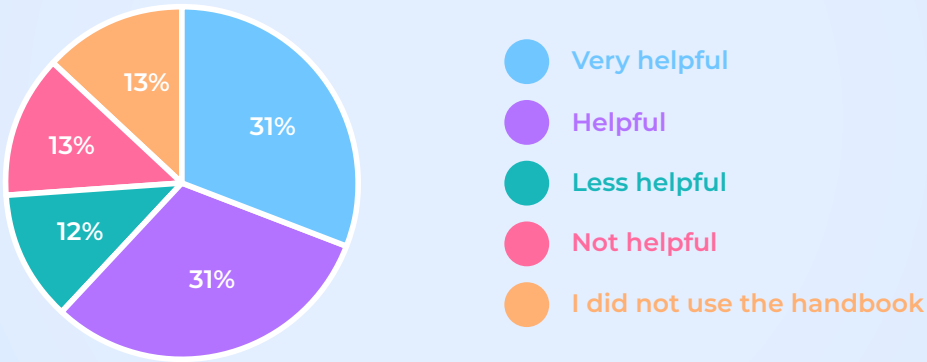


Handbook for energy auditors

Usefulness of the handbook

A majority of auditors found the handbook "very helpful" or "helpful", however a sizable portion did not find it helpful or did not use the handbook.

Was the Handbook helpful for you when you created the Roadmap?



When asked for their suggestions to improve the handbook the auditors have the following recommendations:

- A sample fully completed Roadmap would be a useful guide.
- Include references to "good practice" guides which may be specific to national/international building regulations & standards.
- Include more items on the "Checklist for on-site visit"

iBRoad Logbook

Manageability of Logbook features

The auditors were asked how easy or complicated they found the Logbook features to be. All thought that uploading documents, pictures and energy bills was “easy” or “rather easy”. The other features were perceived by some to be “rather complicated”.

How easy or complicated were the following features of the iBRoad Logbook for you to use?	Very Useful	Rather Useful	Less Useful	Not Useful
Find data in the data storage	33%	**40%**	27%	0%
Enter data into the data storage	14%	**57%**	29%	0%
Upload documents	47%	**53%**	0%	0%
Upload pictures	47%	**53%**	0%	0%
Upload energy bills	10%	**90%**	0%	0%
Create a new building state for renovations in the past	18%	36%	**45%**	0%
Create a new building state for possible renovations in the future	15%	**46%**	38%	0%
Link the iBRoad Renovation Roadmap to the iBRoad Logbook	27%	**40%**	33%	0%

The time it took the auditors to input the data into the Logbook varied from 20 minutes to 3 days with an average of 4 hours. If the 3 day result is excluded the average was 2.2 hours.

Usefulness of Logbook features

Generally, the Logbook features were thought to be “very useful” or “rather useful”. In particular the “storage of building energy performance” was thought to be useful.

How useful are the following features of the iBRoad Logbook for you?	Very Useful	Rather Useful	Less Useful	Not Useful
Storage of general and administrative information	20%	**67%**	13%	0%
Storage of building construction information	**60%**	27%	13%	0%
Storage of building energy performance	**53%**	47%	0%	0%
Storage of building operation and use	36%	**57%**	7%	0%
Storage of smart information	29%	**43%**	29%	0%
Storage of documents and plans	**53%**	33%	13%	0%
Building diagnosis: overall performance	40%	**47%**	13%	0%
Building diagnosis: envelop performance	**53%**	33%	13%	0%
Building diagnosis: equipment performance	27%	**53%**	20%	0%
Link to the iBRoad Renovation Roadmap	**47%**	40%	13%	0%

Statements on the Logbook

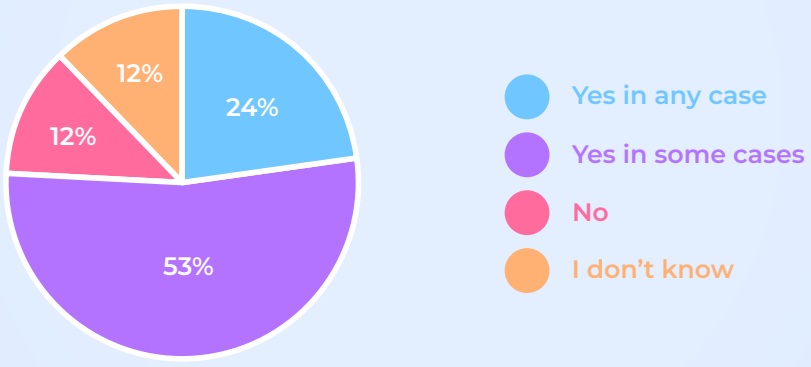
The auditors were asked for a general assessment of the iBRoad Logbook. Overall, the feedback was positive. All agreed that the Logbook gave the homeowner the ability to track all their building related information in the long term and all agreed that the presentation of the envelop efficiency with colour classes was easy to understand, although some agreed less that the Logbook icons were intuitive to understand or that it was easy to navigate the Logbook.

To what extent do you agree with the following statements to the iBRoad Logbook?	Completely Agree	Rather Agree	Agree Less	Completely Disagree
Presentation of the envelop efficiency with colours classes is easy to understand (roof, walls, ...)	**60%**	40%	0%	0%
Presentation of the equipment efficiency with colours classes is easy to understand (heating, hot water)	40%	**53%**	7%	0%
It was easy to navigate through the iBRoad Logbook	13%	**53%**	33%	0%
I understood the icons intuitively	20%	**47%**	33%	0%
The iBRoad Logbook looks appealing to me.	27%	**40%**	33%	0%
The iBRoad Logbook is providing the homeowner with a long-term possibility to track all my building-related information.	53%	**47%**	0%	0%
The iBRoad Logbook enables and motivates the homeowner to realise concrete renovation measures in the near future.	13%	**60%**	27%	0%

Logbook recommendation rate

A large majority said they would recommend the Logbook to their colleagues.

Would you recommend the iBRoad Logbook to your colleagues?



Ideas for further development of the Logbook.

The auditors were asked for their ideas to help further develop the iBRoad Logbook. Their suggestions included:

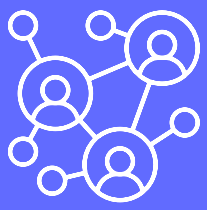
- The Logbook should be better integrated with the Roadmap to avoid duplication.
- A more detailed overview is needed making clear the building state.
- The Logbook should be streamlined and simplified.
- It would appear that everything contained in the Logbook is already contained in the DEAP 4 file. Perhaps DEAP could be drawn on and utilised in creating logbooks or roadmaps.
- Review the ability of homeowners to make significant changes. The Logbook and Roadmap should be completed with the assistance of an energy auditor, particularly for grant aided works.
- With improvements and enhancements, the Logbook can be a very effective tool.

KEY LEARNING HOMEOWNERS

About the homeowners

There was a good response from homeowners to the questionnaires. Of the 20 buildings surveyed, 18 building owners returned questionnaires and only 2 were incomplete. The 18 respondents came from a mixture of age groups: 6% were below 30, 39% between 30-40, 28% between 40-50, 22% between 50-60 and 6% were above 60. 78% of the respondents were male although many couples engaged in the process. All were interested in saving energy costs and improving the indoor climate and well-being. A majority, 76%, already had a BER for the house with 82% agreeing they would always use professional advice. Also, nearly half of the group were already aware of the issues at hand with 47% agreeing they were well informed about building renovation and modernisation. Hence, the sample of homeowners in this pilot cannot be considered entirely representative of the general population but instead is more representative of "early adopters" of the energy rating system. The development of the BRP was free of charge for building owners.

20
Buildings Surveyed



18
Respondents

Age Groups of the Respondents

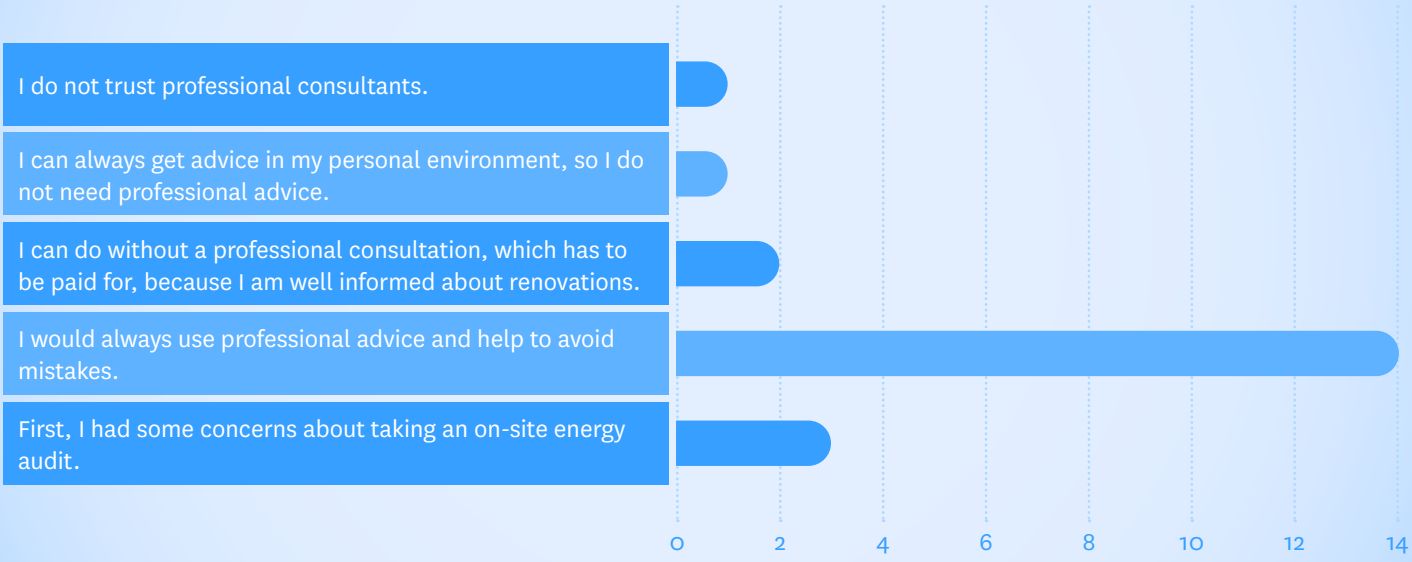
What is your position on building renovation in principle? To what extent do the following state-ments apply to you?	Completely Agree	Rather Agree	Agree Less	Completely Disagree
I am well informed about building renovation and modernisation.	**47%**	**47%**	6%	0%
I carry out renovations myself as far as it is technically possible.	18%	**47%**	35%	0%
It is a burden for me to constantly have to take care of the house.	12%	18%	**35%**	**35%**
For me, the house is a residential object that I look at very unemotionally.	0%	12%	18%	**71%**

> "I've had a few friends and family looking for this kind of information. It would be very useful to have this kind of service integrated with the SEAI technical advisor role." - Homeowner, July 2020

Homeowners' attitudes towards professional building renovation audits

Homeowners were asked about their attitudes towards professional renovation audits. A clear majority of respondents agreed that they would always use professional advice in this context of building renovation.

What is your opinion about professional audits in the context of renovation?



About the dwellings

Building type, size & construction year

All the buildings surveyed were single-family houses and 82% were owner occupied. The buildings were a range of construction dates with some from pre-1900, 1920s, 1930s, 1940s, 1970s, 1980s, 1990s and 2000s. The average size was 169m² with the largest being 371m² and the smallest 46m².

Previous renovation measures

The most commonly implemented renovation measures previously undertaken included installing a more efficient heating system, installing more efficient windows and insulating the roof.

Were renovations carried out in previous years to reduce energy consumption?

Energy audit: On-site visit

Overall the homeowners found the on-site visit by the auditor to be very useful. However, it should be noted that the homeowners were all volunteers to this pilot and therefore should be considered more amenable to the process than a more general sample of homeowners.

On average the auditors' on-site visit lasted just under two hours. According to the homeowners the shortest on-site visit was one hour and the longest five hours.

The homeowners reported that the auditors in the main considered the iBRoad principles during the on-site visit. 82% of homeowners were asked by the auditor about their individual preferences and circumstances and 76% reported that the auditor discussed the "best possible principle" with them. A smaller percentage, 58% reported that the auditor had discussed their financial options.

To what extent do you consider the visit of the energy auditor in your building to be useful for you?	Very Useful	Rather Useful	Less Useful	Not Useful	Not Done
Information about the current building state	**53%**	35%	6%	0%	6%
Information about possible renovations in the future	**71%**	18%	6%	0%	6%
First sketch of a Renovation Roadmap on the blank template	**59%**	35%	6%	0%	0%
Tour of the house to search for weak points	**65%**	24%	6%	0%	6%
Auditor's visit as a whole	**71%**	24%	6%	0%	0%

iBRoad Renovation Roadmap

General assessment of the Roadmap

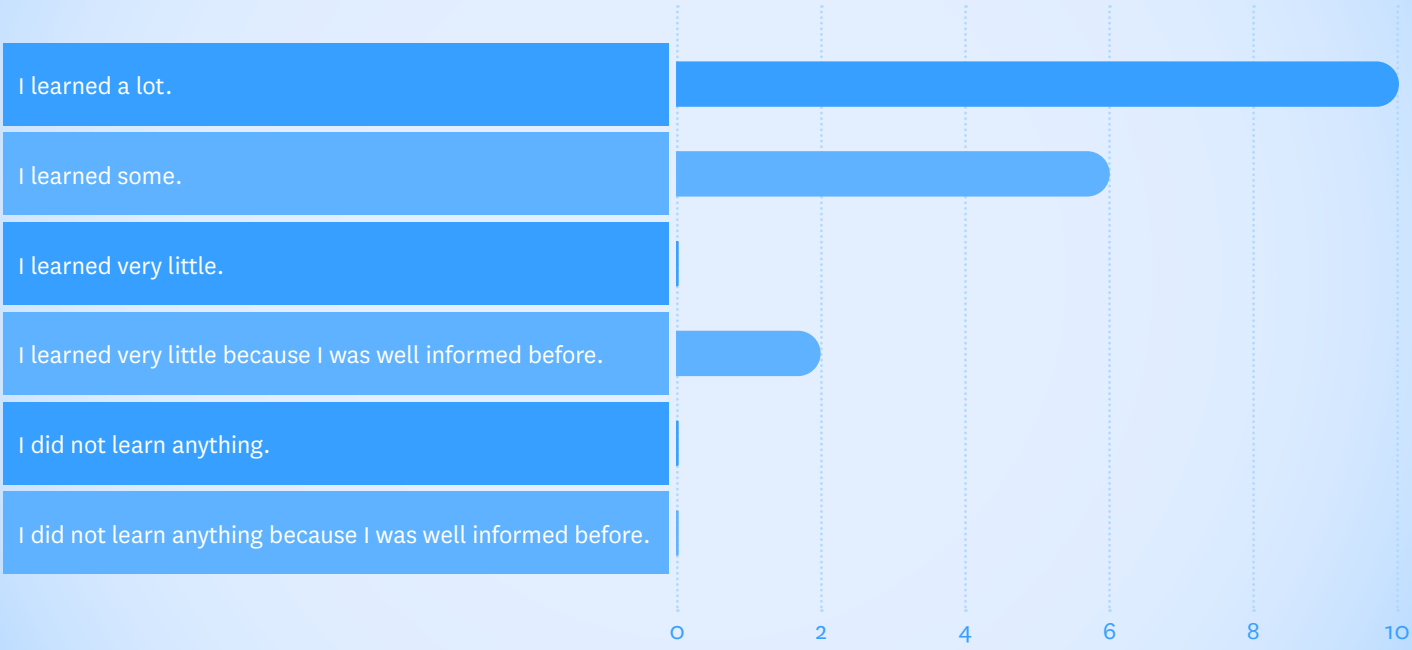
When asked about their general assessment of the iBRoad Roadmap, the building owners were predominantly positive. A sizable majority "completely agreed" that the Roadmap was useful and informative.

What is your position on building renovation in principle? To what extent do the following statements apply to you?	Completely Agree	Rather Agree	Agree Less	Completely Disagree
The iBRoad Renovation Roadmap is useful and informative for me.	**82%**	6%	12%	0%
The iBRoad Renovation Roadmap is easy to understand, clear, and transparent for me.	**53%**	35%	12%	0%
The iBRoad Renovation Roadmap looks appealing to me.	**53%**	41%	6%	0%
The iBRoad Renovation Roadmap takes into account my personal situation (such as preferences and financial options).	29%	**47%**	18%	6%
The iBRoad Renovation Roadmap is providing me with a long-term renovation strategy for my building.	**59%**	24%	12%	6%
The iBRoad Renovation Roadmap will help me to avoid investing in the wrong things	**65%**	18%	18%	0%
The iBRoad Renovation Roadmap enables and motivates me to realise concrete renovation measures in the near future.	**65%**	29%	6%	0%

Learning effect from the Roadmap

The majority of homeowners reported that they learned “a lot” or “some” from the Roadmap.

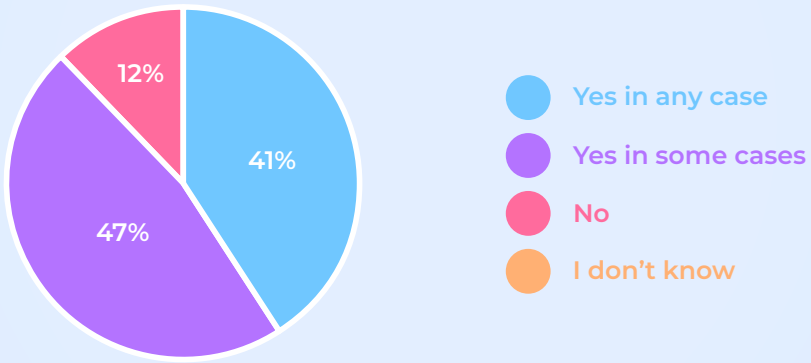
How much did you learn from the iBRoad Renovation Roadmap?



Roadmap recommendation rate

The majority of homeowners would recommend the Roadmap to their family and friends with only two reporting that they would not recommend it. One respondent stated “I've had a few friends and family looking for this kind of information. It would be very useful to have this kind of service integrated with the SEAI technical advisor role”. Another responded “Yes. It was exactly what I wanted - a simple and well described shopping list for energy upgrades that would compliment my project”.

Would you recommend the iBRoad Renovation Roadmap to your family or friends?



Homeowners' satisfaction with Roadmap features

Homeowners were asked to rate how satisfied they were with the various features of the Roadmap. Overall the results are very positive with the majority being "completely satisfied" or "rather satisfied". In particular a high proportion (65%) were completely satisfied that the Roadmap gave them clarity on their renovation perspective over the next few years.

How satisfied are you with the following features of the iBRoad Renovation Roadmap?	Completely Satisfied	Rather Satisfied	Less Satisfied	Not Satisfied
Comprehensibility of the Renovation Roadmap	**53%**	29%	18%	0%
Graphics / appearance of the Renovation Roadmap	35%	**41%**	18%	6%
Presentation of the present building state	**47%**	41%	6%	6%
Degree of detail of the proposed measures	**53%**	29%	12%	6%
Clarity of the renovation perspective over the next few years	**65%**	18%	12%	6%
Information on the energetic benefits of renovations	**53%**	41%	0%	6%
Information on the economic efficiency of renovations	**47%**	35%	18%	0%
Usefulness of the information for you personally	**59%**	29%	6%	6%

Usefulness of Roadmap information

Homeowners were asked for their opinion concerning the usefulness of the various features of the Roamap. Again the response was very positive.

How useful are the following features of the online document iBRoad Renovation Roadmap for you?	Very Useful	Rather Useful	Less Useful	Not Useful
Roadmap page (overview)	**59%**	41%	0%	0%
Detailed Roadmap	**71%**	29%	0%	0%
Current state of your building - energy rating	**71%**	24%	6%	0%
Current state of your building – hints for user influence	**65%**	18%	18%	0%
Details of renovation steps – description of measures	**76%**	18%	6%	0%
Details of renovation steps – renovation costs	**71%**	12%	18%	0%
Details of renovation steps – technical details and notes	**71%**	24%	6%	0%
Details of renovation steps – incentives	**63%**	13%	19%	6%
Details of renovation steps –energy demand	41%	**59%**	0%	0%
Details of renovation steps – carbon emissions	25%	**63%**	13%	0%

Planned implementation rate of renovation measures

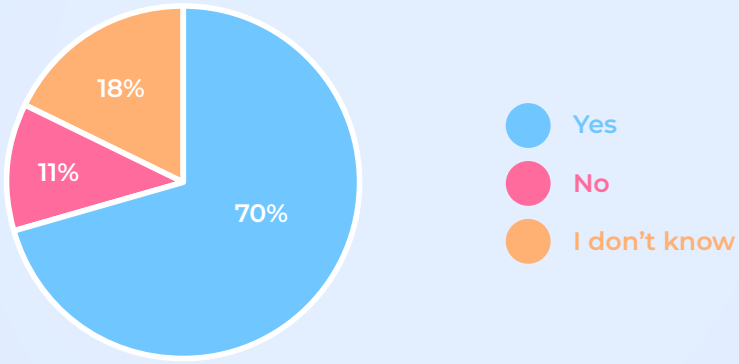
The response to the question regarding renovation measures planned in the near future is very promising with the majority of homeowners responding that they are planning to implement renovation measures in the next five year because the iBRoad Renovation Roadmap motivated them to do so.

Do you plan to implement renovation measures in the next five years because the iBRoad Renovation Roadmap motivated you that you did not plan before?

Usefulness of comparison variants in the Renovation Roadmap

Homeowners were asked if they thought it would be helpful to have a comparison of Roadmap variants. A majority, 70%, thought that it would be helpful.

Do you think it would be helpful if there was a comparison of variants in the iBRoad Renovation Roadmap?



Preferred type of presentation of the Renovation Roadmap

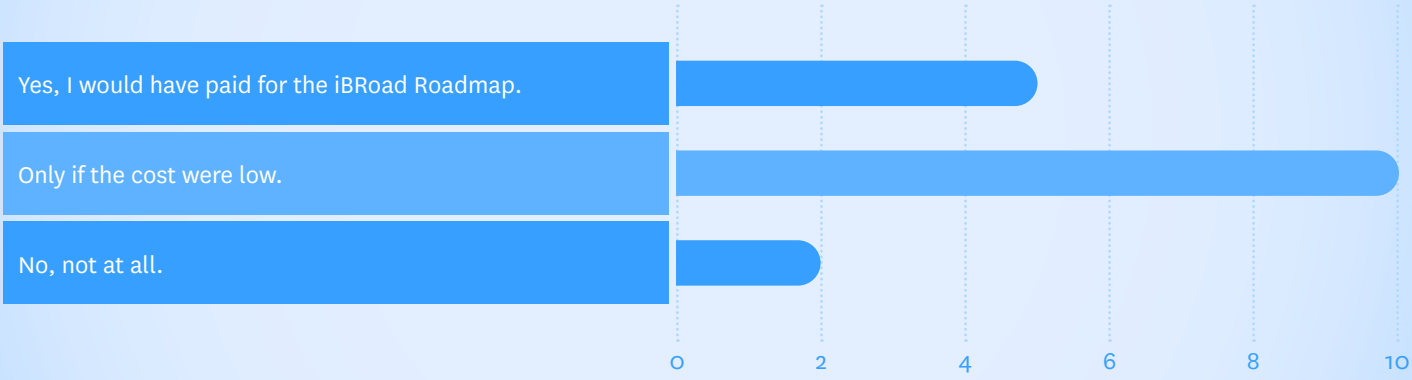
Homeowners were asked what type of presentation they would prefer for the Roadmap. A large percentage, 41%, said they would like to receive a printed document in addition to the online Roadmap presentation.

Which way of presentation do you prefer for the iBRoad Renovation Roadmap?

Homeowners' willingness to pay for a Renovation Roadmap

The homeowners were also asked about their willingness to pay for the Renovation Raodmap. The majority said they would pay if the costs were low. Only two were unwilling to pay for the service.

Would you have had the iBRoad Renovation Roadmap created if it had cost anything?



iBRoad Logbook

General Assessment of the iBRoad Logbook

The Homeowners were asked for a general assessment of the iBRoad Logbook. Of those who responded, all affirmed that the Logbook provided them with a long-term possibility to track their building-related information and that the Logbook enabled and motivated them to realise concrete renovation measures.

To what extent do you agree with the following statements to the iBRoad Logbook?	Completely Agree	Rather Agree	Agree Less	Completely Disagree
Presentation of the envelop efficiency with colours classes is easy to understand (roof, walls, ...)	36%	**45%**	18%	0%
Presentation of the equipment efficiency with colours classes is easy to understand (heating, hot water)	**45%**	36%	18%	0%
It was easy to navigate through the iBRoad Logbook	36%	**55%**	9%	0%
I understood the icons intuitively	18%	**64%**	18%	0%
The iBRoad Logbook looks appealing to me.	9%	**64%**	18%	9%
The iBRoad Logbook is providing me with a long-term possibility to track all my building-related information.	**55%**	45%	0%	0%
The iBRoad Logbook enables and motivates me to realise concrete renovation measures in the near future.	45%	**55%**	0%	0%

Usefulness of the Logbook features

Homeowners were asked about how useful they found the various features of the Logbook. A majority found all the features useful. Of the homeowners who responded, none found that the features were “not useful”. “Building diagnosis: equipment performance” was considered the least useful feature.

How useful are the following features of the iBRoad Logbook for you?	Very Useful	Rather Useful	Less Useful	Not Useful
Storage of general and administrative information	30%	**60%**	10%	0%
Storage of building construction information	40%	**50%**	10%	0%
Storage of building energy performance	**50%**	40%	10%	0%
Storage of building operation and use	**50%**	40%	10%	0%
Storage of smart information	30%	**60%**	10%	0%
Storage of documents and plans	**70%**	20%	10%	0%
Building diagnosis: overall performance	40%	**50%**	10%	0%
Building diagnosis: envelop performance	30%	**60%**	10%	0%
Building diagnosis: equipment performance	20%	**50%**	30%	0%
Link to the iBRoad Renovation Roadmap	**50%**	40%	10%	0%

Usability of Logbook features

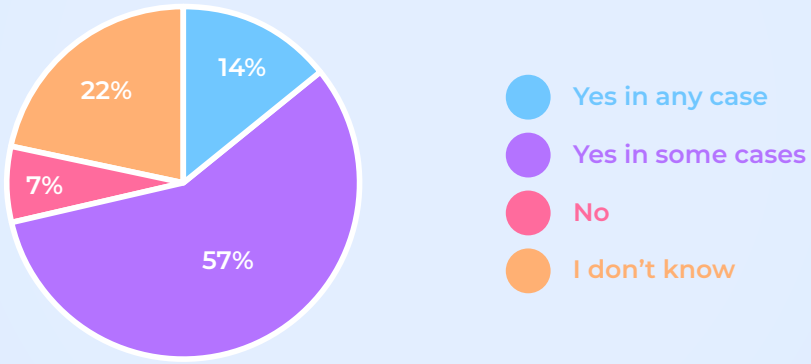
The Homeowners were asked how easy or complicated it was to use the Logbook features. The majority found the features to be “very easy” or “rather easy” to use. However one responded that linking the Logbook with the Roadmap was very complicated.

How easy or complicated were the following features of the iBRoad Logbook for you to use?	Very Easy	Rather Easy	Rather Complicated	Very Complicated
Find data in the data storage	18%	**73%**	9%	0%
Enter data into the data storage	13%	**50%**	38%	0%
Upload documents	25%	**63%**	13%	0%
Upload pictures	25%	**63%**	13%	0%
Upload energy bills	25%	**63%**	13%	0%
Create a new building state for renovations in the past	13%	**63%**	25%	0%
Create a new building state for possible renovations in the future	13%	**75%**	13%	0%
Link the iBRoad Renovation Roadmap to the iBRoad Logbook	13%	**50%**	25%	13%

Logbook recommendation rate

The Homeowners were asked if they would recommend the iBRoad Logbook to their family and friends. The majority would recommend the Logbook in some cases.

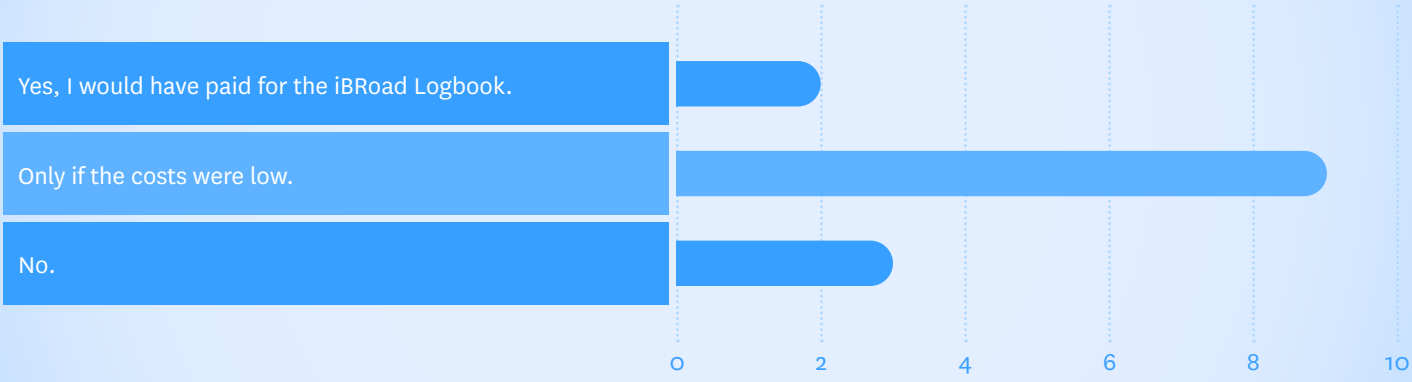
Would you recommend the iBRoad Logbook to your family or friends?



Homeowners' willingness to pay for the Logbook

The majority of homeowners would only pay a small amount for the Logbook or not pay for it at all.

Would you use the iBRoad Logbook if it had cost something?



RECOMMENDATIONS

A tool to drive energy renovation

The introduction of Building Renovation Passports could have a positive direct and indirect impact on energy renovation in Ireland.

BRPs can contribute to raising awareness among building owners as to what measures they need to take, and in what order, to achieve an energy retrofit. Lack of awareness has been cited as a key barrier to Irish homeowners undertaking retrofit projects[6]. Currently, Ireland has the third lowest spending on renovation in the European Union at under 0.5% of a household's disposable income. This lack of investment in retrofitting by Irish homeowners correlates to a lack of awareness and knowledge of not only the benefits of retrofitting but also as to the various initiatives in place for supporting the completion of retrofit projects. This has been found to be a direct result of insufficient motivational information to Irish homeowners and a lack of trust with regards to the information available[7]. A recent report written by BPIE and INIVE for the European Commission shows that the passports are effective in alleviating barriers relating to a lack of awareness and insufficient knowledge. According to the report, BRPs can have an impact on the decision to renovate, the number of measures to implement and the performance level of the selected measures[8].

This is aligned with the finding of the Irish pilot. A large majority of auditors felt that the Roadmap was useful or very useful to increase homeowners' awareness and to improve the skills of the occupants. This was echoed by the feedback of homeowners: 90% said they had learnt some or a lot from the Roadmap, and the vast majority of them said they are planning to implement renovation measures in the next five year because the Roadmap motivated them to do so. Nevertheless, it should be kept in mind that the homeowners involved in the pilot were not fully representative of the wider population in that they were largely aware about energy retrofit issues. Further research into this scheme would call for a bigger and more diverse sample.

The Roadmap enables and motivates the building owner to realise concrete renovation measures in the near future.

78% of the **Auditors** taking part in the Irish pilot rather or completely agree with this statement.

89% of the **Homeowners** taking part in the Irish pilot rather or completely agree with this statement.

[6] Turnkey Market & PESTLE Analysis: https://www.turnkey-retrofit.eu/wp-content/uploads/TR_D2.1_TEC_25_11_2019_FV.pdf
[7] Turnkey Market & PESTLE Analysis: https://www.turnkey-retrofit.eu/wp-content/uploads/TR_D2.1_TEC_25_11_2019_FV.pdf
[8] European Commission, 2020, Technical study on the possible introduction of optional building renovation passports: https://op.europa.eu/en/publication-detail/-/publication/a38ea088-aead-11ea-bb7a-01aa75ed71a1/language-en

> I was very satisfied with the report. I would say that my perception of energy audits before now was negative. I felt that the ratings used to classify buildings were too abstract. This project has been excellent. I'm aiming to complete various stages of a long term project that will incrementally improve my quality of living. This system is much more motivating and relatable." - **Homeowner, July 2020**

Besides raising homeowners' awareness and facilitating the renovation process, BRPs could have an indirect impact on renovation in Ireland. By improving quality assurance, BRPs would de-risk energy renovation investments. BRPs were one of three instruments perceived as critical by banks to introduce energy efficient mortgages as part of the H2020 funded Eemap project.

The introduction of BRPs, which would track the evolution of individual buildings, would also provide policy decision-makers with invaluable information on Ireland's building stock (e.g. energy consumption, executed maintenance and building plans) and progress towards carbon targets. By enabling better monitoring of policy impacts, it would inform future policy and investment decisions [9]. For instance, introducing a Logbook which gathers information on actual energy use - through smart meters or utility bills - in addition to the BER, could support BER (calculated energy use) improvement over time.

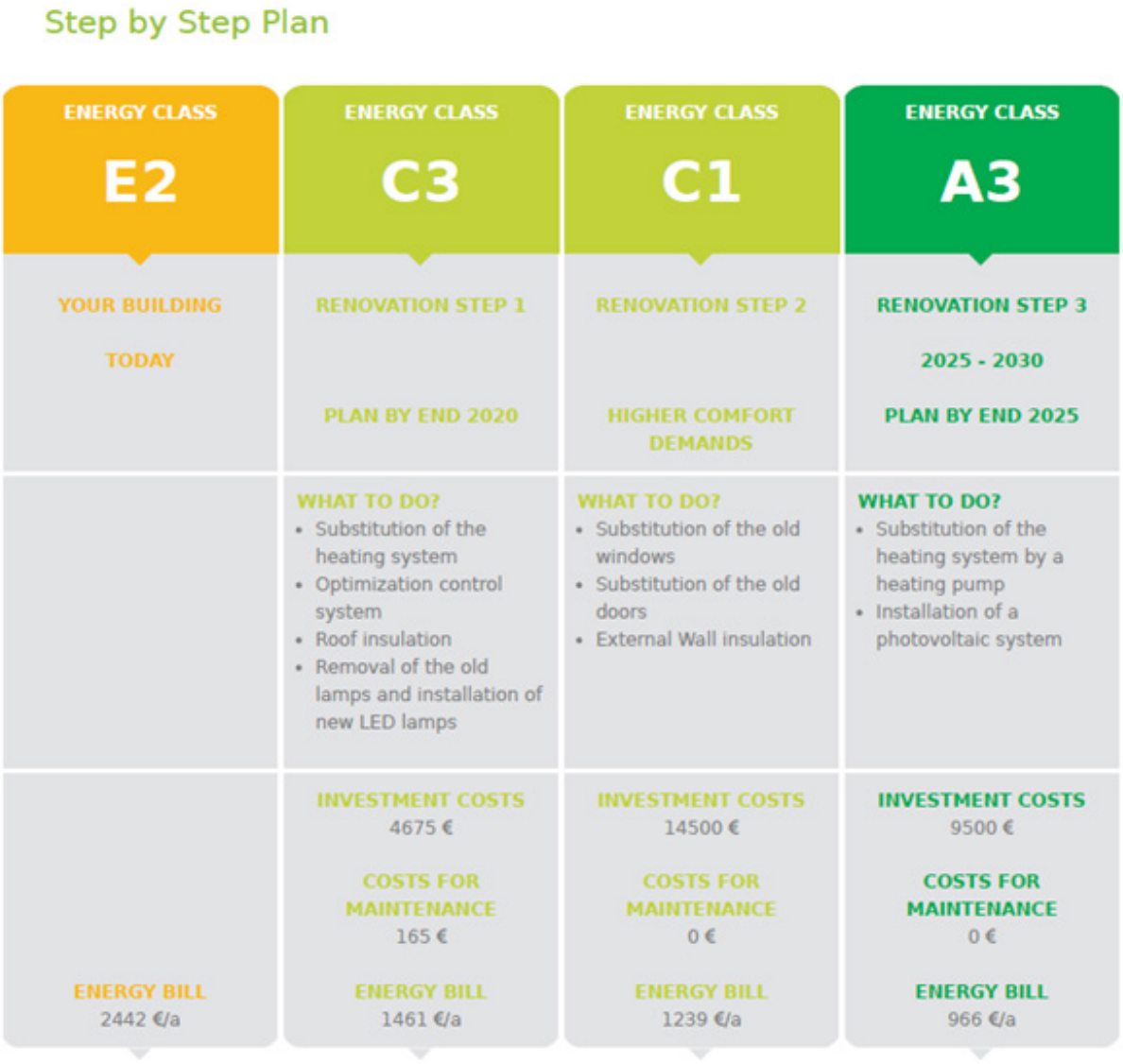
> BRPs, and more specifically the Logbook, could become invaluable going forward for SEAI, for BER assessors and to the homeowner in general". - **Auditor, August 2020**

A BRP for Ireland - Suggested structure

Auditors and homeowners involved in the Irish pilot programme perceive both the Roadmap and the Logbook as useful and informative. To improve consistency and to reduce cost, the Logbook and the Roadmap should be fully integrated with one another, and with DEAP.

A model of how a Building Renovation Passport for Ireland could look like is available in Appendix 1.

[9] BPIE, 2020. Energy performance certificates assessing their status and potential: https://x-tendo.eu/wp-content/uploads/2020/05/X-TENDO-REPORT_FINAL_pages.pdf.



iBroad Roadmap Overview

> “I've had a few friends and family looking for this kind of information. It would be very useful to have this kind of service integrated with the SEAI technical advisor report”. - **Homeowner, July 2020**

The Renovation Roadmap is perceived as useful by both auditors and homeowners involved in the pilot. In particular, the description of renovation steps - technical details, cost and impact on energy demand - was perceived as useful by both groups. Most participants involved in the pilot would like the Roadmap to be available online (as it currently is) but also to receive a hardcopy of it.

Logbook

The Logbook tracks the evolution of the individual building. It has the potential to be a very useful tool for homeowners, energy assessors and policy makers for tracking and storing information on the development of individual buildings. Currently, the BER rating only represents a snapshot in time of a building's energy performance. The Logbook differs in that it

is a tool that evolves over time. The Logbook is set up to store information about a number of previous states, what work was done, how performance was improved, what warranties are in place, etc. thereby providing important historical data about the building's development. In future, logbooks could also improve circularity in the construction sector - owners and building professionals being able to see in one click which materials were used and where.

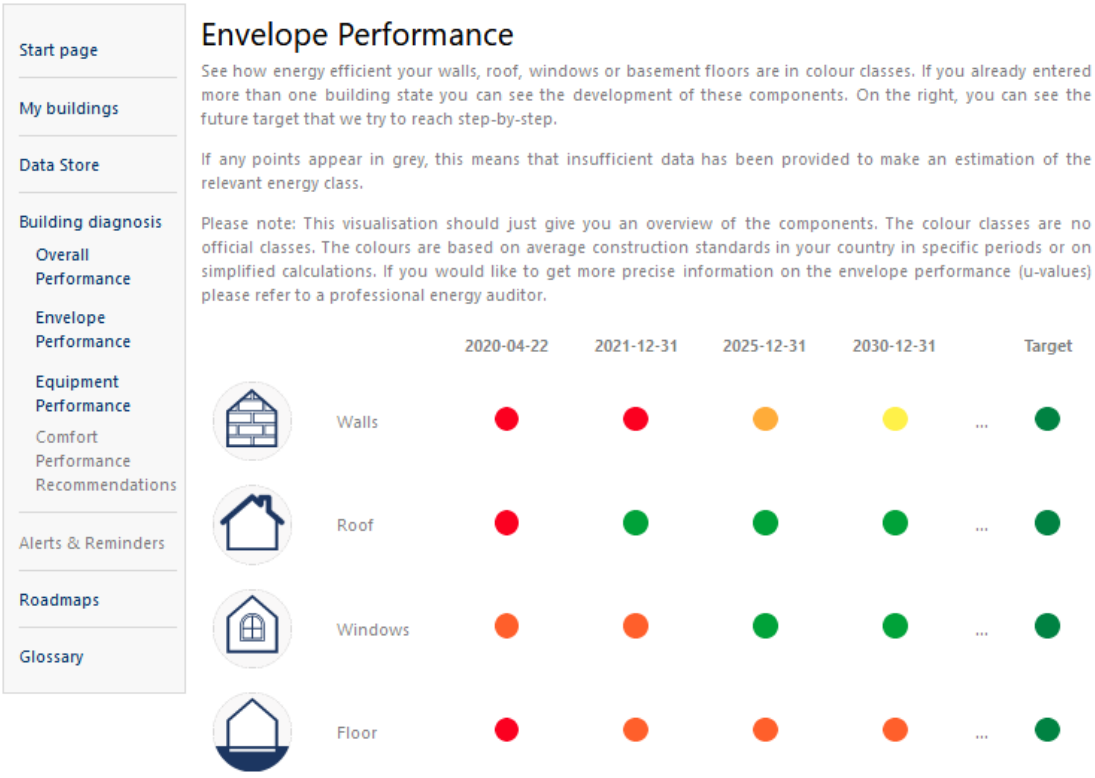
iBroad Logbook data sections

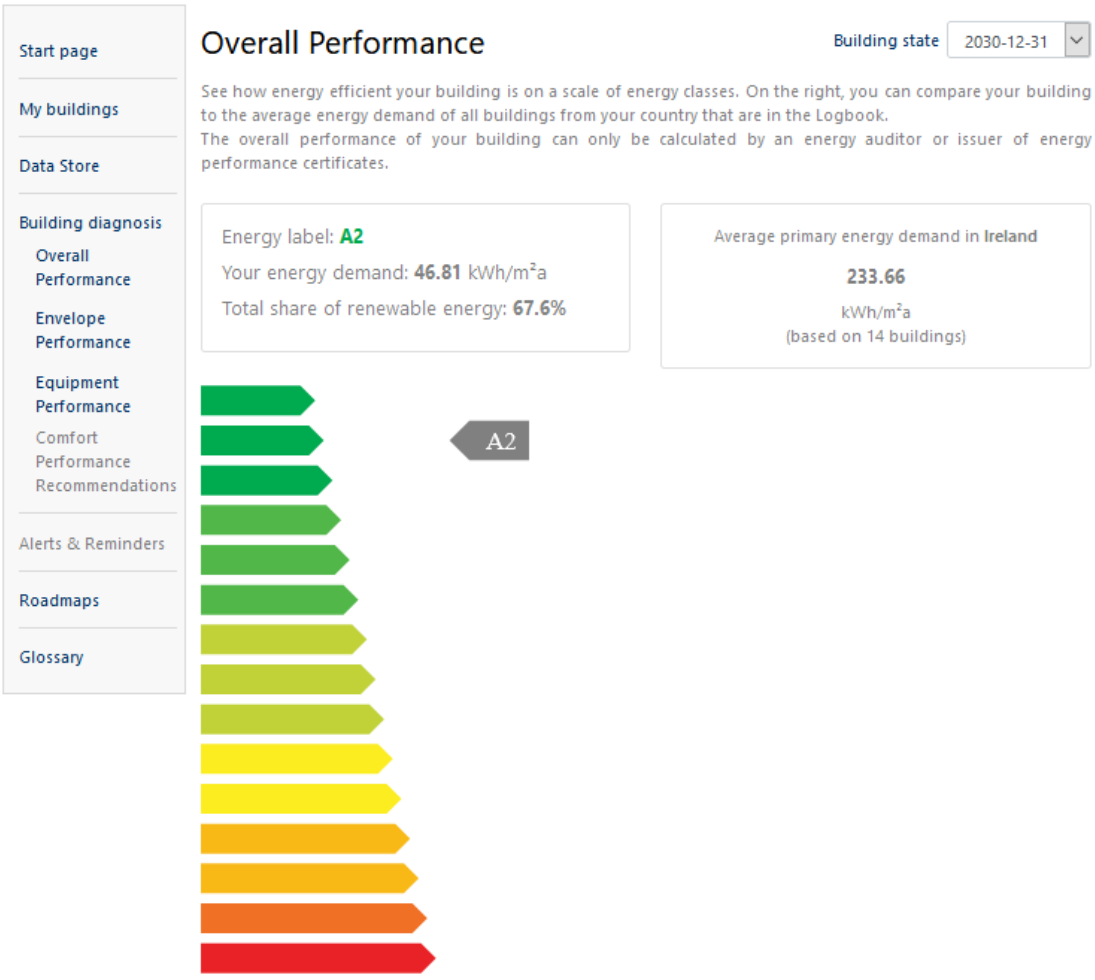
Homeowners involved in the pilot found it particularly useful to be able to access historic information on the building construction and energy use in one place. They also liked that general and administrative information about the building was included in the Logbook.

The introduction of the Logbook would ensure homeowners have a record of works for future reference or warranty issues, a clear plan for any further future improvements, a record and evidence of works that could be transferred to new occupiers on sale or rent which better reflects the condition of the home and lists any necessary work that might still be remaining. By allowing the new owner to take up where the previous owner left off, it should reduce the transactional cost of retrofit where property changes hands. Finally, it would make it easier for homeowners to ensure that opportunities aren't missed to include energy improvements when repairs and maintenance works are done on their homes.

The BRP, and more specifically the Logbook, should be linked to a property and transferred to the new owner when a property is sold. In the interest of transparency, the Logbook could also be made available to prospective buyers as it is currently done in Flanders (Belgium) with the Woning Pass.

Auditors involved in the pilot found the Logbook, and having access to construction and energy performance information, extremely useful. They highlighted that the Logbook would make it easier for them to develop a renovation passport or even a BER. The only additional suggestion which was made was to update the iBRoad Logbook to include data on energy production.





Logbook – Envelope Performance / Overall Performance

> Architects always start with the building and try to interpret what they can see in front of them. For this process, any documentation of previous interventions will be useful, no matter how incomplete. There is clear potential for the Logbook to greatly support the assessment work of building professionals". - **Auditor, August 2020**

Mandatory or Voluntary BRPs?

Given the potential impact of BRPs on renovation rates, there is a strong case to make it mandatory overtime. Making it mandatory would also give a clear indication to the market that it would have to adapt. E.g. Train experts[10]. In its recent report to the European Commission, BPIE suggested to make it mandatory for all buildings with Energy Performance Certificate (EPC) of class E and below by 2030, and for every building sold after 2030. In its report to Welsh Ministers, the Decarbonisation of Homes in Wales Advisory Group recommend introducing a robust regime for passports for all homes from 2025 which will be produced for the sale of a property, during the letting process, when applying for planning permission, or when installing an energy efficiency measure[11]. A Logbook[12] will also come into force in France in 2022 for new builds and major renovations.

A review of the literature indicates that a mandatory BRP should be managed by a public body - an energy agency or a similar body. An approach that was overwhelmingly supported by the auditors involved in the pilot. This would avoid potential conflicts of interest between the various stakeholders (e.g. grant providers, auditors and contractors) and provide a number of potential co-benefits. Firstly, the tool can be linked with other incentives to drive renovation uptake - e.g. grant schemes (see supporting measures section for further details). Secondly and as previously mentioned, it would support the delivery of the renovation targets and policy-making. The Logbook in particular could be a way of interpreting the very large amount of data that is being built up by SEAI. By acting as a repository of information, the Logbook will greatly assist BER assessors and building professionals to find the information they need (e.g. levels of EWI or agrément certs) - especially if the property has recently changed hands. Currently much of the data required by the BRP is already being collected into DEAP therefore, if integrated, the process would be considerably streamlined.

> The logical place to integrate BRPs is in DEAP 4". - **Auditor, August 2020**

[10] European Commission 2020, Technical study on the possible introduction of optional building renovation passports: https://op.europa.eu/en/publication-detail/-/publication/a38ea088-aead-11ea-bb7a-01aa75ed71a1/language-en.

[11] Better Homes, Better Wales, Better World. Decarbonising existing homes in Wales. Report to Welsh Ministers from the Decarbonisation of Homes in Wales Advisory Group. 2019: https://gov.wales/sites/default/files/publications/2019-07/independent-review-on-decarbonising-welsh-homes-report.pdf

[12] Basile Delacorne, 2020. Le carnet d'information du logement entrera en vigueur en 2022: https://www.batiactu.com/edito/carnet-information-logement-entrera-vigueur-2022-60008.php.

> The Logbook could become invaluable going forward for SEAI, for BER assessors and to the homeowner in general". - **Auditor, August 2020**

Yet, to facilitate the transition, auditors involved in the pilot suggested introducing the BRPs on a voluntary basis first. This could be an add-on when someone purchases a BER. In this interim period, it could be managed by other organisations (e.g. energy suppliers or one-stop-shops). BRP assessors would play a critical dissemination role in that period, offering the passport as an additional service.

BRP Assessors

Auditors involved in the Irish BRP pilot came from a variety of backgrounds - e.g. BER assessors and building professionals.

BRP assessors must be able to develop good quality and detailed technical energy assessments, and must have experience of DEAP.

BRP Assessors will need to be similar to the BER Assessors in terms of training, examination both initially and ongoing every 2 years and also the audit system for BER Assessors would need to be similarly introduced for the BRP Assessors.

Although BRPs support the decarbonisation of the building stock, each individual BRP is developed using the "best possible principle". This means that auditors should propose such measures which will make the building as energy efficient as possible. Every building is unique. Therefore, it is not possible to have a universal target that applies to all buildings. However, the target of a nearly climate-neutral building stock must be fulfilled. Thus, Auditors should pursue and propose the measures with the highest potential for energy efficiency, whilst taking into account the circumstances of the building and the preferences or financial capabilities of the owner.

All BRP advisors must be able to think long-term and to develop a 20-year plan for a building.

They must be able to speak about energy savings or returns on investment, but also to listen to homeowners and to talk about other things that matter to them such as improved comfort.

The most controversial point during the pilot phase was the costing of each renovation step. A significant proportion of auditors felt uncomfortable estimating the costs of each step.

Given the importance of financial planning to homeowners several actions could be taken to address this issue:

- Ensuring this is better covered as part of training[13].
- Presenting investment costs as an estimate range - as opposed to a number (as per example below).
- Adding a disclaimer next to investment costs e.g. This estimate is based on the information provided and the site visit conducted on [date]. It is based on the price of mid-range construction materials as of [year]. The price does not include any unexpected issues that may arise during renovation works. Homeowners are strongly encouraged to request quotes from at least 3 different providers before starting any renovation work.

BRP Cost

In spite of some disagreements, auditors involved in the pilot estimated that developing the BRP would cost between €600 - €750[14]. Developing a BRP is more complex than calculating a BER. The auditor must consider more than just energy. They assess individual families' needs, their settings and expectations.

In the survey for this pilot, 12% of homeowners said they would not be willing to pay, 59% said they would pay only if the costs were low and 29% said they would pay for the service. The percentage of homeowners saying they are willing to pay for the service is slightly higher than in other markets[15]. A possible explanation might be that many homeowners involved in the pilot programme are "early adopters". However, it's clear that many homeowners are not ready to pay the full cost of the BRP.

A number of actions could be taken to reduce the cost of the BRP. For instance, the auditors involved in the pilot programme recommended to fully integrate the Logbook and the roadmap with DEAP to reduce cost. They also suggested including more guidance documents and best practice examples to streamline the development of BRPs. Another suggestion in the context of the Climate Action Plan and projects aggregation was to develop several passports simultaneously - e.g. for a specific housing estate.

[13] A recent (unpublished) study by the IGBC shows that only a third of energy renovation courses for building professionals cover costing.
[14] Feedback received as part of the live session organised with the auditors in August 2020.
[15] In a survey of 1502 households conducted in Poland, Portugal and Hungary, nearly half of respondents said they would not be willing to pay for the service - 44%-54%. A quarter said they would be interested and willing to pay: 20%-32%. BPIE, 2019, How can Member States implement iBRoad?

The iBRoad report "How can member states implement iBRoad" states that to be successful in removing barriers to the retrofit planning process they should be free for the building owner or be combined with incentives to renovate[16]. The Decarbonisation of Homes in Wales Advisory Group also recommends to the Welsh Government considering providing them for free for an initial period, perhaps as part of a package of incentives[17]. This is explored further in the supporting measures needed section.

Potential challenges

A number of potential challenges were identified and discussed during the testing phase.

A strong quality assurance mechanism must be in place to ensure BRPs are not perceived as inaccurate and of limited use[18]. All stakeholders using the passports (e.g. homeowners, building professionals, construction workers, lending institutions and policy-makers) must trust the information included in the passport.

Extensive discussions took place around the ownership of the passport and editing rights. Auditors agreed that a BRP should be linked to a specific building and not to a homeowner. In that respect, it would be very similar to the BER. The BRP would be transferred to the new homeowner when a property is sold[19].

Most auditors felt that to ensure the figures are correct and to guard against misuse homeowners should not be able to edit the BRP. However, homeowners should be able to share the passport (or at least part of it) with building professionals and construction workers as required.

Supporting measures needed

In order for the recommendations of the BRP to be implemented and become actual renovation activity, the process must be associated with supporting measures, especially in relation to awareness raising, finance and regulation.

According to BPIE, the most successful schemes are the ones that combine renovation advice with financial support, legal obligations and/or communication campaigns. BRPs hence need to be integrated with and reinforced by other elements in order to be effective[20]. They must be embedded in a broader energy-advisory-service framework and supported by other policies[21].

Awareness Raising Instruments

General awareness campaigns can educate building owners and motivate them to engage in the Roadmap process. There is a wider context, for example the necessity for a climate neutral building stock, that needs to be communicated to building owners in order to stimulate interest in BRPs. In Germany the BRP is part of a broad-based campaign of the Federal Ministry of Economic Affairs and Energy which informs people about energy efficiency and encourages them to undertake energy efficiency measures[22].

Energy Auditor awareness campaigns are important to ensure a high awareness within this group. Energy Auditors, as the ones who will issue the BRPs, will play an important role in dissemination and therefore particular attention to informing this group is key. Training of energy auditors should include communication skills, understanding the main principles, identifying and avoiding renovation lock in effects, and assessing the comfort of the building users. In Germany in 2017, auditors were provided with a detailed handbook, a reference guide with seven steps for issuing a BRP, and a checklist to assist when collecting data[23].

Financial instruments

The iBRoad pilot in Ireland and other jurisdictions show a gap between what homeowners are ready to pay (a small amount) and what auditors would need to charge for the BRP (€600 - €750).

There are various ways to address this issue:

- Reduce cost of the BRP as much as possible by integrating the Logbook and passport together within DEAP
- Provide financial support for audit, for example in Belgium the digital Logbook file is free.
- Link it to existing incentives: In Quebec (Canada), the assessment cost is $150, but homeowners can claim back $100 if they go ahead with some of the renovation work.
- Combine energy audit for BRP with other key actions and obligations that require an auditor to visit a dwelling. For example, the audit could be combined with the assessment for a heat pump readiness report, with the provision of ventilation advice, or with radon testing.
- Roadmap as a prerequisite for funding schemes, tax relief or credits

[16] BPIE, 2019. How can Member States implement iBRoad?: https://ibroad-project.eu/news/how-can-member-states-implement-ibroad/.
[17] Better Homes, Better Wales, Better World. Decarbonising existing homes in Wales. Report to Welsh Ministers from the Decarbonisation of Homes in Wales Advisory Group. 2019: https://gov.wales/sites/default/files/publications/2019-07/independent-review-on-decarbonising-welsh-homes-report.pdf.
[18] Catrin Maby, 2019. Bridging the gap: integrating energy measures into mainstream home repairs, maintenance and improvements.
[19] The BRP might also be made available to prospective homebuyers as it's already done with the WoningPass (logbook) in Flanders.
[20] Jonathan Volt, 2019. EPBD19a feasibility study on Building Renovation Passports.
[21] *Idem*.
[22] ifeu, 2019. Stepwise and structured surrounding policy instruments to support the iBRoad approach for building renovation take-off.
[23] *Idem*.

Homeowners can also be encouraged by regulatory incentives. Having a BRP could be a requirement to receive retrofit grants, could trigger discounts on stamp duty or property / inheritance tax, or be combined with other incentives.

For example, the city of Tübingen in Germany gives €500 cashback to homeowners with a BRP who complete at least one renovation measure suggested by the Roadmap[24]. In a similar way having a BRP could support homeowners in meeting other obligations. For example, in Baden-Wurtemberg, there is legislation which stipulates that if you have a BRP, you do not need as much renewables as normally required (5% less).

- Increased funding for deeper renovations to homeowners with a Roadmap

Another useful lever for action would be to make public funding for energy efficiency measures accessible only to homeowners with a BRP. In this scenario, only homes that have a passport would be able to receive public funds, including government backed loans (with low interest rate) or subsidies[25]. In Bulgaria the Roadmap was considered as a prerequisite for receiving soft credits for renovation of single-family buildings by the Fund for Urban Development[26].

Further Regulatory Instruments

Long-term targets in building codes

Another option is to integrate regulatory approaches with long-term renovation strategies by setting out long-term technical requirements that are gradually refined. For example, in Germany the Energy Savings Ordinance defines primary energy demand requirements (for new builds) which are to be improved over time.

Renovation obligations

A further regulatory approach is to impose renovation obligations on buildings that do not achieve a specific energy rating. In 2011 Boulder, Colorado enacted regulations that required all rental properties to meet a minimum energy rating by 2019. This gave an eight year period for building owners to prepare for and finance their renovations[27].

> “The iBRoad is ideal for Technical Assessors and BER Assessors when it comes to Energy Upgrades, Grant Applications and associated works involved and in particular upgrades with a view to the Heat Pump Grant Process”. - **Auditor, August 2020**

[24] *Idem.*
[25] *Idem.*
[26] *Idem.*
[27] *Idem.*

Appendix 1: A Building Renovation Passport for Ireland

This section summarises how a building renovation passport for Ireland could look like and the type of information that should be included.

01. General Comments

- All wording in the BRP should align with the BER. Suggested words/phrases changes are presented in sub-section 15.
- The issue of maintenance needs to be considered within the current Irish context. Generally, maintenance costs are not considered by Irish homeowners as an annual cost. It should also be noted that the maintenance costs associated with heat pumps and mechanical ventilation are likely to be higher than traditional boiler and natural ventilation, so it is likely that post renovation maintenance costs are higher.
- Although not currently possible any future possibility to automatically integrate utility consumption into the Roadmap and Logbook through smart metering should be adopted.

02. RoadMap Overview

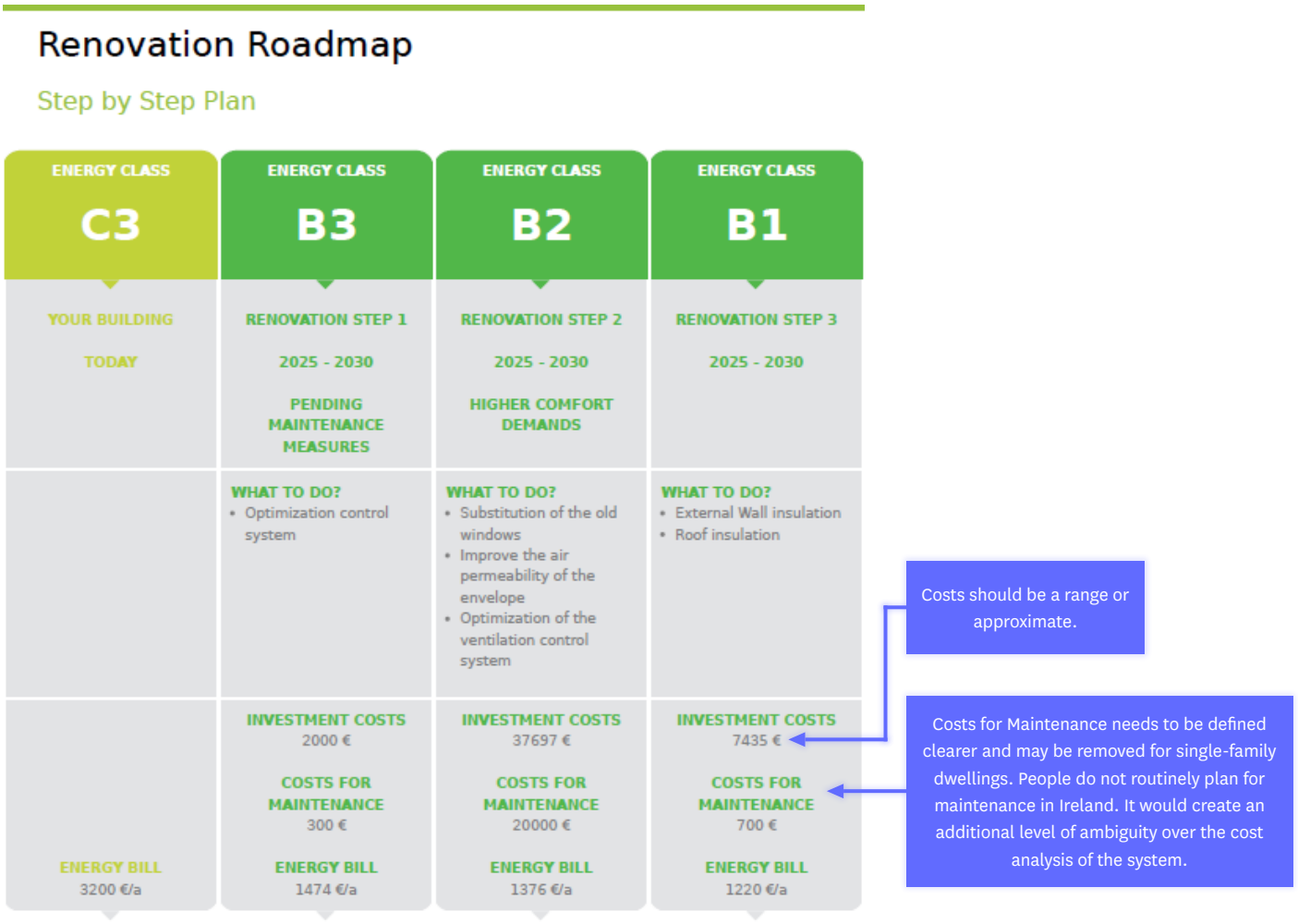


Fig. 1 – iBroad Roadmap Overview

- Auditor feedback was positive for this element of the roadmap (Very Useful – 40%, Rather useful – 60%).
- Homeowner feedback was very positive for this element of the roadmap (Very Useful – 59%, Rather useful – 41%).

Step by Step Plan

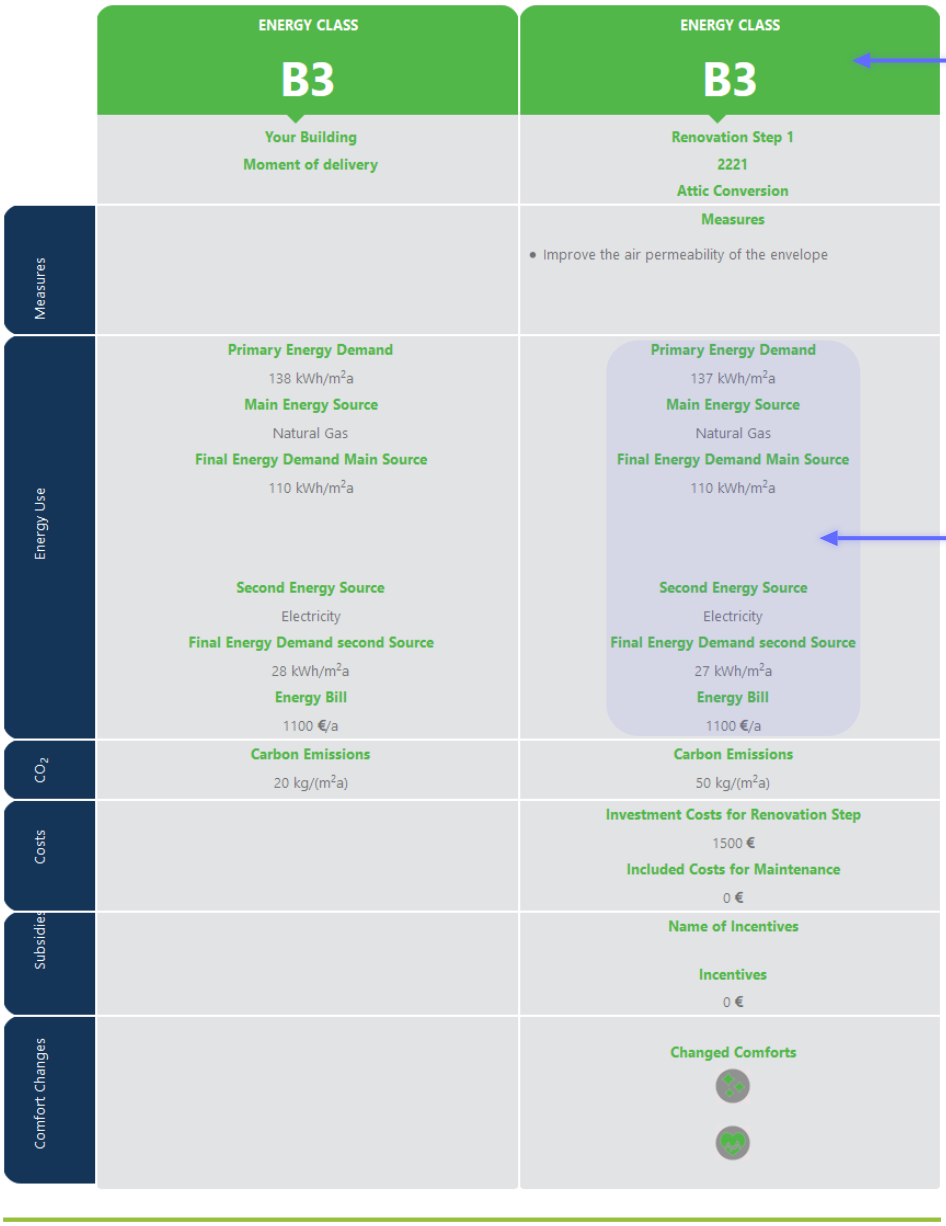


Fig. 2 – Detailed Renovation Roadmap

- Auditor feedback was positive for this element of the roadmap (Very Useful – 55%, Rather useful – 45%).
- Homeowner feedback was very positive for this element of the roadmap (Very Useful – 70%, Rather useful – 30%).

04. Current state of Building – Energy Rating

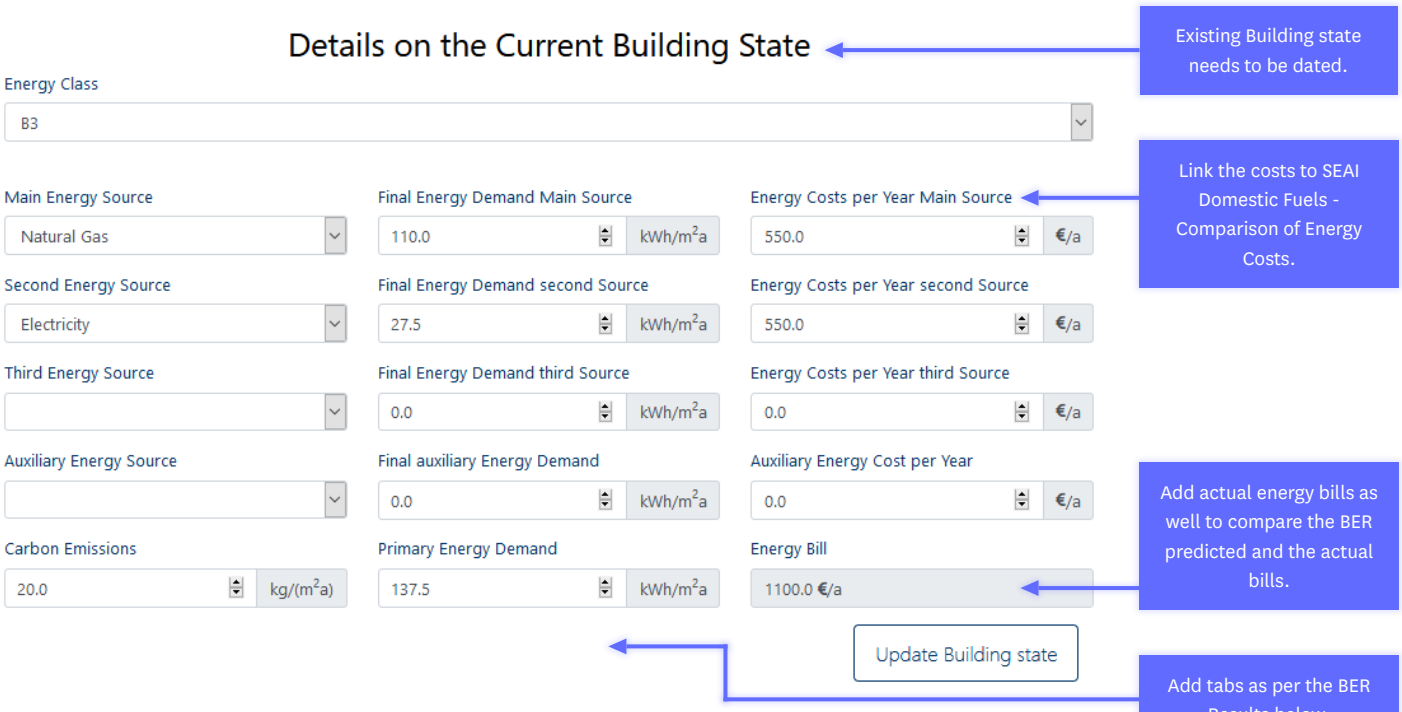


Fig. 3 – Details on the Current Building State – Energy Rating

- Auditor feedback was positive for this element of the roadmap (Very useful or rather useful – 88%, Less useful – 12%).
- Homeowner feedback was positive for this element of the roadmap (Very useful or rather useful – 94%, Less useful – 6%).

Results

	Delivered energy [kWh/y]	Primary energy [kWh/y]
Main space heating system	2215	2437
Secondary space heating system	0	0
Main water heating system	2610	2871
Supplementary water heating system	0	0
Pumps and fans	71	148
Energy for lighting	212	441
CHP input (individual heating systems only)	0	0
CHP electric output (individual heating systems only)	0	0
Renewable and energy saving technologies		
Energy produced and saved	1099	2285
Energy consumed by the technology	0	0
Total	4009	3611
Per m² floor area	43.47	39.15
Energy Rating	A2	

05. Current state of Building – Advice for User Influence

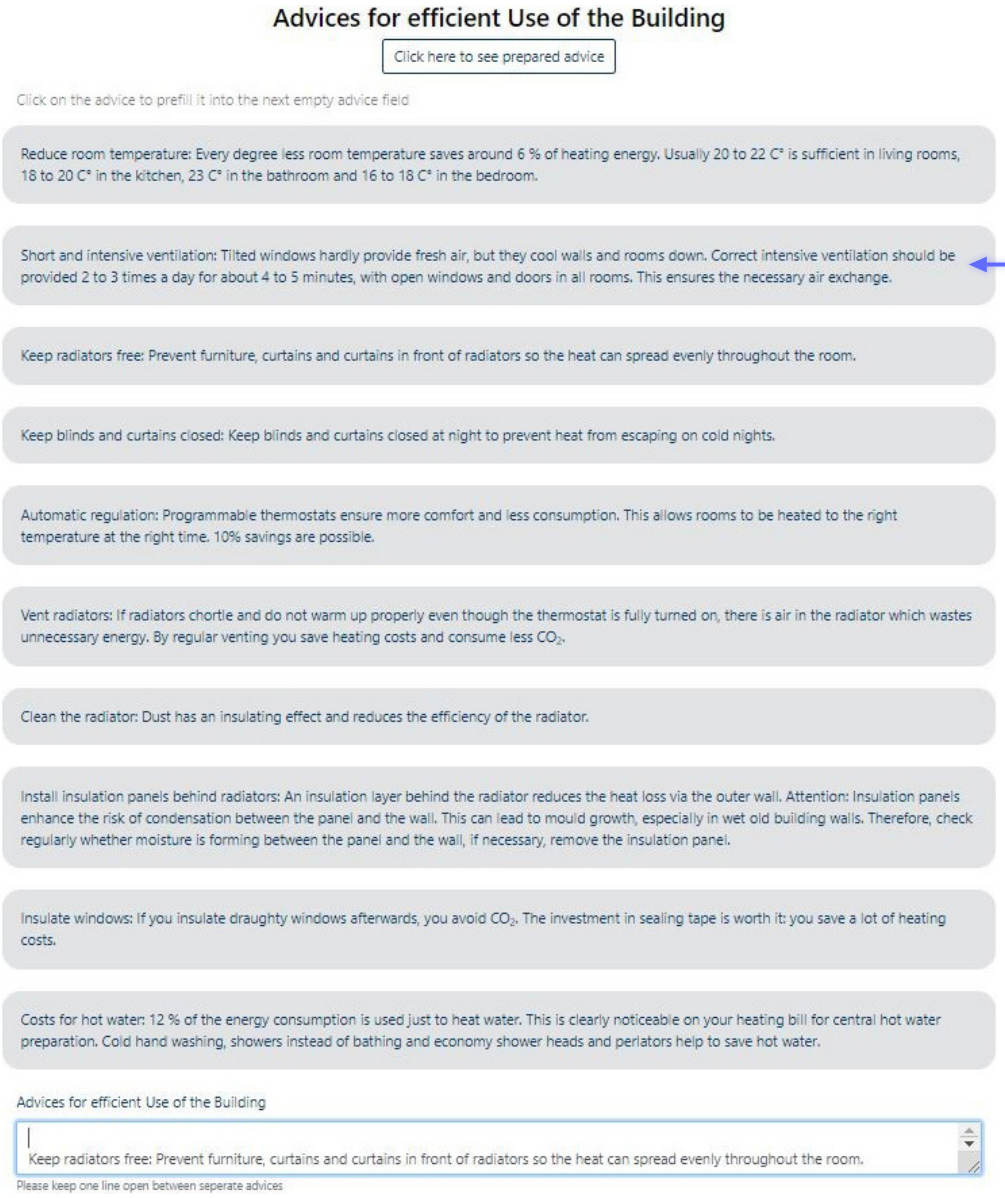


Fig. 4 – Details on the Current Building State – Advice for User Influence

- Auditor Feedback was mixed for this element of the roadmap (Very or rather useful – 74%, Less or not useful – 26%).
- Homeowner feedback was positive for this element of the roadmap (Very or rather useful – 82%, Less useful – 18%).
  - As this section does not quantify the advice relative to reduced running costs or capital costs it does not interest the Technical Assessor. But, homeowners do find it useful.

06. Details of renovations steps

The 5 elements of this section are: Description of measures, Renovation costs, Incentives, Energy Demand and Carbon Emissions.

Fig. 5 – Details on the Renovation Step

- Auditor feedback was positive across the 5 elements of the Renovation Step. Very Useful – 38-50%, Rather useful – 25-42%, Less useful – 38-12%, Not Useful 5%.
- Homeowner feedback was positive across the 5 elements of the Renovation Step. Very Useful – 25-70%, Rather useful – 12-58%, Less useful – 38-12%, Not Useful 6%.
  - ➔ Carbon emissions were the elements that scored lowest on “very useful” for homeowners.

Fig. 6 – Details on the Renovation Step

- Auditor feedback was mixed for technical details and notes. Very Useful – 38-50%, Rather useful – 25-42%, Less useful – 38-12%, Not Useful 5%.
- Homeowner feedback was positive for the technical details and notes. Very Useful 70%, Rather Useful 23%, Less useful – 7%.

08. LogBook – General and Administrative Information

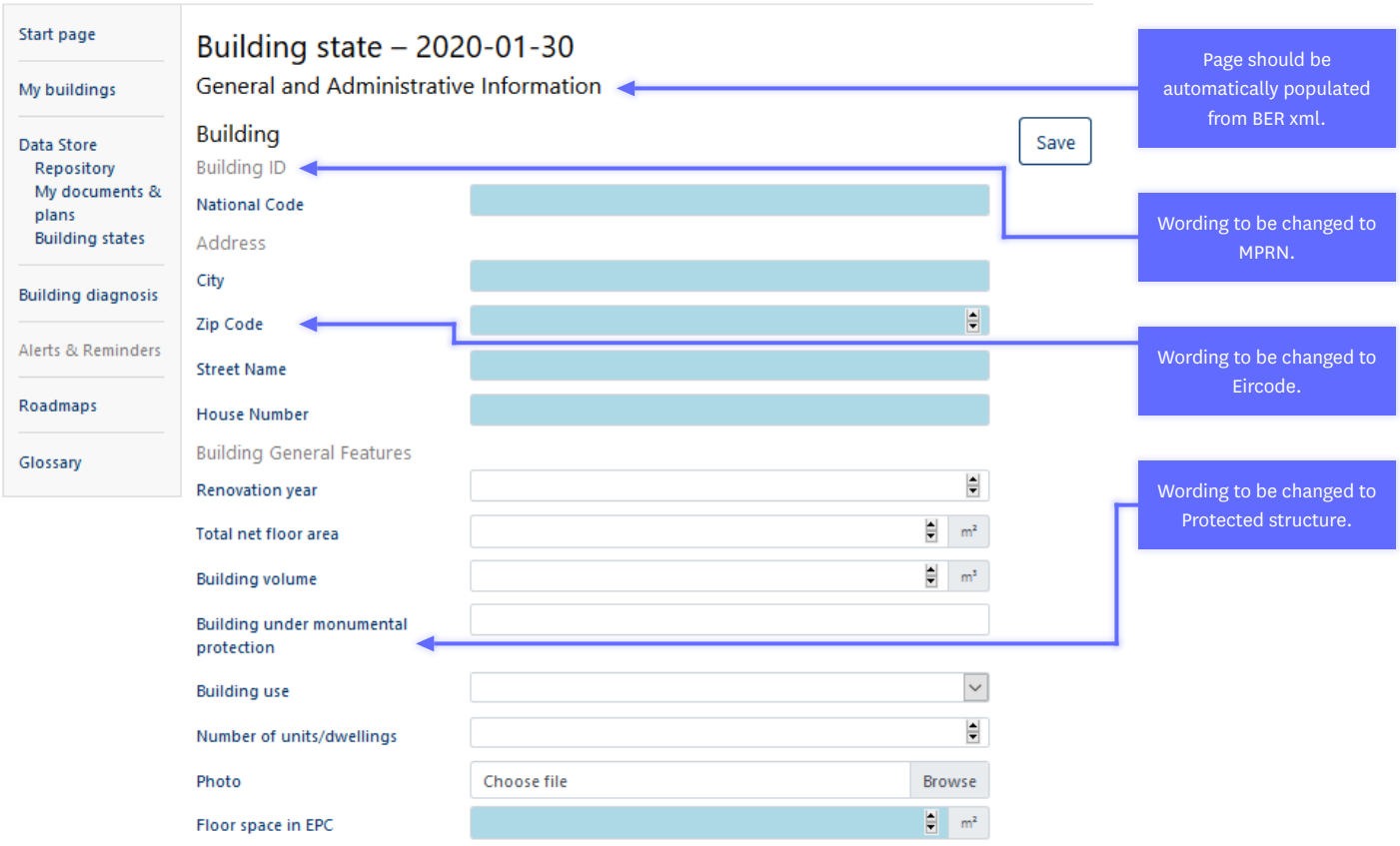


Fig. 7 – LogBook – General and Administrative Information

- Auditor feedback was positive for General Administrative Information. Very or rather useful – 85%, Less useful –15%
- Homeowner feedback was positive for General Administrative Information. Very or rather useful – 90%, Less useful –10%, Not Useful 0%.

09. LogBook – Building Construction Information

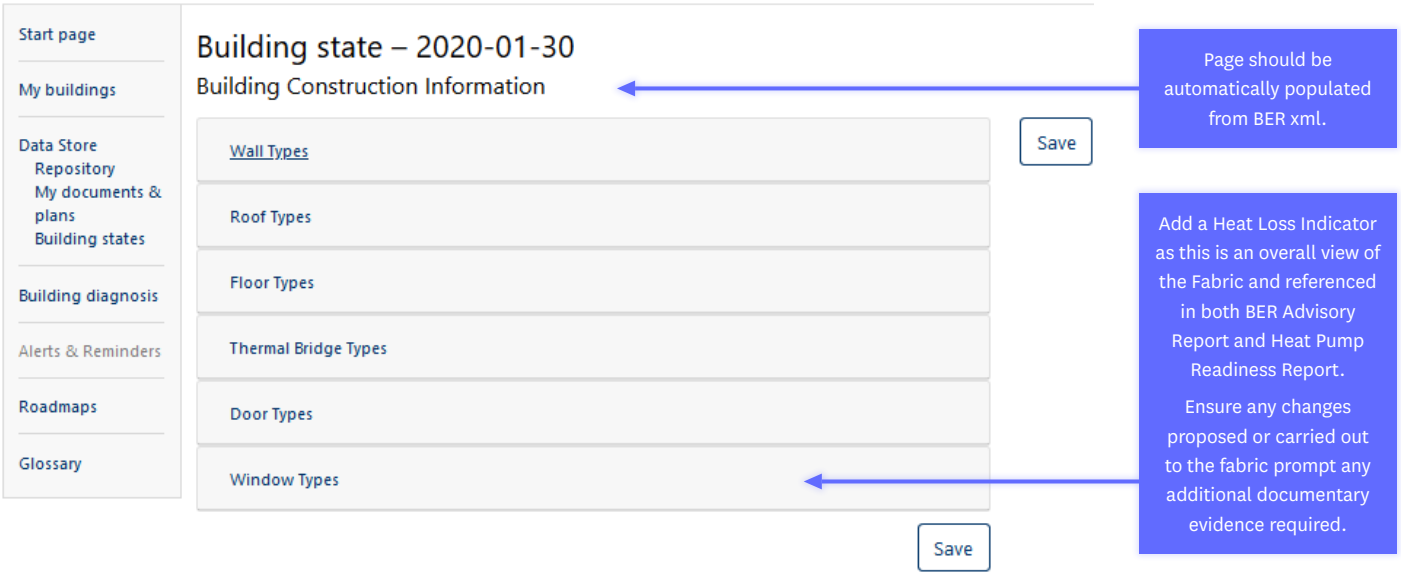


Fig. 8 – Logbook – Building Construction Information

- Auditors' feedback was very positive for Building Construction information. Very Useful – 60%, Rather useful – 25%, Less useful –15%, Not Useful 0%.
- Homeowner feedback was positive for Building Construction Information. Very Useful – 40%, Rather useful – 50%, Less useful –10%, Not Useful 0%.

10. LogBook – Building Operations and Use

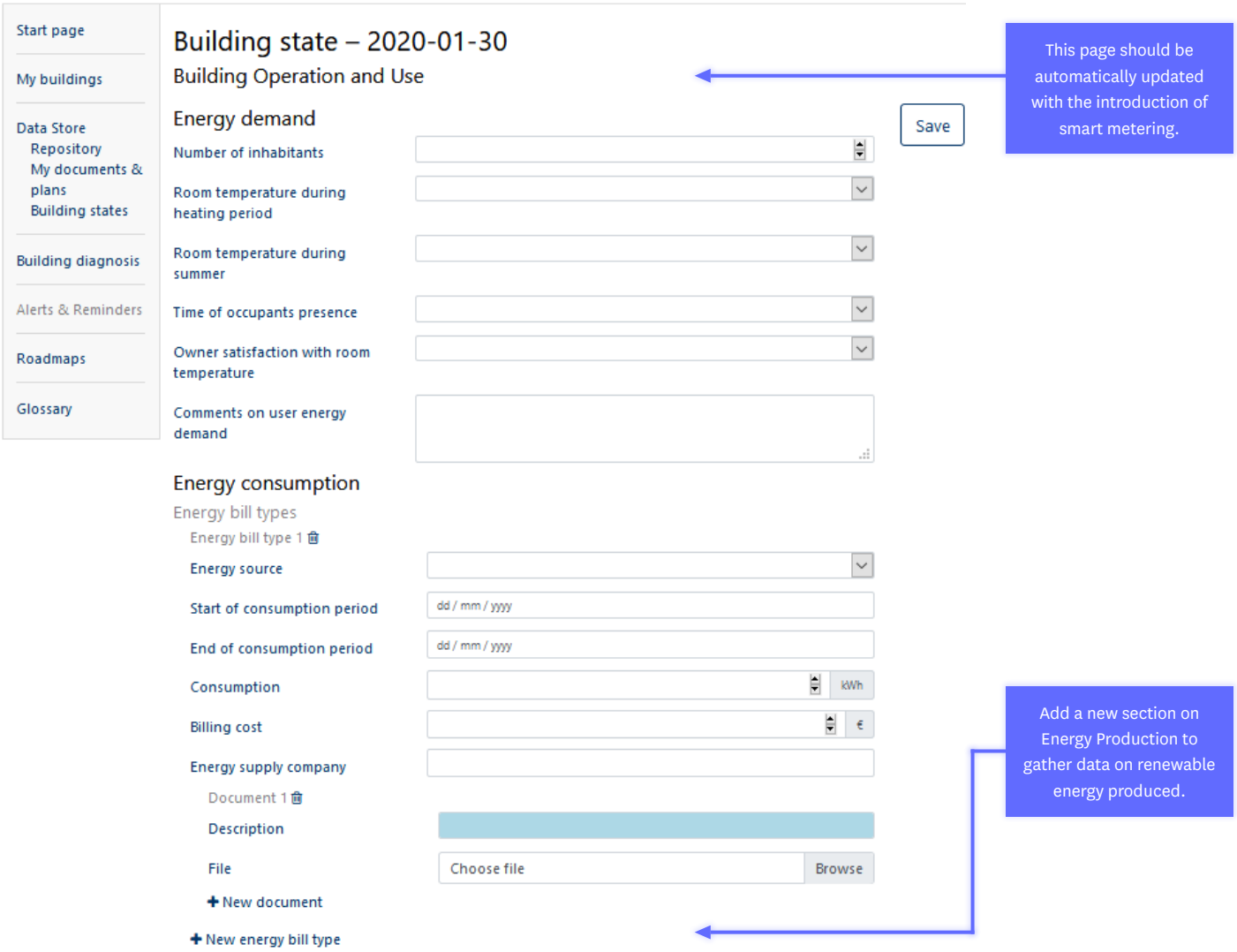


Fig. 9 – LogBook – Building Operation and Use

- Auditors' feedback was positive for Building operation and use. Very Useful – 35%, Rather useful – 55%, Less useful –5%, Not Useful 0%.
  - In particular, they felt this section was very important for analysing actual energy use and looking at ways to reduce it.
- Homeowners' feedback was positive for Building Operations and Use. Very Useful – 50%, Rather useful – 40%, Less useful –10%, Not Useful 0%.

11. LogBook – Building Equipment

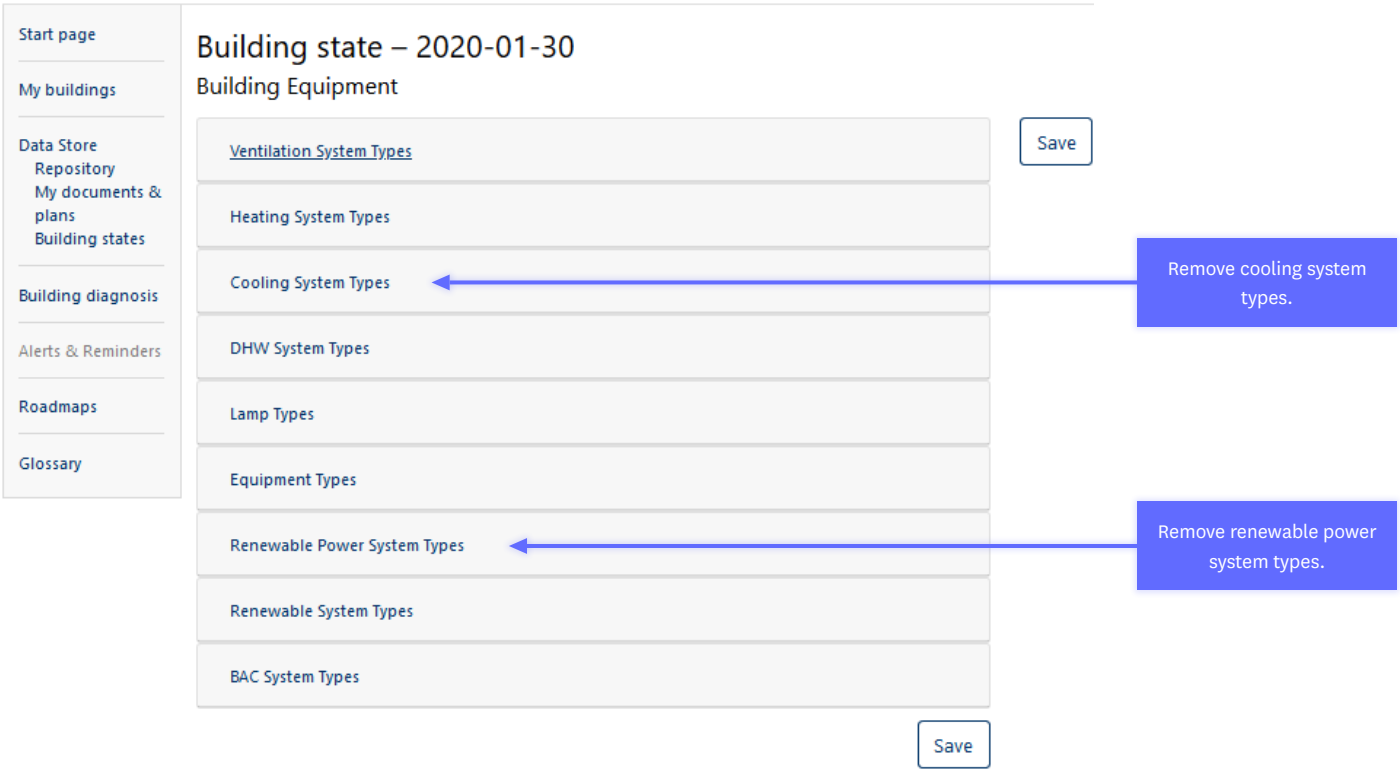


Fig. 10 – LogBook Building Equipment

Recommendations:

- Equipment Types should be limited to ventilation, heating (both hot water and space heating), lighting, Renewables, BAC System types.
- BAC System could feed into smart metering and SRI- Smart Readiness Indicator.
- Ideally there is no need to include cooling in Ireland and this should be designed out through passive cooling strategies.

12. LogBook – Building Energy Performance

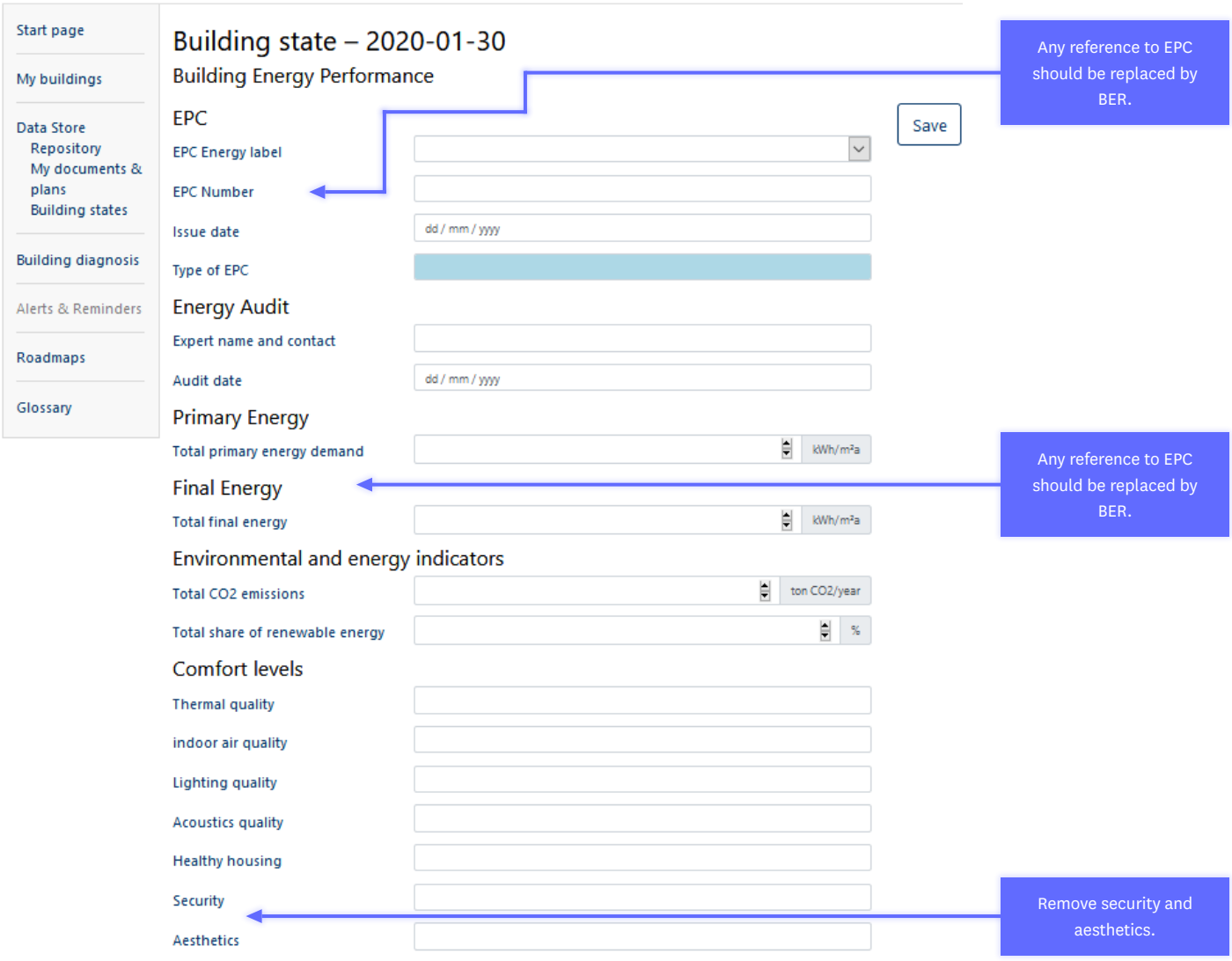


Fig. 11 – Building Energy Performance

- Auditor feedback was positive for Building Energy Performance. Very Useful – 35%, Rather useful – 55%, Less useful –5%, Not Useful 0%.
- Homeowner feedback was positive for Building Energy Performance. Very Useful – 40%, Rather useful – 50%, Less useful –10%, Not Useful 0%.

Recommendations:

- Security and aesthetics are personal and may vary within a household. It may distract from other aspects of the logbook that could be important with regard energy upgrades. It is hence suggested to remove it.

13. LogBook – Envelope Performance

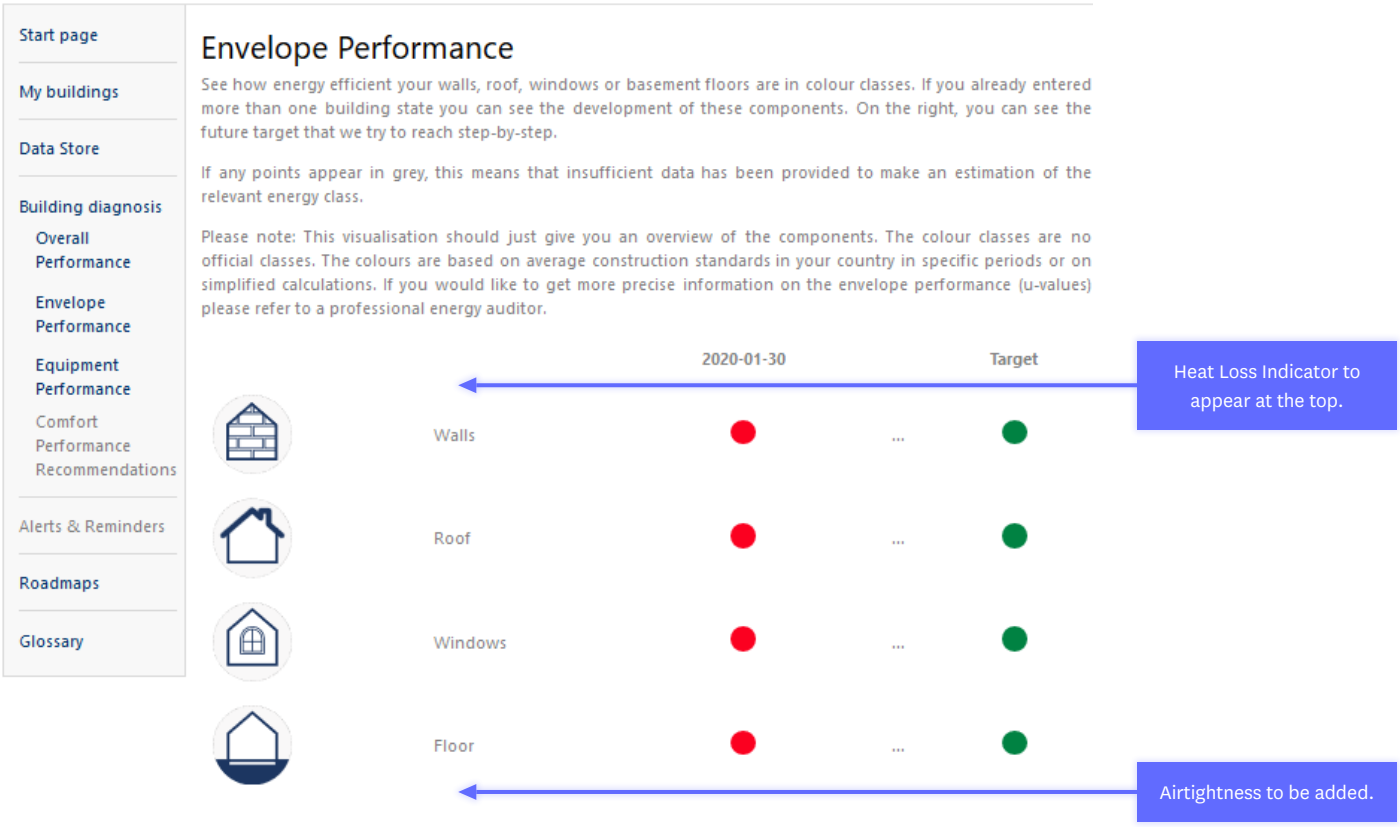


Fig. 12 – Logbook – Envelope Performance

- Auditors' feedback was very positive for Envelope Performance. Very Useful – 53%, Rather useful – 33%, Less useful –13%, Not Useful 0%.
- Homeowners' feedback was mixed for Building Energy Performance. Very Useful – 30%, Rather useful – 60%, Less useful –10%, Not Useful 0%.

Additional recommendations:

- Align the colours with the BER Advisory Report.

14. LogBook – Equipment Performance

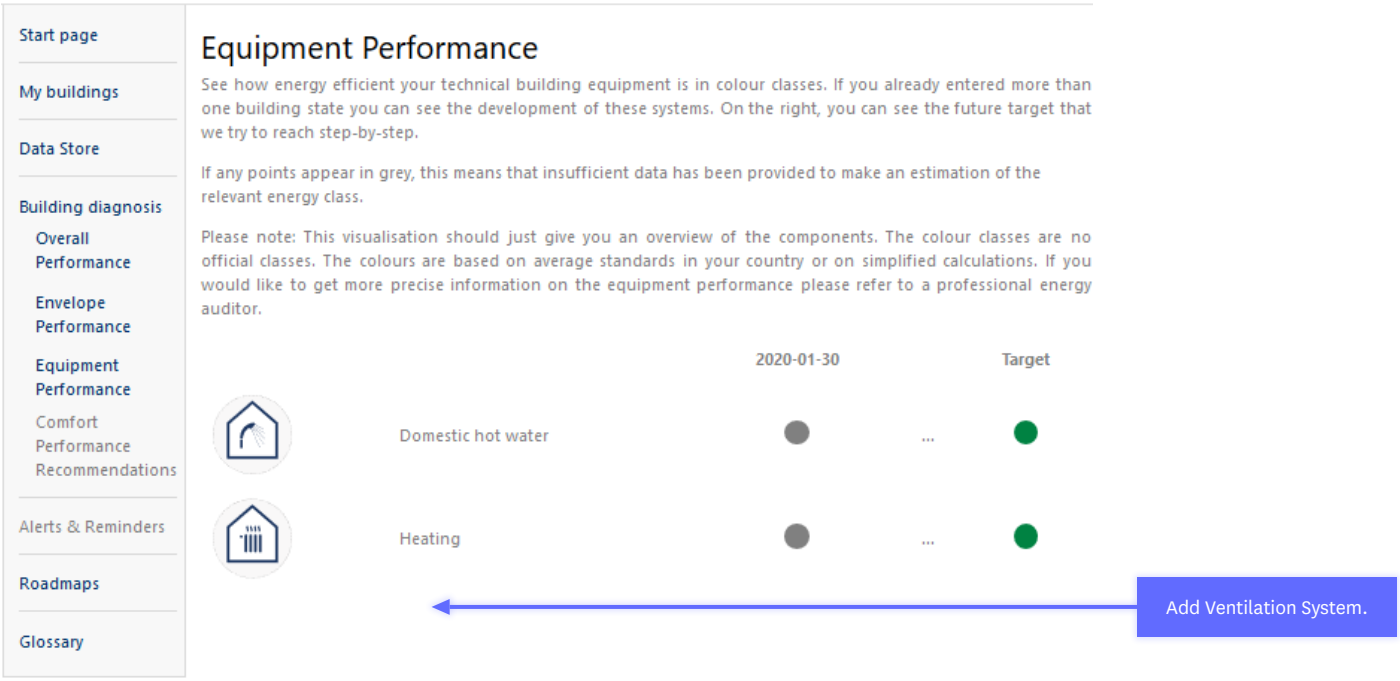


Fig. 13 – Logbook – Equipment Performance

- Auditors' feedback was positive for Equipment performance. Very Useful – 25%, Rather useful – 55%, Less useful –20%, Not Useful 0%.
- Homeowners' feedback was mixed for Equipment Performance. Very Useful – 20%, Rather useful – 50%, Less useful –30%, Not Useful 0%.

Additional recommendations:

- Align with the equipment as per BER Advisory Report which focuses mostly on heating and ventilation.
- Align with the colour coding of the BER Advisory Report.

15. Summary of suggested wording changes

	iBroad Reference	Change to
1	Energy Class	Energy Rating
2	Main Energy Source	Main Space Heating
3	Second Energy Source	Main Water Heating System
4	Third Energy Source	Secondary Space Heating System
5	Auxiliary Energy Source	Pumps and Fans + Energy for Lighting
6	Add	Renewable Energy
7	Add	Heat Loss Indicator

16. Automatic input of BER information through xml file

To reduce cost and to improve quality, the logbook, the roadmap and the DEAP (xml file) must be fully integrated.

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INTRODUCING BUILDING RENOVATION PASSPORTS IN IRELAND

Feasibility Study

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