

A decorative graphic consisting of several colored lines (red, orange, yellow, green) forming a complex, overlapping rectangular frame around the central text. The lines have arrows at their ends, pointing in various directions (up, down, left, right), creating a sense of movement and flow.

BUILDING RENOVATION PASSPORTS

**Customised roadmaps
towards deep renovation
and better homes**

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INTRODUCTION

The European Union is facing a double challenge: increasing building renovation rates while aiming at achieving “deep renovations”¹. Increasing the current EU renovation rate from 1.2% per annum to 2-3% is essential to meet both the EU 2020 targets and the commitment undertaken in Paris in December 2015². About 75% of the EU's 210 million buildings are not energy efficient, and 75% to 85% of them will still be in use in 2050. Ensuring a highly-efficient and fully decarbonised building stock by 2050 is a major challenge. The quality of the energy renovation of our building stock is, therefore, of paramount importance. Despite the proven economic and technical feasibility of building renovation, and despite the societal and environmental benefits it could bring, renovation rates are still low and considerably below the expected level.

Building owners and potential investors face multiple barriers to improve the energy performance of their buildings. Together with difficulty to access finance, one of the most often quoted barriers is the lack of knowledge about what to do, where to start, and which measures to implement in which order.

Energy Performance Certificates (EPCs) were introduced by the first Energy Performance of Buildings Directive in 2002 (2002/91/EC)³ with the aim to make the energy performance of individual buildings more transparent. The EPBD recast in 2010 (2010/31/EU) reconfirmed and strengthened the instrument in a number of ways: independent quality control of EPCs, penalties for non-compliance, display of the energy label in advertisements, a mandatory requirement to hand out a copy of the EPC in sale and rent transactions and improvement of renovation recommendations (cost-effective and cost-optimal measures).

EU Member States have implemented national EPC schemes, although different approaches with regard to the comprehensiveness and quality assurance provide a very diverse picture of its implementation⁴. To date, the implementation of EPCs varies significantly across Member States in terms of scope and information available, with limited market penetration or acceptance by the users due to low reliability and lack of user-friendliness. The required recommendations for measures improving energy performance are mostly scarce, too general or non-existent in most national EPC versions. Additionally, EPC-related services such as energy consultancy and audits for residential buildings differ significantly between Member States and programmes.

¹ There currently isn't a common definition of “deep renovation”. An overview of the main definitions of deep renovation used in the EU is available in Annex 1.

² Keeping the long-term increase in global average temperature well below 2°C above pre-industrial levels, with the aim to limit the increase to 1.5°C .

³ Directive 2002/91/EC and recast: Directive 2010/31/EU, <https://ec.europa.eu/energy/en/topics/energy-efficiency/buildings> .

⁴ BPIE (2014): Energy Performance Certificates across the EU [1] .

As a result, the relevance of EPCs for owners and their stimulating effect for the renovation of buildings is limited⁵.

Among the most important benefits of renovation are increased thermal comfort and air quality, better daylight entry and improved health of occupants. Those benefits, even if they are the main drivers for renovation, are not covered by the current EPC formats.

EPCs could be the appropriate tool to provide the information in a meaningful and comprehensible way to the individuals who are making decisions about renting, buying or investing into a property. To become more relevant, EPCs could contain useful, tailor-made and understandable information directly related to the decision-making criteria of potential investors and building owners.

Thus, two main issues should be solved for EPCs to have a higher impact on energy performance of buildings and renovation: the concerns about reliability and compliance, and their relevance in the decision-making process of building owners.

While an amendment of the EPBD in favour of enforcing stricter compliance and triggering a further evolution of EPCs would certainly be very welcome, some initiatives have started to develop in the past few years, with the aim to establish a more comprehensive and user-friendly instrument to support building owners with personalised instructions on their renovation options. At the core of these initiatives is the idea that renovation plans are very often limited by factors such as financial constraints, the need to reduce the time of renovation, discomfort during the works and the lack of knowledge regarding the best solutions available⁶.

The aim of this report is to provide an overview of initiatives currently developed: three of them were selected, in Flanders, France and Germany, all revolving around the concept of “building renovation roadmap or passport”⁷. These initiatives were chosen for their advanced phase of development (they will soon enter the implementation phase), as they provide a good overview of the process supporting the creation of a Building Renovation Passport and as they cover the main issues that need to be addressed for its development and implementation. In the three cases, public authorities have shown interest for this concept (France) and have supported or driven (Flanders and Germany) its development.

Section 1 will explore the notion of “Building Renovation Passport”, introducing the concept, based on the three case studies. Section 2 presents the three main initiatives: a) the “individueller Sanierungsfahrplan” (individual renovation roadmap) in Germany, b) the Flemish “Woningpas” (Dwelling ID), and c) the “Passeport Efficacité Énergétique” (Energy efficiency passport) in France. Finally, section 3 will outline a series of recommendations for the introduction of building renovation passports across the EU.

⁵ According to the ZEBRA2020 survey: the real-estate market does not see a link between the improvement of the energy performance of buildings and EPCs. [10]

⁶ BPIE (2013): Boosting building renovation: an overview of good practices. [12]

⁷ In this paper, we will use the expression “Building Renovation Passport”.

METHODOLOGY

This research is the result of a combination of secondary and primary research. After completing an initial desk-based research to review available literature, identify target examples and map their key features, BPIE interviewed the project managers of each of these initiatives - Martin Pehnt at ifeu, Tine Vande Casteele at the Flemish Energy Agency (VEA) and Benoît Montels at P2E - to understand the key challenges in the development and implementation of each concept.

WHAT IS A BUILDING RENOVATION PASSPORT?

There is no common definition of what a Building Renovation Passport (BRP) stands for. Each of the examples taken into account differs in some elements and the terminology used. The definitions below are based on the main findings of the cases analysed and could be used to initiate and structure a debate on BRP at the European level.

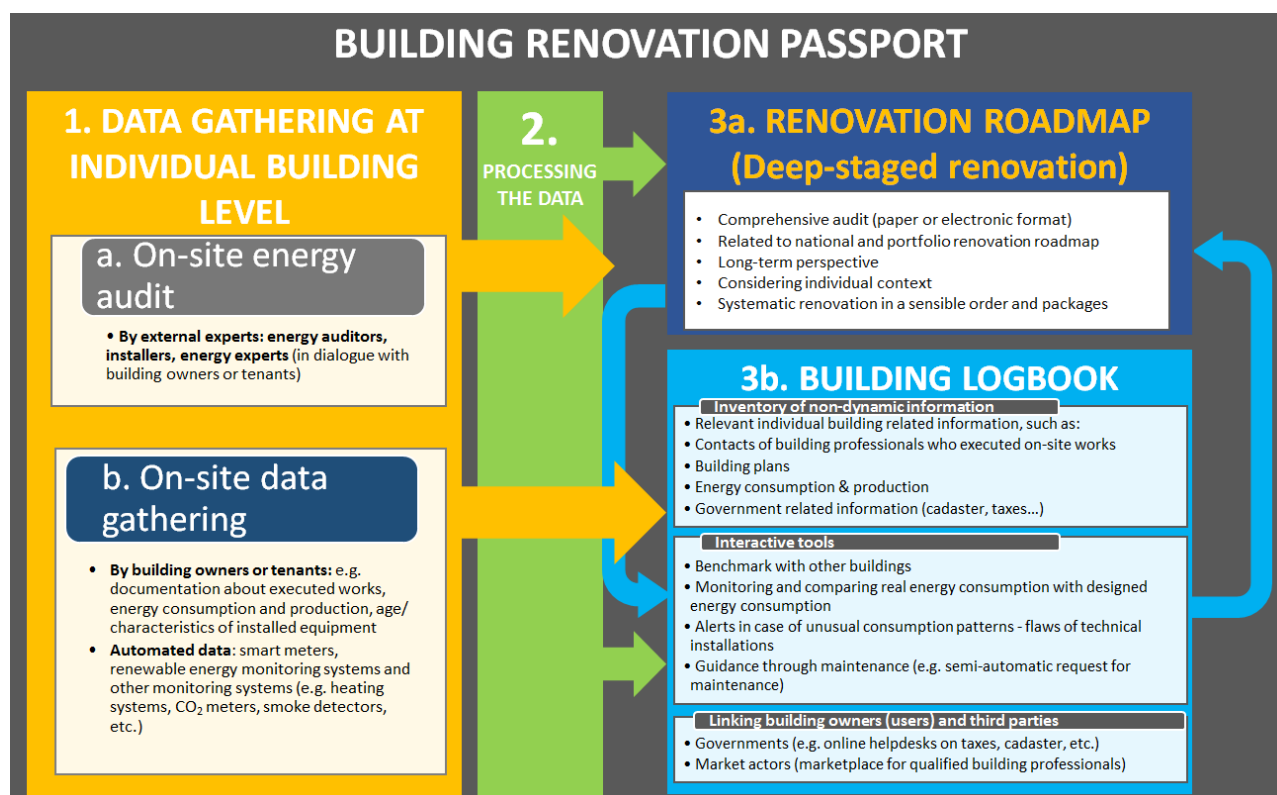
Figure 1 presents an overview of the main components of the BRP to provide a common understanding of the terminology and the different elements covered by the three examples analysed. In section 2, the terminology and definitions adopted in each country will be explained.

A **Building Renovation Passport** is defined as a document - in electronic or paper format - outlining a long-term (up to 15 or 20 years) *step-by-step renovation roadmap* for a specific building, resulting from an *on-site energy audit* fulfilling specific quality criteria and indicators⁸ established during the design phase and in dialogue with building owners. The expected benefits in terms of reduced heating bills, comfort improvement and CO₂ reduction are a constitutive part of the BRP and are explained in a user-friendly communication. The renovation roadmap can be combined with a repository of building-related information (*logbook*) on aspects such the energy consumption and production, executed maintenance and building plans.

On-site data gathering is the first step towards the creation of a BRP. The data processing can change according to each model (e.g. by using a dedicated software or by adapting the existing energy audit software). The outcome of step 1 and 2 is a comprehensive step-by-step renovation roadmap, with tailored solutions aiming at achieving deep-staged renovation.

⁸ E.g. energy consumption, daylighting, indoor air quality, health conditions, thermal comfort, acoustic comfort, cost.

Figure 1 - Building Renovation Passport – Overview of its component (Source: BPIE)



Step-by-step renovation roadmap (or staged renovation)

A renovation plan with a horizon of up to 15-20 years that, by looking at the building as a whole, suggests the installation of selected measures in a certain order to avoid that at any stage of renovation the installation of additional measures is precluded.

Depth of renovation

There is no common definition for “deep renovation”, “staged renovation” and “deep-staged renovation”. As described in section 2, each of the examples analysed uses a different definition of what a deep renovation⁹ is.

There are, however, common features among all initiatives, like the will to raise the level of ambition for achieved energy performance, to ensure consistency between short and long term measures and to align the target for the performance of individual buildings with the long-term target for the entire building stock.

By supporting staged renovations, adapted to the preferences of individual building owners, BRPs give them the opportunity to have an overview of the full range of renovation options and to easily identify each renovation step from beginning to the end. As a result, staged renovation strategies facilitate the owner’s decision to invest in a deeper renovation process, in particular if specific elements that need to be taken into account for later renovations are also highlighted. For example, if a roof is insulated, roof overhangs, downspout connections,

⁹ An overview of the definitions of “deep renovation”, “staged renovation” and “staged deep renovation” commonly used among building experts is available in Annex 1.

adjustment of the boiler and piping penetrations for future solar systems, etc. are also included. The final product is a Renovation Roadmap outlining each renovation step and the links between all measure implemented, presenting the renovation as a home-improvement plan (not just a technical intervention) and helping to avoid lock-in effects¹⁰ (see point 3a in Figure 1).

It is essential for owners to take possession of the project: for individual building owners, the uncertainty regarding future renovation options typically leads to retention with respect to renovation decisions or to limited renovations (installation of easy measures). From this perspective, any instrument that triggers a long-term perspective and allows building owners and potential investors to clearly outline robust long-term renovation plans, including short-term measures and measures that need a more adaptive and flexible approach (e.g. sequencing of measures' installation over time) could increase their confidence and enhance the rate of renovation.

BRPs provide a comprehensive set of relevant indicators (e.g. energy consumption, CO2 emissions, thermal and acoustic comfort, indoor air quality and daylight) and include a dynamic dimension by delivering information about recommended improvement strategies in a detailed way and, by doing so, stimulate deep or staged deep renovations.

Logbook

In addition to the renovation roadmap, the building renovation passport can also include a separate element, a storage space where the building's features and information (e.g. stability, durability, water, installations, humidity, maintenance requirement, etc.) can be collected and regulatory updated, becoming a proper repository of information and data related to a specific building. The logbook could also include other sets of information related to each individual building, such as the financing options available in the area for renovation projects (e.g. green loans, incentives, tax credits) as well as energy bills, equipment maintenance recommendations as well as insurance and property obligations. All this information could be inventoried in a digital register, available to property owners.

Logbook user

The main user of the logbook is the building owner. Depending on the type of logbook or its intended use, owners could grant access to some information to public authorities (e.g. municipality, property tax office), building professionals and craftsmen, and make some information publicly available, while keeping other data private or restricted (semi-public upon authorisation to third-parties).

In Flanders, building owners will have access to the logbook, with the opportunity to authorise access to public authorities too.

¹⁰ The energy savings which are not going to be realised due to un-ambitious and insufficiently stringent energy requirement targets for buildings, building element and equipment (IEA Glossary). [2]

Figure 2 - Data/information modules that can be included in the building renovation passport (Source: VEA)



In its most sophisticated form, the logbook could also be used as an interactive tool to monitor (both at individual building level and building stock level) and compare real energy consumption with designed energy consumption, send alerts in case of unusual consumption patterns or flaws in technical installations. It could also be linked to market actors (such as building professionals, craftsmen or financial institutions) to provide information regarding (certified) contractors and installers, facilitate invoicing and simplify the process for subsidies or loans repayment (see Figure 1, 3b).

All the models described in this paper are still under development and only the Flemish example plans to include a Building Renovation Passport and logbook as described above.


Targeted building typology

The three examples in this paper target residential buildings, with a focus on single-family houses, and provide a tailor-made renovation plan and customised recommendations presented to building owners in an attractive and motivating form. In principle, BRPs could also be adapted to multi-family buildings, but the three cases examined do not include this building typology.

THE ANALYSED MODELS: GERMANY, FLANDERS (BELGIUM) AND FRANCE

This section describes each of the three examples in details. The summary table below shows an overview of the key features included in the three concepts and how they compare with each other.

Figure 3 - Building Renovation Passports –Summary table of the case studies key features
(Source: BPIE)

| Building renovation passports  | | | |
|-------------------------------------------------------------------------------------------------------------------|--------------|--------|---------|
| Process | BE- Flanders | France | Germany |
| Definitions (Deep or staged-deep renovation and/or alternative definition) | ✓ | ✓ | ✓ |
| Long-term target for existing building stock (2050) | ✓ | ✓ | ✓ |
| Barriers | ✓ | ✓ | ✓ |
| Stakeholders mapping | ✓ | ✓ | ✓ |
| Stakeholders engagement | ✓ | ✓ | ✓ |
| Energy audit | ✓ | ✓ | ✓ |
| Auditors' training | ✓ | ✓ | ✓ |
| Tailored solutions | ✓ | ✓ | ✓ |
| Logbook/Database | ✓ | ✓ | ✗ |

✓ = Yes, ✓ = under development/consideration, ✗ = No

Several key elements and common trends emerge from the comparison of the three cases:

- Voluntary tool:** Building renovation passports are developed as a voluntary tool;
- Political support:** Public authorities in Flanders, France and Germany have shown interest for this concept and supported its development. The German government is supporting the preliminary work to introduce the individual renovation roadmap in the country (based on the results of a pilot in Baden-Wuerttemberg) and in France, the Energy Transition Act (Loi de Transition Énergétique et pour la Croissance Verte) mentions that a digital notebook (carnet numérique) has to be deployed by 2017;
- Ambition:** in France, P2E has adopted a definition of deep renovation (corresponding to BBC¹¹ level of renovation to be achieved by 2050, equivalent to 80kWh/m² of primary energy per year, including heating, hot water and cooling), while Flanders

¹¹ Bâtiment Basse Consommation (Low-Energy Building) .

refers to the notion of “long-term efficiency” (an energy efficiency level to be achieved by 2050) and Germany has introduced the “best possible principle”, which establishes that auditors have to recommend the best class to achieve the efficiency level established on average for the building stock and justify any deviation from the best standard;

- d) **Stakeholder engagement:** All have identified the main barriers to renovation in their market and mapped the main stakeholders;
- e) **On-site audits:** All three concepts have on-site energy audits (performed by qualified energy auditors) as the first step towards Building Renovation Passports and tailored solutions as one of the main featured results;
- f) **Dialogue with building owners:** Building owners are at the centre of the three approaches and invited to a dialogue with the auditors;
- g) **Training:** Training for the auditors is offered as part of the process to establish a Building Renovation Passport in France and Germany. In Flanders, the Flemish Energy Agency (VEA) is considering the opportunity to offer specific trainings. In Germany, training also includes communication skills and the life-cycle approach of building elements;
- h) **Logbook:** Flanders foresees the full development of the building logbook as part of the BRP, while in France, P2E will contribute to the Energy Performance and Renovation Component of the so-called ‘Carnet numérique de suivi et d’entretien du bâtiment’ developed by the government¹². Germany has not planned to include the logbook in the Individueller Sanierungsfahrplan (iSFP);
- i) **Performance indicators:** Most of the performance indicators are presently under development or undergoing an internal approval. Thus, the technical details are mostly not available at the moment (September 2016). Ifeu, P2P and VEA have expressed their intention to share them once they will become publicly available;
- j) **A new way to measure comfort:** All three concepts have included indoor air quality and comfort level among the main indicators, but it is not yet clear how they will be accounted for. All three models are exploring a new way to measure comfort. Both in Flanders and Germany this indicator will be measured not based on technical calculations, but in a more subjective way. In France, P2E is also considering the adoption of a mixed approach, combining technical elements with subjective criteria. By using “permanent feedback” from the upcoming pilot implementation, P2E intends to adapt its criteria based on the lessons learnt on the ground during the implementation;
- k) **Upcoming implementation:** The three models will start the implementation phase in the near future (between 2017 and 2018).

¹² [Loi n° 2015-992 du 17 août 2015 relative à la transition énergétique pour la croissance verte.](#)

Key performance indicators

While the list of indicators adopted in the three case studies is not available, Figure 4 below presents a list of potential performance indicators, developed by BPIE, that could be included in a Building Renovation Passport.

Figure 4 - List of performance indicators that could potentially be included in the Building Renovation Passport (Source: BPIE)

| |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Energy consumption |
| <ul style="list-style-type: none">• Primary energy consumption kWh/m²year (heating, DHW, cooling, fans, pumps, control)• Final energy consumption kWh/m²year (heating, DHW, cooling, fans, pumps, control)• Net energy consumption kWh/m²year (heating, DHW, cooling)• Energy need for heating & cooling kWh/m².year• Energy consumption of lighting system kWh/m².year• Building heat transfer coefficient (U value) |
| Indoor climate |
| <ul style="list-style-type: none">• Indoor air temperature °C• Indoor air relative humidity % |
| Airtightness and ventilation |
| <ul style="list-style-type: none">• Type of ventilation system• Air exchanges rate (ACH)• Efficiency of heat recovery (if available OR applicable)• Building airtightness by 50Pa (ventilation)• Building airtightness by 50Pa 1/h (infiltration) |
| Indoor air quality |
| <ul style="list-style-type: none">• Indoor air quality (IAQ) indicator: ACH or CO₂ concentration in indoor air above outdoor concentration in PPM, for different categories in accordance with EN 15251 "Indoor environmental input parameters for design and assessment of energy performance of buildings- addressing indoor air quality, thermal environment, lighting and acoustics"• CO₂ concentration in indoor air in PPM• PM and TVOC content in indoor air |
| Noise insulation |
| <ul style="list-style-type: none">• Sound pressure level dB(A) in living room and bed room |
| Artificial lighting |
| <ul style="list-style-type: none">• Type of lighting• Power of lighting W/m²• Spatial light distribution |
| Daylight |
| <ul style="list-style-type: none">• Daylight factor• Daylight autonomy• Useful daylight illuminance |
| CO₂ emissions |
| <ul style="list-style-type: none">• Equivalent CO₂ emission in kg per year per m², kg CO₂/m²year (heating, DHW, cooling, fans, pumps, controls) |
| Thermal comfort - Qualitative |
| <ul style="list-style-type: none">• Use of scale/colour code to express: Cold - extremely uncomfortable, Cool - uncomfortable, Slightly cool- slightly uncomfortable, Neutral - Comfortable, Slightly warm - slightly uncomfortable, Warm - uncomfortable, Hot - extremely uncomfortable |
| Thermal comfort - Quantitative |
| <ul style="list-style-type: none">• With the use of PPD and PMV (EN ISO 7730) for four different categories of comfort levels in accordance with EN 15251 standard |

INDIVIDUELLER SANIERUNGSFAHRPLAN (INDIVIDUAL RENOVATION ROADMAP) - GERMANY

Key features

- Long-term target for the energy performance level of the building stock
- Building owner at the centre of the process
- Customised measures
- User-friendly
- New skills required for the energy auditor (technical and communication)

Concept

The concept of “individual renovation roadmap” was initially developed and tested on a small scale¹³ in Baden-Wuerttemberg and is now adapted for an application in the entire country.

The Individueller Sanierungsfahrplan (iSFP) is part of the National Energy Efficiency Programme¹⁴ and of the "Federal Efficiency Strategy for Buildings" (ESG) published in December 2015¹⁵.

All the features and details of the project are not available yet¹⁶ but the main steps and characteristics have recently been presented¹⁷. Ifeu (Institute for the Energy and Environmental Protection), dena (the German Energy Agency) and the Passivhaus Institute (Passive House Institute) are in charge of the project, in collaboration with the German Ministry of Economic Development and Energy.

A number of market barriers were identified at the beginning of the project:

- a) Lack of deep renovation;
- b) Lack of knowledge about the advantages of deep renovation (both from the auditors and building owners);

¹³ About 10 audits.

¹⁴ 3rd National Energy Efficiency Action Plan (NEEAP) 2014 for the Federal Republic of Germany, https://ec.europa.eu/energy/sites/ener/files/documents/2014_neeap_en_germany.pdf.

¹⁵ Federal Ministry for Economic Affairs and Energy (BMWi), <http://www.bmwi.de/English/Redaktion/Pdf/energy-efficiency-strategy-buildings,property=pdf,bereich=bmwi2012,sprache=en,rwb=true.pdf>.

¹⁶ A full report is currently developed and will be published later in 2016.

¹⁷ Stakeholderdialog “Der individuelle Sanierungsfahrplan – Methodik und Praxis”: ifeu, DENA and Passivhaus Institut (Juli 2016,) Berlin. [3]

- c) Insufficient training for auditors beyond technical aspects (e.g. communication, life-cycle approach, psychology);
- d) User-friendliness of existing tools (e.g. EPC and energy audit reports' length);
- e) No follow-up after the audits (gap between the number of audits and the renovations delivered).

In Germany, EPCs are not considered reliable enough to stimulate renovation and are often viewed as an administrative obligation. On the other hand, there is a strong culture of on-site energy auditing, but the very detailed standardised reports delivered to building owners (up to 150 pages) are often left unread and do not promote long-term renovation.

The iSFP has been designed to overcome these barriers: it is more compact, future-oriented and takes into account customers' needs. The result is a user-friendly tool that includes both short and long-term measures and suggests ways to avoid lock-in effects.

Behind this tool is the idea that building owners must be given the appropriate means to turn renovation from "a nuisance that I have to endure" (*I have to renovate*) into "an opportunity to improve my house and my living environment" (*I want to renovate*).

The building owner is put at the centre of the process and involved in an open discussion with the energy auditor. The individual approach is considered key for the success of the iSFP.

The individual renovation roadmap foresees seven steps to be completed:

1. An on-site visit to inspect the building and meet with the building's owner and discuss his/her wishes and needs¹⁸;
2. Assessment of the current status of the building (based on a checklist of measures);
3. The auditor then develops different renovation scenarios. The result of the on-site audit provides an overview of all the building components, prioritising what needs to be renovated;
4. Discussion with the owner to select his/her preferred renovation options;
5. The energy auditor provides detailed input into a software;
6. The results are presented to the owner during a second on-site meeting, where a decision on the final renovation options is reached (the auditor and the owner discuss the options together);
7. The auditor then prints the results, presented in the iSFP form (see below).

The audit is based on a combination of predefined elements that have to be checked (checklist)¹⁹ and any additional notes and elements that the auditor may want to add.

¹⁸ There will be various contact points to promote and get access to the service: from marketing campaigns like "Deutschland macht's effizient" to initial contact points, like Internet configurators, hotlines, consumers' agency phone services, etc. (the list is provisional).

¹⁹ The check-list the auditors must use also includes enquiring about how the users feel in the building.

Figure 5 - Overview of the results of the audit, by component (Source: ifeu, dena, PHI; the text in italics is an additional translation by BPIE)



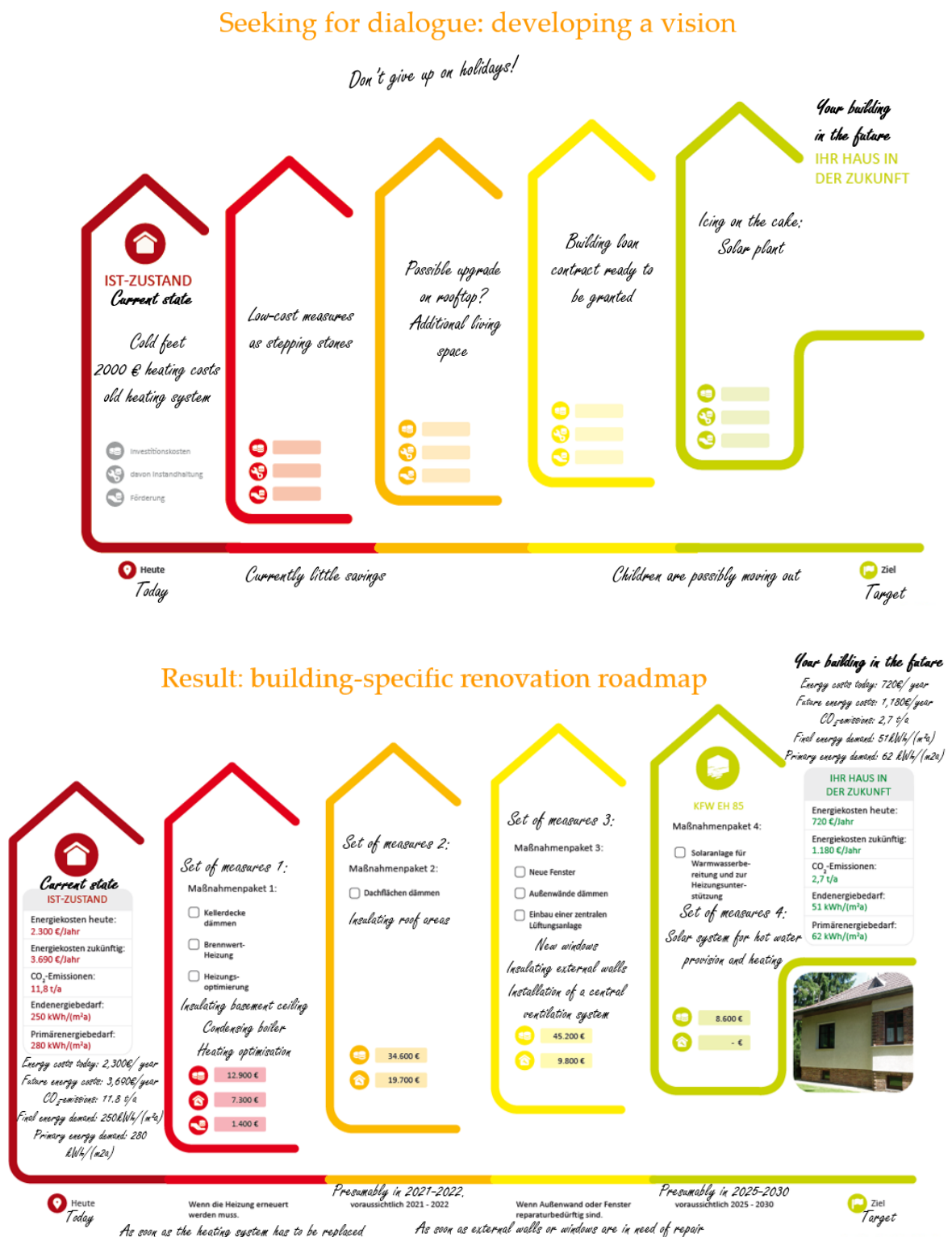
At the basis of this process, there is the will to apply a so-called **“reasonable approach”** and **create a dialogue** between the auditor and the building owners. As a result, the iSPF:

1. Defines the relation among different measures (feasibility, sequencing of measures, functional solutions, etc.);
2. Includes additional measures that could be installed or implemented overtime;
3. Takes into account possible lock-in effects and suggests optimisation solutions to avoid them;
4. Aims to ensure that the best possible standards are implemented at each step of the renovation for every measure (the “best possible principle”, see Definitions below);
5. Takes into account the individual needs of the owner, including affordability, and, as much as possible, finding a balance between what is technically feasible and what the owners want;
6. Provides tailor-made solutions taking into account specific building features and materials.

The energy auditor has to perform an assessment of the energy performance of the building based on a number of requirements. The final classification is done according to a predefined

colour-based scale and with reference to the German legislation²⁰ (see Figure 5). Then, the auditor and the owner exchange views to reach a common vision about a reasonable step-by-step plan for renovation (Figure 6).

Figure 6 - From Vision to Plan (Source: ifeu, dena, PHI; the text in italics is an additional



²⁰ EnEV bzw., KfW-Systematik bzw. Eu-label, etc.

Definitions

Deep renovation

iSFP is not “defining” deep renovation, but introduced the “best possible principle”, replacing the concept. According to this principle, the efficiency level that the building stock has to reach on average is equivalent to the KfW’s Efficiency House 55²¹ (corresponding to about 30-40 kWh/m²/a of primary energy consumption for a single family house).

As a general rule, the auditor has to recommend the most ambitious standards and options for each component of a particular building. If this is not possible, he/she has to explain why they advise the owner to deviate from the best possible standard.

The building modelling used for the iSFP can simulate the impact of each renovation on the overall energy efficiency target, allowing it to monitor if too many buildings deviate from the best possible standard, which could result in the target being missed.

Features

The iSFP includes four main components:

- a) A general introduction regarding long-term planning and the package of measures proposed. For every measure, a description of the expected positive effects is included (e.g. warmer feet and lower heating costs);
- b) A technical documentation (data, technical and energy status, information about the network and recommendations for the next steps) describing in details each proposed measure and their energy performance;
- c) Supporting material for the implementation, including an overview of the technical documentation and information about financing;
- d) Guidelines and supporting material for the energy auditor (check-list, summary and handbook).

Some indicators (energy performance, energy demand and future energy costs, CO₂ emissions) are summarised in the roadmap, using a colour-based scale, while additional technical information is provided in appendix.

iSFP deals with comfort differently than it does for other performance indicators, since the roadmap does not include any formal comfort indicator, like noise or indoor air quality. Instead, comfort levels are measured in a qualitative way, based on the professional judgement of the auditor. Comfort is expressed in a separate box with a description of the expected benefits that the building occupant will gain after the renovation, for instance “warmer feet” or “better light” (see Figure 7).

²¹ In Germany, energy efficiency standards for new buildings are laid out in the German Energy Conservation Ordinance Energiesparverordnung (EnEV). KfW (Kreditanstalt für Wiederaufbau), Germany’s development bank, has developed a financing mechanism for the refurbishment of existing residential building based on these standards. Efficiency House 55 indicates the percentage of the EnEV’s primary energy requirements for new buildings that an existing building has to meet after renovation.

Figure 7 - Overview of the expected positive effects after renovation (Source: ifeu, dena, PHI; the text in italics is an additional translation by BPIE)



The renovation roadmap also includes a page on how to save energy in the use-phase and by changing behaviour.

Auditors' training

Energy auditors are required to acquire new technical and communication skills to successfully implement iSPF and the “best possible principle” with the objective for them to acquire the ability to design a comprehensive package of measures to achieve deep renovation, communicate easily with the building owners, taking into account their needs and successfully motivating them to initiate deep renovations.

Auditors participating to the iSPF receive a handbook where every step of the iSPF is described in details. During the pilot phase in Baden-Wuerttemberg, the programme included a dedicated training scheme for qualified energy auditors (16 hours of additional training), offered by the professional organisations (craftsmen, engineering and architects) and carried out by a private trainer.

A similar scheme has been recommended for the adoption of iSPF at the federal level, but, as of September 2016, the German government had not taken a decision in this regard.

Digital logbook

Contrary to the other two initiatives, the German building renovation roadmap does not foresee the introduction of a digital logbook associated with the renovation roadmap. At the end of the process, building owners receive a printed document with the renovation roadmap.

Stakeholders engagement

When the building renovation roadmap was first introduced in Baden-Wuerttemberg, stakeholders were successfully engaged and actively cooperated in the pilot project.

Three large stakeholder workshops were organised, including craftsmen, architects, the association of building owners, auditors, policy-makers and NGOs. Software companies were invited to a roundtable.

The approach chosen for the federal roll-out of the iSFP is similar to the one adopted in Baden-Wuerttemberg but at a larger scale.

Building typology

iSFP targets privately-owned houses. The audit schemes currently covered one and two-family houses, but they could also be applied to larger ones.

Implementation

The building renovation roadmap was first tested in Baden-Wuerttemberg, where a pilot phase was conducted on a limited number of buildings in 2015. During the test phase, three auditors conducted 10 audits using the methodology developed for the building renovation roadmap. Consumers were involved in the stakeholder process and could provide feedback.

Building on the experience in Baden-Wuerttemberg, the German government decided to launch a national initiative to promote the building renovation roadmap across the country. A new software for iSFP is currently under development. When ready, it will be submitted to a quality control test before a pilot period will be rolled-out (planned for 2017). The software allows iSFP to be improved overtime and to make the necessary adjustments.

A stakeholder dialogue was used to assess the level of acceptance of this new tool. Even though a mapping of the risks has not been done, the biggest risk for the success of iSFP is acceptability. The refusal of building owners to engage in deep renovation and to use iSFP could undermine the success of the initiative. For this reason, putting building owners at the centre of the project and offering an attractive, user-friendly tool are considered two key elements for the success of iSFP.

Graphic design

The final graphic design, as well as the first full report on the development of the German iSFP, are not available yet.

WONINGPAS (DWELLING ID), VEA – BELGIUM FLANDERS

Key features

- Linked to a long-term target for the energy performance of the building stock
- Linked to EPCs (EPC +)
- Building owner at the centre of the process
- User-friendly
- Includes a digital logbook
- Customised measures

Concept

VEA, in strong cooperation with a wide network of stakeholders (see page 22), is developing the “Renovation Pact” (2014-2018²²), that should lead to a thorough improvement of the energy performance of the Flemish housing stock. One of the main actions foreseen in the pact is to create a so-called “renovation advice” by 2018 (renovatieadvies), integrated with the first version of the digital logbook (called Building Passport Light) by 2018. The renovation advice aims to give property owners an insight into the logic of renovation steps as a means to achieve Flanders’ long-term objective of an energy-efficient housing stock: by 2050, the existing building stock should become as energy-efficient as new buildings today (E60²³).

The elaboration of the renovation advice is divided into three sub-tasks, led by three working groups at the Flemish Energy Agency:

- a) Development of general renovation advice for building owners (ongoing);
- b) Development of an evaluation framework, included in the renovation advice, to assess whether demolition should be preferred over renovation (‘demolition versus renovation’), and
- c) Development of a competency profile of the renovation consultant.

Subtask 1 is running, subtasks 2 and 3 are still to be started.

²² 2018 is indicative.

²³ According to Flanders’ energy efficiency legislation (EPB), a number of requirements in terms of insulation and ventilation are set and the overall energy efficiency of a new home is classified according to the so-called E-standard, with a low standard indicative of a highly energy-efficient home. The standard for new buildings in 2016 is E60, corresponding to a primary energy demand for new and non-residential buildings of 100 KWh/m²/y .

Renovation advice and EPC+

The renovation advice will provide a roadmap to help building owners to make a thoughtful, forward-looking plan for their renovation.

Two major groups have been identified as the main beneficiaries of the renovation advice: a) building owners and prospective buyers and b) tenants.

Since the needs of the two groups are different, VEA has decided to develop two different instruments: the renovation advice (targeting property owners) and EPC+ (targeting potential property buyers and tenants).

The renovation advice describes the actions that the owner should take to bring the current energy performance of the property to the level established by the long-term objective (E60 in 2050). The renovation advice contains recommendations for various relevant measures – beyond energy - that accompany a thorough renovation (e.g. airtightness, ventilation, etc.). The information is delivered by an energy expert and should include an estimation of the investment cost.

The renovation advice targets property owners who already intend to renovate. It allows the owner to choose between completing the renovation in one go or doing it in stages while avoiding lock-in effects. The staged renovation advice takes the specific situation of the property owner (age, family situation, duration of the renovations over time, existing planned renovation, etc.) into account and includes an estimation of the cost and the payback time of the proposed measures²⁴.

Even if it is directly targeted to building owners who intend to renovate, this instrument will also be promoted on a larger scale, in order to increase awareness around building renovation and alert owners to the benefits and opportunities of staged renovation. It is anticipated that over 10.000 dwellings per year could adopt the tool when it is rolled out and fully implemented.

In contrast to the Renovation Advice, the EPC+ is an enhanced version of the EPC aiming not only at informing potential building buyers of the energy value of a property, but at providing them with a very clear picture of what is needed in order to achieve a future-proof energy-efficient standard (E60 by 2050). The potential buyers will be informed on the best options for the energy renovation of the property they are interested in. The current EPC will be expanded and information about the renovation-roadmap towards the long-term energy objective will be included.

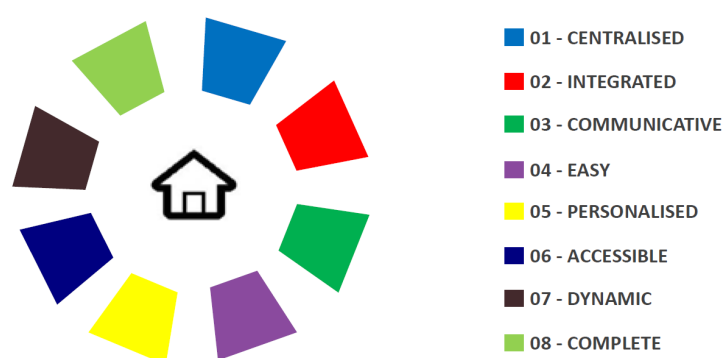
Digital logbook

The long-term goal of the Flemish renovation pact is to improve the energy performance of the existing housing stock. To visualise this path, VEA is also developing a digital logbook (called 'Building Passport') to accompany the renovation advice and EPC+. The 'Building Passport' is a unique digital document for each house, that can be consulted by the property

²⁴ VEA (2016): Renovation Advice, Summary Concept. [4]

owners and authorised third-persons (e.g. craftsmen, architects, energy experts, notaries²⁵). The passport will follow the long-term evolution of each house by collecting data on energy performance, renovation advice, housing quality, other building features (stability, durability, water, installations, humidity, etc.) and other data related to the property that the building owner can safely collect and save²⁶. Building owners will be able to visualise their current energy consumption, as well as the potential savings and the proposed roadmap.

Figure 8 - Characteristics of the digital building passport (Source: BPIE, mock-up based on input provided by VEA)



The primary user of the ‘Building Passport’ is the owner, who can grant permission to make certain information publicly available and keep more detailed data restricted (semi-public upon authorisation to third-parties).

The credibility of the ‘Building Passport’ and reliability of the data are two key elements for the success of the passport. By linking it to authentic sources of building data managed by the government (for example, certificates and inspections), the ‘Building Passport’ can gain credibility.

In its opening page, this digital logbook (“Building Passport”) offers an overview of all needed and available certificates as well as necessary inspections, a sort of checklist to get an insight on the quality and characteristics of the building. The owner gets alert messages regarding the inspections to be carried out periodically or linked to some milestones.

The passport can also be used by a prospective buyer, seller or tenant to get a first glimpse of the building, upcoming inspections or required maintenance, as well as the expected administrative tasks²⁷.

The ability to add new elements and information to the passport over time is crucial. For this reason, the logbook is designed to have a modular structure. A successful building passport is constantly updated and fed with new inputs. VEA, in cooperation with the stakeholders working group, is keen to design the right tool that will motivate building owners to actively

²⁵ Access to banks and other financial institutions is currently not included.

²⁶ VEA (2016): Digital Building Passport, Summary Concept. [5]

²⁷ The use of the Building Passport as a tool to facilitate the assessment of a property by the mortgage industry has not been foreseen.

use this tool and regularly update it.

Definitions

Deep renovation: VEA does not use a definition for deep renovation, but refers to a long-term efficiency objective: existing buildings must achieve the E60²⁸ level by 2050. This corresponds to 100 kWh/m² gross surface, combined with a series of mandatory requirements (measures and installations). Users can choose how to combine these elements based on their individual needs. The long-term efficiency objective is currently a voluntary target, but VEA is exploring the possibility to make it mandatory in the future.

VEA considers this long-term goal “a pragmatic objective”²⁹ that seems feasible for both the citizens and the construction industry. However, this objective will be evaluated regularly and, if necessary, tightened in order to meet the commitments on energy-efficiency improvements and CO₂ reductions.

Features

Automated advice: To reduce costs, VEA will develop a user-friendly tool and distribute it to energy experts. The tool is based on input data and, to the extent possible, works with prefabricated text-blocks. This reduces the amount of learning and time required for energy experts and allows the introduction of specific property parameters gathered on-site to provide a tailor-made advice (personal advice).

Customisation of the proposed measures: The advice should focus on the specific audited building. Energy experts will have the ability to adjust the automatically generated recommendations³⁰. If an automatically-suggested measure is not desirable or its installation is not possible/desirable for the specific building, the expert will have the opportunity to suggest an alternative measure and explain the reasons (technical, functional, economical, regulatory, e.g. the building is listed as protected heritage). In addition to the automatically-generated recommendations, the expert is free to add additional tailored advice.

Tailored to the user: The renovation steps must be tailored to the user's needs and personal financial situation. These aspects have an impact on the sequence and timing of the different steps. In addition, the expert has the ability to take into account the actual energy consumption, the life pattern and the desired comfort level of the user (e.g. desire to heat parts of the house that were previously heated at a lower temperature or not at all), which have an impact on the comfort benefits and potential monthly financial savings resulting from the renovation.

Inclusion in the digital logbook ('digital building passport'): The renovation advice is part of the 'digital building passport', a repository where the user has the possibility to check the renovation steps performed and those still to be completed. It is designed as a 'living' document that can easily be kept up-to-date. Optionally, the owner can also update data

²⁸ New buildings today must achieve an efficiency level of E60, while nZEB level is defined as E30.

²⁹ Interview on July 18, 2016.

³⁰ The methodology to automatically generate the recommendations has not been developed yet.

about the subsidies received and fuel prices linked to the renovation advice.

Performance Indicators

When assessing which indicators should be included in the renovation advice, VEA realised that the key principles of objectivity and personalisation (advice tailored to the user) could conflict. VEA suggests to solve this conflict by using three different scenarios: the first scenario is a generic but objective advice that displays the optimum path towards the long-term, without taking into account the wishes or situation of the current user, the second scenario is an advice tailored to the user, and a third scenario shows a path that goes further than the long-term objective. The energy level that the customer would like to achieve can be incorporated in each scenario.

Depending on the scenario, the renovation advice offers a combination of renovation measures, including:

- Building envelope (including air tightness) elements.
- Renewable energy systems.
- Technical elements: technologies for the generation of space heating and domestic hot water.
- Ventilation: ventilation facilities are also included in the main measures to meet the needs on comfort and health.
- Measures to avoid lock-in.

For each renovation option, the proposed measures are divided into several steps. Each step includes:








- Identification and description of the work to be carried out;
- The impact on energy demand: U-values, overall building envelope S-level (degree of global insulation), energy performance indicator, air-tightness, etc.;
- Investment required;
- Impact on comfort;
- Impact on real-estate value³¹;
- CO₂ savings;
- Non-energy aspects, such as safety, aesthetics, health, maintenance, building lifespan, etc.;
- Recommended timeline;
- Auditors' comments and notes on the renovation advice.

The impact on comfort (e.g. thermal and acoustic comfort) will not be measured by an indicator but will be assessed in a qualitative way (see mock-up below). Depending on the

³¹ A study will investigate the impact of investments on the average real-estate value of a typical dwelling. New buildings today must achieve an efficiency level of E60, while nZEB level is defined as E30.

input given by the users during the design phase, other elements will be added, or proposed elements will be removed from this list.

Figure 9 - Overview of performance indicators included in the Renovation Advice (Source: BPIE, mock-up based on input provided by VEA)³²

| Step | 0 | 1 | 2 | 3 | 4 | 5 | Total |
|---------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Measure | Initial situation | Roof | Walls | Installation | Renewable Energy | ... | Total Renovation |
| Energy performance label | F | C | B | A | ... | AAA | AAA |
| Investment (€) | 0 | 20.000—30.000 | 30.000—40.000 | 4.000—6.000 | ...7... | ...7... | ...7... |
| Comfort |  |  |  |  |  |  |  |
| Real estate value | + 0% | + 5% | + 10% | + 3% | + 3% | + 1% | + 22% |
| Annual CO ₂ - savings (kg) | 0 | 5.500 | 5.000 | 4.000 | 7.000 | 1.500 | 23.000 |

Auditors' training

A dedicated working group is investigating which skills should be required for auditors. VEA is considering setting up training to become a certified 'renovation advice auditor', as a way to keep auditors up-to-date and provide them with specific knowledge.

Building typology

The renovation advice targets single-family houses. The software, as currently foreseen, could also give advice on building units, but not on multi-family buildings.

VEA is investigating if EPC+ and the renovation advice could be implemented for multi-family buildings (apartment-block). A separate working group on renovation advice for multi-family buildings, rather than units, is in place. The working group is assessing if it is desirable to promote renovation for just one unit.

It is not excluded that the EPC+ will be mandatory for single-family (since it will replace the current EPC) and for multi-family buildings in the future.

In this case, the EPC software currently in use, based on a building-unit approach and measurements, will have to be drastically transformed.

Stakeholders engagement

The concept of the renovation advice is being developed with a working group of stakeholders, and similar projects, such as the Sanierungsfahrplan of Baden-Wuerttemberg, have been considered.

³² Note that the AAA levels have not been defined yet. A consultation with building owners will be initiated to define which kind of label could attract and motivate them the most.

In a next phase (beginning in autumn 2016), a service-design project³³ is planned in order to make sure that the proposed concept is fitting the needs and wishes of the identified users.

VEA invited some stakeholders to join the working group on the renovation pact and to co-operate on the design of the renovation advice and the logbook. The aim is to create a support network of co-operating partners who will take care of forwarding the information and action plans to the people connected with the building process, in order to gain project acceptance.

The stakeholders come from the building sector, such as federations and organisations representing large groups involved with the renovation process (see table 1). In addition, notaries and representatives of federal legal services are also included to give advice on data sharing/protection and obligations of building owners. Government agencies on regional, federal and local level that manage data of buildings in Flanders are also consulted.

At the beginning of the process, VEA organised a public survey to test the general concept. A second survey will be organised to gauge public reactions about the content of renovation advice, EPC+ and to enquire about the logbook features (e.g. costs - range/indication/type).

The survey will also help determine if some elements that cannot be part of the renovation advice (ex. indication of costs) could be included in the logbook. For example, costs in the logbook could be linked to other databases and be dynamic. This would relieve the responsibility of auditors regarding suggested costs but it would open questions about the accountability for the information provided.

Table 1 - Stakeholders invited to the Renovation Advice WG (regional and national) (Source: VEA)

| Stakeholder name | Description |
|------------------------------------|---------------------------------------------------------------------------------------------------------------|
| Agoria | Sector-federation for the technology industry in Belgium |
| BCCA | Belgian Construction Certification Association |
| BMP | Belgian Building Materials Producers |
| Bouwunie | Union of SME contractors, providing legal support, an ombudsman, administrative support, start-up supervision |
| VCB | Confederation of professions in the construction industry in Flanders, both major contractors and SMEs |
| CIB Vlaanderen | Confederation of Real-Estate professions in Flanders |
| Infomazout | Interest organisation of consumers of heating oil |
| NAV | Flemish association of architects |
| OVED | Consultation platform for energy experts |
| Steunpunt duurzaam wonen en bouwen | Regional information centres for sustainable building and living |
| Vlaams Raad van het Notariaat | Flemish Notary Council |
| UVS | Flemish union of building managers |
| BBRI | Belgian Building Research Institute |

³³ A methodology to establish best practices to design services, based on customers' needs and the competencies and capabilities of some systems.

| | |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Gezinsbond | Consumer association defending the interests of the families |
| Eandis/ Infrax | The two Distribution System Operators (DSO) in Flanders (responsible as well for the management of the Flemish subsidy schemes for energy efficiency and renewable energy in buildings). |

Implementation

VEA plans to introduce the Renovation Advice and EPC+ in the autumn of 2018.

Several risks were identified regarding the implementation: some are more general (e.g. the proposed tools are not user-friendly and people will not use them), others are more specific: technical risks linked to the need to coordinate and synchronise input from different sources or legal risks (data ownership) and the need to get information and data access from both federal and regional authorities (for instance, property-ownership data are under the federal competence, while energy and health-related information fall under the regional competence).

Graphic design

The graphic design of the renovation advice will be developed during the service-design process. In order to convince the user to take action, the advice must have a visual and appealing graphic design and be easily understandable for the user.

PASSEPORT EFFICACITÉ ÉNERGÉTIQUE, P2E (ENERGY EFFICIENCY PASSPORT) – FRANCE

Key features

- Linked to a long-term target for the energy performance of the building stock
- Building owner at the centre of the process
- Based on a combination of measures based on building type / age/ location (combinable)
- Attempt to 'industrialise' the renovation process and lead to economies of scale
- Three main users (owners, auditors and renovation professionals)
- Access via Internet (web platform)
- Comfort as a key performance indicator (quantitative and qualitative)

The Energy Efficiency Passport is a web platform offering three **independent but connected areas** to three groups of users: owners, auditors and craftsmen, and renovation professionals.

The concept was developed by the Shift Project³⁴ and a group of building specialists and professionals (see list on page 28) between 2012 and 2014 in the attempt to unlock the thermal renovation of buildings, identified as an imperative step towards decarbonising the economy³⁵. Testing and implementation were assigned to Expérience P2E (P2E), an organisation recently created to this effect. Founding members of P2E are the Shift Project, Cercle Promodul, EDF, Saint-Gobain and Schneider Electric. The review below is based on a series of documents provided by the Shift Project team and a series of exchanges with P2E's Project Leader³⁶.

The Shift Project highlighted a number of market barriers that the Energy Efficiency Passport intends to address to bridge the gap between the ambition to significantly scale-up renovation and the reality on the ground³⁷:

- Insufficient energy-price signal;
- Insufficient regulatory signal;
- Lack of long-term objectives and consequent lack of long-term planning;
- Complexity and quality of the offers by building professionals;

³⁴ The Shift Project is a French think-tank dedicated to identifying the step changes required to address the challenges of energy and climate and to developing and sharing resources, proposals and solutions to address them.

³⁵ The Shift Project (2013) : "Performance Énergétique du Bâtiment - Programme de rénovation thermique du parc existant 2015). [1]

³⁶ Benoît Montels (P2E Project Leader), interviewed on July 26, 2016.

³⁷ "The French Passeport Efficacité Énergétique" – PowerPoint presentation (2015). [9]

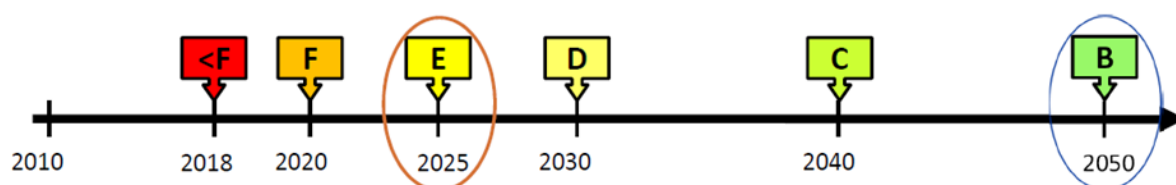
- Green value not materialised enough;
- Lack of guarantee mechanisms and certification of works.

Long-term objectives

In 2015, the Energy Transition Act (Loi de Transition Énergétique et pour la Croissance Verte, LTECV) contributing to the objective to bring the French building stock to the nZEB level by 2050 provided a clear regulatory signal to all stakeholders:

- By 2025, all class F and G buildings have to be renovated. Improvements should be close to the performance of a new building;
- By 2050, all buildings must be in class A or B (based on the French EPC), reaching BBC³⁸ levels or equivalent);
- The LTECV also mentions that, as of 2017, a tool called “carnet numérique de suivi et d'entretien du logement” (a digital notebook for the monitoring and maintenance of dwellings) should be deployed for each new building (as of 2026 for existing buildings).

Figure 10 - France's buildings renovation targets by 2050 (Source: “The French Passeport Efficacité Énergétique” TSP Working Group On Energy Efficiency in Buildings (2015))



Concept

The Energy Efficiency Passport suggests a pragmatic approach, building upon the notion of “energy efficiency reflex”, namely the maximisation of the opportunity to trigger energy renovation every time maintenance work is done in a building³⁹. Using any type of renovation or maintenance work as a trigger to install energy-renovation measures helps promoting energy efficiency among building owners and professionals and may generate higher levels of renovation.

The passport provides a set of solutions (“mesures combinatoires”), combining the best measures that would allow to get the BBC level for the overall building stock, based on specific features like building type, age, climate (etc.) and aiming at achieving the 2050 target for the existing building stock (BBC 2050). Each building is considered as a “puzzle piece” contributing to the overall target. These combinations aim at providing a set of consistent solutions for all parts of the building, which taken together support the realisation of the final goal. By

³⁸ Bâtiment Basse Consommation (Low-Energy Building).

³⁹ Ensuring that roofs and façades are meeting energy requirements when these are renovated for aesthetic or other reasons (e.g. equipment replacement) is now part of the regulation (Loi de Transition Énergétique et de Croissance Verte).

simplifying the choice among possible solutions for the renovation of a specific building and making it as easy as possible for the owner, the combination system aims at “industrialising” the renovation process and achieving economies of scale.

Figure 11 - A multi-dimensional tool (Source: The Shift Project)

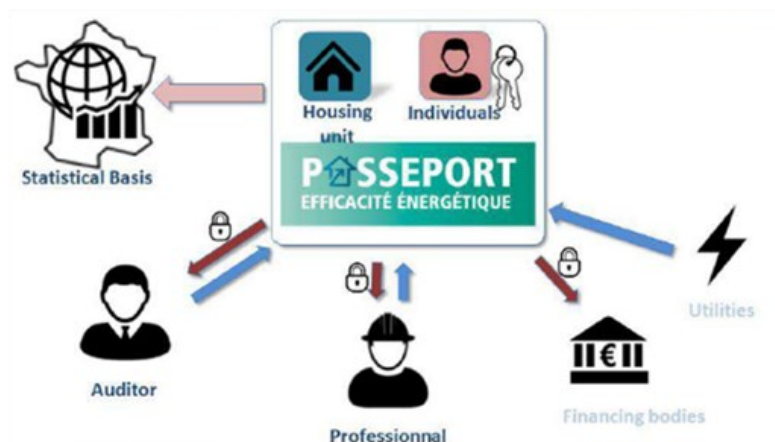


The passport aims at becoming an “all-in-one” solution and combines five different dimensions:

- It is a collaborative tool for all players in the building sector;
- It uses the EPC as a starting point for its analysis, but goes beyond by integrating tailor-made recommendations (based on a combination of solutions to reach “class B” level, as a minimum), information regarding comfort, financial planning (including available national subsidies) and asset valuation;
- It is a pedagogical tool that can be used to facilitate communication among all players in the building sector to simplify the “renovation jargon” for building owners;
- It is flexible enough to elaborate renovation paths tailored to the owners’ needs and wishes (e.g. global renovation vs. staged approach), and to monitor the evolution of the building over time;
- It is an evolving tool, open sourced and sharable. As a web platform, it is designed to fit into existing modelling tools and is open to add functionalities.

The Passport is designed for three specific users: owners, auditors and craftsmen, and renovation professionals. P2E will make the web platform available for free, including training to the professionals and the auditors interested in using it.

Figure 12 - The Passport's 'Ecosystem' - interaction with the building sector (Source: The Shift Project)



Building owners can access the platform in two ways:

- Through local renovation platforms (a national initiative offering renovation advice at local level), the website includes local contacts and a directory of all the craftsmen and auditors operating in a given territory;
- Through certified auditors: the auditor can create the passport during his/her visit and directly input the required data. At the end of the visit, the software will deliver the recommended solutions to achieve the energy renovation target.

The project is built in three phases: design, testing and implementation.

The design phase is complete, testing will start in the fall of 2016, followed by an implementation phase. The results of the testing period will be used to make adjustment to the online tool (starting in autumn 2017).

Some major changes occurred since the design phase started, in particular regarding the software used for calculations. It was decided to replace the online tool initially developed with a new simplified tool, available online and compatible with smartphones and tablets. This tool is currently under development and is expected to be ready for use during the testing phase. Specific features and functionalities are not available yet.

After the testing period, the results and lessons-learned will be used to assess the platform and compile a set of recommendations for the development of a more sophisticated version of the software.

Definitions

Deep renovation



The definition of deep renovation used by P2E is the following: a deep renovation is the renovation of a given dwelling reaching high level of efficiency in one go (global renovation) - the objective is to achieve a BBC level of renovation, equivalent to 80kWh/m² of primary energy per year, including heating, hot water and cooling.

Staged-deep renovation



Staged-deep renovation has the same efficiency target as deep renovation, but renovation can be paced out over a longer time-horizon. According to P2E, this approach has the advantage to limit upfront costs and allows building owners to plan their renovation over time. On the other hand, the risk of lock-in effects and consequent lower comfort-improvement is higher.

The passport aims to reconcile the 2 approaches (global deep renovation vs. staged-deep renovation) and proposes a consistent trajectory to reach a final performance level of “Class B” (EPC). The pilot phase will enable to fine tune and in needed adjusts the definitions.

Building typology

The main focus of P2E is single-family houses.

In the future, the tool may be adapted to multi-family housing and commercial buildings, but it will need to be heavily adjusted (e.g. adapt to specificities of joint-ownership, space management, decision-making process, etc.)

Features

A certified audit is the first step to start the process towards the Energy Efficiency Passport. The audit lasts four hours and is composed of a technical visit and a discussion with the building occupant. The audit is done in three steps:

- **Technical visit:** the technical visit consists of a detailed inventory of each building component and systems: dimension, materials, roof, floors, doors, windows, heating and cooling, air tightness, ventilation, etc.
- **Discussion with occupant:** following the technical audit, a Diagnostic of Energy Performance and a technical report are generated automatically. The auditor and the building occupant discuss the outcome of the technical audit and other elements that need to be taken into account to plan for renovation: funding capability and eligibility for subsidies (only national subsidies are considered⁴⁰), composition of the household and consumption habits, and, as a way to put the “energy efficiency reflex” into practice, future plans for restyling or non-energy renovations (e.g. aesthetic improvements, extension or change-of-use of a specific space, etc.). This step is essential in the scheme, namely to ensure ownership of the project by the occupant. It is also an opportunity to explain improved comfort, health and well-being benefits of the renovation.
- **Complete renovation scenario:** following the completion of the two previous steps, the auditor delivers a renovation scenario, including a roadmap and the cost of each combination of measures. The final renovation scenario is based on the pre-established combinations of measures.

⁴⁰ Funding opportunities are only based on available state-financing. Including other sources of financing (private, regional, local, etc.) requires a high level of cooperation with a wide number of public and financial institutions. The project currently does not have the capacity to engage in such cooperation, but the issue will be further explored during the testing period.

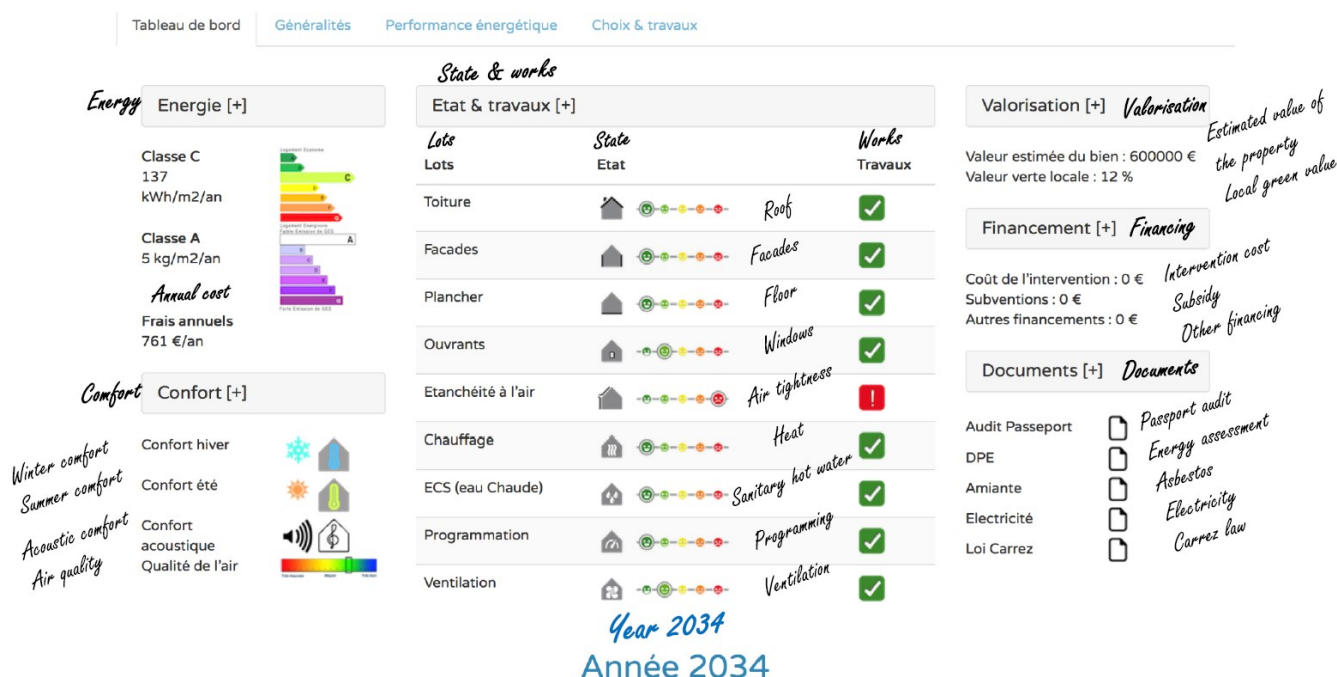
The results of the audit (the renovation scenario) are provided online, in a single webpage, the Dashboard, showing an overview of all the main elements taken into account: energy, comfort, detailed features, valuation, financial aspects and files storage⁴¹. A brief description of each indicator is provided below. Performance indicators are presently under development and may change in the future. The project will be open to constant adjustments and improvements, based on the results of the testing period and user feedback (*démarche d'amélioration continue*).

Energy: This indicator includes the Diagnostic of Energy Performance, the annual energy costs and detailed information about energy consumption (past, present and future) and potential savings.

Comfort: This includes indicators on thermal comfort (winter and summer comfort, also based on use and behavioural habits), acoustic, visual and olfactory comfort, air quality and recommendations about behaviour and system uses. P2E intends to base comfort indicators both on technical and subjective inputs and is currently exploring this opportunity.

Detailed features: The energy efficiency level of each element of the building is displayed on the dashboard based on the evolution of the energy renovation (e.g. to be planned, planned, ongoing, completed). Details for each element (architectural and technical features, etc.) are available in separate pages on the website.

Figure 13 - Energy Efficiency Passport Dashboard (Source: The Shift Project; the text in *italics* is an additional translation by BPIE)



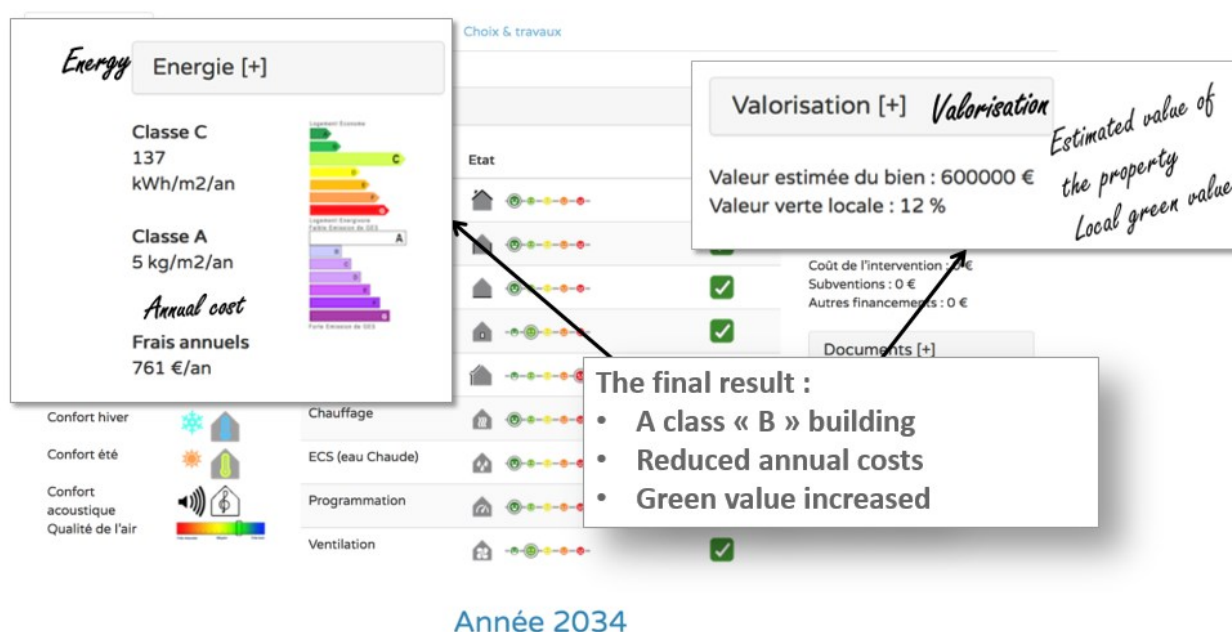
Valuation: An estimation of the value of the building and the evolution of its increased value overtime, the so called "Green Value" (*Valeur Verte*, see Figure 14).

⁴¹ [9]

Financial aspects: This includes a summary of the costs of each measure and intervention (opération), the amount of available subsidies (calculated according to the type of work and financial situation of each household).

Files storage: This includes every file, administrative documents and pictures, plans, 3D-models related to the building are stored and centralised in a unique place (see Digital Logbook).

Figure 14 - Energy Performance and Green Value (Source: The Shift Project; the text in italics is an additional translation by BPiE)



The P2E project will help unlock the financing barriers through enabling investment over time, but the costs of renovation remain a big hurdle as well as the lack of a real obligation for building owners to renovate.

A real obligation to renovate would drive demand and the uptake of tools such as the passport, but the impact that the 2025 milestone (all class F and G buildings should be renovated) will have on the market still remains to be seen. The discrepancy between the duration of state funding (three years) and staged-renovation plans (up to fifteen years) also constitutes a challenge that the project will try to reconcile.

Since P2E is purely voluntary, with no obligation for building owners to renovate and/or use its proposed approach, the success of the pilot phase will be based on the effectiveness of awareness-raising, marketing and communication activities.

This limits not only the type of tools that can be used to increase the rate of deep renovation, but also the objectives that P2E has set for the project: considering the current low rate of energy renovations in France, P2E has not set a target in terms of number of audits or households to be renovated using the energy efficiency passport, but has set a geographical target: testing P2E in 3 to 5 regions in the next two years.

Digital logbook

The web-platform is linked to a page where all relevant files and documents regarding the building's maintenance, equipment replacements and renovation can be stored.

In addition, the data collected through the passport will be anonymised and made available in a public database used to gather information and statistics about the type of works planned and/or implemented, and the most popular measures every year. Issues surrounding data accessibility and data privacy and consumers' protection laws will have to be considered and a dedicated working group will dive further into the matter.

P2E does not plan to fully develop a building logbook but will contribute to the Energy Performance and Renovation component of the so-called 'Carnet numérique de suivi et d'entretien du logement' (Digital notebook for building's operation and maintenance), which covers all aspects related to buildings and of which the French government has proprietary rights.

Stakeholders engagement

The concept of the Energy Efficiency Passport was developed by the Shift Project, in collaboration with an energy-efficiency working group of building professionals. The working group included professionals in the construction sector (Fédération Française du Bâtiment, Groupe Bouygues) and on-the-job training programs, regulatory specialists (Plan Bâtiment Grenelle), industrial companies (Saint-Gobain, Rockwool), energy companies (EDF and GDF Suez), research units (Enertech and Pouget Consultats), expertise banks (BPCE), and, more broadly, technical experts in thermal renovation.

In 2016, P2E was created to relaunch the concept and manage a two-year testing and implementation phase, which will start late 2016. During this phase, different stakeholders will be involved, in particular craftsmen, small and medium enterprises and associations operating in the field of residential renovation, as well as local authorities and organisations in the regions where the platform will be tested.

Stakeholders are organised in thematic working groups, based on their competences and skills. Detailed planning for stakeholders' engagement is ongoing and the frequency of the meetings is still to be defined. All working groups will be active in parallel. The main objective is to familiarise with and support the Passport, simultaneously understanding the perspectives from the other relevant actors.

Implementation

The Energy Efficiency Passport is about to enter its operational phase: in the fall 2016, a testing period will start, followed by a second phase (starting late 2017) when the lessons-learned and the feedback gathered during the pilot phase will be integrated into a more sophisticated tool.

The testing period will focus on:

- a) The promotion of the web platform at the local level and its ability to mobilise and engage stakeholders and market actors;
- b) Auditors' training on how to use the platform and get acquainted with the concept of energy renovation;
- c) Communication activities and disseminations of results.

Graphic design

The graphic design of the Energy Efficiency Passport will be fully developed after the testing period.

CONCLUSIONS AND RECOMMENDATIONS FOR THE DEVELOPMENT OF A BUILDING RENOVATION PASSPORT IN THE EU

Based on the three cases examined in this paper, five common guiding principles can be identified as the basis of the building renovation passport:

- **Long-term perspective:** the integration of a long-term thinking is essential for the success of building renovation passports, since they aim at helping the owner to carefully plan for renovation in a consistent manner, achieve a high-level of energy performance over time and better control the total cost of renovating.
- **Timing and sequencing of actions:** building renovation passports include both short-term and long-term measures and clearly indicate the correct order in which to install them (e.g. sequencing of the measures' installation over time) to avoid lock-ins, increase building owners' confidence and enhance the rate of deep renovation. Passports therefore address uncertainty regarding future renovation steps, which typically lead to retention with respect to renovation decisions or to limited renovations (installation of short-term measures).
- **Customer engagement and consideration of the individual renovation context:** The wishes, needs - in particular expectations regarding comfort - and the financial situation of the occupants must be considered. These include, for example, financial opportunities, living space changes and family planning (e.g. having a baby, or children moving out). In all the study cases, the fact that the owners take ownership of the project is seen as a key success factor.
- **Attractiveness and motivation:** BRPs should be very attractive and user-friendly. Building owners have to be guided throughout the process and receive clear indications so that they can confidently take action without being discouraged by the complexity of the renovations. The visual graphics of the BRPs must therefore be carefully designed and easy-to-understand.
- **Automation:** experts should be able to perform the audit and deliver the results as easily as possible. The instrument offered to the auditors (e.g. software) to input data during the audit should be structured in modular blocks, indicate default values and highlight errors in case of wrong inputs, etc. Once the audit is concluded, an automated information sheet (including text and figures) can be filled with specific property parameters. This facilitates the energy auditors' work while delivering personalised advice at the same time.

In recent years, the concept of building renovation passport has been gaining attention as a way to achieve higher (and deeper) renovation rates. The upcoming review of the Energy Performance of Buildings Directive creates the opportunity to introduce this concept, to strengthen the use of EPC and to evolve the tool with the aim to make it an effective instrument for consumer and investor guidance.

In their current application, EPCs are mostly not considered a suitable instrument to increase renovation rates. As such, it is either not taken into account (like in Germany), or just used as a reference (e.g. P2E) for BRPs.

BPIE therefore suggests steps to initiate a dialogue about the opportunity to successfully promote the notion of building renovation passports across the EU:

- **Adopt a long-term perspective**

BRPs can help to make the concept of “renovating the building stock” a reality for building owners. To do so, BRPs should be linked to long-term renovation targets (e.g. building-stock renovation by 2050) consistent with a common EU vision and ambition, and include an implementation roadmap. This is particularly relevant if BRPs are promoted as a voluntary tool. Setting a clear long-term goal could stimulate the development of BRPs, which could be included in future national renovation strategies.

- **Clearly define the concept and components of the BRPs**

This is important to define the key elements to be included in the passport, based on a modular approach (mandatory components + additional modules, mixed in different manners based on specific situations and needs) that can be built overtime. BRPs should also identify their target audience and include monitoring and evaluation tools to track renovation actions over time.

- **Establish a target (building typology and users)**

Identifying the BRPs’ target users and building typology from the start allows flexibility in design and future implementation.

- **Be clear on ambition and definitions**

Since BRPs promote a step-by-step approach (staged-renovation), a common definition across Europe of deep renovation and deep-staged renovation would be welcome.

- **Adopt the appropriate regulatory framework and link Building Renovation Passports to EPCs**

To avoid uneven implementation across Member States, a common regulatory framework, linking EPCs to deep or staged-deep renovation across the EU is necessary. The ongoing review of the Energy Performance of Buildings Directive (EPBD) would be an excellent opportunity to strengthen the provisions around EPCs and link them to the notion of BRPs.

Integrating EPCs in the process, promoting them as the starting point to develop BRPs (as VEA is doing) has a threefold advantage:

- a) it provides mandatory requirements for Member States to implement BRPs;
- b) avoids competition between these two instruments and
- c) creates an opportunity to encourage deep renovation.

- **Adopt common tools**

Adopting common tools or, at least, clear methodological guidelines for measurement, statistics and analysis of each module will facilitate monitoring and implementation across countries.

- **Engage stakeholders beyond the building sector**

Stakeholders, covering a large range of competences and know-hows, going beyond the building and construction sectors, must be involved from the start. In particular, behavioural experts, data analysts, experts in data acquisition/sharing and protection, market researchers and communication strategists should be consulted.

- **Develop a user-friendly tool (for the auditors and the users)**

The BRPs should be easy-to-use for both the auditors and the final users. The audit process should be systemised as much as possible (modular structure, pre-defined text, graphs, etc.). This is imperative that the savings and non-energy benefits aspects are visible and understandable to owners. Equally important is that energy auditors and craftsmen are aware of the tool and feel confident about its use and effectiveness.

- **Include technical and communication training**

Some of the main barriers to the market uptake of BRPs is the diversity and large numbers of SMEs that characterise the construction market, and the anticipated “resistance to change”, of the craftsmen, energy auditors and, potentially, building owners. For this reason, it is vital to provide craftsmen and energy auditors with the necessary knowledge to understand the benefits of BRPs and how to use them, so they can become “ambassadors” of the BRPs towards building owners.

- **Find the balance between technical features and the ability to communicate**

The ability of auditors and craftsmen to create a dialogue with building owners is a key element for the success of BRPs and their market uptake. Building owners are usually interested in knowing how their comfort experience will change after renovation, but are less involved in the technical aspects of the process.

- **Reduce the administrative hurdles**

Making the BRP as simple as possible for the user is essential to its success. This is important to adapt building permit requirements to avoid extra administrative hurdles for building owners opting for deep-staged renovation. Having a single permit valid over time, rather than

requiring a new permit every few years, may facilitate the market uptake of BRPs.

- **Consider comfort as driver for renovation**

BRPs should express in a clear manner how the various improvements of a building will positively impact the comfort and well-being of its occupants. Therefore, climatic conditions, including the designed indoor climate regarding temperature, indoor air quality, acoustics and lighting should be among the main indicators featured in a BRP.

This will facilitate that, alongside the evaluation of the energy performance of the building, BRPs address comfort. While the notion of comfort varies in each country based on cultural and historical differences⁴², home well-being and energy savings drive renovation across Europe⁴³ today. Most home-owners consider their comfort and well-being (e.g. comfortable indoor temperatures, satisfactory levels of daylight, appropriate levels of humidity and fresh air supply allowing a better living environment and improved sleeping conditions) key characteristics of a healthy and desirable home and one of the main reasons for renovation⁴⁴.

⁴² ENTRANZE (2014): Report on specific features of public and social acceptance and perception of nearly Zero-Energy Buildings and renewable heating and cooling in Europe with a specific focus on the target countries. [13]

⁴³ Velux (2016): Healthy Home Barometer. [14]

⁴⁴ For example, comfort, timing, aesthetic factors, investment costs and cost-savings are important determinants for investments in the building envelope. [13]

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ANNEX 1

OVERVIEW OF COMMONLY USED TERMINOLOGY AND DEFINITIONS

As highlighted in the report, there are a number of ways to define deep renovation, staged renovation and deep-staged renovation. In absence of a common definition of each of these three concepts, below we provide an overview of the terminology as it is currently used by different building experts, including BPIE.

Deep renovation

Deep renovation is a process enabling the full potential of a building to reduce its theoretical energy-demand by a careful planning of the renovation to avoid the installation of lock-in measures. Deep renovation can be approached with the following methods:

- a) Percentage of energy-savings realised;
- b) Maximum energy performance;
- c) A selection of energy-saving measures to be executed.

For the European Commission, deep renovations typically achieve more than 60% energy savings compared to pre-renovation levels⁴⁵.

BPIE adopts, for its modelling approaches on deep renovation, an achieved energy saving of 60 to 90% (anything above this level is considered nZEB).

According to the Global Buildings Performance Network (GBPN), deep renovation combines approaches a) and b).

*“**Deep Renovation** or **Deep Energy Renovation** is a term used for a renovation that captures the full economic energy-efficiency potential of improvement works, with a main focus on the building shell, of existing buildings that leads to a very high-energy performance. The renovated buildings energy reductions are 75% or more compared to the status of the existing building/s before the renovation. The primary energy consumption after renovation, which includes, inter alia, energy used for heating, cooling, ventilation, hot water and lighting after the deep renovation of an existing building is less than 60 kWh/m²/yr⁴⁶”.*

⁴⁵ European Commission Staff Working Document (SWD(2013) 143final).

⁴⁶ GBPN Definition: <http://www.gbpn.org/reports/what-deep-renovation-definition> .

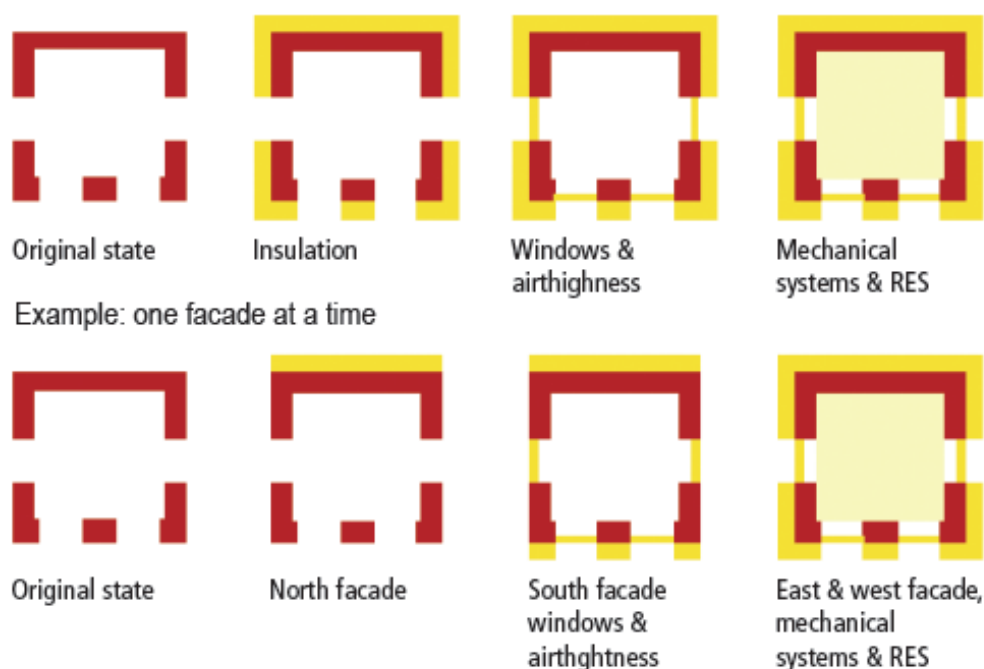
Staged renovation

In the EED guidebook published by the Coalition for Energy Savings⁴⁷, “the successful implementation of a staged-renovation requires the definition of a holistic renovation plan to avoid that any stage of the renovation increases significantly the overall costs, or precludes subsequent stages, in the course of the standard renovation cycle. This renovation plan will look at the building as a whole (including envelope, control systems, technical systems and equipment), and define the sequence of the renovation stages with a view to reach the final goal (the significant reduction of energy consumption).”

BPIE considers an appropriate staged-renovation as a renovation plan stretched over a long period of time ensuring the integrity of the building performance throughout the long-term renovation process avoiding lock-in effect. Under the EuroPHit project, staged-renovation is defined as:

“A master plan can be tailored to fit the needs of the building and/or its owners/users. For example, it could specify the replacement of various components at various points in time or go façade by façade. However the plan is composed, it should define the type, quality and order of measures to be taken. The reward for steps carried out following an integrated plan: a future-proof, comfortable, sustainable building with consistently low running costs.”⁴⁸

Figure 15 - Example of a component-by-component approach (Source: EuroPHIT (2015))

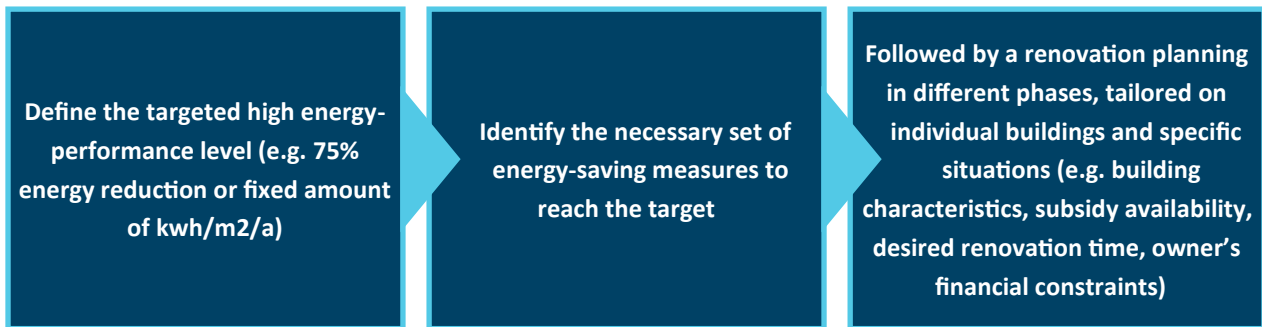


⁴⁷ <http://eedguidebook.energycoalition.eu/national-renovation.html>.

⁴⁸ <http://europhit.eu/step-by-step>.

Deep-staged renovation

None of the three concepts explored in this report has attempted a definition of deep-staged-renovation. BPIE suggests a threefold approach to achieve it:



ANNEX 2

REQUIREMENTS FOR PERFORMANCE BENCHMARK FOR WONINGPAS (DWELLING ID) – BELGIUM FLANDERS (VEA)

Requirements included in the building envelope and technical installations. The package is made of two parts:

1. Maximum U-values for the building envelope:

- Roofs and ceilings: $U_{max} = 0.24 \text{ W} / \text{m}^2 \cdot \text{K}$
- Walls: $U_{max} = 0.24 \text{ W} / \text{m}^2 \cdot \text{K}$
- Windows (profiles and glazing): $U_{max} = 1.5 \text{ W} / \text{m}^2 \cdot \text{K}$ and $U_{glas} = 1.1 \text{ W} / \text{m}^2 \cdot \text{K}$
- Doors and gates (including frame): $U_{max} = 2.0 \text{ W} / \text{m}^2 \cdot \text{K}$
- Floors: $U_{max} = 0.24 \text{ W} / \text{m}^2 \cdot \text{K}$

If the package of measures is not achievable for financial, technical, or regulatory reasons, it is possible to opt for a general building envelope parameter (the newly-developed S-level).

2. A heating system that consists of:

- Condensing boiler or;
- (Micro) CHP;
- Heating on the basis of a renewable energy source (heat pump, ...) or;
- Decentralized heating with a total maximum power $15 \text{ W} / \text{m}^2$ or;
- Connected to an efficient heat network, and
- That operates in accordance with European, Belgian and Flemish legislation.

Ventilation, air tightness and blinds are no required measures, but are taken into account in the communication and awareness-raising campaigns linked to these measures.



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