



Handbook for Energy Auditors

Guidance and advice on how to create an iBRoad Individual Building Renovation Roadmap and how to use the iBRoad Building Logbook

ifeu – Institut für Energie- und Umweltforschung Heidelberg
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INTRODUCTION

What challenges need to be faced?

The building sector accounts for approximately 40 per cent of total energy consumption and 36 per cent of CO₂ emissions in the European Union. Currently, almost 75 per cent of the European building stock is not energy efficient, while the building renovation rate is very low. Roughly 97 per cent of the European Union's building stock, amounting to over 30 billion m² of living area, is not considered energy efficient and 75 per cent to 85 per cent of it will still be in use in 2050. Defining a pathway towards a 'highly efficient and decarbonised building stock by 2050' is a fundamental pillar of the revised Energy Performance of Buildings Directive (EPBD), requiring the transformation of the majority of buildings from highly inefficient to, at least, nearly zero-energy buildings (NZEBs). Deep building renovation, has the potential to lead to significant energy savings and to lower CO₂ emissions and thus, contributes to the energy and climate objectives at national and European level.

However, building owners face multiple barriers when planning a renovation, which they have to overcome to achieve this goal. Building renovation is often considered a burden usually associated with time-consuming planning, uncertainty about the costs and value of the planned measures, dust and unreliable professionals.

The iBRoad project

The iBRoad project funded by the Horizon 2020 European programme aims at overcoming and eliminating barriers to deep renovation and, at the same time, avoiding the risk of lock-in effects by developing, designing and demonstrating the concept of individual Building Renovation Roadmaps for residential buildings, combined with a digital repository of building-related information – the iBRoad

Logbook. Thus, the iBRoad project focuses on an evolution of existing energy audit products and Energy Performance Certificates (EPCs) in order to become a real driver for deep renovations.

Renovating a building can be very complex and time consuming. For building owners, the lack of knowledge about what to do, where to start and in which order to implement renovation measures, is one of the main obstacles to improve the energy performance of their buildings. For building owners, this uncertainty typically leads to limited renovations (e. g., one-to-one replacements or installation of easy measures only) or most often postponement with regard to renovation decisions. So far, appropriate tools, which drive deep renovations and turn them from "a nuisance" into an "opportunity to improve the home and the living environment" are widely lacking. The individual Building Renovation Roadmap developed in this project will serve as a tool outlining a customised renovation plan with a long-term horizon for deep step-by-step renovation of single- and two-family houses as well as small multi-family houses. The Individual Building Renovation Roadmap will allow building owners to have an overview over the full range of a renovation strategy adapted to their individual preferences. As a result, individual Building Renovation Roadmaps will facilitate the owners' decision to invest in deeper renovation.

In addition, the iBRoad Logbook will serve as sort of a building repository for the building owner where all building-related information can be stored digitally (e. g., energy bills, incentives, loan and tax documents). Also, the iBRoad Logbook will provide simple automated renovation recommendations, reminders for maintenance and, where possible, interfaces to national databases such as qualified craftsmen and building professionals.

PURPOSE OF THIS REPORT

This report shall enable you as energy auditor to help homeowners understand the importance of a long-term building renovation strategy by creation of an iBRoad Roadmap and an iBRoad Logbook. The present handbook will guide you through all necessary steps via short explanations and illustrations, and will explain the underlying fundamental principles that

should be observed in the process. Finally, the handbook will equip you with useful tips.

If you have questions do not hesitate to contact your regional iBRoad project partner (ADENE, KAPE or EnEffect). During the field test period the iBRoad country project partner will set up a hotline to clarify all upcoming questions.

KEY FACTS AT A GLANCE

The iBRoad Individual Building Renovation Roadmap

The iBRoad Individual Building Renovation Roadmap (short: the Roadmap) is a tool primarily intended for building owners, which provides a diagnosis on the building's overall performance, and delivers a customised and stepwise renovation plan for single-family houses as well as small multi-family houses over a long-term period (e. g., 5 – 30 years). The Roadmap shows how building owners or investors can improve the building both in terms of energetic as well as comfort aspects while ensuring to avoid unwanted so-called lock-in-effects and taking into account the preferences and capabilities of the building owner. Thus, it will allow building owners to have an overview of upcoming or pending renovation measures including additional

information e. g., information on how to finance and implement these actions, what are practicable “renovation steps” (renovation measures that should and can be combined) and what are the effects of implementation.

Essentially, your task as energy auditor is to support your client in specifying his or her vision of the house and in visualising retrofit implementation strategies. This requires high empathy, since you need to look over the technical aspects of the building as well as the living conditions of the residents. Both technical competence and human understanding are required here in order to create a trusting environment.

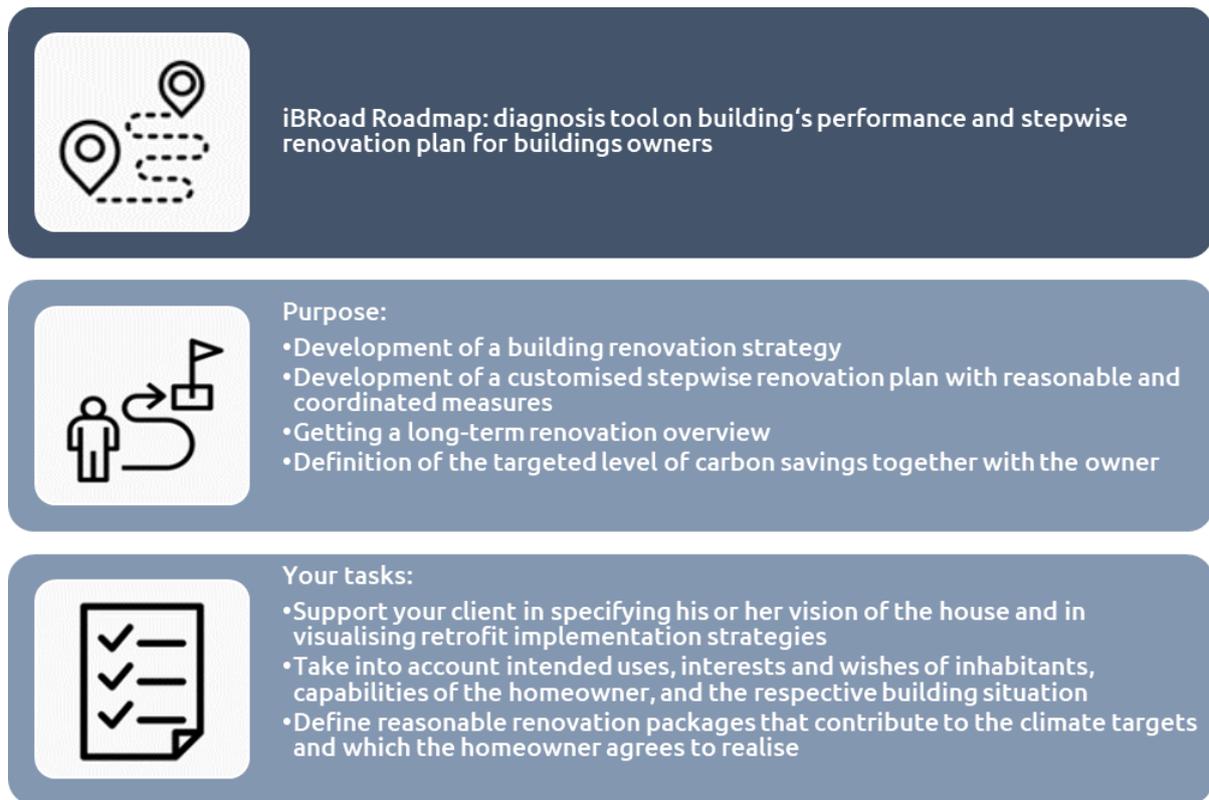


Figure 1: The iBRoad Roadmap: definition, purposes, and associated tasks and responsibilities at a glance.

The iBRoad Building Logbook

The iBRoad Building Logbook (short: the Logbook) serves primarily as sort of a building repository where all building-related information can be stored digitally (e.g., renovation measures, energy bills, incentives, loan and tax documents). Thus, the homeowner can keep track of everything. Main user of the Logbook is the building owner. However, he/she can grant access to third parties, for instance, energy auditors.

Within the iBRoad project, four main functionalities will be developed (ADENE et al. 2018):

1. Building data repository: this functionality allows the user to enter and view information in the Logbook data repository. Each change (e.g., renovation) is entered in a new building state while all older states are being saved. Step by step, the Logbook will grow with each new building state and "log" all changes in time.
2. Building diagnosis: this functionality allows displaying the actual building performance by showing the building's energy class (as stated, for instance, in the EPC). Furthermore, there is an assessment of the building's envelope and the building's equipment energy performance by showing a rating in a coloured scale. In addition, the homeowner is shown the energy consumption in relation to all buildings that also use the logbook.
3. Link to the iBRoad Roadmap: this functionality allows displaying both a summarised and a detailed overview of the iBRoad Roadmap if available.
4. Alerts and Reminders: this functionality is intended to motivate homeowners to undertake action in case of low energy performance of the building or building equipment. For instance, timely alerts for specific refurbishment or maintenance needed as well as for available financial

incentives relevant for the measure or action needed will be pop-up.

Many other functionalities can build upon the Logbook data in the future. The Logbook could for example provide interactive features to monitor and compare real energy consumption with calculated building energy demand and

send alerts in case of strange consumption patterns or flaws in technical installations. The data that is stored in the Logbook could also help to communicate with architects, craftsmen or public authorities through a so-called Market Place, where owners could also grant (partial) access to their data to third parties.

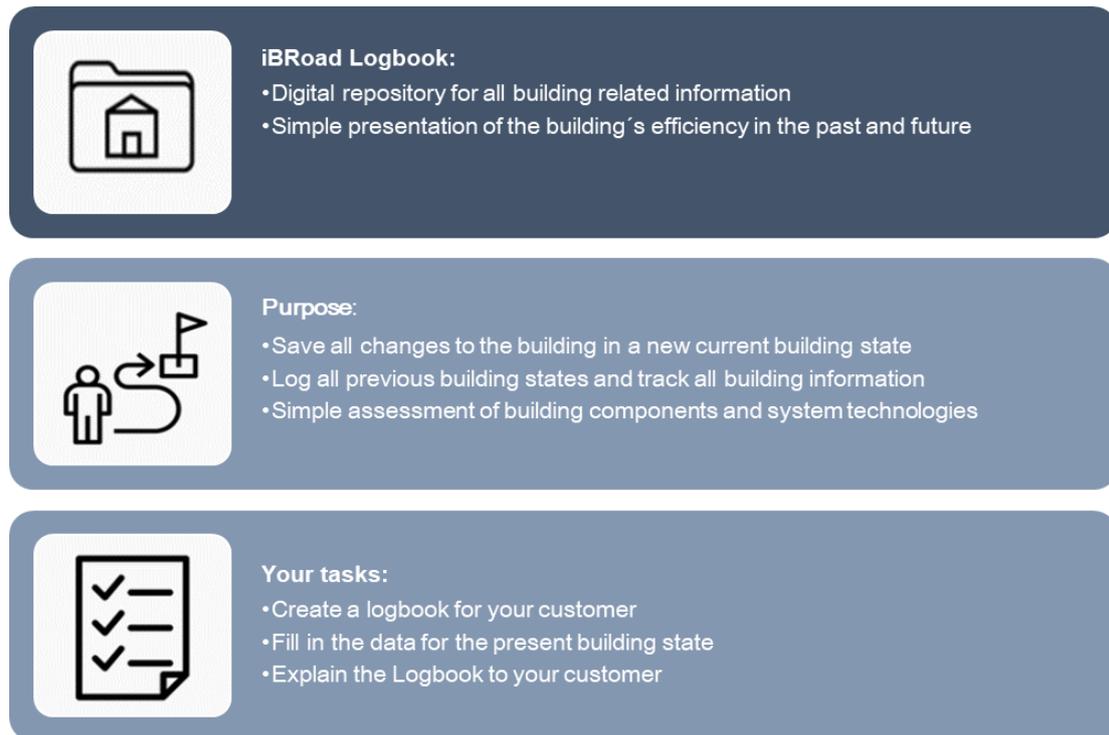


Figure 2: The iBRoad Logbook: definition, purposes, and associated tasks and responsibilities at a glance.

ROADMAP PRINCIPLES

When producing the Roadmap there are five basic principles to follow:

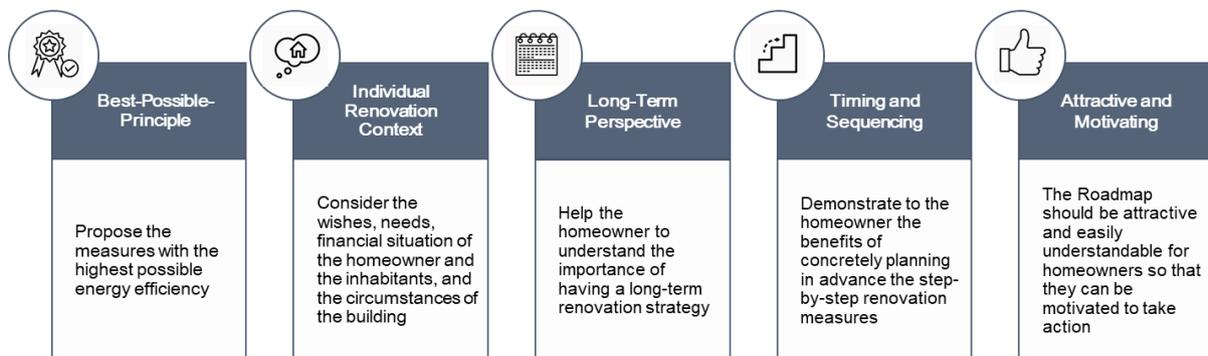


Figure 3: The iBRoad Roadmap Principles at a glance.

Best-Possible-Principle

Every building is unique. Therefore, it is not possible to formulate a universal target that applies to all buildings. However, all existing buildings in total must fulfil the target of a nearly climate-neutral building stock. Thus, you should pursue and propose the measures with the highest possible energy efficiency, taking into account the technical circumstances of the individual building and the preferences or financial capabilities of the owner – importantly, "best possible" does not mean "no matter how expensive". However, a renovation that is pending anyway is the best occasion to make a building fit for the future. A guiding approach should be, once a building component needs refurbishment to do it not only half way but future proof.

Individual Renovation Context

Assessing the homeowner's and building inhabitant's situation today and how it is expected in the future is essential. This includes, for instance, financial opportunities, comfort requirements, living space changes, or family planning (e. g. having a baby, children moving out or grandparents moving in).

Also, when creating the iBRoad Roadmap, you need to consider the circumstances of the respective building, e. g.: Are there weaknesses in the building requiring immediate or rapid action? Are there measures that lead with little effort to major improvements? The Roadmap should be based upon the homeowner's perspective. It is intended to support the homeowner, not oblige him.

Long-Term Perspective

It is important to pursue a long-term renovation strategy in order to avoid lock-in effects: Building components have a life span of 40 years or more. If the opportunity for the targeted standard is missed an additional renovation is needed later at extra cost.

Lock-in effects can occur in a step-by-step renovation when the interlinkage of components is not planned ahead: e. g., if you renovate a roof think of a sufficient overhang for a future wall insulation. To avoid unwanted lock-in effects, you will find a list of typical renovation situations to pay attention to in a later chapter of the handbook.

Timing and Sequencing

Often, renovations cannot be carried out in a single operation so that many buildings are only renovated partially. In many cases, the financial situation of the homeowner does not allow comprehensive refurbishment at once. However, a step-by-step renovation does not mean that it is not as good as a renovation at once. In contrast, early replacement of components can also lead to economic losses. A step-by-step renovation, however, is also possible with limited budget. Summarising, also a step-by-step modernisation leads to the final goal, if each renovation step is well planned and takes into account every next step.

Attractive and Motivating

The Roadmap needs to be attractive and easily understandable for homeowners in order to motivate them to take action. Therefore, make sure that you use, for instance, pictures whenever appropriate to illustrate specific situations and pay attention to comprehensibility. Building owners have to be guided throughout the Roadmap process and receive clear indications so that they can take action without feeling lost. The homeowner should recognise his own wishes, needs and future plans in the Roadmap.

HOW THE ROADMAP IS PRODUCED

Five steps towards the Roadmap

1



Initial contact: As a first step, raise awareness for the Roadmap: inform your clients about the possibility of getting a Roadmap, what it is, and which associated advantages it provides. Importantly, in the pilot phase of the iBRoad project the Roadmap is free of charge for homeowners. If your clients are interested, make an appointment with him/her to examine his/her building and to find out the homeowners' and inhabitants' preferences.

2



On-site visit: In the second step, it is getting practical: It is your turn to inspect and examine the building and its components. This part is not different from your normal energy auditor's examination. For the purpose of the Roadmap, however, you should also figure out what is the homeowner's relevant situation today (e.g. financial opportunities) and what is expected and wished for the future (e.g. individual preferences and comfort requirements). To support you in this task a blank template of the Roadmap is provided.

3



Calculation of the building with your national calculation software: As a next step and starting point for the technical modelling of the Roadmap, your task is to model the present building state as it is today (the u-values of the building envelope, the heating demand, the efficiency of the heating system, etc.) with the help of your national calculation software.

4



Definition of renovation steps: Based on the current energy demand and the detected weak points of the building, in combination with the wishes and preferences of the building owner, you should define useful renovation measures to combine and also adequate points in time when these renovations should be carried out. Also, financing advice and information on support schemes should be considered.

5



Production of the Roadmap in the iBRoad Roadmap Assistant: With the energy demand of the present building state and after composing the renovation steps, you are now able to produce the Roadmap within the iBRoad Roadmap Assistant – a tool that supports you in displaying and printing the Roadmap and also supports you with preconfigured text blocks.

Roadmap Steps in Detail

Step 1: initial contact

As a first step, raise awareness for the Roadmap among your clients: inform them about the possibility of getting a Roadmap, what the tool provides and what are its purposes as well as the associated advantages. The summarised benefits of the Roadmap for the homeowner below might help you in your argumentation.

Also, the country partners (EnEffect, KAPE and ADENE) within the iBRoad project context will serve as multipliers to accelerate the awareness of the Roadmap among building owners.

Importantly, within the context of the iBRoad project the Roadmap is free of charge for homeowners. Also, for the purposes of the iBRoad context, you should observe that clients who are interested in a Roadmap should

consent to take part in the upcoming evaluation. Please indicate that all necessary data security will be observed.

If your clients are interested in the Roadmap make an appointment with him/her to examine his/her building and to find out the homeowners' and inhabitants' preferences, relevant situation, future wishes and capabilities.

Also, you can already prepare a few things: inform the building owner in advance that available documents such as building descriptions, planning protocols or energy bills will be helpful to you. This may reduce your effort of data acquisition in the following steps and provides you with helpful approaches for a target-oriented argumentation.

Benefits of the Roadmap for the Homeowner at a Glance

- **Long-term building overview:** The Roadmap easily enables the homeowner to get a long-term overview of the energetic improvement of his/her building, its comfort status, and its design possibilities.
- **Individual tailored renovation strategy:** The Roadmap is individually tailored to the homeowner's building and the living conditions of the owner. The financial possibilities and expectations of the owner will be taken into account in the whole renovation strategy, and thus, there will be no overburdening.
- **High standard of efficiency and comfort:** With the step-by-step renovation method, the Roadmap displays to the house owner, that he/she can bring his/her building to a high standard of efficiency and comfort without overburdening.
- **Cost saving:** The long-term perspective of the Roadmap allows component connections to be planned in advance, interfaces between the trades to be described and subsequent changes to previous refurbishment steps to be avoided as far as possible. This can save considerable costs.

Step 2: on-site visit

In this step, a comprehensive inventory needs to be composed: It is your turn to inspect and examine the home owner's building and the building components (e. g. u-values of walls, windows, roof, etc., available heating and ventilation, weaknesses of the building etc.). Perhaps, performance measurements with regard to the energy consumption will be necessary and also, you might have to measure thicknesses of insulation layers or the size of surfaces, etc.

If you take pictures of the building and its components, the Roadmap can be enhanced with these. In this way appealing Roadmap might lead to a higher implementation rate.

Also, it is essential that you figure out the homeowner's and building habitants' preferences and wishes for the future (e. g., with regard to comfort requirements) as well as relevant situation today (e. g., financial opportunities). Your task is to develop a rough step-by-step renovation concept together with

Checklist for the on-site visit

- ✓ What does the homeowner feel disturbing about his/her current living situation?
- ✓ Is it mostly too warm or too cold in the house?
- ✓ Will there be changes in the living situation with regard to the building or are changes foreseeable (e. g. child birth, children moving out, grandparents moving in etc.)?
- ✓ What are the homeowner's and habitants' preferences in comfort?
- ✓ What kind of measures does the homeowner plan to undertake anyway?
- ✓ What measures is the homeowner interested in anyway?
- ✓ Is a certain system technology preferred by the homeowner?
- ✓ Which renewable energy source is the homeowner interested in?
- ✓ Does the owner face a problem with moisture or mould?
- ✓ Is the ambient air polluted or is there a lot of noise outside?
- ✓ Are there foreseeable occasions, when future renovation steps can be carried out preferably concerning the living situation of the owner or user, or periods in which renovation is inappropriate?
- ✓ Are there weak points in the building that require rapid action?
- ✓ Are there any measures that lead to major improvements with little effort?
- ✓ Are there any measures that can be carried out at any time without preconditions?
- ✓ Which components and systems of the building will soon reach the end of their life cycle? Which components and systems can probably be used longer?
- ✓ Which components and systems should be renovated simultaneously for physical or technical reasons, even if their life span has not reached the end yet?
- ✓ In which technically useful order should the components and systems be renovated?

the homeowner taking into account the individual capabilities and preferences. The plan has to regard the living habits of the owners. You may judge, which habits would be very helpful to change and which of them have to be considered in the roadmap.

The checklist of relevant questions could guide you through this part of your on-site visit.

Additionally, you can also use the blank template to develop a first sketch of the Renovation Roadmap during the on-site visit. It shows the components of the building in rows as well as one row for the whole building and one row for the inhabitants of the building. The time scale starts on the left with the year of construction of the building and ends on the right. You can define together with the homeowner which period should be considered. As the Renovation Roadmap intends to provide a long-term overview, the period might range from 5 to 30 years. You can proceed with the blank template as follows:

- Write the original year of construction of the building into the row "building" to the very left. This is the starting point.
- Enter the years when single components have been renovated or exchanged in the past into the respective row of the component.
- Add the usual life spans of the components to their last years of renovation to estimate when the next renovation is due (e.g., 20 years for heating boilers). You may also ask for the homeowner's estimation, which renovation measures are pending.
- Together with the homeowner, you can develop an overview over short-, mid- and long-term renovation measures.
- You should also ask the homeowner for opportunities in his personal life that he can already foresee and that might influence the renovation measures. You can enter such occasions into the row for inhabitants.

The sketch in the blank template should support you with the definition of the renovation steps.


Blank Template

	year of construction	
		
building		
		
inhabitants		
		
roof		
		
outer walls		
		
windows / doors		
		
floor/cellar		
		
heating system		
		
domestic hot water		
		
ventilation		
		
cooling		

Figure 4: Blank template to develop a first sketch of the Roadmap during the on-site visit


Blank Template

	year of construction	Past	Future	
	1970			
building				
				
inhabitants				
				
roof				
				
outer walls				
				
windows / doors				
				
floor/cellar				
				
heating system				
				
domestic hot water				
				
ventilation				
				
cooling				

Handwritten notes on the template:

- Past:** 1970 (building), 1992 new boiler (domestic hot water), 2010 new windows (windows / doors)
- Future:** 2019 (building), 2025 ~ 2030 (roof), 2028 life insurance (circled), 2028 X PV ←? (roof), X (outer walls), insulate cellar (floor/cellar), new boiler (heating system), new heat? pump (heating system)

Figure 5: Example use of a blank template

Step 3: calculation of the present building state

As starting point for the technical modelling of the Roadmap, you need to model the present

building state with the help of your national calculation/simulation software, see Figure 6.



Figure 6: National Calculation/Simulation Software Tools

This comprises the building envelop with surface areas and u-values, the heating system, domestic hot water, ventilation and cooling according to your national requirements. You can use EPC data, if available and up to date. If an EPC is not available or not up-to-date, you need to specify the components and the respective surfaces, technical data, etc.

Based on this calculation, the final and primary energy demand, the actual energy costs, the CO₂ emissions and the energy label of the building (if nationally defined) can be provided. This information will be fed in to the roadmap assistant as the ‘present building state’ using the online interface.

Step 4: definition of renovation steps

Based on the current energy demand and the detected weak points of the building in combination with the wishes and preferences of the building owner, it is now your turn to define appropriate so-called “renovation steps”. These can consist of one or more renovation measures. The following questions might guide you through the definition of renovation steps:

- Can the owner implement measures that are independent from the age of a building component (e.g. insulation of the cellar ceiling)? Such measures might be implemented already in the first step.
- Are there measures that provide considerable energy savings at low investment cost? Such measures should preferably be implemented in the first step.
- Do the owners complain about specific comfort aspects, e.g. draught or summer

heat? Measures that highly improve the comfort should rather be implemented in one of the first steps.

- Are there components that need to be renovated or exchanged anyway in the near future? It is much easier and cheaper to implement efficiency measures together with pending maintenance.
- When will components need maintenance in the future according to their specific life span? Usually, this can only be defined as a period of time but not as a specific year (e.g. 2030 – 2035).
- Are there technical needs that require a specific order of renovations (e.g. first insulation of the walls, second new heating system)? Some renovations are much easier if they are combined (e.g. insulation of the walls together with new windows to enable high quality connections between components).

Please estimate a suitable period or point in time for the implementation for each renovation step. This can be either a fixed date (e.g. 2025), a period (e.g. 2023 – 2025) or a specific trigger (e.g. when the boiler needs to be replaced, when the children move out). These implementation dates are important to keep the overview over pending measures. The time schedule also enables you to decide whether measures that follow in a short period of time could be combined. Financing is usually a very important information for homeowners. Please name the total investment cost for each renovation step as well as the energy related cost and incentives, if available.

Example: A typical renovation step could be the exchange of single-glazed windows in combination with the insulation of the outer walls. Another example would be to combine the exchange of the boiler with a solar thermal collector and the optimisation of the radiators, including a hydraulic balancing of the system.

Based on technical life spans and individual wishes, you can decide the best order of renovation steps and thus, build up a long-term strategy. All renovation steps should be discussed with the building owner to reassure his acceptance. However, you as an auditor have deeper technical knowledge and background insight about interdependencies that need to be considered. Accordingly, you

can explain to the owner the reasons why you chose a certain order of the renovation steps.

Using the same national calculation software as in step 3, you should calculate the energy demand after the implementation of each renovation step. The resulting energy demand can then be submitted to the iBRoad Roadmap Assistant (see step 5).

Example: If the first renovation step in a building was the insulation of the roof, you can copy the calculation of the present building state from step 3 and enter the new u-value of the roof. You can feed the new energy demand after the roof insulation from the calculation software into the iBRoad Roadmap Assistant as "Energy demand after step 1". If the second step was the exchange of the heating system, you copy the calculation of step 1 and replace the heating system in your calculation software, calculate the resulting energy demand and submit this as "Energy demand after step 2" to the iBRoad Roadmap Assistant.

At the end, one building renovation plan with specific directions and advices based on previous discussions between you and the homeowner should be provided. You should investigate and compare different options and pathways. But one default iBRoad-Roadmap, being your recommendation, should be presented. The iBRoad-Roadmap must include a calculation/estimation of cost of measures/renovation steps (see step 5).

Step 5: production of the Roadmap with the iBRoad Roadmap Assistant

After defining all renovation steps and completing all energy calculations for the steps in your national calculation software, you are able to produce the Roadmap with the help of the iBRoad Roadmap Assistant (short: Roadmap Assistant).

The Roadmap Assistant is an online tool to produce the Roadmap in a standardised layout, which was developed in the iBRoad project. The

Roadmap Assistant asks you to enter all relevant data to create the Roadmap. The Roadmap Assistant guides you through the whole process and enables you to easily fill in all required data (e.g., through dropdown menus and pre-formulated text blocks). In the following section you will get instructions on how to use the Roadmap Assistant. Figure 7 illustrates the Roadmap Assistant navigation menu.

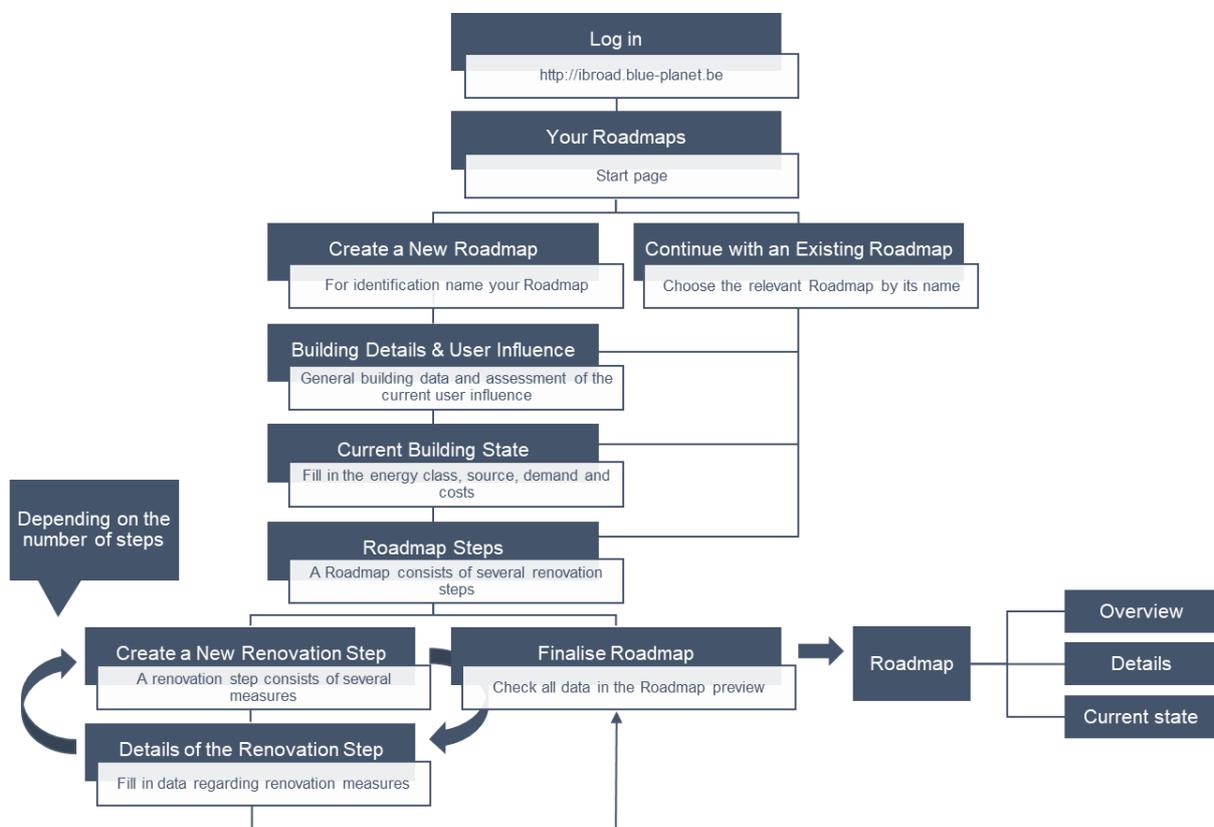


Figure 7: Roadmap Assistant navigation menu

Log in to the Roadmap Assistant



To enter the Roadmap Assistant (Figure 8), use the following URL address, usernames and passwords. Please note, that it is necessary to fill in a

username and a password twice. After that, you will be directed to the welcome page of the Roadmap Assistant, see Figure 9.

Log in data for the Roadmap Assistant

- **URL address:** <https://ibroad.blue-planet.be/>
- **Username 1:** credentials available upon request in order to control and monitor access
- **Password 1:** as above
- **Username 2:** your email address
- **Password 2:** your password

The screenshot shows a login form with the following elements:

- Title:** Log in
- Email field:** Labeled 'Email', containing the text 'user_2@mail.com'.
- Password field:** Labeled 'Password', containing masked characters (dots).
- Remember me:** A checkbox labeled 'Remember me' which is currently unchecked.
- Log in button:** A button labeled 'Log in' located at the bottom right of the form.

Figure 8: Log in Roadmap Assistant



iBRoad Plan your roadmaps log out

Logged in successfully. ×

Welcome to the iBRoad Roadmap Assistant!

What is iBRoad and what is the iBRoad Roadmap Assistant?

iBRoad is a new project funded by the Horizon 2020 European programme, aimed at exploring, designing, developing and demonstrating the concept of individual Building Renovation Roadmaps. Renovating a building can be complex and time consuming. For building owners, the lack of knowledge about what to do, and in which order to implement renovation measures, is one of the main obstacles to improving the energy performance of their building. The iBRoad project works on lifting these barriers by developing an Individual Building Renovation Roadmap for single- and small multifamily houses. The individual Building Renovation Roadmap looks at the building as a whole, and provides a customised renovation plan over a long-term horizon considering the occupant's needs and specific situation (e.g. age, financial situation, composition and expected evolution of the household, etc.) and avoids the risk of 'lock-in' future renovation solutions due to a lack of foresight. The iBRoad Roadmap Assistant is a tool which assists in the production of the individual Building Renovation Roadmap. It allows you to enter all building relevant information and supports you by defining renovation steps and measures.

[View Roadmaps](#)

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Figure 9: Welcome page of the Roadmap Assistant

Your Roadmaps



At first after you logged in, you will be directed to a front-end page with the name "Your Roadmaps". If you want to create a new Roadmap for a new client, you start with naming your Roadmap (e. g., use the client's surname). If you already created

some Roadmaps and you want to continue with an existing one, you click on the button "Continue with existing Roadmap". Figure 10 illustrates the front-end page for creating a new Roadmap.


Your Roadmaps [log out](#)

Create New Roadmap

Name of Roadmap

Create New Roadmap



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Figure 10: Front-end page "Your Roadmap" in the Roadmap Assistant

Building Details and User Influence



At first, general building data such as the building address is required in order to identify the examined building, see Figure 11. Please fill in all required fields. For the purpose of an appealing Roadmap, please

upload a picture showing the relevant building. There is also possibility to upload several pictures, e.g., showing the building from various viewpoints or pictures of building components.

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Building Address

Street: Number: Postal Box:

Municipality: Zip Code: Country:

Building Facts

Subtitle: 

Subtitle: 

Subtitle: 

Subtitle: 

Number of Residential Units: Building Type:

Living Space Area: m² Year of Construction of the Building:

Year of Construction of the Heating System: Year of Construction of the Cooling System:

Renewable Energies:

Number of Floors: Previous Renovations:

Figure 11: Front-end page "Building Details" in the Roadmap Assistant

Following, there is a section focusing on the user influence, see [Figure 12](#). Your Roadmap should always reflect the building habitants' specific situation. Thus, please fill in the required information regarding e.g. the number of habitants, time of occupants' presence or ventilation, hot water use and heating habits.

Please note, that all input fields refer to the current state. Also, please choose relevant advices for the specific case from the provided default text blocks. You can select several advices that are suitable, and which will be subsequently shown in the Roadmap. You also have the possibility to add your own advices for the homeowners.

User Influence

Assessing the user influence is very important in producing the Renovation Roadmap. The Roadmap should always reflect the occupants needs and specific situation.

Please note that the following input fields all refer to the **current building state**.

<p>Number of Inhabitants</p> <input style="width: 90%;" type="text" value="2"/>	<p>Room Temperature during Heating Period</p> <input style="width: 90%;" type="text" value="few rooms warmer than 23°C, rest cooler"/>
<p>Time of Occupants Presence</p> <input style="width: 90%;" type="text" value="usually in the morning and in the evening"/>	<p>Hot Water Use Habits</p> <input style="width: 90%;" type="text" value="several persons take a shower daily and take a bath at least once a w"/>
<p>Ventilation Use Habits</p> <input style="width: 90%;" type="text" value="during heating period one window open for several hours per day"/>	<p>Owner Satisfaction with Room Temperature</p> <input style="width: 90%;" type="text" value="hard to adjust - either too hot or too cold"/>

Advices for efficient Use of the Building

[Click here to see prepared advice](#)

Click on the advice to prefill it into the next empty advice field

Reduce room temperature: Every degree less room temperature saves around 6 % of heating energy. Usually 20 to 22 C° is sufficient in living rooms, 18 to 20 C° in the kitchen, 23 C° in the bathroom and 16 to 18 C° in the bedroom.

Short and intensive ventilation: Tilted windows hardly provide fresh air, but they cool walls and rooms down. Correct intensive ventilation should be provided 2 to 3 times a day for about 4 to 5 minutes, with open windows and doors in all rooms. This ensures the necessary air exchange.

Keep radiators free: Prevent furniture, curtains and curtains in front of radiators so the heat can spread evenly throughout the room.

Keep blinds and curtains closed: Keep blinds and curtains closed at night to prevent heat from escaping on cold nights.

Automatic regulation: Programmable thermostats ensure more comfort and less consumption. This allows rooms to be heated to the right temperature at the right time. 10% savings are possible.

Vent radiators: If radiators chortle and do not warm up properly even though the thermostat is fully turned on, there is air in the radiator which wastes unnecessary energy. By regular venting you save heating costs and consume less CO₂.

Clean the radiator: Dust has an insulating effect and reduces the efficiency of the radiator.

Install insulation panels behind radiators: An insulation layer behind the radiator reduces the heat loss via the outer wall. Attention: Insulation panels enhance the risk of condensation between the panel and the wall. This can lead to mould growth, especially in wet old building walls. Therefore, check regularly whether moisture is forming between the panel and the wall, if necessary, remove the insulation panel.

Insulate windows: If you insulate draughty windows afterwards, you avoid CO₂. The investment in sealing tape is worth it: you save a lot of heating costs.

Costs for hot water: 12 % of the energy consumption is used just to heat water. This is clearly noticeable on your heating bill for central hot water preparation. Cold hand washing, showers instead of bathing and economy shower heads and perlaters help to save hot water.

Advices for efficient Use of the Building

Reduce room temperature: Every degree less room temperature saves around 6 % of heating energy. Usually 20 to 22 C° is sufficient in living rooms, 18 to 20 C° in the kitchen, 23 C° in the bathroom and 16 to 18 C° in the bedroom.

Please keep one line open between separate advices

Figure 12: Front-end page "User Influence" in the Roadmap Assistant

Current Building State



In the next step, you will be directed to the front-end page "Current Building State", see Figure 13. Please

fill in all required fields regarding the buildings' energy class, energy source(s), energy demand(s) and energy costs.

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Please enter the current Building State ✕

Create current Building State

[← back to building](#)

Energy Class:

Main Energy Source: <input type="text" value="Natural Gas"/>	Final Energy Demand Main Source: <input type="text" value="200"/> kWh/m ² a	Energy Costs per Year Main Source: <input type="text" value="4000"/> €/a
Second Energy Source: <input type="text"/>	Final Energy Demand second Source: <input type="text" value="0"/> kWh/m ² a	Energy Costs per Year second Source: <input type="text" value="0"/> €/a
Third Energy Source: <input type="text"/>	Final Energy Demand third Source: <input type="text" value="0"/> kWh/m ² a	Energy Costs per Year third Source: <input type="text" value="0"/> €/a
Auxiliary Energy Source: <input type="text" value="Electricity"/>	Final auxiliary Energy Demand: <input type="text" value="30"/> kWh/m ² a	Auxiliary Energy Cost per Year: <input type="text" value="600"/> €/a
Carbon Emissions: <input type="text" value="40"/> kg/(m ² a)	Primary Energy Demand: <input type="text" value="250"/> kWh/m ² a	Energy Bill: <input type="text" value="4600"/>

[Create Building State](#)

Figure 13: Front-end page "Current Building State" of the Roadmap Assistant

Roadmap Steps



Now you are ready to enter the front-end page "Renovation Steps", see

Figure 14. Essentially, the Renovation Steps are the core of the Roadmap.

The screenshot shows the iBRoad Plan web interface. At the top left is the iBRoad Plan logo, and at the top right is a user menu with 'Your Roadmaps' and 'log out'. Below the header is a breadcrumb trail: 'You are here / 190211_Example_Handbook 2'. The main heading is 'Roadmap: 190211_Example_Handbook' with a pencil icon. Below this are three links: 'Edit Building', 'Edit Current building state', and 'Show Roadmap Preview for Building Owner'. The section title is 'Renovation Steps'. There are two buttons: 'Create new Renovation Step' and 'Finalize Roadmap' (which has a checkmark icon). At the bottom, there is a European Union logo and a disclaimer: 'This project has received funding from the European Union's HORIZON 2020 research and innovation programme under grant agreement No 754045. The sole responsibility for the content of this website lies with the authors. It does not necessarily reflect the opinion of the European Union. Neither the EASME nor the European Commission are responsible for any use that may be made of the information contained therein.' Below the disclaimer is a row of logos for various partners including sympleon, ire, ifre, TU, INZEB, EnEffect, and others.

Figure 14: Front-end page “Renovation Steps” of the Roadmap Assistant

By clicking on the button “Create New Renovation Step”, you enter a page (see Figure 15) where you should fill all relevant data

regarding your predefined first renovation step. Please note that a renovation step can consist of several renovation measures.

Example: Roadmap Step 1

 You examined your clients’ building and determined that the existing heating system consumes too much energy and costs too much money. In the page “New Renovation Step” (Figure 15), please enter the trigger for the renovation step and the approximate renovation time. In our example, the trigger could be “Pending Maintenance Measures” and the approximate

renovation time could be “When Boiler needs to be exchanged”.. Please also fill in all required fields regarding the building state after renovation. Under "Economic Analysis" you can enter incentives if available for the renovation step. This incentive refers to the entire renovation step. When editing the measures (Figure 18), it is possible to specify individual incentives.


Your Roadmaps [log out](#)

You are here / [Test_Brüssel](#)

New Renovation Step

Trigger for Renovation Step

Estimated Date for Renovation Step

Building State after Renovation

Energy Class

Main Energy Source <input type="text"/>	Final Energy Demand Main Source <input type="text" value="0"/> kWh/m ² a	Energy Costs per Year Main Source <input type="text" value="0"/> €/a
Second Energy Source <input type="text"/>	Final Energy Demand second Source <input type="text" value="0"/> kWh/m ² a	Energy Costs per Year second Source <input type="text" value="0"/> €/a
Third Energy Source <input type="text"/>	Final Energy Demand third Source <input type="text" value="0"/> kWh/m ² a	Energy Costs per Year third Source <input type="text" value="0"/> €/a
Auxiliary Energy Source <input type="text"/>	Final auxiliary Energy Demand <input type="text" value="0"/> kWh/m ² a	Auxiliary Energy Cost per Year <input type="text" value="0"/> €/a
Carbon Emissions <input type="text" value="0"/> kg/(m ² a)	Primary Energy Demand <input type="text"/> kWh/m ² a	Energy Bill <input type="text" value="0.0"/> €/a

Economic Analysis

Name of Incentives

Incentives

 €

The incentives relate to the complete renovation step, not only to a single measure.

Conditions of Incentives

Figure 15: Front-end page “New Renovation Step” of the Roadmap Assistant

Additional benefits

Aesthetics

Improved architectural Quality and Prestige of the Building

Health

Reduction of indoor Humidity, Mold and Toxins

Noise Protection

Reduction of Noise Immissions

Security

Improved Protection against Burglary and Theft

Thermal Comfort

Reduction of Draught, Overheating and Cold

Indoor Air Quality

High indoor Air Quality

Lighting

More efficient Lighting, higher Amount of Daylight and better Illumination.

Create Renovation step

Figure 16: Front-end page "Additional benefits" in the Roadmap Assistant

Usually energy renovations provide also additional benefits that go beyond energy savings. Mostly, these benefits refer to improved living comfort. For many building owners, these benefits are a major motivation. In the Roadmap, the additional benefits are shown for each renovation step (Figure 16). You can simply enter a brief description how a renovation step contributes to higher comfort and the specific icon will appear in the Detailed Roadmap in the right step.

For example: If in a renovation step the walls should be insulated the appearance and aesthetics of the building will improve. You can enter 'Refurbishment of the façade, thus,

optical improvement of the building' into the field next to the icon. In the Roadmap the comfort improvement will be shown in two pages:

- the icon for improved aesthetics will show in the detailed Roadmap in the specific step (Figure 22),
- the icon and the text you entered will show in the detailed description of the renovation step (Figure 23).

All details of the renovation step are now shown in "Detail of the Renovation (Figure 17).


Your Roadmaps [log out](#)

You are here / 190211_Example_Handbook / Renovation Step 1

Detail of the Renovation - Renovation Step 1

Measures

Name	Actions
Add a thermal solar system	✎✕

[✎ edit this Renovation Step](#)

[Create new Measure](#)

Trigger for Renovation Step: Pending Maintenance Measures

Estimated Date for Renovation Step: When Boiler needs to be exchanged

Building State after Renovation

Energy Class		
E		
Primary Energy Demand		
210.0		
Main Energy Source	Final Energy Demand Main Source	Energy Costs per Year Main Source
Natural Gas	200.0 kWh/m ² a	2000.0 €/a
Second Energy Source	Final Energy Demand second Source	Energy Costs per Year second Source
Solar and Ambient Energy	15.0 kWh/m ² a	0.1 €/a
Auxiliary Energy Source	Final auxiliary Energy Demand	Auxiliary Energy Cost per Year
Electricity	15.0 kWh/m ² a	300.0 €/a
Carbon Emissions	Primary Energy Demand	Energy Bill
30.0 kg/(m ² a)	210.0 kWh/m ² a	2300.1 €/a

Economic Analysis

Investment Costs for Renovation Step	Included Costs for Maintenance
10000.0 €	15000.0 €
Name of Incentives	Incentives
KWK	5000.0 €
Conditions of Incentives	

[← back](#)

[Go to Overview](#)

[Create next Renovation Step](#)

Figure 17: Front-end page "Detail of the Renovation" in the Roadmap Assistant


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Edit Measure

You are here / 190211_Example_Handbook / Renovation Step 1 / Add a thermal solar system

Level 0

Heating, Ventilation and Cooling ▼

Level 1

Heating ▼

Level 2

Add a renewable energy sources ▼

Level 3

Add a thermal solar system ▼

Note Dropdown

▼

Note

Lorem ipsum dolor sit amet, consetetur sadipscing elitr, sed diam nonumy eirmod tempor invidunt ut labore et dolore magna aliquyam erat, sed diam voluptua. ⋮

Improvement

Lorem ipsum dolor sit amet, consetetur sadipscing elitr, sed diam nonumy eirmod tempor invidunt ut labore et dolore magna aliquyam erat, sed diam voluptua. At vero eos et accusam et justo duo dolores et ea rebum. Stet clita kasd gubergren, no sea takimata sanctus est Lorem ipsum dolor sit amet. ⋮

Technical Details

Lorem ipsum dolor sit amet, consetetur sadipscing elitr, sed diam nonumy eirmod tempor invidunt ut labore et dolore magna aliquyam erat, sed diam voluptua. At vero eos et accusam et justo duo dolores et ea rebum. Stet clita kasd gubergren, no sea takimata sanctus est Lorem ipsum dolor sit amet. ⋮

<p>Incentives Information only relating to this Measure</p> <div style="border: 1px solid #ccc; height: 30px; width: 100%;"></div>	<p>Specific Incentive Bonus</p> <div style="display: flex; align-items: center;"> <input style="width: 80%; border: 1px solid #ccc;" type="text" value="0"/> <div style="margin-left: 10px;"> ⬇ ⬆ ⬇ </div> <div style="margin-left: 10px;">€</div> </div>
<p>Renovation Costs</p> <div style="display: flex; align-items: center;"> <input style="width: 80%; border: 1px solid #ccc;" type="text" value="10000"/> <div style="margin-left: 10px;"> ⬇ ⬆ ⬇ </div> <div style="margin-left: 10px;">€</div> </div>	<p>Included Costs for Maintenance</p> <div style="display: flex; align-items: center;"> <input style="width: 80%; border: 1px solid #ccc;" type="text" value="15000"/> <div style="margin-left: 10px;"> ⬇ ⬆ ⬇ </div> <div style="margin-left: 10px;">€</div> </div> <p style="font-size: small; margin-top: 5px;">Share of the Renovation Costs that is needed anyway to maintain the Building</p>

Update Measure

← back

Figure 18: Front-end page "Edit Measure" in the Roadmap Assistant

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You are here / [190211_Example_Handbook](#)

Roadmap: 190211_Example_Handbook

[Edit Building](#) |
 [Edit Current building state](#) |
 [Show Roadmap Preview for Building Owner](#)

Renovation Steps

Renovation Step 1	Add a thermal solar system	Edit Measures	
Renovation Step 2	External Wall insulation	Edit Measures	
Renovation Step 3	Roof insulation Substitution of the old windows	Edit Measures	
Renovation Step 4	Substitution of the heating system by a heating pump Installation of a heat recovery unit	Edit Measures	

Create new Renovation Step
✓ Finalize Roadmap

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Figure 19: Front-end page "Renovation Steps" in the Roadmap Assistant

You can enter additional renovation steps by clicking 'create new renovation step' and then enter the specific data of the further steps in the same manner as for the first step. All renovation steps are now visible in the page "Renovation Steps" (Figure 19). After you have entered all the required data, you can view all pages of the completed roadmap online with a click on 'Show Roadmap Preview for Building Owner'. This link will open the Roadmap as the homeowner will see it (Figure 20 - 23). In this Roadmap form, no changes can be edited. If corrections should be necessary,

they can be made on the input pages. To check the results, just create new output pages.

If all data is correct, you can finalise the Roadmap with the respective button. Changes can still be entered in the usual way; however, a warning will pop up at the top of the page.

Usually, the iBRoad Renovation Roadmap is meant to be an online tool. If a paper copy is required, you can make a screenshot or use the print command of your browser. However, the Roadmap is not optimised for a specific paper format.



Figure 20: Output page "Home-Page" in the iBRoad Plan

If you click on the single Roadmap pages you can see all the data that you entered in the

frontend. The information is now shown in the unified iBRoad design output pages.

Current State

Your Building Today



House_side 1



Hous_side 2



House_side 3



House_side 4

<p>ENERGY CLASS</p> <p>G</p>	<p>Building Data</p> <p>Year of Construction of the Building</p> <p>1994</p> <p>Building Type</p> <p>Single Family House</p> <p>Number of Floors</p> <p>3</p> <p>Number of Residential Units</p> <p>1</p> <p>Living Space Area</p> <p>250 m²</p> <p>Previous Renovations</p>	<p>User Influence on Energy</p> <p>Attendance Time</p> <p>Hot Water Use Habits</p> <p>several persons take a shower daily and take a bath at least once a week</p> <p>Ventilation Use Habits</p> <p>during heating period one window open for several hours per day</p>	<p>Technical Data</p> <p>Renewable Energies</p> <p>Year of Construction of the Heating System</p> <p>1994</p> <p>Energy Bill</p> <p>4600 €/a</p>
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User Influence

Even your behaviour influences energy use. Here are some pointers to lower your total energy use.



Reduce room temperature: Every degree less room temperature saves around 6 % of heating energy. Usually 20 to 22 C° is sufficient in living rooms, 18 to 20 C° in the kitchen, 23 C° in the bathroom and 16 to 18 C° in the bedroom.



Short and intensive ventilation: Tilted windows hardly provide fresh air, but they cool walls and rooms down. Correct intensive ventilation should be provided 2 to 3 times a day for about 4 to 5 minutes, with open windows and doors in all rooms. This ensures the necessary air exchange.



Vent radiators: If radiators chortle and do not warm up properly even though the thermostat is fully turned on, there is air in the radiator which wastes unnecessary energy. By regular venting you save heating costs and consume less CO₂.

Figure 21: Output page "Current State" in the iBRoad Plan

Detailed Renovation Roadmap

Step by Step Plan

	ENERGY CLASS G	ENERGY CLASS E	ENERGY CLASS D	ENERGY CLASS B	ENERGY CLASS A
	Your Building Moment of delivery	Renovation Step 1 When Boiler needs to be exchanged	Renovation Step 2 2025 - 2030	Renovation Step 3 2030 - 2035	Renovation Step 4 2035 - 2040
Measures		Measures <ul style="list-style-type: none"> Add a thermal solar system 	Measures <ul style="list-style-type: none"> External Wall insulation 	Measures <ul style="list-style-type: none"> Substitution of the old windows Roof insulation 	Measures <ul style="list-style-type: none"> Installation of a heat recovery unit Substitution of the heating system by a heating pump
Energy Use	Primary Energy Demand 250 kWh/m ² a	Primary Energy Demand 210 kWh/m ² a	Primary Energy Demand 160 kWh/m ² a	Primary Energy Demand 100 kWh/m ² a	Primary Energy Demand 100 kWh/m ² a
	Main Energy Source Natural Gas	Main Energy Source Natural Gas	Main Energy Source Natural Gas	Main Energy Source Natural Gas	Main Energy Source Electricity
	Final Energy Demand Main Source 200 kWh/m ² a	Final Energy Demand Main Source 200 kWh/m ² a	Final Energy Demand Main Source 150 kWh/m ² a	Final Energy Demand Main Source 80 kWh/m ² a	Final Energy Demand Main Source 30 kWh/m ² a
	Final Energy Demand second Source 0 kWh/m ² a	Final Energy Demand second Source 15 kWh/m ² a	Final Energy Demand second Source 15 kWh/m ² a	Final Energy Demand second Source 15 kWh/m ² a	Final Energy Demand second Source 15 kWh/m ² a
	Auxiliary Energy Source Electricity	Auxiliary Energy Source Electricity	Auxiliary Energy Source Electricity	Auxiliary Energy Source Electricity	Auxiliary Energy Source Electricity
	Final auxiliary Energy Demand 30 kWh/m ² a	Final auxiliary Energy Demand 15 kWh/m ² a	Final auxiliary Energy Demand 15 kWh/m ² a	Final auxiliary Energy Demand 15 kWh/m ² a	Final auxiliary Energy Demand 15 kWh/m ² a
	Energy Bill 4600 €/a	Energy Bill 2300 €/a	Energy Bill 1800 €/a	Energy Bill 1100 €/a	Energy Bill 900 €/a
CO ₂	Carbon Emissions 40 kg/(m ² a)	Carbon Emissions 30 kg/(m ² a)	Carbon Emissions 20 kg/(m ² a)	Carbon Emissions 10 kg/(m ² a)	Carbon Emissions 10 kg/(m ² a)
Costs		Investment Costs for Renovation Step 10000 €	Investment Costs for Renovation Step 2500 €	Investment Costs for Renovation Step 25000 €	Investment Costs for Renovation Step 26000 €
		Included Costs for Maintenance 15000 €	Included Costs for Maintenance 20000 €	Included Costs for Maintenance 40000 €	Included Costs for Maintenance 26000 €
Subsidies		Name of Incentives KWK	Name of Incentives	Name of Incentives KWK	Name of Incentives
		Incentives 5000 €	Incentives 0 €	Incentives 10000 €	Incentives 0 €
Comfort Changes		Changed Comforts	Changed Comforts 	Changed Comforts  	Changed Comforts 

Figure 22: Output page "Detailed Renovation Roadmap" in the iBRoad Plan

Details of the renovation Roadmap

Renovation Step 4

ENERGY CLASS	Measure	Installation of a heat recovery unit
A	Improvement	Lorem ipsum dolor sit amet, consetetur sadipscing elitr, sed diam nonumy eimod tempor invidunt ut labore et dolore magna aliquyam erat, sed diam voluptua. At vero eos et accusam et justo duo dolores et ea rebum. Stet clita kasd gubergren, no sea takimata sanctus est Lorem ipsum dolor sit amet.
Renovation Step 4 2035 - 2040	Technical Details	Lorem ipsum dolor sit amet, consetetur sadipscing elitr, sed diam nonumy eimod tempor invidunt ut labore et dolore magna aliquyam erat, sed diam voluptua. At vero eos et accusam et justo duo dolores et ea rebum. Stet clita kasd gubergren, no sea takimata sanctus est Lorem ipsum dolor sit amet.
Primary Energy Demand 100 kWh/m ² a	Renovation Costs	8000 €
Main Energy Source Electricity	Included Costs for Maintenance	8000 €
Final Energy Demand Main Source 30 kWh/m ² a		
Final Energy Demand second Source 15 kWh/m ² a		
Auxiliary Energy Source Electricity	Measure	Substitution of the heating system by a heating pump
Final auxiliary Energy Demand 15 kWh/m ² a	Improvement	Lorem ipsum dolor sit amet, consetetur sadipscing elitr, sed diam nonumy eimod tempor invidunt ut labore et dolore magna aliquyam erat, sed diam voluptua. At vero eos et accusam et justo duo dolores et ea rebum. Stet clita kasd gubergren, no sea takimata sanctus est Lorem ipsum dolor sit amet.
Energy Bill 900 €/a	Technical Details	Lorem ipsum dolor sit amet, consetetur sadipscing elitr, sed diam nonumy eimod tempor invidunt ut labore et dolore magna aliquyam erat, sed diam voluptua. At vero eos et accusam et justo duo dolores et ea rebum. Stet clita kasd gubergren, no sea takimata sanctus est Lorem ipsum dolor sit amet.
Carbon Emissions 10 kg/(m ² a)	Renovation Costs	18000 €
Investment Costs for Renovation Step 26000 €	Included Costs for Maintenance	18000 €
Included Costs for Maintenance 26000 €		
Name of Incentives		
		Lorem ipsum dolor sit amet, consetetur sadipscing elitr, sed diam nonumy eimod tempor invidunt ut labore et dolore magna aliquyam erat, sed diam voluptua. At vero eos et accusam et justo duo dolores et ea rebum. Stet clita kasd gubergren, no sea takimata sanctus est Lorem ipsum dolor sit amet.

Previous Steps Benefits

Aesthetics



Refurbishment of the facade, thus optical improvement of the building.

Improved architectural Quality and Prestige of the Building

Health



The renovation measures reduce the amount of moisture entering your room.

Reduction of indoor Humidity, Mold and Toxins

Noise Protection



There will be new windows with better sound insulation.

Reduction of Noise Immissions

Thermal Comfort



The temperature at the walls increases, so that they obtain a higher comfort.

Reduction of Draught, Overheating and Cold

Additional Benefits

Indoor Air Quality



Regulated ventilation improves the quality of your indoor space.

High indoor Air Quality

Figure 23: Output page: Detailed description of a renovation step

EXAMPLES OF TYPICAL RENOVATION DETAILS TO PAY ATTENTION TO IN THE IBROAD

Especially in a step-by-step renovation, it should be ensured that component connections are suitable. In this section, you will find a collection of typical renovation situations, for instance, the insulation of the roof, the outer wall, or the replacement of windows and doors. For all of these renovation measures, certain aspects with respect to other building components or building equipment need to be observed, if the components or systems are not being renovated in the same renovation step.



In case of insulating the roof, take into account ...

... with regard to a later outer wall insulation

Extension of the roof overhang: The roof overhang must be built in a way that the future wall insulation is sufficiently covered (thickness of the insulation and sufficient overhang). In some cases, it may become necessary to extend the rafters. Also, gutters need to be adjusted.

... with regard to the existing heating boiler

Adjustment of the heating system: Due to the insulation of the roof, the heat demand of the building reduces. Consequently, the heating system needs to be adjusted: the heating curve should be set to lower flow temperatures, a proper hydraulic balancing of the heating circuits needs to be performed, and the performance of the heating circuit pump can possibly be reduced.

... with regard to the radiators

Performance check: It should be checked whether the performance of the radiators matches the reduced room heating loads, and, if necessary, hydraulic balancing needs to be performed. The heating circuit temperatures should be lowered.

... with regard to the operation and installation of a ventilating system

The fresh and exhaust air outlets for a future ventilation system should be provided in the roof seal. Potentially, ventilation shafts could be laid inside the insulation layer or behind the jamb wall. All component connections in the roof space must be produced in such a way that the tightness in the roof space meets the higher requirements for controlled domestic ventilation. The tightness should already be checked during the work to be able to rectify, if necessary.

The ventilation behaviour may need to be changed as the building is much more airtight than before. It may become necessary to change the air in a room and to ventilate several times a day.

... with regard to a later installation of a solar thermal system

The pipe ducts through the roof seal for the future thermal solar system should be provided. Potentially, solar pipelines could be preliminarily laid in the roof insulation.



In case of insulating the outer walls, take into account ...

... with regard to a later pitched roof insulation

The low thermal bridge connection to the later sloping roof insulation is to be prepared. Existing panels on the eaves must be opened and the insulation should be installed to a defined height, e.g., to top edge rafters. At the verge, the insulation is to be led up to the upper edge of the gable wall. For this purpose, the roof overhang usually has to be rebuilt and extended.

... with regard to a flat roof insulation

The upper edge of the attic is to be covered. The metal plate has to be so broad and cantilevered out that the later flat roof insulation can be connected.

... with regard to an insulation of the attic floor

The low thermal bridge connection to the subsequent insulation of the top floor ceiling is to be prepared. Existing panels on the eaves must be opened to guide the insulation to the top of the rafters. On the inside, a defined junction should be created for the later gapless connection of the insulation of the upper floor ceiling. On the outside of the gable wall, the insulation should not end at the earliest 50 cm above the upper edge of the upper floor ceiling - as a rule it is led to the verge for visual reasons. There are no energy requirements for the detailing of the upper degree.

... window replacement

It is to prepare a later low-heat window installation / door installation. Check that the window stops / door stops are removed so that windows / doors can be set against the front edge of the masonry in the future. The existing roller shutter boxes can be removed, and new roller shutters integrated into the ETICS. Instead of the old shutters insulating parts are used. If the windows / doors are to be installed at a later date in the same installation level, then the

reveal insulation must be connected to the existing windows in a weather-proof and impact-proof manner with a diffusion-open joint.

... with regard to the existing heating boiler

The control of the existing heat generator is adapted to the reduced heat load. Above all, the heating curve should be set to lower flow temperatures, to carry out a hydraulic balancing of the heating circuits. The performance of the heating circuit pump can possibly be reduced.

... with regard to changing the domestic hot water heating

In the insulation layer of the thermal insulation composite system, the pipes can be laid for the later transition from decentralised to a centralised water heating.

... with regard to a heating optimisation

The heating circuit temperatures can be lowered. Fundamentally, consideration should be given to insulation measures whether the performance of each radiator matches the reduced space-heating loads and possibly hydraulic balancing to be performed.

... with regard to operation and installation of a ventilation system

The shafts for the later ventilation system can be installed in the insulation layer of the thermal insulation composite system. Outside wall openings for fresh and exhaust air shafts can already be prepared. Facade integrated ventilation units for single or multiple rooms are most easily installed in the same step as the wall insulation.

... with regard to an installation of a solar thermal system

In the insulating layer of the thermal insulation composite system, the pipes for the later solar thermal system can be installed. If a thermal insulation composite system is applied to the outer wall, it is possible to install a solar thermal system for heating support at the same time. This can be used within the thermal insulation level.



In case of a replacement of windows or doors, take into account ...

... with regard to an outer wall insulation

The thermal bridges and connections to the soffit, parapet and lintel shall also be designed for the intermediate state up to the insulation of the external walls so that the minimum thermal protection and moisture protection are maintained.

... with regard to an internal insulation

The thermal bridges and connections to reveal, balustrade and camber are thus for the intermediate state to the inner insulation airtight and taking into account the minimum thermal protection and moisture protection.

... with regard to an insulation under the basement ceiling

The basement windows should be mounted so that even after the later insulation of the basement ceiling there is enough room to open the ceiling.

... with regard to an insulation on the basement ceiling

The heights of sleepers, balustrades and lintels should be aligned with the future height of the top floor insulated from above.

... with regard to an existing heating system

The regulation of the existing heat generator must be adjusted. Above all, the heating

curve should be set to lower flow temperatures, to carry out a hydraulic balancing of the heating circuits. The performance of the heating circuit pump can possibly be reduced.

... with regard to heating optimisation

The heating circuit temperatures can be lowered. In principle, after insulation measures, it should be checked whether the performance of the individual radiators matches the reduced room heating loads and, if necessary, hydraulic balancing is carried out.

...with regard to operation or installation of a ventilation system

If more than one third of the windows are replaced, a ventilation concept must be prepared. Also, the ventilation behaviour may need to be changed as the building is much more airtight than before. It may be necessary to ventilate windows several times a day.

... with regard to a rooftop insulation

The threshold to the roof terrace is to be set so high that a later roof terrace insulation is possible.

... with regard to a perimeter insulation

The thermal bridges and connections to the soffit, parapet and lintel shall also be designed for the intermediate state up to the installation of the perimeter insulation so that the minimum thermal protection and moisture protection is maintained.

IBROAD LOGBOOK

Aim of the iBRoad Logbook

The logbook is primarily intended to be a main repository of all relevant building related information and includes, e. g., actual energy consumption, energy performance, maintenance requirements, design plans, etc.

The logbook is also intended to be a sort of dynamic building identity card that could additionally include other sets of individual building related information, such as financing options available in the area for renovation projects (e.g., green loans, incentives, tax credits), as well as energy bills, equipment, maintenance recommendations, insurance and property obligations. The logbook may serve several purposes:

- Repository and database for the building owner.
- Simple automated renovation recommendations. E. g. if the heating is > 20 years old, the system can produce an automated alert. Also, if the energy consumption seems untypically high, alerts can be produced, e. g. indicating flaws in the technical installation.
- Automated reminders for maintenance, e. g. for the heating system.
- Automated energy saving tips on a regular basis.
- Benchmark with surrounding buildings, based on the energy performance, indicating for instance the performance of the buildings in the neighbourhood, thus creating an incentive to renovate.
- Marketplace for qualified building professionals and materials.

However, within the iBRoad project it is not possible to implement all those features.

HOW THE LOGBOOK IS PRODUCED

There is not just one way of producing the Logbook. In principle, there are several possible options.

Figure 24 illustrates some alternatives ways. In general, either the homeowner or the energy auditor creates the logbook.

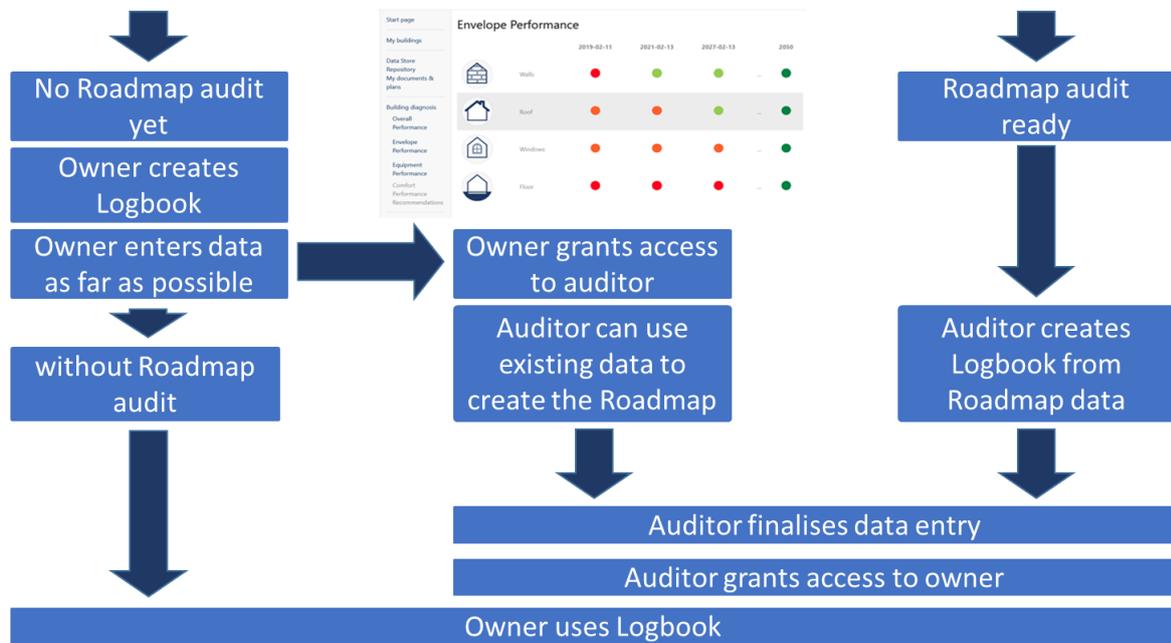


Figure 24: Alternative ways to produce the Logbook

However, within the iBRoad project context, we follow the way where you as energy auditor

create the Logbook from the Roadmap data, see Figure 25.

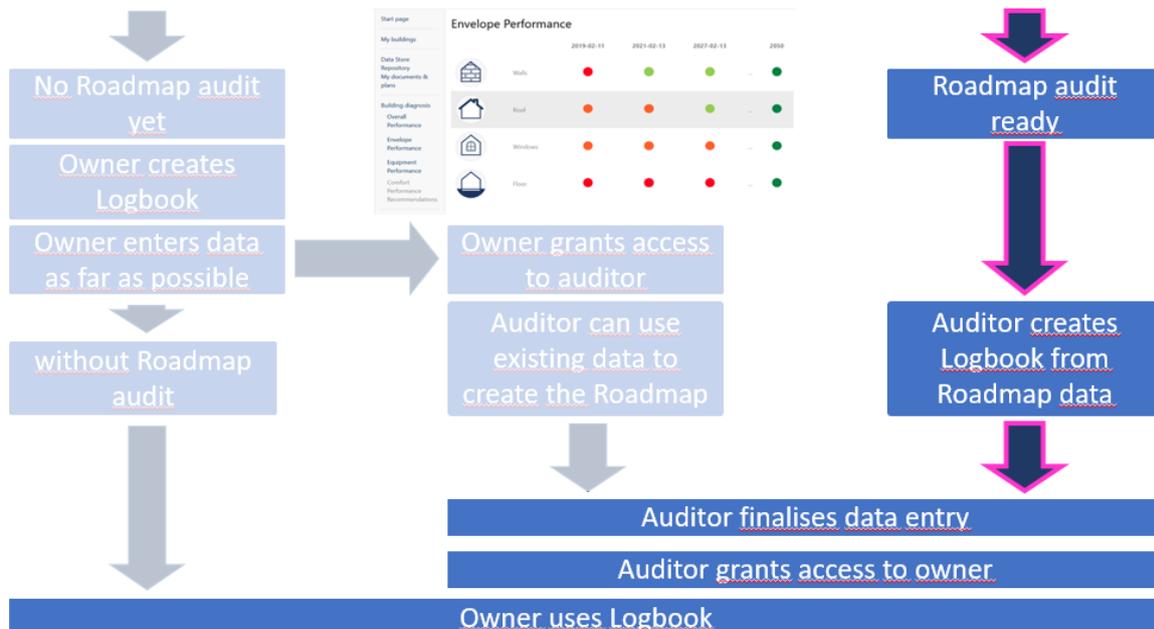


Figure 25: iBRoad project way to produce the Logbook

Logbook steps in detail

The following pages show an overview of the data input and evaluation functionalities in the iBRoad Logbook.

Log in to the Logbook



To enter the Logbook (Figure 26), use the following URL address, usernames and passwords. Please note, that it is necessary to fill in a username and a password twice.

After that, you will be directed to the welcome page of the Logbook. The Welcome page of the Logbook provides you with information regarding the iBRoad project and describes the iBRoad Logbook, see Figure 27.

Log in data for the Logbook

- **URL address:** <https://ibroad-logbook.blue-planet.be/>
- **Username 1:** credentials available upon request in order to control and monitor access
- **Password 1:** as above
- **Username 2:** your e-mail address
- **Password 2:** your password

Figure 26: Log in page

Figure 27: Welcome page with brief introduction

My buildings



If you access the Logbook for the first time you will be asked to add a new building. To do that you just need to click on “+new building”.

Of course, the Logbook can contain information for several buildings, as one user can own several buildings. In this case, add as many buildings as needed. All entered buildings are displayed in an overview page (Figure 28).

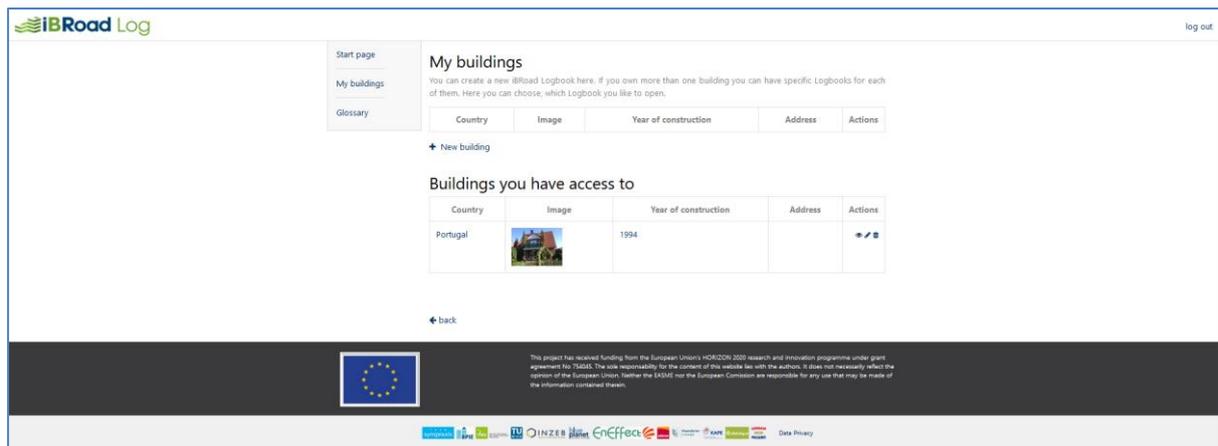


Figure 28: Overview of all buildings of one user

For each added building, basic data is shown, for instance, the country, the year of

construction and, also, uploaded building images (Figure 29).

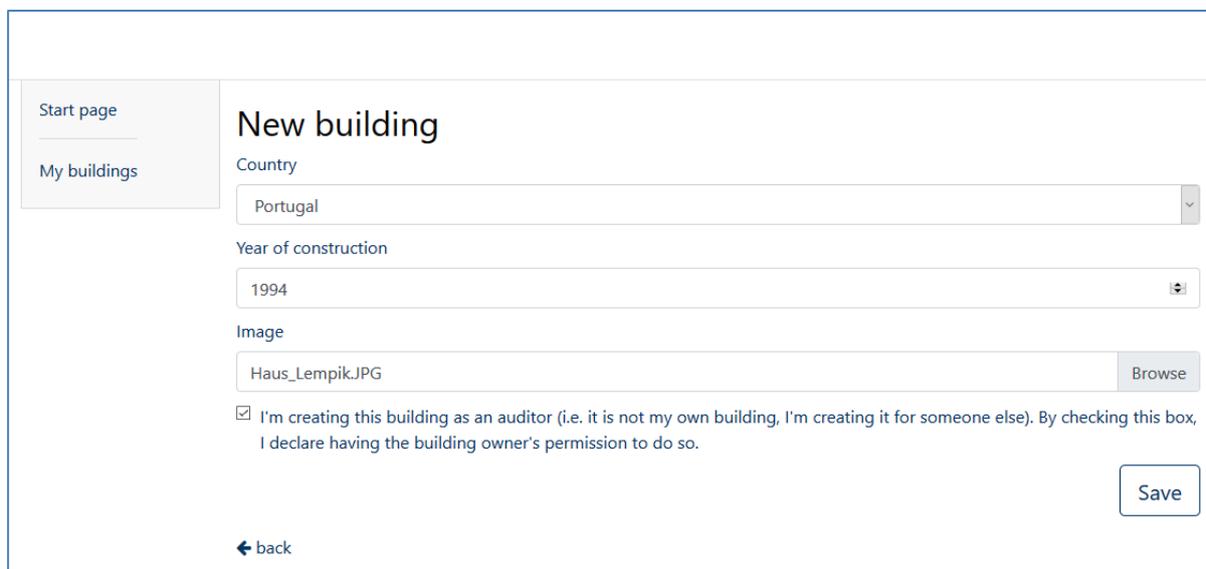


Figure 29: Basis data to create a Logbook for an additional building

Data Store



If you click on “Data Store” you will find the repository, where you should enter all building relevant information, and you will find the opportunity to upload building documents and plans (see Figure 30). If you click on “repository” you can enter different information regarding general

and administrative facts, building energy performance, building construction, building operation and use, and so-called smart information. You just need to click on the icon with the relevant topic that you want to feed with information (see Figure 31).

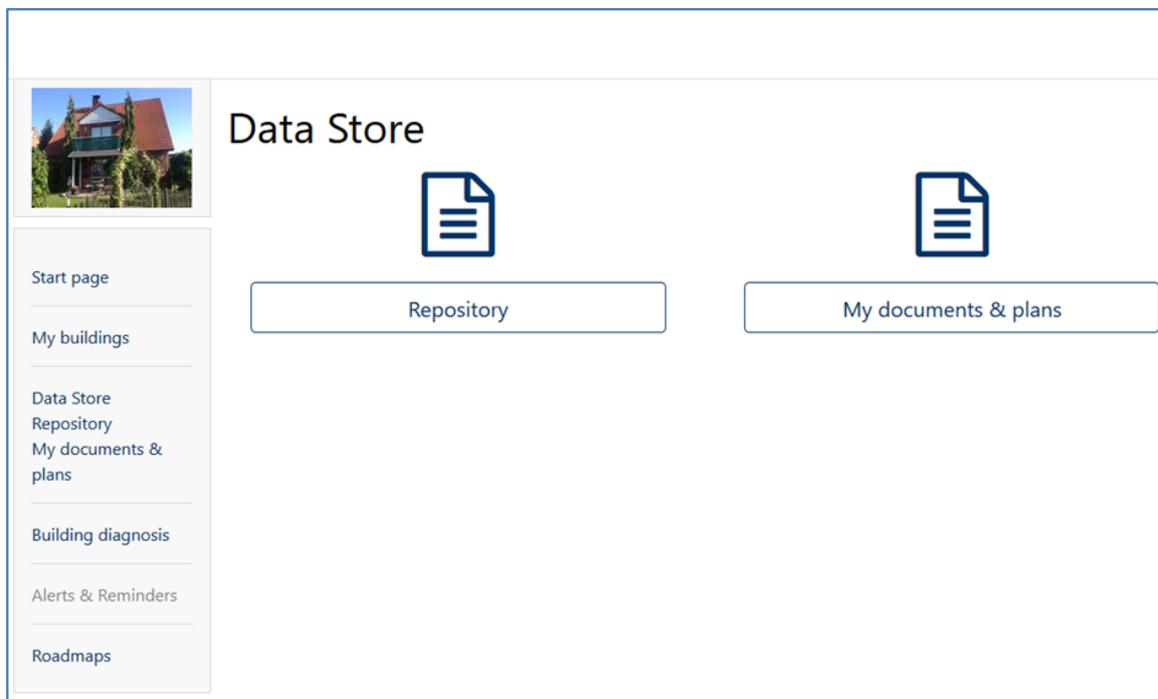


Figure 30: Overview page of the data store functionality

Repository

Building state – 2019-02-11

Building state 2019-02-11

+ New building state Manage building states

Start page

My buildings

Data Store

- Building states
- Repository
- My documents & plans

Building diagnosis

Alerts & Reminders

Roadmaps

Glossary

General and Administrative Information

Building Construction Information

Building Energy Performance

Building Operation and Use

Smart Information

← back

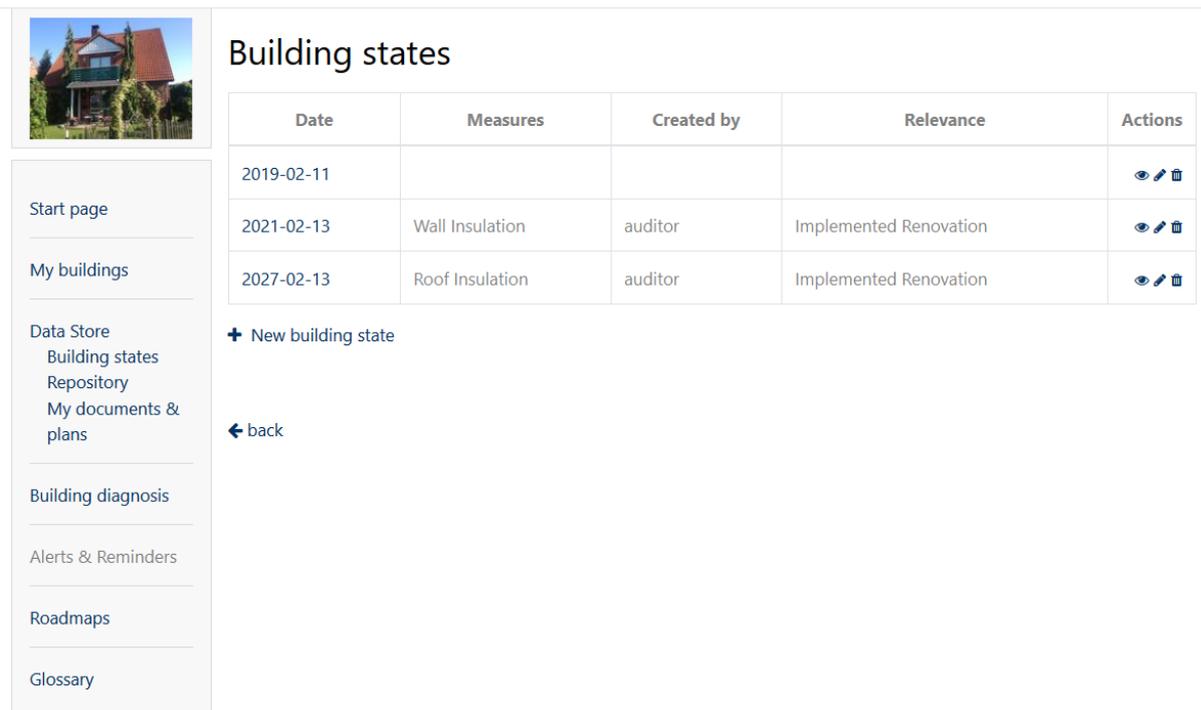
Figure 31: Overview page of the repository functionality in the data store

Under “General and Administrative Information” you will, for instance, find fields that need to be filled out regarding the building address and the property ID (see Figure 33).

In the upper right corner of the page, the building state is displayed. This is the state that is currently shown and edited in the Logbook. When you start a new Logbook, you will enter the current state of the building, as complete as possible. Only after the initial building state contains all available information, you can create new building states. This is a copy of the current building state. In general, there are three reasons to create a new building state:

1. A renovation measure was carried out in the building and you want to update the Logbook without losing the old state. This would be the most common usage of new building states.
2. You want to add past renovation measures to the Logbook to make already made improvements visible. Therefore, you enter the date of the past renovation and change the respective component (wall, boiler, etc.) to the state it comprised before the measure.
3. You want to simulate future renovation measures in the Logbook. Therefore, you enter the desired date in the future and change the respective component (wall, boiler, etc.) to the state that you plan to implement.

Please be aware that a new building state is always based on a copy of the building state with the most recent date.



Date	Measures	Created by	Relevance	Actions
2019-02-11				  
2021-02-13	Wall Insulation	auditor	Implemented Renovation	  
2027-02-13	Roof Insulation	auditor	Implemented Renovation	  

[+ New building state](#)

[← back](#)

Figure 32: Overview page of the repository functionality in the data store

In the upper right corner of the repository overview (Figure 31) there is a button called manage building states. This leads to an overview of all building states that were created for the specific building (Figure 32). For each building state the following information can be added:

- Date of the building state; this is by default the present date but can be changed to create future or past building states. Note that in the Logbook there can be only one building state per day.
- Measures that are implemented in this building state or description of the state. Who created the building state? For example, a state can either be created by an energy auditor or by a homeowner.

- The relevance of a building state describes, e.g., if it adds an implemented renovation to the Logbook or if a state is just created to simulate possible future renovation measures.

In addition, building states can be edited or deleted.

To create a new building state, click the appropriate link beneath the table. A new building state is generally created as a copy of an existing one. You can choose which of the existing states you wish to copy.

Please note

In general, in the Logbook, many of the data fields are mandatory. This is necessary because this data is required for certain Logbook features.

As the Logbook is designed for building relevant information in four countries (Bulgaria, Germany, Poland and Portugal), there is a stock of data that is the same for all attending countries. Additionally, however, there are country specific fields that allow adapting the Logbook to individual country requirements. The following illustrations (Figure 33 - 38) show the adapted version for Portugal. Please note that in the Bulgarian, Polish or German case there could be some changes. In the illustrations below, all mandatory fields (that are the same for all countries) are coloured in white and the Portuguese fields (country specific fields) are coloured in blue.



Current building state – 2019-02-11

General and Administrative Information

Save

Building

Building ID	
National Code	<input style="width: 95%; height: 20px;" type="text"/>
Inspire ID	<input style="width: 95%; height: 20px;" type="text"/>
Energy Supplier ID	<input style="width: 95%; height: 20px;" type="text"/>
Address	<input style="width: 95%; height: 20px;" type="text"/>
Latitude	<input style="width: 95%; height: 20px;" type="text"/> DD
Longitude	<input style="width: 95%; height: 20px;" type="text"/> DD
NUTS III	<input style="width: 95%; height: 20px;" type="text"/>
City	<input style="width: 95%; height: 20px;" type="text"/>
Zip Code	<input style="width: 95%; height: 20px;" type="text"/>
Street Name	<input style="width: 95%; height: 20px;" type="text"/>
House Number	<input style="width: 95%; height: 20px;" type="text"/>
Floor Number	<input style="width: 95%; height: 20px;" type="text"/>
Property ID	<input style="width: 95%; height: 20px;" type="text"/>
Legal registration	<input style="width: 95%; height: 20px;" type="text"/>
Fiscal registration	<input style="width: 95%; height: 20px;" type="text"/>

Building General Features

- Start page
- My buildings
- Data Store
Repository
- My documents &
plans
- Building diagnosis
- Alerts & Reminders
- Roadmaps

Figure 33: Data entry and display for general and administrative information in the current building state (example for Portugal)



Current building state – 2019-02-11

Building Construction Information

Save

Start page

My buildings

Data Store
Repository

My documents &
plans

Building diagnosis

Alerts & Reminders

Roadmaps

Wall Types

Wall Types

Wall Type 1 

Name / Specification	<input style="width: 95%;" type="text"/>
Location	<div style="background-color: #0070C0; color: white; padding: 2px; border: 1px solid #0070C0; display: flex; justify-content: space-between; align-items: center;"> ▼ </div>
Description of the constructive solution	<div style="border: 1px solid #0070C0; height: 25px; width: 95%;"></div>
Orientation	<input style="width: 95%;" type="text"/>
Surface area	<div style="display: flex; align-items: center;"> <input style="width: 90%;" type="text"/> <div style="border: 1px solid #0070C0; padding: 2px 5px; font-size: 0.8em;">m²</div> </div>
Structural material type	<input style="width: 95%;" type="text"/>
Environment on backside of component	<div style="background-color: #0070C0; color: white; padding: 2px; border: 1px solid #0070C0; display: flex; justify-content: space-between; align-items: center;"> ▼ </div>
Structural material thickness	<div style="display: flex; align-items: center;"> <input style="width: 90%;" type="text"/> <div style="border: 1px solid #0070C0; padding: 2px 5px; font-size: 0.8em;">m</div> </div>
Structural material thermal conductivity	<div style="display: flex; align-items: center;"> <input style="width: 90%;" type="text"/> <div style="border: 1px solid #0070C0; padding: 2px 5px; font-size: 0.8em;">W/mK</div> </div>
Structural material density	<div style="display: flex; align-items: center;"> <input style="width: 90%;" type="text"/> <div style="border: 1px solid #0070C0; padding: 2px 5px; font-size: 0.8em;">kg/m³</div> </div>
Structural number of panes	<div style="display: flex; align-items: center;"> <input style="width: 90%;" type="text"/> <div style="border: 1px solid #0070C0; padding: 2px 5px; font-size: 0.8em;">m</div> </div>
Air gap thickness	<div style="display: flex; align-items: center;"> <input style="width: 90%;" type="text"/> <div style="border: 1px solid #0070C0; padding: 2px 5px; font-size: 0.8em;">m</div> </div>

Figure 34: Data entry and display for building construction information in the current building state (example for Portugal)



Current building state – 2019-02-11

Building Energy Performance

EPC

EPC Energy label	<input type="text"/>	<input type="button" value="v"/>
EPC Number	<input type="text"/>	
Issue date	<input type="text" value="TT. MM .JJJ"/>	
Expert name	<input type="text"/>	
Expert ID	<input type="text"/>	
Type of EPC	<input type="text"/>	
Term date	<input type="text" value="TT. MM .JJJ"/>	
Photograph report	<input type="text" value="Choose file"/>	<input type="button" value="Browse"/>
Energy audit support document	<input type="text" value="Choose file"/>	<input type="button" value="Browse"/>

Energy Audit

Expert name and contact	<input type="text"/>	
Audit date	<input type="text" value="TT. MM .JJJ"/>	
Professional order	<input type="text"/>	
Energy label	<input type="text"/>	
Photograph report	<input type="text" value="Choose file"/>	<input type="button" value="Browse"/>
Energy audit support document	<input type="text" value="Choose file"/>	<input type="button" value="Browse"/>

- Start page
- My buildings
- Data Store Repository
- My documents & plans
- Building diagnosis
- Alerts & Reminders
- Roadmaps

Figure 35: Data entry and display for the energy performance in the current building state (example for Portugal)



Current building state – 2019-02-11

Building Operation and Use

Save

Start page

My buildings

Data Store
Repository
My documents &
plans

Building diagnosis

Alerts & Reminders

Roadmaps

Energy demand

Number of inhabitants

Room temperature during heating period

Room temperature during summer

Time of occupants presence

Owner satisfaction with room temperature

Energy consumption

Energy bill types

Energy bill type 1

Energy source

Start of consumption period

End of consumption period

Consumption kWh

Billing cost €

Energy supply company

Contracted power

Tariff option

[Document 1](#)

Figure 36: Data entry and display of information on building operation and use in the current building state (example for Portugal)



Current building state – 2019-02-11

Smart Information

Save

Start page

My buildings

Data Store
Repository
My documents &
plans

Building diagnosis

Alerts & Reminders

Roadmaps

SRI - Smart Readiness Indicator

Other smart indicators

Number of EV charging points

Smart district indicators

Save

[← back](#)

Figure 37: Data entry and display for smart information in the current building state (example for Portugal)



My documents & plans

You can upload all documents that are relevant for your building: building plans, energy bills, contracts with sellers, architects, craftsmen, photos, photo-documentations of construction works, insurance policies and many more. Upload any format: e.g. pdf, jpg, jpeg, png.

- Start page
- My buildings
- Data Store
 - Repository
 - My documents & plans
- Building diagnosis
- Alerts & Reminders
- Roadmaps
- Glossary

Document 1

Description

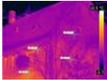
File



Document 2

Description

File



Document 3

Description

File

Grundriss.pdf

[+ New document](#)

Figure 38: Overview page of the documents' and plans' upload functionality in the data store

Building Diagnosis



If you click on “Building diagnosis”, you will find three subcategories: the overall building performance, the

performance of the buildings’ envelope, and the performance of the buildings’ equipment (see Figure 39).

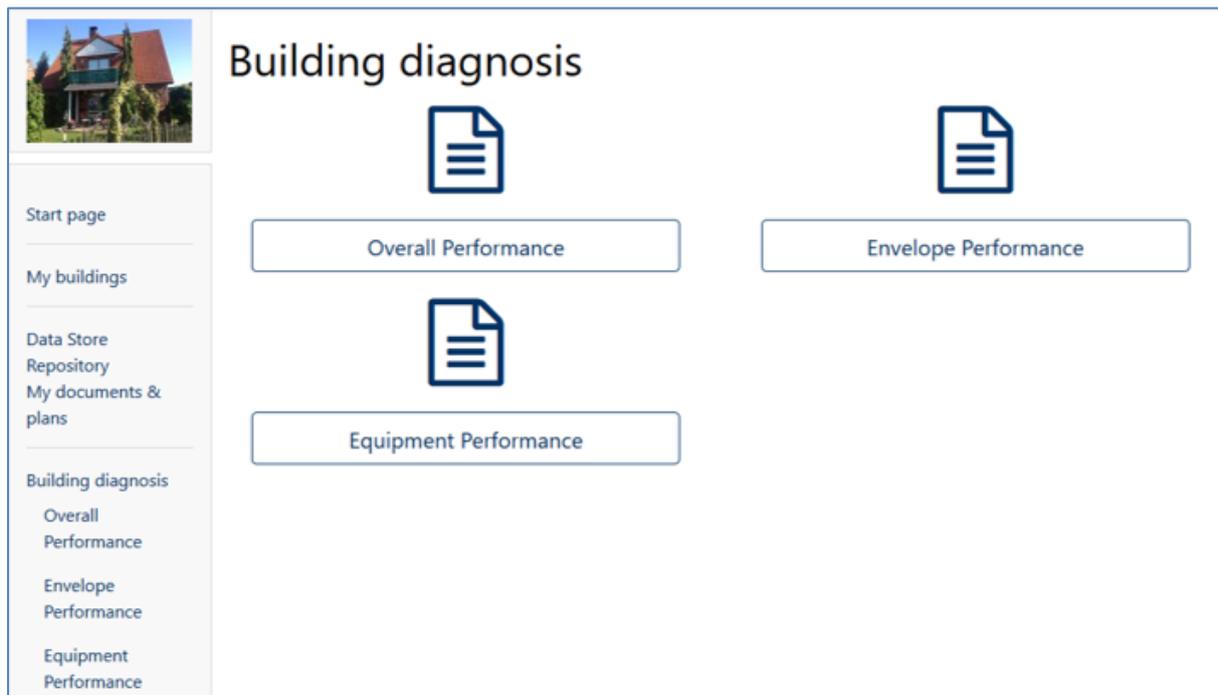


Figure 39: Overview page of the building diagnosis functionalities

The overall performance of the building (Figure 40), shows the building’s energy performance class and the primary energy demand in kWh/m²year. These are based on the data that you enter. The energy performance class has to

be the same as in the Energy Performance Certificate (EPC). Otherwise, the homeowner could be confused. As a comparison, the average energy demand of all buildings in the Logbook in the respective country is shown.

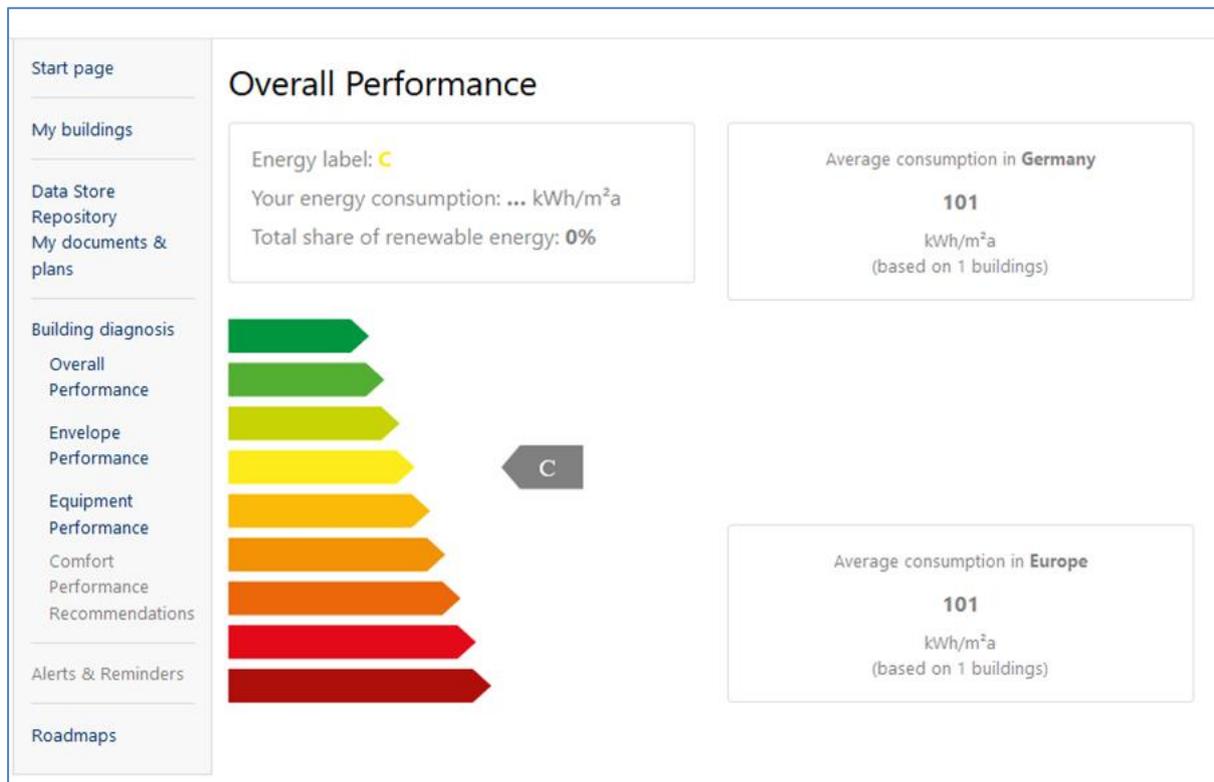


Figure 40: Overall building energy performance in the building diagnosis

The envelope performance of the building shows an individual assessment of the roof, walls, floor and windows. The colours refer to the u-values of the components. The thresholds and the number of the classes are country specific.

The assessment of the envelop performance can be based on different data fields. Depending on which of the following data is present in the Logbook, the most detailed will be used.

- Year of construction of the building. The u-values are based on typical construction standards in different periods for each specific country. The year of construction is generally present in the Logbook as it is required for creating a new building.

- Year of the last renovation of a component. The u-values are based on typical renovation standards in different periods for each specific country. If a year of renovation is present in the Logbook this will determine the assessment instead of the year of construction.
- The specific u-value if entered in the Logbook. If the u-value is present in the Logbook, the assessment will be based on this as it is the most detailed and reliable information.

For each new building state that is added to the Logbook, a new column is added to the display. Thus, the temporal development and improvement of the building will evolve in time. The assessment of the components for the year 2050 shows the green category for all components by default. This should be the long-term target for all buildings.

The equipment performance (Figure 41) shows an individual assessment of the heating and domestic hot water system. The colours refer to the system's efficiency. The thresholds and the number of the classes are country specific.

The assessment of the equipment for the year 2050 shows by default the green category for all systems. This should be the long-term target for all buildings.

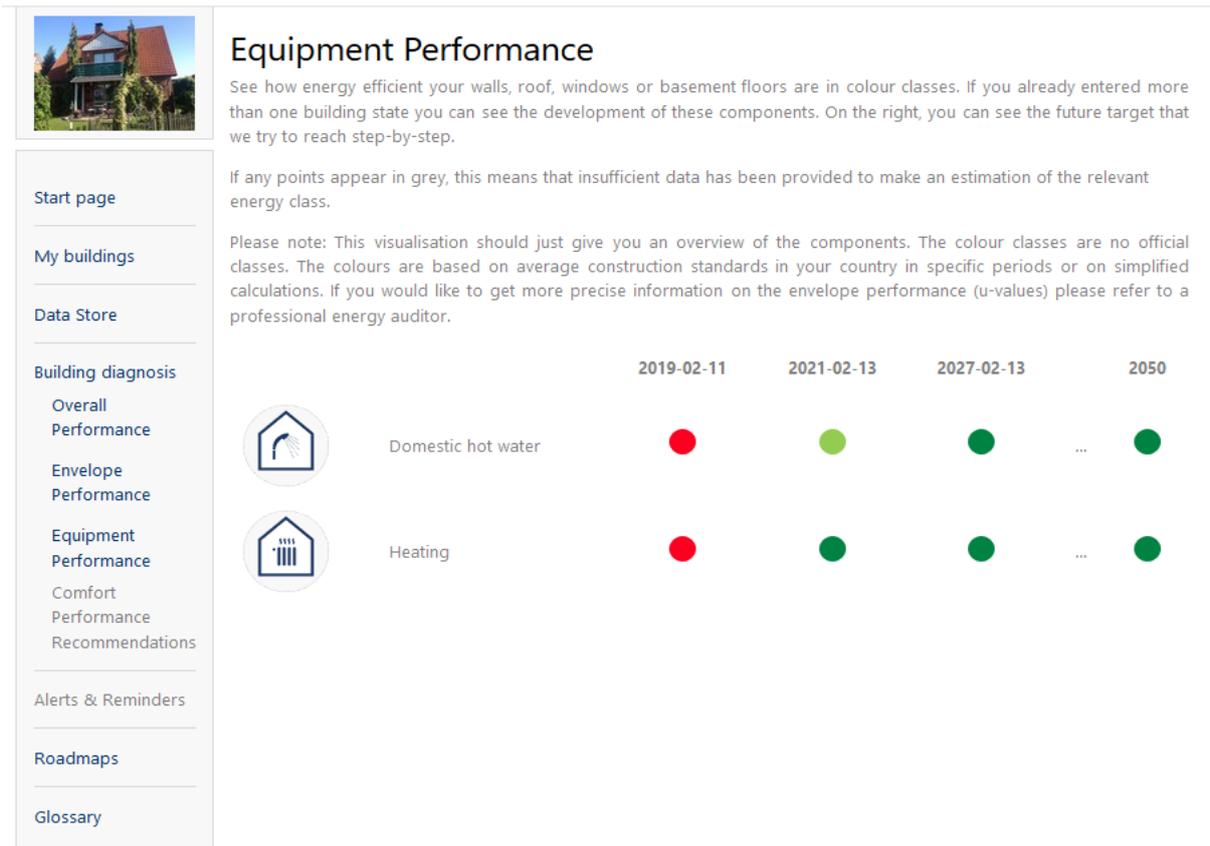


Figure 41: Equipment performance in the building diagnosis

Show Roadmap from the Logbook



The Logbook provides the possibility to show a created Roadmap. If a roadmap has been issued for the building, it can be displayed in the Logbook. After the Roadmap is finalised, the Roadmap Assistant creates a coupling code (Figure 42). You can copy this code and enter it into the Logbook (Figure 43).

Thus, you are directed to an overview where the available Roadmaps for this building are listed (Figure 44). The roadmap itself (as shown in Figure 20) will open if you click on 'View roadmap'

The screenshot shows the 'iBRoad Plan' interface. At the top right, it says 'Your Roadmaps log out'. Below the header, there is a breadcrumb 'You are here / Donald Dummy'. The main title is 'Roadmap: Donald Dummy' with a pencil icon. Below the title are three links: 'Edit Building', 'Edit Current building state', and 'Show Roadmap Preview for Building Owner'. The section is titled 'Renovation Steps' and contains a table with three rows:

Renovation Step	Description	Actions
1	Improve the air permeability of the envelope Optimization control system	Edit Measures [up/down arrows] [x]
2	Installation of a thermal insulating layer on top of concrete ground floor in contact with the ground	Edit Measures [up/down arrows] [x]
3	Optimization control system	Edit Measures [up/down arrows] [x]

Below the table are two buttons: 'Create new Renovation Step' and 'Share the Roadmap'. A text block below explains sharing options:

You can share this roadmap with the owner of the building in two ways:

- Copy this link and share it with the owner of the building:
https://ibroad.blue-planet.be/roadmaps/3/welcome_page?public_roadmap_id=326172699063C6
- Give the owner the following roadmap coupling code: **326172699063C6**
He/she can then enter this code in the iBRoad Logbook application to create a permanent link between their building's logbook and the roadmap.

Figure 42: The coupling code between Roadmap and Logbook can be found at the bottom of the page

The screenshot shows a sidebar on the left with navigation links: 'Start page', 'My buildings', 'Data Store Repository', 'My documents & plans', 'Building diagnosis', 'Alerts & Reminders', and 'Roadmaps'. The main content area is titled 'Link roadmap to this building' and contains the text: 'Please enter the roadmap coupling code you've received from your auditor.' Below this is a text input field labeled 'Roadmap coupling code' containing the value '326172699063C6'. To the right of the input field is a 'Save' button. A 'back' link is located below the input field.

Figure 43: Entering the link for the roadmaps

Start page

My buildings

Data Store
Repository
My documents &
plans

Building diagnosis

Alerts & Reminders

Roadmaps

Your roadmap(s)

+ Link roadmap to this building

Date roadmap was linked	Link to roadmap	Actions
2019-02-12	View roadmap	 

Figure 44: Overview of linked roadmaps



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