



Final report – Technical study on the possible introduction of optional building renovation passports

[Written by BPIE and INIVE]
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TABLE OF CONTENTS

PART 1: REVIEW OF BUILDING RENOVATION PASSPORT SCHEMES AND INITIATIVES	5
PART 2: REVIEW OF BUILDING RENOVATION PASSPORT SCHEMES AND INITIATIVES – <i>ANALYSIS OF THE RELEVANCE FEASIBILITY AND POSSIBLE SCOPE OF MEASURES AT EU LEVEL</i>	49
PART 3: SELECTION OF POLICY OPTIONS FOR BUILDING RENOVATION PASSPORTS AND ANALYSIS OF RELATED POTENTIAL IMPACTS	106

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Part 1

Review of building renovation passport schemes and initiatives

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PART 1 – TABLE OF CONTENTS

GLOSSARY.....	9
INTRODUCTION	10
Methodology	10
Identification of schemes and initiatives	10
Evaluation of the schemes and initiatives	11
Selection of deep dives	12
DEEP DIVES	13
[1] BetterHome	13
Key results.....	14
[2] Certificação Energética dos Edifícios	15
Key results.....	16
[3] Det digitale energimærke	17
Key results.....	18
[4] Energieberatung	19
Key results.....	20
[5] EPC+ & Woningpas	21
Key results.....	22
[6] HeizCheck	23
Key results.....	24
[7] Home Energy Masterplan	25
[8] Individueller Sanierungsfahrplan & [15] Sanierungsfahrplan BW	27
Key results.....	29
[9] Ma Rénov	30
Key results.....	31
[10] Oktave	32
Key results.....	33
[11] Passeport Efficacité Énergétique & [12] Passeport Energie Habitat	34
Key results.....	35
[13] Picardie Pass Rénovation	36
Key results.....	37
[14] Rénoclimat	38
Key results.....	39
[16] Superhomes	40
Key results.....	41
CONCLUSION	42
REFERENCES	45
ANNEX 1: OVERVIEW OF THE SCHEMES AND INITIATIVES	47

GLOSSARY

Energy audit – An assessment of the energy needs and efficiency of a building, conducted by an energy expert.

Energy performance certificate (EPC) – An EPC is a rating scheme indicating the energy performance of a building in the European Union. Each Member State (and, in certain cases, region) has developed its own EPC framework according to the framework given by the EPBD [2010/31/EU – Article 2 (12)].

Energy Performance of Buildings Directive (EPBD) – The objective of this Directive [2010/31/EU] is to promote the improvement of the energy performance of buildings within the Community, taking into account outdoor climatic and local conditions, as well as indoor climate requirements and cost-effectiveness. The EPBD was amended [by way of Directive 2018/844/EU] in 2018.

Individueller sanierungs fahrplan (iSFP) – One of the first examples of building renovation passport, developed by the German federal government providing a renovation roadmap for single family buildings.

Indoor environmental quality (IEQ) – IEQ is a general indicator of the quality conditions inside a building. It most commonly refers to indoor air quality, thermal comfort, aesthetics, ergonomics, biophilia, acoustics and lighting. Several of these elements have a significant impact on our health, comfort and productivity¹.

Logbook – A (digital) repository where all building information can be stored and continuously updated².

Long-term renovation strategies – These strategies must be established and implemented by Member States pursuant to Article 2a of the EPBD to support the renovation of the national stock of buildings into a highly efficient and decarbonised building stock by 2050, and will form part of Member States' integrated National Energy and Climate Plans.

Minimum Energy Efficiency Standards (MEES) – A renovation obligation depending on the energy rating of a building (such as primary energy demand). If the performance doesn't meet the minimum standards, the building must undergo a renovation.

One-stop-shop – An advisory service for building owners, compiling all information related to the renovation process and facilitating the contact with contractors and installers³

Passeport efficacité énergétique (P2E) – One of the first BRP, developed and implemented in France

Sanierungsfahrplan Baden-Württemberg (SFP BW) – A German renovation roadmap in the region of Baden-Württemberg.

¹ See for example the Buildings 2030's (2018) [Building 4 People](#) study and BPIE's (2018) [The inner value of a building](#).

² See for example iBRoad (2018) [The logbook data quest](#).

³ See for example JRC (2018) [One-stop-shops for energy renovations of buildings](#).

INTRODUCTION

This study is commissioned and supervised by the European Commission's (EC) Directorate-General for Energy (DG ENER) and intends to provide technical support to investigate the feasibility of introducing optional building renovation passports (BRP) in the EU. In particular, pursuant to Article 19a of the Energy Performance of Buildings Directive (EPBD), this study evaluates the relevance, feasibility and potential impact of BRPs based on a number of aspects. This work is carried out in close consultation with stakeholders and in collaboration with leading experts, including [IFEU](#) and the [Shift Project](#).

This first report provides information on the most relevant existing schemes and initiatives. First section outlines the methodology and background for analysing the cases and for selecting cases for further analysis (i.e. deep dives). These deep dives are presented in the [following chapter](#), which includes a description of the model, key features and relevant results. The [final chapter](#) concludes the main findings of the review.



Methodology

There is no universally agreed definition of a building renovation passport and its meaning and purpose overlaps with other instruments. The BRP is generally considered as an instrument that can stimulate cost-effective renovation in the form of a “long-term, step-by-step deep renovation roadmap for a specific building based on quality criteria, following an energy audit, and outlining relevant measures and renovations that could improve the energy performance” [[EPBD 2018/844/EU](#)]. The stakeholder involvement process of this project will further discuss the BRP definition.

The review presented in this report comprises BRP schemes that largely correspond to the above definition, including the German federal renovation roadmap ([individueller sanierungsfahrplan](#)) and the Flemish roadmap and logbook ([EPC+](#) and [Woningpas](#)). The review does also include schemes and initiatives that share some characteristics and objectives with the BRP, including one-stop-shops, energy performance certificates, energy audit frameworks and online renovation advice tools.

Identification of schemes and initiatives

The selection of cases follows a three-step approach:

1) Define the intended outcomes of the concept

The first step is to outline what the concept could contribute with, such as providing better renovation guidance or aligning financial support for deep renovations. The intended outcomes were agreed together with the European Commission and supported by the stakeholder input.

2) Classify the indicators needed to evaluate the relevant initiatives

Based on the defined outcomes, we identify observable and measurable characteristics that can be used to evaluate how the scheme is contributing to achieving a specific outcome.

3) Identify and select relevant schemes and initiatives

The last step was to identify the most relevant schemes and initiatives.

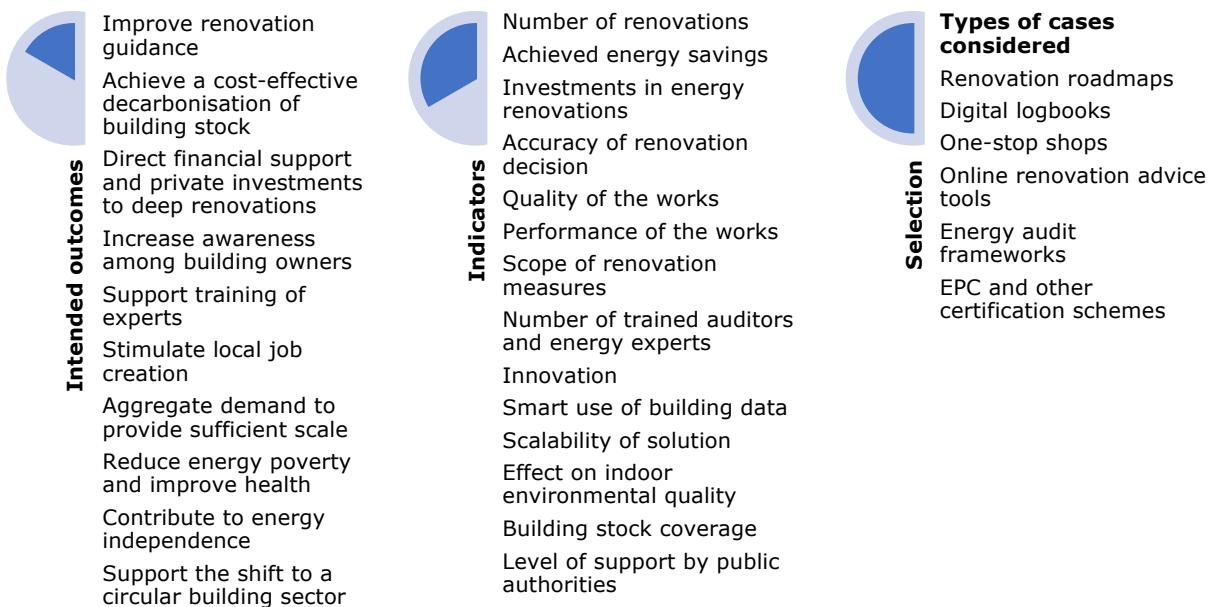


Figure 1: The three-step selection process

The required information was gathered through desk research⁴, interviews with experts and stakeholder input.

Evaluation of the schemes and initiatives

Each case on the primary list, which includes 33 schemes and initiatives, are scanned and assessed on how well they fulfil the identified indicators (second column presented in Figure 1). For each indicator, the case was given a rating (from 0 to 3 points) based on how well it fulfils this indicator (see criteria in Figure 2)⁵. The evaluation was based on expert input, interviews and accessible data.

0	No impact/potential
1	Minor impact/potential
2	Significant impact/potential
3	High impact/potential

Figure 2: Rating criteria

Out of 33 cases, 27 reached a total score of 26 or higher, indicating that most of the schemes are having, or could have, a significant impact. The indicators with the highest average score are “scalability of solution”, “building stock coverage” and “scope of renovation measures”, while the “effect on indoor environmental quality” is being neglected in many of the cases.

⁴ The research covered available studies on this topic, especially reports from the European Commission’s Joint Research Centre, National Renovation Strategies, and compilations and analyses made by Energy-cities, Covenant of Mayors and BPIE.

⁵ Three indicators – i) number of renovations, ii) quality of the works and iii) scalability of the solution – we considered as the most important indicators and was weighted higher than the rest. The three indicators were deemed as crucial and was given a weight 2 (i.e. the rating is multiplied with two for these indicators). The weighting did, however, not influence the final selection of cases.

Selection of deep dives

The selection of the deep dives is based on the rating of cases. Fifteen of the selected cases are the highest ranked, while the sixteenth (an online renovation advice tool) is included to add diversity.

Table 1: Description of the cases selected for deep dives

Number of deep dives	16
Geographical spread	8 countries (7 European countries + Canada)
Types of cases	6 one-stop-shops 6 building renovation passports 2 energy performance certification schemes 1 energy audit framework 1 online application
Level of governance	8 regional, 4 national and 4 privately governed schemes

The selected schemes and initiatives are presented in Table 2 and the full primary list is presented in Annex 1 (on page 47). Please note that the cases are described in alphabetical order.

Table 2: Selected deep dives⁶

1	BetterHome	DK	One-stop-shop
2	Certificação Energética dos Edifícios	PT	Energy performance certificate
3	Det digitale energimærke	DK	Energy performance certificate
4	Energieberatung	DE	Energy audit framework
5	EPC+ & Woningpas	BE	Building renovation passport
6	HeizCheck	DE	Online renovation advice tool
7	Home Energy Masterplan	UK	Building renovation passport
8	Individueller Sanierungsfahrplan für Wohngebäude	DE	Building renovation passport
9	Ma Rénov	FR	One-stop-shop
10	Oktave	FR	One-stop-shop
11	Passeport Efficacité Energétique	FR	Building renovation passport
12	Passeport Energie Habitat	FR	Building renovation passport
13	Picardie Pass Rénovation	FR	One-stop-shop
14	Rénoclimat	CAN	One-stop-shop
15	Sanierungsfahrplan BW	DE	Building renovation passport
16	Superhomes	IE	One-stop-shop

The research of existing schemes and initiatives have resulted in much more information and evidence than what is possible to include in this report. The consortium has compiled further information in a BRP case registry that will be used to provide additional context when outlining policy packages (task 5) and assessing their impact (task 6). The registry is shared with the European Commission for consultation.

⁶ The two German renovation roadmaps (sanierungsfahrplans) are presented together, as the regional case inspired the national one and, as a result, they have several similarities. The same goes for the French Passeport Efficacité Energétique (P2E) and Le Passeport Energie Habitat (PEH), as their definitions of the BRP are very similar.

DEEP DIVES

The schemes and initiatives described in this section are considered the most relevant for the purposes of this study. Each case is briefly described, including relevant political and financial contexts when relevant. If accessible, we include some key evidence used to estimate the impact of the respective scheme, including aspects such as average energy saving per project and user survey results. The evidence and rating will feed into the forthcoming impact assessment and should be seen in the light of this.

[1] BetterHome



BRP characteristics: *tailored renovation advice, on-site check, smart data solution*

BetterHome is an industry-driven one-stop-shop model. Since it was launched in Denmark in 2014, it has proven successful in increasing demand for deep energy renovations. The model reduces the burden on the building owner by streamlining the renovation process [1].

BetterHome partners with other players in the construction value chain, including financial institutions providing mortgages, utility companies with energy saving obligations, local governments, real-estate agencies as well as building professionals and installers, in order to deliver a comprehensive one-stop-shop solution. In this service-oriented model, homeowners are offered tailor-made solutions based on their specific preferences, covering energy improvements on the building envelope and heating, cooling, ventilation and hot water systems inside the building. The process is holistically planned, optimising the value chain by minimising efficiency losses and miscommunication issues and avoiding lock-in effects [1].

A single installer is responsible for the whole renovation process and coordinates with the other installers involved in the renovation of the same property, allowing for better planning and building trust with the homeowner. The involved expert can also share relevant information on the renovation project via BetterHome's digital platform, creating a leaner process [1]. The solution also simplifies the work for the energy expert by providing online checklists and forms, while enabling a better customer relationship. BetterHome trains and guides the energy expert on how to approach the homeowner, from the first contact to the finalisation of the process [1].

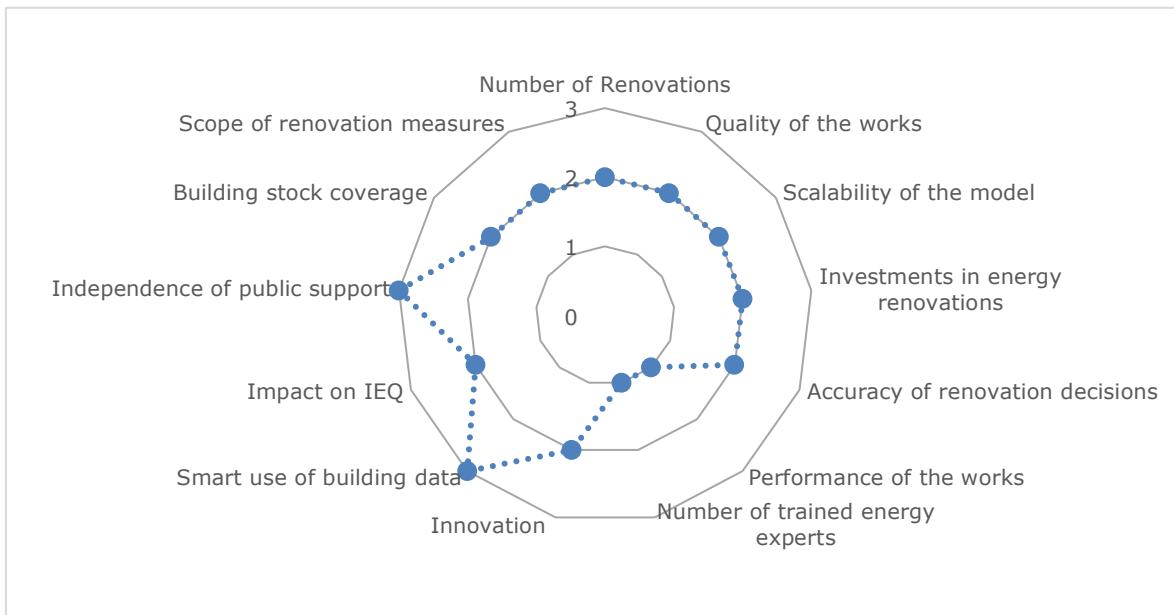


Figure 3: Betterhome - rating per indicator



Key results

- Mainly deep renovation projects, with investments of ~ €70 000 [1]
- Energy savings ranges from 30-70% [1]
- 200 projects per year (status in 2016) [1]

[2] Certificação Energética dos Edifícios



BRP characteristics: tailored renovation advice, on-site check, dynamic registry of buildings, integrates financial possibilities, monitor decarbonisation of building stock

The Portuguese energy performance certificate (EPC) scheme is one of the European frontrunners, with a publicly available database of more than 1.6 million EPCs. The national energy agency, **ADENE**, is responsible for the design and implementation of the framework, as well as of the EPC registry. Around 2,000 auditors are authorised to issue EPCs and ADENE estimates that over 2 million energy saving measures have been identified within the framework [2].

The EPC database is structured into eight main sections: (1) geographic information, (2) building identification, (3) building characterisation, (4) envelope, (5) ventilation, (6) technical systems, (7) energy balance indicator, and (8) improvement measures. For each section, there are several variables based on which the EPC is evaluated and categorised. The public authorities use the EPC registry to evaluate the building stock, monitor the impact of policies, and predict the impact of future policies [3].

The design of the EPC is user-friendly and aims at alleviating the lack of awareness of energy efficiency in buildings, which is one of the main barriers to energy efficiency investments in Portugal [4]. The EPC comprises information on:

- The overall energy performance score and other general information, such as address, picture and size of the building.
- The quality of the envelope components based on a simple grading system, showing the grade of thermal insulation for walls, roofs, floors and windows.
- Illustration of the building's heat losses.
- A list of recommendations of potential measures selected by the energy expert from a predefined list and completed with open text. The EPC can display up to 10 potential measures with detailed information on the technical description, the necessary investment and the benefits coming from the implementation of each measure.
- A comparison of the building's performance with similar buildings on the market.

The EPC framework plays a vital role in the financial scheme IFRRU 2020, which supports investments in urban rehabilitation. In this scheme, the EPC data is used to evaluate the renovation needs, support the application process and monitor the financing programme [2].

ADENE is planning to link the EPC database with a public one-stop-shop, CasA+, which aims to fill the market gap between homeowners and solution-providers. The integrated model will connect homeowners, installers, energy experts, public authorities, insurance and financial institutions, and by doing so facilitate the uptake of renovation measures. One proposed feature is that the homeowner will be able to indicate what measures they are interested in implementing, and solution providers can submit offers for specific measures [2].

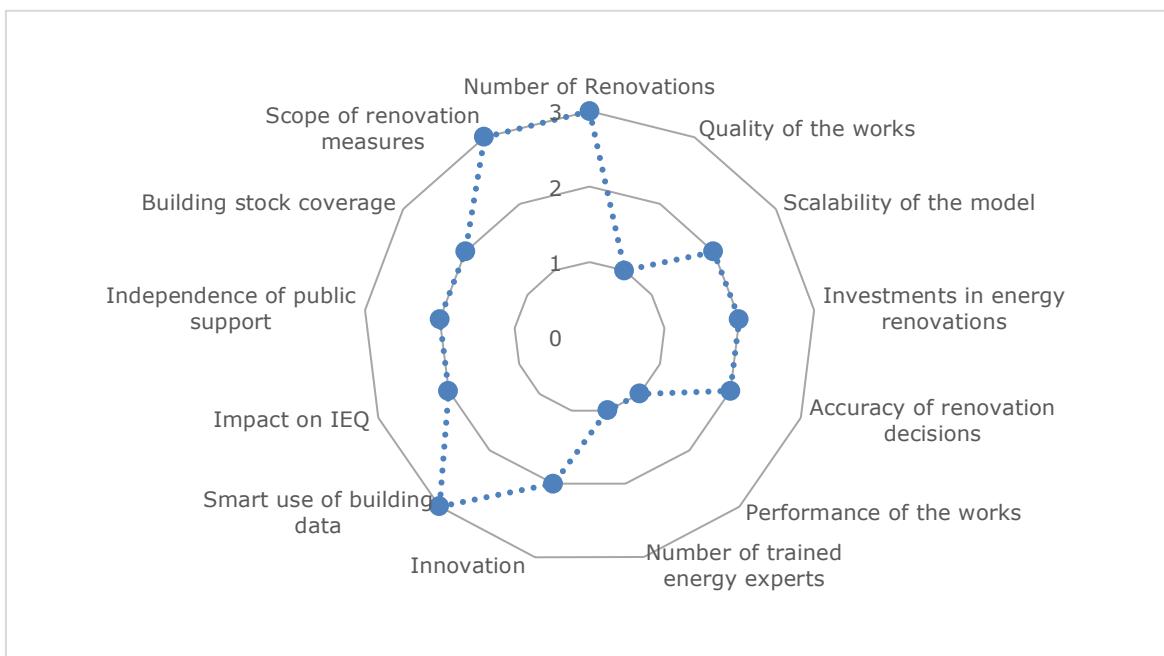


Figure 4: Certificação Energética dos Edifícios – rating per indicator



Key results

- An Ipsos survey on the potential of BRPs, conducted for the Horizon 2020 project iBRoad, shows that 47% of respondents in Portugal would trust the EPC for advice about renovation measures (compared to 17% and 18% in the other surveyed countries, Bulgaria and Poland) [4]
- In Portugal, almost three quarters (73%) of respondents think that there is more they could do to reduce the energy consumption in their home. Three out of five (61%) agree that their household's energy use can be reduced through renovation measures [4]
- 94% of house buyers consider energy efficiency to be an important aspect in their purchasing decision [4]
- When asked whether they would consider having an energy audit of the house/apartment they are about to buy, 78% said that they would. One in five homeowners (20%) said that they have had an energy audit of their home [4]
- The most cited items respondents wanted to see in a renovation roadmap were estimated costs of each renovation step (67%), expected benefits in terms of reduced heating/bills (60%) and technical information to help them avoid mistakes (56%) [4]
- According to the survey, the ideal timeframe for a renovation roadmap is five years [4]

[3] Det digitale energimærke



BRP characteristics: building data registry, tailored renovation advice, monitor decarbonisation of building stock

Denmark has one of Europe's most ambitious EPC schemes, with over 600,000 EPCs issued since it was launched in 1997. The information included in the EPC covers a brief description of potential renovation measures and an assessment of their estimated costs, savings, payback time and impact on the EPC rating. The recommendations are tailored to the specific building, but it is not specified in which order the measures ought to be installed [5].

In Denmark, all EPCs are registered in a publicly accessible database by the [Danish Energy Agency](#). The database includes detailed data for each building, including the EPC report. The database is dynamic as it allows users to easily compare their building with neighbours, or to the whole Danish building stock, and illustrates how much energy could be saved through various measures. The database also comprises a detailed EPC map showing the status of every building with an EPC. Users can also retrieve more detailed information, including on water supply and soil contamination but access must be granted first [6].

The Danish EPC database is one element of the [Danish strategy for energy renovation of buildings](#), which sets out how Denmark is planning to decarbonise its building stock. Several objectives are described as part of the government's approach to maintaining an effective and targeted energy certificate scheme for buildings. The database also enables public authorities and researchers to track energy demand and assess what impact energy renovation measures have⁷ [7].

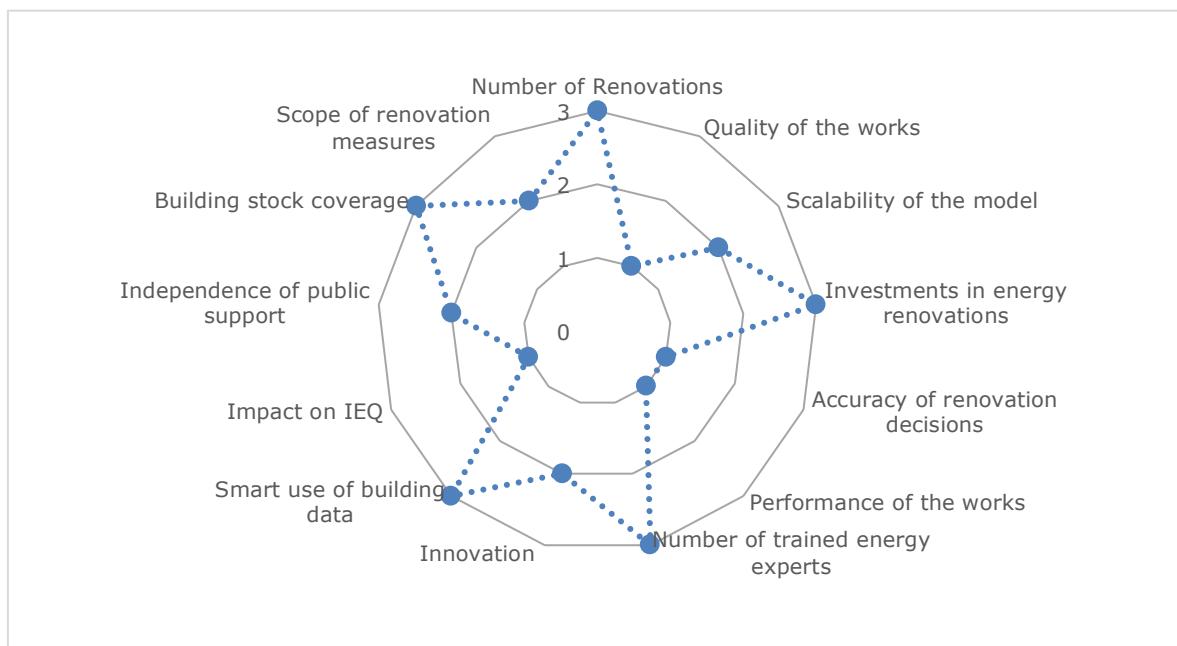


Figure 5: Det digitale energimærke – rating per indicator Edifícios

⁷ One example is the analysis done by Wittchen & Kragh ([2016](#)), *Danish Building Typologies and Building Stock Analyses*.



Key results

- A survey of 1006 Danes who bought a property in 2015, shows that 65% stated that they read the whole report that comes with the EPC [8]
- 45% of owners are living in a building with a lower EPC rating (E-F-G) have implemented at least one of the EPC-listed energy-saving measures (for people living in D=35%, C=16%, B=15%, and A=7%) [8]
- When asked about the importance of the EPC when they bought their building, 22% described the EPC as very important, while 36% saw it as somewhat important [8]
- Most building owners were satisfied with an EPC rating C (37%), followed by D (22%). Only 7% desired an EPC rating A to be satisfied [8]
- 38% of the building owners implemented measures because it was “financially attractive”, while 28% did so in conjunction with other renovation work. Only 5% did so to reduce their climate and environmental impact [8]
- 46% of the building owners knew that it is possible to view their own or other EPCs online; while 46% out of these had used this function [8]
- 6% said they would have renovated if the EPC report included more detailed information and additional suggestions for renovation measure [8]
- The most commonly implemented measures from the recommendations related to windows (42%), roof (39%), heating system (28%), doors (21%) and external wall (19%) [8]

[4] Energieberatung



BRP characteristics: on-site audit, integrated with other instruments, tailored renovation advice

There is a long tradition of energy efficiency services in Germany, including energy audits and energy checks. Germany's framework of energy audits and checks goes far beyond the requirements in Article 8 of the [Energy Efficiency Directive](#), which addresses the requirements and promotion of energy audits for enterprises. The number of energy consultants in Germany is estimated to be between 12,500 and 13,500, of which around 3,800 are energy auditors [9].

In 2017, a federal individual renovation roadmap ("individueller Sanierungsfahrplan") was launched as an evolution of the on-site energy audit. The roadmap provides detailed step-by-step renovation guidance to the building owner of how the building can become a low-energy building (see more on page 27).

There are several schemes to support energy audits and checks in Germany, including:

- The 740 local consumer centres exist across the country to provide energy advice to private households, which [service](#) ranges from online and telephone consultations to on-site energy counselling.
- Consumer associations offer energy checks and carry out around 5,000 audits per year, while the federal BAFA support programme '[Vor-Ort-Beratung](#)' offers energy audits to homeowners, delivering about 9,000 audits per year.
- The BAFA programme for non-residential buildings, "[Energieberatungen für Nichtwohngebäude](#)", offers support to municipalities. The energy consultancy provides a detailed renovation solution for the building, either as a step-by-step roadmap or a one-step renovation.

On behalf of the German government and the federal states, the KfW Development Bank provides a bundle of programmes, including subsidies and low-interest loans, to encourage energy renovation of buildings as well as the construction of new buildings with very low energy requirements. The [KfW schemes](#) are designed specifically to promote deep renovation following the motto: "The deeper the renovation, the higher the incentive". To illustrate this point, a grant of 30% is offered if the refurbishment reaches the most ambitious KfW Efficiency House 55 standard, while the slightly less ambitious level of KfW Efficiency House 70 attracts a lower grant of 25%.

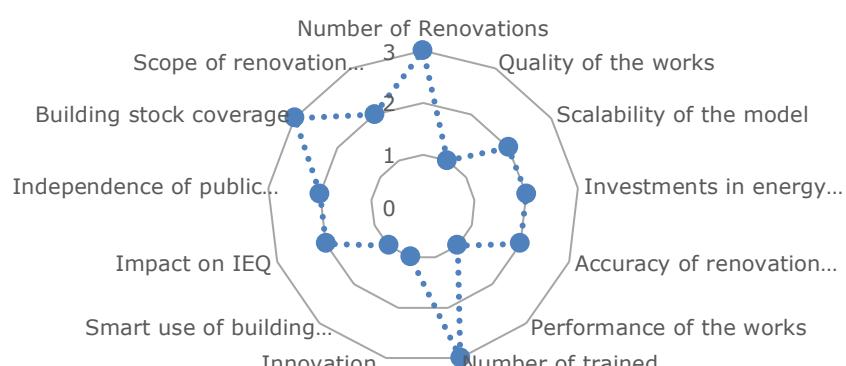


Figure 8: Energieberatung - rating per indicator



Key results

Energy checks/advice (Evaluation of "Energieeinsparberatung" and "Energie-Checks") [10]

- Between 2012 and 2015, an average of around 100,000 energy consultations were carried out under the projects Energieeinsparberatung and Energie-Checks
- 1 Euro of public funds spent on these programmes reduced energy consumption by 213 kWh (Energieeinsparberatung) and 118 kWh (Energie-Checks) on average
- 1 Euro of public funds spent triggered €14.63 (Energieeinsparberatung) and €6.04 (Energie-Checks) of private investments in energy-saving measures
- On average, 52% of building owners and 44% of tenants state that they have avoided bad investments thanks to the energy advice
- The energy advice has a positive effect on the performance of installed components; 3% thicker wall insulation, 20% thicker roof insulation, 13% thicker basement (geschossdecke) insulation. The basement ceiling insulation (kellerdecke) was 21% weaker on average, which is probably due to the low number of participants installing this measure
- 67% of recipients of energy advice chose A+++ products, compared to 47% of the control group

On-site audits (Energiesparberatung vor Ort) [11]

- 84% of the counselled homeowners said the audit increased their understanding of which measures are meaningful in the long term
- More than 90% of the surveyed building owners implemented, or "firmly planned", energy-saving measures after the audit
- Each on-site audit triggered an average gross investment of between €34,822 (2012) and €42,541 (2009)
- An additional renovation investment (carried out and planned) of around €6,600 for one- and two-family houses and €9,400 for multi-family houses was triggered per on-site audit
- Almost half (2012: 44%, 2009: 46%) of the building owners receiving an on-site audit were helped to avoid bad investments
- Available subsidy was the main reason (66%) for people to pursue an on-site audit

Energy audit for non-residential buildings (Energieberatung für Nichtwohngebäude) [12]

- 40% of the municipalities and non-profit organisations were interested in receiving advice on how to reach a low-energy building (i.e. KfW Efficiency House standard)
- 28% of the municipalities said that they would not have implemented any renovation measure if they had not received the energy advice
- Roughly 40% mentioned financial restrictions due to high investment costs as the reason they did not implement some of the measures
- 1 Euro of public funds spent on this programme reduced energy consumption by 14.29 kWh on average
- 1 tonne of CO₂ was reduced per €214 invested in the programme
- 1 Euro invested in the programme triggered additional investments of €31

[5] EPC+ & Woningpas



BRP characteristics: logbook, renovation roadmap, tailored renovation advice, monitoring of decarbonisation of building stock

The Flemish Energy Agency ([VEA](#)), in cooperation with a wide network of stakeholders, designed and implemented the “Renovation Pact” (2014-2018) with the aim to improve the region’s building stock. Flanders (Belgium) established that by 2050 the existing building stock should become as energy efficient as the current requirements for new buildings (E60⁸). One of the main actions foreseen in the Renovation Pact is to develop the Woningpas, a logbook, as well as the EPC+, which is a more user-friendly version of the EPC, including a clear overview of measures, ordered by priority, needed to reach the 2050 objective [13].

The Woningpas is a unique integral digital file of each individual building. The file can be retrieved by the building owner and by individuals who have been granted access. The logbook features energy performance, renovation advice, the housing quality (such as stability, humidity, safety) and data on the environment. In the future other building aspects such as durability, water, installations and building permits will be included. The Woningpas makes it possible to track the evolution of each individual building. The first version of the instrument was launched in 2018 [13].

The EPC+ was launched in January 2019 and outlines the actions the building owner should take in order of priority to bring the current energy performance of the property to the level of the long-term objective. The tool includes recommendations for various elements that accompany a thorough renovation (airtightness, ventilation etc.) and technical information to avoid lock-in effects. No recommendation is provided if the building is compliant with the long-term objective [13].

The enriched version of Woningpas (updates will be integrated throughout 2019 and 2020) will link the EPC+ recommendations with the financial incentives available (e.g. prime lending rates, subsidies, tax credits, eco-loans).

⁸ According to Flanders’ energy efficiency legislation (EPB), requirements for insulation and ventilation are set and the overall energy efficiency of a new home is classified according to the so-called E-standard. A low E number indicates a highly energy-efficient home. The standard for new buildings in 2016 was E60, corresponding to a primary energy demand for new and non-residential buildings of 100 kWh/m²/y.

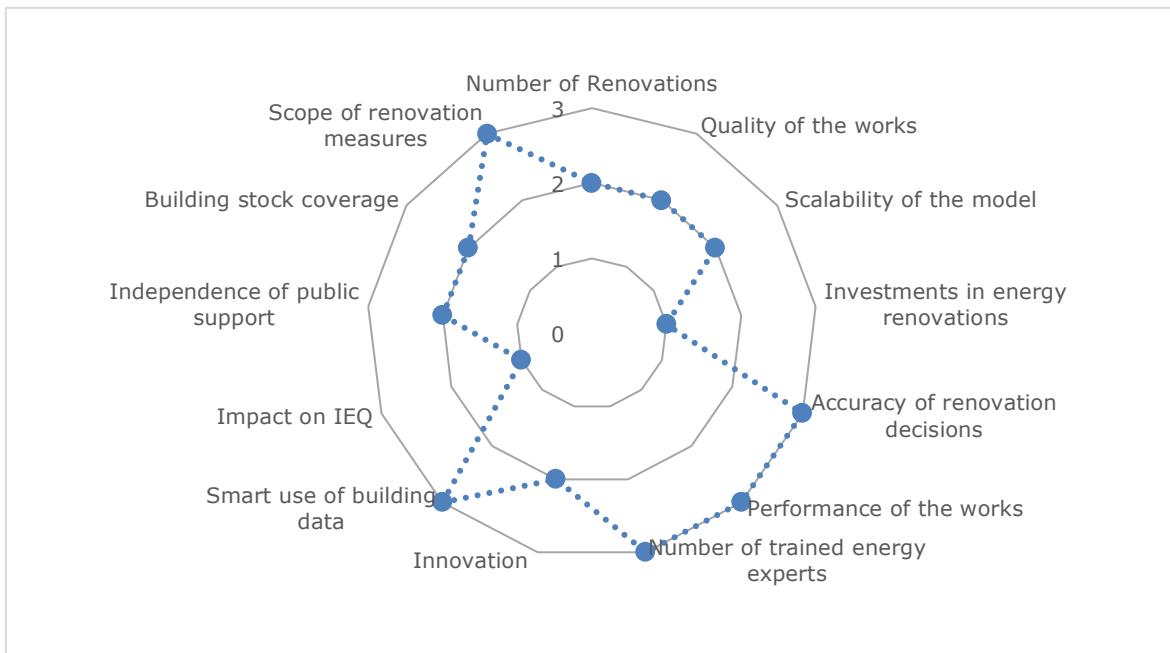


Figure 6: EPC+ & Woningpas - rating per indicator



Key results

Woningpas [14]

- A survey of the users shows that 35% of respondents think the information in the Woningpas stimulated them to renovate
- 49% of respondents think the Woningpas brings “added value to their home”
- 47% said the Woningpas gives a good overview of the renovation steps needed in the future
- 48% said the Woningpas makes clear why “saving energy is important”
- 40% think that the Woningpas gives a good overview of the building elements that determine the energy performance of the building
- 85% consider “information on energy” to be the most interesting feature of the Woningpas
- The most important reason for people to carry out energy renovations are; to reduce energy bill (35.9%), increase comfort (27.5%) and because they are “environmentally conscious” (20.8%)

EPC+ [14]

- Since its launch in January 2019, 12,814 EPC+'s for single-family houses and 7,339 EPC+'s for individual apartments have been issued (status in April 2019)
- Buildings with EPC rating B are on average worth 10.9% more than buildings with rating E
- Buildings with rating B are on average sold 25% faster than buildings with rating E [6]

[6] HeizCheck



BRP characteristics: automatic renovation advice, data registry

HeizCheck (heating check) is a German online advice instrument developed by [co2online](#), a not-for-profit consultancy. The instrument provides building owners with a first analysis of the building, initial recommendations and information on how to proceed. HeizCheck aims at increasing transparency on the housing market and trigger energy-saving investments. The technical instrument is designed to be very user-friendly and the information is accessible for all. Around 1,600 HeizChecks are issued every week.

For the evaluation of heating consumption and related costs, information that can be derived from a heating bill is required, including heating source, consumption and heated floor area. The result categorises the building according to the energy consumption (low, medium, high, very high), which provides the user with a first understanding of the situation and compares the energy use with other buildings in the district and country. The building owners receive an automated energy report, comprising the result of the check [15].

In addition to the HeizCheck, co2online has developed nine complementary checks, including an electricity check ([StromCheck](#)) and a subsidy check ([FördermittelCheck](#)). Based on building data and electricity consumption, the StromCheck compares the consumption to similar households and indicates how much electricity is used, which saving measures to implement, as well as an indication of costs and how much CO₂ they could save. The FördermittelCheck is a popular instrument as it informs the user of the available public subsidies for each measure and performance level [15].

Over 1 million users have used the different checks, providing the organisation with an impressive data set. The data includes details of the buildings, location and energy consumption, as well as details on construction material. The data will be made available to the public for research purposes from May 2019 [15].

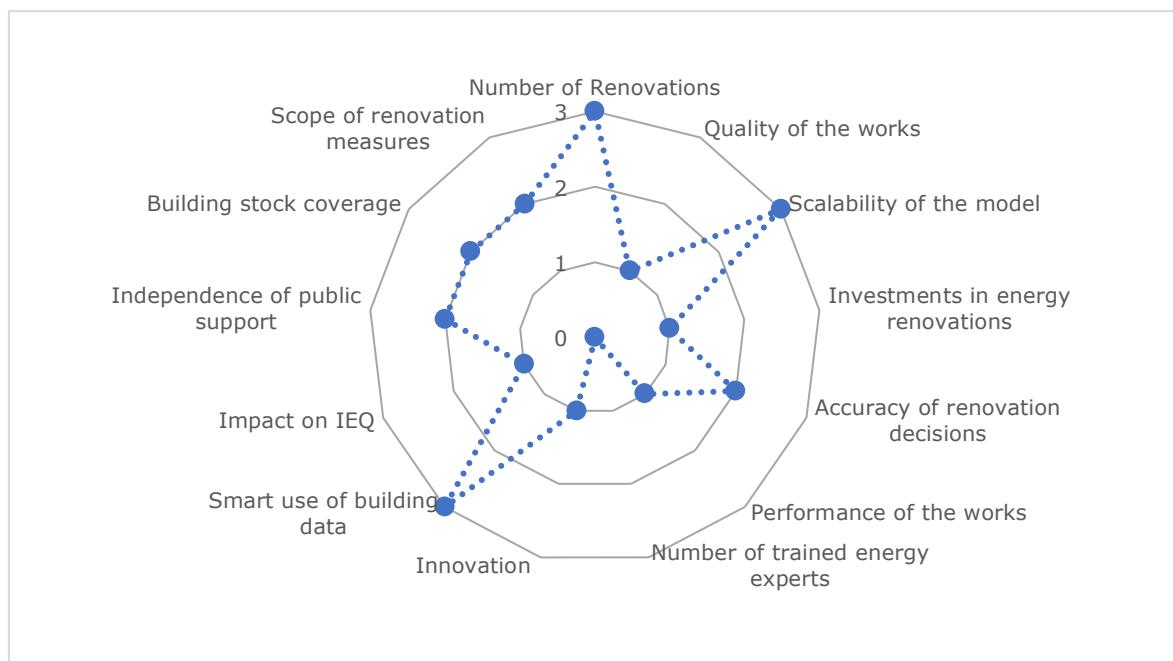


Figure 7: HeizCheck - rating per indicator



Key results

- 1,321,000 HeizChecks were conducted up to April 2019. The current weekly average is 1,550, which amounts to around 83,500 per year [16]
- Co2online has evaluated the impact of the 1,321,000 HeizChecks to have:
 - avoided 2,409,000 tonnes of CO₂ emissions
 - triggered €911 million in sales (Umsatz-potenzial)
 - created 11,636 persons-year of labour (Beschäftigungs-potenzial) [17]
- 11% of HeizCheck users state that the instrument was decisive in their renovation decision [16]
- 64% of the HeizCheck recipients had either finished their renovation (8%), started their renovation but not finished all the foreseen measures (31%), or were planning to implement measures in the near future (25%) [16]
- The most common reason not to renovate is a satisfactory, or good, HeizCheck result (81% said this was the reason) [16]
- Users with larger buildings are less likely to invest in renovations: among buildings that are smaller than 400 m², 46% renovated or were planning to do so, compared to 28% in buildings larger than 400 m² [16]
- Lack of information is the most important reason why people don't apply for funding: 38% did not apply because they could not find the appropriate support for their measure, while 28% thought the procedure was too complicated. A quarter (26%) did not have enough information about the available subsidies and 23% considered the funding conditions to be unfavourable [16]
- 56% said that they would renovate less if there were no subsidies available, though only 9% said that they wouldn't implement any measures if this was the case [16]
- Most users plan to implement 2 or 3 renovation measures (each 23% of respondents) while 17% are planning to implement a single measure [16]
- Most common (implemented and planned) measures are related to the building heating system (58%), windows (48%), roof insulation (46%), insulation of the basement ceiling (36%) and façade insulation (35%) [16]

[7] Home Energy Masterplan



BRP characteristics: renovation roadmap, tailored renovation advice, on-site visit

The Home Energy Masterplan is an integrated one-stop-shop solution in the United Kingdom, which comprises a detailed survey tailored to help homeowners identify the best possible approaches to improve their home. The model was launched in 2009 by [Parity Projects](#), a company providing a range of energy solutions to the residential building sector.

A Home Energy Masterplan is developed based on site visits from which a detailed survey is answered. The plan is tailored to the building status and the needs of the occupants. The data from the site visit is inputted into a program, which generates a report outlining the current building status together with a number of options. Each renovation option includes a cost-benefit analysis, energy use and costs, environmental impact and comfort. Personalised energy saving recommendations are provided along with details on the order in which the measures should be carried out [18]. The model does not, however, incorporate a long-term decarbonisation plan for the building.

The UK has a long tradition of energy reports indicating a building's energy performance level and energy use, with over [25 million EPCs issued](#). The Home Energy Masterplan is an instrument for building owners wanting a more in-depth analysis of their building, as well as tailored advice on how to increase the building's energy performance.

Compared to countries such as France and Germany, there are few financial support schemes targeting renovation of buildings in the UK. Over the last few years, building owners have seen the removal of many of the retrofit incentives, including the disappearance of insulation subsidies, massive reductions in feed-in tariffs and the demise of the Green Deal [19]. The main schemes remaining are:

- the [Domestic Renewable Heat Incentive](#) which is a financial incentive to promote the use of renewable heat.
- [Energy Company Obligations](#) which obligates energy suppliers to promote measures which improve the ability of low income, fuel poor and vulnerable households to heat their building.
- [minimum energy efficiency standards](#) that requires rented domestic and non-domestic building to comply with EPC rating E.
- [Boiler Plus](#) which aims to improve energy efficiency of homes in the UK by increasing the requirement of domestic heating systems.

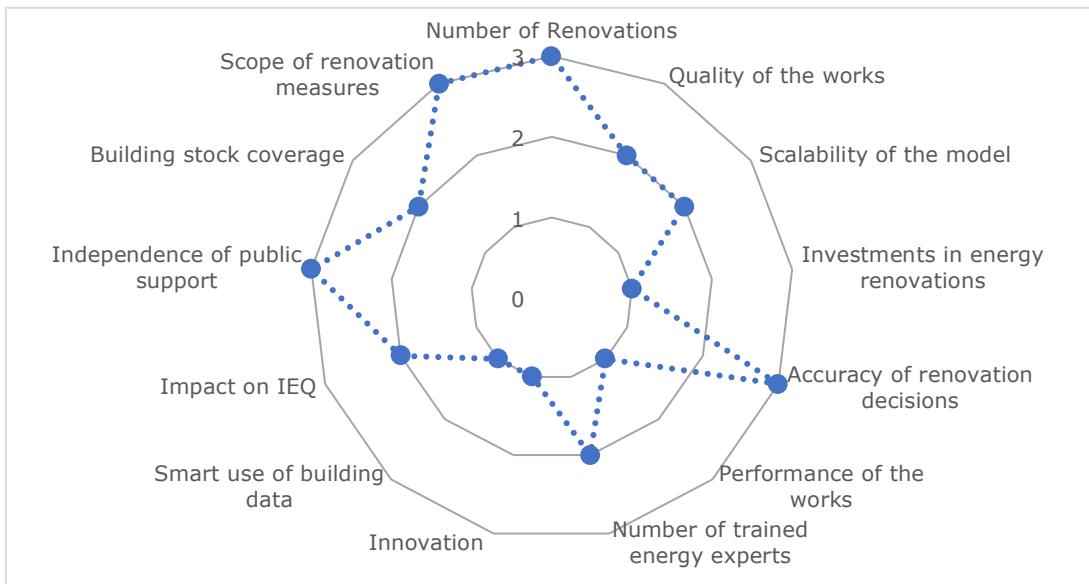


Figure 8: Home Energy Masterplan: rating per indicator

It was not possible to obtain any evidence from this scheme.

[8] Individueller Sanierungsfahrplan & [15] Sanierungsfahrplan BW



BRP characteristics: renovation roadmap, tailored renovation advice, on-site audit, integrated with other instruments and policies

The Sanierungsfahrplan in the German region of Baden-Württemberg (SFP BW) was the first renovation roadmap for individual buildings. It is designed as an energy audit instrument and carried out by certified energy auditors. It was developed in 2013 by ifeu and ECONSULT on behalf of the Ministry of Environment, Climate Protection and the Energy Sector Baden-Württemberg. The roadmap is an evolution of the rather simple energy audit scheme ("Energiesparcheck"), and is based on an on-site audit of the building. The instrument widens the idea of an energy audit by integrating a personalised and long-term perspective as well as a life-cycle approach. The core of the product is a so-called "roadmap page" which contains all the required renovation steps and a summary of the core information [20].

In 2008, the region was the first to mandate the installation of renewable heating technologies (EWärmeG), which obliged building owners to employ renewable energy to cover at least 10% - increasing to 15% in July 2015 – of the heat demand when replacing their heating system. The regulation covers all residential buildings and most types of non-residential buildings. A part of the obligation can be fulfilled by carrying out an energy audit of the building based on an individual building roadmap (5 percentage points in residential buildings) [21]. The SFP BW is supported by a funding scheme run by the state bank of Baden-Württemberg, the L-Bank. An SFP for one- and two-family houses receives €200 in funding, with each apartment unit adding a further €50 up to a limit of €500⁹ [22].

Based on the experience in Baden-Württemberg, the "individueller Sanierungsfahrplan" (iSFP) was launched at the national level in 2017. The iSFP has been designed to be a user-friendly tool that includes both short- and long-term renovation measures and suggests ways to avoid lock-in effects. As about 85% of the energy renovation measures funded in Germany concern only one building component, the iSFP puts a strong focus on staged renovation and the interdependences between the stages [23].

The iSFP is a further development of the SFP BW. It leads to a more detailed consultancy document, including an eight-page summary and a detailed booklet with a description of all the measures and renovation packages, including, if necessary, photos, sketches, graphics and further information relevant for tradespeople or planners. In addition, it is graphically more advanced, placing an emphasis on the psychological barriers to renovation by giving background information, next steps, etc. In an update of the iSFP to be published in summer 2019, additional features will be available, including a layout update, a new page on the co-benefits of renovation and more tailored information on renewables and user behaviour [23].

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 reports delivered to building owners (up to 150 pages) are often left unread and do not promote staged renovations. Since July 1, 2017, the iSFP has been accepted as an audit report within the federal Office for Economic Affairs and Export Control (BAFA) support programme "Energieberatung vor Ort" (see page 18). This programme grants subsidies of up to 60% of the cost for an on-site audit (maximum €800 for single and two-family buildings, and up to €1,100 in buildings with three or more dwellings).

⁹ With the iSFP funding at national level and changes in the national programme with respect to the accredited energy auditors, the L-Bank programme will only continue until end of 2019.

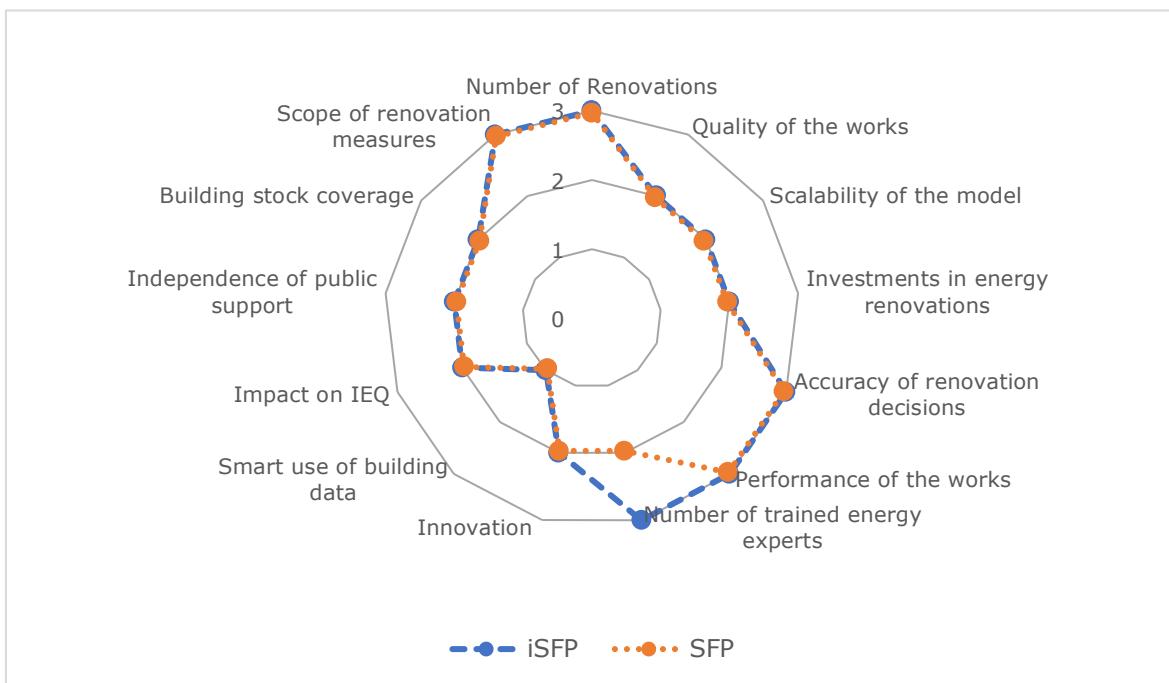


Figure 9: iSFP & SFP: rating per indicator



Key results

Sanierungsfahrplan BW

- Around two-thirds of the subsidised SFP BW were issued for one- and two-family houses [21]
- The final energy demand of the buildings receiving an SFP was around 180 kWh/m²/yr, and 85% of buildings had efficiency class E or worse [21]
- The building's CO₂ emissions are estimated to decrease by an average of 65% between the initial and final stage of the roadmap [21]
- The average consulting costs for single- and two-family buildings are around €735 and €760 respectively, while for a multi-family building with nine residential units the average costs amount to around €1,540 [21]
- By mid-2018, around 2,300 renovation roadmaps had been developed as part of the "EWärmeG" programme, amounting to CO₂ savings of around 1,300 tonnes per year [21]
- 33%-40% of building owners receiving an SFP stated that they would have commissioned a roadmap without any subsidies, while 17%-18% saw the subsidy as decisive for their decision and 25%-35% saw it as a major incentive [21]
- Most building owners say they are satisfied with the advisory effect of the SFP and its explanations: 75% rate it at least as partially useful [21]
- The SFP is particularly effective in triggering measures that would have otherwise been neglected, such as hydraulic balancing (45% stated that the SFP was causally responsible for carrying out or planning this measure), insulation of the basement (44%), or the use of renewables (39%) [21]
- The number of publicly funded detailed audits per inhabitant in Baden-Württemberg has increased by 107% since 2015 (when the SFP was introduced), while the number of detailed audits decreased by 29% in the rest of Germany (analysis based on BAFA data for 2013 - 2018)

Individueller Sanierungsfahrplan

- For the iSFP, the only available data is from an early pilot stage since it was launched in the fall of 2017 [23]
- A pilot study was carried out in 2018 testing the iSFP on 20 residential buildings, of which 17 were finalised [23]. The study shows that 9 out of 17 (53%) building owners preferred a step-by-step renovation process, while 4 building owners preferred one-time renovation and 4 owners had not decided
- 9 out of 12 building owners answered yes to the question "has the iSFP helped you develop a long-term perspective?"
- 10 out of 12 building owners answered yes to the question "has the iSFP made you interested in carrying out further renovation measures?"
- 10 out of 14 building owners answered yes to the question "has the iSFP increased your understanding of how energy renovations affect energy costs and comfort?"
- 9 out of 14 building owners answered yes to the question "has the iSFP increased your understanding of how different energy measures work together?"
- 11 out of 14 building owners answered yes to the question "has the iSFP increased your understanding of which renovation measures are economically sensible?"
- 13 out of 14 building owners answered yes to the question "has the iSFP increased your understanding of which renovation measures are technically necessary or meaningful?"
- 11 out of 14 building owners answered yes to the question "has the iSFP increased your understanding of the current state of the building?"

[9] Ma Rénov



BRP characteristics: tailored renovation advice, integrated with other instruments/subsidies, post-renovation checks

French [Bordeaux Metropole](#)'s integrated renovation platform "[Ma Rénov](#)" was launched in 2017 to achieve the objectives of the Bordeaux Metropole Climate Plan, to renovate 2,000 private and 1,000 social housing units per year. The city's focus is on deep renovation to increase the number of low-energy buildings¹⁰ [24]. The solutions aim to create a critical mass of renovation projects providing financial and technical support to homeowners while coordinating all key stakeholders.

Energy advisors guide the homeowners throughout the whole renovation process, from an initial contact to the end of the renovation works. The homeowner visits the platform and creates a personal account, which is followed up by an online self-energy audit. Based on the available data, an energy advisor develops an energy renovation plan including expected energy savings and estimated renovation costs. The homeowner is then matched with the most appropriate tradespeople and the best financial solution is identified [24]. The support for the homeowner includes:

- An automatic diagnostic of their energy consumption through an online tool
- A renovation plan tailored to the building
- A financial plan guiding the owner to accessible subsidies and low-interest loans (Bordeaux Metropole collaborates with banks to offer energy renovation loans)
- Help with finding the right tradespeople
- Post-renovation monitoring [24]

The renovation advice is tailored to the specific building and is based on a step-by-step guidance. The reasons are that few people can afford a BBC-renovation in one step but also a lack of skilled tradespeople and companies that can carry out this kind of work [25].

The data needed for the renovation plan includes area and age of the property, estimated energy performance certificate before the works, previous renovations and invoices. The city is considering integrating a database of the actual energy savings, which would allow Bordeaux Metropole to track the decarbonisation of its building stock [26], similar to what Flanders is doing with the Woningpas (see page 21).

If the model is successful in increasing the number of deep renovations, Bordeaux will need more highly skilled building professionals in the area. While no training sessions have been provided within the project to this point, a new [ELENA](#)¹¹-funded project includes training of "building firms and engineering consultants" to facilitate this objective [25].

¹⁰ i.e. Bâtiment Basse Consommation (BBC) which requires a performance of 50 kWh/m² per year

¹¹ ELENA is a joint initiative by the EIB and the European Commission under the Horizon 2020 programme. ELENA provides grants for technical assistance focused on the implementation of energy efficiency, distributed renewable energy and urban transport programmes.

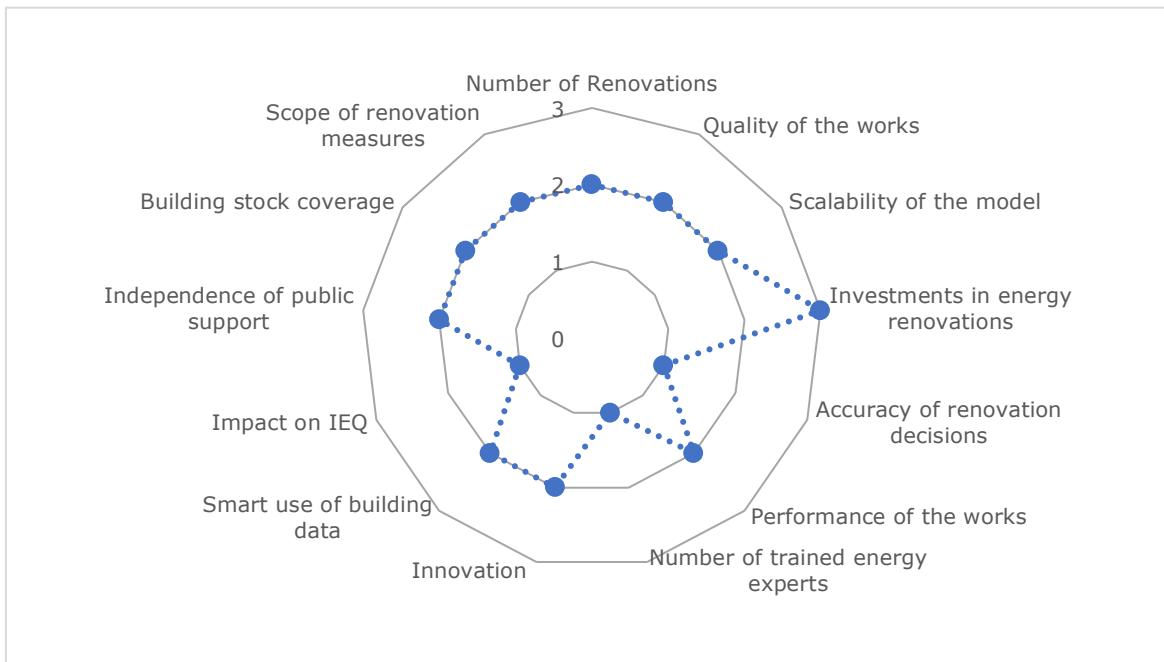


Figure 10: Ma Rénov – rating per indicator



Key results

- Ma Rénov is still at an early stage and no real evaluation exists
- In 2018, 18 186 people visited the platform and 2 512 families received support from the energy advisors [25]
- 97% of the families that meet the energy advisors are satisfied by the service provided [25]

[10] Oktave



BRP characteristics: tailored renovation advice, on-site audit, post-works care, integrates financial possibilities

Oktave is a one-stop-shop model in the French region of Alsace, which aims to increase the number of deep renovations. The model provides the building owner with a main point of contact that guides them throughout the renovation process. The support includes:

- Technical renovation advice tailored to the specific building
- Support with a financial plan, combining potential grants, tax rebates and low-interest loans
- Project management assistance throughout the renovation process
- Personalised “post-works care” for two years after completion of the renovation
- A directory of qualified and experienced professionals trained by Oktave to guarantee long-term performance [27]

The renovation process follows four main steps:

1. The first step comprises the initial contact and on-site visit, from which the suggested measures are derived. The renovation plan is discussed and outlined based on the need and financial means of the homeowner. Following this, an Oktave contract is signed, stipulating the terms and cost.
2. The Oktave advisor gathers offers from relevant building professionals and puts together the most appropriate renovation package. The homeowner agrees on a renovation and financial package suggested by the advisor.
3. The renovation works take place, during which the advisor supports the homeowner when needed. A blower-door test is used to control the general quality and performance of each renovation.
4. The final step is the “post-work care”, in which the advisor stays in contact with the homeowner and ensures the technical and financial plans work as they intended to.

Oktave has set up a teaching programme to improve the contractors’ technical and sales expertise in deep renovations. After the teaching programme is completed, contractors are entitled to perform deep renovations. Oktave experts are also available for hire on demand to solve complicated situations. The overall goal is to increase the capability of professionals (management, sales technicians and construction workers) to manage a deep renovation process in a simplified and coordinated way and by doing so reduce the risk of mistakes. By 2017, around 250 building professionals had been trained within the programme [27].

Oktave has also developed a partnership with the real-estate agency ORPI France. A simulation tool and training programme were developed for real-estate agencies and are currently being tested (April–December 2019), which will enable Oktave to effectively target clients with a suitable budget and needs [28].

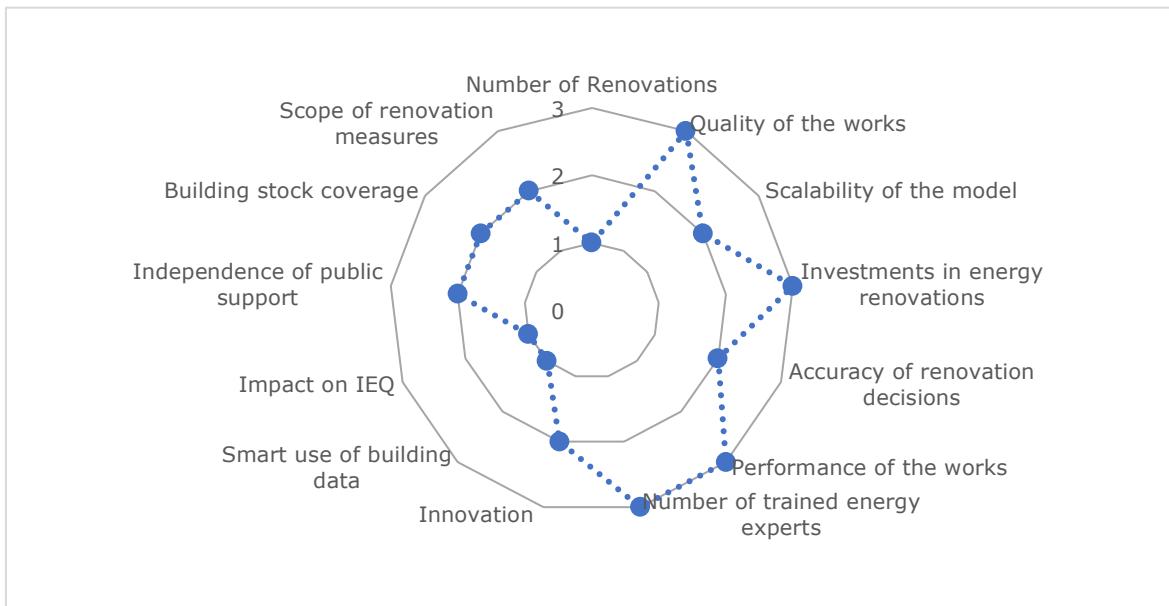


Figure 11: Oktave - rating per indicator



Key results

- Average energy saving per project: 10.6 MWh/year (heating only) [28]
- Number of projects: 180 projects (from 2016 to 2018). The number of supported renovation projects is projected to increase to 1,000 per year in 2021/2022 [28]
- Total investment: €10.3 million [28]
- Share of private investments: 86% (23% personal contribution, 63% loans)
- Share of public grants: 14% [28]
- Conversion rates:
 - First contact → dialogue: 25%
 - Dialogue → investment: 50%
 - First contact → contract: 12.5% [28]
- Performance level: all projects reach a low-energy level (BBC)[28]
- The energy advisors spend on average 35 hours per project [28]
- Annual communications cost: €200,000 [28]
- The total advisory service cost amounts to around €2,754 plus VAT (up to €1,500 of this will be funded by regional operators through "Energy Saving Certificates") [28]

[11] Passeport Efficacité Énergétique & [12] Passeport Energie Habitat



BRP characteristics: automatic and tailored renovation advice, renovation roadmap

The Passeport Energie Habitat (PEH) and Passeport Efficacité Énergétique (P2E) are two new French BRP models. P2E is a BRP concept that was first developed by the [Shift Project](#) together with a group of building specialists and professionals, with the objective to unlock the thermal renovation of residential buildings. The P2E was made operational by [Experience P2E](#), an association of think tanks, regional and local authorities, and industrial stakeholders. The PEH instrument was developed by l'Agence Locale de l'Energie et du Climat ([ALEC49](#)), an association of stakeholders initiated by Angers Loire Métropole to support the region's climate and energy work. It aims to incentivise building owners to renovate and by extension contribute to the decarbonisation of the building stock [29].

The P2E includes basic information on the house, household and the energy expert. It outlines two-stage renovation process, including indication of performance for each of the measures, the overall cost, information on why renovation should be coherently staged and how to ensure this, as well as general information on why renovation will benefit the homeowner. The P2E web application is used by the expert to develop a very simple diagnosis of the building and outlines a set of "performance combinations" that would allow that specific building to become a low-energy building (BBC¹² and SNBC¹³ levels). These combinations provide a set of consistent solutions for all parts of the building, enabling an effective renovation procedure [13].

Inspired by the P2E, ALEC49 developed the PEH as a local version of the instrument. As with P2E, PEH is developed based on available data and user-input. The roadmap shows the energy performance level and quality of different components and provides tailored recommendations. After the roadmap is developed, an energy expert meets the homeowner and explains the details of the PEH, an opportunity also used to further explain the benefits of more comprehensive measures. Ultimately, the homeowner decides how ambitious the roadmap will be. While the P2E roadmap is in two pages, the PEH roadmap runs to eight pages and provides detailed energy simulations as well as financial simulations [29].

By simplifying the choice among possible solutions for the renovation and making it easier both for the building owner and the energy expert, the system aims at "industrialising" the renovation process while maintaining a high degree of "individualisation". Indeed, the passport requires an on-site visit by an energy auditor but is quicker and far less expensive than a traditional audit in order to enable rapid upscaling. This approach frees energy experts from time-consuming on-site measurements and detailed energy simulations and lets them focus on adapting technical solutions to the house and raising households' confidence through exchange. The performance requirements should also help standardise renovation materials, achieving economies of scale.

¹² French Low Energy Building Standard, max 80 kWh PE/m²/y – Bâtiment Basse Consommation

¹³ French Low Carbon National Strategy – Stratégie Nationale Bas Carbone

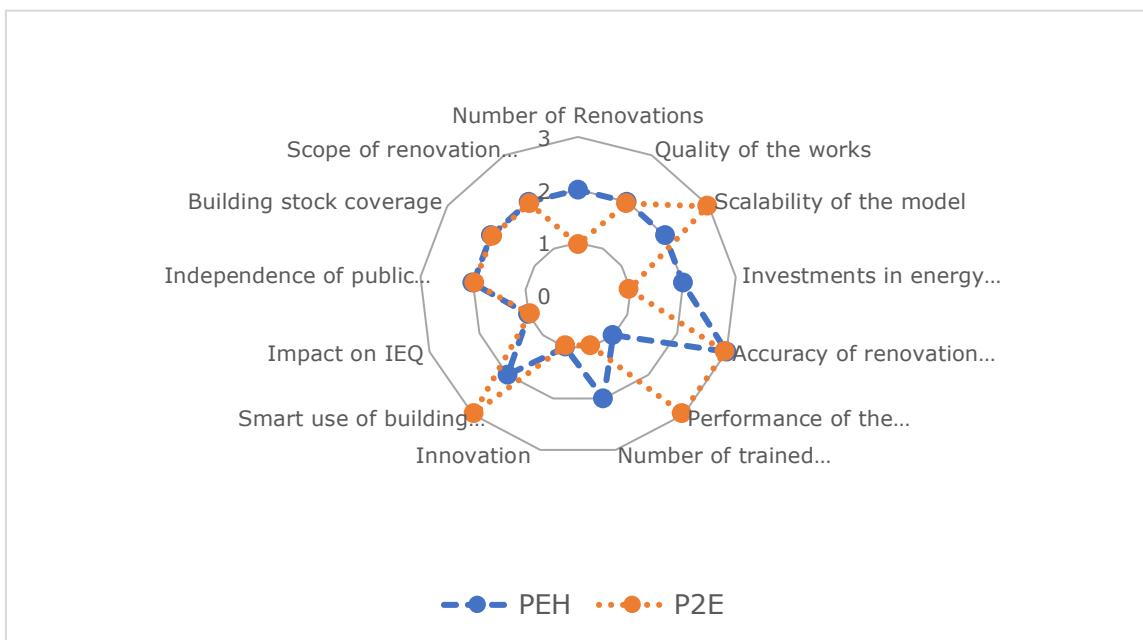


Figure 12: P2E & PEH: rating per indicator



Key results

P2E

- 1,172 P2Es were carried out in several test phases between 2016 and 2018 [29]
- The survey of piloted households shows that they are very satisfied by the passport in terms of duration, reliability and value of the provided information [29]
- Two-thirds (68%) of the piloted P2Es stated that the instrument triggered additional energy saving measures:
 - 19% extended the planned renovation to cover additional measures
 - 19% increased the energy performance level of an already-planned measure
 - 30% integrated energy performance measures in their previously non-energy-related renovation project
 - 32% said the P2E had no effect on their project [29]
- 72% of the households found the information provided by the energy expert to be "reliable" or "very reliable" [29]
- All piloted households said the P2E recommendations were more useful than recommendations received through other assessments of their building [29]
- 39% of energy experts felt comfortable with the tool after first use, 44% stated the same after the second use, while 39% felt they needed more time to become familiar with the instrument [29]
- The overall time of a P2E for the energy expert is half a day (4 hours on average, including first contact and transport and the on-site visit, which itself takes around 2-2.5 hours to conduct [29]
- Energy experts estimate the P2E would cost around €400 including VAT, yet households are on average willing to pay around €105 [29]

PEH

- 682 PEHs were carried out between 2015 and 2018 [30]
- From these 136 renovations were conducted, a conversion rate of 20% [30]
- The PEH renovations had an average energy saving of 30% [30]

The energy expert spends around one hour to explain the PEH to the homeowner [30]

[13] Picardie Pass Rénovation



BRP characteristics: tailored renovation advice, on-site audit, integrates financial possibilities

Picardie Pass Rénovation is a one-stop-shop for homeowners in the Picardie region of France, launched in 2014. The model provides the homeowner with a single point of contact, an on-site energy audit, recommendations of how to optimise energy savings, integrated financial solutions and post-installation checks. The model also assists the homeowner in finding the right expert and construction workers to carry out the work [31].

The homeowner is offered a free on-site audit, from which personalised recommendations are derived. During this audit, the technician gives information, offers personal advice and makes a technical diagnosis (envelope, heating systems, ventilation etc.) as well as a financial evaluation. This diagnosis defines an optimal and appropriate work programme, considering the needs and desires expressed by the household. In a second phase, after a contract between the owner and Picardie Pass Rénovation has been signed, the homeowner receives support for the selection partner companies, the planning of the renovation works, as well as financial guidance until the homeowner finds a suitable solution that he/she accepts [32].

The installed measures consist typically of improvements to the building envelope, as well as renewing the heating system, ventilation and on-site renewables. The energy consumption of the building is monitored over a five-year period to make sure the goals are achieved. During this five-year period, the homeowner also receives "eco-coaching" and support for equipment use and maintenance in order to limit the "rebound effect"¹⁴.

The region was a pioneer in setting up a third-party financing mechanism (Picardie PSEE) to facilitate investments in deep energy renovations and by doing so boost the local economy. The innovative financial model is made possible through Picardie Region allowances, grants from ADEME, ELENA and FEDER, as well as a loan from the European Investment Bank. The PSEE also includes a public fund, which enables long-term renovation investments that wouldn't be financially viable otherwise. The intention is that loan repayments plus energy costs after the renovation are not greater than the energy costs before the renovation. On average, 70% of the monthly loan repayments are covered by energy savings. The average financial package consists of 13% subsidies, 17% self-finance and 70% covered by the third-party mechanism [32].

¹⁴ The rebound effect is the difference between the theoretically expected savings and the savings achieved in reality.

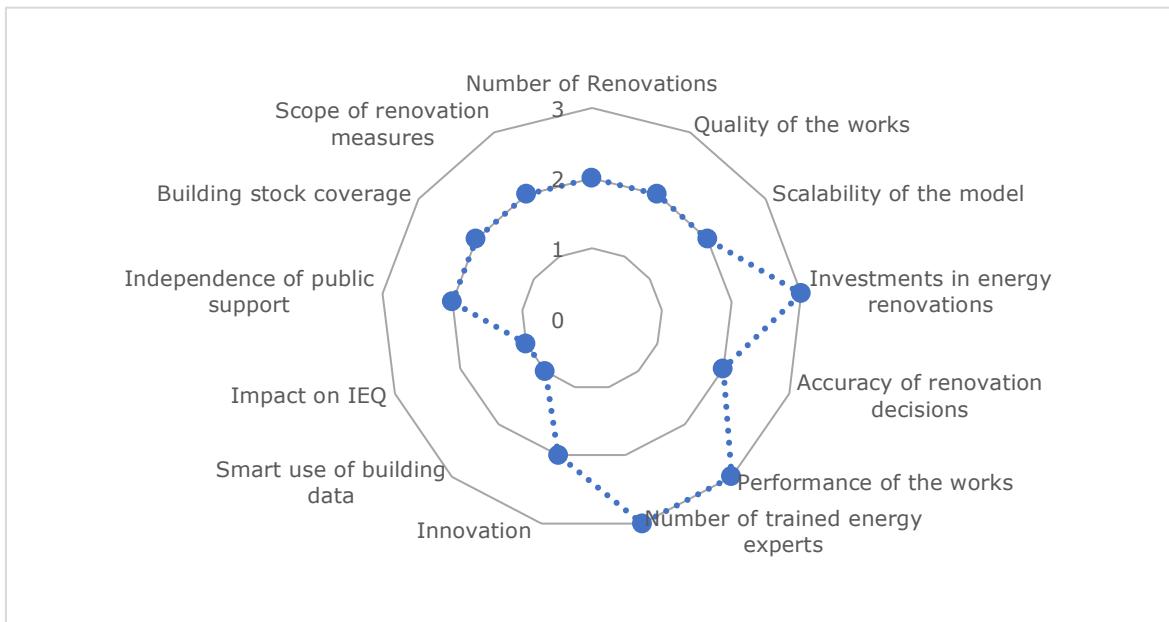


Figure 13: Picardie Pass Rénovation - rating per indicator



Key results

- 868 single-family houses and 863 dwellings in multi-family houses have been, or are planned to be, renovated [33]
- 20% of the Picardie projects reached a low-energy building (BBC) level [33]
- Average energy savings are 54% (before: 272 kWh/m²/y, after: 124 kWh/m²/y). Average EPC rating went from E to C [33]
- Conversion rates:
 - First contact → diagnostic: 45%
 - Diagnostic → contract: 20%
 - First contact → contract: 9.1% [33]
- By the end of 2018, 7,288 single-family houses had had a first contact, while 2,758 energy audits had been conducted and 868 renovations were planned or already finished. 24 condominiums (2,606 dwellings) had had a first contact, 14 (1,207 dwellings) energy audits had been conducted, and 7 (863 dwellings) renovations were planned or already finished [33]
- The average investment cost for single-family houses was €42,780 and €15,400 per dwelling in a multi-family house [33]
- While the homeowners have the option to only utilise the technical support, 70% choose to use both the technical and financial services [33]

[14] Rénoclimat



BRP characteristics: tailored renovation advice, post-renovation check, integrates financial possibilities

Rénoclimat is a one-stop-shop model in the Canadian region of Québec, launched in 2007¹⁵ to encourage homeowners to invest in energy-saving measures. Like many European one-stop-shops, the model combines technical renovation advice with financial guidance and support [34].

An energy assessment of the building is central to the programme, which covers more than 50% of the costs associated with energy assessments. During the renovation process, an energy advisor carries out two on-site energy assessments, before and after the renovation works:

1. On the first visit, the energy advisor establishes an "EnerGuide rating"¹⁶ of the building. The homeowner also receives a personalised energy report including renovation guidance and recommendations. The homeowner is then expected to conduct the renovation according to what is outlined in the report.
2. When the renovation is completed, the energy advisor evaluates the work and establishes a new energy rating for the home. The second visit also confirms if the installed measures are eligible for financial support.

Financial assistance is provided for insulation work (including airtightness, replacing doors and windows) and for installing or replacing mechanical systems (including ventilation system, water heater, heat pump, geothermal heating system). The attainable grant varies between measures and how comprehensive they are: for example, financial support for insulation of external wall ranges from \$295 to \$2,440 (\approx €196 to €1622) depending on how much of the wall is being reinforced [35].

¹⁵ The governmental Transition énergétique Québec has been responsible for this programme since 2017, which also corresponded with changes in how the programme worked

¹⁶ The EnerGuide rating provides homeowners with a government-approved label indicating the building energy efficiency level. The rating was developed by [Natural Resources Canada](#).



Figure 14: Rénoclimat – rating per indicator



Key results

- On average, the Rénoclimat programme helped participants to save 20% on their heating bills after their renovations were completed [36]
- 78% of the homeowners receiving the first on-site visit implemented at least one of the recommended measures, while 14% implemented all of them [36]
- The implementation rate of insulation and heating measures among homeowners only getting the first on-site assessment, is on average 10% higher than among the control group [36]
- The implementation rate among homeowners getting two on-site assessments (before and after works), is on average 26% higher than among the control group [36]
- A survey shows that 78% of the investments would have been made even in the absence of on-site visits and grants, while 86% would have been made if the visit was available but no grant [36]
- 78% of respondents planned to make energy efficiency work before hearing about the programme [36]
- 50-60% of the people who carried out renovation work said that the programme had no influence on their decision. From this, it is estimated that the programme had a decisive impact on the renovation decision in 20-50% of cases [36]

[16] Superhomes



BRP characteristics: tailored renovation advice, integrated financial support

Superhomes is an Irish one-stop-shop project that has been successful in increasing the number of deep energy renovations by providing technological and financial support for homeowners. The project is run by the Tipperary Energy Agency and is mainly funded by the Sustainable Energy Authority of Ireland¹⁷. Superhomes offers subsidies to building owners of up to 50% of the renovation cost¹⁸ for renovation that brings pre-2011 buildings to an A3 Building Energy Rating (which corresponds with requirements for a new building), or as close as financially and technically feasible. The whole renovation package is carried out in one step [37].

Superhomes assists homeowners with all aspects of the energy renovation process. The customer journey comprises financial guidance, selecting the best energy saving measures and finding the right contractors. The potential customers are reached through visibility online or at actual information events. The primary target group is homeowners who are interested in doing more than a single renovation measure. The renovation is typically conducted in one stage.

Within the project, an on-site home survey is conducted, going beyond the common EPC assessment. The complexity of a deep renovation is simplified and presented in a digestible way to the homeowner, while the recommendations are tailored to the specific building and the incentives of the homeowner.

The homeowner is obliged to upgrade certain parts of the building, in order to receive financial support. The primary heating system must be renewable, such as a heat pump, while an advanced ventilation system must be installed. In addition, the building's airtightness must also be upgraded. Support is also available for non-mandatory measures, such as window and door upgrades, insulation and solar PV [37].

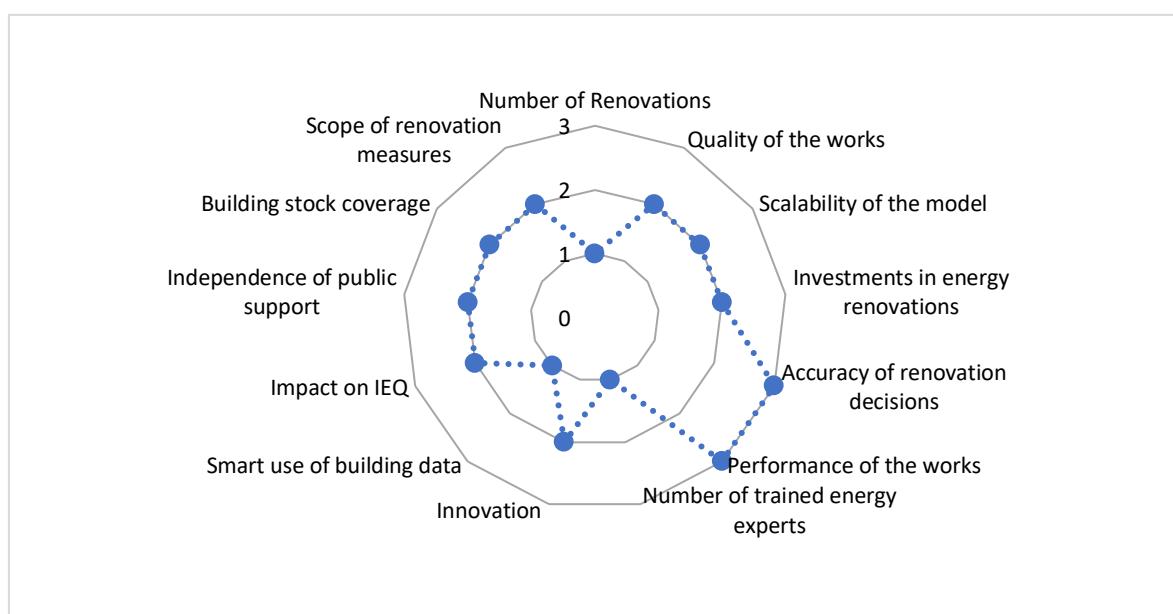


Figure 15: Superhomes – rating per indicator

¹⁷ The project has received financial support from the EU ELENA and Horizon2020 programmes

¹⁸ The grant can go up to a maximum cost of €26,000



Key results

- Around 80 deep renovations in 2019 [38]
- Average primary energy saving is 71% [38]
- Conversion rate: 33% accepted the proposed renovation package [38]
- Average cost €33,000 [38]
- A survey conducted of potential user show that the main drivers of renovation are, reducing energy costs (65%), improving comfort (60%), and reducing fossil fuel use and improving the environmental performance of the building (55%) [38]
- The same survey shows that people want their investments pay back within a reasonable time frame. 80% are happy with a payback period of 5-7.5 years, while 60% are happy with up to 10 years. Smaller market for retrofit over 10 years payback [38]
- Among homeowners who have not renovated, 69% state the barrier is that "cost is too high" followed by 38% who say they lack "understanding of what and how to improve my home" [38]
- Average energy cost reduction: €1,800 per year [38]

CONCLUSION

The review comprises 28 European and 5 non-European schemes and provides some valuable insights, of which 16 featured as “deep dives” (see page 12). **The most successful BRPs have combined the renovation advice with financial support, legal requirements and/or communication campaigns.** The review shows that the BRP should be integrated with and reinforced by other elements (e.g. simple access/use, financial support, communication) in order to be effective.

The most common elements among the deep dives are “tailored renovation advice” (14 out of 16) and “integrated financial possibilities” (7 out of 16). The common understanding, underlying these cases, is that **finding the right information is time-consuming and it is difficult to make informed choices about the combination of renovation measures**, especially that make sense over the long-term. The second main understanding is that **aggregating and streamlining financial support (grants and loans) is required to make long-term solutions (i.e. deep renovations) viable.**

Financial constraints are the main reason for people not to renovate and the explanation to why the innovative one-stop-shops, analysed in this report, have not conducted more than 100-1,800 deep renovations each. **Financial constraints are also the main reason why building owners choose less efficient solutions, hampering the long-term transition.** Cheap and reliable long-term finance might not be enough, the review shows that targeted renovation advice is also needed to better align the direction of private investments with the long-term vision for the building stock.

The review shows that **BRPs are effective in alleviating two of the main barriers; low awareness of the benefits of energy renovation and insufficient knowledge of what measures to implement and in which order.** The analysis confirms that the tailored renovation advice, together with other support measures, has an impact on the decision to renovate, the number of measures to implement, the performance level of the selected measures, as well as on what kind of measures that are being implemented. The major influences on the renovation decision are listed below.

- The whisker chart in Figure 16, displays the percentage of building owners who were stimulated to renovate by the received energy advice. The impact ranges from 11% (in the online renovation advice instrument) to 50% (in a one-stop-shop that provides on-site audits), with an average of 28%.

Impact of renovation advice
Percentage (%) of building owners who were stimulated to renovate by the energy advice (BRP, energy audit or other advice) [n=result from 7 deep dives]

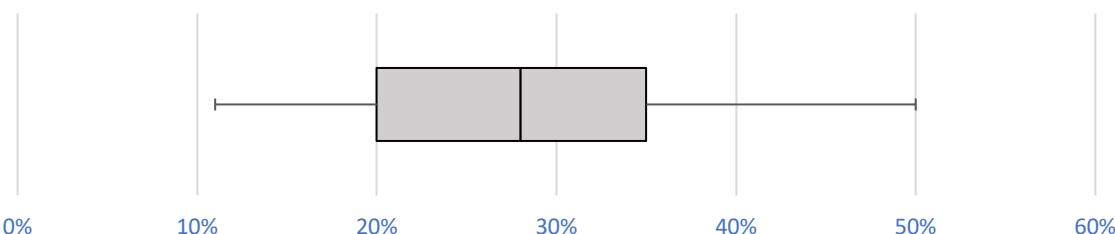


Figure 16: Impact of renovation advice

- Data from co2online's (the managers of HeizCheck) comprehensive database¹⁹ shows that most building owners (63%) are planning to implement between 1 and 3 measures, which seldom is enough to bring a building to a low-energy level. The review shows that BRPs are having a significant effect on the number of measures the building owners are planning to implement. In the iSFP pilot study (see page 27), 83% said the BRP got them interested in implementing additional measures, while in the P2E pilot study (see page 34), 19% extended their already planned renovation to cover additional measures.
- The evidence also indicates that the renovation advice influences the performance of the selected renovation measures. For example, the evaluation of the German energy check/advice (see page 18) revealed that 67% of recipients of energy advice chose A+++ product compared to 47% in the control group. In France, 19% of P2E's pilot cases state the BRP influenced them to install higher performing components.
- The renovation advice also has an impact on the type of measures that are being implanted. For example, the evaluation of the SFP BW (see page 27) shows that the majority (70%) of window replacements would have occurred even without the BRP but a considerable share of building owners that invested in hydraulic balancing (45%) or insulation of the basement (44%) did so because of the advice in the BRP.
- Furthermore, evidence from the German energy audit framework (see page 18) and the iSFP indicates the advice increased building owners' understanding of which measures are meaningful in the long-term (84% resp. 75% of respondents).
- Finally, evidence from the German audits and building checks shows the renovation advice helped building owners "avoid bad investments" (between 44% and 52% of respondents).

The conversion rate describes the process of a potential owners actually investing in an energy renovation. An optional BRP scheme will first need to convince building owners to get a BRP and subsequently the BRP will have to inspire recipients to invest in energy renovations. Figure 17 illustrates the conversion rate from four different one-stop-shops. On average, 35% of building owners informed about the scheme chose to continue with an energy check, and 31% of the people receiving the energy check and resulting advice continues to invest in energy renovation.

Consequently, 10.8% of the building owners receiving the first contact will go on and finally invest in an energy renovation. The conversion rate depends on aspects, such as available subsidies, how complicated the renovation process is perceived, and quality of communication (user-friendly website, likeability of energy expert etc.).



Figure 17: Conversion rate

¹⁹ It includes user-inserted data from over 1 million online building checks

The analysed schemes and initiatives do not provide a satisfying answer on how to influence the hard-to-reach groups, who are not interested in receiving renovation advice nor investing in energy saving measures. While most people take the advice into consideration, a considerable portion are more difficult to influence. For example, 35% of building owners in Denmark did not read the renovation recommendations in the EPC-report (see page 17).

Indoor environmental quality (IEQ) is generally overlooked in the cases. Comfort is often used a key selling point, yet improved air quality, noise reduction and sufficient lighting are rarely mentioned. While building regulations and energy experts incorporate these aspects to a certain extent, **the BRP could help to optimise IEQ alongside the building performance**. Circularity is another crucial concept that is not sufficiently covered in the existing cases. Again, the BRP could potentially be used to facilitate an effective recycling of certain components.

The review indicates that training of energy auditors, financiers, public officials and other professionals is needed to facilitate the shift to deep (staged) renovations. Training is needed on several levels, from how to develop the BRP to how to approach building owners. In addition, training is needed to increase the technical skills to facilitate effective installations of deep renovation measures, which often are more complex. The experience of Bordeaux metropole, where the construction value chain is not ready to carry out one-stage deep renovations (see page 31), is shared by many regions in Europe. A higher technical knowledge is also needed to ensure the deep staged renovations are successfully planned and implemented.

A core strength of the one-stop-shop model is that it assembles the fragmented services from the construction value chain, which simplifies the process for the building owner. The review reiterates that the BRP ought to be "user-friendly" and contribute to making the renovation process more comprehensible for the building owner.

The Flemish and Portuguese energy agencies are developing their schemes (Flemish EPC+ and Woningpas (see page 21), and Portuguese EPC (see page 15)) to directly support the objectives of their **long-term renovation strategies**. The public authorities will be able to monitor the energy transition of each building but also modify policies and financial support as necessary. Integrating the BRP with a digital logbook and linking it to financial schemes and one-stop-shops are potentially effective solutions.

The schemes and initiatives presented in this report are diverse and most of them have not reached their full potential yet, while some still being at the research phase. The derived evidence is therefore of mixed quality. The next phase of this project will translate these findings, together with input from the European Commission, EPBD Concerted Action and stakeholder input, into potential policy packages. The ongoing stakeholder process will further discuss and define the concept, and scope, of the BRP.

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Annex 1: Overview of the schemes and initiatives

Title	Geographical coverage	Timing (project start/launch)	Conceptual basis	Link
ALDREN	EU	2018	A Horizon 2020 project that develops a renovation roadmap and logbook for non-residential buildings	Link
BetterHome	Denmark	2014	Industrial driven one-stop-shop, facilitates a smoother renovation process by setting up a central contact point and transforming the work of the energy expert	Link
BMWi Sanierungskonfigurator	Germany	2013	A public online renovation advice instrument provides a first building check based on user-inserted data	Link
Building Energy Asset Score	USA	2015	The U.S. Department of Energy's instrument is a national standardised tool for assessing the building performance of non-residential buildings and larger multi-family buildings	Link
Building Energy Rating Certificate	Ireland	2011	The national EPC framework, which comprises a public database and innovative features	Link
Certificação Energética dos Edifícios	Portugal	2007	The national EPC framework, which comprises a public database and innovative features. The data is, for example, used to evaluate the renovation needs, support the process of loan applications and monitor progress of the financing programme.	Link
Det digitale energimærke	Denmark	2006	The national EPC framework, which comprises a public database and innovative features. The database is dynamic as it allows users to easily compare their building with neighbours, or to the whole Danish building stock, and illustrates how much energy could be saved through various renovation measures.	Link
DORéMi	Multiple regions in France	2011	An innovative private initiative that works with regional governments to offer one-stage deep renovations.	Link
Efficiency Capital	Toronto (Canada)	2015	A one-stop-shop offering a customised approach for non-residential buildings, including financing, installation and monitoring. Energy performance contract solution for the cost.	Link
Effilogis	Bourgogne-France-Comté (France)	2012	The regional Effilogis programme helps individuals, social landlords and communities to carry out nearly-zero renovation, in one or several steps.	Link
Effizienzhaus-online	Germany	2013	A private online renovation advice instrument providing a first building check based on user-inserted data.	Link
Eigenheim Manager	Germany	2016	An app that allows homeowners to manage and control energy and economic aspects, such as energy consumption and cost, while storing appointments and vital documents.	Link
Enerfund	EU	2018	A Horizon 2020 project focusing on deep renovation opportunities. It uses EPC data	Link

			in a dynamic tool to enhance public awareness.	
Energieberatung	Germany	n/a	A compilation of German public support schemes focusing on energy audits and checks, for residential and non-residential buildings.	Link
HeizCheck	Germany	2004	A private online renovation advice instrument providing a first building check based on user-inserted data	Link
HERS index	USA	2013	The HERS Index is an easy-to-understand approach to measuring a building energy performance level. Over 2 million buildings have been "HERS-rated".	Link
Home Energy Masterplan	United Kingdom	2009	The private model offers a "masterplan" for the homeowner to reduce energy consumption. The plan is based on a detailed on-site survey. Each renovation option includes a cost-benefit analysis, including energy use and cost, environmental impact and comfort.	Link
Home Energy Score	USA	2012	The U.S. Department of Energy's instrument provides homeowners, buyers and renters with comparable information about a home's energy use	Link
Huizenaanpak	IJmond and Zuid-Kennemerland (the Netherlands)	2014	A Dutch one-stop-shop model that helps building owners to plan, implement and finance their energy renovation.	Link
iBRoad	EU	2017	A Horizon 2020 project developing an individual building renovation roadmap for single-family houses.	Link
Individueller Sanierungsfaehrplan für Wohngebäude (iSFP)	Germany	2017	The federal renovation roadmap has been designed to be a user-friendly tool that includes both short- and long-term renovation measures and suggests ways to avoid lock-in effects. The roadmap targets the highest efficiency level that is technically and economically feasible.	Link
Irish "Building Renovation Passport"	Ireland	2019	Research project analysing and testing the BRP in Ireland.	Link
Ma Rénov	Bordeaux Métropole (France)	2017	A one-stop-shop supporting energy renovation of private homes	Link
Oktave	Alsace (France)	2016	A one-stop-shop offering personalised support on technical, financial and administrative aspects of low-energy renovation projects.	Link
Parma Progetto Energia	Parma (Italy)	2016	The municipality offers technical advice and financial support to carry out energy renovations.	Link
Passeport Efficacité Energétique	France	2012	A BRP concept developed by a group of building specialists and professionals. The P2E web application is used by the expert to develop a very simple diagnosis of the building and outlines a set of "performance combinations" that would allow that specific building to become a low-energy building.	Link
Passeport Energie Habitat	Angers Loire Métropole (France)	2015	A renovation roadmap concept in the region of Angers Loire Métropole. The roadmap shows the energy performance level and quality of different components and provides tailored recommendations.	Link

Picardie Pass Rénovation	Picardie Region (France)	2013	A one-stop-shop for homeowners. The model provides the homeowner with a single point of contact, an on-site energy audit, recommendations of how to optimise energy savings, integrated financial solutions and post-installation checks.	Link
Rénoclimat	Quebec (Canada)	2007	A one-stop-shop model in the Canadian region of Québec, which combines technical renovation advice with financial guidance and support.	Link
Sanierungsfahrplan BW	Baden Württemberg (Germany)	2013	The regional roadmap is an evolution of the rather simple energy audit scheme ("Energiesparcheck"), and is based on an on-site audit of the building. The instrument widens the idea of an energy audit by integrating a personalised and long-term perspective as well as a life-cycle approach.	Link
Stuttgart's care-free energy renovation package	Stuttgart (Germany)	n/a	A city initiative that offers a holistic "care-free" renovation package for homeowners, who are interested in carrying out energy renovations.	Link
SuperHomes	Tipperary (Ireland)	2015	A one-stop-shop which supports homeowners with all aspects of the energy renovation process. The customer journey comprises financial guidance, selecting the best energy saving measures, and finding the right contractors.	Link
Woningpas & EPC+	Flanders (Belgium)	2018 and 2019	The Woningpas is a unique integral digital file of each individual building. The logbook comprises all building-related information and makes it possible to track the evolution of each individual building. The EPC+, a EPC equipped with a renovation roadmap, includes recommendations for various elements that accompany a thorough renovation (airtightness, ventilation etc.), and provides a selection of technical information to avoid lock-in effects.	Link

PART 2

Support for setting up an optional building renovation passport

Analysis of the relevance feasibility and possible
scope of measures at EU level

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Partners



Subcontractors



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1. EXECUTIVE SUMMARY

This report has been prepared as part of a study commissioned, and supervised, by the European Commission's (EC) Directorate-General for Energy. It is intended to provide technical support about the feasibility of introducing an optional building renovation passport in the European Union (EU). In particular, this study evaluates the relevance, feasibility and potential impact of building renovation passports. This work is carried out in close consultation with stakeholders and in collaboration with leading experts in the field. As part of the consultation process, a first stakeholder meeting was organised in June 2019, and a second meeting is planned for November 2019 where the content and suggestions in this report will be discussed.

The Directive on the Energy Performance of Buildings (EPBD) [2010/31/EU] does not include a definition of a building renovation passport, and no commonly agreed definition exists in the EU. Existing building renovation passports differ in some key features, purposes and in the terminology used. The definition presented below is based on the text in the EPBD, stakeholder input, and existing research.

Proposed definition of *building renovation passport*

A building renovation passport provides a long-term, tailored renovation roadmap for a specific building, following a calculation based on available data and/or an on-site audit by an energy expert. The instrument identifies and outlines deep renovation scenario(s), including steps to implement energy saving measures that could improve the building's energy performance to a significantly higher level over a defined period of time²⁰. The instrument can be complementary to energy performance certificates and/or combined with digital logbooks²¹.

The report comprises an analysis of the relevance and feasibility of introducing optional building renovation passports, and an investigation of the possible scope for additional measures for introducing a building renovation passport at EU level. Based on the review of existing schemes and initiatives, and an analysis of related policies, 33 policy options for the introduction of the building renovation passport were considered and analysed. The policy options are classified in six categories: (1) regulatory, (2) communication, (3) best practice exchange, (4) financial, (5) training and (6) guidance. In addition, they are divided into direct and supporting policy options.

Direct policy options focus on the introduction of building renovation passports. These options are to (1) let Member States decide whether to design and implement the instrument, (2) introduce an EU-wide common reference framework, or (3) incorporate staged renovation advice in existing energy performance certificates. Supporting policy options are measures that complement the direct measures (e.g. financial instruments, regulatory amendments, training of energy experts, or guidance documents).

Six feasible policy packages were developed, using many of the 33 policy options. Every policy package consists of one direct option and a number supporting options. Each of the three direct options described above has been included in two policy packages, and complemented by suitable supporting measures. The three direct measures have one policy package that is 'soft' and one that is more 'stringent'. The

²⁰ The time of the roadmap could span from 5 to 20 years and the definition of the time horizon should be left to the implementing authority based on national/local conditions. The building owner can, of course, opt to implement all steps in one go.

²¹ See chapters: Linking the BRP with EPCs and Linking the BRP with a digital registry.

supporting measures have been tailored to the direct measure and the ambition level of the specific package.

In addition to the below listed policy options, all policy packages include training of energy experts and increase of awareness through national/local communication campaigns. They both have an enabling effect on the uptake of BRPs and were considered relevant under all packages.

The direct measure in policy packages 1 and 2 leave the decision to implement, and design, the building renovation passport fully to the Member States. In both packages, the EU encourages Member States to explore the instrument through existing legislations (most notably through the long-term renovation strategies). Both packages include enabling options, including finance, communication and training, however the second package is more wide-ranging. In the second package, the EU encourages Member States to introduce minimum energy efficiency standards for renovation to boost the uptake of renovations and need for building renovation passports.

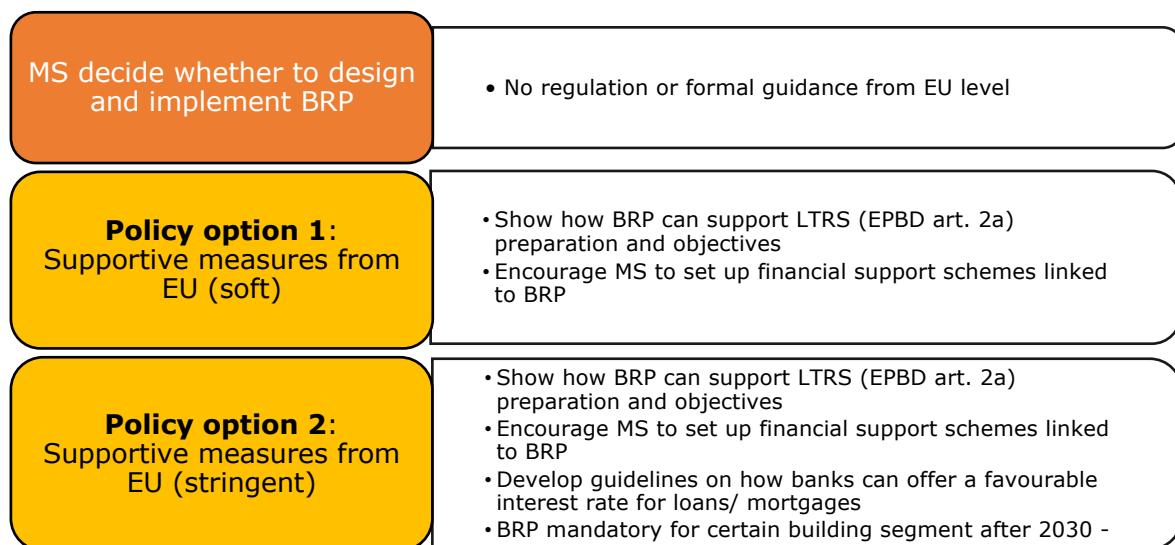


Figure 18: Policy options 1 and 2

In policy packages 3 and 4, the EU introduces a common reference framework for building renovation passports. In policy package 3, the framework does not include minimum requirements for the Member States, while policy package 4 does. The common reference framework is supported by other guidance documents and efforts, best practice exchange, as well as communication campaign and training for energy experts. Package 4 complements this with financial support measures and an EU framework for certification of experts. In package 4, the option is supported with more far-reaching financial instruments.

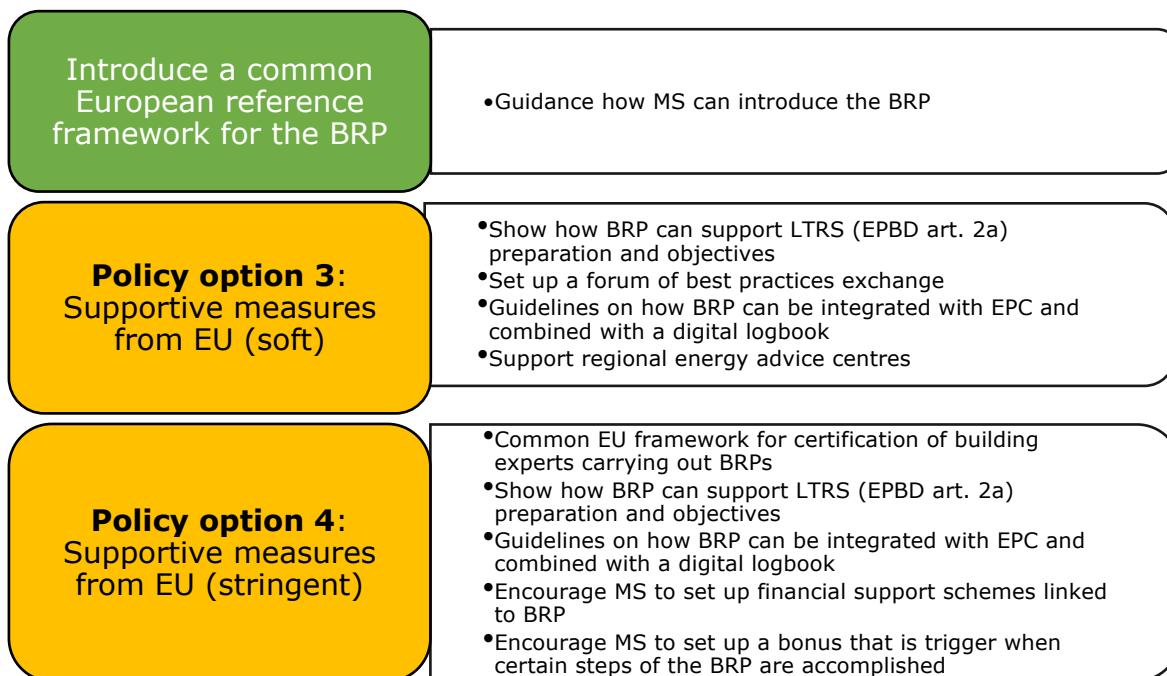


Figure 19: Policy options 3 and 4

In policy options 5 and 6, the EU actively promotes the idea of building renovation passports, as complementary to the energy performance certificates, and proposes their introduction to complement EPCs in the next EPBD revision in 2026. In policy package 5, the uptake is complemented by targeted financial measures, best practice exchange, training, communication campaigns as well as guidance documents. In policy package 6, the provision is supported by mandatory measures driving a deep renovation of the building stock.

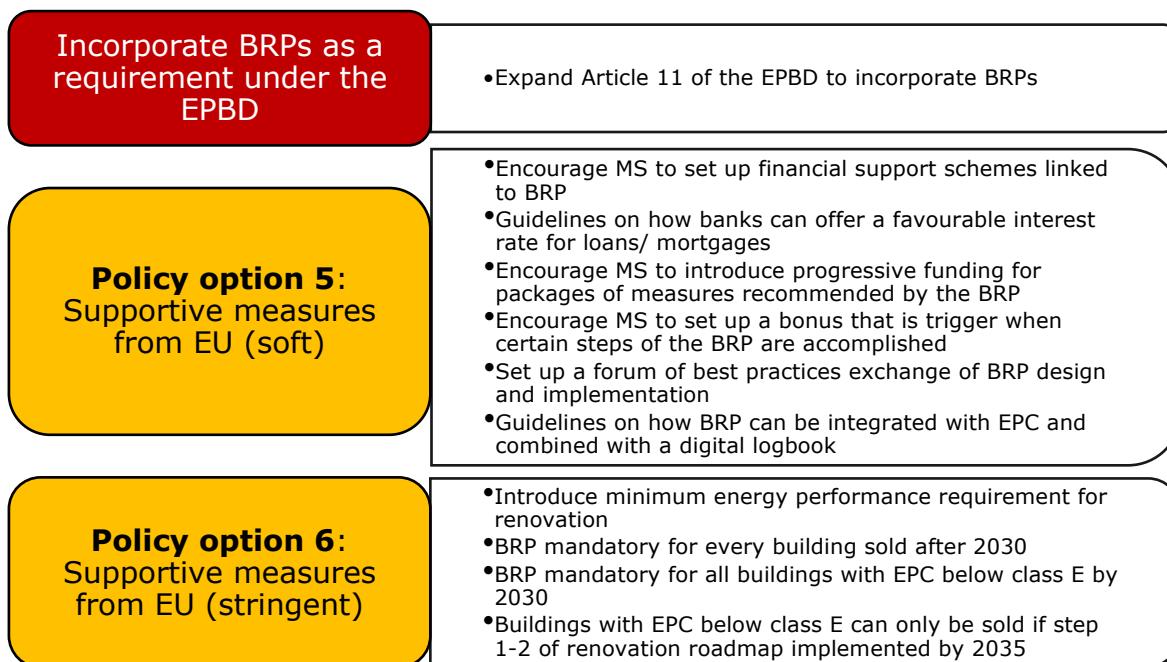


Figure 20: Policy options 5 and 6

The impact of the six policy packages will be analysed and modelled in the final report and presented at the stakeholder meeting in November 2019.

PART 2 – TABLE OF CONTENTS

Glossary	56
About the study and this report	57
Background.....	57
Objectives of this report	58
1. The building renovation passport concept	60
1.1. Proposed definition of building renovation passport.....	62
1.2. Weighting the BRP components	62
2. Relevance of the building renovation passport.....	64
2.1. The need to address barriers to deep renovation	64
2.2. Building typologies and tenure.....	65
2.3. Supporting staged and one-step deep renovation	67
2.4. Link with long-term renovation strategies.....	68
2.5. Integrating the BRP into existing and new frameworks	69
2.5.1. Linking the BRP with EPCs.....	69
2.5.2. Linking the BRP with a digital registry	71
3. Feasibility of the building renovation passport	72
3.1. Bearing the cost of a building renovation passport	72
3.2. The need for an enabling framework	73
3.2.1. Competence and skills to carry out deep renovations.....	73
3.2.2. Competence and skills to carry out a BRP	73
3.2.3. Data protection and privacy.....	74
4. Additional factors influencing the building renovation passport	76
4.1. Three key elements of BRP frameworks	76
4.1.1. Reaching out to building owners.....	76
4.1.2. Data collection requirements	76
4.1.3. Technical framework for building modelling.....	77
4.2. How is the renovation roadmap delivered to the customer?	78
4.2.1. The number of renovation steps.....	78
4.2.2. Linking energy renovation to 'trigger points'.....	79
4.2.3. Personalisation of BRPs.....	80
4. Policy options	81
Role of mandatory measures.....	87
Role of financial measures	88
Role of other enabling measures	88
4.2. Policy packages	88
Measure tree	88
Policy package option 0: No change	90
Policy package option 1: Leave design and implementation to MS.....	91
Policy package option 2: Leave design and implementation to MS.....	91
Policy package option 3: Introduce a common reference framework	92
Policy package option 4: Introduce a common reference framework.....	93
Policy package option 5: Incorporate BRPs as a requirement under the EPBD	95
Policy package option 6: Incorporate BRPs as a requirement under the EPBD	96
5. Next steps – Assessing the impact of the policy packages.....	97
5.1. Impact assessment methodology	97
5.2. Impact categories	98
Annexes	99
Annex 1: Survey results	99
Annex 2: Deep renovation definitions	103
Annex 3: Policy list.....	105
References.....	106

GLOSSARY

Energy audit – An assessment of the energy needs and efficiency of a building, conducted by a certified energy expert.

Energy performance certificate (EPC) – An EPC is a rating scheme indicating the energy performance of a building in the European Union. Each Member State (and, in certain cases, region) has developed its own EPC framework according to the framework given by the EPBD [2010/31/EU – Article 2 (12)].

Energy Performance of Buildings Directive (EPBD) – The objective of this Directive [2010/31/EU] is to promote the improvement of the energy performance of buildings within the Community, taking into account outdoor climatic and local conditions, as well as indoor climate requirements and cost-effectiveness. The EPBD was amended [by way of Directive 2018/844/EU] in 2018.

Individueller sanierungs fahrplan (iSFP) – One of the first examples of a building renovation passport, developed by the German federal government providing a renovation roadmap for single family buildings.

Indoor environmental quality (IEQ) – IEQ is a general indicator of the quality conditions inside a building. It most commonly refers to indoor air quality, thermal comfort, aesthetics, ergonomics, biophilia, acoustics and lighting. Several of these elements have a significant impact on our health, comfort and productivity²².

Logbook – A (digital) repository where all building information can be stored and continuously updated²³.

Long-term renovation strategies: These strategies must be established and implemented by Member States pursuant to Article 2a of the EPBD to support the renovation of the national stock of buildings into a highly efficient and decarbonised building stock by 2050, and will form part of Member States' integrated national energy and climate plans.

Minimum energy efficiency standards (MEES): A renovation obligation depending on the energy rating of a building (such as primary energy demand). If the performance doesn't meet the minimum standards, the building must undergo a renovation.

One-stop-shop – An advisory service for building owners, compiling all information related to the renovation process and facilitating the contact with contractors and installers²⁴.

Passeport efficacité énergétique (P2E) – One of the first BRPs, developed and implemented in France.

²² See for example the Buildings 2030's (2018) [Building 4 People](#) study and BPIE's (2018) [The inner value of a building](#).

²³ See for example iBRoad (2018) [The logbook data quest](#).

²⁴ See for example JRC (2018) [One-stop-shops for energy renovations of buildings](#).

About the study and this report

This study, commissioned and supervised by the European Commission's (EC) Directorate-General for Energy (DG ENER), intends to provide technical support to investigate the feasibility of introducing optional building renovation passports (BRPs) in the EU. In particular, pursuant to Article 19a of the EPBD, this study evaluates the relevance, feasibility and potential impact of BRPs based on a number of aspects. This work is carried out in close consultation with stakeholders and in collaboration with leading experts, including [IFEU](#) and [the Shift Project](#). As part of the consultation process, a first stakeholder meeting was organised in June 2019, and a second meeting is planned for November 2019, where the content and suggestions from this report will be discussed. In addition, 77 stakeholders from 22 countries completed an extensive survey on the concept of BRP and have been invited to provide written statements. The input received by stakeholders has shaped the direction of this feasibility study, as well as the assumptions the authors considered in the process.

This report is the second of three deliverables. Its main objective is to summarise the relevance, feasibility and possible scope of measures that could be introduced in the EU for the implementation of a BRP. Figure 21 provides an overview of the three deliverables of this project. The final report will be published by the end of 2019.

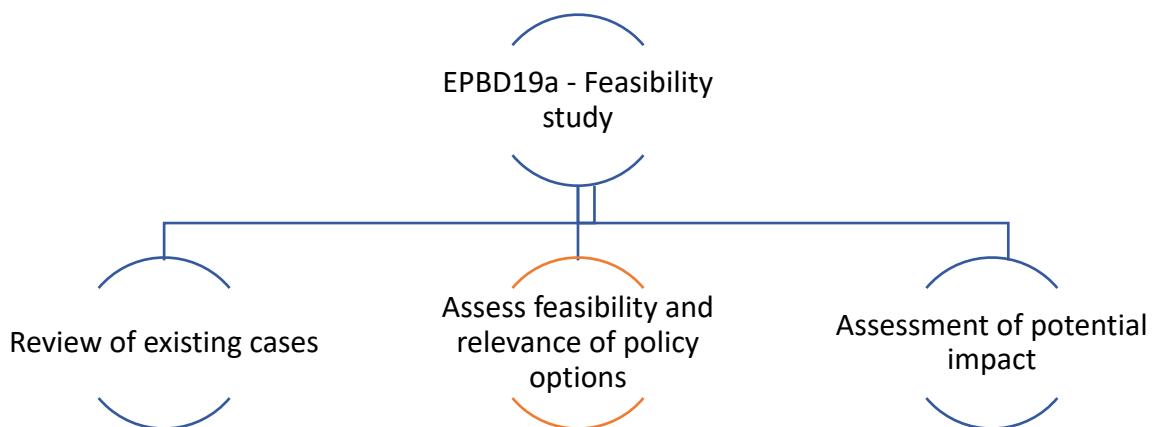


Figure 21: Deliverables on the optional building renovation passport

Background

Buildings are responsible for approximately 40% of energy consumption and 36% of CO₂ emissions in the EU, making them the largest energy consuming sector in Europe. About 35% of the EU's buildings are now over 50 years old. At the same time, only 0.4-1.2% of the building stock is energy-renovated each year. The renovation of existing buildings could lead to significant energy savings and play a key role in the clean energy transition.

At the end of November 2016, the EC adopted the '[Clean Energy for All Europeans](#)' package, a series of legislative proposals in the field of energy efficiency, renewable energy, electricity market design, security of electricity supply and energy governance. In the scope of this initiative, buildings are considered an essential driver of the clean energy transition.

As a part of the clean energy package, the Energy Performance of Buildings Directive (EPBD) [2010/31/EU] was amended; [the amending Directive \[2018/844\]](#) entered into force in July 2018. Member States are required to transpose the amended EPBD into national law by 10 March 2020. One central amendment is the new Article 2a on long-term renovation strategies (LTRS). The requirement to establish national renovation strategies was first introduced in 2012 in the EU Energy Efficiency Directive

[2012/27/EU]. It has been moved to the EPBD to ensure greater alignment with other aspects of energy performance of buildings. Article 2a of the EPBD strengthens this requirement and seeks to make these strategies a tool to support the transition to a highly energy efficient and decarbonised building stock by 2050, facilitating the cost-effective transformation of existing buildings to nearly zero-energy buildings.

According to Article 2a of the EPBD, Member States must include policies and actions to support targeted cost-effective measures and renovation in their LTRS. Such measures can include the introduction of optional schemes for building renovation passports. In addition, Article 19a²⁵ of the EPBD requests the EC to carry out a feasibility study investigating the relevance and feasibility of introducing an optional building renovation passport, including a spectrum of policy options and their related impact at EU level. The BRP concept is still new in Europe, with few examples currently implemented. The concept raises interest as it enables a staged renovation approach through a long-term, step-by-step renovation roadmap for an individual building to improve its energy performance.

Objectives of this report

This report provides an analysis of the relevance, feasibility and possible scope of additional measures to support a BRP at EU level. The report aims to offer a balanced view and to highlight positive and negative aspects of different options and policy paths. It outlines a range of options for possible approaches at the EU and MS level for the possible adoption of BRPs. These options cover all possible measures, including non-legislative ones (e.g. supporting the exchange of best practices, promoting standards, guidelines, etc.), legislative ones (inclusion of dedicated provisions under the EPBD), and combinations of both.

The evidence derived from the first report of the feasibility study²⁶ is used in this report. It concludes that, to be effective, BRPs should be integrated with and reinforced by other measures (e.g. simple access/use, financial support, communication). The most progressive and successful BRPs have combined renovation advice with financial support, legal requirements and/or communication campaigns.

Based on the existing findings, interviews with experts, available policy assessments and long-term renovation strategies, 33 relevant policy options were derived and evaluated in relation to the BRP (see Table 2). The policy options are categorised into regulatory, best practice exchange, communication, finance, guidance and training measures. Each policy option is assessed based on its potential impact and feasibility.

The most suitable policy options have then been used to derive six different policy packages (see chapter on [Policy options](#)) The aim is, however, not to perform a detailed evaluation of each policy option, but to present a first qualitative assessment of the policy packages, to evaluate whether the considered packages are feasible. The evaluation highlights the pros and cons of each policy package. The impact of the six policy packages will be analysed and modelled in the final report and presented/discussed at the stakeholder meeting in November 2019.

²⁵ Article 19a of the EPBD [2018/844]: “The Commission shall, before 2020, conclude a feasibility study, clarifying the possibilities and timeline to introduce the inspection of stand-alone ventilation systems and an optional building renovation passport that is complementary to the energy performance certificates, in order to provide a long-term, step-by-step renovation roadmap for a specific building based on quality criteria, following an energy audit, and outlining relevant measures and renovations that could improve the energy performance.”

²⁶ Deliverable 4.1: Review of building renovation passport schemes and initiatives. The report has been published on the project website: EPBD19a.eu

The first parts of the report discuss the BRP, including its definition and scope. Following that, the discussion focuses on the framework conditions, which includes barriers to deep renovation, structure and design of the concept, links with other instruments, as well as other relevant factors. The subsequent section outlines the suggested policy options. The final section describes

Next steps – Assessing the impact of the policy **packages**, including the impact assessment methodology.

How to read these boxes?

These grey boxes will show up throughout the report and highlight key lessons learnt

1. The building renovation passport concept

The EPBD does not include a definition for a BRP, and no common definition exists in the EU. Existing examples differ in some key elements and in the terminology used. This section outlines a definition, for use in this feasibility study, based on the text in the amended EPBD, stakeholder input and existing research (including findings from iBRoad, Aldren, BPIE and IFEU).

Building renovation passport in the EPBD

Article 19a of the EPBD declares that the European Commission shall, before 2020, 'conclude a feasibility study, clarifying the possibilities and timeline to introduce [...] an optional building renovation passport that is complementary to the energy performance certificates, in order to provide a long-term, step-by-step renovation roadmap for a specific building based on quality criteria, following an energy audit, and outlining relevant measures and renovations that could improve the energy performance'.

Article 2a(1)(c) of the EPBD provides that each LTRS 'shall encompass policies and actions to stimulate cost-effective deep renovation of buildings, including staged deep renovation, and to support targeted cost-effective measures and renovation for example by introducing an optional scheme for building renovation passports'.

In the process of developing this report, a survey was shared with stakeholders to gather information on various focus areas, including how the BRP is perceived and what stakeholders think are important criteria for it. A question on the aspects a BRP should encompass, results of which are presented in Figure 225, reveals that the most favoured aspects focus on information on the current and future status of the building, staged renovation guidance and financial information, including energy costs and available loans/subsidies. Most stakeholders think the BRP should include information on health and comfort, while whole-life carbon emissions and the building's smartness are considered less vital.

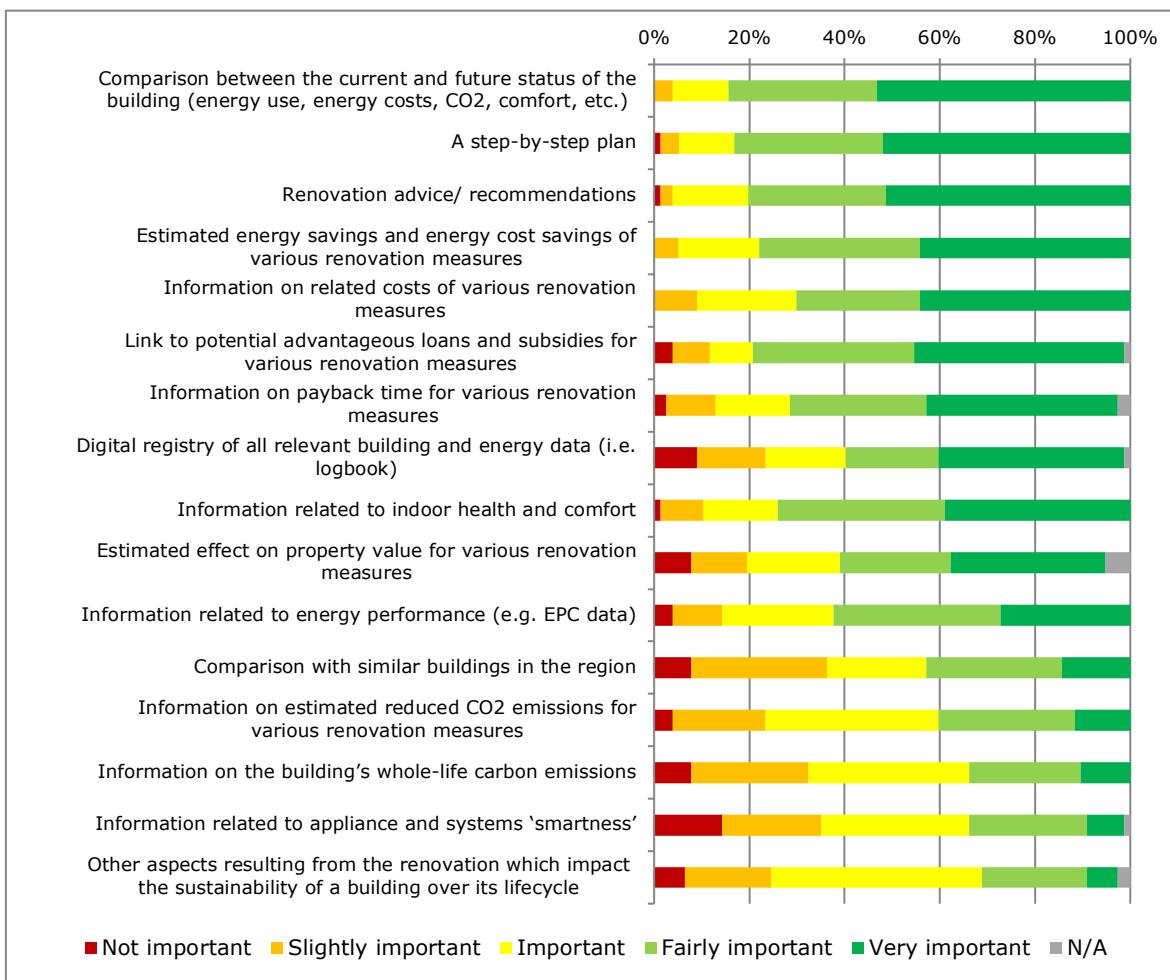


Figure 22: Survey results: How important are the following aspects for a building renovation passport?

Examples from the field

- The Belgian Flemish Energy Agency has developed one of the existing BRPs. They do not use a definition for deep renovation but link the BRP to a long-term performance objective, stating that 'existing buildings must achieve E60-level²⁷ by 2050' [8].
- The German federal authorities, responsible for another BRP, have not defined deep renovation but introduced a rule of the 'best possible principle'. According to this principle, the energy expert must recommend the most ambitious option for each component of a particular renovation and justify any deviation from it. The measures ought to be compatible with the requirements of the KfW support scheme which ultimately leads to an efficiency level of around 30-40 kWh/m²/yr of primary energy demand for a single-family house. If certain measures cannot achieve the best possible option, e.g. due to technical reasons, the auditor must explain why they advised the owner to deviate from the best possible standard [8].

²⁷ 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 score 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.

1.1. Proposed definition of building renovation passport

The definition presented below is based on the existing knowledge of stakeholder input and is only a recommendation of how a BRP could be defined and which features it should include. A definition of the common concept is necessary to assess its feasibility and potential impact.

Proposed definition of building renovation passport

A building renovation passport provides a long-term, tailored renovation roadmap for a specific building, following a calculation based on available data and/or an on-site audit by an energy expert. The instrument identifies and outlines deep renovation scenario(s), including steps to implement energy saving measures that could improve the building's energy performance to a significantly higher level over a defined period of time²⁸. The instrument can be complementary to energy performance certificates and/or combined with digital logbooks²⁹.

1.2. Weighting the BRP components

Stakeholders have different views of what the scope of the BRP should comprise. While most stakeholders favoured including many aspects in the BRP, they also emphasised the importance of keeping the instrument economically and practically feasible.

A long-term, tailored renovation roadmap for a specific building to reduce its energy need is the primary purpose of the BRP. Several stakeholders think the concept should also incorporate aspects such as comfort, sustainability, accessibility and indoor environmental quality.

Figure 6 illustrates two layers of BRP components: central and complementary. The central components assist the building owners in their renovation process, while the complementary provide information on non-energy aspects. The layers have been derived from discussions with stakeholders, authorities that have implemented BRPs and technical experts.

²⁸ The time of the roadmap could span from 5 to 20 years and the definition of the time horizon should be left to the implementing authority based on national/local conditions. The building owner can, of course, opt to implement all steps in one go.

²⁹ See chapters: Linking the BRP with EPCs and Linking the BRP with a digital registry

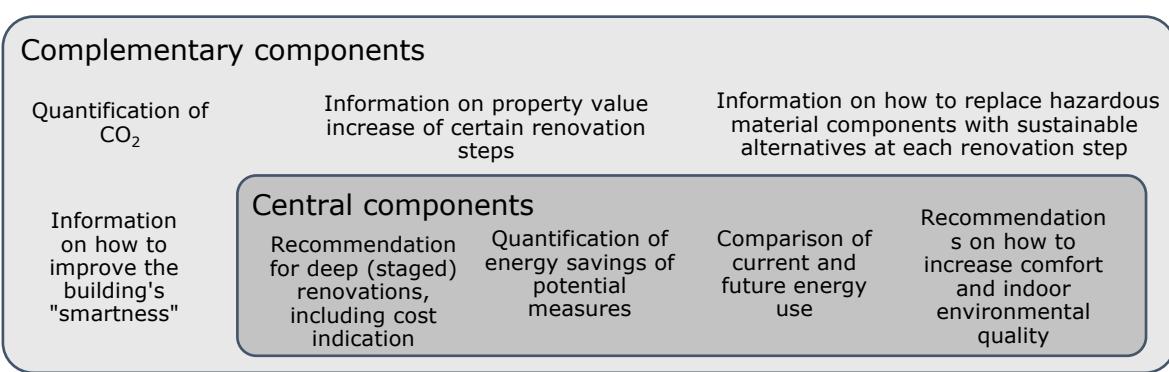


Figure 23: BRP components

Lessons learnt

The BRP can be designed following a modular approach, allowing the implementation of the core components first and of the complementary elements at a later stage.

2. Relevance of the building renovation passport

The *relevance* of the BRP refers to how well the instrument fulfils its overall objectives. The analysis discusses the BRP's suitability for different [building typologies](#) and how it can alleviate [key barriers](#) to renovation by facilitating staged and one-step deep renovations. This section also includes an analysis of how BRPs can support Member States' long-term renovation strategies.

2.1. The need to address barriers to deep renovation

The EU faces multiple barriers to improving the energy performance of the existing building stock. On the individual level, building owners also face multiple obstacles to improve the performance of their buildings. Together with high cost and difficulties in accessing finance, two of the most-often quoted barriers are the low awareness of the long-term benefits of renovation and the lack of knowledge about what to do, where to start, and which measures to implement in which order.

Our review of existing BRPs showed that the instrument can be effective in alleviating two of the main barriers: low awareness of the benefits of energy renovation and insufficient knowledge of what measures to implement and in which order. The analysis confirms that tailored renovation advice, together with other support measures, has an impact on the decision to renovate, the number of measures to implement, the performance level of the selected measures, as well as on what kind of measures to implement.

The BRP is a more comprehensive instrument than the EPC, as it provides tailored recommendations on how to achieve deep renovation over time for each individual building. Delivering a BRP may entail higher costs than delivering an EPC (e.g. additional training for the auditors and EPC certifiers) and if these additional costs are transferred to the building owners, they may become a barrier to its uptake.

Financial constraints are one of the main reasons why building owners choose less efficient solutions. The broad preference for suboptimal solutions hampers the long-term transition and makes the path to highly performing buildings more complicated. The review shows that long-term renovation advice, as provided by BRPs, can be used to better align the direction of private investments with the long-term vision for the building stock.

Table 3 displays the main relevant barriers³⁰ related to building type and tenure, resulting from the stakeholder survey. All the results from the stakeholder survey can be found in the annexes.

³⁰ The rating is based on the results from the stakeholder survey, results from Deliverable 4.1, and existing research, including the EPBD [Impact Assessment](#) (SWD (2016) 414 final), which features a similar, but more general, ranking.

Table 3: Summary of the relevant renovation barriers by type and according to building category and tenure

Type of barrier	Barrier	Residential		Non-residential	
		Owner occupied	Rented	Public	Service
Awareness	Don't know where to find the right information	**	**	**	*
	Limited understanding of energy performance	***	***	***	***
	Uncertainty of what to do and where to start	***	***	**	**
Financial	Cost of renovation is too high	***	***	**	*
	Lack of attractive financial products	***	***	***	**
	No energy savings guarantees	**	**	**	**
Other	Lack of time for renovation works	**	**	**	**
	Low trust in installers/professionals	*	*	*	*
	Too much hassle	**	***	**	**
	Administrative barriers	**	**	*	**
	Need to use the space (i.e. no room for renovation)	**	**	*	**

Lessons learnt

The BRP ought to be accompanied by an enabling policy framework to effectively alleviate these barriers

2.2. Building typologies and tenure

Energy performance and renovation potential can be affected by the tenure of buildings (social housing, private rental or private ownership) and the building type³¹ (single-family house, multi-family building, terraced house etc.). For example, some building tenures and types are more suitable for large-scale renovation programmes³², while others require a staged renovation approach. Figure 7 shows that the majority of buildings are residential single-family houses, which is a typology the existing BRPs have focused on [17].

³¹ See the [TABULA webtool](#) for an overview of building typologies and their specific characteristics.

³² See, for example, [Energiesprong](#) in The Netherlands which offers large-scale, net-zero renovations for housing.

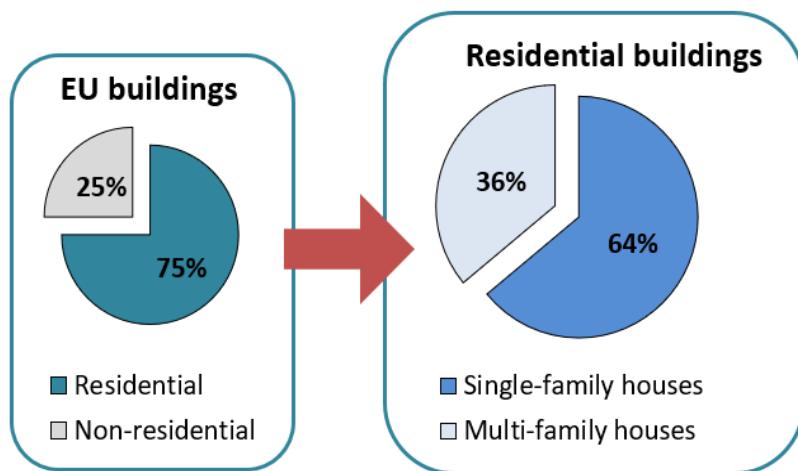


Figure 24: Building typologies in EU

The answers from stakeholders show that most respondents (61%) think that the BRP can be useful for all building typologies because inappropriate renovation decisions can be made for all types of building. Other stakeholders considered the BRP most appropriate for residential buildings (single-family 26% and multi-family 23%)³³, arguing that the owners in these buildings generally have lower expertise than in commercial and public buildings. Figure 8 displays the full results.

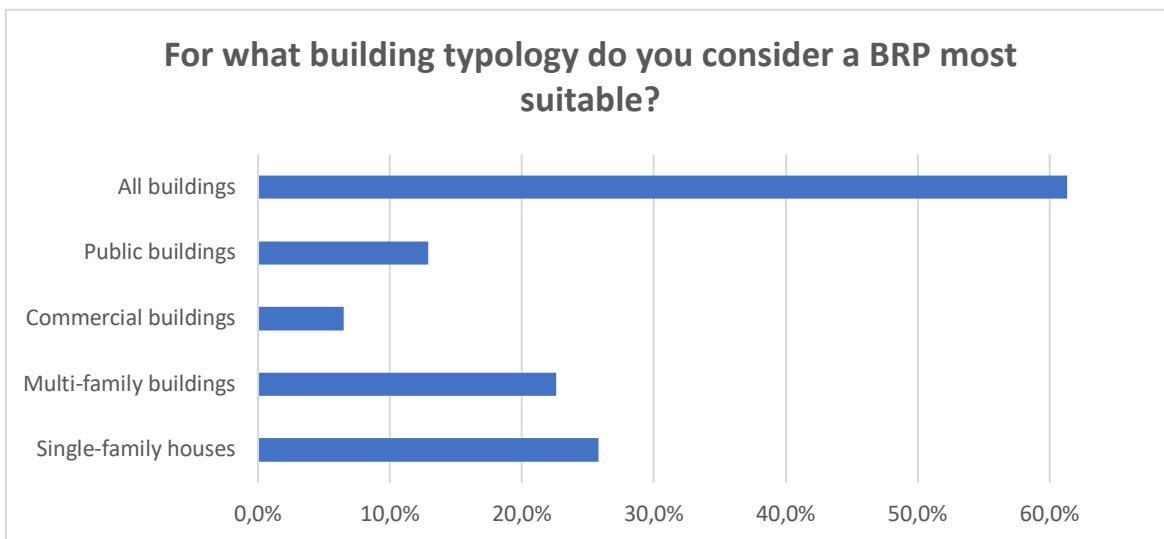


Figure 25: Answers from stakeholders at the first meeting in Brussels, June 2019

The share of owner-occupied dwellings in the EU exceeds 70%; it ranges from 51.4% in Germany to 96.8% in Romania. While the existing BRPs target owner-occupied single-family houses, the BRP could be adapted to multi-family buildings. One of the benefits would be that the instrument helps owners to reach consensus on which energy saving measures to implement.

³³ Multiple choices were allowed.

However, the largest information deficit about renovation is among single-family owners. It is relatively common for larger buildings (multi-family, commercial and public) to perform a detailed energy audit before detailing the renovation steps, while many single-family owners often make their decision by relying on the advice of friends and family members instead of building professionals.

2.3. Supporting staged and one-step deep renovation

There is a longstanding debate on whether the EU and Member States should favour one-step or staged deep renovation approaches. In the context of climate urgency and the need to drastically reduce energy consumption from the building stock, some stakeholders argue that the necessary path would be to renovate a large part of the building stock to a low-energy level in one step³⁴. At the same time, excluding the possibility of staged renovations would increase the barrier for people to invest in any energy saving measure as it would increase the upfront cost³⁵.

The BRP can facilitate both one-step and staged renovations by setting out the required measures and in which sequence they ought to be implemented. Staged deep renovation, consisting of several renovation steps spread over several years, can utilise relevant trigger points in the building life-cycle. The counterpart is one-step deep renovations, where all components are replaced with energy efficient alternatives at once [5]. Both variants – staged deep renovations and one-step deep renovations – have their advantages and disadvantages, which are presented below.

Most renovations today aim to renew one, or a few, part(s) of the building. A study by the German Federal Office for Building and Regional Planning (BBSR) reveals that only 6% of renovations are done in one step primarily due to high investment costs and disruption. Another study reveals that the rate is similar in Sweden at 5% [18]. In non-residential buildings, the share of one-step renovations is somewhat higher and amounts to 28% [5].

Existing BRPs do not favour one approach over the other. The building owner gets to decide if they prefer to implement the renovation steps in multiple stages or all in one go. The French *Passeport Efficacité Energétique* encourages the building owner to implement all measures in 2-3 steps, as it sees that too many steps might lower the final quality of the works.

Valid arguments support staged deep and one-step renovations (see Figure 26). When BRPs are introduced, it would be beneficial to design them to present both options, based on building typology and tenure, regulatory requirements, technical potential and the owners' needs and financial capacity.

³⁴ www.euractiv.com/section/energy/opinion/energy-efficient-buildings-why-meeps-should-ban-the-staged-renovation-approach

³⁵ www.eceee.org/library/conference_proceedings/eceee_Summer_Studies/2019/7-make-buildings-policies-great-again/planned-staged-deep-renovations-as-the-main-driver-for-a-decarbonised-european-building-stock

The main arguments for staged deep renovation

- 1.Lower upfront cost enables more people to engage in energy renovations (that might lead to a low-energy level over time).
- 2.Carrying out renovation works at the time when certain building components (windows, boilers, etc.) must be replaced anyway due to completion of service life reduces costs (see section on trigger points).
- 3.Staged renovation enables flexibility and the possibility to incorporate measures that weren't considered initially, such as additional rooms or space planning requirements.
- 4.Staged renovation allows the integration of new technologies that may not exist or have reached maturity when the renovation is initiated.
- 5.Staged renovation may not require the building to be completely vacated and regular activities can (partially) continue.
- 6.Staged renovation reduces overall carbon emissions due to usage of legacy equipment with the new systems.

The main arguments for one-step renovation

- 1.Lower risk of lock-in effects (e.g. the obstruction of highly efficient renovation measures because of recently performed low efficient measures) because of the possibility of integrated planning and implementation of the renovation.
- 2.The cumulative energy savings are higher in one-step renovation if it's carried out immediately.
- 3.Overall quality of renovation is better in one-step renovation (better airtightness, less thermal bridges, systems dimensioned consistently with envelope performance).
- 4.Staged renovation can cause a larger inconvenience to the occupants due to multiple construction works on the building's envelope.
- 5.Lower total investment costs as synergies arise, from scaffolding to site set-up to planning costs, along with being able to scale heating equipment to lower capacities.
- 6.Greater ability to assess work quality and building performance than after a partial renovation (blower-door test not relevant if the building envelope is only partly renovated).
- 7.Indoor environmental conditions can be improved more effectively than in staged renovation.

Figure 26: Arguments for staged and one step renovations (elaboration based on IFEU compilation)

Lessons learnt

One-step deep renovations can achieve energy savings faster than staged renovation, but supporting policies for deep staged renovation could be introduced and made available to guarantee the same level of savings over time, e.g. financial schemes promoting staged deep renovation with the condition that the renovation follows the steps outlined in a BRP and is completed within an agreed number of years.

2.4. Link with long-term renovation strategies

One original feature of BRPs is the integration of a long-term perspective. If an outer wall is insulated today, it will not be renovated again in the near future. Buildings that have been partially restored, but with insufficient depth, will likely not be renovated again before a decade or two. This is because the successive renovation steps are usually less economical due to the now lower monetary saving potential [1]. Based on the current status of the building, BRPs can display how the building could be transformed in the short, medium and long term.

Article 2a of the EPBD requires EU countries to adopt a long-term renovation strategy (LTRS), which 'support the renovation of the national stock of residential and non-residential buildings, both public and private, into a highly energy

efficient and decarbonised building stock by 2050, facilitating the cost-effective transformation of existing buildings into nearly zero-energy buildings.' The strategies must include an overview of the building stock, a long-term roadmap to 2050 and an identification of policies to achieve the objectives set out.

BRPs could support long-term renovation strategies by (i) providing public authorities with information on the building stock and which type of renovation measures are primarily needed, (ii) assisting policymakers in identifying the most effective policies and financial incentives to increase the quality and volume of deep renovations, (iii) providing the market, financial institutions and investors with a long-term projection on the type of refurbishments to be implemented.

Lessons learnt

BRPs could support the preparation and implementation of LTRS by providing data on the status of the building stock and the renovation measures mostly needed. This would be possible if BRPs were designed to feed this information to Member States (e.g. via a database) and make it accessible at any given moment.

2.5. Integrating the BRP into existing and new frameworks

2.5.1. Linking the BRP with EPCs

Energy performance certificates (EPCs) were introduced by the EPBD in 2002 [2002/91/EC] 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 by introducing independent quality control of EPCs, penalties for non-compliance, the obligation to display 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).

A BRP can be viewed as an evolution of the EPC, as it not only indicates the energy performance of a building and gives recommendations on renovation, but it also supports building owners with personalised suggestions and a more detailed renovation roadmap. The BRP function could be included as an optional add-on to the EPC or be automatically integrated, as done in Flanders where they use existing building data to develop the BRP renovation steps.

The Flemish BRP is a direct continuation of the existing EPC scheme and other Member States (most notably France and Ireland) are exploring the possibility to evolve their EPCs in the same direction. In Germany, there is no link between the federal BRP and the country's EPC framework. Instead, the BRP has been linked to their energy audit framework. The building owner gets an EPC as an automatic by-product of the BRP.

Most stakeholders think the BRP should be an expansion of the EPC framework (36% said it should be linked and 39% would link them if the quality of the existing EPC framework was perceived as effective).

Lessons learnt

The BRP should be coupled with existing EPC frameworks where it's feasible to do so. The existing EPC 'infrastructure' can be used to introduce and facilitate the use of BRPs, including relying on, and additional training for, building professionals issuing EPCs. In some Member States, the BRP is more complementary to an audit framework (such as Germany) or other renovation advice framework.

Linking the BRP with existing databases and registries can be an opportunity to re-evaluate existing schemes and improve them to ensure the information provided to building owners is up-to-date and tailored to their needs (e.g. building on a static instrument like EPC to deliver a more suitable instrument for renovations over time).

2.5.2. *Linking the BRP with a digital registry*

The BRP can be combined with a repository of building-related information (i.e. a logbook) on aspects such as the energy consumption and production, executed maintenance and building plans. This provides several functionalities to the building owner that could go beyond energy performance. The type of information stored in the logbook and its functionalities can evolve over time and could range from energy production and consumption to equipment maintenance, as well as insurance, property plans and obligations, energy bills, smart meter data and links to available financing options for renovation projects (e.g. green loans, incentives, tax credits).

Combining the two concepts can support public authorities in fulfilling reporting requirements and in developing new policies and financial instruments. Data concerns are discussed further in the following sections. Flanders and Portugal are developing their EPC and BRP schemes to directly support the objectives of their [long-term renovation strategies](#). In doing so, public authorities will be able to not only gather information on the energy transition of each building, but also modify policies and financial support according to market developments (such as changes in renovation rate). Integrating the BRP with a digital logbook and linking it to financial schemes and existing one-stop-shops are potentially effective solutions to further enhance these positive synergies.

The Flemish energy agency sees the benefits of integrating the renovation roadmap (titled *EPC+*) with a logbook (titled *Woningpas*):

- The incorporation of the renovation roadmap in the logbook creates higher visibility for the instrument. The renovation roadmap is not a static piece of paper but always consultable in the logbook (i.e. the digital registry). As people can consult the logbook for other reasons (e.g. questions about the environment), they also get information on energy.
- The renovation advice in the EPC will be interactively combined (from autumn 2019) with available premiums tailored to the citizen at the time of logbook consultation.
- The information can be continuously updated, including the costs for implementing certain renovation measures. As the cost varies over time, this enables a more accurate prediction.
- The building owner will be able to update the implementation of the renovation through the logbook. The owner can indicate which steps he/she has already carried out and which steps he/she plans to carry out in the coming years.
- In the future, there may be renovation obligations in Flanders, whereby a new owner has the obligation to fulfil a number of measures within five years after purchasing the home. The BRP will provide a list of steps to follow and the logbook would help to keep track of their implementation and follow-up.
- The logbook simplifies the administrative requirements. After indicating that certain work has been completed (and after proving it with relevant documents, such as invoices), the premiums/financial supports can be automatically requested or paid out.

Lessons learnt

The BRP can be developed independently of a logbook. If developed in parallel, the EC could provide public authorities with guidance and a forum for best practice exchange on how to couple the two instruments.

3. Feasibility of the building renovation passport

The feasibility section comprises an assessment of the practicality of implementing the BRP, including the related costs, the need for an enabling framework and data protection and privacy issues.

3.1. Bearing the cost of a building renovation passport

Producing the BRP itself comes with a cost, which mainly comprises labour costs, administration and data management. For example, the cost for producing the EPC has been an obstacle for implementing the entire framework [19]. As with EPC, the BRP should be produced at a reasonable price to meet its expectations. It can be difficult for implementers to find a good balance between cost and quality.

In terms of allocating the responsible actor to cover the cost of the BRP, there are several design framework possibilities: the cost could be covered by the building owner (e.g. paying a fee for the on-site visit), through the repayment of an energy efficiency loan/mortgage, or they could be covered or subsidised by whoever offers the service (e.g. a public authority or a private company).

Examples from the field:

- In Germany, a subsidy is available for the iSFP, run by the Federal Office for Economic Affairs and Export Control (BAFA), under the 'Energieberatung vor Ort' programme. This programme grants subsidies of up to 60% for an on-site audit (maximum €800 in single and two-family buildings, €1100 up from three dwellings)³⁶.
- In France, for the time being, the on-site visit is free of charge, but different options are considered for the future, including introducing a fee of a maximum €400, or recovering costs via financing programmes. If a fee were to be introduced, the project managers foresee exceptions for vulnerable groups, such as low-income households, to alleviate an additional access barrier.

Analysis of existing schemes and initiatives shows that building owners are rarely willing to fully pay for a BRP. According to a survey done by the French Shift Project, building owners are on average willing to pay around €105 for a BRP. Our survey showed that most stakeholders (39%) thought €200-€500 was a reasonable cost for a BRP for a single-family house, followed by €50-€200 (22%) and €500-€1000 (19%).

Lessons learnt

Encourage Member States to subsidise the cost for the development of the BRP to a level where it becomes attractive to building owners. The subsidy can be reduced when the instrument has penetrated the market. Quality of the BRP is crucial to gain trust for the instrument and its usability.

³⁶www.bafa.de/SharedDocs/Kurzmeldungen/DE/Energie/Vor_Ort_Beratung/20170512_sanierungsfahrplan.html

3.2. The need for an enabling framework

The lack of sufficient competence and skills in the workforce is one of the main barriers to effective implementation of BRPs. Another obstacle is to make BRPs an attractive option for building owners, which initially probably requires public funding to bring down the cost.

3.2.1. Competence and skills to carry out deep renovations

The transition to a low-carbon economy will require higher skills in the renovation value chain, including energy experts, contractors and installers. In order to ensure the effective implementation of the solutions provided by BRPs, the schemes should be accompanied by a clear plan, establishing which skills are needed for the workforce and how they are going to be acquired. The analysis of existing schemes and initiatives reiterates this, as several project managers highlighted that the lack of skilled auditors/construction workers is a main hurdle. An increase in demand for deep renovations needs to be matched with a supply of a skilled workforce.

A report published by the European Construction Observatory states that 3 million construction workers in Europe need to increase their skills in energy efficiency and renewable energy in the coming years. The report concludes that 'obstacles to the development of skills include structural barriers, such as the low predictability of the industry and structural fragmentation, which leads to short-term employment and limited incentives for long-term investment in the workforce skill base. The construction industry suffers from a negative image, being considered tiring, unattractive, unproductive and having low-service orientation.' [1]

3.2.2. Competence and skills to carry out a BRP

When considering the introduction of BRP, an analysis of the skills needed to deliver this tool is needed, to ensure that experts issuing renovation roadmaps are properly trained to do so. Developing a BRP might require additional abilities or perspectives from the energy expert. The difference between issuing an EPC and conducting an energy audit is that a renovation roadmap requires considering the long-term perspective of the building (up to 20 years). The energy expert should be able to explain the different steps in a long-term staged renovation process. Proper training of energy experts is essential for the effectiveness of BRPs: auditors/experts often follow specific routines and while they usually have an excellent technical knowledge, their ability to clearly communicate with their clients is a weak spot. The required 'new' skills include building energy modelling, elimination of lock-in effects, comfort and risk assessment (thermal comfort, IAQ, etc.), knowledge of how measures interact, cost evaluation, as well as communication and motivational skills.

Two of the central skills are explained below:

- Knowledge of renovation works and their interaction**

To conduct successful BRPs, auditors need to develop their skills in building energy modelling to accurately model the impact of renovation measures. They will need to develop knowledge on the technical specification of renovation works by attending trainings and by examining the physical mock-ups (on-site or off-site).

- **Knowledge of renovation lock-in effects**

The policy support, technical specifications, availability of products, adequate financial mechanisms and optimal sequencing will be assessed by auditors when preparing a BRP and also adequately avoiding any lock-ins (renovation interventions that prevent a better intervention in the future). This aspect is particularly critical in staged renovation approaches.

Lessons learnt

The success of the implementation of the BRP is dependent on an increase in competence and skills of the construction workforce. Policymakers could support this through, for example:

- Introducing policies and measures to support training activities, development of guidelines and other support material.
- A quality framework for development of a BRP, in which the expert provides a declaration of conformity to the client, which he/she can use to receive subsidies for the work.

3.2.3. Data protection and privacy

Data privacy and security are protected by EU legislation (most notably under the [General Data Protection Regulation \(GDPR\)](#)) and every development regarding the addition of confidential information to a digital document will have to adhere to this regulation. The GDPR is designed to harmonise privacy laws in the European area, to protect and ensure the privacy of all European citizens and to reform the European approach to data privacy. The scope of the GDPR is securing the processing of personal data by wholly or partially automated means as well as the processing by non-automated means of personal data contained in filing systems or intended to form part of a filing system.

The data privacy and ownership aspects relevant when setting up a BRP, or related logbook, can be summarised as follows:

- Confidentiality: Ensuring that the information can only be seen by authorised people. When properly achieved, confidentiality prevents unauthorised access to restricted data in an organisation. An organisation can enforce confidentiality by implementing access controls, such as authentication and encryption.
- Integrity: Ensuring that the information cannot be changed or removed without authorisation. An organisation needs to validate that the data, while in transit or at rest, has not been modified from its original state. Digital signatures and encryption help maintain data integrity.
- Availability: Ensuring that only authorised people can access information when needed. Data and access to data must be available and resistant to single points of failure. Data backups, redundant disks and multiple network connections help ensure availability³⁷.

Examples from the field

- In Flanders, building owners have access to the logbook (Woningpas), which comprises the BRP, through their electronic ID card. In the future, building owners will have the opportunity to grant access to public authorities and third parties, such as buyers, tenants, architects, experts, contractors, lawyers and real estate agents. The use of blockchain

³⁷ The Horizon 2020 project iBRoad discussed privacy issues related to the BRP and especially the logbook. Read more here: <https://ibroad-project.eu/news/the-logbook-data-quest>

technology is also being considered to facilitate a smooth and safe exchange of information. Building owners can, and are encouraged to, expand Woningpas data with information on investments and energy savings (for example from invoices, adoption of grid premium for energy-saving investments) by uploading supporting documents. For instance, after each investment, owners may decide to update energy performance on the basis of evidence and information on the performance of the installed equipment or installations. This enables public authorities to monitor the path towards the long-term target for the building stock and assists them in planning and implementing their long-term renovation strategy [8].

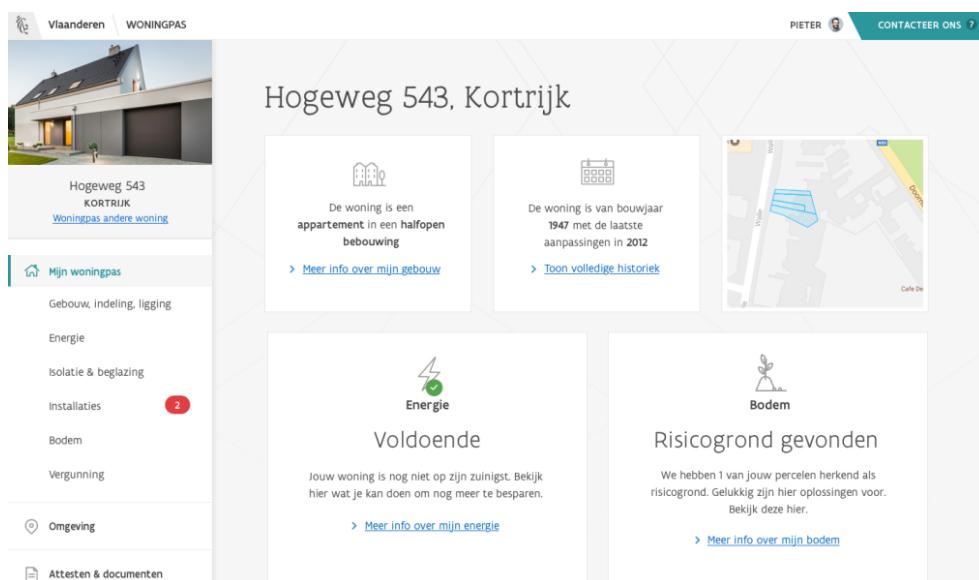


Figure 10: Excerpt from the Woningpas

- In Germany, the building owner is provided with a hard copy of the BRP. If the building owner sells the estate, there is no automatic procedure to hand over the roadmap to the buyer, nor is there any right to request this document. The iSFP is owned solely by the building owner, meaning that no commercial activities can be linked with the roadmap [8].

Lessons learnt

While legislation exists in the EU to ensure building owners' data privacy, a guidance document clarifying existing rules and options to ensure proper data protection would be useful for public authorities that are designing and implementing BRPs and aiming to link them with external registries, like EPC databases.

4. Additional factors influencing the building renovation passport

This chapter presents considerations about how key elements of the BRP design and implementation can influence its impact. The first part outlines three key elements of BRP frameworks, including how to [reach building owners](#), [data collection requirements](#) and [technical framework for building modelling](#). The second part discusses how the roadmap is delivered to the customer, including [number of renovation steps](#), [link to renovation trigger points](#) and [degree of personalisation](#).

4.1. Three key elements of BRP frameworks

The analysis of existing schemes and initiatives shows that BRPs are generally based on three key elements: the initial contact with building owners, data gathering procedures and the technical modelling.

4.1.1. Reaching out to building owners

Communication campaigns are needed to make people interested in deep renovations in general but specific and targeted communication and marketing campaigns to promote BRPs are also necessary to make sure building owners will seek them out when deciding to renovate. The review of existing cases also showed that one-stop-shops and local advice centres play a key role in getting homeowners interested in energy renovations.

The majority of homeowners do not consult an expert before deciding which renovation measure to implement³⁸. A local authority representative said that 'people are not interested in the BRP simply because they don't know about it'³⁹.

Lessons learnt

Develop guidelines and set up best practice exchange forums to assist interested Member States and local authorities to integrate the BRP in existing renovation advice venues.

4.1.2. Data collection requirements

The BRP can be developed based on various data inputs, including an extensive energy audit (as done in Germany) or based on existing data, as in Flanders. A BRP that is primarily based on an on-site audit is likely more accurate than one based on available data, such as EPCs, user-inserted information or automated data (house templates, construction norms, climate data, etc.). On the other hand, gathering on-site data is more expensive.

On-site data gathering is the first source of information for the BRP. To generate a successful process for data gathering, some key aspects should be considered: make the tool simple for the auditor, generate value for the building owner and use the data in a smart way. For example:

³⁸ An Ipsos survey of the potential BRP users in Portugal, Bulgaria and Poland shows that homeowners are most likely to trust friends, family and colleagues for advice on renovation measures [18]. Consulting energy experts is more common for non-residential buildings.

³⁹ Interview (by email) with local implementer of the federal BRP in Germany.

- Create a checklist for the energy expert: the German iSFP, P2E and the Danish BetterHome model supply their energy experts with comprehensive checklists on how to conduct the on-site visit, what information to collect and what to ask the building owner. The expert fills in simple checklists on the state of the building, the information is then fed into an online application to calculate energy savings and indoor air quality improvement depending on different packages of measures. Furthermore, the installer can easily extract a renovation proposal for the building owner based on the information gathered [9].
- Integrate automation as much as possible: this involves uploading building information in defined templates⁴⁰ online, which can include utility bills, building components (e.g. technical details, age etc.), building operation (e.g. number of occupants, occupancy schedules, etc.) and equipment and lighting details. Data is collected in an online repository that can be automatically accessed by energy experts for analysis and energy modelling.

How the required data is collected has an impact on cost. Until now, the cost of BRP schemes based mainly on on-site audits is higher than the costs of other BRP schemes. The average cost for a German BRP, which uses on-site data, starts at €900⁴¹ for a single-family house, compared with €400 for the French P2E and €200-€400 for the Flemish EPC+, which require less data from on-site audits.

Experts conclude that other important determinants for the cost are how many times the auditor visits the site and how much the owner is willing to pay [13]. Existing BRP schemes show that it might be necessary to visit the site more than once (a second time to explain the results and details of the BRP and maybe also a follow-up check).

Lessons learnt

The BRP could be based on a combination of available data and an on-site check, in order to find a balance between quality and cost. Available and automatically gathered data based on climatic region, building typology and other attainable information could save the auditor/expert time on-site and thus save money. To save time and further reduce costs, the homeowner can be asked to prepare as much as possible in advance (energy bills, building plans, etc.), if the information is not available in a public registry.

4.1.3. Technical framework for building modelling

As a starting point for the technical modelling of the BRP, the expert generally models the building as it is today using thermo-physical values of the building envelope, heating demand, occupancy schedules, efficiency of the heating system, etc. Some of this data can be derived from the EPC register but should be checked and possibly updated. If not available or not up to date, the expert needs to assess the existing building components (insulation, heating system, occupancy, etc.), and other necessary technical data. If available and accepted, the expert can use a national calculation/simulation software, which calculates the energy demand of the building

⁴⁰ Data templates help arrange and synthesise the information.

⁴¹ The cost for the regional BRP in Baden Wuertemberg is €750, not including the €200 state subsidy. The cost for the federal iSFP is even greater.

based on the national calculation procedures (building code, etc.). If a national calculation software is not available, the expert needs to find another solution⁴².

The expert conducts a simulation and compares the calculated annual energy demand with the actual energy consumption and carries out an adjustment in input values (calibration) so that the model mirrors the actual building situation as much as possible. Based on this calculation, the final and primary energy demand, the actual energy costs, the CO₂ emissions and the EPC label of the building can be derived accurately [11]. Using monthly energy consumption over a representative period (e.g. at least one year) can enhance modelling reliability.

Based on the state and condition of the building, and potentially in combination with the wishes and preferences of the building owner and individual trigger points (such as children moving out, financial availability, etc.), the expert defines the energy demand of a set of renovation packages to be implemented in a specific sequence.

Currently, there is no common EU framework that would ensure these steps are consistently followed in the BRP schemes that exist.

Lessons learnt

Set up a European common reference framework to ensure a high quality of simulation using the national calculation tool/simulation software. If the EU is to provide guidelines for BRPs, the technical modelling is a central aspect to be covered. It would also enable comparison across the EU.

4.2. How is the renovation roadmap delivered to the customer?

BRPs are intended to provide detailed and individualised renovation advice to building owners. The evaluation of existing BRPs showed that effectiveness partly depends on interactions with building owners. In the end, they are the users of the instrument. This chapter discusses some of the key aspects, including the number of renovation steps, trigger points, personalisation of the concept and privacy issues.

4.2.1. The number of renovation steps

After compiling all required data and evaluating how to achieve the highest level of energy performance, the expert informs the owner of envisioned renovation steps, based on the target energy performance level that the owner wishes to achieve over a defined period of time indicated in the BRP.

The list of renovation measures provided to the owner outlines the performance parameters such as reduction in energy demand, ease of application, related costs and time required. In addition to the main parameters, other impacts of renovation measures must be given, like improvement of indoor air quality, thermal comfort, reduction in noise etc. Depending on local conditions, design and preferences of the owner, the number of renovation steps can vary.

In most of the existing BRPs, the number of renovation steps is not settled before the energy expert discusses with the building owner and/or visits the site. In the German federal renovation roadmap, the number of renovation packages/steps is decided by the energy auditor (see illustration in Figure 11). In the French Passeport Efficacité

⁴² The H2020 iBRoad project is developing a simple streamlined techno-economic calculation tool that can be used for this purpose.

Energétique, they encourage a BRP that includes only 2-3 steps, as they see that too many steps might lower the final quality of the works.



Figure 11: iSFP - renovation roadmap

Lessons learnt

The number of renovation steps should be decided jointly by the energy expert and the building owner. The number of steps can be defined for each building based on specific technical aspects and the financial plan of the building owner.

4.2.2. Linking energy renovation to 'trigger points'

Trigger points are key moments in the life of a building when carrying out energy renovations would be less disruptive and more economically advantageous than in other moments. The EPBD [2010/31/EU] clarifies that a 'trigger point' is 'an opportune moment in the life-cycle of a building, for example from a cost-effectiveness or disruption perspective, for carrying out energy efficiency renovations'. The EC recommendations state that a trigger point could be: (a) a transaction (e.g. the sale, rental or lease of a building, its refinancing, or a change in its use); (b) renovation (e.g. an already planned wider non-energy-related renovation); or (c) a disaster/incident (e.g. fire, earthquake, flood).

Linking energy-efficiency renovation with trigger points should ensure that energy-related measures are not neglected or omitted at a later stage in the life-cycle of the building. Focusing on energy efficiency at trigger points should limit the risk of missing opportunities to renovate and increase possible synergies with other actions [20]. Aligning renovation advice with (foreseeable) trigger points may require the need to train energy experts to identify/consider trigger points when issuing a BRP.

Lessons learnt

BRPs could have greater impact if available or produced when a trigger point occurs, as they could provide ready-to-use guidance to owners. Where possible, the renovation steps in the BRP could also be aligned with certain trigger points.

4.2.3. Personalisation of BRPs

Existing BRPs support building owners with personalised instructions on their renovation options. Personalised recommendations and advice allow a more tailored approach based on the property's energy usage, the way it is occupied and used. In Germany, the building owner is put at the very centre of the BRP development process and the individual approach, including in-depth dialogues between the building owner and the energy auditors, is considered key.

Challenges of a personalised approach

- The BRP becomes more expensive, as discussions with the owners are relatively time consuming and it becomes harder for the auditor to recycle advice.
- Harder to transfer the BRP to new owners of the building [8].

Advantages of a personalised approach

- More effective in incentivising investment in renovation works.
- The possibility to adapt the recommendations to the users' energy behaviour.

Lessons learnt

The BRP should foresee a certain level of customisation and input from building owners should be integrated in the BRP plan. One advantage of combining advice tailored to each specific building with advice tailored to its owner(s) and linked to behaviour and other external factors is that in case of sale, only the personalised part needs updating.

4. Policy options

Based on the review of existing BRP schemes and initiatives, and an analysis of related policies, 33 policy options for the introduction of BRPs have been identified. The identification of these policies is based on stakeholder input⁴³, expert interviews⁴⁴ and desk research⁴⁵. The policy options are divided into six categories: regulatory, communication, best practice exchange, financial, training and guidance. They are further divided into direct and supporting policy options.

Direct policy options correspond to the different ways BRP schemes could be established in the EU: (i) let Member States decide whether to design and implement the instrument without any specific guidance, (ii) introduce an EU-wide common reference framework, or (iii) incorporate BRPs as a requirement under the EPBD. Supporting measures are those that complement the direct measure (e.g. financial instruments, regulatory requirements, training of auditors or guidance documents).

The identified policy options are expected to be effective in supporting the uptake of BRP as an instrument to enable higher rate, depth and quality of renovations in Europe. The full analysis is available in Annex 3, including an analysis of potential impacts, existing case studies and an appraisal of the feasibility for the EU to implement the specific policies.

The policy options have been derived as measures to be introduced at the EU level, but they could be used by national and local authorities to select options suiting their specific conditions.

Based on the 33 policy options, six policy packages have been developed. Each of the packages consists of one direct policy option and a number of supporting policy options. Each of the three direct policy options described above has been included in two policy packages, one with a 'soft' and one a 'stringent' approach. Accompanying supporting measures have been tailored to the direct measure and the ambition level of the specific package.

Table 4 below summarises the selected policy options. The first three measures are direct, while the others are supportive.

⁴³ Stakeholders have been involved through a stakeholder meeting in Brussels in June 2019, an extensive online survey mid-2019 and an informal workshop at the eceee summer study early June 2019.

⁴⁴ The EPBD19a team has been in contact with national implementers and experts from France, Germany, Belgium, Ireland and Portugal.

⁴⁵ The desk research comprises a review of European directives, most notably the EPBD and EED, national long-term renovation strategies and evaluations of policies and strategies at EU, national and local levels.

Table 4: Policy options

Code	Direct/ supporting	Voluntary (V), Mandatory (M)	Type of measure	Policy options	Related measures
R.1	Direct	V	Regulatory	Design and implementation of BRPs entirely left to MS	a) Do nothing b) Use LTRS to encourage uptake of BRP c) Encourage the BRP through EPBD Article 20(2)
R.2	Direct	V	Regulatory	Introduce a common EU reference framework for BRPs	a) The EC to publish guidelines or recommendations on how MS can introduce the BRP b) The EC to publish guidelines or recommendations on how MS can introduce the BRP, including mandatory core features c) Introduce a CEN standard for the implementation of the BRP
R.3	Direct	M	Regulatory	Incorporate BRPs as a requirement under the EPBD	a) Expand Article 11 of the EPBD to incorporate BRPs b) Develop the BRP as a new separate requirement and link with EPC frameworks
B.1	Supportive	V	Best practices exchange	Establish a forum for best practices exchange	a) Set up a new BRP forum for MS (similar to EPBD-CA and EMA network) b) Encourage local best practices exchange fora through existing initiatives, including Covenant of Mayors and Energy-Cities c) Establish a forum as part of the CA EPBD
C.1	Supportive	V	Communication	Support regional energy advice centres and one-stop-shops	Encourage MS's operational programmes (conveying funds from CF, ERDF and ESF) - or other financial programmes - to support regional energy advice centres
C.2	Supportive	V	Communication	Communication campaign	Encourage national/regional communication campaigns increasing awareness of the BRPs, including where to get a BRP, its benefits and costs
C.3	Supportive	V	Communication	Align local and national bodies providing renovation support	Develop a communication 'network' of bodies/actors providing renovation support/advice services
C.4	Supportive	V	Communication	Explore how the BRP can support building experts and public authorities	Fund a study exploring how the BRP can simplify and benefit the work for professionals, including automated support and simplified administration requirements
F.1	Supportive	V	Finance	Couple BRP to property purchase taxes	a) Develop guidance on how the BRP could be integrated into existing taxation policies, such as the property purchase tax. The size of the tax could be

					contingent on the EPC rating and/or the existence of a BRP b) Encourage MS to explore if/how existing funds can be used to set up fiscal support schemes linked to the use of BRPs. c) EU Commission establish a technical assistance facility for setting up a tax support scheme for BRP
F.2	Supportive	V	Finance	Encourage progressive funding - or tax support - for packages of measures (or individual measures) as recommended by the BRP	a) Encourage MS to explore if/how existing funds can be used to set up fiscal support schemes linked to the use of BRPs b) EU Commission establish a technical assistance facility for setting up a tax support scheme for BRP c) Develop guidelines on how to design financial subsidies linked to BRPs
F.3	Supportive	V	Finance	Encourage MS/regions to introduce a financial bonus that is triggered when a certain percentage of stages in the BRP have been implemented. For example, the bonus could consist of a lump sum handout when the first recommendation(s) of the BRP is completed; or could foresee the reimbursement of the cost of issuing the BRP once two steps have been realised.	a) Encourage MS to explore if/how existing funds can be used to set up financial support schemes linked to the use of BRP b) EU Commission establish a technical assistance facility for BRP implementation c) Develop guidelines on how to design financial subsidies linked to BRPs
F.4	Supportive	V	Finance	Encourage MS to set up a bonus-malus system for building. As a bonus, highly efficient buildings could be exempt from certain property taxes. The malus is an extra fee on energy inefficient buildings, defined based on the energy demand/EPC rating. Getting a BRP could lead to a deferment of the malus.	a) Encourage MS to explore if/how existing funds can be used to set up fiscal support schemes linked to the use of BRPs b) EU Commission establish a technical assistance facility for setting up a bonus-malus scheme c) Develop guidelines on how to design financial subsidies linked to BRPs
F.5	Supportive	V	Finance	Subsidise the cost of preparing/ issuing a BRP for a given building	a) Encourage MS to explore if/how existing funds can be used set up financial support schemes linked to the use of BRP

					b) EU Commission establish a technical assistance facility for BRP implementation c) Develop guidelines on how to design financial subsidies linked to BRPs
F.6	Supportive	V	Finance	Introduce a new financial scheme incentivising MS/regional authorities to launch a BRP	a) Direct certain EU funds (ERDF, CF, EEEF, Invest EU, Elena, Horizon Europe) to assist MS, and regional authorities, in setting up BRP frameworks b) Link certain EU funds (ERDF, CF, EEEF, Invest EU, Elena, Horizon Europe etc.) to BRPs and related initiatives
F.7	Supportive	V	Finance	Incentivise energy efficiency improvements of existing buildings through preferential financing conditions linked to loans and mortgages. BRPs can improve the availability of data for valuers and lenders and ensure that renovation works are planned and implemented in a technically sound manner.	a) Encourage MS to explore if/how existing funds can be used to set up financial support schemes linked to the use of BRPs b) EU Commission establish a technical assistance facility for BRP implementation c) Set out a clear definition of an Energy Efficient Mortgage to enable banks to differentiate between energy efficient and conventional mortgages in their risk management processes d) The EU Commission to promote this practice, either as part of a communication exercise or in regular activities linked to best practice (meetings, publications, etc.)
F.8	Supportive	V	Finance	Encourage banks to offer lower interest rate on loans taken for measures linked to a BRP	a) Encourage MS to explore if/how existing funds can be used to set up fiscal support schemes linked to the use of BRPs b) EU Commission establish a technical assistance facility for lower interest rate for deep renovation steps c) Develop guidelines on how to support and enable banks to lower the interest rate for loans linked to the BRP
F.9	Supportive	V	Finance	Link BRP to the annual property tax. A certain part of the property tax could be dependent on the building's energy efficiency level. Issuing a BRP could lead to lower tax level.	Develop guidance on how the BRP could be integrated into already existing taxes, such as the property tax
F.10	Supportive	V	Finance / regulatory	Set BRP as prerequisite for certain financing	a) Encourage MS to explore if/how existing funds can be used set up financial support schemes linked to the use of BRP b) EU Commission establish a technical assistance facility for BRP implementation

					c) Develop guidelines on how to design financial subsidies linked to BRPs
G.1	Supportive	V	Guidance	Develop guidelines on how to integrate the BRP into EPC, energy audit and renovation advice schemes	Develop guidance document, including step-by step advice and best practices, outlining how a BRP can be integrated with existing frameworks
G.2	Supportive	V	Guidance	Develop guidelines on interoperability of BRP databases, as well as data protection for public authorities wishing to store and utilise BRP data	Develop guidance document clarifying how the managing authorities can store BRP data
G.3	Supportive	V	Guidance	Develop guidelines on how to integrate BRP with one-stop-shop services	Develop guidance document clarifying how the BPR can be linked to one-stop-shops
G.4	Supportive	V	Guidance	Develop guidelines for public authorities on local, regional and national level	Develop guidance document clarifying how the BPR can be supported at local level, including communication and financial support
G.5	Supportive	V/M	Guidance/regulatory	Introduce a combined approach for the BRP and the digital logbook	a) Introduce the requirement of a digital logbook in the next EPBD revision b) Develop a guidance document outlining how a BRP can be combined with a digital logbook
G.6	Supportive	V/M	Guidance	Issuing a BRP can lead to compliance with certain obligations, such as an energy efficiency and renewable heating obligation	Develop guidance on how the BRP could be coupled with energy efficiency and renewable obligations
R.4	Supportive	V	Regulatory	Introduce BRP in energy efficiency obligation schemes	Amend article 7 of the next Energy Efficiency Directive to make BRPs, and other advice instruments, acceptable as eligible EEO measures
R.5	Supportive	M	Regulatory	Make the BRP mandatory for all buildings with EPC from class E and below by 2030, which could be regularly strengthened	a) Introduce requirements in the next EPBD revision b) Encourage MS to implement requirements at national level (e.g. as part of their LTRS)
R.6	Supportive	M	Regulatory	BRP mandatory for every building sold after 2030	a) Introduce requirements in the next EPBD revision b) Encourage MS to implement requirements at national level (e.g. as part of their LTRS)
R.7	Supportive	M	Regulatory	Buildings with EPC below class E can only be sold/rented if certain BRP steps have been implemented by 2030	a) Introduce requirements in the next EPBD revision b) Encourage MS to implement requirements at national level (e.g. as part of their LTRS)

R.8	Supportive	M	Regulatory/guidance	Define long-term renovation targets in national building regulations, comprising an automatic tightening of renovation requirements from 2030	a) Introduce provision in next EPBD requiring MS to align and regularly update national building regulations to long-term renovation targets b) Develop guidance on how to include long-term aspects in regulatory approaches
R.9	Supportive	M	Regulatory	Establish minimum energy efficiency standard (MEES) for energy renovations. MEES could be set progressively to ensure that energy efficiency improvements are achieved no matter the size of the renovation.	Introduce requirements in the next EPBD revision defining a primary energy demand threshold for buildings above which a building must be renovated, which increase over time
R.10	Supportive	V/M	Regulatory	Expand competence requirement of the EPC certifiers to cover BRPs	a) Expand article 17 of EPBD to cover BRP requirements to ensure recognition of professional qualifications of BRP experts b) Amend article 17 to introduce a common EU competence framework, or introduce a new article to this effect
T.1	Supportive	V/M	Training	Qualification of energy experts	Publish guidelines for qualifications of BRP implementers in the EU
T.2	Supportive	V	Training	Training of energy experts	Publish guidelines for training of BRP implementers, including energy/building calculation procedures, formal procedures, design approaches, execution aspects, etc.

The BRP is more than just an advisory tool for building owners. Its main component, the long-term staged-renovation plan, can also be integrated into other policy instruments. For example, support programmes or tax credits can integrate elements of a BRP in various ways. The BRP can, for example, be a prerequisite for being granted a higher subsidy level for certain renovation measures.

The review of existing BRPs concluded that most of the successful BRPs have combined renovation advice with financial support, legal requirements and/or communication campaigns. The review showed that the BRP ought to be integrated with and reinforced by other elements (e.g. simple access/use, financial support, communication) in order to be effective. The example below illustrates how Germany supports its federal BRP with supportive policies at federal and regional levels.

Example from the field: German policies supporting the building renovation roadmap

The German building renovation roadmaps, the 'Sanierungsfahrplan Baden-Württemberg' (SFP BW) and the 'individueller Sanierungsfahrplan' (iSFP) at federal level, are embedded into a supportive policy framework. Figure 12 shows the existing policies sub-divided by typical categories of instruments.

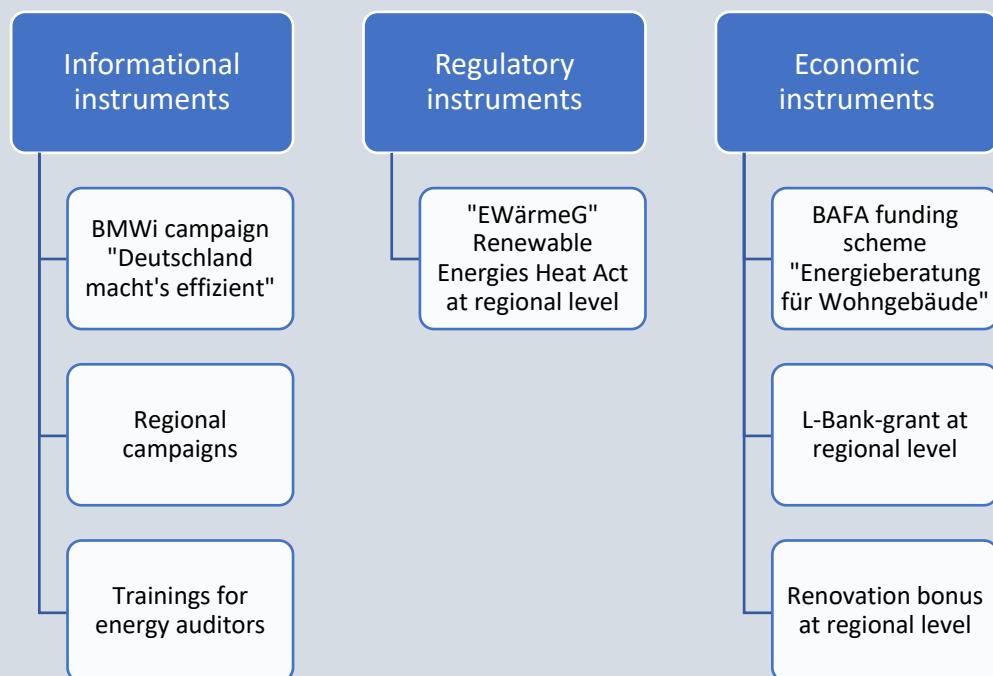


Figure 12: Embedding policy framework for German building renovation roadmaps

One approach that is being discussed in Germany is improving funding conditions in case a BRP is available to further boost the interest. This would be coupled with the new support schemes that are currently developed as part of the 'support scheme strategy' of the Federal Ministry of Economic Affairs. Some stakeholders suggest the renovation roadmap as a prerequisite for funding individual renovation measures with tax reliefs [4].

Role of mandatory measures

Mandatory measures are in general more effective than voluntary measures, however they can be harder to implement (e.g. these measures could face lower social acceptability).

- Advantages include increased effectiveness, if designed and implemented properly, and the obligation to monitor and enforce mandatory provisions tends to provide better data for evaluation. In addition, evaluation can be used to adjust the mandatory measure to ensure greater effectiveness and better impacts.
- Among the disadvantages, the trusted relationship between the auditor and the client tends to be lower when the relationship is not optional.

Three of the six policy packages (presented in the next chapter) propose mandatory measures.

Role of financial measures

Although some energy efficiency improvements can be made without significant investments, reaching significant levels of energy savings through renovation and the installation of measures and equipment requires substantial funding. The review of existing BRPs revealed that aggregating and streamlining financial support (e.g. grants and loans) is a necessary condition to make deep renovations viable and attractive to building owners. Even when building owners are aware of the benefits that energy renovations deliver, energy improvements are rarely prioritised.

Financial constraints are the main reason for people not to renovate and the explanation to why innovative one-stop-shops analysed in this study have not conducted more than 100-1,800 deep renovations each. Financial constraints are also the main reason why building owners choose less efficient solutions. However, the availability of cheap and reliable long-term finance alone might not be enough to incentivise renovation; the review shows that targeted renovation advice which increases awareness is needed to better align the direction of private investments.

The financial measures included in this analysis include measures that incentivise people to get a BRP (e.g. subsidising the cost of a BRP) and measures that incentivise them to carry out the renovation steps outlined in the BRP (e.g. a bonus that is triggered when a certain percentage of steps – or savings – in the BRP have been implemented).

Three out of the six policy packages include one or several financial measures.

Role of other enabling measures

Some measures play a more accompanying role (e.g. disseminating information, training of energy experts/auditors and raising awareness) without themselves directly aiming to increase renovation activities. For methodological reasons, at this stage of the study, it is not possible to assign a specific effect to such measures. However, even these non-quantified measures make a substantial contribution to the objectives of the policy packages. Without these, the forecasted impact would be lower.

All policy packages (excluding the reference option) feature a communication campaign and training of energy experts, which both are enabling measures.

4.2. Policy packages

Measure tree

The ‘measure tree’ below outlines the six policy packages. The six direct measures are presented in the first horizontal row, while the supportive measures are presented in the second vertical column. The supportive measures are presented in groups, with coding (e.g. R.1 = Regulatory policy 1) that can be retrieved in Table 4). The vertical green highlighted areas show which policy groups are included in that specific policy package.

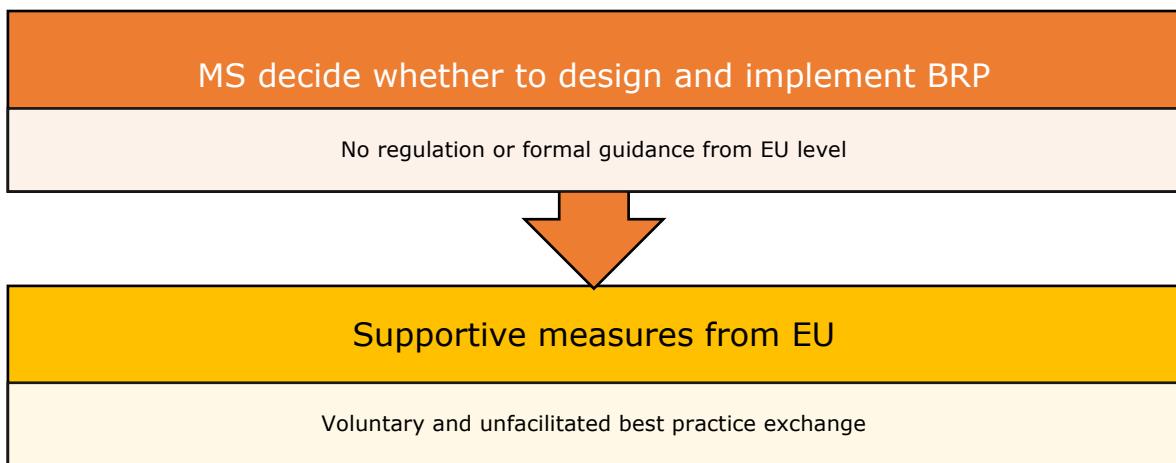
Type of measure	Group of measures - code	Reference	MS decide whether to design and implement BRP (soft) - R.1	MS decide whether to design and implement BRP (stringent) - R.1	Introduce a common reference framework (soft) - R.2	Introduce a common reference framework (stringent) - R.2	Incorporate BRPs as a requirement under the EPBD (soft) - R.3	Incorporate BRPs as a requirement under the EPBD - R.3
Voluntary	Encourage BRP in LTRS (EPBD art. 2a)		R.1	R.1	R.1	R.1		
Voluntary	Introduce awareness programme to promote renovation advice - C.1-C.4		C.2	C.2	C.2	C.2	C.2	C.2
Voluntary	Qualification and training programmes for energy experts and auditors - T.1 - T.2		T.2	T.2	T.2	T.2	T.2	T.2
Voluntary	Encourage MS to set up financial support schemes linked to BRP - F.1-F.6		F.5	F.5		F.3, F.5	F.2, F.3, F.5	
Voluntary	Encourage financial institutions to link services (loans, mortgages etc.) to BRPs - F.7-F.9			F.8			F.8	
Voluntary	Set up a forum of best practices exchange of BRP design and implementation - B.1				B.1		B.1	
Voluntary	Develop a guidance document outlining how a BRP can be combined with a logbook - G.7				G.7	G.7	G.7	
Voluntary	Support BRP through regional energy advice centres and one-stop shops - C.1, G.3				C.1, G.3			
Voluntary	Develop a guidance document on how to integrate the BRP into existing EPC, energy audit schemes - G.1				G.1	G.1	G.1	
Mandatory	Create a common EU framework for certification of building experts carrying out BRPs - R.10					R.10		
Mandatory	Introduce minimum energy efficiency standard for renovation - R.9							R.9
Mandatory	Make BRP mandatory for certain building segments (EPC rating, buildings for sale etc.) after 2030 - R.5 - R.6			R.6				R.5, R.6
Mandatory	Buildings with EPC below class D can only be sold if step 1-2 of renovation roadmap implemented by 2030 - R.7							R.7

The six policy packages plus the reference option are presented below. Each policy package includes a short explanation of the rationale of the selected supportive policies and an indication of strengths, weaknesses, potential impact and feasibility.

Policy package option 0: No change (reference option)

Rationale: The reference option assumes that:

- No additional regulation or formal guidance to support the introduction of BRPs from the EC is provided, but that Member States will move forward with the implementation of the EPBD.
- Supportive measures, such as sharing good practices, facilitated by existing exchange platforms (e.g. [EPBD Concerted Action](#) and [Energy and Managing Authorities Network](#)) will continue their work.

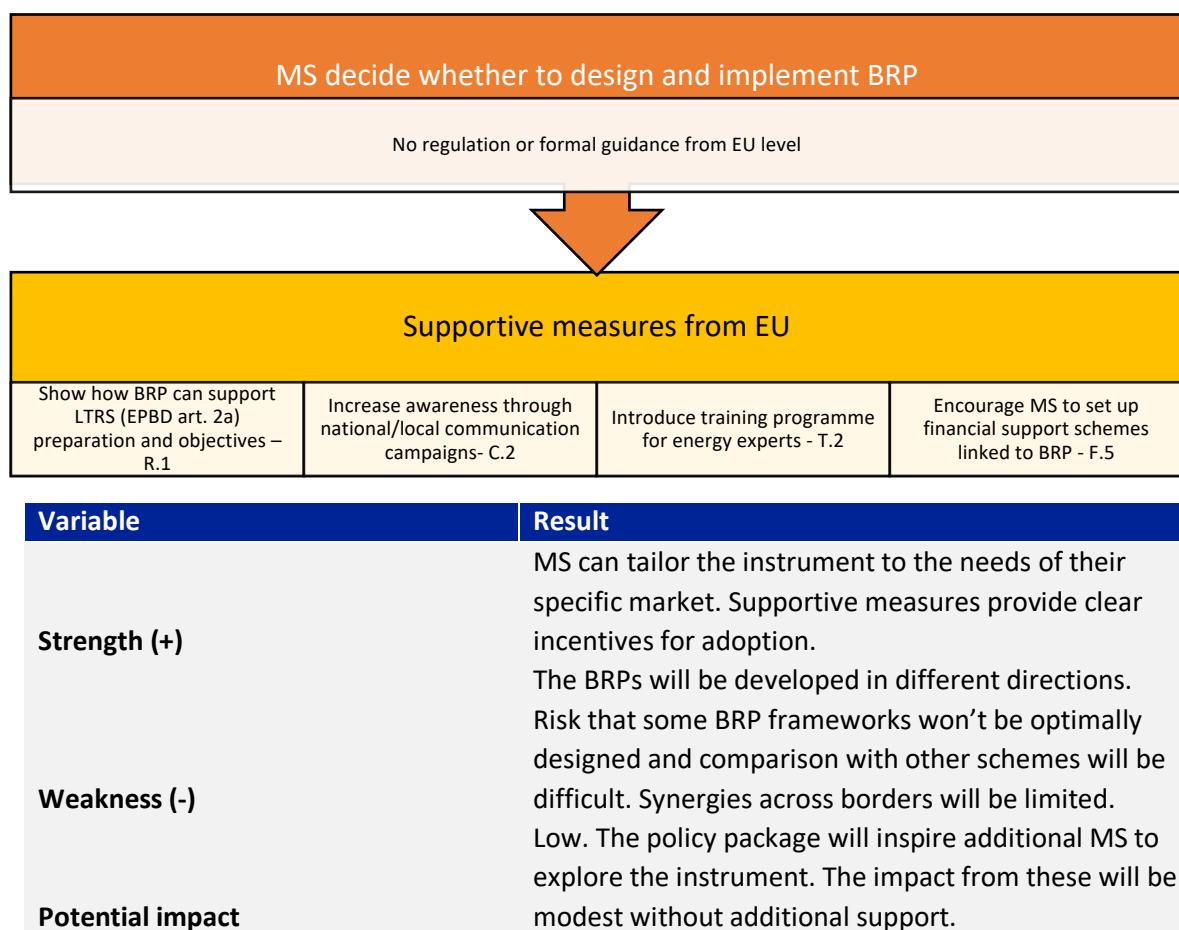


Variable	Result
Strength (+)	Minimal effort required from EU and MS. No additional administrative procedures.
Weakness (-)	Limited impact/missed opportunity.
Potential impact	Low. Implementation will proceed in frontrunner countries, with few additional followers.

Policy package option 1: Leave design and implementation to MS (soft)

Rationale: Policy package option 1 assumes that:

- The decision to implement and how to design the BRP is fully left to the Member States.
- The EU supports the uptake of the instrument through a number of supportive measures and actions:
 - o Guidelines and best practice exchange on how the BRP can support the objectives of the LTRS. The requirement for EU countries to adopt LTRS is set out in Article 2a of EPBD. These strategies will support the renovation of the national stock of buildings into a highly efficient and decarbonised building stock by 2050 and a cost-effective transformation of existing buildings into nearly zero-energy buildings. Among other things, the strategies must include 'policies and actions to stimulate cost-effective deep renovation of buildings'.
 - o EU supports Member States which have or are planning to implement a BRP by making funds, such as [European Energy Efficiency Fund](#) or [European Fund for Strategic Investments](#), available for BRP development and implementation (i.e. to subsidise the cost of the BRP preparation).
 - o Support national/regional communication campaigns to increase awareness of the BRPs.
 - o Introduce and support training of energy experts.

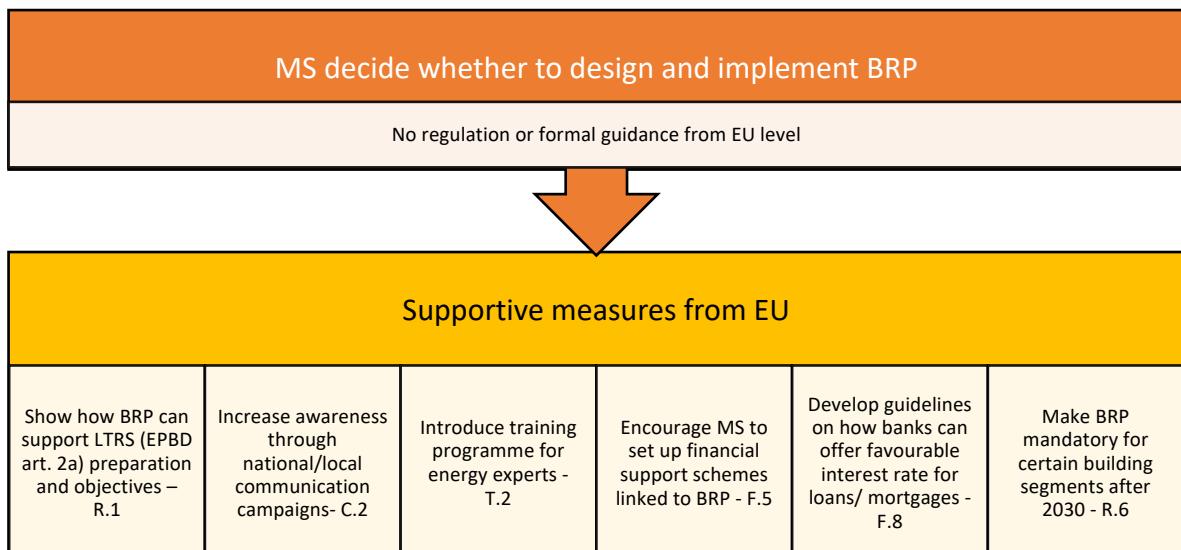


Policy package option 2: Leave design and implementation to MS (stringent)

Rationale: Policy package option 2 assumes that:

- The decision to implement BRP and how to design it is fully left to Member States.
- The EU supports the uptake of the instrument through a number of supportive measures and actions:
 - o Guidelines and best practice exchange on how the BRP can support the objectives of the LTRS (as in policy package 1).
 - o Support national/regional communication campaigns to increase awareness of the BRPs.
 - o Introduce and support training of energy experts.
 - o EU supports Member States which have or are planning to implement a BRP, by making funds, such as [European Energy Efficiency Fund](#) or [European Fund for Strategic Investments](#), available for BRP development and implementation (i.e. to subsidise the cost of the BRP preparation).
 - o Guidelines on how to support and enable banks to offer a favourable interest rate on loans/mortgages which are linked to a BRP.
 - o Introduce in the next EPBD a requirement stating that BRP becomes mandatory for certain building segments (EPC rating, buildings for sale etc.) after 2030.

None of the supportive measures contradict Member States' right to design the BRP and their decision to implement the instrument.

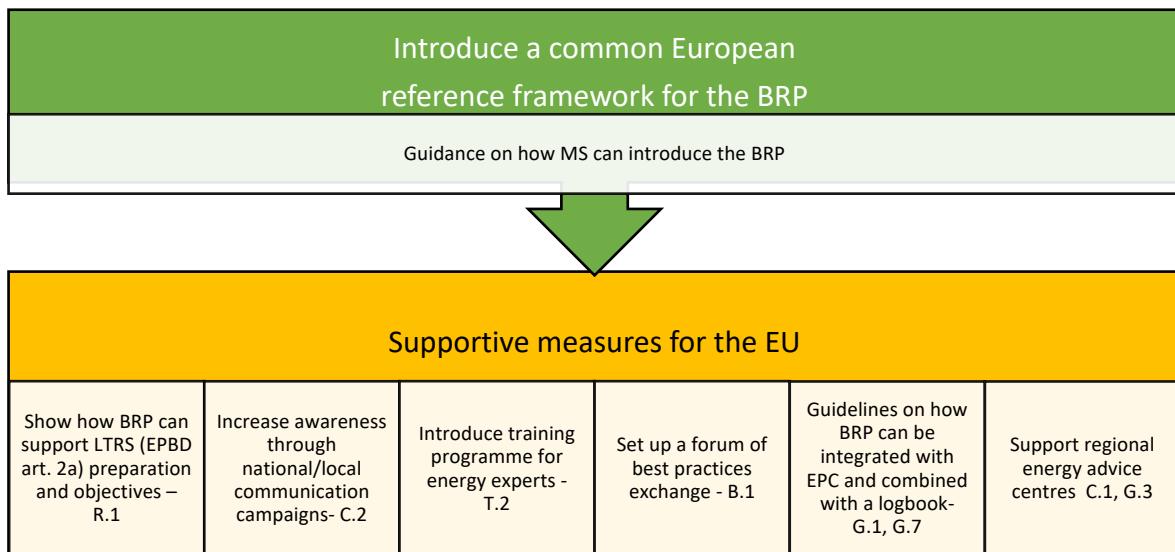


Variable	Result
Strength (+)	MS can tailor the instrument to the needs of their specific market and supportive measures provide clear incentives for adoption. The introduction of a BRP obligation (mirroring EPC requirements) in the next EPBD would impose a long-term perspective in the market.
Weakness (-)	The BRPs will be developed in different directions. Risk that some BRP frameworks won't be optimally designed and comparison with other schemes will/could be difficult.
Potential impact	Moderate.

Policy package option 3: Introduce a common reference framework (soft)

Rationale: Policy package option 3 assumes that:

- The EU introduces a common reference framework, that comprises detailed guidelines and/or recommendations outlining how Member States can develop and implement a BRP but doesn't include minimum requirements for the Member States.
- The EU supports the uptake of the instrument through a number of supportive measures and actions:
 - o Guidelines and best practice exchange on how the BRP can support the objectives of the LTRS (as in policy package 1).
 - o Support national/regional communication campaigns to increase awareness of the BRPs.
 - o Introduce and support training of energy experts.
 - o Establish a forum as part of the CA EPBD to exchange best practices.
 - o Guidance documents on how to integrate the BRP into EPC and existing audit schemes BRP, and how it can be combined with a digital logbook.
 - o Encourage Member States to set up and support regional energy advice centres, including one-stop-shops.
 - o Guidelines on how banks can offer a favourable interest rate for loans/mortgages.

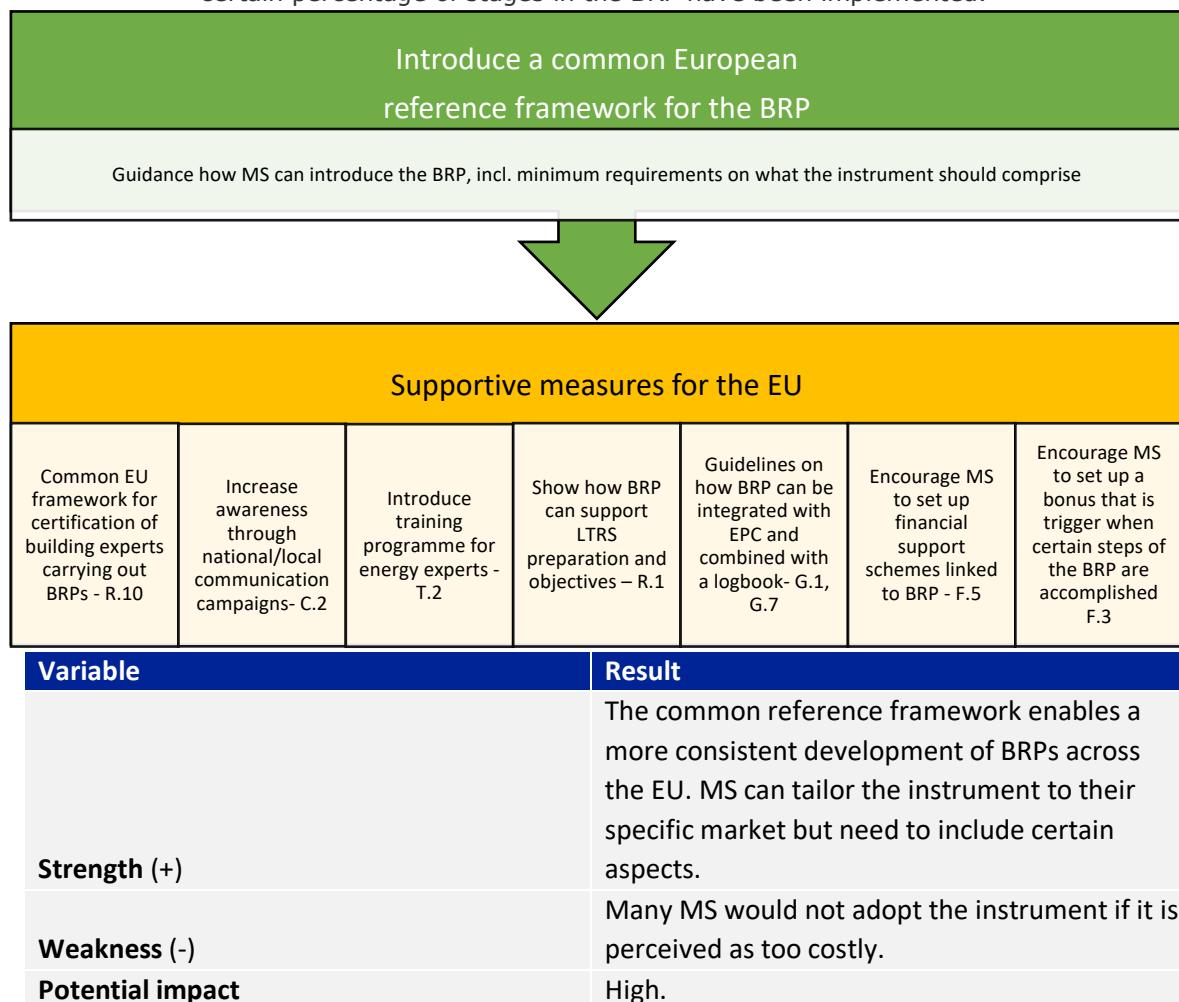


Variable	Result
Strength (+)	The common reference framework enables a more consistent development of BRPs across the EU. MS can still tailor the instrument to their specific market but are empowered by information and guidance documents.
Weakness (-)	Lack of minimum requirements allows for ineffective BRPs.
Potential impact	Moderate/high. The BRPs would, on average, reach a higher and homogeneous quality, but many MS could opt out of the scheme and its impact be limited.

Policy package option 4: Introduce a common reference framework (stringent)

Rationale: Policy package option 4 assumes that:

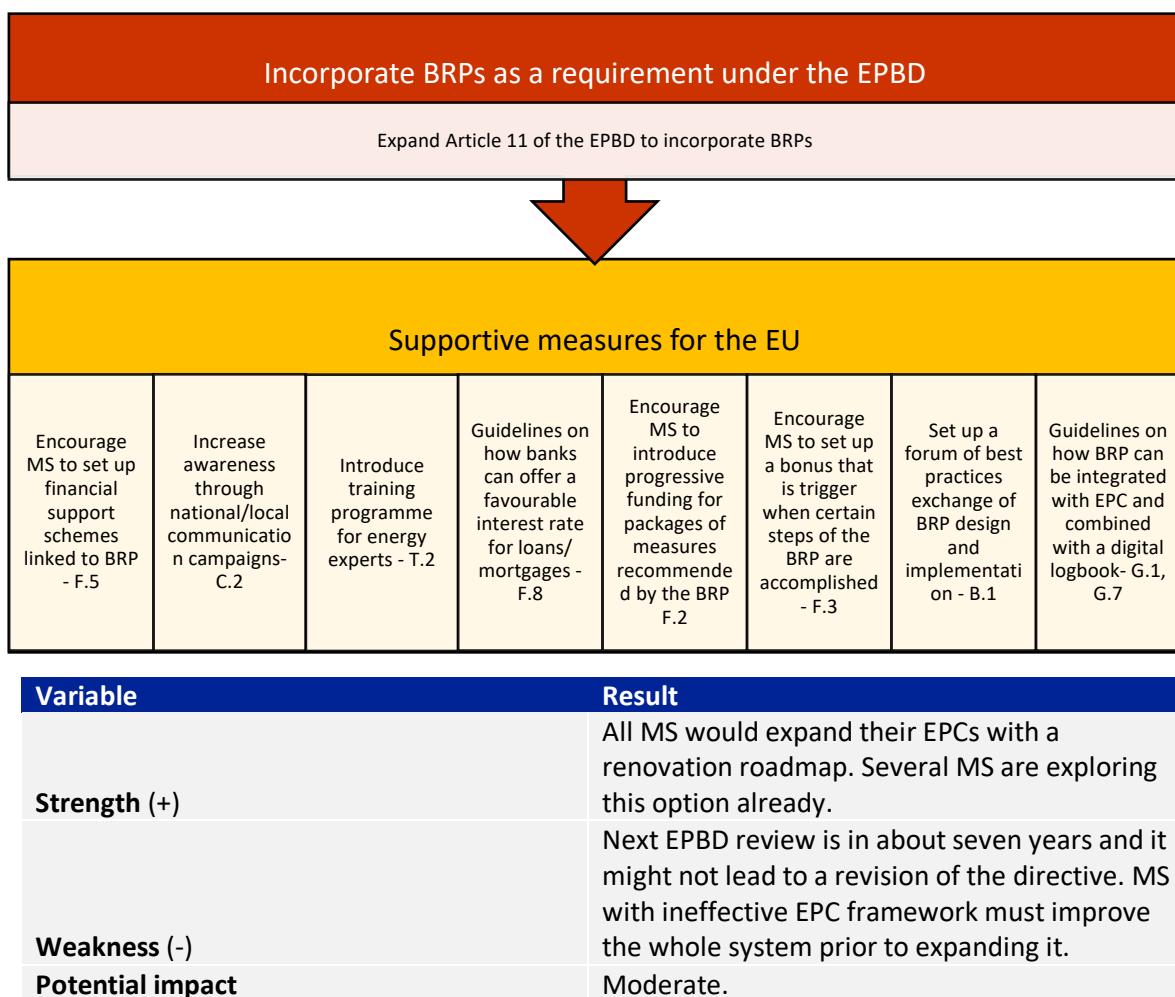
- EU introduces a common reference framework, which includes mandatory requirements of what the instrument should include. The mandatory requirement defines the core features of BRP, which could include links to EPC, target nZEB renovation level, prepared by qualified experts.
- This is supported by:
 - o An expansion of Article 17 of the EPBD, to introduce a common EU certification framework for EPC/BRP certifiers to enhance quality of both instruments.
 - o Support national/regional communication campaigns to increase awareness of the BRPs.
 - o Introduce and support training of energy experts.
 - o Guidelines and best practice exchange on how the BRP can support the objectives of the LTRS (as in policy package 1).
 - o Guidance documents on how to integrate the BRP into EPC and existing audit schemes, and how it can be combined with a digital logbook.
 - o EU supports Member States which have or are planning to implement a BRP, by making funds, such as [European Energy Efficiency Fund](#) or [European Fund for Strategic Investments](#), available for BRP development and implementation (i.e. to subsidise the cost of the BRP preparation)
 - o Encourage Member States/regions to introduce a bonus that is triggered when a certain percentage of stages in the BRP have been implemented.



Policy package option 5: Incorporate BRPs as a requirement under the EPBD (soft)

Rationale: Policy package option 5 assumes that:

- The EU actively promotes the idea of a BRP as complementary to the EPC and proposes its introduction to reinforce EPCs in the next EPBD review⁴⁶ in 2026.
- This activity is supported by:
 - EU supports Member States which have or are planning to implement a BRP, by making funds, such as [European Energy Efficiency Fund](#) or [European Fund for Strategic Investments](#), available for BRP development and implementation (i.e. to subsidise the cost of the BRP preparation).
 - Support national/regional communication campaigns to increase awareness of the BRPs.
 - Introduce and support training of energy experts.
 - Guidelines on how to support and enable banks to offer a favourable interest rate on loans/mortgages which are linked to a BRP.
 - Encourage Member States to introduce progressive funding – or tax support – for packages of measures (i.e. renovation steps) as recommended by the BRP.
 - Encourage Member States/regions to introduce a bonus that is triggered when a certain percentage of stages in the BRP have been implemented.
 - Guidance documents on how to integrate the BRP into EPC and existing audit schemes, and how it can be combined with a digital logbook.

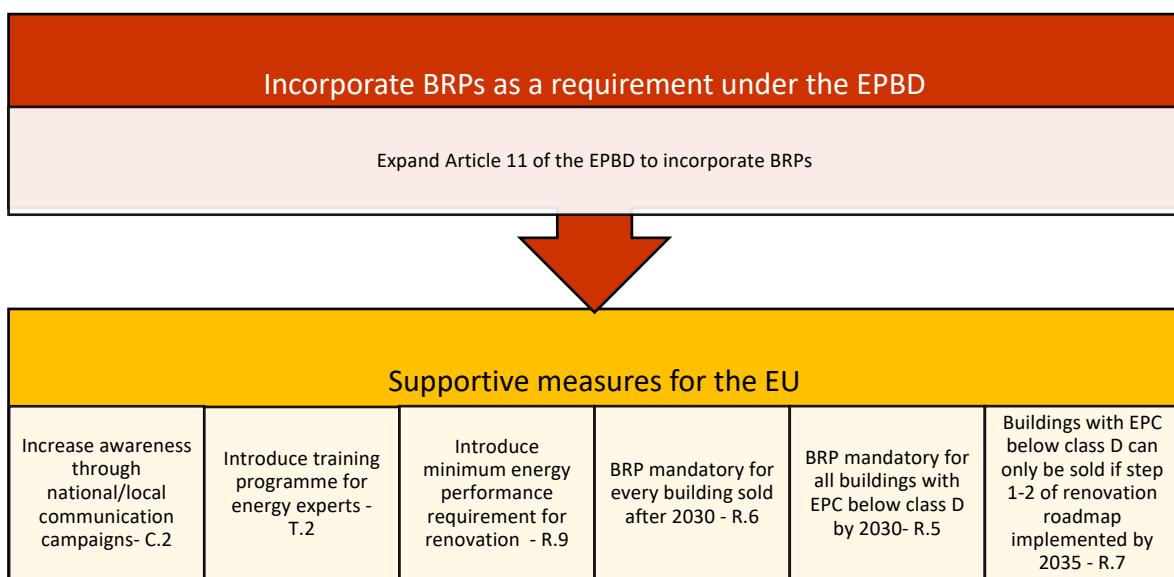


⁴⁶ A review does not have to lead to a revision of the directive.

Policy package option 6: Incorporate BRPs as a requirement under the EPBD (stringent)

Rationale: Policy package option 6 assumes that:

- EC actively promotes the idea of BRP as complementary to the EPC and proposes its introduction to reinforce EPCs following the next EPBD revision.
- Support national/regional communication campaigns to increase awareness of the BRPs.
- Introduce and support training of energy experts
- The provision is also supported by new EPBD requirements, including:
 - Introduce minimum energy performance requirements for energy renovation, going beyond the current EPBD requirement for 'major renovations'.
 - BRP mandatory for every building sold after 2030.
 - BRP mandatory for all buildings with EPC from class D and below by 2030 and regularly strengthened after that (e.g. class C by 2035 etc.)
 - Buildings with EPC below class E can only be sold if steps 1-2 of renovation roadmap implemented by 2030.



Variable	Result
Strength (+)	The mandatory supportive measures would drive demand for deep renovation, while the BRP would include the guidance and know-how. Clear indication to the market that it would have to adapt, including training of experts, innovative construction methods etc.
Weakness (-)	Renovation obligations can come with unexpected consequences. Energy-poor people are at risk and should be supported through other measures.
Potential impact	High.

5. Next steps – Assessing the impact of the policy packages

5.1. Impact assessment methodology

The aim of the impact assessment model to be developed within Task 6 is to simulate the impacts of implementing the six policy packages in the EU. The impacts will include, among others, energy savings, CO₂ emissions trajectory, employment, level of investments mobilised, etc.

A three-step approach will be followed to estimate the impact of the policy packages in large-scale implementation. These steps have been defined undertaking certain assumptions.

Step 1: Quantification of the impact per building renovation passport scheme

First, the effects of BRPs will be quantified. Based on evaluations of energy consultations, results of existing BRP schemes and experts' estimations, the impacts per BRP will be estimated. For example, the BRP can lead to energy savings stemming from different effects:

- Increase in renovation rate (at least at a component level, e.g. more windows or boilers replaced, more walls insulated, etc.) due to higher awareness of the benefits of energy efficiency and the available financial options.
- Increase in renovation depth due to better information made available to building owners, making the decision to invest in deep renovation easier (more renewables, better U-values, less lock-in effects, etc.).
- More impactful measures compared to similar investments – again, because owners are better informed.
- Faster/ earlier realisation of savings (anticipated renovation steps).

Step 2: Regionalisation of these savings

As data from existing BRP schemes is limited, it will be necessary to make assumptions in order to predict their impact on a larger scale. The assumptions will include extrapolation, regional matching (based on available historical datasets of neighbouring countries), monetary matching (based on available data of countries with similar GDP per capita) and consultation with experts. Assumptions will also include improvement due to learning curves (e.g. decrease in cost per renovation, as the number of renovated cases increases).

Step 3: Definition of policy packages

The final step will be to define the policy packages based on information from existing BRP schemes, where we will set reasonable upscale rates, depending on available audits, possible financial support from Member States, etc.

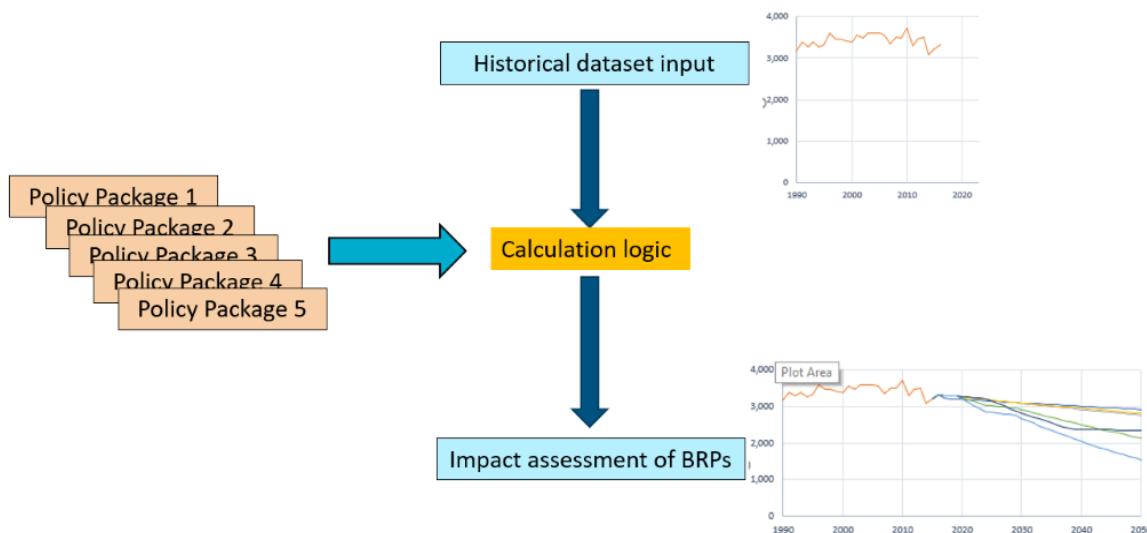


Figure 13: BRP impact assessment approach

An indicative representation of impact assessment is given in Figure 13. The calculation logic for assessing the impact would depend on quantified impact parameters, the regionalised data from different Member States and the definition of policy packages.

5.2. Impact categories

The potential impact of the BRPs will be assessed by modelling, where possible, their impact on some of the following categories:

- Energy savings (percentage reduction in energy use)
- Energy cost savings (percentage reduction on annual energy costs)
- CO₂ emissions trajectory (tonnes of CO₂ emitted)
- Total investment costs for policy packages (investments required by Member States) (million €)
- Annual investments in building renovations (investments from buildings owners) (million €)
- Share of renewables (impact on heat pumps, solar PV, etc.)
- Multiple benefits (health and productivity)
- Fuel imports
- Employment.

Depending on the results from the research under tasks 4 and 5, and the input from stakeholders, the impact categories could be further developed.

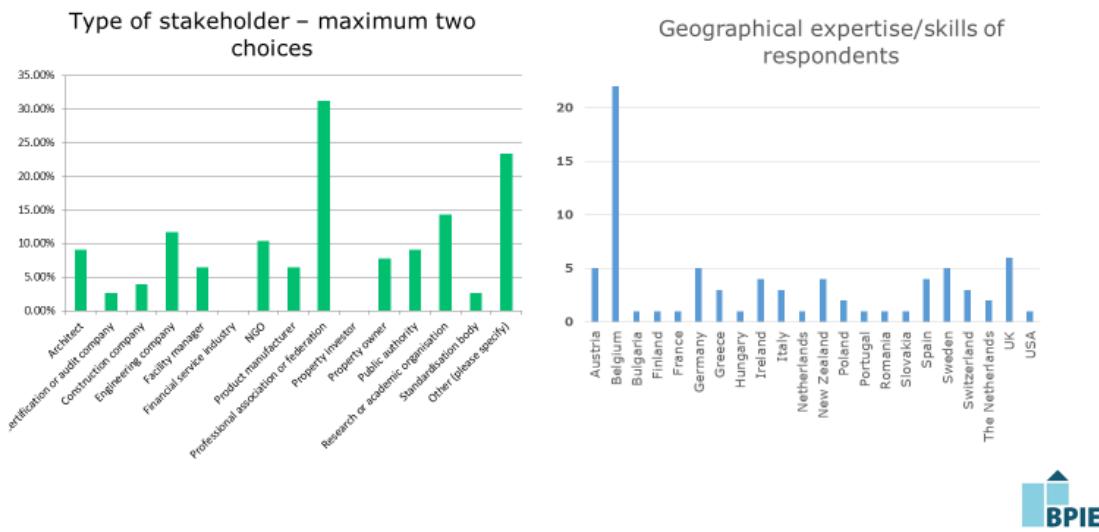
Annexes

Annex 1: Survey results



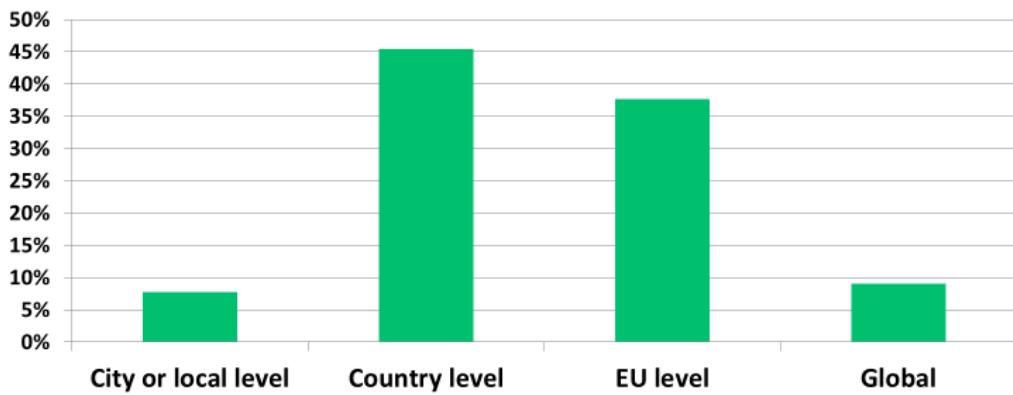
Main results on-line survey

77 Respondents from 22 countries



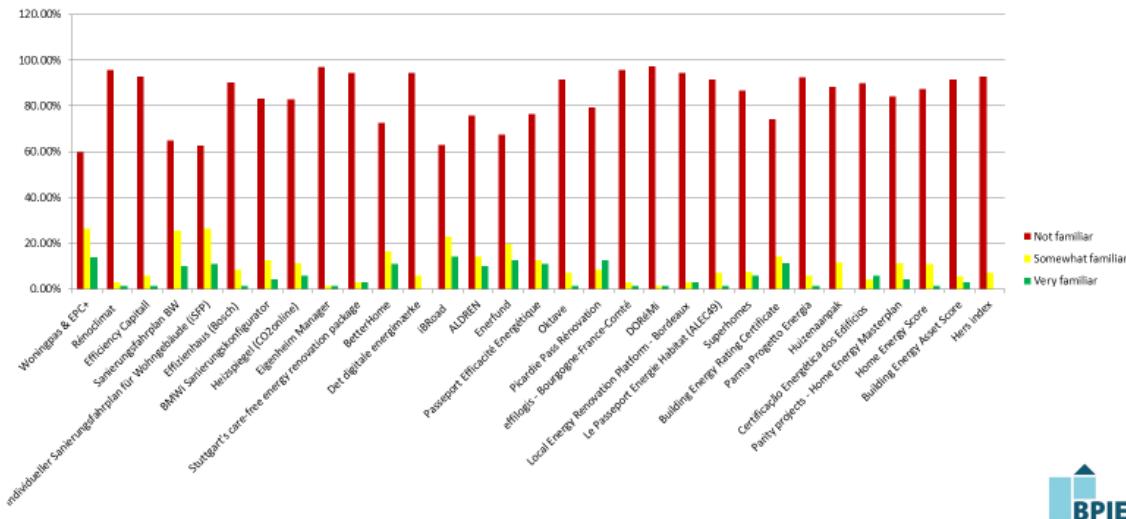
Stakeholders scope of interest/expertise

Geographical scope of interest/expertise:

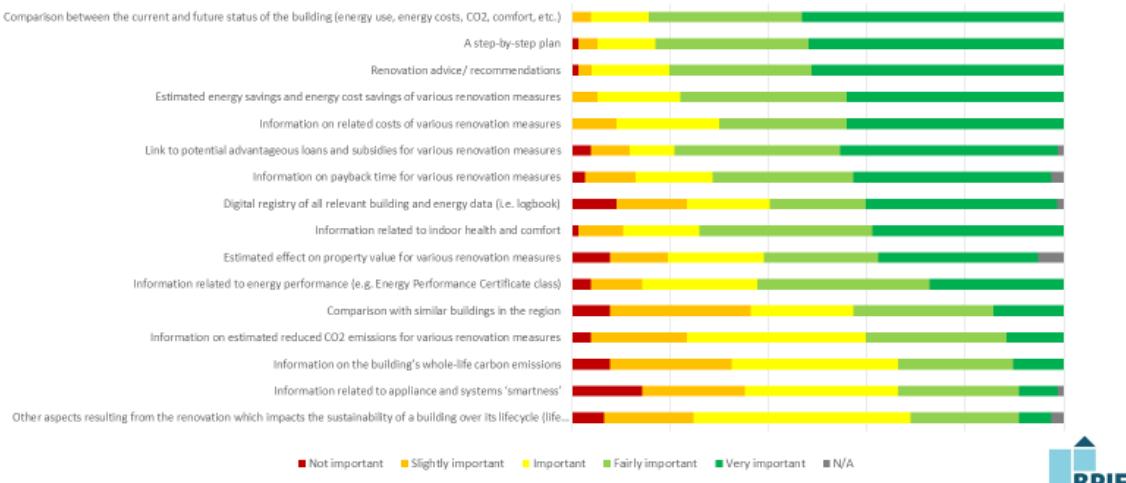




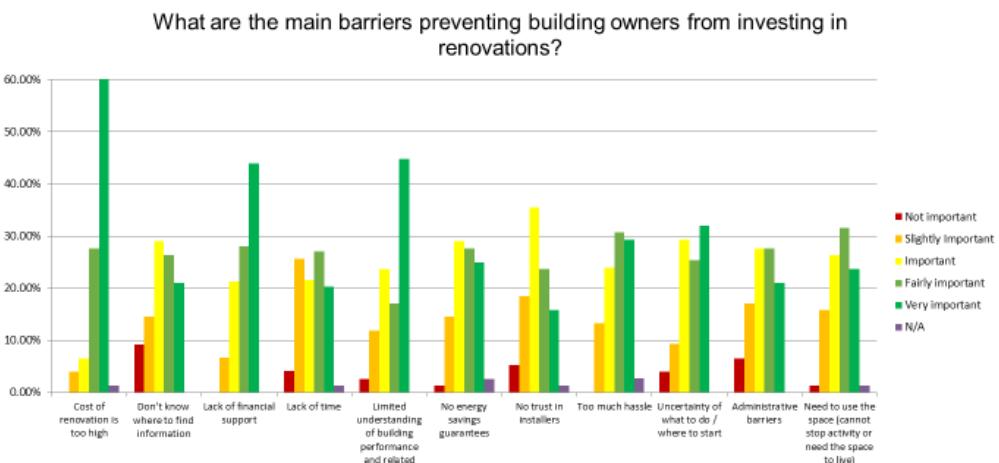
Which of the following initiatives, related to the concept of the building renovation passport, are you familiar with?



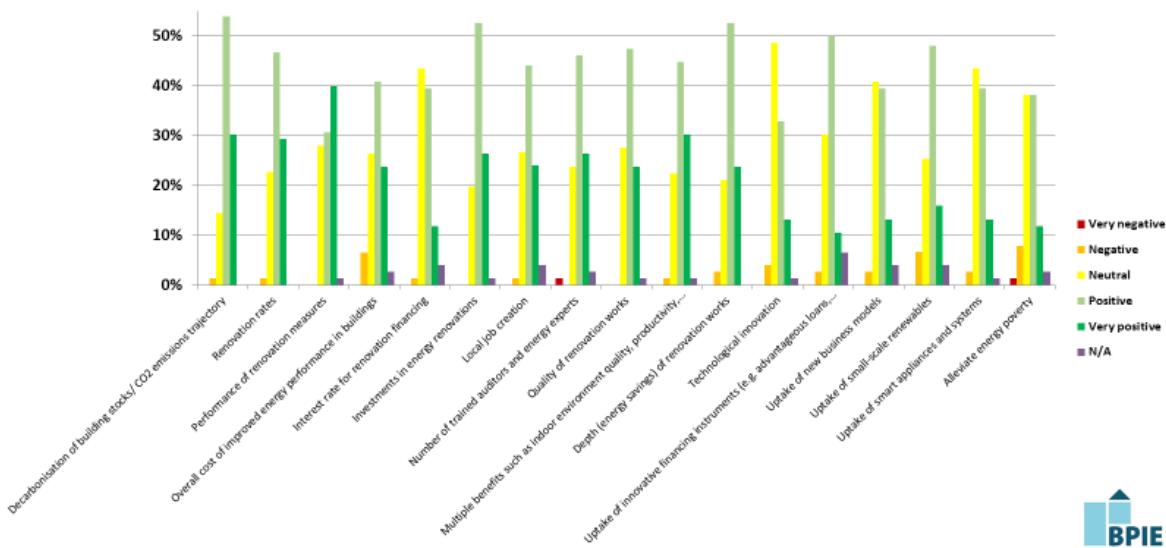
How important are the following aspects for a building renovation passport?



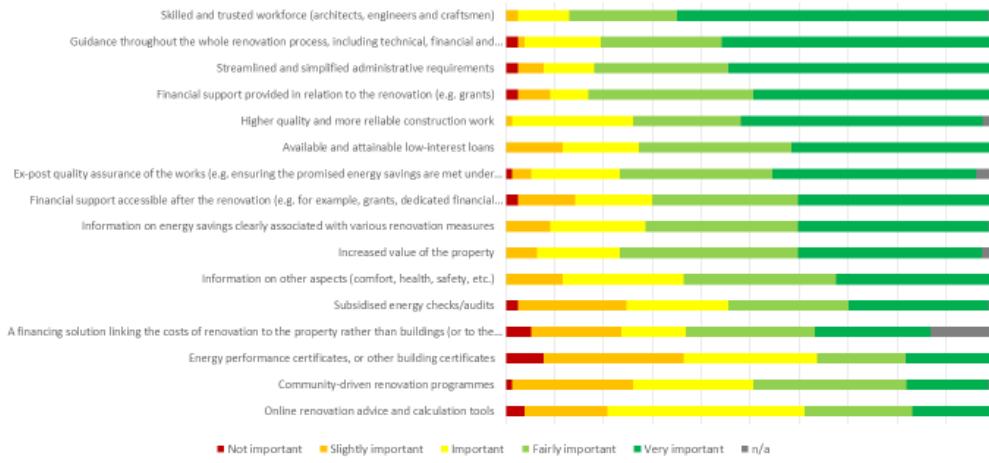
Barriers to renovations according to respondents



Indicate what effect you think building renovation passports could have on:



How important do you consider each factor in increasing investments in deep energy renovations?



A building renovation passport...



Annex 2: Deep renovation definitions

The EPBD does not provide definitions of 'deep renovation', 'step-by-step renovation' or 'deep staged renovation'. There are several ways to define deep renovation, step-by-step renovation and deep staged renovation. Some are presented below.

Deep renovation

- The Energy Efficiency Directive [2012/27/EU] states that the long-term renovation strategies⁴⁷ should 'address cost-effective deep renovations which lead to a refurbishment that reduces both the delivered and the final energy consumption of a building by a significant percentage compared with the pre-renovation levels leading to a very high energy performance. Such deep renovations could also be carried out in stages.'

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 Commission⁴⁸, deep renovations typically achieve more than 60% energy savings compared to pre-renovation levels.

According to the Global Buildings Performance Network, 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 buildings 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/a⁴⁹'.

- The Flemish Energy Agency (VEA), which has developed one of the existing BRPs, does not use a definition for deep renovation, but refers to a long-term efficiency objective: existing buildings must achieve the E60-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 and preferences.
- The Shift Project in France, the developer of P2E, one French BRP, defines deep renovation as the renovation of a given dwelling reaching a high level of efficiency in one go – the objective is to achieve a Bâtiment Basse Consommation (BBC; low-energy building) level of renovation, equivalent to

⁴⁷ Between 2014 and 2017, EU Member States submitted strategies to show how they plan to foster investment in the renovation of residential and commercial buildings. These strategies were an obligation under Article 4 of the Energy Efficiency Directive and part of their [National Energy Efficiency Action Plans](#). With the Clean Energy for all Europeans package, the requirement was revised, enforced and transferred to Article 2a of the EPBD.

⁴⁸ European Commission Staff Working Document (SWD(2013) 143final).

⁴⁹ GBPN Definition: www.gbpn.org/reports/what-deep-renovation-definition.

80kWh/m² of primary energy per year, including heating, hot water and cooling.

- Germany has not defined deep renovation, but introduced the 'best possible principle'. According to this principle, the efficiency level that the building stock has to reach on average is equivalent to the KfW's Efficiency House 55 (corresponding to about 30-40 kWh/m²/yr 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.
- Finland defines deep renovation in its [long-term renovation strategy](#) (2017) as follows: 'a renovation is extensive if the total costs of repairs relating to the external walls and roofs of technical systems of a building based on reconstruction costs exceed 25 percent of the value of the building, excluding the value of the building land. In connection with an extensive renovation, anyone undertaking repairs must demonstrate that the measures selected are at a cost-optimal level.'
- Greece defines deep renovation in its [long-term renovation strategy](#) (2017) as a renovation that decreases the energy need by at least 60%.

Staged renovation

In the [EED guidebook](#) published by the Coalition for Energy Savings, staged renovation is described as follows: '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).'

The [EuroPHit project](#) defines staged renovation as: 'A master plan [that] 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 futureproof, comfortable, sustainable building with consistently low running costs.'

Deep staged renovation

No definition of 'deep staged renovation' exists but the Flemish and French cases do elaborate on the subject:

- The Flemish authorities expanded the EPC with a renovation roadmap. Together with the stakeholders in the Flemish Renovation pact, a concept note was set up and approved by the Flemish government, in which the requirements of the enhanced EPC were described: 'The standard recommendations from the current EPC will be replaced by recommendations fit to the specific dwelling. These recommendations will describe the renovation works and investments, needed to renovate the dwelling in line with the long-term goals of 2050'.
- Staged deep renovation in France 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 of limiting upfront costs and allowing 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.

Annex 3: Policy list

Provided as an Annex to the EU Commission.

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PART 3

Selection of policy options for building renovation passports and analysis of related potential impacts

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PART 3 – TABLE OF CONTENTS

Table of content.....	110
Glossary	111
Introduction	112
Problem definition.....	113
Task description and approach.....	114
Methodology	114
1. What are the policy packages?	116
Logic models.....	117
Policy package 0	118
Assumptions	118
Policy package 1	119
Assumptions	119
Policy package 2	121
Assumptions	121
Policy package 3	123
Assumptions	123
Policy package 4	125
Assumptions	125
Policy package 5	127
Assumptions	127
Policy package 6	129
Assumptions	129
2. How are the impacts calculated?.....	131
Number of BRPs	131
Renovation rate and depth	132
Impact categories	135
Energy demand	135
CO ₂ emissions	135
Residential energy expenditure	136
Estimated improvement in EPC ratings.....	136
Health benefits.....	137
Triggered private investments in renovation	138
Public investments required for different policy packages.....	138
Increase of on-site renewables	139
3. What are the impacts of the policy packages?.....	140
The estimated increase of BRPs	140
Energy demand	141
Residential building stock.....	141
Non-residential building stock	142
CO ₂ emissions	143
Residential building stock.....	143
Non-residential building stock	144
Residential energy expenditure	145
Estimated improvement of EPC ratings.....	146
Health benefits	147
Triggered private investments	148
Public investments required for different policy packages	149
Increase of on-site renewables	150
Heat pumps	150
Solar PV	150
4. Conclusion.....	151
Annex A: Tables	156
Annex B: Further elaboration of the assumptions behind the policy packages.....	159
Policy Package 1	159
Policy Package 2	159
Policy Package 3	161
Policy Package 4	162
Policy Package 5	164
Policy Package 6	165
Annex C: Investment figures	167

GLOSSARY

Final energy consumption – Total energy consumed by end-users, such as households, industry and agriculture. It refers to the energy that reaches the final consumer's door and excludes that which is used by the energy sector itself.

Energy performance certificate (EPC) – A rating scheme indicating the energy performance of a building in the European Union. Each Member State (and, in certain cases, region) has developed its own EPC framework according to the framework given by the EPBD [2010/31/EU – Article 2 (12)].

Energy Performance of Buildings Directive (EPBD) – The objective of this Directive [2010/31/EU] is to promote the improvement of the energy performance of buildings within the Community, taking into account outdoor climatic and local conditions, as well as indoor climate requirements and cost-effectiveness.

Building stock – All buildings from residential and services sectors (i.e. residential and non-residential buildings)

Residential building – A building at least half of which is used for housing purposes. If less than half of the overall useful floor area is used for housing purposes, the building is classified as a non-residential building in accordance with its purpose-oriented design (Eurostat, CC1998). The residential building category can be further divided, e.g. depending on the ownership and the tenure status.

Indoor environmental quality (IEQ) – A general indicator of the quality conditions inside a building. It most commonly refers to indoor air quality, thermal comfort, aesthetics, ergonomics, biophilia, acoustics and lighting. Several of these elements have a significant impact on our health, comfort and productivity.⁵⁰

Logic model – Graphic depiction that presents the relationship between the policy package activities and their intended effects.

Long-term renovation strategies – These strategies must be established and implemented by the Member States pursuant to Article 2a of the EPBD to support the renovation of the national stock of buildings into a highly efficient and decarbonised building stock by 2050, and will form part of Member States' integrated national energy and climate plans.

Minimum energy efficiency standards (MEES) – A renovation obligation depending on the energy rating of a building (such as primary energy demand). If the performance doesn't meet the minimum standards, the building must undergo a renovation.

⁵⁰ See for example Buildings 2030 (2018) [Building 4 People](#) study and BPIE (2018) [The inner value of a building](#).

INTRODUCTION

This study, commissioned and supervised by the European Commission's (EC) Directorate-General for Energy (DG ENER), provides technical support to investigate the feasibility of introducing optional building renovation passports (BRPs) in the EU. In particular, pursuant to Article 19a of the EPBD, this study evaluates the relevance, feasibility and potential impact of BRPs. This work is carried out in close consultation with stakeholders and in collaboration with leading experts, including IFEU and [the Shift Project](#). As part of the consultation process, a first stakeholder meeting was organised in June 2019 and the second meeting in November 2019, where the content and suggestions of this report were discussed. In addition, 77 stakeholders from 22 countries completed an extensive survey on the concept of BRP and have been invited to provide written statements.

This report is the last of three deliverables. Its main objective is to detail the most relevant policy options and analyse their impact to assess the feasibility of a European implementation of BRPs. Figure 27 provides an overview of the three deliverables of this project.

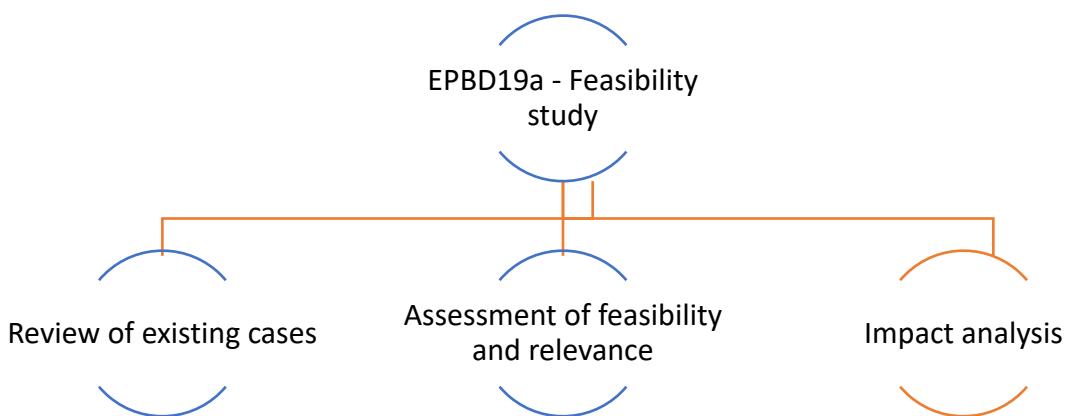


Figure 27: the feasibility study in 3 parts

The Directive on the Energy Performance of Buildings (EPBD) [2010/31/EU] does not include a definition of a BRP, and no commonly agreed definition exists in the EU. Existing BRPs are also diverse as they vary in key features, main purposes and in the terminology they use. The definition presented below is based on the text in the EPBD, stakeholder input and existing research⁵¹.

The proposed definition of *building renovation passport*

A building renovation passport provides a long-term, tailored renovation roadmap for a specific building, following a calculation based on available data and/or an on-site audit by an energy expert. The instrument identifies and outlines deep renovation scenarios, including steps to implement energy-saving measures that could improve the building's energy performance to a significantly higher level over a defined period of time.⁵² The instrument can complement energy performance certificates and/or combined with digital logbooks.⁵³

⁵¹ Definition is further explained and explored in the second report of this study: [Support for setting up an optional building renovation passport](#).

⁵² The time of the roadmap could span from 5 to 20 years and the definition of the time horizon should be left to the implementing authority based on national/local conditions. The building owner can, of course, opt to implement all steps in one go.

⁵³ See chapters: Linking the BRP with EPCs and Linking the BRP with a digital registry.

Problem definition

The EU faces multiple barriers to improving the energy performance of the existing building stock. On the individual level, building owners also face multiple obstacles to improve the performance of their buildings. Together with high cost and difficulties in accessing finance, two of the often quoted barriers are the low awareness of the long-term benefits of renovation and the lack of knowledge about what to do, where to start, and which measures to implement in which order.

Problem 1: knowledge barrier. Our review of existing BRPs (see [review here](#)) showed that the instrument can be effective in alleviating two of the main barriers to renovation: low awareness of the benefits of energy renovation and insufficient knowledge of what measures to implement and in which order. The analysis confirms that tailored renovation advice, together with other support measures, has an impact on the decision to renovate, the number of measures to implement, the performance level of the selected measures, as well as on what kind of measures to implement.

Problem 2: financial barrier. Financial constraints are one of the main reasons why building owners choose less efficient solutions. The broad preference for suboptimal solutions hampers the long-term transition and makes the path to highly performing buildings more complicated. The review shows that long-term renovation advice, as provided by BRPs, can be used to better align the direction of private investments with the long-term vision for the building stock.

Table 5: Summary of the relevant renovation barriers by type and according to building category and tenure (more details in the report on feasibility and relevance)

Type of barrier	Barrier	Residential		Non-residential	
		Owner-occupied	Rented	Public	Service
Awareness	Don't know where to find the right information	**	**	**	*
	Limited understanding of energy performance	***	***	***	***
	Uncertainty of what to do and where to start	***	***	**	**
Financial	Cost of renovation is too high	***	***	**	*
	Lack of attractive financial products	***	***	***	**
	No energy savings guarantees	**	**	**	**
Other	Lack of time for renovation works	**	**	**	**
	Low trust in installers/professionals	**	**	*	*
	Too much hassle	**	***	**	**
	Administrative barriers	**	**	*	**
	Need to use the space (i.e. no room for renovation)	**	**	*	**

Task description and approach

Based on the preliminary analysis of policy options, this report provides a detailed impact analysis of the relevant approaches for the promotion of BRPs at the EU level.

The report presents the impact of six identified policy packages⁵⁴. Each policy package outlines a potential EU approach to the BRP.⁵⁵ In this report, we carry out a thorough analysis of the potential impacts of each policy option until 2030, 2040 and 2050. This analysis accounts for different scenarios based on the evolution of the building stock, renovation rates, the evolution of renovation practices, and possible additional supporting measures at EU and national level.

The objective is to analyse the potential impact of each policy package. This analysis encompasses a set of impact categories, including renovation rate, energy demand, triggered private investments, etc. It aims to provide technical evidence to inform the EU decision-making process on the BRPs, as asserted by Article 19a of the EPBD [2010/31/EU].

Methodology

The methodological approach uses scenario analysis to assess the potential impacts of each identified policy package. The impacts of introducing BRPs in Europe have been estimated in economic, social and environmental terms.

The approach follows four main steps:

1. Selection and description of policy packages, based on previous work in the project

The section describes the development and definition of six policy packages, outlining different potential policy approaches to the BRP. These have been described in detail within a previous report.

2. Calibration and adjustment of BPIE's renovation model to calculate the impact of the six policy packages

Figure 28 displays a snapshot of the model used for the impact analysis.

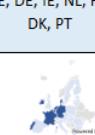
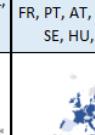
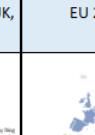
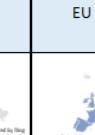
Implementation year		Policy Package 1	Policy Package 2	Policy Package 3	Policy Package 4	Policy Package 5	Policy Package 6
2020	Select Member States -->	BE, DE, IE, NL, FR, DK, PT	BE, DE, IE, NL, FR, DK, PT, AT, IT, SE, UK	BE, DE, DK, IE, NL, FR, PT, AT, IT	BE, DE, DK, IE, NL, FR, PT, AT, IT, UK, SE, HU, EE	EU 28	EU 28
	Map of selected Member States						
	Ratio of residential heated floor area of selected Member States	43%	71%	56%	73%	100%	100%
	Ratio of energy use of selected Member States	45%	74%	59%	76%	100%	100%
	Ratio of CO ₂ emissions of selected Member States	48%	78%	62%	80%	100%	100%

Figure 28: A snapshot of the model used for impact modelling

Individual scenarios for implementing each policy package were evaluated from 2020 and until 2050.

⁵⁴ See how the policy packages were developed in the previous report: [Analysis of the relevance, feasibility and possible scope of measures at EU level for building renovation passports](#)

⁵⁵ The policy packages are described in chapter 1

3. Modelling of the potential impact of the six policy packages

The assessment estimated the links between potential policy packages (input) and their effects in terms of renovation activities (outcome) through *logic models*, including related impact categories. The effect of every link in the logic model has been estimated based on existing evidence and necessary assumptions⁵⁶. The logic model elaborates on the inputs, process and output for evaluating the impact of each policy package. The definitions of selected impact categories and their calculation methodology are detailed in Chapter 1.

The modelling exercise is performed using BPIE's proven building stock performance model, which is frequently used to calculate the impact of various policy options on the renovation rate in Europe. The model allows several policy scenarios to be examined with respect to the impact on energy use using different renovation rates (i.e. the share of the building stock being renovated each year) and depths (i.e. the level of energy savings achieved per renovation) of renovation in the building sector up to 2050. It also estimated the on the following impact categories

- Renovation rate and depth
- Energy demand
- CO₂ emissions
- Residential energy expenditure
- Improvement in EPC ratings
- Health benefits
- Increase in share of on-site renewables
- Triggered private investments
- Public investment required to execute the policy packages

4. Lessons learnt

The section summarises the key findings gained from the modelling exercise and outlines suggestions for the next steps.

⁵⁶ The assumptions have been discussed with leading experts.

1. What are the policy packages?

Six feasible policy packages were developed based on 33 initial policy options (see [this report](#) for more details). Every policy package consists of one direct option and a number of supporting options. The three direct measures have one policy package that is 'soft' and one that is more 'stringent'. The supporting measures have been tailored to the direct measure and the ambition level of the specific package. The underlying logic of the policy packages is described in Figure 29.

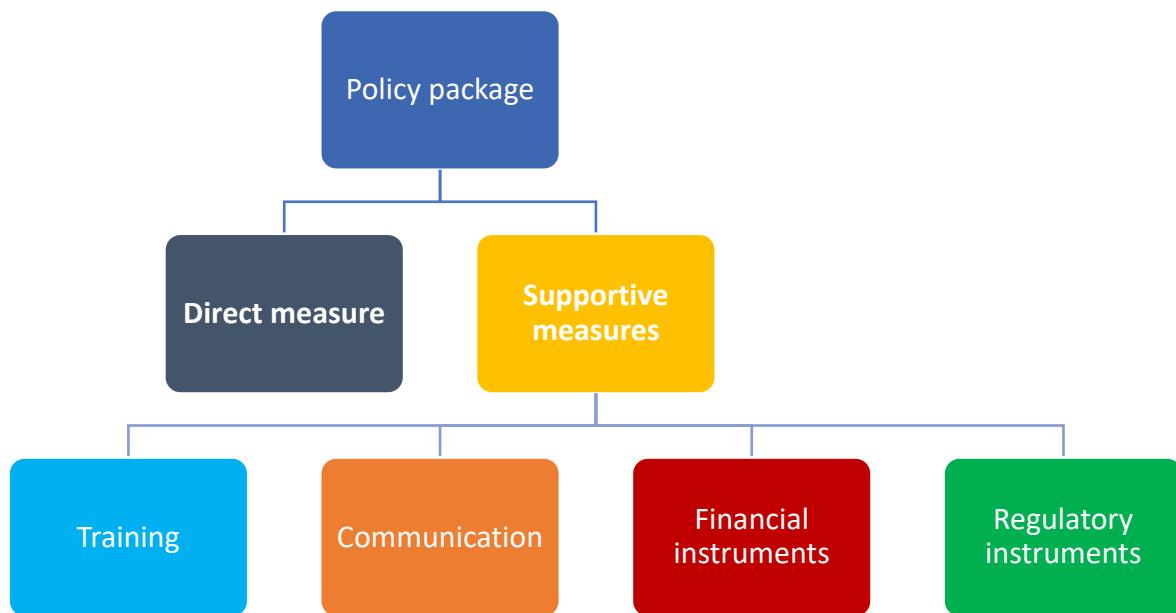


Figure 29: Policy package rationale

The direct measure in policy packages 1 and 2 leaves the decision to implement, and design, the BRP fully to the Member States. In both packages, the EU encourages the Member States to explore the instrument through existing legislation, most notably through the long-term renovation strategy (LTRS). Both packages include enabling options, including finance, communication and training, however, the second package is more extensive. In the second package, the EU encourages the implementing Member States to make the BRPs mandatory for certain building segments (e.g. the most inefficient buildings) at certain circumstances (e.g. when sold or rented).

In policy packages 3 and 4, the EU introduces a common reference framework for BRPs, which sets out clear guidelines of what the BRP should include and how it could be implemented. In policy package 3, the framework does not include minimum requirements of what the BRP should include, while policy package 4 does. The common reference framework is supported by other guidance documents and efforts, best practice exchange, as well as communication campaigns and training for energy experts. Policy package 4 complements this an EU framework for certification of experts. In package 4, the option is also supported with more far-reaching financial instruments.

In policy packages 5 and 6, the EU actively promotes the idea of BRPs, as complementary to energy performance certificates (EPCs), and proposes their introduction to complement EPCs in the next EPBD revision in 2026. In policy package 5, the uptake is complemented by targeted financial measures, best practice

exchange, training, communication campaigns as well as guidance documents. In policy package 6, the provision is supported by mandatory measures driving a deep renovation of the building stock.

Logic models

Logic models are theoretical descriptions of the causal chain of events, from an input to an outcome. In this report, we estimate the links between hypothetical policy packages (input) and their effects in terms of renovation activities (outcome), including related impact categories. The effect of every link in the logic model has been estimated based on existing evidence and necessary assumptions as outlined in Annex B.

Based on the content of the six policy packages, we estimate and quantify how they will impact the number of BRPs. The estimation considers the number of Member States that are expected to introduce BRPs as a result of the measures in the policy package and how the measures will affect the number of BRPs in these Member States.

Policy package 0

Policy package 0, the status quo option, assumes that no further measures are taken at the EU level to support the uptake of BRPs.

Rationale: The reference option assumes that:

- No additional regulation or formal guidance to support the introduction of BRPs comes from the EU level but the Member States will move forward with the implementation of the EPBD.
- Supportive measures, such as sharing good practices, facilitated by existing exchange platforms (e.g. [EPBD Concerted Action](#) and [Energy and Managing Authorities Network](#)) will continue their work.

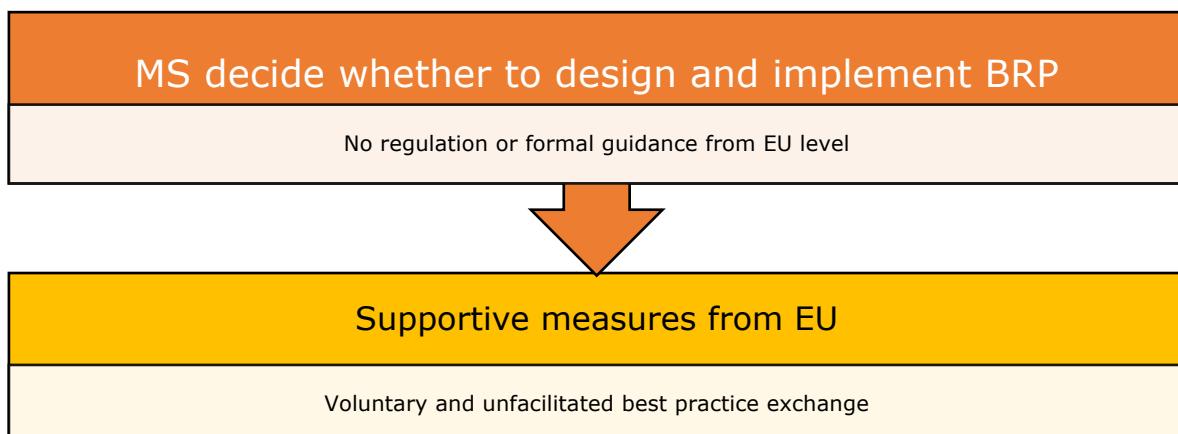


Figure 30: Policy package 0 elements

Assumptions

The policy package assumes business as usual, which implies the continued implementation of the current EPBD but no additional EU measures. In this policy package, we assume that developments in Germany and Belgium, which have already developed and implemented variants of BRPs, will continue.

- The German BRP ([Individueller Sanierungs fahrplan](#)) is not linked to the country's EPC but to its energy audit framework. The increase of BRPs in Germany is estimated to follow last year's growth.⁵⁷
- The Flemish BRP is an enlargement of the existing [EPC](#), in which the renovation roadmap is a new addition. The BRP is an automatic by-product of the EPC and is thus estimated to follow the number of issued EPCs. The rest of Belgium is assumed to follow Flanders' example.

The German BRP is more comprehensive, as it is developed based on an energy audit. The estimated impact per BRP is thus higher for Germany, which is supported by evaluation figures (see the previous report⁵⁸ describing the cases in detail).

⁵⁷ Based on experiences from federal level and from the region of Baden-Württemberg, which was the first region to launch a BRP.

⁵⁸ See Deliverable 4.1, “Review on building renovation passport schemes and related initiatives”

Policy package 1

In policy package 1, the decision to implement and design the BRP is fully passed on to the Member States.

Policy package 1 presumes that:

- The decision to implement and how to design the BRP is fully left to the Member States.
 - o The EU supports the uptake of the instrument through several additional supportive measures:
 - o Guidelines and best practice exchange on how the BRP can support the objectives of the LTRS. The requirement for EU countries to adopt an LTRS is set out in Article 2a of EPBD. These strategies will support the renovation of the national stock of buildings into a highly efficient and decarbonised building stock by 2050 and a cost-effective transformation of existing buildings into nearly zero-energy buildings. Among other things, the strategies must include ‘policies and actions to stimulate cost-effective deep renovation of buildings’.
 - o Making funds, such as the [European Energy Efficiency Fund](#) and [ELENA](#), available to the Member States for BRP development and implementation.
 - o National/regional communication campaigns to increase awareness of deep renovation and BRPs.
 - o Training of energy experts.

Assumptions

Figure 31 illustrates the estimated causal links of policy package 1. It consists of one direct and four supportive measures. The direct measure states that the EU leaves the decision to implement a BRP to the Member States. One of the supportive measures states the EU Commission will encourage Member States to launch BRPs, which can be done through the [LTRS](#).⁵⁹ The other supportive measures are assumed to have an enabling effect, implying that if they were to be omitted the estimated impact would be lower.

We assume that these actions will trigger five additional Member States to introduce a BRP. The assumption is based on the composition of the policy package and current activities in these countries. The five countries, Denmark, the Netherlands, Ireland, Portugal and France, have all shown some interest in the BRP.⁶⁰ The Member States assumed to adopt BRPs under this package cover 43% of the EU’s heated floor area.

⁵⁹ The LTRS mandates Member States to come up with policies and actions to stimulate cost-effective deep renovation of buildings. The BRP is one policy option that could help them to fulfil the [EPBD article 2a](#) requirements.

⁶⁰ Why these five Member States? Ireland, Portugal and France are formally exploring the potential of implementing BRPs, while the Netherlands and Denmark have several private initiatives with BRP potential (such as innovative one-stop-shops) and are frequent [frontrunners](#) when it comes to energy efficiency policies (see [here](#) and [here](#)).

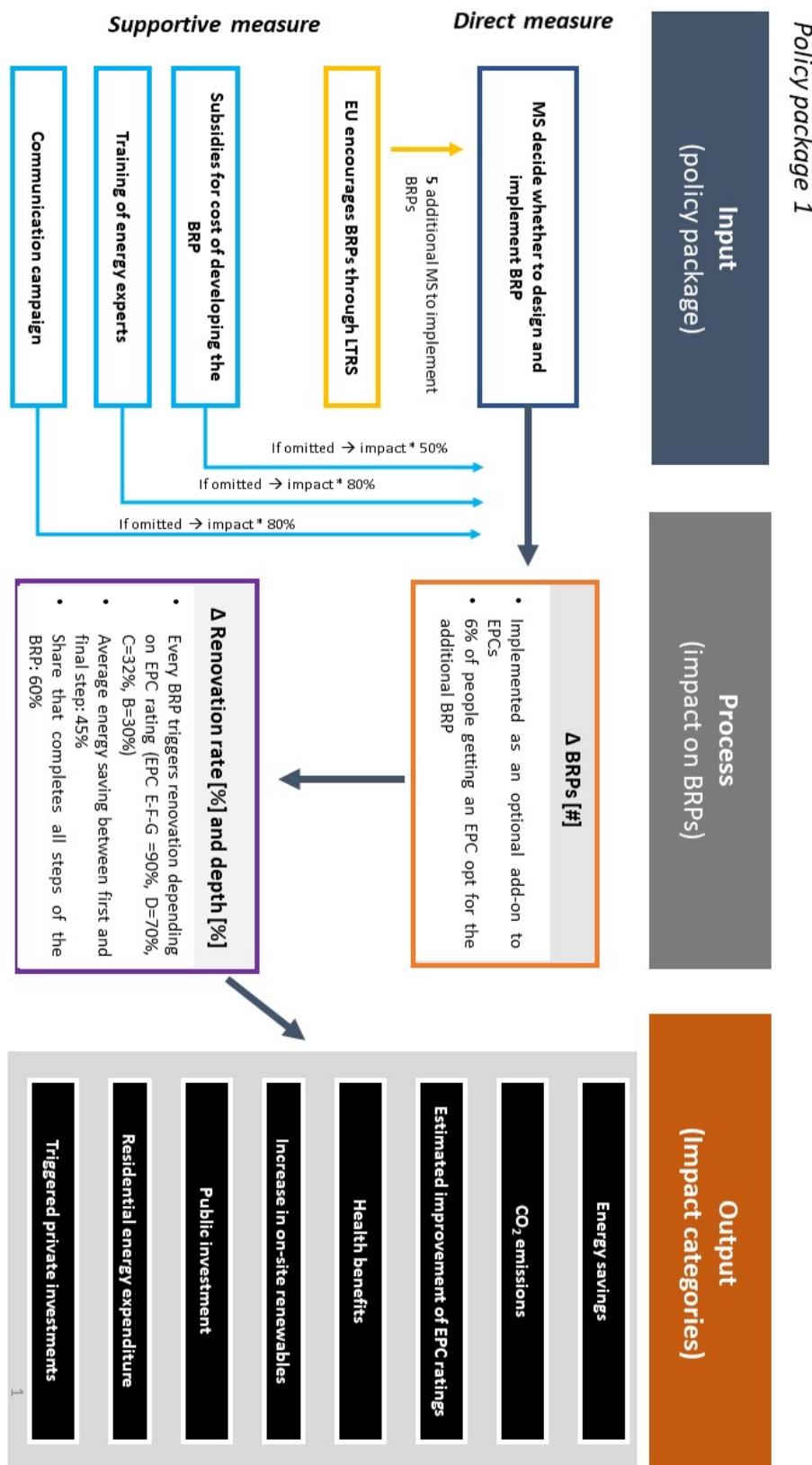


Figure 31: Logic model, policy package 1

Policy package 2

In policy packages 2, the decision to implement and design the BRP is also fully left to the Member States. The supportive measures are more far-reaching than in policy package 1.

Policy package 2 presumes that:

- The decision to implement BRP and how to design it is fully left to the Member States.
- The EU supports the uptake of the instrument through a number of additional supportive measures and actions:
 - o Guidelines and best practice exchange on how the BRP can support the objectives of the LTRS.
 - o National/regional communication campaigns to increase awareness of the BRPs.
 - o Training of energy experts.
 - o Making funds, such as the [European Energy Efficiency Fund](#) or [ELENA](#), available to the Member States for BRP development and implementation.
 - o Guidelines on how to support and enable banks to offer a favourable interest rate on loans/mortgages which are linked to a BRP.
 - o Introducing in the next EPBD review in 2026 a requirement stating that BRP becomes mandatory for certain building segments (replicating the EPC regulations, buildings for sale, etc.) after 2030.

None of the supportive measures contradicts Member States' right to design the BRP and their decision to implement the instrument.

Assumptions

Figure 32 shows the estimated causal links of policy package 2. It consists of one direct and six supportive measures. The direct and four of the supportive measures mirror those in policy package 1. It is also foreseen that the BRP is made mandatory for certain building segments, as in current EPC legislations, after 2030 in the Member States that have introduced it. In addition, the EU establishes a technical assistance facility for setting up a financial bonus linked to BRPs, which is assumed to increase investments.

It is assumed that this policy package will trigger nine additional Member States to introduce a BRP: Denmark, the Netherlands, Ireland, Portugal, France, Sweden, Spain, United Kingdom and Austria.⁶¹ These Member States cover 71% of the EU's heated floor area. The supportive measure where the EU encourages Member States to make the BRP mandatory for certain building segments by 2030 increases focus on the instrument. This, together with the possibility to link the BRP to favourable loans/mortgages, motivates four additional Member States to implement BRPs compared to policy package 1.

⁶¹ Why these nine Member States? We assume that the supportive measures in this package will trigger four additional Member States compared to policy package 1. Based on several transfer indicators (including similar existing approaches, similar institutional preconditions, expressed interest, general frontrunner country) the most likely would be Sweden, UK, Italy and Austria. Sweden has already shown some light interest in the instrument and is a common frontrunner when it comes to [progressive certification](#) services. Austria is observing the development in Germany (and "Der individuelle Sanierungsfahrplan"), while the UK has a very mature EPC system in place and is prone to innovative solutions. Italy has several ambitious regions showing some interest that would be likely to implement BRPs, if the right financial framework was in place. In addition, these regions have shown leadership in the past (e.g. [Emilia-Romagna](#), [Lombardy](#)).

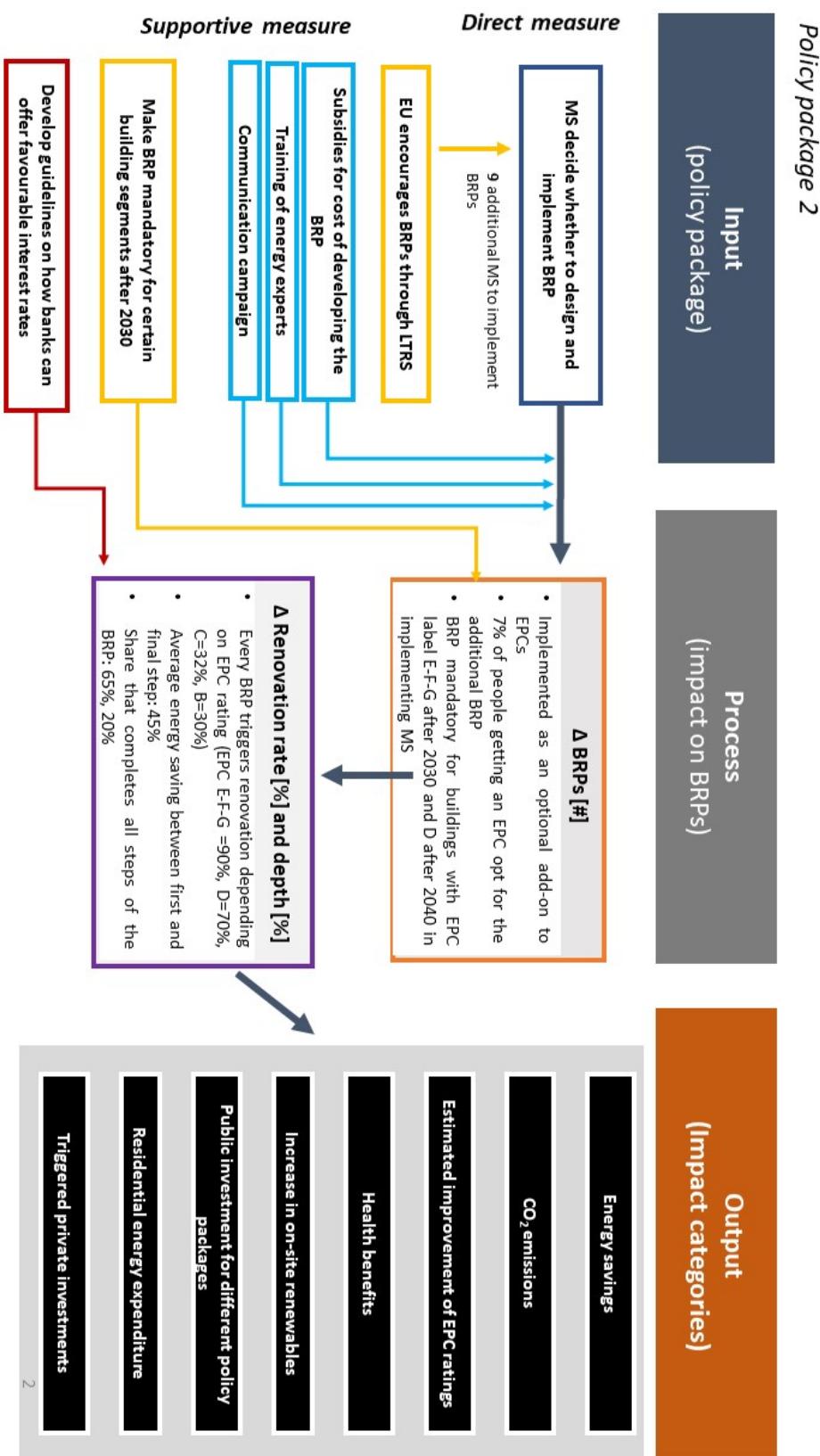


Figure 32: Logic model, policy package 2

Policy package 3

In policy package 3, the EU introduces a common reference framework for BRPs, which enables a more harmonised BRP development across the EU.

Policy package 3 presumes that:

- The EU introduces a common reference framework that comprises detailed guidelines and/or recommendations outlining how Member States can develop and implement a BRP. It does not include minimum requirements for the Member State on what the BRP should comprise.
- The EU supports the uptake of the instrument through several supportive measures and actions:
 - o Guidelines and best practice exchange on how the BRP can support the objectives of the LTRS.
 - o National/regional communication campaigns to increase awareness of the BRPs.
 - o Training of energy experts.
 - o Establishing a dedicated forum as part of the Concerted Action EPBD to exchange best practices.
 - o Guidance documents on how to integrate the BRP into EPC and existing audit schemes, and how it can be combined with a digital logbook.
 - o Encouraging Member States to utilise existing regional energy advice centres, including one-stop-shops, to increase awareness of the BRP.
 - o Guidelines on how banks can offer a favourable interest rate for loans/mortgages which are linked to a BRP.

Assumptions

Figure 33 shows the estimated causal links of policy package 3. It consists of one direct and five supportive measures. The direct measure is a common reference framework, that comprises detailed guidelines and/or recommendations outlining how Member States can develop and implement a BRP but doesn't include minimum requirements on what the instrument should comprise. Four of the supportive measures are assumed to have only an enabling effect, while it is also foreseen that the BRP is supported through existing advice centres and one-stop-shops.

It is estimated that this policy package will trigger seven additional Member States to introduce a BRP: Denmark, the Netherlands, Ireland, Portugal, France, Sweden and the UK.⁶² These Member States cover 56% of the EU's heated floor area. The EU common reference framework will contribute to an increased focus on the BRP, but the supportive measures are less progressive than in policy package 2.

⁶² Why these seven Member States? In addition to the Member States in policy package 1, Sweden and the UK have existing renovation frameworks that could be easily integrated with a common European reference framework. The seven Member States are the same as in policy package 2 but without Austria and Italy, which are assumed to be more contingent on the financial framework in place.

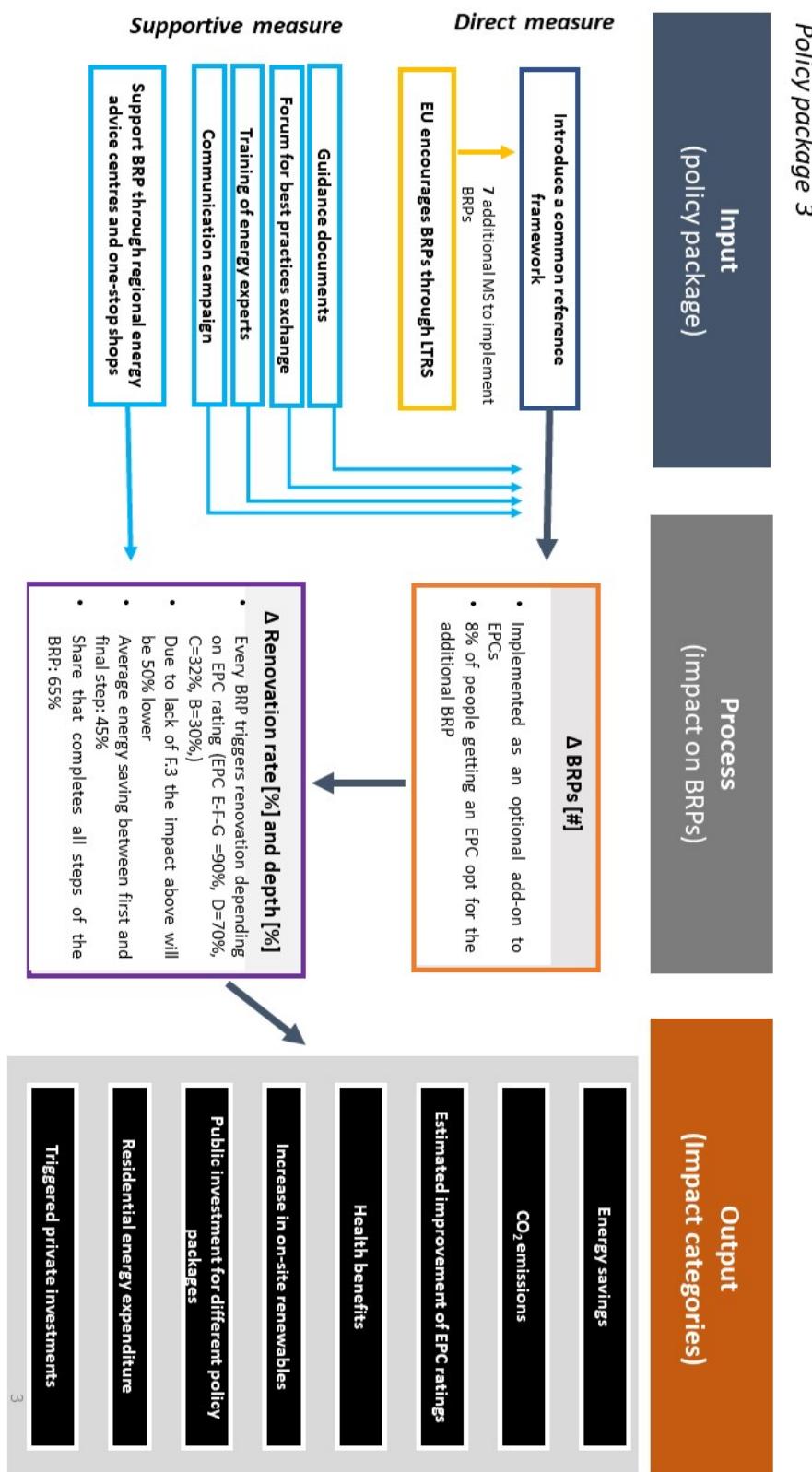


Figure 33: Logic model, policy package 3

Policy package 4

In policy package 4, the EU introduces a common reference framework for BRPs. In contrast to policy package 3, it includes mandatory requirements for what the BRP should comprise, which ensures a harmonised BRP development across the EU.

Policy package 4 presumes that:

- EU introduces a common reference framework, which includes mandatory requirements for what a BRP comprises. The requirement defines the core features of the BRP, which could include aspects such as links to EPC, targeting near-zero energy building (nZEB) renovation level, or preparation by qualified experts. If a Member State develops an instrument that doesn't fulfil these requirements, it is not entitled to take part in EU supportive measures targeting the BRP, such as linked financial instruments.
- This is supported by:
 - o An expansion of Article 17 of the EPBD, to introduce a common EU certification framework for EPC/BRP certifiers to enhance the quality of both instruments.
 - o National/regional communication campaigns to increase awareness of BRPs.
 - o Training of energy experts.
 - o Guidelines and best practice exchange on how the BRP can support the objectives of the LTRS.
 - o Guidance documents on how to integrate the BRP into EPCs and existing audit schemes, and how it can be combined with a digital logbook.
 - o Making funds, such as the [European Energy Efficiency Fund](#) or [ELENA](#), available to the Member States for BRP development and implementation.
 - o The Commission establishing a technical assistance facility assisting Member States to introduce a bonus that is triggered when a certain percentage of stages in the BRP has been implemented. For example, the bonus could consist of a lump sum handout when the first recommendation of the BRP is completed.

Assumptions

Figure 34 shows how policy package 4 influences the number of BRPs and renovations. The direct measure is a common reference framework that comprises detailed guidelines and/or recommendations outlining how Member States can develop and implement a BRP, including minimum requirements. Six of the supportive measures are assumed to have an enabling effect. It is also foreseen that Member States are encouraged and supported to set up a financial mechanism that triggers a bonus when certain steps of the BRP have been implemented, which influences the share that implements all steps.

It is estimated that this policy package will trigger 11 additional Member States to introduce a BRP: Denmark, the Netherlands, Ireland, Portugal, France, Sweden, UK, Italy, Austria, Poland and Spain⁶³. These Member States cover 73% of the EU's heated floor area. The common reference framework and the composition of supportive measures incentivise additional Member States to develop a BRP.

⁶³ Why these 11 Member States? The selection includes the Member States in policy package 3 plus Austria, Italy, Spain and Poland as new additions. Austria is currently looking to the development in Germany ("Der individuelle Sanierungsfahrplan"), while Italy has several ambitious regions showing some interest that would be likely to implement BRPs, if the right financial framework was in place. Similarly, the BRP is already being explored in Spain at the regional level and the supportive measures in this package are likely to boost that development. The iBROAD [survey](#) revealed that there is a large potential for a BRP in Poland, if comprehensively developed and supported, which we assume this policy package would do.

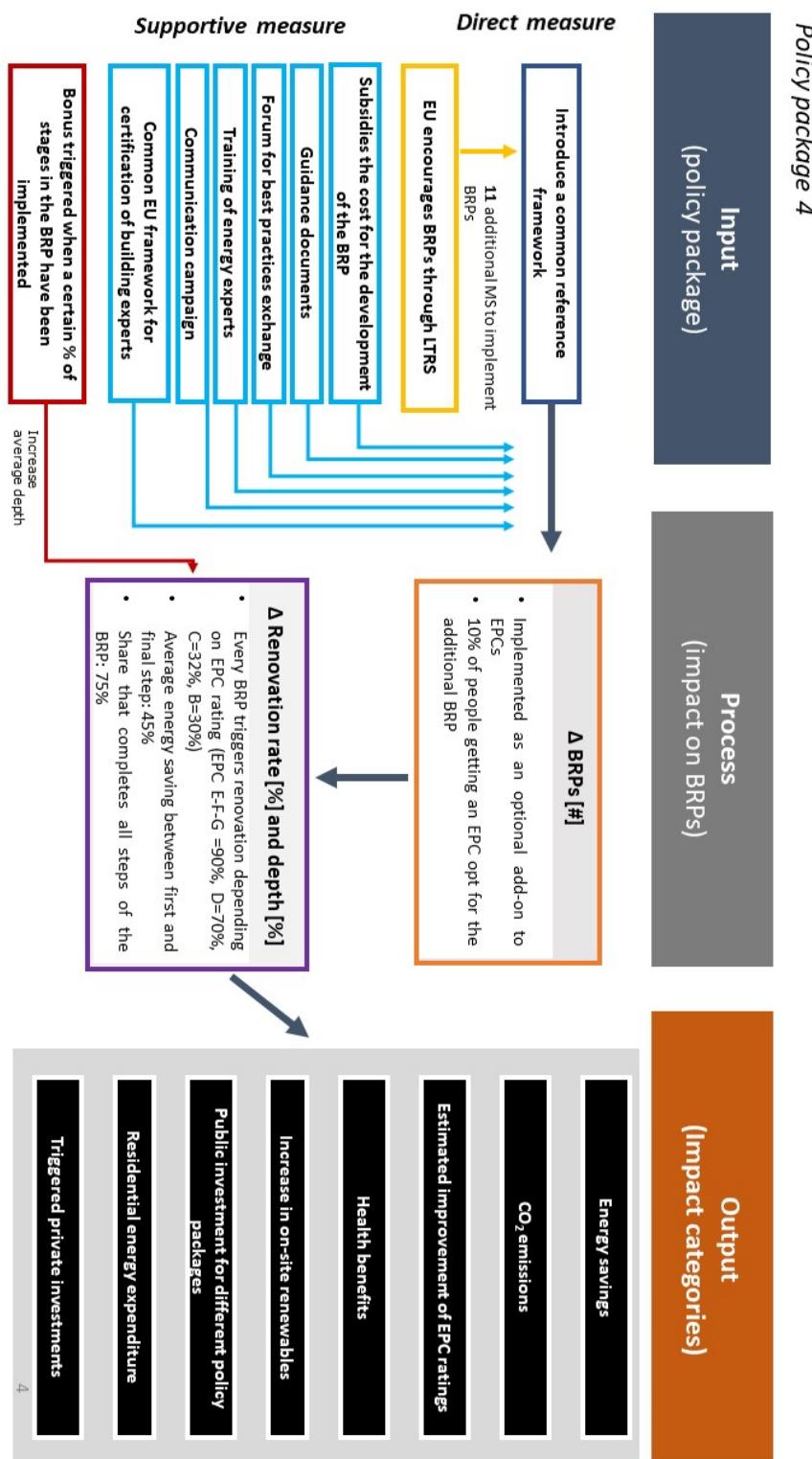


Figure 34: Logic model, policy package 4

Policy package 5

In policy package 5, the EU actively promotes the idea of BRPs, as complementary to the EPC, and proposes their introduction to complement EPCs in the next EPBD revision in 2026.

Policy package 5 presumes that:

- The EU actively promotes the idea of a BRP as complementary to the EPC and proposes its introduction to reinforce EPCs in the next EPBD review⁶⁴ in 2026.
- This activity is supported by:
 - Making funds, such as the [European Energy Efficiency Fund](#) or [ELENA](#), available to the Member States for BRP development and implementation (i.e. to subsidise the cost of the BRP preparation).
 - National/regional communication campaigns to increase awareness of the BRPs.
 - Training of energy experts.
 - Guidelines on how to support and enable banks to offer a favourable interest rate on loans/mortgages which are linked to a BRP.
 - Encouraging Member States to introduce progressive funding – or tax support – for packages of measures (i.e. renovation steps) as recommended by the BRP.
 - Establishing a technical assistance facility assisting Member States to introduce a financial bonus that is triggered when a certain percentage of stages in the BRP has been implemented. The bonus can be a lump sum or recoup the cost of the BRP.
 - Guidance documents on how to integrate the BRP into EPC and existing audit schemes, and how it can be combined with a digital logbook.

Assumptions

Figure 35 consists of one direct and seven supportive measures. The direct measure incorporates the BRP in the next possible EPBD revision. Five of the supportive measures are assumed to have an enabling effect. It is also foreseen that Member States are supported to set up a financial mechanism that offers building owners a bonus when certain steps of the BRP have been implemented. In addition, banks are encouraged to offer favourable loans that are linked to BRP renovations. The financial measures are expected to increase the share of building owners implementing several BRP steps and overall renovation investments.

All Member States will implement BRPs by 2030 as a result of this policy package.

⁶⁴ A review does not have to lead to a revision of the directive.

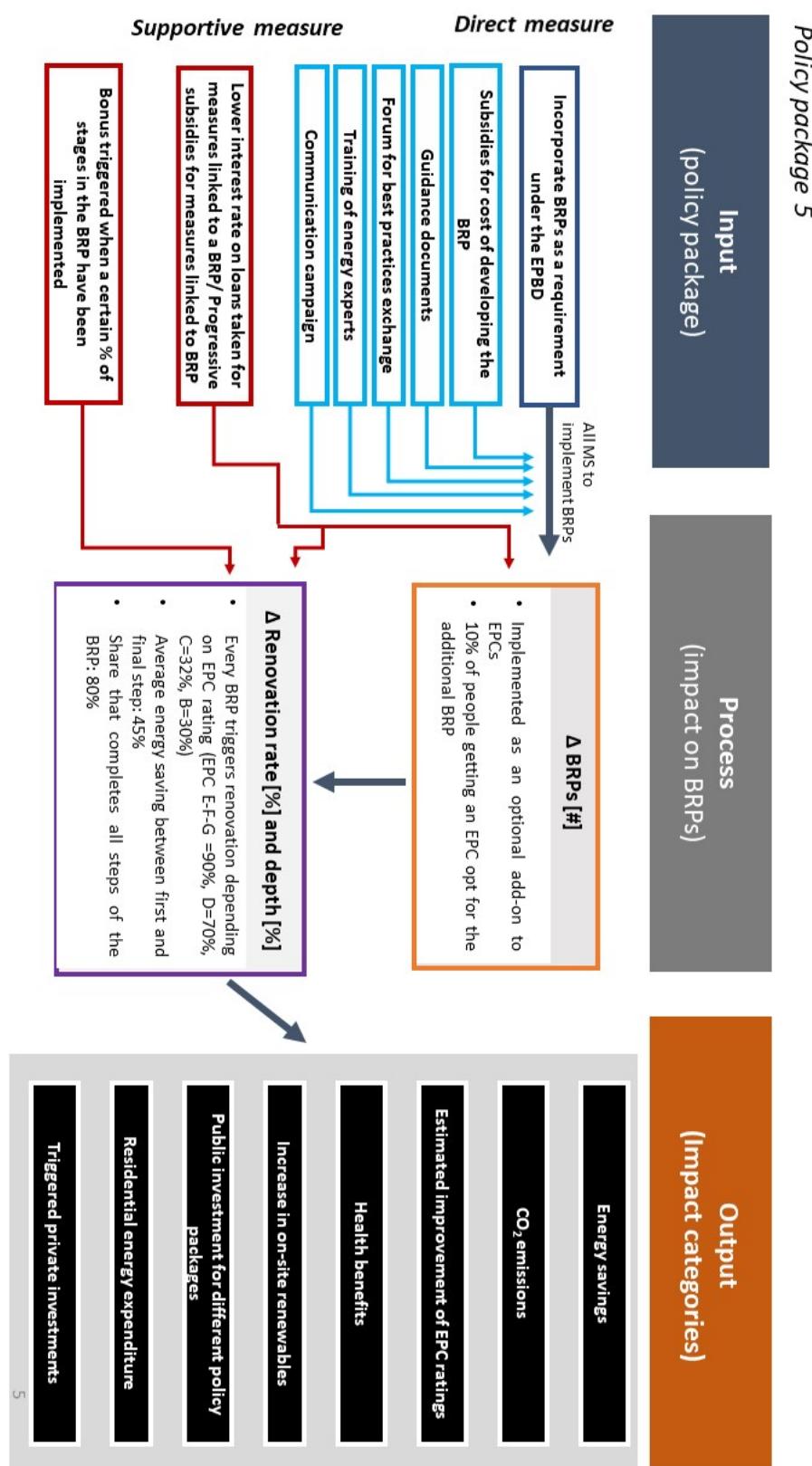


Figure 35: Logic model, policy package 5

Policy package 6

In policy package 6, the EU actively promotes the idea of BRPs and proposes its introduction to complement EPCs in the next EPBD revision in 2026. In contrast to policy package 5, these supportive measures are mandatory and far-reaching.

Policy package 6 presumes that:

- The EU actively promotes the idea of BRP as complementary to the EPC and proposes its introduction to reinforce EPCs following the next EPBD revision.
- The EU supports national/regional communication campaigns to increase awareness of the BRPs.
- The EU introduces and supports the training of energy experts
- The provision is also supported by new EPBD requirements, including:
 - Minimum energy performance requirements for energy renovation, going beyond the current EPBD requirement for 'major renovations'.
 - BRP mandatory for all buildings (residential and non-residential) sold after 2030.
 - BRP mandatory for all buildings (residential and non-residential) sold with EPC from class D and below by 2030 and regularly strengthened after that (e.g. class C by 2035 etc.)
 - Buildings with EPC below class E can only be sold if steps 1-2 of the renovation roadmap implemented by 2030.

Assumptions

Figure 36 displays policy package 6, which consists of one direct and six supportive measures. The direct measure incorporates the BRP in the next possible EPBD revision. Two of the supportive measures are assumed to have an enabling effect. Four far-reaching supportive measures are foreseen to be included in future revisions of the EPBD, with significant effects on energy renovations of buildings. All Member States will implement BRPs by 2030 as a result of this policy package.

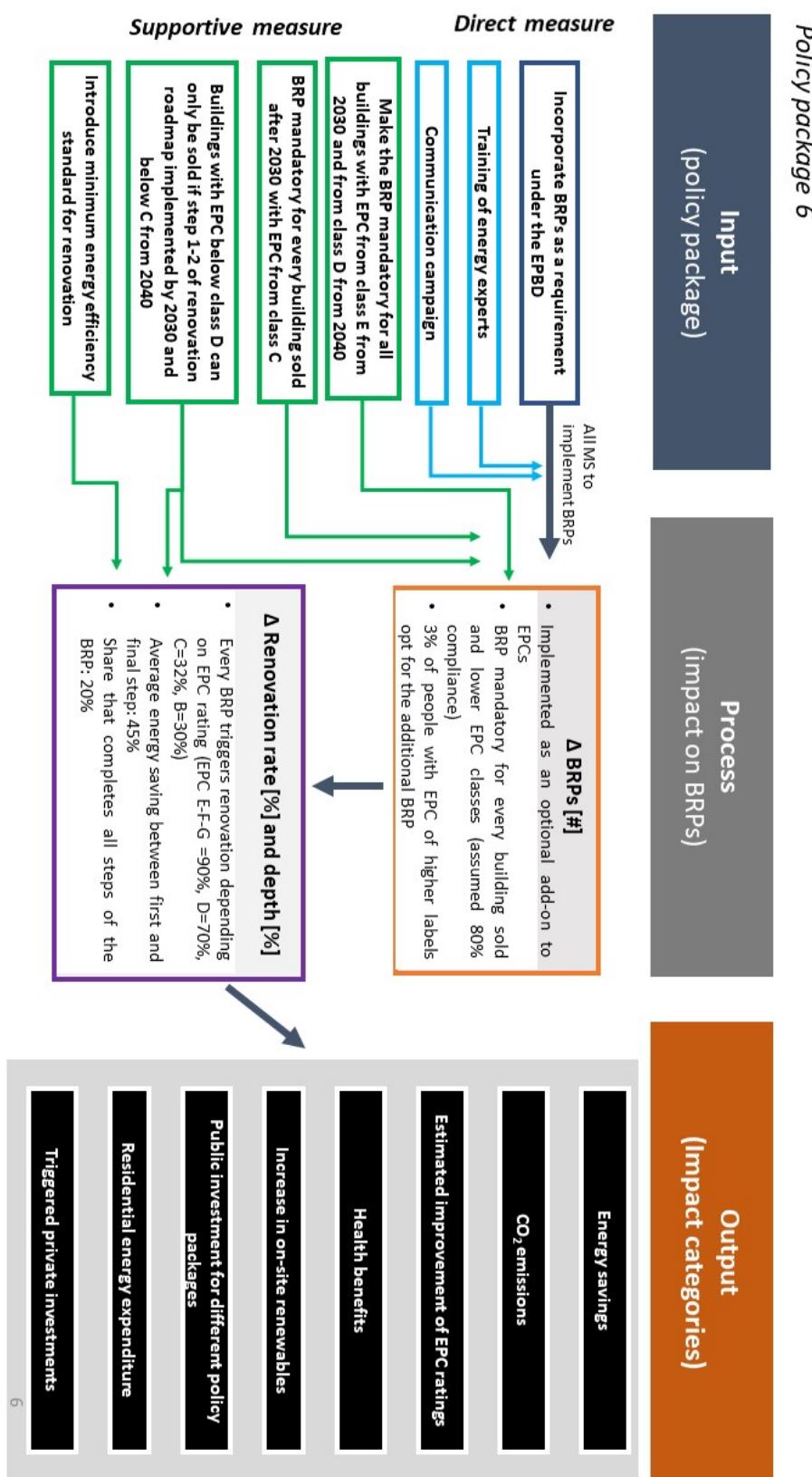


Figure 36: Logic model, policy package 6

2. How are the impacts calculated?

The definition of impact categories is closely linked with the development of the policy packages established in Task 5. The categories have been selected according to their environmental, economic and social relevance and the availability of reliable data to support the calculations. In total, eight impact categories were identified. The impact of policy packages is calculated using the model that has been developed to assess various scenarios and forecast the impact of BRPs in 2030, 2040 and 2050. These calculations are complemented with informed assumptions estimated and derived from the existing cases, relevant evaluations and in consultation with experts. A detailed elaboration of these assumptions is presented in Annex B. The following subsections present the calculation approach to BRPs, renovation rate and the impact categories.

Number of BRPs

The different policy packages will influence Member States' decision on whether to introduce a BRP. The composition of measures in the policy packages will also influence the uptake of the BRP in the countries where it has been implemented.

Assumptions:

1. The BRP is assumed to be an optional addition to the EPC for which the homeowner must pay a subsidised fee of €100⁶⁵. Policy packages 2 and 6 foresee the BRP to be mandatory under certain circumstances.
2. Based on the number of issued EPCs per year for the implementing Member States, we assume the share of homeowners that will opt for additional BRP service with their EPC. Surveys show that around 20% of residential homeowners say they would opt for an additional BRP if they were provided with the opportunity⁶⁶. This number is likely to be smaller if they were faced with the actual decision. Based on discussion with experts, we revised the number to a range of 6-10%, depending on the policy packages.
3. The BRP is a novel instrument that will attract some users by itself. Based on discussions with experts, we assume this will increase the issued EPCs (result from bullet 1 and 2) with 5-10%, given the composition of the policy packages.

Example: Denmark issues around 55,000 EPCs per year, of which 92% (i.e. 50,600) have been calculated to represent existing buildings. In policy package 1, we assume that 6% of the homeowners will opt for the optional BRP, which amounts to 3,036 BRPs per year. In addition, we assume that an additional 5% will get a BRP because of the instrument itself, bringing the total number to 3,187.

The calculation is specified as:

The number BRPs issued each year is calculated by the relationship:

⁶⁵ Based on existing schemes, the total cost for an optional BRP combining an on-site audit with automated data and calculations is estimated to be €400. The subsidised cost that the homeowner will pay is assumed to be €100, which is what surveys show most homeowners are willing to pay for a service like the BRP. See [report](#) on feasibility and replicability for more details.

⁶⁶ See iBRoad study “[Understanding Potential User Needs](#)”, in which 1500 building owners, from Poland, Portugal and Bulgaria, were interviewed on their views on BRPs.

$$BRPs = (EPCs_{yearly} * EPC_{BRP}) + new\ clients$$

Symbol	Description	Unit
BRPs	Number of BRPs per year	#
<i>EPCs_{yearly}</i>	Number of EPCs issues per year in the implementing MS	#
<i>EPC_{BRP}</i>	Share of building owners that will opt for an additional BRP service with their EPC	%
<i>New clients</i>	People getting an EPC and BRP because the new instrument activates these people (which are not obliged to get an EPC)	

Renovation rate and depth

The renovation rate at Member State level varies from 0.4-1.2%. The main impact of BRPs is measured in increased renovation activity. BRPs as an optional add-on to existing EPCs will trigger new homeowners to renovate, reassure people already planning to renovate and increase the renovation quality/depth.

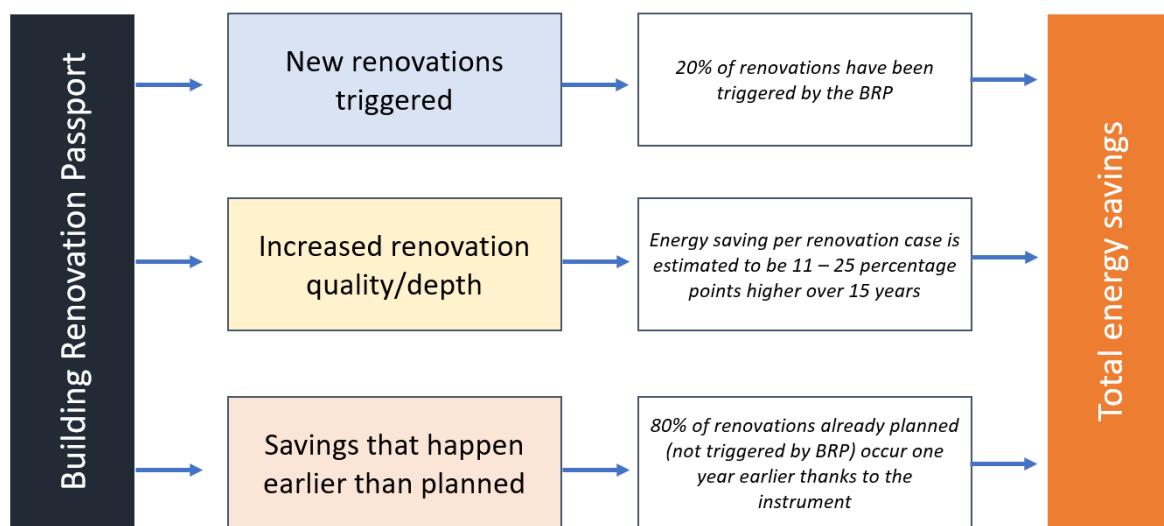


Figure 37: Illustration of how BPR impacts renovation/energy savings

Assumptions:

1. The share of building owners that decided to renovate after obtaining an optional BRP depends on the EPC rating of their building, assuming that homeowners in very inefficient buildings will be more likely to renovate. 90% of building owners with a low EPC rating (E-F-G) will implement at least one measure (D=70%, C=32%, B=30%). We assume that people in buildings with EPC label A won't get a BRP in the first place⁶⁷.
2. The renovation depth achieved per renovation depends on two aspects. The first is the share of homeowners that implement multiple steps of the BRP within 15 years, which is assumed to be between 20% (for policy packages where the BRP is linked to mandatory implementation) and 80% (for a policy package with strong supportive measures encouraging deep renovations). The second aspect is the average energy saving for the fulfilled and uncompleted BRPs. We assume the average energy savings to be 45% for the BRPs where several steps have been completed and 20% for the uncompleted BRPs where only 1-2 measures have been completed.
3. New triggered measures are those that wouldn't have happened if the BRP was not in place. Evidence suggests that around 80% of the potential BRP renovations would have occurred without the existence of a BRP.
4. Evidence also shows that an instrument such as the BRP makes homeowners more confident in their renovation decisions and triggers the renovation to happen earlier. For the 80% of renovations that would have occurred anyway, we assume that on average the renovation occurs one year earlier than if they hadn't had a BRP.

The assumptions have been developed through discussions with local experts, as well as relevant and accessible evaluations⁶⁸.

For new triggered renovations, we allocate the whole energy saving to the BRP. Figure 38 illustrates the savings from the increased depth and the fact that the renovations happen earlier. In this example, the building that is renovated with a BRP reaches a higher performance level and thus demands less energy. During the 12 years displayed in Figure 38, the BRP also contributes to savings as the measures are implemented earlier (the building's energy consumption will be lower in 2021 as the renovation has already occurred).

⁶⁷ See findings in first report of this study: [Review on building renovation passport schemes and related initiatives](#)

⁶⁸ See resources and findings in the first report of this study: [Review of building renovation passport schemes and initiatives](#). In addition, IFEU's [evaluation](#) of the local BRP in Baden-Württemberg and its wider policy framework, as well as BAFA's [evaluation](#) of German energy audits, have been especially useful in this work.

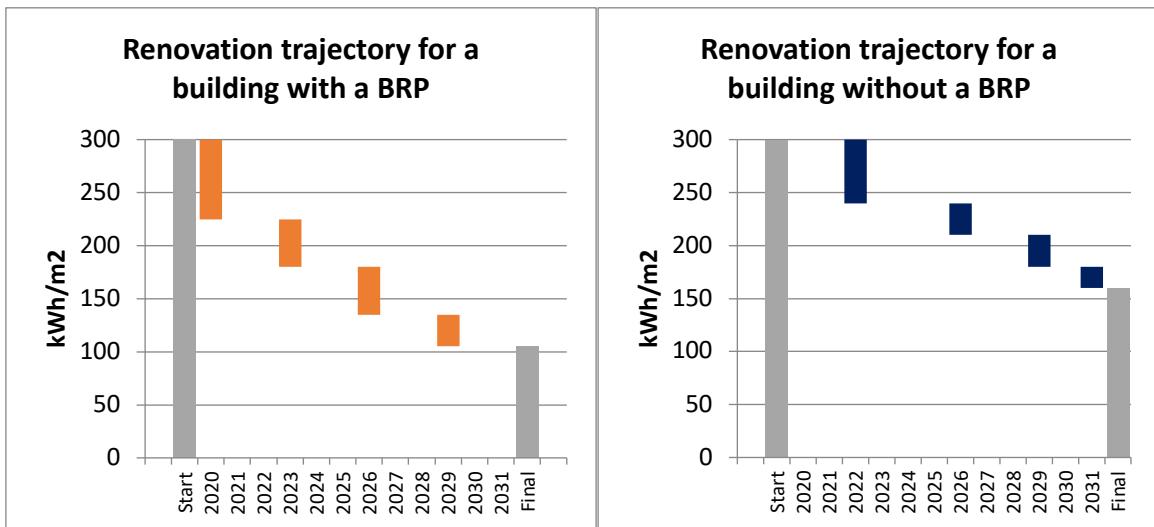


Figure 38: Renovation trajectory of a building with and without a BRP (please note this is an example and the numbers are arbitrary)

The calculation is specified as:

$$BRP_{impact} = BRPs * (BRP_{triggered} + BRP_{reassured} + BRP_{depth})$$

$$RT_{resid_country,year} = \frac{BRP_{resid,renov} * FA_{average}}{FA_{country}}$$

Symbol	Description	Unit
BRP_{impact}	The total impact of the BRPs	
BRP_{all}	Total number of BRPs materialising in renovation measures. Based on EPC rating (E-F-G = 90%, D=70%, C=32%, B=30%) (calculation)	#
$BRP_{triggered}$	New triggered measures are those that wouldn't have happened if the BRP was not in place	%
$BRP_{reassured}$	Renovations that happen earlier because the instrument pushes homeowners to renovate	%
BRP_{depth}	Increased renovation depth	%
$RT_{resid_country}$	Added renovation rate of the residential sector in a specific country and year	%
$BRP_{resid,renov}$	Number of renovations due to BRPs issued in a specific country in a year	#
$FA_{average}$	The average floor area of a dwelling	m^2
$FA_{country}$	The total floor area of the residential sector	m^2
$BRPs$	Number of BRPs per MS	#

Impact categories

Figure 39 displays the eight impact categories and in which order they are described.

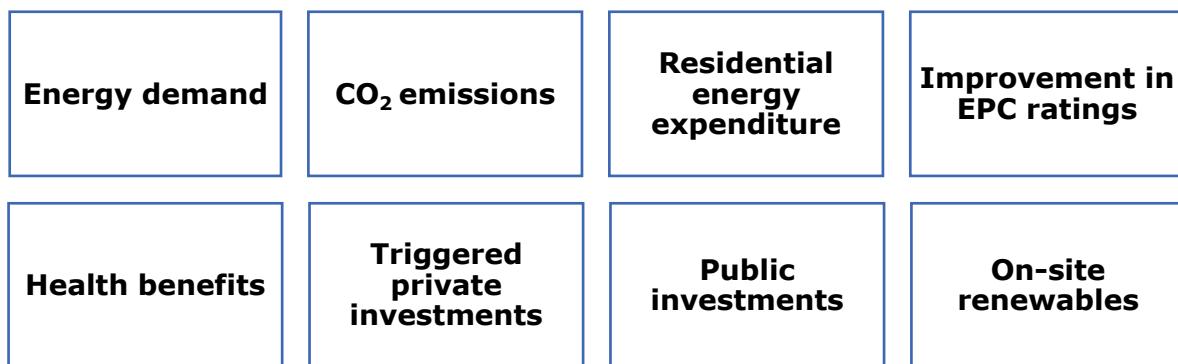


Figure 39: Impact categories

Energy demand

In the context of the EPBD, the impact of introducing BRPs on energy use is evaluated as a first key impact category. Final energy consumption is used to determine the energy demand excluding the energy used by the energy sector itself as BRPs are only expected to impact the end-users. In policy package 6, it has been assumed that the included mandatory supportive measures are less effective for non-residential buildings than for residential buildings. The historical final energy consumption data used in the assessment comes from [Eurostat](#).

The calculation is specified as:

$$E_{country,year} = E_{country,(year-1)} * (1 - RT_{avg}) + E_{country,(year-1)} * RT_{avg} * (1 - RD_{avg})$$

Symbol	Description	Unit
$E_{country,year}$	The energy use of the building sector in a specific country and year	TWh
$E_{country,(year-1)}$	The energy use of the building sector in a specific country the previous year	TWh
RT_{avg}	Average renovation rate	%
RD_{avg}	Average renovation depth (average energy savings per case)	%

CO₂ emissions

Carbon dioxide (CO₂) emissions, mainly from heating and cooling, are linked to a building's energy use. Building energy consumption has a direct impact on the overall building's CO₂ emissions. BRPs would trigger renovations that in turn result in mitigation of CO₂ emissions. The historical CO₂ emissions data used in the assessment comes from [Eurostat](#).

The calculation is specified as:

$$CE_{country,year} = CE_{country,(year-1)} * (1 - RT_{avg}) + CE_{country,(year-1)} * RT_{avg} * (1 - CE_{avg})$$

Symbol	Description	Unit
$CE_{country,year}$	CO ₂ emissions of the residential sector in a specific country and year	MT
$CE_{country,(year-1)}$	CO ₂ emissions of the residential sector in a specific country the previous year	MT
RT_{avg}	Average renovation rate	%
CE_{avg}	Average CO ₂ emission savings per case	%

Residential energy expenditure

Households represent approximately 27%⁶⁹ of final energy consumption in the EU. Households use energy for a variety of purposes, including space and water heating, space cooling, cooking, lighting, and electrical appliances, but heating is the largest component. Household energy expenses make up a large share of the total household disposable income and the increasing expenses are a growing concern in the context of energy/fuel poverty. As BRPs would trigger a change in the overall energy expenditure of households, this has been included as an impact category. The historical data used in the assessment comes from [Eurostat](#).

The calculation is specified as:

$$EC_{country,year} = EC_{country,(year-1)} * (1 - RT_{avg}) + EC_{country,(year-1)} * RT_{avg} * (1 - RD_{avg})$$

Symbol	Description	Unit
$EC_{country,year}$	Energy expenditure of the residential sector in a specific country and year	€
$EC_{country,(year-1)}$	Energy expenditure of the residential sector in a specific country the previous year	€
RT_{avg}	Average renovation rate for residential sector	%
RD_{avg}	Average renovation depth for the residential sector (average energy savings per case)	%

Estimated improvement in EPC ratings

The renovation impact linked to BRPs would also influence EPC ratings. Better ratings mean higher energy performance of buildings, which is also linked to higher property values [1]. The EPC data is gathered from the [EU Building Stock Observatory](#), national EPC registries and [EPBD Concerted Action](#) publications.

The calculation considers the number of buildings with a certain EPC rating and adds the share of buildings that reaches this rating through BRP renovations. As the calculation below indicates, every completed BRP renovation (where several steps have been achieved) upgrades the rating by one or two levels (from E to D, or E to C), though a minority of cases achieves more than two steps.

The calculation below shows the increase in EPC rating A for one year. Every renovated (i.e. completed most BRP steps) EPC B building climbs to EPC A, along with 60% of EPC C and 10% of EPC D buildings. The calculation assumes the EPCs to be constant over time, in order to isolate the impact from BRPs.

⁶⁹ <https://ec.europa.eu/eurostat/data/database>

The calculation is specified as:

$$EPC_{A,(year\ x)} = EPC_{A,(year\ x-1)} + Ren(EPC_{B,(year\ x-1)} + (EPC_{C,(year\ x-1)} * 60\%) + (EPC_{D,(year\ x-1)} * 10\%))$$

Symbol	Description	Unit
$EPC_{A,(year\ x)}$	Number and share of buildings with EPC rating A in year X. Similar calculations are made for the other ratings.	%
Ren	Number of renovations	#
$EPC_{A,(year\ x-1)}$	Number of EPC A buildings in the year before X	%
$EPC_{B,(year\ x-1)}$	Number of EPC B buildings in the year before X	%
$EPC_{C,(year\ x-1)}$	Number of EPC C buildings in the year before X	%
$EPC_{D,(year\ x-1)}$	Number of EPC D buildings in the year before X	%

Health benefits

Renovation is an opportunity to improve the indoor environmental quality,⁷⁰ while at the same time achieving a high energy performance. BRPs, if properly designed, will have a positive effect on the indoor environmental quality, which in turn has a positive effect on inhabitants' health, productivity and overall wellbeing.⁷¹ The BRP steps are defined by a building expert, which increases the chances that the indoor environmental quality is improved after the renovation.

It is challenging to estimate the non-energy benefits of energy renovations. In this report, we look at health benefits in terms of absence from work due to illness, which is referred to as "absenteeism". Many workers are unable to perform their work due to building-related sickness, caused by bad indoor air quality, dampness or thermal discomfort.

Total absence across Europe ranges between 3% and 6% of total working time, which amounts to a cost of approximately 2.5%⁷² of the EU's gross domestic product (GDP) due to loss in productivity.

It is also estimated that energy efficiency interventions bring benefits such as improved indoor air quality that reduce sick days by 1.2 to 1.9 days,⁷³ improving the health and wellbeing of people.

The introduction of BRPs would influence the share of the population living in better rated and healthier buildings. Reduced sick days provide an indicator of increased productivity due to the renovation of buildings.

The calculation is specified as:

$$AC_{EU\ avg} = W_{EU\ avg} * 8hrs/day$$

⁷⁰ Indoor environmental quality comprises multiple elements, such as air quality, (thermal) comfort, light and noise.

⁷¹ See for example Buildings 2030 (2018) [Building 4 People](#) – Quantifying the benefits of energy renovation investments in schools, offices and hospitals

⁷² Report on absence from work:

www.eurofound.europa.eu/sites/default/files/ef_files/docs/ewco/tn0911039s/tn0911039s.pdf

⁷³ COMBI final report (Quantification of productivity impacts): https://combi-project.eu/wp-content/uploads/D5.4a_20180508a_final.pdf

$$AB_{cost} = WP_{EU} * (SD_{EU\ avg} - SD_R) * AC_{EU\ avg}$$

Symbol	Description	Unit
AB_{cost}	Absenteeism cost gain	€
WP_{EU}	The average working population in each EPC rated category (e.g. A, B, C, D, >D) in the EU	#
$SD_{EU\ avg}$	Average sick days per person in the EU	#
SD_R	Sick days per person reduced due to renovation for each EPC category (assumption: A=1.9, B=1.2, C=0.6, D=0.3, >D=0) in the EU	#
$W_{EU\ avg}$	Average wage per person in the EU (€27.4/h-2019)	€
$AC_{EU\ avg}$	The average cost of absence per person per day in the EU	€

Triggered private investments in renovation

The BRP will increase the number of renovations and thus also private investments. Public funding alone cannot renovate all of Europe's buildings, so the private investment is needed to increase the uptake and support the BRPs.

The triggered private investment is based on the share of triggered renovations and the average energy saving per renovation. The cost per renovation is based on average figures from existing cases and reports (see Annex C). The investment considers all renovation measures that are implemented according to the BRP within 15 years.

The calculation is specified as:

$$TPI = NR * I_{avg\ per\ BRP} - PS$$

Symbol	Description	Unit
TPI	Triggered private investment	€
NR	Total number of triggered renovations	#
$I_{avg\ per\ BRP}$	Average investment per BRP renovation	€
PS	Public investment	€

Public investments required for different policy packages

Introducing BRPs will come with a cost for the EU and its Member States. The cost will vary depending on the number of implementing countries and on the supportive measures being introduced within each policy package.

Cost for setting up a BRP (based on existing BRPs)

- Expanding the EPC to a BRP: €250,000–€600,000 (including analysis, testing and development)

Communication and training activities

- Communication: €90,000 for an average-sized Member State (including media plan, designing and printing brochures, short introduction movie, buying space in printed media and social media)
- Training of experts: €0 (leave it to the market) to €200,000 for an average-sized Member State
- The measures introduced in policy package 6, triggering huge impact on the number of BRPs, will require a larger investment in training activities

Subsidies for BRP preparation (including on-site visit, the cost for application, etc.)

- Assumed to be on average €300 per issued BRP

The calculation is specified as:

$$PI_{MSX} = BRP_{prep} + BRP_{sub} + BRP_{com} + BRP_{tr}$$

Symbol	Description	Unit
PI_{MSX}	Required public investment for MS x	€
BRP_{prep}	Costs related to setting up the instrument, including analysis, design, test and development of the BRP.	€
BRP_{sub}	Most policy packages foresee a public subsidy for the cost for preparing a BRP, including an on-site visit, talking with residents, outlining the BRP etc.	€
BRP_{com}	Cost related to communication activities	€
BRP_{tr}	Cost related to training activities	€

Increase of on-site renewables

The role of BRPs is not only to increase the energy efficiency of buildings but also to increase the uptake of the on-site renewables such as heat pumps and solar PV to cover a large part of energy consumption. As self-consumption in buildings is expected to increase through BRPs, its impact had been quantified in this assessment for residential buildings. It is assumed that the large majority of solar PV and heat pumps will be installed in later steps in the BRP. There are other on-site renewables that could be considered, such as solar thermal and biomass heating, but no reliable data could be allocated within this project.

The calculation is specified as:

$$PV = NR * NR_{PV}$$

$$HP = NR * NR_{HP}$$

Symbol	Description	Unit
PV	The number of PV installations	#
NR	Total number of triggered renovations	#
$NR_{PV/HP}$	Share of triggered renovations that include PV or HP	%
HP	The number of heat pump installations	€

2. What are the impacts of the policy packages?

We used a model developed by BPIE to assess the impact of the policy packages on the impact categories described above. All the assumptions are further detailed in Annex B.

The estimated increase of BRPs

Figure 40 **Erreur ! Source du renvoi introuvable.** shows how the number of BRPs is expected to increase over time for residential and non-residential buildings together. The graph shows that policy package 6 reaches 150 million BRPs by 2050, followed by policy package 2 with almost 50 million. Both these policy packages assume that the BRP will become mandatory for inefficient buildings at various points by 2030.⁷⁴ Policy package 4 and 5 reach around 15 million, due to favourable supportive packages that incentivise building owners to get a BRP. Policy package 3 reaches almost 10 million by 2050 and policy package 1 almost 2 million. The calculation does not reflect the possibility that people might renew the BRP over a 30-year period.

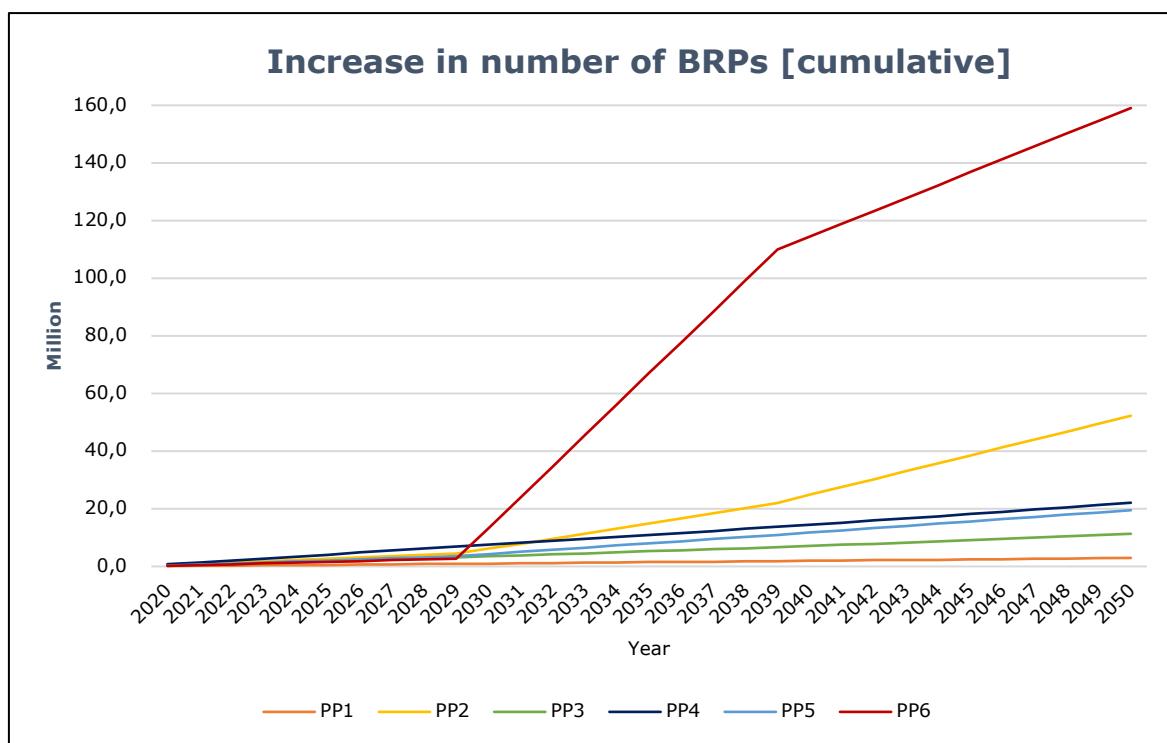


Figure 40: The Estimated increase in BRPs

⁷⁴ The mandatory measures in policy package 6 cover the lowest EPC ratings from 2030 and are expanded to EPC rating D in 2040. It is assumed that majority of inefficient buildings will get a BRP between 2030 and 2040, which explains the decreased pace from 2040.

Energy demand

The impact analysis shows that the introduction of BRPs will contribute to a reduction in final energy consumption. The results are divided for residential and non-residential buildings.

Residential building stock

All policy packages show a significant effect on the residential final energy demand. The total final energy demand for the sector will be 8-9% lower by 2050 in policy packages 5 and 6 compared to the “no action” scenario, amounting to around 300 terawatt-hours. Policy package 4 reaches 6%, while policy packages 1-3 range between 3% and 4%. Although policy package 6 assumes a large deployment of BRPs (see Figure 40), the impact per BRP is lower than in other policy packages⁷⁵.

Figure 41 displays the comparative impact of the six policy packages on residential final energy demand.

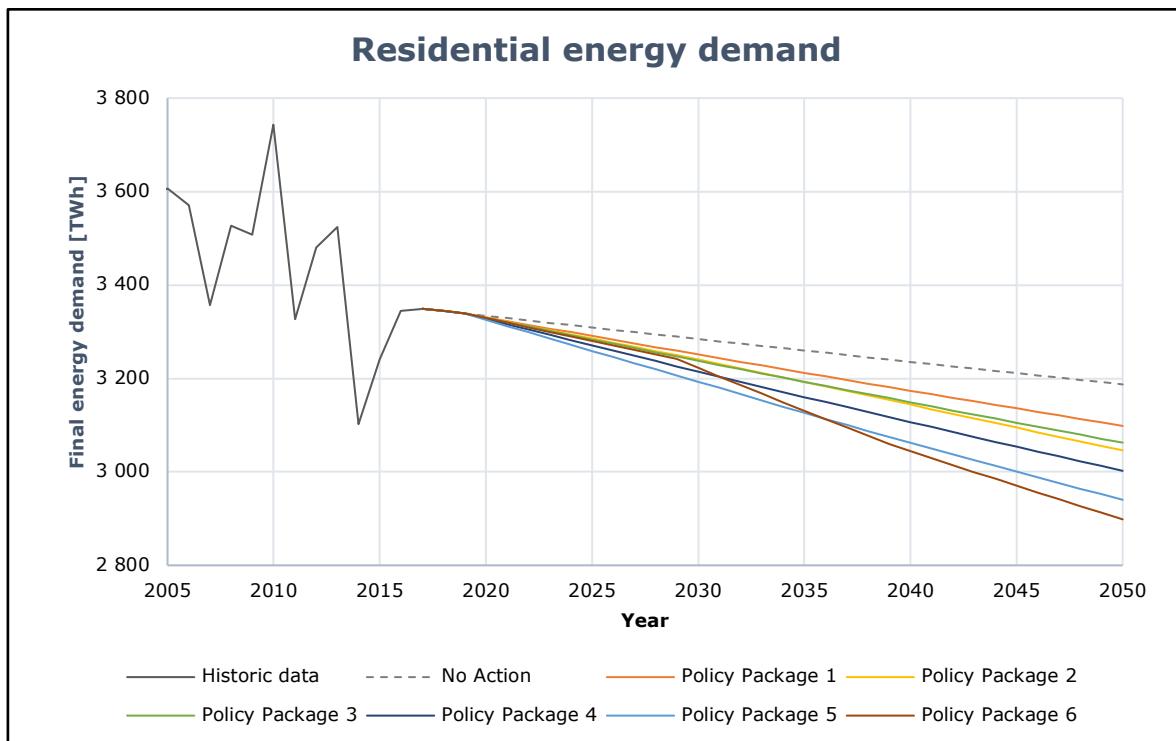


Figure 41: Residential energy demand. The historical data has not been normalised and shows the real energy consumption. The yearly variance can mainly be explained by climatic conditions, where, for example, “household energy consumption increased both in 2015 and 2016 mainly because the 2016 winter was slightly colder than that of 2015, which was, in turn, a bit colder than that of 2014” (see EEA).

⁷⁵ People that are mandated to get a BRP will be less likely to implement all renovation steps. The average energy saving will therefore be lower.

Non-residential building stock

Non-residential buildings require an average of 55%⁷⁶ more energy than residential buildings. However, the awareness of energy renovations and their benefits is generally higher. It is relatively common for larger buildings (commercial and public) to perform a detailed energy audit before detailing the renovation steps, while many single-family owners often make their decision by relying on the advice of friends and family members instead of building professionals.

Policy package 5 is expected to result in the largest energy savings at 7.5%, amounting to more than 130 terawatt-hours. Policy package 4 and 6 are estimated to reduce energy demand by approximately 6%, while the impact from the other policy packages ranges between 3% and 4%.

The impact of each policy package in reference to no action scenario is shown in Figure 42.

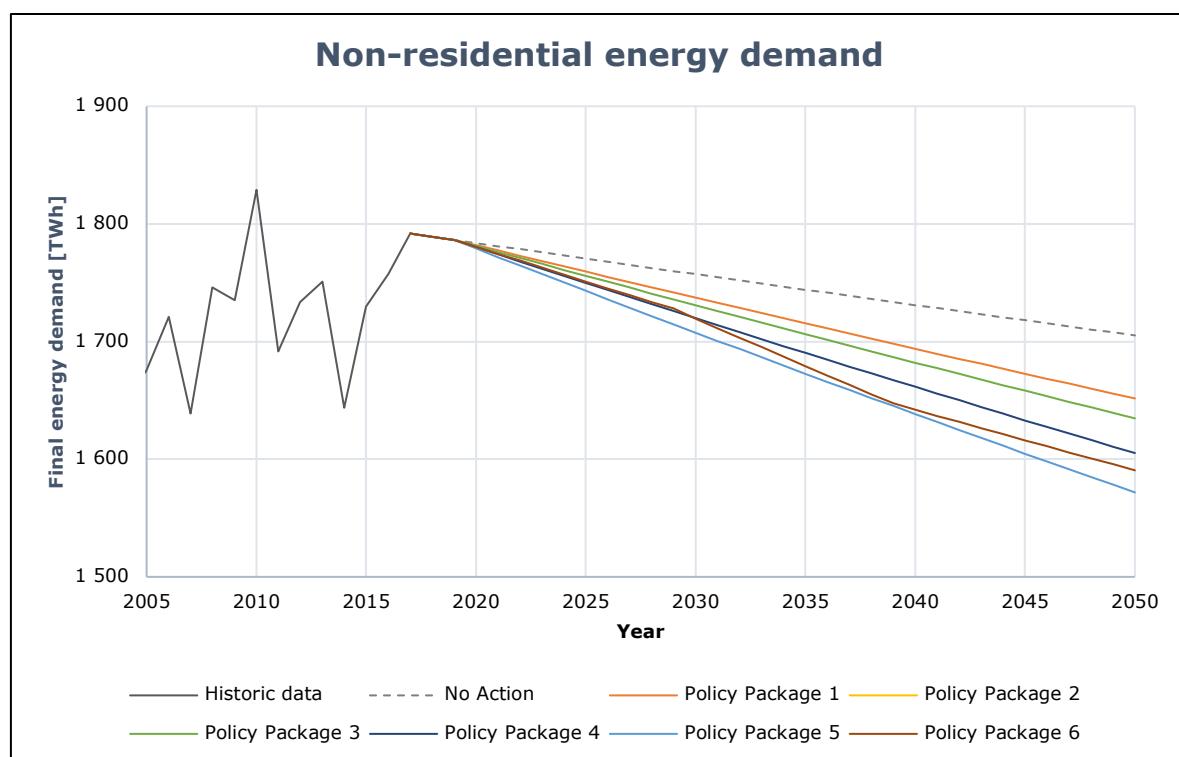


Figure 42: Non-residential energy demand. The historical data has not been normalised and shows the real energy consumption. The yearly variance can mainly be explained by climatic conditions, where, for example, "household energy consumption increased both in 2015 and 2016 mainly because the 2016 winter was slightly colder than that of 2015, which was, in turn, a bit colder than that of 2014" (see EEA).

⁷⁶ See for example this report: D'Agostino (2017) [Energy consumption and efficiency technology measures in European non-residential buildings](#)

CO₂ emissions

Energy use in buildings is responsible for over one-third (around 36%) of all CO₂ emissions in Europe. The impact on CO₂ emissions takes into account the energy use in residential and non-residential buildings. It is therefore heavily correlated to the final energy demand analysis. The results are divided based on residential and non-residential building stock.

The analysis only considers energy use and does not reflect the impact on embodied carbon⁷⁷.

Residential building stock

Figure 43 shows the relative impact of the different policy packages on the reduction of CO₂ emissions by 2050. The sectoral CO₂ emissions correlate with the final energy demand. The expected CO₂ emissions will be 8-9% lower by 2050 in policy packages 5 and 6 compared to the “no action” scenario, which amounts to around 30 million tonnes of CO₂. Policy package 4 reaches almost 6% and policy packages 1-3 ranges between 3% and 4%.

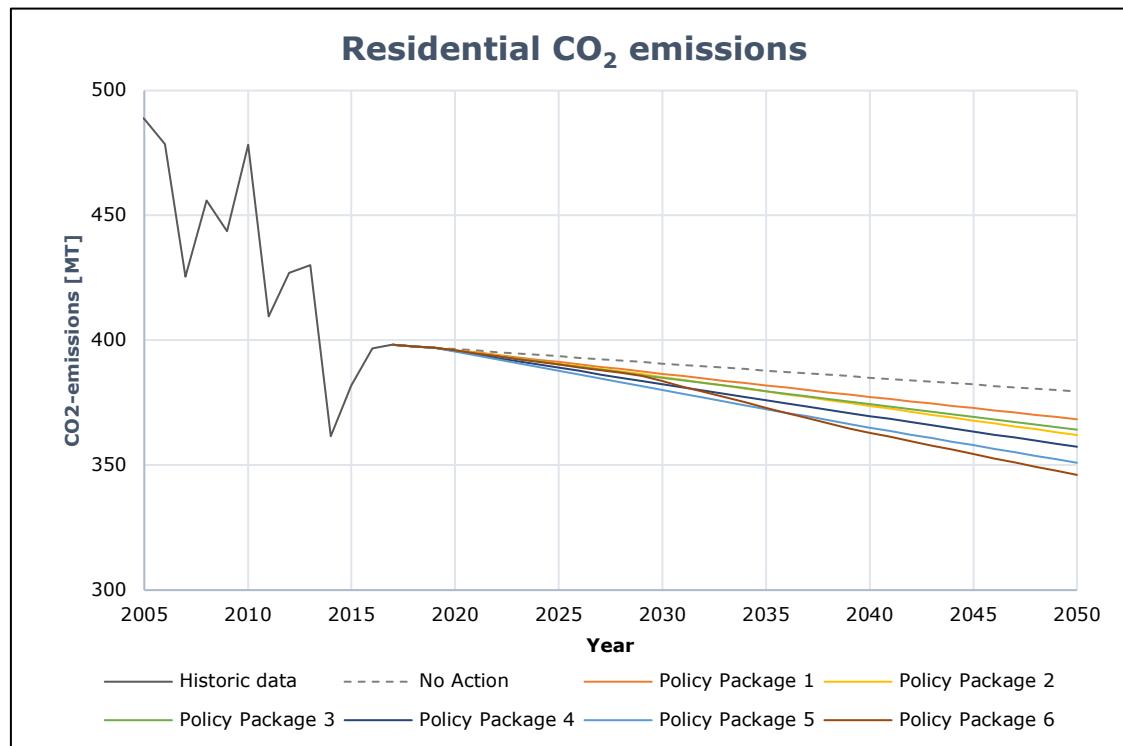


Figure 43: Residential CO₂ emissions. The historical data has not been normalised and shows the real CO₂-emissions.

⁷⁷ Embodied carbon is the impact of all the GHG emissions attributed to the materials throughout the building's life cycle (including manufacturing, construction, maintenance etc.).

Non-residential building stock

Figure 44 shows the relative impact of the policy packages on the CO₂ emissions savings achieved by 2050. The estimated impact correlates with the expected final energy savings. Policy package 5 is expected to result in the largest CO₂ emissions savings with almost 8%, amounting to almost 12 million tonnes of CO₂. Policy package 6 reaches almost 7% while policy package 2 and 4 achieves almost 6%. Policy packages 1 and 3 ranges between 4% and 5%.

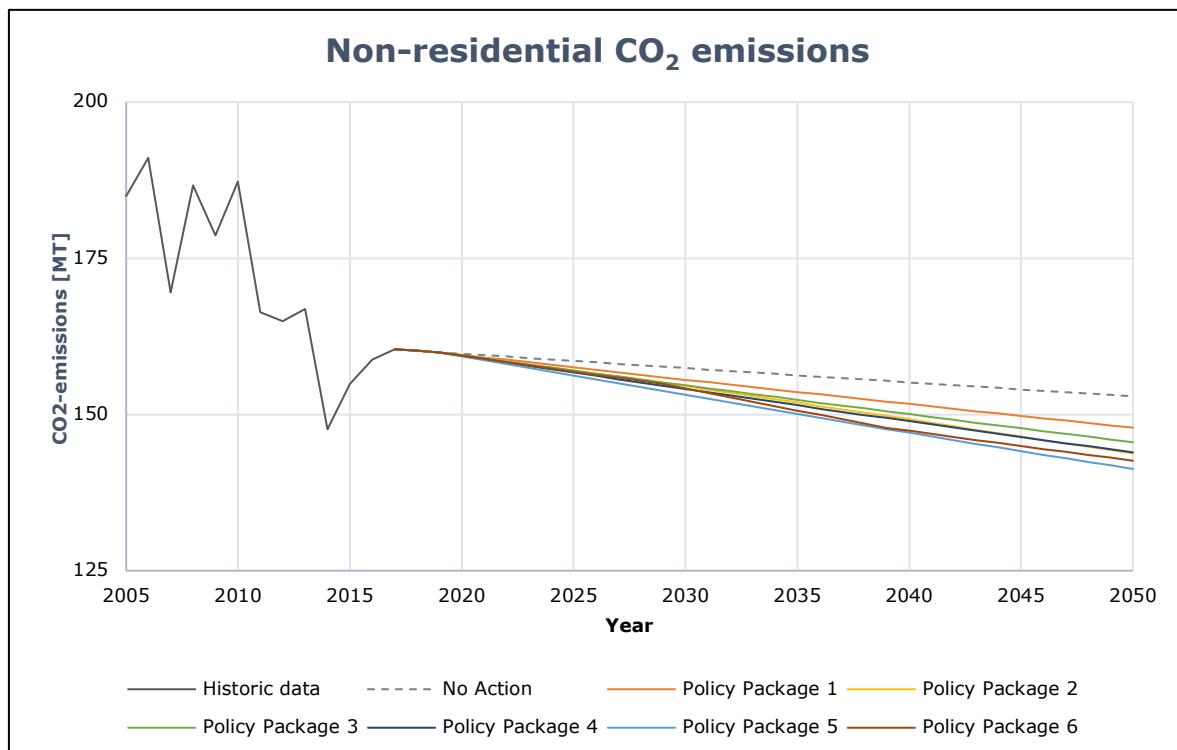


Figure 44: Non-residential CO₂ emissions savings. The historical data has not been normalised and shows real CO₂ emissions.

Residential energy expenditure

The residential sector accounts for about 27.2%⁷⁸ of the total final energy consumption in the EU. Most of the final energy consumption is covered by natural gas (36.0%) and electricity (24.1%), while the main use is for heating (64.1%).

The improvement in the sector's energy performance will facilitate a reduction of energy need and thus also residential energy expenditure. High energy expenditure can force households into energy poverty,⁷⁹ which is correlated with negative health effects and other societal problems. As described previously, the launch of BRPs would lead to a decrease in energy demand and thus reduce the related costs.

Figure 45 shows the relative impact of all the policy packages on the reduction of energy expenditure. Policy package 5 and 6 estimates that the EU's residential energy expenditure will be 23-€27 billion lower in 2050, due to the number of BRP renovations conducted by then.

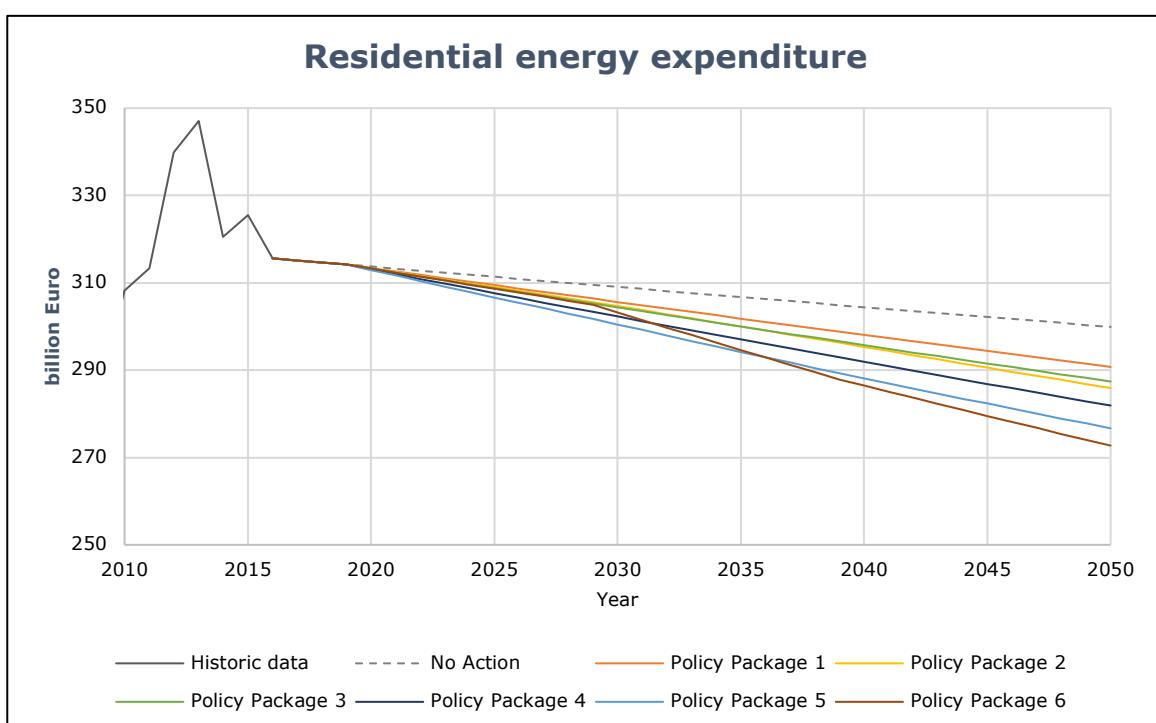


Figure 45: Residential energy expenditure. The calculation does not reflect on future changes in energy prices or any changes in the building stock that are not related to the BRPs. The historical data has not been normalised and shows the real energy expenditure. The yearly variance can mainly be explained by climatic conditions, where, for example, "household energy consumption increased both in 2015 and 2016 mainly because the 2016 winter was slightly colder than that of 2015, which was, in turn, a bit colder than that of 2014" (see EEA).

⁷⁸ <https://ec.europa.eu/eurostat/web/products-eurostat-news/-/DDN-20190620-1>

⁷⁹ Energy poverty occurs when a household suffers from a lack of adequate energy services in the home.

Estimated improvement of EPC ratings

The introduction of BRPs will influence the improvement of existing EPC ratings. A larger share of homeowners with lower energy ratings will get a BRP and renovate to improve the performance of their building. A relative estimation of the increase in EPC ratings is shown in Figure 46**Erreur ! Source du renvoi introuvable.**. By 2050 policy package 6 is expected to reduce EPC >D (E-F-G) rated buildings with more than 3%.

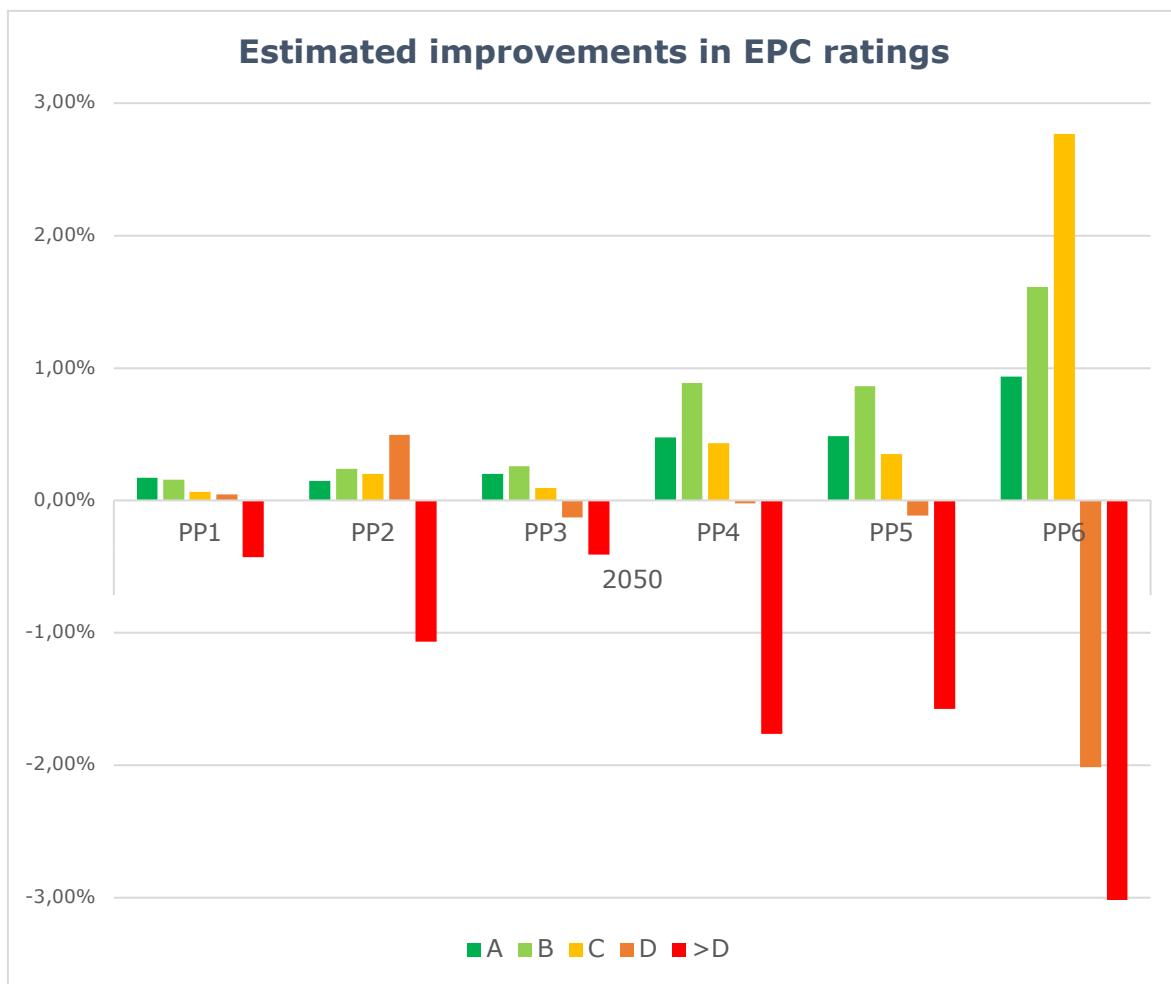


Figure 46: Estimated improvement in EPC ratings. The changes only consider BRP related renovations until 2050.

Health benefits

BRPs enable building owners to make wise renovation decisions, while also ensuring that measures supporting health and well-being are considered.

Suitably heated and cooled buildings will avoid drowsiness and help people to stay healthy and focussed. Achieving and even improving upon recommended levels for air quality such as minimum requirements for CO₂, particulate matter and volatile organic compounds reduces the likelihood of sick building syndrome. Adequate lighting improves activity levels, general health and sleep. Noise attenuation enables us to focus better and alleviates stress.

BRPs enable the building owners to make wise renovation decisions, while also ensure that measures supporting health and well-being are considered.

The number of sick days, or absenteeism, is a common predictor of reduced productivity on a macro level. Existing residential buildings and non-residential buildings (schools, offices etc.) with poor indoor environments affect the health of the occupants. Since BRPs would improve the renovation rate and the condition of the existing buildings, reduction in absenteeism is expected to bring cost gains. Figure 47 shows the relative impact of the six policy packages on absenteeism cost gains for the EU.

Policy package 6 includes supportive measures that, for example, mandate people to renovate the least efficient buildings. As the number of renovations of highly inefficient buildings is much higher in this package, so to are the possible health gains.

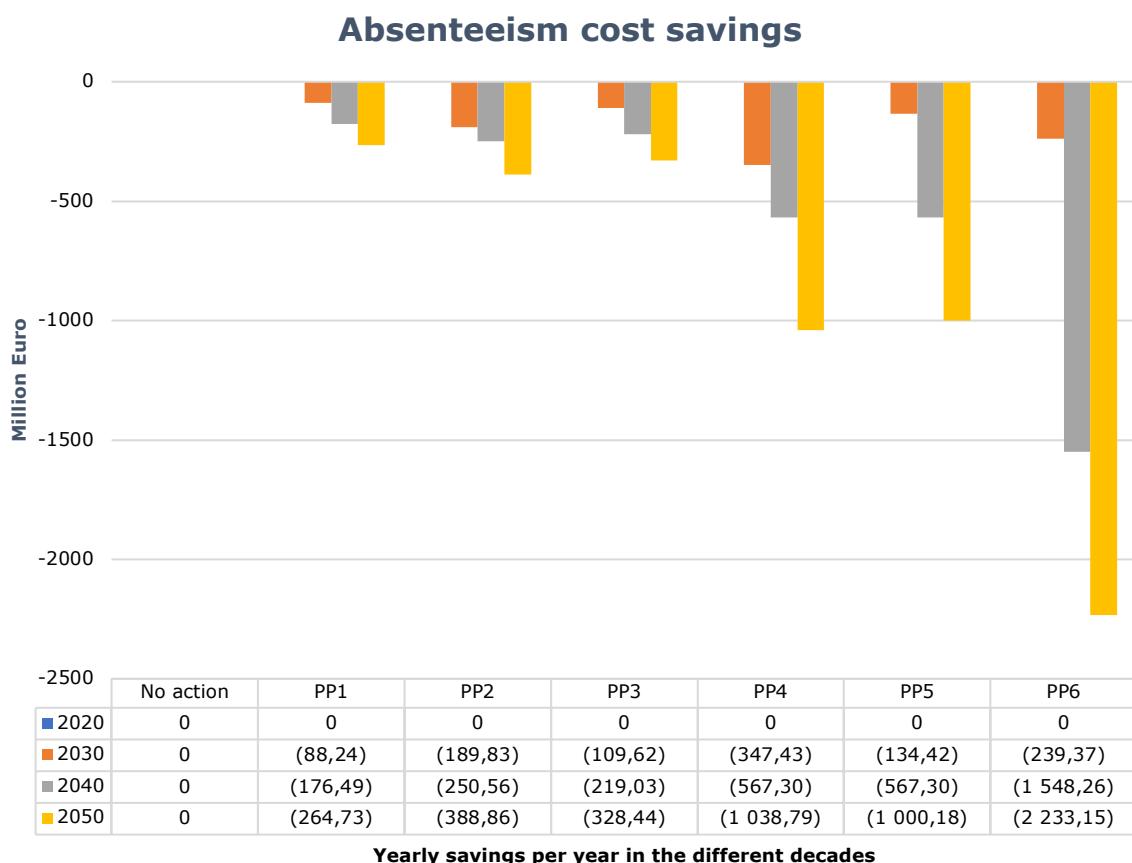


Figure 47: Absenteeism costs gains

Triggered private investments

Achieving a decarbonised building stock by 2050 will require renovation at a faster rate, which will need considerable investment, estimated at around €60-100 billion⁸⁰ annually up to 2020, and even more thereafter. Attracting private investment in building renovation is considered difficult; however, BRPs can play a key role in leveraging the private investments required for renovation. **Erreur ! Source du renvoi introuvable.** 22 shows the estimated annual triggered private investments.

Each policy package has a varied impact on mobilising private investments. Policy packages 2, 4, 5 and 6 indicate higher triggered private investments, ranging from €1.2 to €2 billion, compared to other policy packages.

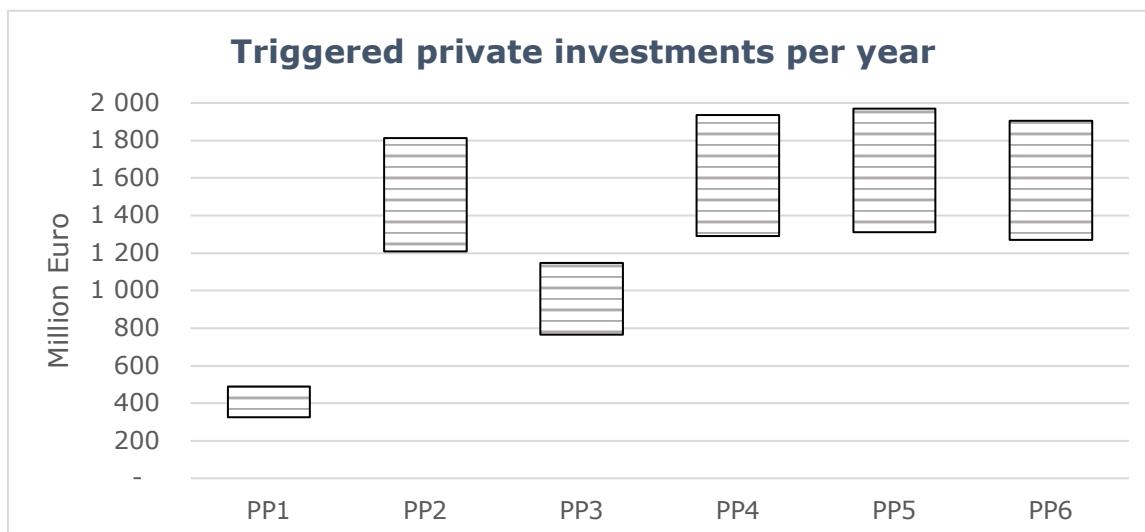


Figure 48: Triggered annual private investments, average for the 30 year period. The boxes indicate margin of error depending on the estimated investment cost per renovation which varies across the EU.

See Table 17 in Annex A: **Tables** for more detailed figures. The estimated investment cost (public, private and triggered) is based on real renovation services (see Annex C: Investment figures).

⁸⁰ See BPIE (2015) [Energy efficiency – the first fuel for the economy.](#)

Public investments required for different policy packages

The development and implementation of new instruments require sustainable funding from public and/or private sources to ensure the necessary funds for the design, testing and implementation of the project are available. This type of funding can take different forms – full public funding, private funding or a combination of the two. The costs presented in Table 2 are based on existing experiences in Germany and Flanders in Belgium.

The cost for expanding the existing EPC with a BRP in one new Member State, including analysis, testing and development, is estimated to fall in the range of €250,000 - €600,000. The communication cost depends on the size of the country but is estimated to be around €90,000 on average. The cost of training experts can be carried by either public or private actors, depending on the market situation in the country. The cost for training is estimated to be between 0 and €200,000 initially, followed by a lower annual cost.

It is likely that the cost of setting up a BRP would be lower in the policy packages that include best practices exchange, but this has not been possible to estimate.

Table 6: Total public investments required for the different policy packages (total for all the implementing Member States in million Euros)

	Cost for setting up a BRP	Communication and training activities	Subsidies (average per year)
PP1	2.25	0.45	57.77
PP2	4.05	0.81	337.52
PP3	3.15	0.63	No subsidies foreseen
PP4	4.95	0.99	113.06
PP5	11.70	2.34	107.98
PP6	11.70	12.34	1,252.74

Public funding can play a key role in leveraging private investments. The most common types of financing support are grants and favourable loans. Table 4 shows the investments required to prepare the BRPs.

Table 7: Estimated required subsidy cost per year for the preparation of the BRP in each decade

	million €	2020-2030	2031-2040	2041-2050
Total		74	77	85
PP1	Private	19	20	22
	Subsidy	54	57	62
	Total	117	488	771
PP2	Private	31	129	204
	Subsidy	86	359	567
	Total	87	90	98
PP3	Private	87	90	98
	Subsidy	No subsidies are foreseen		No subsidies are foreseen
	Total	149	152	160
PP4	Private	39	243	113
	Subsidy	109	112	118
	Total	86	173	181
PP5	Private	23	46	48
	Subsidy	63	128	133
	Total	77	3,650	1,384
PP6	Private	20	965	366
	Subsidy	56	2,684	1,018

Increase of on-site renewables

Integration of on-site renewables has been slow owing to a low renovation rate. It is assumed that the implementation of BRPs would support and increase the share of on-site renewables in the Member States. However, the uptake of on-site renewables will mainly depend on other factors, such as cost decreases, financial instruments and regulatory support/obligations.

Heat pumps

Figure 49 shows the impact of all the policy packages relative to the no-action scenario on the growth of the number of residential heat pumps. Policy package 6 reaches the highest impact by 2050, with almost 400,000 additional installations. The increase is estimated to be between 3% and 12% for the different policy packages.

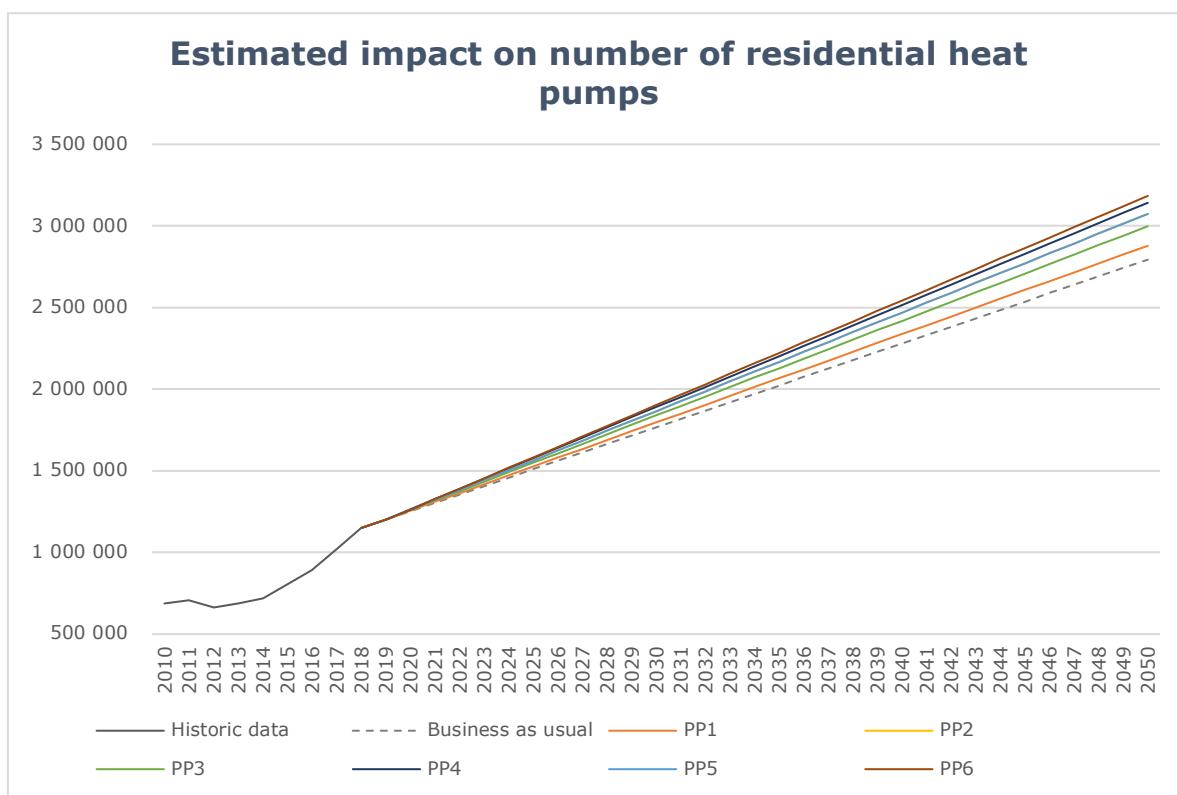


Figure 49: Estimated impact on residential heat pumps. "Business as usual" is based on historical data only.

Solar PV

The introduction of BRPs would also stimulate the uptake of solar PV in the residential sector, which is a common element of a deep renovation. The BRP is expected to increase awareness of what is required for a PV installation, as well as of its related benefits. If solar PV is included as a later step in the BRP, the earlier steps could make sure the building is adapted for this pending installation. For example, combining the insulation of the roof with making it solar PV compatible.

Figure 50 shows the impact of each policy package on the number of solar PV installations in the residential sector from 2020. Policy package 6 is expected to show the highest impact, achieving an increase of almost 9% in the estimated installed capacity installations by 2050. The increase in the total capacity of solar PV installations is estimated to range between 2% and 8% for the different policy packages.

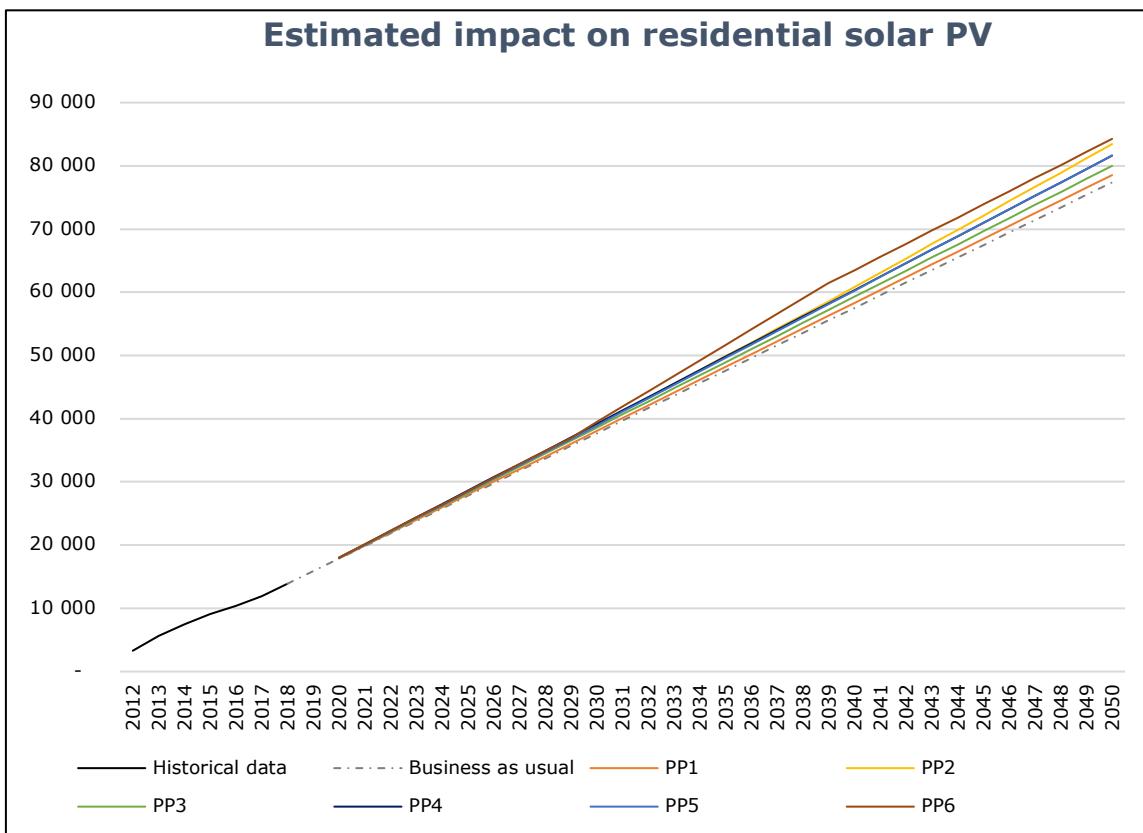


Figure 50: Estimated impact on Solar PV. Business as usual is based on historical data only.

3. Conclusion

One of the aims of the amended EPBD is to improve energy advice services across the EU. Existing BRPs have proven that the instrument is effective in providing renovation advice taking into account the long-term vision for the building stock. It has an effect on renovation rate (number of energy renovations), renovation depth (magnitude of the renovations), the timing of the works (people with a BRP tend to renovate earlier than they previously planned) and the quality of the works (fewer mistakes and unwise renovation decisions).

As described in the previous report, many aspects will influence the success of the BRP in the market. The design of the BRP is central but it has to be supported by trained experts, communication activities and financial mechanisms to be effective. While we have tried in this impact analysis to isolate the triggered effect of the policy packages, it has not been possible to separate the effect of the BPR from some of the supportive measures. This is especially true in policy package 6, where much of the total estimated effect is ascribed the far-reaching supportive measures rather than the BRP itself.

The relative impacts by 2050 of all the impact categories are summarised in Table 8. The table provides a realistic indication of the impact of the potential policy packages designed for implementation of BRPs.

- Policy package 6 reaches the highest combined energy savings, 403 TWh, largely due to far-reaching supportive measures, followed by policy package 5 at 380 TWh.
- The estimated CO₂ savings range from 16 to 43 million tonnes.

- Policy package 6 shows the largest reduction in residential energy expenditure, with over €27 billion in savings.
- Improvement in EPC rating >D and increase in corresponding BRPs is expected to be substantial for policy package 6 but also for policy package 2, 4 and 5.
- The estimated cost gain due to health benefits reaches more than 2 billion Euros annually in policy package 6 and around 1 billion annually in policy packages 4 and 5. This calculation only accounts for the reduction in sick days due to triggered BRPs; the significant other multiple benefits are not included.
- Triggered private investments can reach almost €2 billion per year for several policy packages.
- Residential solar-PV installations are expected to increase with 2-9% until 2050, while the impact on residential heat pumps ranges from 3-12%.

Table 8: Comparison of policy packages impact until 2050

	PP1	PP2	PP3	PP4	PP5	PP6
Residential energy savings [TWh]	89	141	125	185	247	289
Non-residential energy savings [TWh]	54	78	71	100	134	115
Residential CO₂-emission savings [Mio Ton]	11	17	15	22	29	33
Non-residential CO₂-emission savings [Mio Ton]	5	9	7	9	12	10
Residential energy expenditure reduction [m€]	9,159	13,996	12,506	17,996	23,231	27,175
Improvement in EPC ratings, decrease of >D)	-0.11%	-0.60%	-0.07%	-1.64%	-1.67%	-3.29%
Increase in BRPs [million]	2.9	52.3	11.3	22.1	18.6	159.1
Absenteeism cost gain [m€]	53	274	66	1,039	1,095	2,285
Triggered private investments [m€] (per year) average	326-489	1,208-1,812	765-1,148	1290-1,934	1,313-1,969	1,271-1,906
Public investments for policy packages [m€]	85	771	98	160	181	1384
Increase in PV installed capacity [MW]	1,157	6,063	2,619	4,247	4,261	6,891
Increase in HP installation [#]	84,839	280,088	204,828	348,315	280,187	390,779

Table 9 summarises the analysis in three key categories:

- (i) Impact: the impact on the EU for each of the policy packages
- (ii) Efficiency: the usefulness of the policy packages in mobilising the BRP instrument
- (iii) Costs: the cost-effectiveness of each policy package in realising the BRPs for the Member States

Table 9 Comparison of impact, efficiency and cost of each policy package

	PP1	PP2	PP3	PP4	PP5	PP6
Impact	Modest. Only five MS are expected to adopt the BRP. MS can tailor the instrument to the needs of their specific market and supportive measures provide clear incentives for building owners. The estimated impact per invested Euro is greater than in PP1.	Moderate. Nine MS are expected to adopt the BRP. MS can tailor the instrument to the needs of their specific market and supportive measures provide clear incentives for building owners. The estimated impact per invested Euro is greater than in PP1.	Modest. Seven MS implement BRPs but without subsidies for development. The common reference framework enables a more consistent development of BRPs across the EU. MS can still tailor the instrument to their specific market but are empowered by information and guidance documents. Lack of minimum requirements allows for ineffective BRPs.	Relatively high. 11 MS will implement the BRP. The common reference framework enables a more consistent development of BRPs across the EU. MS can tailor the instrument to their specific market but need to include certain aspects. Many MS would not adopt the instrument if it is perceived as too costly.	Relatively high. All MS would expand their EPCs with a BRP. Next EPBD review is in about seven years and it might not lead to a revision of the directive. MS with ineffective EPC framework must improve the whole system prior to expanding it.	High. The mandatory supportive measures would drive demand for deep renovation, while the BRP would include guidance and know-how. A clear indication to the market that it would have to adapt, including training of experts, innovative construction methods etc.

Efficiency	Moderate. The MS can tailor BRP to local factors but BRPs will be very diverse and little comparison will be feasible. Modest synergy and learning effects.	Moderate. The BRPs will be developed in different directions. The risk that some BRP frameworks won't be optimally designed and comparison with other schemes could be difficult.	Moderate/high. No subsidies are provided. Building owners getting a BRP are very interested in the service.	Moderate/high. Impact per BRP is relatively high due to enabling measures.	Relatively high. The package incentivises building owners to get a BRP and follow its recommendations.	Low. Most building owners are obliged to get a BRP/renovate. A large share won't renovate more than required to comply with legislation.
Cost	Low	Moderate	Low	Moderate	Moderate	High

Key takeaways

- All the policy packages are expected to trigger considerable energy and CO₂ emission savings. The energy demand in the residential sector is estimated to be 3-10% lower by 2050 than in the absence of BRPs.
- The impact of the BRP will be limited unless it is embedded with financial, regulatory and informational instruments. BRPs alone, without any of the enabling conditions and measures outlined in this report, are expected to have a limited impact.
- The potential impact of BRPs on renovation activity is largely threefold:
 - It entices building owners with no previous intention to renovate to invest in energy efficiency measures
 - It enhances the quality, performance and overall depth of the renovation measures
 - It triggers people that have planned to renovate to do so earlier.
- The BRP does not only triggers additional investment/savings but reduces the wrong implementation of single measures and technical lock-ins, thus saving investment cost and sunk costs.
- The potential for BRPs is very contingent on how the Member States design the BRP and how it is integrated into the wider policy framework.

Stakeholder feedback

- A couple of stakeholders noted that the impact on indoor environmental quality is an important factor which must be included in the calculations. The French example shows that, due to its complex nature, indoor air quality is difficult, though not impossible, to consider in the definition and calculations.
- Building owners must be at the centre of the BRP design, as they are the ones who demand the building renovation. The auditor has a critical role to play in this, defining how to best meet the specific owner's needs and create demand for the BRP. The auditor should design an instrument that is good enough to alleviate barriers without compromising the homeowner's needs.
- The BRP framework itself does not need to be rigid but needs to include guidance on how to use the BRP, what are the starting points/objectives, etc.
- Stakeholders saw an interesting opportunity for enlarging the scope of EPCs by illustrating reasons for renovation to increase the conversion rate with triggers that go beyond energy savings.
- A fundamental condition for the success of the BRP is to ensure the perceived and actual quality of both EPCs and the BRP. Stakeholders noted that the level

of trust in the EPC schemes currently varies from country to country. Additional training will be necessary to cater to changing requirements and to improve quality but is not the only measure required. Among others, there is a clear link between energy efficiency and property price, demonstrating an improved trust in the EPCs.

- It was noted that the inspectors' qualifications for the BRP will be more demanding than those for the EPC. This is considered by some stakeholders an opportunity for improvement. The BRP should be seen by building owners as a tool complementary to the EPC, that aims to guide them in their decision-making.
- Stakeholders also emphasised the potential of linking the BRP with one-stop-shops for building renovation and using it to facilitate renovations for multi-apartment buildings.

Annex A: Tables

Number of BRPs

Table 10: The estimated increase in BRPs for all policy packages

	PPO No action	PP1 [million]	PP2 [million]	PP3 [million]	PP4 [million]	PP5 [million]	PP6 [million]
Increase in BRPs by 2030	-	1.0	6.0	3.4	7.1	4.1	13.3
Increase in BRPs by 2040	-	2.0	24.9	6.9	13.8	11.2	114.5
Increase in BRPs by 2050	-	2.9	53.2	11.1	21.1	18.6	159.1

Residential energy savings

Table 11: Created energy savings results for the residential sector for all policy packages

	No action	PP1 [TWh]	PP2 [TWh]	PP3 [TWh]	PP4 [TWh]	PP5 [TWh]	PP6 [TWh]
Energy savings by 2030	-	33.2	44.0	46.6	69.4	91.3	61.6
Energy savings by 2040	-	61.9	91.5	86.6	128.8	173.6	191.3
Energy savings by 2050	-	88.9	141.0	124.5	185.0	246.9	288.8

Non-residential building

Table 12: Energy savings results for the non-residential sector for all policy packages

	No action	PP1 [TWh]	PP2 [TWh]	PP3 [TWh]	PP4 [TWh]	PP5 [TWh]	PP6 [TWh]
Energy savings by 2030	-	20.0	23.8	26.4	37.5	49.6	37.6
Energy savings by 2040	-	37.2	49.9	49.0	69.6	92.7	88.9
Energy savings by 2050	-	53.6	77.9	70.5	100.0	133.5	114.7

CO₂-emissions for residential buildings

Table 13: CO₂-emissions results for the residential sector for all policy packages

	No action	PP1 [Mio Ton]	PP2 [Mio Ton]	PP3 [Mio Ton]	PP4 [Mio Ton]	PP5 [Mio Ton]	PP6 [Mio Ton]
CO₂-emission savings by 2030	-	4.2	5.4	5.7	8.3	10.5	7.1
CO₂-emission savings by 2040	-	7.7	11.3	10.6	15.4	20.1	22.1
CO₂-emission savings by 2050	-	11.1	17.4	15.3	22.1	28.5	33.4

CO₂-emissions for non-residential buildings

Table 14: CO₂-emissions results for the non-residential sector for all policy packages

	No action	PP1 [Mio Ton]	PP2 [Mio Ton]	PP3 [Mio Ton]	PP4 [Mio Ton]	PP5 [Mio Ton]	PP6 [Mio Ton]
CO₂-emission savings by 2030	-	1.9	2.9	2.7	3.4	4.3	3.3
CO₂-emission savings by 2040	-	3.5	5.9	5.1	6.2	8.1	7.8
CO₂-emission savings by 2050	-	5.0	9.1	7.3	9.0	11.6	10.3

Residential energy expenditure

Table 15 Residential energy expenditure reduction results for all the policy packages

	No action	PP1 [m€]	PP2 [m€]	PP3 [m€]	PP4 [m€]	PP5 [m€]	PP6 [m€]
Energy expenditure reduction by 2030	-	3,421	4,368	4,678	6,753	8,588	5,798
Energy expenditure reduction by 2040	-	6,366	9,085	8,698	12,535	16,338	17.996
Energy expenditure reduction by 2050	-	9,159	13,996	12,506	17,996	23,231	27.175

Health benefits

Table 16: Absenteeism costs gain per year

	No action	PP1 [m€]	PP2 [m€]	PP3 [m€]	PP4 [m€]	PP5 [m€]	PP6 [m€]
Cost gain by 2020	-	-	-	-	-	-	-
Cost gain by 2030	-	17.29	36.42	20.94	322.14	293.40	239.37
Cost gain by 2040	-	34.57	138.16	41.67	694.13	694.13	1548.26
Cost gain by 2050	-	51.86	273.63	62.40	963.22	1094.86	2233.15

Table 17: Triggered private investments per year over a decade (in Euros). Investments in policy package 6 declines in pace after 2040 as the mandatory measures introduced in 2030 peak in terms of impact around 2040.

	2021-2030	2031-2040	2041-2050
PP1	366,294,464	404,427,741	453,013,220
PP2	1,255,841,016	1,325,363,230	1,948,891,055
PP3	918,397,675	947,035,955	1,004,933,651
PP4	1,571,695,246	1,601,735,400	1,662,467,248
PP5	1,256,285,267	1,832,945,211	1,832,945,211
PP6	1,388,286,862	2,741,974,890	634,303,527

Annex B: Further elaboration of the assumptions behind the policy packages

Policy Package 1

Policy options	Ref	Type	Description/Assumptions		Impact on BRPs	Source/rationale
MS decide whether to design and implement BRP	R.1	Direct	Effect of current provisions depend on voluntary measures and how BRP is promoted	No effect	None for standalone measure	The policy option assumes that no future action is taken on the BRP from the EU's side. This is the status quo.
Encourage BRP in LTRS (EPBD art. 2a)	R.1	Supportive	5 additional MS will implement a BRP by 2030 due to increased focus on BRP (assumption based on current developments is that France, Ireland, Denmark, Netherlands and Portugal are the first followers). Implementation will differ in design and impact.	Indirect effect	The number of BRPs = 6% of the number of issued EPCs in the implementing MSs. 90% of building owners in these MS that have obtained a BRP with a low EPC rating (E-F-G) will implement, at least, <u>one measure</u> (D=70%, C=32%, B=30%).	Based on discussions with national experts and energy agencies. A "soft" encouragement is likely to influence a few MS that already considered the possibility of implementing a BRP. <ul style="list-style-type: none"> • iBRoad (2018) Understanding potential user needs [link] • Epinion (2016) Brugerundersøgelse af energimærkeordningen (in Danish) [Link]
Introduce a communication campaign to increase awareness of the BRP	C.2	Supportive	Communication campaign increases awareness and demand for BRPs in MS where they are available.	Enabling effect	Evidence on that communication campaigns is vital to get people aware of the instrument. Especially if not linked to existing provisions. The impact will only be 80% without communication measures.	<ul style="list-style-type: none"> • France in JRC (2016) Effective information measures to promote energy use reduction in the EU Member States [link] • Hamburg communication campaign on German BRP. Expert insight.
Qualification and training programmes for energy experts and auditors	T.2	Supportive	Training of experts does not increase the number of BRPs or renovation rate. But enables uptake of both. Training is needed to carry out BRPs and make them effective.	Enabling effect	Based on evidence showing a lack of expertise in deep renovation/advice. the impact will only be 80% without training activities.	<ul style="list-style-type: none"> • Fit-to-NZEB (2018) D2.1 Analysis of existing training programmes on deep energy retrofit [link] • QUALICHECK project [link]
Encourage MS to set up financial support schemes to subsidise the cost for the BRP	F.5	Supportive	This measure will increase the uptake of BRP. All MS implementing BRPs will subsidise the cost for the instrument.	Enabling effect	The number of issued BRP would decrease with 50% if the cost for issuing a BRP was not included (share of people getting a BRP in BR that saw the subsidy as decisive or very important). We assume that the BRP is subsidies so that it cost 100 EUR for the homeowner.	<ul style="list-style-type: none"> • IFEU (2018) Evaluation des Erneuerbare-Wärme-Gesetzes (EWärmeG) [link]

Policy Package 2

Policy options	Ref.	Type	Description/ Assumptions	Impact on BRPs	Source/rationale
MS decide whether to design and implement BRP (stringent)	R.1	Direct	Effect of current provisions depend on voluntary measures and how BRP is promoted	No effect	None for standalone measure The policy option assumes that no future action is taken on the BRP from EU's side. Status quo.
Encourage BRP in LTRS (EPBD art. 2a)	R.1	Supportive	9 additional MS will implement a BRP by 2030 due to increased focus on BRP (In addition to MSs in PP1, Sweden, Austria, Italy and UK follow due to R.1 in combination with F8 and R.6, which contributes to a larger focus on the instrument). Implementation will differ in design and impact.	Indirect effect	Number of BRPs in the implementing MS = 7% of number of issued EPCs in the implementing MSs. 90% of building owners in these MS that have obtained a BRP with a low EPC rating (E-F-G) will implement at least one measure (D=70%, C=32%, B=30%). Based on discussions with national experts and energy agencies. A "soft" encouragement is likely to influence a few MS that already considered the possibility of implementing a BRP. <ul style="list-style-type: none">• iBRoad (2018) Understanding potential user needs [link]• Epinion (2016) Brugerundersøgelse af energimærkeordningen (in Danish) [Link]
Introduce a communication campaign to increase awareness of the BRP	C.2	Supportive	Communication campaign increases awareness and demand for BRPs in MS where they are available.	Enabling effect	Evidence suggest that communication campaigns are vital to get people aware of the instrument. Especially if not linked to existing provisions. The impact will only be 80% without communication measures. <ul style="list-style-type: none">• France in JRC (2016) Effective information measures to promote energy use reduction in EU Member States [link]• Hamburg communication campaign on German BRP. Expert insight.
Qualification and training programmes for energy experts and auditors	T.2	Supportive	Training of experts do not increase the number of BRPs or renovation rate. But enables an uptake of both. Training is needed to carry out BRPs and make them effective.	Enabling effect	Based on evidence showing lack of expertise in deep renovation/advice. the impact will only be 80% without training activities. <ul style="list-style-type: none">• Fit-to-NZEB (2018) D2.1 Analysis of existing training programmes on deep energy retrofit [link]• QUALICHeCK project [link]
Encourage MS to set up financial support schemes to subsidise the cost for the BRP	F.5	Supportive	This measure will increase the uptake of BRP. All MS implementing BRPs will subsidise the cost for the instrument.	Enabling effect	Number of issued BRP would decrease with 50% if the cost for issuing a BRP was not included (share of people getting a BRP in BR that saw the subsidy as decisive or very important). We assume that the BRP is subsidies so that it cost 100 EUR for the houseowner. <ul style="list-style-type: none">• IFEU (2018) Evaluation des Erneuerbare-Wärme-Gesetzes (EWärmeG) [link]
Encourage financial institutions to offer lower interest rate on loans taken for measures linked to a BRP	F.8	Supportive	EU Commission establishes a technical assistance facility for a lower interest rate for deep renovation steps. Only banks/financial inst. in BRP MS are eligible.	Indirect effect	All the MS with BRPs have projects that take part of the technical facility by 2030, which leads to lower interest rates for deep (staged) renovation. A considerable lowering of the interest rates is not realistic given the existing low interest rate environment. A reduction of 0.5%-1% is assumed to have a limited effect. We assume that the it will increase BRP related renovation investments with 5%. <ul style="list-style-type: none">• European Commission (2016) Evaluation of the Project Development Assistance implemented under the Intelligent Energy Europe [link]• Schmidt et al. (2019) Adverse effects of rising interest rates on sustainable energy transitions [Link]
BRP mandatory for certain building segment (EPC rating, buildings for sale etc.) after 2030	R.6	Mandatory	Number of BRPs follow the number of issued EPCs from 2030 in BRP-countries.	Direct effect	Strong increase of BRPs in MS where the instrument is implemented. Number of BRPs in implementing MS follows the number of EPCs below label D. Rationale.

Policy Package 3

Policy options	Ref	Type	Description/Assumptions	Impact on BRPs		Source/rationale
Introduce a common reference framework (soft)	R.2	Direct	The effect on the number of MS implementing BRPs is minor but improves the overall quality of the implemented BRPs.	Indirect effect	Enable a more homogenous and streamlined implementation across the EU. The learning curve is expected to rise in this package.	
Encourage BRP in LTRS (EPBD art. 2a)	R.1	Supportive	7 additional MS will implement a BRP by 2030 due to increased focus on BRP. (In addition to MSs in PP1, Sweden and UK follow due to R.2 in combination C3/G3 which contributes to a larger focus on the instrument).	Indirect effect	The number of BRPs = 8% of the number of issued EPCs in the implementing MSs. 90% of building owners in these MS that have obtained a BRP with a low EPC rating (E-F-G) will implement at least one measure (D=70%, C=32%, B=30%).	Based on discussions with national experts and energy agencies. A "soft" encouragement is likely to influence a few MS that already considered the possibility of implementing a BRP. <ul style="list-style-type: none"> iBRoad (2018) Understanding potential user needs [link] Epinion (2016) Brugerundersøgelse af energimærkeordningen (in Danish) [Link]
Introduce a communication campaign to increase awareness of the BRP	C.2	Supportive	Communication campaign increases awareness and demand for BRPs in MS where they are available.	Enabling effect	Evidence suggests that communication campaigns are vital to get people aware of the instrument. Especially if not linked to existing provisions. The impact will only be 80% without communication measures.	<ul style="list-style-type: none"> France in JRC (2016) Effective information measures to promote energy use reduction in the EU Member States [link] Hamburg communication campaign on German BRP. Expert insight.
Qualification and training programmes for energy experts and auditors	T.2	Supportive	Training of experts does not increase the number of BRPs or renovation rate. But enables uptake of both. Training is needed to carry out BRPs and make them effective.	Enabling effect	Based on evidence showing a lack of expertise in deep renovation/advice. the impact will only be 80% without training activities.	<ul style="list-style-type: none"> Fit-to-NZEB (2018) D2.1 Analysis of existing training programmes on deep energy retrofit [link] QUALICHeCK project [link]
Establish a forum for best practices exchange	B.1	Supportive	Enables a more effective implementation of BRPs	Enabling effect	Increases synergies and learnings across the EU. Not possible to derive figures on how it will influence renovation and number of BRPs. Positive impact on the learning curve.	European wide: EPBD CA National: BEBO in Sweden
Develop a guidance document outlining how a BRP can be combined with a logbook	G.7	Supportive	No effect on uptake of BRPs but likely to increase the number of logbooks and thus also add value to the BRP instrument.	Enabling effect	Not possible to derive figures on how it will affect BRPs.	n/a
Support BRP through regional energy advice centres and one-stop shops	C.3, G.3	Supportive	Increase in awareness causes an increase of investments in renovations in MS with BRPs	Indirect effect	<ul style="list-style-type: none"> 1 Euro of public funds spent on these programmes reduced energy consumption by between 118 and 213 kWh through renovation measures. Size of programme TBC. 1 Euro of public funds spent triggers between €6.04 and €14.63 of private investments in energy-saving measures 	<ul style="list-style-type: none"> BAFA (2017) Evaluation der Energiesparberatung und Energie-Checks der Verbraucherzentralen [link]

					<ul style="list-style-type: none"> Effect on BRP is indirect due to higher demand for renovation. 	
Guidance document of how to integrate the BRP into existing EPC, energy audit schemes	G.1	Supportive	No effect on uptake of BRPs but likely to increase the quality of implemented schemes.	Enabling effect	Not possible to derive figures on how it will affect BRPs.	n/a

Policy Package 4

Policy options	Ref.	Type	Description/Assumptions		Impact on BRPs	Source/rationale
Incorporate BRPs as a requirement under the EPBD (soft)	R.3	Direct	The effect on the number of BRPs is minor but improves the overall quality of the implemented BRPs		Enable a more homogenous and streamlined implementation across the EU	
Encourage BRP in LTRS (EPBD art. 2a)	R.1	Supportive	11 additional MS will implement a BRP by 2030 due to increased focus on BRP. Support from additional instruments is required. Implementation will differ in design and impact.		The number of BRPs = 10% of the number of issued EPCs in the implementing MSs. 90% of building owners in these MS that have obtained a BRP with a low EPC rating (E-F-G) will implement at least one measure (D=70%, C=32%, B=30%).	Based on discussions with national experts and energy agencies. A "soft" encouragement is likely to influence a few MS that already considered the possibility of implementing a BRP.
Introduce a communication campaign to increase awareness of the BRP	C.2	Supportive	Communication campaign increases awareness and demand for BRPs in MS where they are available.		Evidence suggests that communication campaigns are vital to get people aware of the instrument. Especially if not linked to existing provisions. The impact will only be 80% without communication measures.	<ul style="list-style-type: none"> France in JRC (2016) Effective information measures to promote energy use reduction in the EU Member States [link] Hamburg communication campaign on German BRP. Expert insight.
Qualification and training programmes for energy experts and auditors	T.2	Supportive	Training of experts does not increase the number of BRPs or renovation rate. But enables uptake of both. Training is needed to carry out BRPs and make them effective.		Based on evidence showing a lack of expertise in deep renovation/advice. the impact will only be 80% without training activities.	<ul style="list-style-type: none"> Fit-to-NZEB (2018) D.2.1 Analysis of existing training programmes on deep energy retrofit [link]
EU Commission establish a technical assistance facility to help MS to introduce a financial bonus that is triggered when a certain percentage of stages in the BRP has been implemented	F.3	Supportive	EU Commission establishes a technical assistance facility for setting up a financial bonus linked to BRPs.		Renovation investment per issued BRP increased with an average of 5 percentage points.	<ul style="list-style-type: none"> Tübingen in Germany. Experts and project managers believe the limited impact in Tübingen is due to lack of communication/awareness of the programme.
Encourage MS to set up financial support schemes to subsidise the cost for the BRP	F.5	Supportive	This measure will increase the uptake of BRP. All MS implementing BRPs will subsidise the cost for the instrument.		The number of issued BRP would decrease with 50% if the cost for issuing a BRP was not included (share of people getting a BRP in BR that saw the subsidy as decisive or very important). We assume that the BRP is subsidies so that it cost 100 EUR for the homeowner.	<ul style="list-style-type: none"> IFEU (2018) Evaluation des Erneuerbare-Wärme-Gesetzes (EWärmeG) [link]

Develop a guidance document outlining how a BRP can be combined with a logbook	G.7	Supportive	No effect on uptake of BRPs but likely to increase the number of logbooks and thus also add value to the BRP instrument.	Enabling effect	Not possible to derive figures on how it will affect BRPs.	n/a
Guidance document of how to integrate the BRP into existing EPC, energy audit schemes	G.1	Supportive	No effect on uptake of BRPs but likely to increase the quality of implemented schemes.	Enabling effect	Not possible to derive figures on how it will affect BRPs.	n/a
Common EU framework for certification of building experts carrying out BRPs	R.1 0	Mandatory	Improve the quality of BRPs and renovations	Enabling effect	Not possible to derive evidence.	n/a

Policy Package 5

Policy options	Ref	Type	Description/ Assumptions	Impact on BRPs	Source/rationale
Incorporate BRPs as a requirement under the EPBD (soft)	R.3	Direct	All MS implements optional BRPs	Direct effect All MS implements optional BRPs by 2030 due to the revised EPBD text.	Rationale.
Introduce a communication campaign to increase awareness of the BRP	C.2	Supportive	Communication campaign increases awareness and demand for BRPs in MS where they are available.	Enabling effect Evidence suggests that communication campaigns are vital to get people aware of the instrument. Especially if not linked to existing provisions. The impact will only be 80% without communication measures.	<ul style="list-style-type: none"> France in JRC (2016) Effective information measures to promote energy use reduction in the EU Member States [link] Hamburg communication campaign on German BRP. Expert insight.
Qualification and training programmes for energy experts and auditors	T.2	Supportive	Training of experts does not increase the number of BRPs or renovation rate. But enables uptake of both. Training is needed to carry out BRPs and make them effective.	Enabling effect Based on evidence showing a lack of expertise in deep renovation/advice. the impact will only be 80% without training activities.	Fit-to-NZEB (2018) D2.1 Analysis of existing training programmes on deep energy retrofit [link] QUALICHeCK project [link]
EU Commission establish a technical assistance facility help MS to introduce progressive funding - or tax support - for packages of measures (or individual measures) as recommended by the BRP	F.2	Supportive	EU Commission establishes a technical assistance facility for setting up a tax support scheme for BRP.	Indirect impact This measure incentivises homeowners to invest in more than single measures, which influences the share of homeowners with BRPs that will fulfil all the steps. It is assumed not to have a significant effect on the number of BRPs.	No experience exists. Figure based on expert input.
EU Commission establish a technical assistance facility help MS to introduce a financial bonus that is triggered when a certain percentage of stages in the BRP has been implemented	F.3	Supportive	EU Commission establishes a technical assistance facility for setting up a financial bonus linked to BRPs.	Indirect effect This measure incentivises homeowners to invest in more than single measures, which influences the share of homeowners with BRPs that will fulfil all the steps. It is assumed not to have a significant effect on the number of BRPs.	<ul style="list-style-type: none"> Tubingen in Germany. Experts and project managers believe the limited impact in Tubingen is due to lack of communication/awareness of the programme.
Encourage MS to set up financial support schemes to subsidise the cost for the BRP	F.5	Supportive	This measure will increase the uptake of BRP. All MS implementing BRPs will subsidise the cost for the instrument.	Enabling effect The number of issued BRP would decrease with 50% if the cost for issuing a BRP was not included (share of people getting a BRP in BR that saw the subsidy as decisive or very important). We assume that the BRP is subsidised so that it cost 100 EUR for the homeowner.	<ul style="list-style-type: none"> IFEU (2018) Evaluation des Erneuerbare-Wärme-Gesetzes (EWärmeG) [link]

Establish a forum for best practices exchange	B.1	Supportive	Enables a more effective implementation of BRPs	Enabling effect	Increases synergies and learnings across the EU. Not possible to derive figures on how it will influence renovation and number of BRPs. Positive impact on the learning curve.	European wide: EPBD CA National: BEBO in Sweden
Develop a guidance document outlining how a BRP can be combined with a logbook	G.7	Supportive	No effect on uptake of BRPs but likely to increase the number of logbooks and thus also add value to the BRP instrument.	Enabling effect	Not possible to derive figures on how it will affect BRPs.	n/a
Guidance document of how to integrate the BRP into existing EPC, energy audit schemes	G.1	Supportive	No effect on uptake of BRPs but likely to increase the quality of implemented schemes.	Enabling effect	Not possible to derive figures on how it will affect BRPs.	n/a

Policy Package 6

Policy options	Ref.	Type	Description/ Assumptions	Impact on BRPs	Source/rationale
Incorporate BRPs as a requirement under the EPBD (soft)	R.3	Direct	All MS implements optional BRPs	Direct effect All MS implements optional BRPs by 2030 due to the revised EPBD text.	Rationale.
Introduce a communication campaign to increase awareness of the BRP	C.2	Supportive	Communication campaign increases awareness and demand for BRPs in MS where they are available.	Enabling effect Evidence suggests that communication campaigns are vital to get people aware of the instrument. Especially if not linked to existing provisions. The impact will only be 80% without communication measures.	<ul style="list-style-type: none"> France in JRC (2016) Effective information measures to promote energy use reduction in the EU Member States [link] Hamburg communication campaign on German BRP. Expert insight.
Qualification and training programmes for energy experts and auditors	T.2	Supportive	Training of experts does not increase the number of BRPs or renovation rate. But enables uptake of both. Training is needed to carry out BRPs and make them effective.	Enabling effect Based on evidence showing the lack of expertise in deep renovation/advice. the impact will only be 80% without training activities.	<ul style="list-style-type: none"> Fit-to-NZEB (2018) D2.1 Analysis of existing training programmes on deep energy retrofit [link] QUALICHeCK project [link]

Introduce a minimum energy efficiency standard for renovation	R.9	Mandatory	Introduce requirements in the next EPBD revision defining a primary energy demand threshold for buildings above which a building must be renovated, which increase over time	Direct effect	All EPC F-G must renovate at least until 2035, E until 2040 and D until 2050. Interlinked with R.7.	<ul style="list-style-type: none"> BPIE, RAP (2019) Minimum Energy Efficiency Standards for a fair energy transition [link] UK experience [link]
Make the BRP mandatory for all buildings with EPC from class E and below by 2030, which could be regularly strengthened	R.5	Mandatory	The number of BRPs follows the number of issued EPCs from 2030 in BRP-countries.	Direct effect	BRP mandatory for all buildings with an EPC F-G must equip a BRP by 2032, E until 2038 and C-D until 2045.	Rationale.
BRP mandatory for every building sold after 2030	R.6	Mandatory	The number of BRPs follows the number of issued EPCs from 2030 in BRP-countries.	Direct effect	BRP mandatory when building sold from 2030 = same as EPC. Rate of BRP = rate of issued EPCs (- new built). Minus the buildings covered by R.5.	Rationale.
Buildings with EPC below class D can only be sold if step 1-2 of renovation roadmap implemented by 2030	R.7	Mandatory	Encourages people to invest in energy renovations before they are obliged to.	Direct effect	All EPC F-G must be renovated if sold after 2030, E after 2035 and C-D after 2040.	Rationale.

Annex C: Investment figures

Average investment per renovation		
	Average investments	Average energy saving
Single-family house		
BetterHome	€ 70,000	50%
Superhomes	€ 50,000	71%
Picardie pass	€ 43,000	54%
Oktave	€ 80,000	62%
CEREMA renovations Alsace	€ 68,000	67%
Average	€ 54,333	61%
Estimated BRP investments	€ 40,214	Assumed: 45%
Public investment	€ 5,630	14%
Triggered private investment	€ 8,043	
Multi-family dwelling		
Picardie pass	€ 15,400	54%
Estimated BRP investments	€ 13,546	Assumed: 45%
Public investment	€ 2,156	14%
Triggered private investment	€ 2,709	

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