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Policy options for residential housing in Europe: Scaling energy renovation at multi-building level

Deliverable 5.5 within the project DREEAM task 5.4

Deliverable 5.5

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List of abbreviations

Art.	Article
BAT	Best Available Technology
CA	Concerted Action
CHP	Combined Heat and Power
CO_2	Carbon dioxide
COM	European Commission
DG	Directorate General
DSO	Distribution System Operator
EED	Energy Efficiency Directive
EEEF	European Energy Efficiency Fund
ELENA	European Local Energy Assistance
EPBD	Energy Performance of Buildings Directive
EPC	Energy Performance Certificates
ERDF	European Regional Development Fund
ESCO	Energy Service Company
ETS	Emission Trading System
EU	European Union
GHG	Greenhouse gases
H2020	Horizon 2020 Research Programme
IEE	Intelligent Energy Europe
KfW	Kreditanstalt für Wiederaufbau
MEPS	Minimum Energy Performance Standards
MS	Member State / Member States
Mtoe	Million tonnes of oil equivalent
MVHR	Mechanical Ventilation with Heat Recovery
MWh	Megawatt hour
NECP	Integrated National Energy and Climate Plan
nZEB	Nearly Zero Energy Building
PDA	Project Development Assistance
PV	Photovoltaic
R & D	Research and Development
RES	Renewable Energy Sources Directive
ROI	Return on Investment
SEAP	Sustainable Energy Action Plan
SME	Small and Medium Enterprise
TWh	Terawatt hour
UK	United Kingdom
ULEB	Ultra-Low-Energy Building

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Executive summary

Due to its significant share of the EUs overall CO_2 emissions, the deep renovation of the EU building stock is a priority for EU climate action, as the sector has the potential for significant energy savings. However, due to a multitude of different barriers faced by building owners and other stakeholders, there has been an insufficient progress to achieve climate targets so far. Against the background of an evident market failure to provide optimal outcomes from a societal perspective, increased targeted policy action is warranted. The objective of this study is to analyse and explore areas, in which improvements can be achieved in the existing body of EU legislation and European Commission monitoring and support its national implementation in the MS, in particular to identify a set of policy options and recommendations for strategies for energy efficient renovation of residential buildings at multi-building level in Europe.

To this end, the analysis takes a problem- and actor-centred approach, starting from an examination of prevalent barriers and incentives for deep building renovation from a multi-building owner perspective. As a result, a taxonomy of barriers touching upon financial, technical, informational, legal and social aspects has been developed from which objectives for policy action are derived. Furthermore, drawing on an analysis of the existing policy frameworks for deep building renovation in the EU and the DREEAM pilot countries Italy, Germany and UK, a long list of policy options to address the identified barriers is established. Lastly, a criteria-based assessment of these options is performed to identify the most suitable selection of policies for EU level action.

The findings from the analysis suggest a number of key recommendations concerning policies, practices and effective approaches towards deep building renovation in a multi-building context in Europe. These key recommendations are summarised below and are explained in more detail in this report:

1. While the EU policy framework for deep building renovation in the residential sector is already quite comprehensive, the European Commission (COM) should take further action to induce the adoption of additional or improved policies by EU Member States to accelerate the process.
2. The COM should aim to implement a well-balanced combination of energy efficiency supporting and information infrastructure (support for local and regional energy agencies, Project Development and Implementation Assistance, training of building professionals and aggregation of demand), planning (local heating and cooling plans), regulation (stronger minimum energy performance requirements and mandatory renovation requirements) and financial incentives (grants for investment, cost recovery regulation and tax bonus-malus scheme).
3. To this end, we recommend a two-layered approach, first using the governance process on national long-term renovation strategies and the integrated National Energy and Climate Plans (NECPs) and the Concerted Action (CA) on relevant directives (i.e. EPBD, EED and RES) to induce immediate MS action. Secondly, in the medium-term, the COM should aim to amend the respective directives with new or strengthened policy requirements in order to extend and ensure their application.
4. To facilitate the implementation of these policy options and to increase political support for them, we recommend the COM to also provide more funding to MS for policy implementation, e.g. via the European Structural Investment Funds or stricter requirements for earmarking EU ETS revenues.
5. For novel approaches, the provision of funding to explore the potential and impacts of their introduction via the H2020 Research Programme should be considered.

1 Introduction

1.1 Background

Under the Paris Agreement, the EU has committed to implement appropriate actions to limit the global temperature increase to 1.5°C. For this purpose, it adopted the 2030 climate and energy framework, which includes EU-wide targets and policy objectives for the period from 2021 to 2030:

- At least 40% cuts in **greenhouse gas emissions** (from 1990 levels)
- At least 32% share for **renewable energy**
- At least 32.5% improvement in **energy efficiency**

The building sector will play an important role to achieve these targets, given that buildings are responsible for approximately 40% of energy consumption, 36% of CO_2 emissions and 55% of electricity consumption in the EU. Currently, about 35% of the EU's buildings are over 50 years old and almost 75% of the building stock is energy inefficient[1]. The Buildings Performance Institute Europe (BPIE) has found that just 3% of buildings in the EU were assessed as highly energy efficient in 2017, leaving the other 97% in need of energy renovation before 2050[2]. Deep renovation of buildings could cut 36% of their energy consumption by 2030, while reducing EU energy import dependency, creating growth, innovation and employment, reducing fuel poverty and resulting in more comfortable and healthier buildings. To achieve the EU climate targets, it is estimated that a 3% rate of deep building renovations per year is required. However, due to a multitude of barriers, it was found that the deep renovation rates are only between 0.5% and 2.5% per year (depending on the country), indicating to the need for policy action to accelerate the process (Meijer et al. 2012).

In recognition of the need to accelerate the renovation of the EU building stock, the European Parliament and the European Council recently revised the Energy Performance of Buildings Directive (EPBD), which now requires MS to focus more on the energy renovation of their building stock to transform it into a highly energy efficient and decarbonised stock by 2050, facilitating its cost-effective transformation towards nearly zero-energy buildings (nZEB). However, with the amended Directive being the result of political compromise, from a climate protection perspective it still leaves room for improvement to effectively tackle existing barriers for deep building renovation.

The DREEAM project under the HORIZON 2020 Framework aims to show that renovating at a larger scale opens the opportunity for a better integration of renewable energy and is generally more cost effective. The project aims to demonstrate that a **multi-building and single owner renovation approach** can achieve a 75% reduction of total energy demand. The core of DREEAM is to identify optimal combinations of technologies, which a) can deliver highest energy reduction for a set of buildings, while at the same time, b) taking into consideration building owners' financial capacity and the preferences of tenants. The project considers interconnected energy systems including a range of energy demand reduction, renewable energy

[1] https://ec.europa.eu/energy/en/topics/energy-efficiency/buildings.
[2] http://bpie.eu/wp-content/uploads/2017/10/FireShot-Screen-Capture-184-bpie_eu_wp-content_uploads_2017_10_State-of-the-building-stock-briefing_26Ott_v1_pdf.jpg.

generation, energy storage and dynamic control. DREEAM focuses on **social and public housing (representing 12% of the EU building stock), whose owners manage large portfolios of residential buildings** with high potential for energy performance improvements. In such an environment, the economies of scale can be best validated. On the one side, many activities and technologies become cheaper per unit. On the other side, smart energy management systems work best in connected systems. This report is a result of task 5.4 "Replication potential at the EU scale" (deliverable 5.5) within the DREEAM project. It focuses on barriers preventing the broader uptake of deep building renovation and identifies suitable policy options to overcome them.

1.2 Objective of this report

The objective of this task 5.4 study is to analyse and explore areas, in which improvements can be achieved on the existing body of EU legislation and European Commission monitoring and support its national implementation in the MS, in particular to identify a set of policy options and recommendations for strategies for energy efficient renovation of residential buildings at multi-building level in Europe. The policy options developed are targeted towards policy makers at EU level. The DREEAM approach is demonstrated at pilot sites in the UK, Germany and Italy, thus the baseline analysis and stakeholder involvement of the study focuses on these countries.

1.3 Structure of the document

This report is structured into five chapters including this introductory chapter:

- The following chapter 2 presents the approach and methods used.
- Chapter 3 outlines the objectives and the baseline for energy renovation at multi-building scale in Europe and the DREEAM pilot countries.
- Chapter 4 discusses and evaluates policy options based on a range of criteria to select policies that are capable of overcoming the identified barriers for deep building renovation and strengthening incentives to owners and other relevant actors. It also presents the key aspects of the selected policy options, including the rationale for implementation, design and implementation options, as well as examples of good practice to underline their applicability.
- Finally, chapter 5 summarizes the findings of the report and provides recommendations for EU policy makers.

2 Approach and Methodology

The approach chosen within this analysis is based on the "Better Regulation Guidelines and Toolbox" of the European Commission (European Commission 2017)[3].

To support better regulation, the European Commission (COM) opens up policy and law making and involves the people affected. Better regulation relies on evidence and a transparent process, which involves citizens and stakeholders throughout. The better regulation agenda is about designing and evaluating EU policies and laws transparently, with evidence and backed up by the views of citizens and stakeholders. This study is therefore supported by the better regulation guidelines and toolbox which set out the principles followed and suggested by the European Commission (2017) when preparing new initiatives and proposals and managing and evaluating existing legislation. Obviously, the stakeholders relevant for this analysis and contacted through interviews are the owners of multiple-building rented accommodation portfolios.

The research project was divided into three steps:

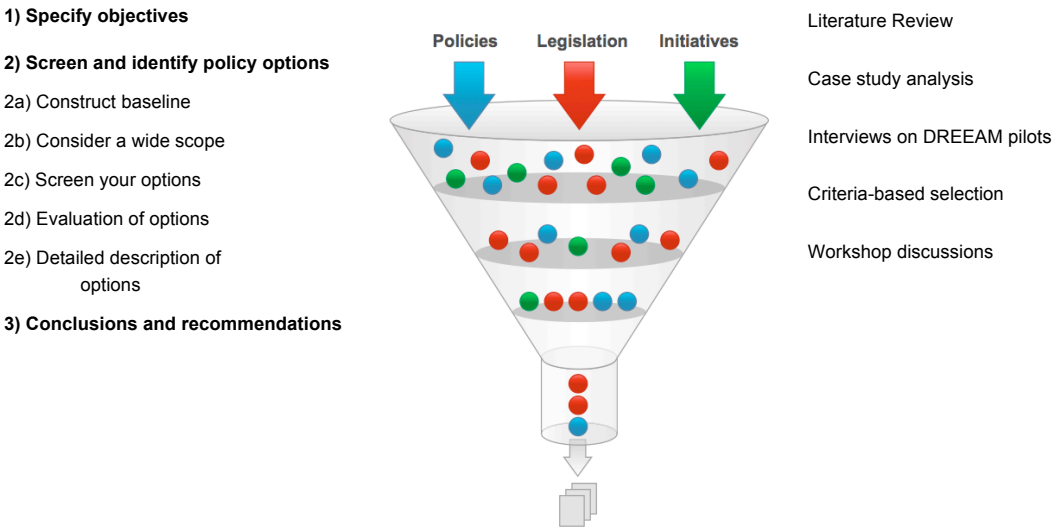

Figure 1: Analytical proceeding within DREEAM task 5.4

Step 1: Specify objectives

In the first step, the **objectives** for deep energy renovation at multi-building scale in Europe were **set and defined**. To this end, the analysis examines the status quo and perspectives for deep renovation of residential buildings in the EU and provides a short overview on the different actors in the sector and their roles within the building energy efficiency value chain. Subsequently, based on a pertinent literature review as well as the authors' own and outside expert knowledge (via stakeholder interviews), the key barriers and drivers for deep building renovation are described and clustered according to their type. This barrier and

[3] For further information see: https://ec.europa.eu/info/sites/info/files/better-regulation-guidelines.pdf and https://ec.europa.eu/info/better-regulation-toolbox_en.

driver analysis forms the basis of formulating the objectives to be targeted by policy. These objectives link the analysis of the barriers and drivers, which exist among the target group in relation to deep energy efficiency renovation, to the options for the policy response (chapter 4.1). They set the level of policy ambition (chapter 4.2), fix the yardsticks for comparing policy options and determine the criteria for monitoring and evaluating the achievements of implemented policies (see tool #16 from the "Better Regulation Guidelines and Toolbox"). Concrete options for policy instruments that would address the objectives are collected in this step as well. This will support the identification and mapping of policy options in chapter 4. The methods used in this first step are a literature review, the conduction of interviews with DREEAM pilot project partners and experts (see Annex 7.2) and the first internal workshop.

Step 2: Screen and identify policy options (tool #17)

The second step is divided into five sub-steps. The **first sub-step (2a)** aims to **construct a baseline** ("no policy change" scenario) against which policy options for the achievement of the defined objectives are compared. To this end, first the existing policy frameworks for building renovation (i.e. all relevant policies and measures which are assumed to continue in force) on both EU level as well as in the DREEAM pilot countries are examined and described (chapter 3.3). The analysis is structured using an analytical framework developed within the *bigEE* project (www.bigee.net), which categorizes policies according to their function within a prototypical policy package to promote energy efficiency in buildings. The result of the analysis (the policy baseline) first serves as reference frame for the analysis of policy options in chapter 4, to check whether an option would rather need to improve an existing policy, or whether it would need to be introduced as a new policy to fill a gap. In this first sub step, the same methods as in the previous step (1) are used; a literature review, the conduction of interviews with DREEAM pilot project partners and experts as well as the first internal workshop.

The **second sub-step (2b)** considers a **wide variety of policy options** in addition to the baseline to look at content, tools and instruments. This is again based on the analysis of barriers and drivers and the identified objectives. It helps to think outside the box, avoid regulatory bias and to show DREEAM stakeholders that their preferred policy options have been considered (or it explains why they might not be pursued). Therefore the stakeholders´ ideas and opinions have been instrumental (see results of the interviews). Here, the widest range of instruments is considered, from the less intrusive to the more interventionist and from the more classical tools to those suggested by the more recent developments in relevant academic fields, to address energy efficiency and renewable energies in buildings. Alternative types of policy responses are considered to reach the objective as regards the content/design of the measures. The methods are identical to the ones from step 1 and 2 (a literature review, the conduction of interviews with DREEAM pilot project partners and experts). These are complemented by the conduction of the second internal workshop. The result is a long list of policy options (presented in chapter 4.2 and Annex 7.3).

The **third sub-step (2c)** aims to **screen the options and identify the most viable ones**. The pre-selection helps to focus the analysis on the viable options, because the exclusion of options at this stage is easier to legitimate (the reasons need to be as clear, self-evident and incontrovertible as possible). The key criteria for screening the viability of the options (chapter 4.1) are based on the criteria of the "Better Regulation Toolbox" #17, including policy consistency (effectiveness, proportionality, relevance, coherence with other EU policy objectives, and efficiency), legal, technical and political feasibility and the ecological, economic and social impact. The result of the screening is presented in chapter 4.2 and Annex 7.3.

The **fourth sub-step (2d)** focuses on the **evaluation and double check of the suitability of the retained policy options**. This ensures that the resulting policy combination will properly inform political decision makers. Here it is important to check if all options are realistic and to choose the level of aggregation of the policy options (broad alternative options, alternative packages of measures, timing of potential implementation, individual sets of measures targeting specific issues to be bundled together at the end of the analysis or a mix of high-level options and sub-options). This conclusion is also part of chapter 4.2.

The **fifth** and last **sub-step (2e) describes in reasonable detail the key aspects of the retained policy options** to allow an in-depth analysis of the associated impacts. This step allows the identification of alternative options (for transparency). Therefore, the selected options had to be sufficiently well developed to permit the differentiation of them on the basis of their performance in achieving the identified objects. The presentation in chapter 4.3 includes the rationale for implementation, design and implementation options, as well as examples of good practice to underline their applicability.

Step 3: Conclusions and recommendations

The last step encompasses the elaboration of the conclusion and recommendations. Therefore, the final policy options are identified and summarized. Then, the conclusions are drawn on feasible policy combinations as well as instruments or combinations of instruments that may be used to reach the objectives of the intervention. The result is presented in chapter 5.

3 Objectives and the baseline for deep energy renovation at multi-building scale (Steps 1 and 2a)

In this chapter 3, the objectives for deep energy renovation at multi-building scale in Europe are set and defined.

3.1 Context of deep energy renovation in Europe

Buildings in the EU have a floor area of 25 billion m^2, with about three quarters of this being residential buildings.[4] According to Boermans et al. (2015) deep renovation of the existing stock together with new buildings that are nearly zero energy can save 80% of the final energy use for space heating by 2050, compared to 2012. The deep renovation of 3% of the building stock (25 billion m^2), would generate energy savings of approximately 100 TWh/y by 2020. If around 20% of the building stock was deeply renovated by 2030, it would save 750 TWh/y. With regard to the overall energy and climate targets, more renovation of existing buildings has the potential to lead to significant energy savings – potentially reducing the EU's total energy consumption by 5 to 6% and lowering CO_2 emissions by about 5%. With regard to the economic potential, a recent study estimated that the EU energy renovation market was worth approximately EUR 109 billion in 2015 and accounted for 882,900 jobs (Saheb 2016). According to the same study, renovation accounts for 57% of the total construction market, with residential buildings, accounting for 65% of the renovation market in 2015 (ibid.) The investment required to renovate Europe's building stock has been estimated to be of the order of EUR 1 trillion (IEA 2014). Estimates of energy renovation costs range from EUR 200 to 450 per m^2 depending on the depth of renovation (JRC 2015). Focusing less on energy efficiency and more on renewable energy supply (as an alternative to deep renovation) turns out to be 3.5% more expensive (Boermans et al. 2012).

3.1.1 Actor constellation in the (multi-building) renovation market

Large-scale deep retrofitting of residential buildings is a complex process consisting of different phases, namely initiation, planning and project management, financing, implementation, installation of systems, commissioning (in case of large residential buildings), sale/(re-)letting and operation/use. This process also involves a significant number of different market actors, the most relevant of them are architects, financiers, construction companies, contractors/crafts, component/material suppliers, and finally building owners and tenants/users (see Figure 2). Throughout the different phases of planning, implementation and operation, all these actors make decisions that can influence the energy performance of the building in question. And they all have some inherent incentives to initiate, offer, demand or invest in energy-efficient building solutions, but are on the other hand facing strong barriers that prevent them from choosing energy efficiency. In order to be able to adequately design and implement energy efficiency policies and measures for deep building renovation, political decision-makers must therefore have good knowledge of the concerned market actors and thoroughly analyse the specific incentives and barriers faced by each of them.

[4] http://www.odyssee-mure.eu/publications/efficiency-by-sector/buildings/buildings-eu.pdf.

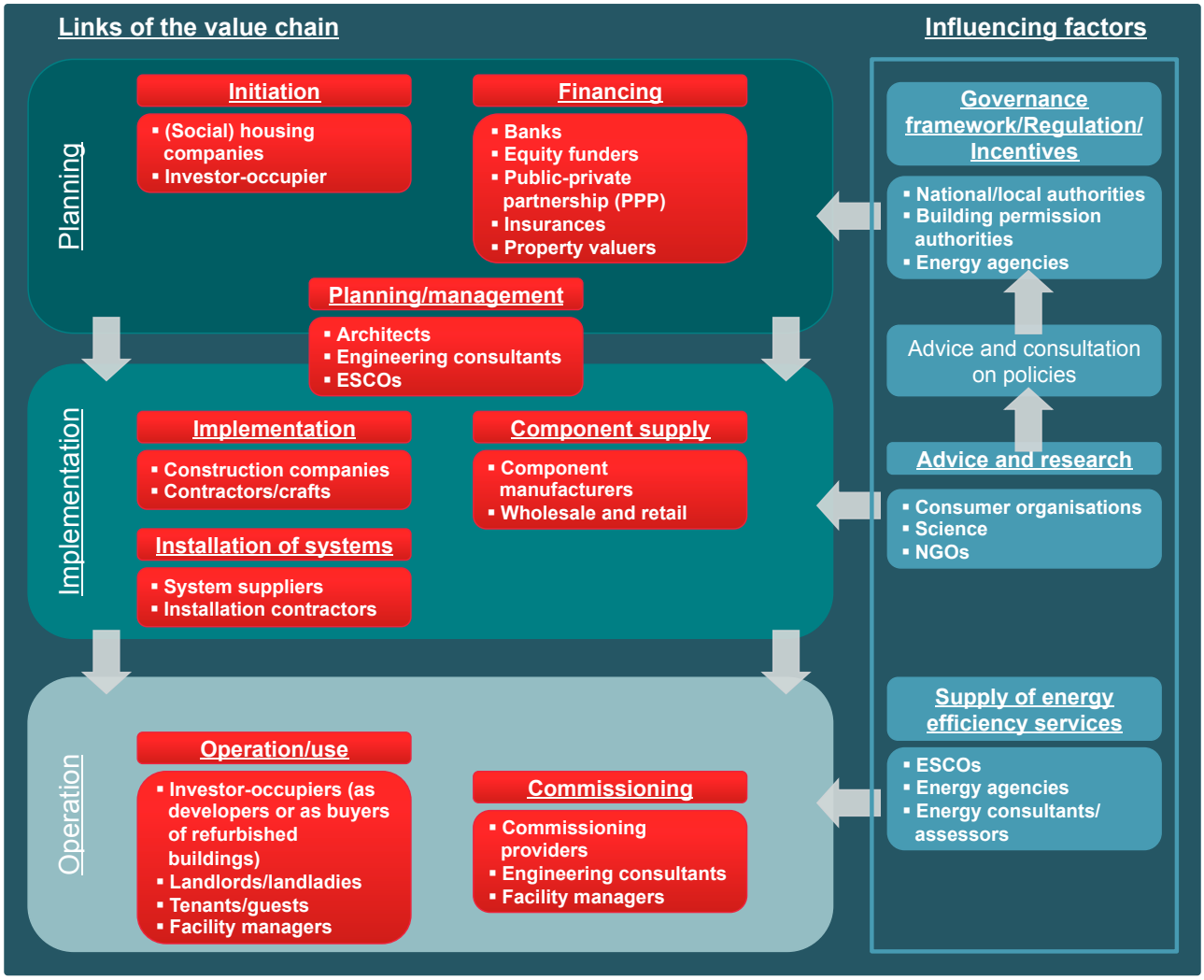

Figure 2: Actor constellation in the building renovation sector

3.1.2 Barriers and drivers for large-scale deep renovation

Accelerated deep renovation of the residential building stock in the EU is currently impeded by a wide range of barriers faced by different actors within the energy efficiency value chain (BPIE 2011; Tuominen et al. 2012; Karlsson et al. 2013; Duce et al. 2018). These barriers relate to different aspects and phases of deep building renovation and are often clustered in different categories to provide guidance for the selection of appropriate policy responses. Within the present analysis, identified barriers for large-scale deep renovation of residential buildings have been clustered into financial, technical, informational, legal/institutional and social barriers.

Financial barriers

Deep renovations of existing buildings require **high upfront investments** from building owners that may only be recovered over a longer period. This **extended payback time** is often **incompatible** with the prevalent business models and respective expectations of housing companies but also of financial institutions. Also, assumptions on the life-cycle of buildings and their components within these business models tend to be too conservative, thus negatively shaping cost-benefit calculations of deep building renovations (interview 4). In addition, the immediate benefits of respective undertakings such as comfort

and health gains as well as energy savings are reaped by building inhabitants, which in a multi-building context are (for the most part) different from the investors. Due to this **landlord/tenant dilemma** (more generally also known as split-incentives) (interviews 1,4,8), building owners often lack a financial incentive to make energy efficiency and decarbonisation investments beyond legal requirements. This may be further aggravated by existing/perceived uncertainties with regard to the **level of market demand** (i.e. the willingness to pay) for very energy efficient dwellings, interest rate development as well as future maintenance costs (interview 8), which translates into **higher economic risk perception** of investors (interview 9). Market demand for energy efficient dwellings is shaped by the **level of energy prices**, which are often subsidised and thus do not reflect the full economic cost. Generally, energy efficient renovation measures **compete with other building investments** such as measures to improve accessibility or for the renovation of sanitary installations, which may yield more immediate returns in terms of market valuation. Another financial barrier, faced particularly by small private landlords and smaller housing companies, can be **limited access to funding** for the required high upfront investments (interviews 4, 8). This may be due to a lack of (easily accessible) public funding programmes (e.g. providing low interest loans) or **low market supply of respective financing offers**. The latter often is a result of lacking knowledge on and financial incentives for complex energy efficiency project financing in the banking sector (see below).

Table 1: Financial barriers for deep building renovation

<table>
<tr><th>Barriers</th><th>Drivers</th><th>Objectives</th><th>Policy options</th></tr>
<tr><td>High upfront investment
Access to funding/low supply of market financing offers
Incompatibility with traditional investment approaches
Competing investment options
Landlord/tenant dilemma
Perceived economic risks
Distorted energy prices
Low market demand</td><td>• Subsidies, financial incentives, etc.;
• Market demand/willingness to pay;
• ROI
• Project development assistance (PDA) funds
• Public guarantees to de-risk investment
• Third party financing</td><td>Facilitating investments: (1) Improve cost effectiveness / mitigate landlord/tenant dilemma (2) overcome financial restrictions
De-risking energy efficiency/low carbon building investments
Eliminate market distortions</td><td>• Tax rebates/breaks,
• Soft loans,
• Grants for investment in deep renovation
• Cost recovery regulation
• Removal of energy price subsidies
• EEOs or REOs
• Public credit default guarantees
• Energy or CO_2 taxation
• EU ETS
• Loans connected to the building not the owner
• EPC related Bonus-malus payments for building owners
• Energy efficiency fund
• Standard calculations and contracts for renovation projects
• State run innovative financing schemes (PAYS)</td></tr>
</table>

Technical barriers

Technical barriers for deep low-carbon building renovation may arise due to **building characteristics** such as its structure or pre-existing installations that prevent the technical implementation of certain

measures/render them uneconomical. For example, low apartment ceilings or a lack of space for air ducts may prevent the installation of building central or apartment based mechanical ventilation with heat recovery (MVHR) systems. Another key barrier may be a **lacking market supply of (integrated) technical solutions** to effectively and/or economically achieve building energy performance standards in different building types or climates. In the context of diverse multi-building renovation, the lack of ubiquitously applicable solutions may drastically increase planning and implementation efforts and costs, which negatively affects cost-benefit considerations of potential investors. On the other hand, renovation of structurally similar multi-buildings holds the potential for efficiency gains through standardisation. Furthermore, some building technologies or combinations thereof may exhibit a **performance gap** between indicated and actual energy savings during building operation, thus adding uncertainty to the investment (interview 5).

Table 2: Technical barriers for deep building renovation

Barriers	Drivers	Objectives	Policy options
Building characteristics Lacking market supply of (integrated) technical solutions Performance gap of building technologies	• Urgency for renovation & awareness of lock-ins • Availability of tailor made stepwise approach for nZEB-renovation; • Inconveniences and defects in the house • Comprehensive energy audits	(1) Technology development: improve energy and resource efficiency, reduce costs, make technologies simpler to install (2) improve market uptake of innovative solutions	• Financial support for RD&D projects • Public procurement • Aggregation of demand for standardised integrated solutions • Technology or best practice solution competitions • Market based mechanisms • Ban of fossil-fuel heating systems

Informational barriers

Informational barriers for deep building renovation refer to prevalent **information gaps among different actors in the energy efficiency value chain** on various technical, financial and legal aspects. Respective information deficits range from lacking knowledge on / awareness of the general benefits of energy efficiency, on existing saving potentials as well as technical options to harvest them and their implementation costs (building owners, tenants, architects) to practical knowledge gaps on how to properly plan (architects, engineering consultants, project developers) (interview 6), finance (financiers) and implement (crafts, construction companies) deep building renovation works. **Low awareness of building energy efficiency and its benefits** among building owners and tenants (interviews 4, 6) may prevent the former from initiating deep renovations and renders the latter less likely to accept associated inconveniences and costs passed on. In addition, information on energy efficient building solutions is scattered, abundant and sometimes contradicting, which makes it **difficult for building owners to identify and access relevant information**. But also building professionals may struggle to keep pace with the newest developments in building technologies. In consequence, they may **lack an overview of available options** (interview 6), which effectively limits their ability to advice building owners on the most efficient combination of measures. Furthermore, building professionals may **lack the necessary skills to properly plan or implement renovation works** (interview 6) that include new or complex technologies (interview 8),

resulting in low market supply of respective services (see above). In consequence, a **low supply of technically skilled workers** to implement renovation works or install low carbon HVAC systems in some countries may impede progress towards a low carbon residential building stock. Lastly, actors in the finance sector tend to have little knowledge on the details and economic prospects of complex energy efficiency project financing and therefore shy away from making (attractive) financing offers for what is considered risky investments.

Table 3: Informational barriers for deep building renovation

<table>
<tr><th>Barriers</th><th>Drivers</th><th>Objectives</th><th>Policy options</th></tr>
<tr><td>Difficult access to information; contradicting information
Low awareness of building energy efficiency and its benefits
Lack of awareness of innovative technologies</td><td rowspan="2">• Advice, unburdening & guidance
• Awareness of energy saving potential & technical options
• Accurate, reliable & tailor-made information
• General knowledge level</td><td>Improve knowledge on deep renovation possibilities and reduce transaction costs for search of information and for project implementation</td><td rowspan="2">• Awareness raising campaigns for multiple benefits of energy efficiency and renewable energy
• Building individual deep renovation passports/roadmaps
• Training of building professionals,
• EPCs (integrating individual deep renovation passports/roadmaps)
• Local actor networks on energy efficiency renovation at building and district scale
• Requirement for larger building portfolio owners to employ an energy manager
• Information on good practice examples</td></tr>
<tr><td>Low supply of skilled supply side actors</td><td>(1) Ensure availability of skilled suppliers/ contractors at reasonable cost
(2) Improve knowledge on deep renovation possibilities and reduce transaction costs</td></tr>
</table>

Legal/institutional barriers

Unclear, complex or insufficient provisions of the regulatory framework may prevent the development and/or broader implementation of energy efficient building solutions or increase their costs. Such legal barriers for deep building renovations comprise **unclear nZEB definitions**, **unambitious building energy codes** including loopholes/exemptions (interview 1) that effectively allow lower energy performance levels and **low** Minimum Energy Performance Standards (**MEPS)** for energy using products in comparison to BAT. Besides lacking clarity or ambition, the regulatory framework may also hamper energy efficient building transformation if it **does not define clear enforcement mechanisms** and assign responsibility to a supervisory authority with sufficient technical, financial and personnel resources. In addition, there often exists building related regulation with different (competing) policy targets (e.g. housing affordability vs. climate protection) that may impede deep building renovations, substantially increase the price thereof (interview 7) or limit investors' ability to recover investment costs such as **heritage rules**, **fire safety provisions** or **legal rent caps** (interview 1). Also, existing privacy and rent regulation may prevent

transparency on building energy consumption for building owners, thus impeding access to relevant information for energy efficiency planning (interview 4). **Cumbersome, complex and/or time-consuming administrative procedures** related to the renovation process (e.g. for building permits; EPC issuing) (interview 8) or the application for public funding (see above; interview 3) add to the transaction costs of deep building renovation and thus may constitute another barrier. Lastly, housing market actors make investment decisions in consideration of existing regulatory framework conditions that may affect their ROI and payback times. **Volatile and/or unpredictable regulatory framework** conditions (interview 7) thus are likely to increase risk perception of building owners and may thus prevent deep building renovation investments.

Table 4: Legal/institutional barriers for deep building renovation

Barriers	Drivers	Objectives	Policy options
Volatile and/or unpredictable regulatory framework	• Clear and stable/predictable regulatory framework • Precise nZEB definitions • Consequent enforcement of energy efficiency provisions	Provide long-term technical and policy development certainty to market actors	• Long-term renovation strategy • Building individual deep renovation passports/roadmaps • Building stock energy targets • Competent authority with sufficient resources • Building regulation (minimum requirements for overall energy performance; share of renewable energy for heating and cooling; roof usage) • Cost recovery regulation • MEPS • Ban of fossil-fuel heating systems • Mandatory regular inspection of heating and cooling systems
Unclear, complex or insufficient provisions		(1) Ensure minimum efficiency in case of renovation and in operation (2) Possibly: Induce renovation	
Lack of enforcement/responsible authority		Ensure enforcement of regulation	
Conflicting regulation (heritage rules, fire safety provisions, rent caps/barriers for cost recovery)		Eliminate/minimize legal barriers	
Cumbersome and time-consuming administrative procedures		Increase bureaucratic efficiency/facilitate administrative procedures	

Social barriers

The realisation of projected energy savings in deep building renovation projects depends on different factors such as the proper implementation of measures, the proper installation and adjustment of technical building systems, their adequate use/behavioural adjustments by occupants (e.g. with regard to Mechanical Ventilation with Heat Recovery systems) and the absence of technical performance gaps (see above). Failure to deliver on the promise of energy savings against the background of rent increases for cost recovery bears the risk of conflicts between landlords and tenants. The inconveniences and discomfort associated with the implementation of renovation works or improperly installed building systems represents another factor, which may result in **low acceptance** and possibly resistance **among building**

occupants (interviews 1, 4). In light of these perceived risks, landlords may decide not to implement deep renovation measures in the first place to avoid the **hassle** of dealing with tenant complaints. **Risk aversion** as an innate feature of human nature plays a central role here and thus works as a psychological barrier. Furthermore, to avoid respective complications, building owners may have to provide tenants with sufficient information and process support, which some housing companies lack the capacity for (interview 4).

Table 5: Social barriers for deep building renovation

Barriers	Drivers	Objectives	Policy options
Low acceptance of/resistance from tenants	• (Personal) Tenant consultation and information and process support • One-stop-shop • Standardised projects/processes • Market demand/willingness-to-pay • Clear and stable/predictable regulatory framework	Increase acceptance of deep renovation measures	• Demonstration projects • Awareness raising campaigns • Standardisation of energy efficiency projects/renovation process • Promotion of energy performance contracting • Financial support (up to 100%) for an independent moderator and coaching role • One-stop-shop • Tenant information and support measures
Risk aversion		De-risk energy efficiency investments	
Transaction costs/hassle		Decrease transaction costs for building owners	

3.2 Objectives for policy (improvement)

The overall objective of the policy options should be to achieve the EU (and national) climate and energy saving targets by **scaling energy renovation rates and depths at multi-building level in EU MS**. More specifically, based on the analysis of the problem (and its drivers), the policy options should be able **to overcome actor-specific barriers and strengthen incentives of multi-building owners as well as other relevant actors for deep building renovation as** identified in the previous chapter**.** Based on the preceding barrier analysis a range of policy objectives have been derived, which will guide the further policy option selection process.

With regard to the financial barriers, EU policy should aim to **facilitate investments** in deep building renovations by improving the cost-effectiveness of respective investments and by mitigating the landlord/tenant dilemma via adequate means. Furthermore, policy should **support building owners to overcome financial restrictions** due to limited access to funding. In order to incentivise more private investment into energy efficient/low carbon building renovation, another objective for policy is to **de-risk respective investments**. A further area for policy action to overcome financial barriers is the **elimination of market distortions** with regard to energy prices that negatively affect the economic attractiveness of implementing renovation measures or the purchase/rental of energy efficient dwellings respectively.

With regard to the identified technical barriers, the derived main objectives for policy are to **support the development of easily applicable and affordable technology** with improved energy and resource efficiency and to **accelerate market uptake** of such innovative solutions.

The identified informational barriers can be translated into a need for policy to **improve knowledge of building owners on deep renovation possibilities** and **reduce transaction costs for search of information and for project implementation**. With regard to the supply side, policy should foremost aim to **ensure availability of skilled suppliers/contractors at reasonable cost** but also to improve the knowledge base of building professionals.

Legal barriers are related to the policy framework that may directly prevent action by different market actors or fail to induce action to fully harness existing energy saving potentials due to a lack of stringency and stability. Accordingly, an overarching objective for policy is to **provide long-term technical and policy development certainty** to market actors. On an operational level, policies should **ensure minimum efficiency in case of renovation and in operation** and aim to actively **induce renovation**. To safeguard effectiveness of legal provisions, policies need to **ensure enforcement of respective regulation**. Besides providing a stable and conducive regulatory environment, policies should also aim to **eliminate/minimize legal barriers** in the existing framework. Lastly, to facilitate the process of deep building renovation, in some instances a policy objective might be to **increase bureaucratic efficiency/facilitate administrative procedures** (e.g. for building permits or funding applications).

With regard to social barriers for deep building renovation, the main policy objective is to **increase acceptance of deep renovation measures among tenants**. Furthermore, to respond to widespread risk aversion among building owners as well as aversion towards the hassle of implementing deep building renovation measures, policies should aim to **de-risk energy efficiency investments** and to **decrease transaction costs for building owners**.

3.3 Baseline construction

The following chapter builds the baseline as a reference for the assessment of policy options and to identify gaps in the policy frameworks. The analysis is structured using an analytical framework developed within the *bigEE* project (www.bigee.net), which categorizes policies according to their function within a prototypical policy package to promote energy efficiency in buildings. The prototypical policy package, its elements and their interaction are described in the following chapter. Subsequently, the framework is applied to structure the baseline construction on both EU level as well as in the DREEAM pilot countries. To this end, the existing policy frameworks for building renovation are examined and described.

3.3.1 Prototypical policy package and interaction of policies

Due to the complex value chains in the building sector, market forces alone are unlikely to bring about the deep low-carbon renovation of the European building stock. Many different actors – investors, end-users but also building developers, equipment manufacturers, designers, trade and builders – have to work together to achieve an optimal outcome. A well-designed package of policies and measure's needs, therefore, to assist the various actors in overcoming their specific barriers and to strengthen their incentives. Experience from advanced countries and an analysis of market barriers show that several instruments will need to interact and reinforce each other in a comprehensive policy package. Every policy

or measure has its own function in the package, its advantages, target groups and specific operational mechanisms. Each is tailored to overcome one or a few certain market barriers and to strengthen the actor-specific incentives, but none can address all these barriers and incentives. Therefore, the impact of well-combined policies is often larger than the sum of the individual expected impact (IEA 2005).

Governments seeking to improve the energy efficiency do not necessarily have to implement all possible policies in order to be successful, but should combine a selection of instruments tackling the most important market barriers. As successful countries have demonstrated, a comprehensive and coherent policy package for building energy efficiency will usually provide a sound balance between clear mandatory measures, incentives, information and capacity building (Thomas et al. 2016, 2015). It also needs a governance framework to enable implementation of these policies. Figure 3 presents the different elements of a prototypical policy package for energy efficiency, which are shortly described in the following.

Targets and Concepts

A clear political commitment to energy efficiency is the necessary basis for long-term investment decisions in the construction industry and building market. It provides a reliable planning framework for market actors and reduces investment risk for investors and suppliers of energy-efficient buildings and technologies. To make such a commitment credible, it is crucial to set ambitious, yet achievable energy saving targets and to develop comprehensive medium- to long-term strategies towards eventually making Ultra-Low-Energy Buildings (ULEB), the standard both in new build and retrofit.

Infrastructure and Funding

The administrative infrastructure and the funding for the other policy elements need to be in place. This includes (1) an energy agency or similar institution for co-ordinating activities. To ensure (2) stable funding, government energy efficiency funds and/or an obligation of energy companies to achieve energy savings via energy efficiency programmes are also required.

Eliminating distortions

Energy prices should ‘tell the economic and ecological truth’. It is essential that subsidies for energy production or on energy prices be gradually removed - governments are advised to rather use the budget saved to fund energy efficiency schemes for low-income households, to keep energy bills affordable instead of keeping energy prices artificially low. In addition to removing energy subsidies, energy or CO_2 taxes or market-based CO_2 pricing (e.g. via an Emission Trading System) will internalise environmental damage and threats to health into final energy prices.

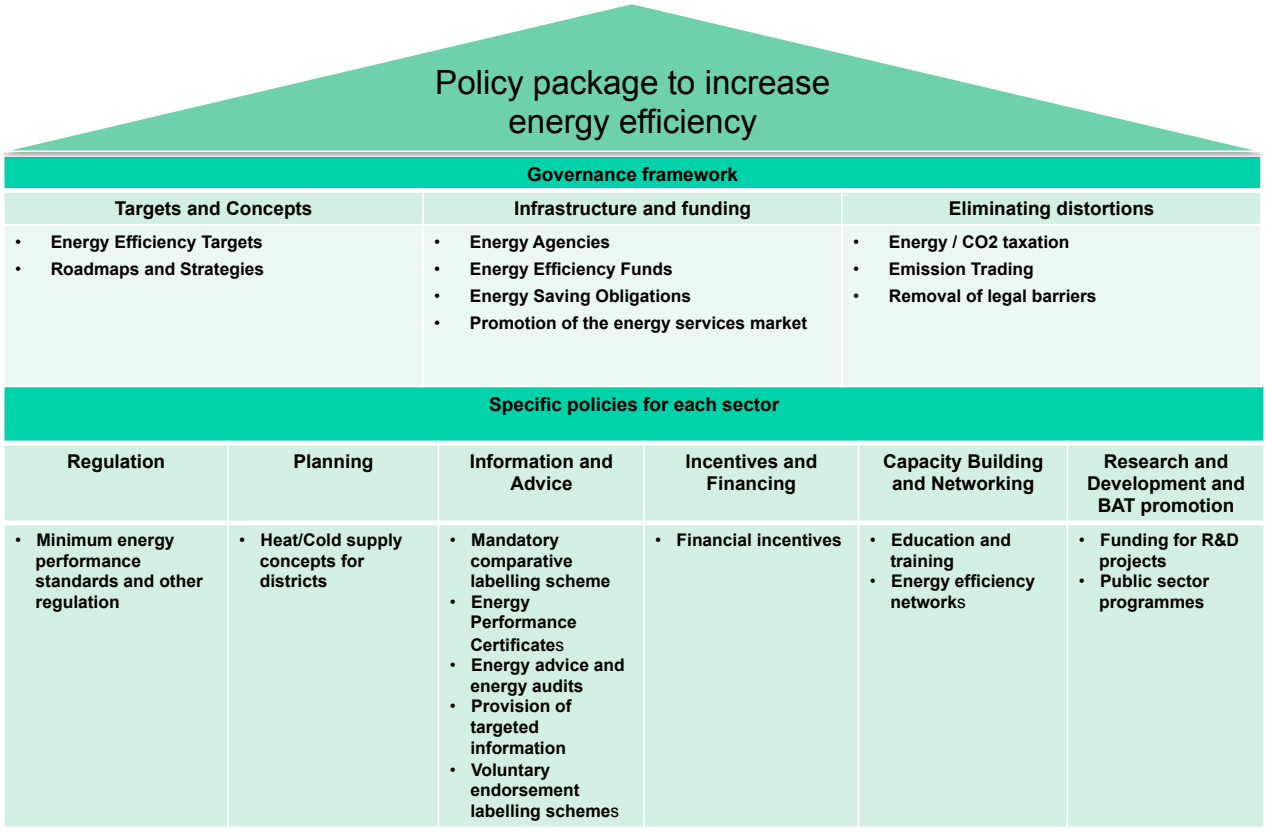

Figure 3: Prototypical policy package for energy efficiency

Regulation

Mandatory minimum energy performance standards (MEPS) for existing buildings undergoing major renovation as well as for building components and heating and cooling systems are an important regulatory instrument for energy efficiency in existing buildings. MEPS reduce transaction costs as well as the landlord/tenant and seller/buyer dilemmas by removing the least energy-efficient building practices and components from the market. In order to be effective, compliance with MEPS must be controlled at the local level in cases of major renovation. However, for existing buildings it is much more important to accompany MEPS with individual advice as well as financial incentives or financing for meeting the MEPS requirements, since otherwise building owners may wait with major renovation. Other statutory requirements such as individual metering, energy management for larger buildings and building portfolios, or regular inspections of heating, ventilation, and air conditioning systems would complement the legal framework to ensure energy-efficient operation of buildings.

Planning

Heating-/cooling concepts and plans for residential building districts can guide the way to a more sustainable heating/cooling supply system. The development of such plans sensitizes public authorities for the possibilities to cover existing and future demand by means of more efficient (renewable or waste heat/cold based) district heating. Accordingly, placing the competence for the development of such plans with local authorities in combination with a legal requirement to do so, decreases the risk of missed opportunities for the sustainability transformation of supply infrastructure.

Information and Advice

The most important policies and measures for energy efficiency in existing buildings are those tackling the substantial information deficits and financing barriers, in order to first move markets towards very energy-efficient retrofit levels ("deep renovation") and then to trigger energy-efficient renovation at all, to increase retrofit rates. These instruments include building energy performance certificates (EPCSs) (and energy labels for components where useful) with mandatory display upon advertisement, rental or sale, show-casing of demonstrated good practice building renovations, and award competitions for very energy-efficient renovations, combined with information and motivation programmes to disseminate the results, to raise awareness for energy efficiency opportunities in renovation and to develop more energy-efficient and cost-effective technologies and concepts for building renovation. In addition to these instruments, individual advice, such as energy audits need to show building owners what they (or their tenants) can save and what is cost-effective, and coaching can be essential to assist investors in implementing the retrofits.

Incentives and financing

Scaling up investment in energy efficiency is crucial to achieve a sustainable energy future. Financing instruments target the barrier of insufficient availability of, or access to, capital for financing the incremental up-front costs of energy-efficient buildings or retrofits. Among the vast variety of different financing schemes, preferential loans or government-facilitated third party financing schemes (e.g. on-bill or property tax financing) are exemplary and suitable public policy responses to address the existing financing gap and to foster private investment. In order both to increase awareness of the benefits of energy efficiency and to improve the benefit-to-cost ratio and thus foster decisions in favour of deep energy-efficient retrofits, financial incentives may be powerful instruments. They can make an important contribution to accelerating the market penetration of energy-efficient retrofitting as well as certain energy efficiency technologies or services with a better energy efficiency than required by MEPS. As a result, they help prepare markets for the next steps in strengthening MEPS towards higher energy efficiency levels for retrofitting existing buildings. Examples of financial incentives include: direct grants, tax incentives, or indirect incentives (e.g. granting larger floor area, higher density, or expedited building permits).

Capacity building and networking

For scaling up deep building renovation, there must also be a sufficient number of skilled providers willing and able to perform the energy-efficient renovation tasks. Education and training of building professionals (architects, planners, portfolio managers, builders, building and installation contractors, financiers and other relevant market actors) is essential to increase renovation rates and ensure high quality and very energy-efficient retrofit. Easy-to-use tools for energy-efficient building design and for life-cycle cost calculation are important for the training. Certification of successful participation to the training can make it more attractive for both the qualified market actors and their customers.

R&D and BAT promotion

Future steps of MEPS regulation towards energy efficiency levels equivalent or close to ULEB should be prepared by innovation support through R&D funding, demonstration (including in public buildings), award competitions, and maybe also already by financial incentives for broad market introduction. The public sector should lead by example through very energy-efficient renovations and ambitious energy savings targets for its own buildings, thereby paving the way for the other sectors to follow.

3.3.2 EU level baseline

Targets and concepts

Within its 2030 climate and energy framework, the EU has set targets and policy objectives for the period from 2021 to 2030. Key targets for 2030 comprise at least 40% cuts in greenhouse gas emissions (from 1990 levels), at least 32% share for renewable energy and at least 32.5% improvement in energy efficiency compared to the PRIMES 2007 reference scenario. The Renewable Energy Directive (RES) requires MS to set national contributions to meet the binding target as part of their NECPs and specifies national renewable energy targets for 2020 for each country, taking into account its starting point and overall potential for renewables (Art. 3). Furthermore, it defines how the share of renewable energy sources is to be calculated (Art. 7). MS are also required to increase the share of renewable energy in the heating and cooling sector by an indicative 1.3 percentage points as an annual average calculated for the periods 2021 to 2025 and 2026 to 2030 (Art. 23). The EPBD requires MS to develop and regularly update a long term renovation strategy for the domestic building stock (Art. 2a). Furthermore, MS are obligated to draw up national plans for increasing the number of nearly zero energy buildings (nZEB), including the development of policies and targets to stimulate the transformation of refurbished buildings into nZEB (Art. 9). The Energy Efficiency Directive (EED) sets annual final energy saving targets to be achieved by the MS amounting to 1.5% of annual energy sales up to 2020 and 0.8% (on a different calculation basis than for 2020) for the following period between 2021 and 2030 (Art. 7). Furthermore, it requires MS to set and report an indicative national energy efficiency target, based on either primary or final energy consumption, primary or final energy savings, or energy intensity (Art. 3). With regard to heating and cooling of buildings, the EU has formulated a strategy, which aims to facilitate building renovation and increases the share of renewables. Lastly, the EU has developed an Energy Roadmap 2050 guiding the transition towards an energy efficient low-carbon economy.

Infrastructure and funding

On EU level, DG Energy is concerned with matters of energy efficiency in the building sector. Further organisations concerned with supporting the implementation of pertinent EU law (EED, RES, EPBD) are the Concerted Actions (CA) as well as the Executive Agency for SMEs (EASME), which manages several EU programmes in the fields of SME support & innovation, environment, climate action, energy and maritime affairs. The Joint Research Centre (JRC) supports EU policies with independent scientific evidence throughout the whole policy cycle. While there is no European Energy Agency, the European Energy Network provides an organisational setting for exchange between national energy agencies. With regard to the funding of energy efficiency measures, the European Energy Efficiency Fund (EEEF) provides (co-)funding for energy saving and small-scale renewable energy projects to local/regional public authorities and private entities acting on their behalf. In addition, funding for energy efficiency measures in the building sector is also offered via the Cohesion Fund and the European Regional Development Fund, which invest €13.3 billion into energy efficiency measures in public and residential buildings between 2014 and 2020. The EED (Art. 7) allows the introduction of energy saving obligation schemes as a means to coordinate and fund measures to achieve national saving targets. Furthermore, the EED (Art. 20) allows MS to set up national energy efficiency funds as an alternative or complementary action to promote energy saving activities within their jurisdiction.

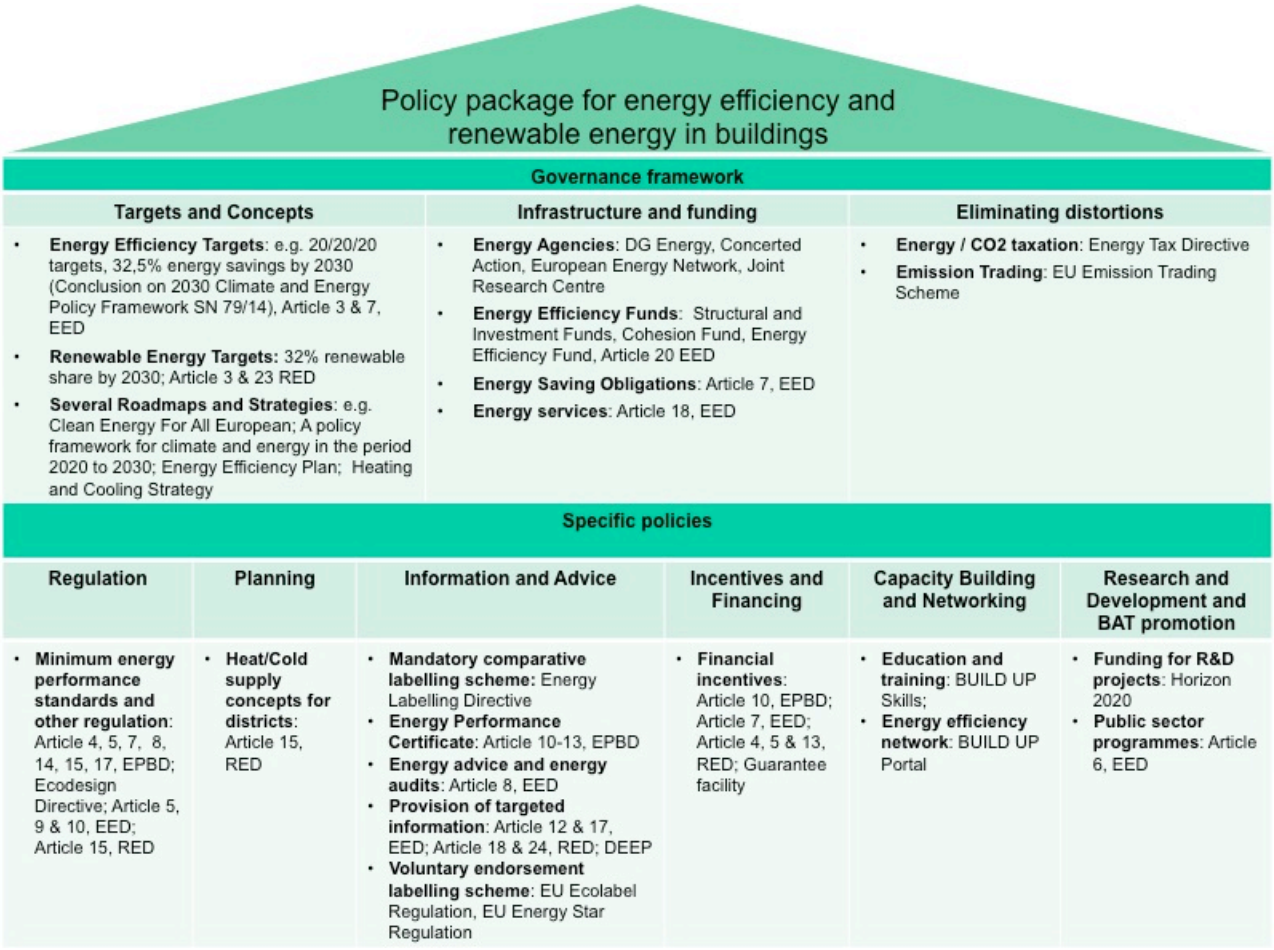

Figure 4: Current EU policy package for deep building renovation

Eliminating distortions

According to the Lisbon Treaty, the EU itself has no competence to raise direct taxes. The Energy Taxation Directive establishes the minimum excise duty rates that MS must apply to energy products for fuel and transport, and electricity. However, the current provisions of the Directive need to be adjusted upwards to better reflect the ecological and economic costs of fossil fuel use. A central mechanism for carbon pricing on EU level is the EU Emission Trading System (ETS), which requires companies in the sectors of power and heat generation, energy-intensive industry and commercial aviation to acquire emission allowances in line with their greenhouse gas emissions. For many years, the ETS' effectiveness was undermined by low certificate prices due to a surplus of market supply. In 2019, certificate prices increased to around €25 per tonne of CO_2.

Regulation

There are several EU Directives with regulatory provisions that directly or indirectly affect deep residential building renovation, namely the EPBD, the EED, the Ecodesign Directive and the RES. While Art. 4 of the EPBD requires MS to set minimum energy performance standards (MEPS) for the overall energy efficiency in buildings with view to achieving cost optimal levels, Art. 5 defines a methodological framework for the underlying calculation. Art. 7 requires MS to ensure that these standards are met by existing buildings in cases of major renovations. This provision however is conditional on technical, functional and economic feasibility. Art. 8 of the EPBD requires MS to define system requirements for renewal, replacement and

upgrading of technical building systems in existing buildings in respect of the overall energy performance, the proper installation, and the appropriate dimensioning, adjustment and control (i.e. heating, hot water, ventilation, air conditioning systems). Furthermore, in case of heat generator replacement, the installation of self-regulating devices for the separate regulation of room temperature levels is required. Again these provisions are conditional on technical, functional and economic feasibility. Lastly, information on changes to the overall energy performance is to be documented for the purpose of compliance checks and the issuing of EPCs. Art. 14, 15 and 16 require MS to ensure regular inspection of building heating (Art. 14) and air-conditioning systems (Art. 15) that include an assessment of their efficiency and sizing, which in combination with recommendations on the cost-effective improvement of these systems are then to be provided to the owner or tenant of the building in the form of an inspection report (Art. 16). Art. 9, 9a, 9b, and 9c of the EED require MS to ensure that (from 2020 on remotely readable) individual metering devices for heating, cooling and domestic hot water are installed to enable consumption-based billing. The Ecodesign Directive sets MEPS for different building related energy using products, such as boilers, water heaters, circulation pumps, mechanical ventilation systems and so on. Lastly, the RES requires MS to introduce appropriate measures in their building regulations and codes in order to increase the share of all kinds of energy from renewable sources in the building sector (Art. 15). To this end, MS shall require the use of minimum levels of energy from renewable sources in existing buildings that are subject to major renovation in so far as technically, functionally and economically feasible. MS shall permit those minimum levels to be fulfilled, inter alia, through efficient district heating and cooling using a significant share of renewable energy and waste heat and cold.

Planning

The RES asks MS to encourage local and regional administrative bodies to include heating and cooling from renewable sources in the planning of city infrastructure where appropriate (Art. 15). Furthermore, MS should consult network operators to reflect the impact of energy efficiency and demand response programs as well as specific provisions on renewables self-consumption and renewable energy communities on the infrastructure development plans.

Information and advice

Information and advice measures to bring forward deep renovation measures are promoted via different provisions of the EPBD and the EED. Art. 11 of the EPBD obligates MS to establish a system of certification of the energy performance of buildings and defines the content to be included in these energy performance certificates (EPCs) (e.g. cost-effective improvement options) and their temporal validity. Requirements for the issuing of EPCs as well as the mandatory presentation to new tenants/owners in case a building is newly constructed, rented or sold are laid down in Art. 12. The EED asks MS to promote high quality and cost-effective energy audits for all final customers in order to improve awareness of energy saving potentials and to provide recommendations for improvement (Art. 8). Art. 10 provides for transparent billing information on gas and electricity that reflects actual and historical energy consumption and heating costs. Furthermore, Art. 17 requires MS to ensure the wide dissemination of information on available energy efficiency mechanisms and financial and legal frameworks to all relevant market actors. Specifically, the provision of information to banks and financial institutions on how to participate in the financing of energy efficiency measures is requested. With regard to the integration of renewable energy sources, the RES requires MS to ensure that information on the net benefits, cost and energy efficiency of

equipment and systems for the use of heating, cooling and electricity from renewable sources as well as support measures is made available to all relevant actors to promote an increased replacement rate of old heating systems and an increased switch to solutions based on renewable energy (Art. 18). Furthermore, MS shall ensure that information on the energy performance and the share of renewable energy in their district heating and cooling systems is provided to final consumers in an easily accessible manner, such as on the suppliers' websites, on annual bills or upon request (Art. 24). In order to extend the knowledge base on energy efficiency investments and to decrease risk perception among investors, the Energy Efficiency Financial Institutions Group (EEFIG) has launched the De-Risking Energy Efficiency Platform (DEEP - www.deep.eefig.eu). The platform provides detailed analysis and evidence on the performance of energy efficiency investments to support the assessment of the benefits and financial risks.

Incentives and financing

Financial incentives to increase the energy efficiency of buildings (especially refurbishment) are available at EU level, e.g. by the different funds. However, compared to the actual investment requirements within the EU their budget is too limited to achieve the potential. To make more effective use of public funding towards energy efficiency renovations the EU has in 2018 launched the Smart Finance for Smart Buildings Initiative (SFSB), which amongst others aims to facilitate the deployment of financial instruments across Europe and better target subsidies towards vulnerable consumers or specific market failures. To leverage more private investment, the initiative set up a guarantee facility to provide more risk protection to commercial banks. According to Art. 10 of the EPBD, MS shall provide financial incentives to accelerate building efficiency. Nevertheless, clear targets and obligation to introduce funding schemes are missing. Such targets (in particular to support energy efficiency investments for low-income households) should be specified in EU Directives (like Art. 7 of the EED or Art. 10 of the EPBD). With regard to the promotion of renewable energy sources, Art. 4 of the RES enables MS to set up support schemes that provide financial incentives for their deployment (Art. 4). Such support schemes may also be set-up as a joint effort between different MS (Art. 13). Art. 5 allows MS to include renewable electricity providers from other MS within these support schemes.

Capacity building and networking

The main activity on EU level for capacity building among building professionals is the EU Build Up Skills initiative, which aims to provide training to craftsmen and other on-site construction workers and systems installers in the building sector. Furthermore, the EU Build Up Portal (www.buildup.eu) provides a wide range of practice-oriented information, trainings and tools for building professionals and enables networking.

Research and Development and BAT promotion

The Horizon 2020 Research Programme dedicates €2.5 billion between 2014-2020 to fund research and innovation programmes related to energy efficiency and renewable energy sources. Building energy efficiency is specifically addressed.

First observations on typical gaps

The current EU policy package for energy efficiency in buildings includes most of the types of policies that literature finds necessary (see chapter 3.3.1). However, there are shortcomings when it comes to their

implementation and effectiveness, particularly in the area of building refurbishment, which should be improved. One way to achieve this could be to make a larger number of policy instruments or provisions a mandatory requirement for MS.

3.3.3 DREEAM pilot countries baselines

The following chapter describes the current situation in the DREEAM pilot countries Italy, Germany and the UK. The analysis is based on the latest National Energy Efficiency Action Plans (NEEAPs) and the Integrated National Energy and Climate Plans (NECPs) as well as supplementing grey literature. Existing policies and measures are again structured according to their function within the prototypical policy package.

3.3.3.1 Italy

Targets and Strategies

In line with the provisions of the EED and the RES, Italy has set indicative targets for primary (40%) and final (39.7%) energy consumption reduction as a well the share of renewable energy across all sectors (30%) by 2030. These targets are part of the 2017 National Energy Strategy, which additionally sets the target of phasing out the use of coal in electricity generation by 2025. With regard to the building sector, Italy in compliance with the EPBD has developed both a NZEB Action Plan as well as updated its long-term renovation strategy.

Infrastructure and Funding

In terms of competent authorities to promote energy efficiency, the National Agency for New Technologies, Energy and Sustainable Economic Development ENEA and the National Agency for Energy Efficiency UTEE are the key actors in charge of supporting the government and market actors to implement energy efficiency policy and measures. In addition, there are regional and local energy agencies. The main funding instrument for cross sectoral energy efficiency measures is the white certificate scheme, which obligates electricity and gas distributors (DSOs) with more than 50 000 clients to achieve primary energy savings of 36.36 Mtoe in the period 2017-2020 and enables to pass on the costs via a surcharge on final energy prices.

Eliminating distortions

An excise tax on energy applies to oil products, natural gas and coal and coke across all sectors. Fuels used to generate electricity are also taxed, but at much lower statutory rates. Electricity output is taxed (per MWh) except when used for transport purposes.

Regulation

Italy has implemented several regulatory measures to improve energy efficiency and reduce primary energy consumption in the building stock. To comply with the EPBD provisions Italy has introduced both minimum energy efficiency requirements for buildings as well as technical systems regulation concerning the operation, management, control, maintenance and inspection of heating, cooling and hot water systems in buildings. In compliance with the provisions of the RES, Italy has established an obligation to include renewable energy sources in new buildings and buildings undergoing major renovations for heat,

electricity (share depending on the size of the building) and cooling. Furthermore, to simplify and harmonise nationwide building standards, an updated building code defines general building principles and rules as well as local building regulations. Lastly, since 1991 in Italy it is mandatory to appoint an energy manager for every industrial organization with an annual consumption of more than 10 000 tonnes of oil equivalents (toe) and for organizations from other sectors above 1 000 toe.

Planning

In Italy, the regions are obligated to develop Regional Energy and Environmental Plans (REEP), which include assessments of the potential for high efficiency CHP and district heating.

Information and Advice

Italy has implemented EPBD provisions to improve transparency of building energy consumption by introducing a requirement when selling or letting a property to enclose the EPC with the sales or letting agreement and requirements for the transparency of bills for electricity and/or gas distributed via urban networks to harmonise, rationalise and simplify billing information. Additional information measures comprise the set-up of an internet portal maintained by UTEE – ENEA, which provides information on the regulatory framework, incentive mechanisms, technological solutions, training being offered, good practice and simplified methods for achieving energy efficiency improvement targets. Lastly, a three-year broad information and training programme on energy efficiency and saving targeted at SMEs, government employees, schools, households in multi-family buildings, banks and financial institutions, ESCOs, energy management experts and service providers was implemented.

Financial incentives and Financing

Italy has a range of financial instruments to incentivise deep energy renovation of buildings. The Government grants tax deductions of 65% of investment costs for measures to reduce energy requirements for heating through overall energy-efficient retrofitting (via thermal insulation) and transformation into NZEBs, installation of solar thermal panels and replacement of winter heating installations and electric water heaters. Furthermore, the Thermal Account (Conto Termico) scheme supports businesses, households and public authorities with subsidies for renewable thermal energy measures and measures aimed at improving the energy efficiency of buildings and installations (only public sector bodies). Lastly, the revolving Italian National Fund for Energy Efficiency provides both financing guarantees and subsidised loans to support energy-efficient measures implemented by companies and public bodies on properties (including energy-efficient retrofitting of buildings) and installations.

Capacity building and Networking

With regard to capacity building of building professionals, Presidential Decree No 75/2013 provides for training courses leading to professional qualifications for issuing EPCs, to be offered at national and regional level. It defines the minimum course content and establishes the criteria for checking the quality of service. Furthermore, Legislative Decree No 28/2011 sets out the installer qualification rules for the installation and supplementary maintenance of renewable power sources.

Research and Development

There are several instruments to foster low carbon building technologies. Italy is part of Mission Innovation, a multilateral initiative, which aims to promote acceleration of technological innovation to support the energy transition by means of a significant increase in public funding, dedicated to clean-tech research. Furthermore, the Ministry of Education, Universities and Research established public-private research partnerships, which are coordinated by ENEA. Lastly, a 50% tax credit for incremental Research and Development costs is offered, which may be granted up to a maximum annual amount of €20 million per recipient and aims to stimulate private investments in R&D.

3.3.3.2 United Kingdom

Targets and Concepts

In its 2012 Energy Efficiency Strategy (DECC 2012) the UK has set an indicative energy saving target of 129.2 mtoe for final energy consumption by 2020, representing an 18% reduction in final energy consumption, relative to the 2007 BAU projection. There are several regional energy efficiency and renewable targets for Scotland and Wales. While UK set a very clear and ambitious overall sectors legally binding target (i.e. cutting carbon emissions by 80% by 2050), specific targets for the building sector are not clearly indicated, except for new buildings (i.e. the introduction of zero carbon homes standards for new homes in England by 2016). Specific targets on building renovations, and in particular on deep renovations are not provided in the long term renovation strategy. The Clean Growth Strategy proposes the development of a long-term trajectory to improve the energy performance standards of privately-rented homes to EPC Band C by 2030. Furthermore, it states the ambition to phase out the installation of high carbon fossil fuel heating in new and existing off gas grid residential buildings during the 2020s.

Infrastructure and Funding

With regard to the promotion of energy efficiency, the Department of Business, Energy and Industrial Strategy (BEIS) (which took over responsibility for energy efficiency in 2016 when the Department for Energy and Climate Change (DECC) was abolished) is the national competent authority. There is no public energy agency on any governance level. Delivery of residential energy efficiency measures is largely organised and funded via the Energy Company Obligation (ECO) scheme, which requires gas and electricity suppliers with more than 250 000 customers (150 000 by 2020) to contribute a certain amount to energy-efficiency home improvements, based on their market share. Furthermore, to promote the electricity generation from renewable sources the Renewables Obligation Certificates (ROC) Scheme sets an annual obligation on electricity suppliers to source a proportion of their generation from renewable sources during an obligation year. Suppliers buy these ROCs from renewable generators (or traders). Until 2019 Feed-in tariffs were in place for renewable generation but these have been largely removed.

Eliminating distortions

There are different taxes on energy in the UK. The Fuel Duty (oil products and natural gas use across all sectors) and the Climate Change Levy (CCL) (LPG, natural gas and coal and coke products outside of the transport sector) are applied except when these energy carriers are used to generate electricity. The

Carbon Price Support (CPS) applies to oil products, natural gas and coal and coke products for electricity generation. Lastly, electricity output is taxed at a uniform rate (per MWh).

Regulation

To comply with the EPBD provisions the UK has introduced minimum energy efficiency requirements for new buildings and when people carry out controlled 'building work' to existing properties including extensions, conversions and certain categories of renovation and replacement of windows and boilers. Due to the Private Rented Sector (PRS) Energy Efficiency Regulations, there is a requirement for any properties rented out in the private rented sector to have a minimum energy performance rating of E on an Energy Performance Certificate (EPC). The regulations will come into force for existing tenancies on 1 April 2020. It is however not clear how providers that do not comply will be sanctioned.

Planning

The UK has introduced a National Planning Policy Framework, which sets out how planning should support the transition to a low carbon future. The Framework looks to local councils to, for example, plan new development in locations in ways which reduce greenhouse gas emissions and, when determining planning applications, expect new development to take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption. Most new developments are required to be 'low carbon' in order to receive planning permission. Local councils in their planning should actively support energy efficiency improvements to existing buildings.

Information and Advice

The UK has implemented EPBD provisions to improve transparency of building energy consumption by introducing a requirement when selling or letting a property to enclose the EPC with the sales or letting agreement. Additional information measures comprise the funding of the Energy Saving Trust, which provides advice to businesses and households (through the Energy Savings Advice Service helpline), and also provides free resources to energy efficiency professionals throughout the UK. To increase transparency on energy consumption, the smart metering programme aims to replace 53 million meters with smart electricity and gas meters in all domestic properties in Great Britain by the end of 2020.

Financial incentives and Financing

The UK has a range of national and regional financial instruments to incentivise deep energy renovation and decarbonisation of buildings. The Domestic Renewable Heat Initiative (RHI) is a financial incentive (£4.5 billion between 2016 and 2021) to promote the use of renewable and low carbon heat (such as heat pumps, biomass boilers and solar water heaters). On a regional level, the Energy Efficient Scotland (EES) Programme not only targets energy efficiency improvements in buildings, but also seeks to address the decarbonisation of heat in Scotland's buildings.

Capacity building and Networking

In terms of building professional's capacity building, the UK has supported the Build UP Skills project, which aims to identify skills gaps and implement long-lasting training infrastructure to improve the skills related to the installation and maintenance of building energy efficiency technologies.

Research and Development

The UK government aims to foster low carbon building technologies via different funding programmes. The Building Mission aims to at least halve the energy use of new buildings by 2030, reduce the cost of retrofitting efficiency measures in existing buildings, and to ensure homes and businesses are heated by clean energy sources. To this end, the government will invest £170 million - matched by £250 million from industry - to modernise construction processes and techniques. Furthermore, the BEI's Energy Innovation Programme provides up to £505 million to accelerate the commercialisation of innovative clean energy technologies and processes.

3.3.3.3 Germany

Targets and Strategies

In its 2010 Energy Concept, Germany has set a target of reducing primary energy consumption of 20% by 2020 and of 50% by 2050 (compared to 2008). Furthermore, it sets the goal of achieving a drop in greenhouse gas emissions of at least 80 to 95% by 2050 (compared to 1990) and of increasing the share of renewables to 50% by 2030. With regard to buildings, the Federal Government set the goal of an almost climate-neutral building stock by 2050 and adopted a strategy for the energy transition in the buildings sector, which demonstrates how this can be achieved through a combination of energy efficiency and the use of renewable energies. In order to achieve these targets, a Funding strategy for energy efficiency and renewable heat has been issued to increase the funding efficiency, audience reach and clarity of existing funding programmes and leverage and bundle their synergies.

Infrastructure and Funding

With regard to the promotion of energy efficiency, the Federal Energy Agency 'dena' and the Federal Agency for Energy Efficiency 'BfEE' are the central national authorities. In addition, 32 energy and climate protection agencies are organised within the German Federation of Energy and Climate Protection Agencies (eaD). The National Energy Efficiency Fund, which was established in 2011, provides funding for energy efficiency programmes to implement the National Action Plan on Energy Efficiency. The measures supported to leverage energy and electricity saving potentials range from consumer information and product innovation through to the market launch of energy-efficient products. With regard to RES deployment in the electricity sector, the Renewable Energy Sources Act safeguards funding (guaranteed compensation, priority feed-in) and the financing of any extra costs incurred as a result of the Renewable Energy Surcharge (see below).

Eliminating distortions

An energy tax applies to oil products, natural gas and coal and coke products, at rates differing according to whether the product is used as a transport fuel or for heating and process purposes. Electricity output is taxed at a uniform rate (per mWh). Another key measure to eliminate market distortions is the phasing out of hard coal subsidies. These have been paid for the last time in 2018.

Regulation

The Energy Saving Regulation (EnEV) is the main instrument for building energy regulation. It implements the EPBD provisions and sets minimum requirements for the energy performance of the building shell and the system technology for new buildings, and both also for larger renovations of existing buildings. Additionally, according to EnEV from 2015 onwards, 'constant temperature' boilers have to be decommissioned after 30 years of use. The Heating Costs Order exempts buildings reaching the so-called passive house standards (heating requirement less than 15 kWh/m^2) from billing requirements, thus creating an incentive for deep renovations of multi-family buildings. Furthermore, the Act on energy services and other energy efficiency measures obliges all non-SMEs to perform an energy audit by 5 December 2015 and every 4years thereafter. Companies may alternatively introduce an energy management system (pursuant to DIN EN ISO 50001).

Planning

There is no regulation in Germany requiring local authorities to develop sustainable district heating/cooling plans and concepts. However, the Government via its national climate protection initiative NKI financially supports communities regarding the development of climate protection concepts, which may contain such heating and cooling supply concepts.

Information and Advice

Germany has implemented EPBD provisions to improve transparency of building energy consumption by introducing a requirement when selling or letting a property to enclose the EPC with the sales or letting agreement. Furthermore, the Federal Office for Economic Affairs and Export Control BAFA promotes energy consulting for residential buildings which is targeted at owners of residential buildings and may comprises individual renovation roadmaps. Another programme operated by the consumer protection agencies and funded by the government offers initial energy advice to homeowners. Furthermore, energy companies are legally required to inform final customers about the energy efficiency service offers available to them, the effectiveness of efficiency measures and on locations from which they can request further information about energy efficiency service offers, final customer comparison profiles, and technical specifications for energy-using products. Additional information measures comprise the "House of the Future" motivation and information campaign targeting different actors in the building sector and the broader 'Germany Does It Efficiently' information and mobilisation campaign. Moreover, since 2001 the Federal Energy Agency "dena" has operated an Energy hotline and Internet platform providing end consumers as well as specialists with information about the various kinds of energy production, the rational use of energy and renewable energies. Lastly, a national efficiency label for old heating installations is meant to increase the replacement rate for old heating installations by 20% (up to a rate of 3.7% a year).

Financial incentives and Financing

Germany has a wide range of financial instruments to incentivise deep energy renovation and decarbonisation of buildings. The central instrument is the CO_2 Building Modernisation Programme administered by the state-owned KfW Bank. It is the most generously funded instrument in the field of energy efficiency, providing low-interest loans, in some cases with redemption subsidies or alternatively with investment grants, to fund energy-efficiency measures in the buildings sector. The more energy-efficient the renovation, the higher is the subsidy or grant level. Financial incentives for the installation of building based renewable energy plants for electricity are provided via a Feed-in-Tariff funded through the surcharge under the Renewable Energy Sources Act. The Landlord-to-Tenant Electricity Act has extended the financial incentive to rental buildings by providing a supplement for electricity that is generated on site and then sold to tenants. The market incentive programme for renewable energies in the heating market provides funding for installations which use renewable energies to generate heating and cooling, as well as for certain heat storage facilities and local heat networks, both in residential and non-residential buildings. The efficient provision of heat and electricity is incentivised by a CHP surcharge, which is temporarily paid for the electricity produced by cogeneration plants. Furthermore, Mini CHP plants are being funded under certain conditions and up to a capacity of 20 kW since April 2012. This investment allowance granted only once and determined according to the electrical performance of the micro-CHP lies between €1 500 and €3 500. Lastly, the BAFA funding programme for heating optimisation incentivises the replacement of inefficient heating and hot water circulation pumps with high-efficiency pumps and the optimisation of existing heating systems by means of hydraulic balancing.

Capacity building and Networking

There are no state-run training or qualification schemes for building professionals in Germany.

Research and Development

The German Government aims to foster low carbon building technologies via different funding programmes. The central framework for energy research funding in Germany at a research policy level is the Federal Government's cross-departmental energy research programme, which is a multi-annual programme aimed at steering the funding activities of the various ministries involved. In addition, there are research initiatives which provide funding targeted at research for sustainable building practices such as the construction research initiative Efficiency House Plus and the funding initiative EnEff.Building.2050. The Funding initiative 'Solar Construction/Energy-Efficient City' provides funding for energy-optimized construction, refurbishment and operation of buildings and energy infrastructures in neighbourhoods including the integration of renewables.

4 Identification and assessment of policy options

In the following chapter, suitable policy options to address the identified barriers and to strengthen incentives for deep building renovation are identified. To this end, the more abstract policy options identified in chapter 3.1.2 have been translated into concrete EU level policy actions. In a second step, these policy options are further scrutinized via a criteria-based assessment to narrow down the focus to a selection of policies deemed most appropriate to improve the current EU policy framework. The criteria for policy assessment are developed from the key criteria by the EU Better Regulation Guideline (European Commission 2017/Tool#17). Lastly, the selected policies are described in more detail and (where possible) exemplified using implemented examples of good practice.

4.1 Identification and mapping of policy options (Steps 2b-d)

Although the objective of DREEAM task 5.4 is to develop policy recommendations for the EU level, most of the actual policy implementation is likely to happen in transposition of revised EU Directives, notably the EPBD, the EED and the RES Directive. Therefore, first a long list of policy options to improve the rate and depth of energy-efficient renovations in the target sector of multiple building portfolio owners has been developed, based on preliminary results of the analysis of actor constellations, barriers, drivers, and objectives, the base case of existing policies at EU level and in the three DREEAM case study countries Germany, Italy, and UK, and on the interviews held with stakeholders as part of this task. This long list includes options irrespectively of whether they may already exist at EU level or in a MS, because even existing instruments may be too weak and could be strengthened. Table 7 lists the policy options by category. Existing EU legislation or instruments for a policy option are highlighted in bold. A more detailed description of the policy options and their possible concrete design at EU level is presented in Table 16 in the Annex.

4.2 Selecting policy options (Step d)

As indicated, the selection of suitable policy options is based on an assessment using criteria from the EU Better Regulation Guideline (European Commission 2017/Tool#17). These key criteria for screening the viability of policy options are presented in Table 6, which also includes an assessment of their applicability for the analysis of options in DREEAM task 5.4.

Table 6: Applicability of key criteria from EU Better Regulation Guideline

Criterion	Explanations	Need and usefulness for DREEAM assessment
Legal feasibility	Options should respect the principle of conferral. They should also respect any obligation arising from the EU Treaties (and relevant international agreements) and ensure respect of fundamental rights. Legal obligations incorporated in existing primary or secondary EU legislation may also rule out certain options.	Important but only to be done for options remaining after all other criteria. Difficult if not impossible to assess without further in-depth analysis.

Criterion	Explanations	Need and usefulness for DREEAM assessment
Technical feasibility	Technological and technical constraints may not allow for the implementation, monitoring and/or enforcement of theoretical options.	Constraints unlikely for building renovation policies but need to be assessed.
Previous policy choices	Certain options may be ruled out by previous Commission policy choices or mandates by EU institutions.	Similar as for legal feasibility
Coherence with other EU policy objectives	Certain options may be ruled out early due to poor coherence with other general EU policy objectives.	Similar as for legal feasibility
Effectiveness and efficiency	It may already be possible to show that some options would incontrovertibly achieve a worse cost-benefit balance than some alternatives.	Effectiveness for DREEAM target group with respect to overcoming barriers and strengthening incentives by requiring and/or supporting deep building renovation (and renewable energy) is the most important criterion for the DREEAM policy analysis. However, this should not only be assessed for one policy option in isolation, but in its mutual reinforcement with other policy options of different types interacting as a policy package. This should be assessed in a second step for the selection of policy options that remains after the first step of assessment. Some options that were not estimated highly effective on their own may thus be reinserted into the selection. On the other hand, since deep building renovation usually is cost-effective for society, any policy that will increase the rate and depth of deep building renovation will be efficient. So, efficiency does not need to be assessed.
Proportionality	Some options may clearly restrict the scope for national decision-making over and above what is needed to achieve the objectives satisfactorily.	Needs to be assessed for each option, whether and which new or amended EU legislation or programmes would be required or even useful to achieve implementation of an option, or whether it is only useful to implement it at national (or even regional/local) level. In the latter type of cases, the only useful EU action would be to support knowledge transfer on these options.
Political feasibility	Options that would clearly fail to garner the necessary political support for legislative adoption and/or implementation could also be discarded.	Similar as for legal feasibility
Relevance	When it can be shown that two options are not likely to differ materially in terms of their significant impacts or their distribution, only one should be retained.	Among two similar options, the more effective one should be kept. However, in case that one may not be feasible in a MS, the next effective one could still be useful.

Following this analysis, the **following criteria and process** were adopted for the **assessment of policy options in DREEAM task 5.4**:

(1) The most important criterion seems **effectiveness**. It draws directly from the overarching objective presented in chapter 3.2. All policy options in the long list will thus be assessed for it.

(2) The next important criterion according to task 5.4 is the **proportionality** in the way it has been adapted in Table 6. Even though the EBPD, the EED, and the RES Directive are unlikely to be updated during the next five or more years, the question what EU policy can do to spread policy options is to be covered in this project. This includes an assessment whether a policy option could be implemented directly at EU level or required from MS through EU legislation or funding, and how; or whether they could only be implemented at national or even local level. All policy options will be assessed for it too.

(3) For those options, for which the effectiveness is rated high or at least medium, and for which the analysis finds a suitable role for EU legislation or programme support, the **remaining criteria** are briefly analysed as far as possible in this project:

- Legal, technical, and political feasibility
- Previous policy choices, coherence with other EU policy objectives, and relevance.

Only in case there have been any observations from this analysis, these are reported.

(4) For the remaining selection of policy options, its **coherence** and mutual reinforcement with other policy options of different types interacting as a **policy package** is assessed. If there are options that fulfil the same function, one may be retained or flexibility for MS may be created (relevance). Some options that were not estimated highly effective on their own may thus in this step be reinserted into the selection. Based on this assessment a combination (or package) of new or strengthened instruments to achieve the identified policy objectives is prioritised.

The results of steps (1) and (2) are presented in the respective columns of Table 7. With regard to their effectiveness, the options are rated from low (o) over medium (+) to high (++). For policies with indirect effects on multi-building deep renovation, assessment results are put into parentheses. The proportionality assessment ranges from '--' (EU level action not warranted/sensible) to '++' (EU level action sensible and in line with the subsidiarity principle). A more detailed description of the effectiveness and proportionality assessment as well as the results of step (3) are presented in Table 16 in the Annex. Here the assessment is differentiated with view to the possible design options that could either be realised in the short term, i.e. without a further revision of the recently revised EPBD and EED, or in the medium term, with a further revision of the EPBD and EED. Furthermore, Table 7 also reflects the outcome of the prioritisation of policy options in line with the proceeding described in step (4). As first priority, those options with an effectiveness of '++' or '+ to ++' have been selected; as second priority, those with a '+' or 'o to ++'. The first priority options are highlighted in green colour. In chapter 4.3, more detail on all criteria for the policy options retained after this criteria-based assessment (priority 1) is provided in the detailed description of these policy options.

Table 7: Long list and assessment of policy options to promote deep building renovations (Overview).
The first priority options are highlighted in light green. With regard to the effectiveness, the options are rated from low (o) over medium (+) to high (++). For policies with indirect effects on multi-building deep renovation, assessment results are put into parentheses. The proportionality assessment ranges from '--' (EU level action not warranted/sensible) to '++' (EU level action sensible and in line with the subsidiarity principle). Existing EU legislation or instruments for a policy option are highlighted in bold.

Objective	Category	Policy Option	Effective-ness	Propor-tionality	Prio-rity
Provide long-term technical and policy develop-ment certainty to market actors	**Targets and policy strategies**	Building stock long-term energy consumption or climate neutrality **target**	o to +	+/++	
		National Energy and Climate Plans (NECPs), particularly the long-term renovation strategies	o to +	+/ –	
Provide agencies and funding for implementation of sector- and technology-specific policy instruments	**Infrastructur e and funding**	National energy agencies for policy development and monitoring/policy implementation	(+)	– – to ++	
		1) Financial and technical support for local or regional energy agencies	+ to ++	– – to ++	1
		Energy efficiency/Renewable energy funds to fund policy and programme implementation	(+) to (++)	– to ++	2
		Energy efficiency (**EED Art. 7**) and renewable energy (RES) obligations for energy suppliers or DSOs	(+) to (++)	– to ++	2
		Promoting the market for building energy efficiency and renewable energy services	+	+	2
Improve general cost effectiveness of energy efficiency investments and other energy savings actions; eliminate legal barriers	**Eliminating distortions**	Eliminate subsidies for fossil fuels or fossil fuel technologies and introduce or increase energy or CO_2 taxation (**energy taxation directive**)	o to (+)	+	
		Tighten EU ETS (**EU ETS Directive**)	o	+	
		Eliminating legal barriers (**Art. 19 EED**)	o to ++	+ to ++	2
(1) Ensure minimum efficiency in case of renovation and in operation (2) possibly: Induce renovation	**Regulation**	2a) Minimum energy performance requirements in case of 'major renovation' (**EPBD Art. 7**)	++	– to ++	1
		2b) Strengthened minimum requirements for the share of renewable energies in space and water heating, space cooling in case of major renovation (**RES Art. 15**)	++	– to ++	1
		Strengthen ecodesign requirements for building-related energy-using products (**Ecodesign directive**)	+	++	2
		3a) Mandatory energy renovation requirements (at least to the minimum energy performance requirements)	+ to ++	– to ++	1
		3b) Requirement to use roofs, either for solar PV, or for solar thermal, or for vegetation (green roof)	+ to ++	– to ++	1
		Ban of fossil-fuel heating systems where district heating based on CHP and/or renewable energy is available	o	– to ++	
		Strengthened requirements for mandatory regular inspection of heating and cooling systems (**Art. 14 and 15 EPBD**)	o to +	+	

Objective	Category	Policy Option	Effective-ness	Propor-tionality	Prio-rity
		Requirements to base heating and cooling bills on amount of energy used (**Art. 9 to 11 EED**)	o	N/A	
		7) Law on possibility for landlords/-ladies to increase basic rents to recover costs of energy efficiency renovation	++	+	1
		Strengthened requirement for larger building portfolio owners to employ an energy manager or to implement an energy management system (or regular energy audits, **Art. 8 EED**)	+	– to ++	2
		Requirement that rents include energy	o to ++	+ to ++	
Provide opportunities for district heating/ cooling and use of renewable energies	**Planning**	4) Requirement for local authorities to develop heat and cold supply concepts for districts (possibly as part of Sustainable Energy Action Plans (SEAPs) or local climate change action plans)	+	– to ++	1
Improve knowledge on deep renovation possibilities and reduce transaction costs for search of information and for project implementation	**Information and advice**	Energy performance certificates (EPCs, **Art. 11 to 13 EPBD**)	o to +	– to ++	
		Financial support for building energy concepts and targeted advice in project development; Individual building deep renovation passports/roadmaps as a result (**Art. 19a EPBD**)	+	– to ++	2
		Provision of well-structured information on good practice examples	o to +	+	
		Financial support for coaching through renovation projects (support in tendering, problem-solving, quality control)	+	– to ++	2
		6b) Financial support (up to 100%) for an independent moderator and coaching role	+ to ++	– to ++	1
		Standard calculations and contracts for renovation projects	o to ++	+	2
		Communicate multiple benefits of energy efficiency and renewable energy	o to +	+	
Facilitating investments: (1) Improve cost effectiveness / mitigate landlord/tenant dilemma (2) overcome financial restrictions	**Incentives and Financing**	5) Grants for *investment* in deep renovation (**Art. 10 EPBD**) possibly differentiated by region (interview 7) or type of housing/tenants	++	– to ++	1
		Soft loans (combined with grants) (**Art. 10 EPBD**)	o to ++	– to ++	2
		Loans connected to the building not to the owner	o to ++	+ to ++	2
		Tax reductions, e.g. through direct reductions or accelerated depreciation rules	+	– to ++	2
		6a) Project development assistance (PDA) funding with appropriate risk sharing	+	– to +	1
		State or municipality financing of incremental costs for energy renovation projects	++	+ to ++	2

Objective	Category	Policy Option	Effective-ness	Propor-tionality	Prio-rity
		8) Bonus-malus payments for building owners based on their building's EPC relative to dynamic target values	++	+ to ++	1
(1) Ensure availability of skilled suppliers/ contractors at reasonable cost (2) Improve knowledge on deep renovation possibilities and reduce transaction costs	**Capacity Building and Networking**	9) Education and training (**Build Up Skills programme**) with certification of energy consultants	+	– to ++	1
		Local actor networks on energy efficiency renovation at building and district scale	o	– to ++	
		Regional peer networks of building portfolio owners on energy and environment, with a facilitator	o	– to ++	
		Voluntary agreements between government and building portfolio owners (and possibly others) on energy renovations	o	– to ++	
(1) Technology development: improve energy and resource efficiency, reduce costs, make technologies simpler to install (2) improve market uptake of innovative solutions	**Research and Development and BAT promotion**	Financial support for RD&D projects (**H2020 programme**)	o to +	++	
		Technology or best practice solution competitions	o	++	
		10) Aggregation of demand for deep renovation technologies or integrated building renovation projects	o to ++	– / ++	1
		Regulations or national programmes on public procurement to lead by example	(+)	- to ++	

4.3 Key aspects of the selected policy options (Step 2e)

In this chapter, the selected priority 1 policy options from the table above are described in more detail with regard to their functionality (i.e. how they achieve to address specific barriers for deep building renovation), possible design options (i.e. short-term versus medium-term) as well as which actors will be involved regarding their implementation, monitoring, and enforcement. Due to the recent revision of the central EU Directives as part of the Clean Energy Package, an adaptation of their provisions in the near future is considered unlikely. Hence, many of the short-term design options described here refer to making use of other forms of governance such as the governance process or the Concerted Actions (CA) on the EPBD, the EED and the RES Directive. In order to exemplify the viability of the selected policy options, good practice cases of respective or similar policies on EU or MS level will be presented and described. Six of the priority 1 options have been merged into three joint options (policy options 2, 3, and 6 below).

1. **Support for local or regional energy agencies**

Category: Infrastructure and funding

Rationale:

Local and regional energy agencies can take on a vital role with regard to the implementation of building energy efficiency and renewable energy policy and the provision of associated services. Depending on the institutional arrangements, they may be assigned responsibility for the administration of financial support programmes, the implementation of training, qualification and networking measures for building professionals, for monitoring the compliance with building energy regulation and/or for providing advice and assistance to building owners to facilitate the renovation process. Due to their local/regional embedding, such entities are well suited to closely engage with relevant local stakeholders and act as facilitators for or agents of policy implementation. They are also well suited to act as an independent moderator and facilitator of renovation processes in the rented housing sector (policy option 6) and as the coordinator of regional training and certification activities (option 9) as well as regional demand aggregation (option 10). However, they may lack the competences or the necessary financial or personnel resources to fulfil these tasks. Accordingly, EU policy makers should take action to ensure that local or regional energy agencies (or other suitable agencies) are endowed with adequate financial and technical resources to enable their active involvement in promoting deep building renovations.

Policy design options:

To this end, there are different policy options that may also be implemented in a consecutive manner. In the short term, the EU may either attempt to induce increased level of MS' support of regional and local energy agencies via the governance process on the NECPs and the CA on the EED or by itself create funding options for MS either by earmarking a) EU Emission Trading System (ETS) revenues, b) via EU structural funds or c) via direct grants to MS. In the medium term, the EED could be amended to include a requirement for MS to support regional and local energy agencies, listing their tasks, and a minimum staff and budget requirement depending on MS population.

Expected impacts:

The policy mainly addresses legal/institutional barriers such as a lack of enforcement/responsible authority. Furthermore, it enables local and regional energy agencies to implement policy action and thus

indirectly addresses different informational barriers such as low awareness of building energy efficiency and its benefits and difficult access to information/contradicting information, but also high transaction costs and low skills of designers and contactors. The impact of implementing this policy option can be assessed as medium to high, depending on the range and intensity of programmes and services offered to local or regional agencies.

Estimated policy readiness level[5]: 9 of 9

Good Practice example(s):

An exemplary instrument to promote regional sustainable development by provision of financial support to local and regional public entities is the European Regional Development Fund (ERDF). ERDF action is designed amongst others to support the shift towards a low-carbon economy in all sectors by supporting energy efficiency, smart energy management and renewable energy use in public infrastructure, including in public buildings, and in the housing sector (Art. 5 EU Regulation No 1301/2013). As such, public organisations may apply for funding to promote action towards deep building renovation, including the costs of regional or local energy agencies to coordinate such action.

2. Strengthened minimum requirements for energy performance and renewable energy share in case of major renovation

Category: Regulation

Rationale:

Minimum requirements for energy performance and renewable energy share that apply *in case* of major renovations are important regulatory means to take advantage of windows of opportunity to improve the energy performance of existing buildings and to avoid lock-ins. According to current EU legislation, building owners planning to refurbish more than 25% of the surface of the building envelope or where renovation costs exceed 25% of the value of the building are required to adhere to set minimum standards (Art. 7 EPBD, Art. 15 RES). However, MS are allowed to set standards based on cost optimality definitions that lack harmonization and provide leeway for MS to decrease requirements below ambition levels necessary to achieve renovation and climate targets in the building sector. Accordingly, policy options to improve the impact of respective regulation need to focus on tightening the provisions of existing legislation. This policy options needs to be combined with others that increase the rate of renovations, and possibly also their depth above the minimum requirements. This is basically the objective of all other policy options in this selection.

Policy design options:

There are different medium-term policy options for EU level action in this regard. One would be to harmonise cost-optimality and nZEB definitions within the EPBD (Art. 5 & 9) towards ultra-low energy consumption requirements, thus increasing the regulation's impact in cases of major renovations. Furthermore, the provisions of Art. 9 EPBD could be adapted to advance from nZEB to net zero or plus energy buildings. As a complementary measure to improve regulatory effectiveness, the EPBD could be

[5] The policy readiness level indicates the authors' assessment regarding the maturity of a policy option and its potential for immediate implementation. The scale is oriented towards the one used within technology readiness level (TRL) assessments and ranges from 1 (early development stage/no empirical evidence on policy impacts) to 9 (policy is well established with a broad range of implementation examples).

amended to require MS to strengthen control of compliance with the minimum requirements in case of major renovations. In the short term, the European Commission could make use of the governance process on the NECPs and the national long-term renovation strategies as well as the Coordinated Actions on the EPBD and the RES to induce MS action equivalent to the described medium-term options.

Expected impacts:

The policy mainly addresses the legal barrier of unclear, complex or insufficient provisions by clearly outlining building owner responsibilities in case of major renovation. The impact of implementing this policy option can be assessed as high but depends on the effectiveness of monitoring and enforcement.

Estimated policy readiness level: 9 of 9

Good Practice example(s):

All EU MS have legal minimum requirements for major renovations, but the level differs. The Nordic countries are often cited as good examples in this respect. With regard to controlling compliance with minimum requirements, Belgium for its regions Flanders and Brussels has adopted an elaborate monitoring system, which is considered to deliver reliable information on compliance rates (ICF 2015).

The German State of Baden-Wuerttemberg has passed the so-called Renewable Heat Act in 2007, which from 2010 on has obliged non-residential and residential building owners exchanging their old heating system to ensure that 10% (after 2015 15%) of the yearly heating energy demand originates from renewable sources. The requirement applies to all buildings built before 2009, is technology open and allows to achieve the target through implementation of alternative measures such as higher levels of thermal insulation of the building fabric, the use of combined heat and power (CHP) or photovoltaic installations. An evaluation of the law in 2018 showed yearly net savings of 224 kt CO_2 eq for measures implemented between 2010 and 2017, which translates into 1.5% of overall GHG-emissions for heating and warm water supply in the residential building sector (Pehnt et al. 2018).

3. **Mandatory energy renovation and renewable energy requirements**

Category: Regulation

Rationale:

Minimum energy efficiency or renewable energy requirements that apply to specific situations (i.e. new build and major renovations) are important instruments to avoid lock-ins, but may not be sufficient to induce a quick enough transformation of the energy-inefficient building stock. The persistently low (deep) renovation rates across the EU point to the limits of such conditional requirements. Accordingly, in order to accelerate the renovation of the least efficient building stock, the introduction of unconditional mandatory energy renovation and renewable energy requirements should be considered. These would require building owners to implement measures that improve the energy efficiency of their properties at least to the minimum energy performance requirements and/or to make use of roofs, either for solar PV, or for solar thermal, or for vegetation (green roof). Mandatory energy-efficient renovation could be required for walls or roofs older than e.g. 40 years, since these parts of the building will normally get renovated at intervals of around 40 years anyway. The requirement should be coupled with support, e.g. for project development and implementation assistance (policy option 6). Although it is unusual to combine mandatory legal requirements and financial support, this would even be justified in this case,

since the assumed 40 years lifetime/renovation cycle with its basic renovation costs is not a legal requirement either.

Policy design options:

There are different design options for the configuration as well as implementation of such mandatory requirements. In the medium term, the EPBD could be adapted to include an obligation for MS to introduce such mandatory requirements into their national regulatory framework. Requirements could apply to all existing buildings or to specified segments of the building stock, e.g. to all public buildings (in the same way as for central government buildings) or to all rented residential buildings below a specific energy performance standard. Furthermore, the energy requirements could refer to the overall building performance or focus on specific parts of the building envelope or technical building systems (e.g. insulation of lofts or upper ceilings, heat or cold pipes and ducts or exchange of heating systems). Apart from the last configuration focusing on low-cost and usually cost-effective measures, more extensive requirements should be accompanied by additional financial and technical support measures to facilitate compliance for building owners.

With a short-term perspective, again, utilizing the governance process on long term renovation strategies as well as the CA on the EPBD to induce similar action by MS would be an option for the COM.

Expected impacts:

The policy mainly addresses the legal/institutional barrier of unclear, complex or insufficient provisions by clearly outlining building owner responsibilities. Indirectly, it also addresses social and financial barriers such as risk aversion, transaction costs/hassle and competing investment decisions by restricting the choice of building owners not to invest. The impact of implementing this policy option can be assessed as medium to high depending on the scope of regulation and the level of energy efficiency required. Making a too low energy efficiency level mandatory may prove short-term savings but create lock-in effects that prevent future deep renovations.

Estimated policy readiness level: 2 of 9 (Mandatory whole building deep renovation) and 9 of 9 (Mandatory implementation of cost-effective low-cost measures, e.g. attic and upper ceiling insulation, pipe and duct insulation)

Good Practice example(s):

In order to improve the energy related quality of the domestic residential building stock and to tackle fuel poverty in the rented sector, the Scottish Government has announced that mandatory minimum standards will be introduced. These will be phased in and will increase over time: From 1 April 2020, any new tenancy will require the property to have an EPC of at least band E, which will be extended to all properties by 31 March 2022. From 1 April 2022 then, any new tenancy will require the property to have an EPC of at least band D, which will again be extended to all properties by 31 March 2025. To support the ambition of eradicating fuel poverty by removing poor energy efficiency as a driver the Scottish Government are consulting on setting a more ambitious target for those households in fuel poverty - for all homes with households in fuel poverty to reach EPC band C by 2030 and EPC band B by 2040 (where technically feasible and cost effective).

Similarly, France has introduced mandatory requirements for the least efficient residential buildings (>330 kWh/m^2/a) to be renovated by 2025 as well as for tertiary buildings with more than 1 000 m^2 to gradually

reduce their energy consumption by 60% by 2050[6]. As another example, Germany has a mandatory requirement for insulation of lofts or upper ceilings, heat or cold pipes, and ducts and for oil and gas boiler (without low-temperature or condensing technology) older than 30 years.

4. Requirement to develop district heating and cooling concepts

Category: Planning

Rationale:

Besides reducing overall energy demand and decarbonising the power supply, an efficient design of the future heat and cold supply system and increasing the share of renewable energies in heat and cold supply are necessary steps to promote the climate friendly transformation of the residential building stock. This entails the promotion of district level heating and cooling supply concepts in order to move away from less efficient building based supply infrastructure (e.g. gas or oil based heating). Such concepts should also focus on the integration of heat and cold from renewable energy sources as well as consider waste heat and cold from industrial processes. From an environmental but also an economic point of view, investments into district heating infrastructure can be reasonable but are often not considered due to a lack of systemic energy planning within communities/district governments. In addition, a high connection rate for district heating networks is crucial for economically viable operation. A requirement for local authorities to develop heat and cold supply concepts for districts (possibly as part of SEAPs or local climate change action plans) would thus provide an impetus to think local/regional energy systems in a more integrated and efficiency oriented manner. The aim is to avoid the economically irrational development of double competing infrastructures of both gas and district heating networks.

Policy design options:

The medium-term option for EU level policy action would be to introduce into the EED a requirement for MS to require local authorities to develop heat and cold supply concepts for districts or Sustainable Energy Action Plans (SEAPs) including such concepts, and for MS to provide technical and financial assistance to local authorities for development of the concepts or SEAPs. However, given the recent revision of the EED, the more likely short-term option would be for the COM to use the governance process to induce MS action equivalent to the medium-term option, to continue to work with the Covenant of Mayors and to support SEAP development through the Horizon 2020, the upcoming Life Energy, and InterReg programmes.

Expected impacts:

The policy mainly addresses the legal/institutional barrier of a volatile and/or unpredictable regulatory framework as well as the financial barriers of distorted energy prices and low market demand for sustainable energy supply systems. The impact of implementing this policy option can be assessed as medium, as it may ease connection of residential buildings to high-efficiency heating/cooling systems, such as CHP, and/or renewable energy systems.

Estimated policy readiness level: 9 of 9

[6] https://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000038812251&categorieLien=id.

Good Practice example(s):

The Danish legislation governing the planning and setup of heat supply systems is a good practice example of how policy can steer the development of sustainable heating. The Heat Supply Act from 1979 (revised in 1990, 2000 and 2005) laid responsibility for local heat planning in the hands of local authorities, who have since been obligated to develop plans based on an assessment of heating needs and possibilities. In consequence the country was segmented into three different heating zones: 1) District Heating (DH), 2) Individual Heating (Gas) and 3) Individual Heating (Other). Furthermore, it enabled the Government to ban the use of electric (direct) heating in new buildings and from 1994 on also existing buildings with water based central heating systems that are located within a public district heating or natural gas supply network. Additional legal measures to promote DH comprised a halt to installation of oil-fired and gas-fired boilers in new buildings from 2013 and a halt to installation of oil-fired boilers in existing buildings from 2016 in areas with DH or natural gas. Another central provision in the Heat Supply Act was to enable municipalities to require the connection of buildings to the district heating or natural gas supply network. In conjunction with high taxation of fossil energy carriers gas and oil and a non-profit principle governing public DH, the Heat Supply Act provisions considerably increased the coverage of DH. About 63% of Denmark's 2.7 million households utilise district heating. Furthermore, in 2015 about 66% of district heating has been co-generated with electricity, due to the Heat Supply Acts provision, that plants larger than 1 MW have to be operated as combined heat and power plants. 59% of the energy for district heat origin come from renewable sources (including waste) (Danish Energy Agency 2017).

5. Grants for investment in energy efficiency

Category: Financial Incentives and Financing

Rationale:

As the preceding analysis has pointed out, financial barriers such as the landlord/tenant dilemma, long pay-back times of energy efficiency investments and a lacking/low supply of financing options remain among the central impediments for the large-scale deep renovation of the EU building stock. While several MS have implemented energy efficiency grant or subsidised loan schemes focusing on deep building renovation (e.g. Germany), there is no provision in the current EU legal framework requiring MS to do so. In order to overcome financial barriers for building owners and to foster private investment, the EU should require MS to provide subsidies for deep building renovation via suitable mechanisms. To account for differing framework conditions for renovation investments (e.g. local housing market characteristics), it might be sensible to encourage MS to differentiate grant levels by region or housing type/tenant.

Policy design options:

As a medium-term option for policy implementation, the COM could change the requirements of Art. 10 EPBD from "consider and report" to "implement" investment grants and loans for deep renovation/towards nZEB or a more ambitious standard (see above) with a minimum rate of deep renovations to be supported (e.g. 1.5% per year, with stepwise increases to 2.0 or 2.5%). The political feasibility for this policy option will strongly depend on whether the COM will provide or devise funding options for MS that do not wish to implement EEOS. These could for instance consist of a) earmarking EU ETS revenues, b) exemption from financial stability pact for first 2 years of implementation of the scheme (afterwards, additional revenues or savings for the MS' budgets should be higher than programme

expenditures; this was proven for the German KfW scheme, Kuckshinrichs/Hansen 2015) or c) EU grants to MS. The first funding option a) will require a specification within the earmarking process towards deep building renovation. To increase available funds, the COM could in the medium-term require, rather than suggest, that the vast majority of auction revenue go toward climate action by changing the wording in the ETS Directive to "shall" rather than "should," and increasing that required percentage towards 100%. While option b) would increase MS' funding flexibility it also contradicts deeply rooted beliefs in the financial stability pact and debt limits, thus rendering it unlikely to receive sufficient political support. Option c) would require additional EU budget, which may possibly stem from a reallocation of EU structural funds. In the short term, COM could use the governance process on national long-term renovation strategies and CA on EPBD to induce increased levels of MS' grant programmes.

Expected impacts:

The policy primarily addresses financial barriers such as the landlord/tenant dilemma, lack of cost-effectiveness, and to a lesser extent also lack of finance. The impact of implementing this policy option can be assessed as high, depending however on the adequacy of grant levels to overcome financial barriers, and the energy performance levels required for receiving the grants or loans.

Estimated policy readiness level: 9 of 9

Good Practice example(s):

The German state-owned KfW bank manages the national energy-efficient renovation programme. The programme addresses the refurbishment of existing buildings by offering financial products (a choice of upfront grants or soft loans, which may have a grant component) to building owners to overcome certain economic barriers (e.g. lack of sufficient loan financing or own upfront capital, short payback expectations) in order to enable them to realise energy-efficient investments. The innovative element of the policy is that KfW makes use of a scaling system, to which the amount of funding is tied: the more energy-efficient, the higher is the grant. Hence, if the MEPS are tightened (and therewith the Efficiency House Level classification scheme), the scaling system's criteria automatically become stricter. In 2017 almost 130 000 grant applications were approved for measures in about 275 000 dwellings, providing around 30 000 soft loans and 100 000 investment grants (Diefenbach et al. 2018).

6. Financial support for Project Development and Implementation Assistance (PDIA) and for an independent moderator and coaching role

Category: Information and Advice combined with Financial incentives and financing

Rationale:

The development of deep energy renovation projects in large housing portfolios can be complex and may require significant up-front investments for planning activities including mobilising relevant stakeholders, developing feasibility studies and business cases, applying for funding, and addressing legal issues. It may even require an independent moderator between the interests of landlords and tenants (or between multiple flat owners) in order to overcome initial resistance. Against the background of potential failure to actually implement the developed project for legal, financial or technical reasons, building owners may be unwilling or unable to make such investments. The support should not end at project preparation stage but continue through all of the implementation and re-commissioning process of the renovation, in order to stimulate implementation of the projects developed that the building owner him-/herself may not be

able to organise. To address this financial and organisational barriers for building renovation, the provision of financial support for Project Development and Implementation Assistance (PDIA) and for an independent moderator and coaching role is a suitable tool. The classical Project Development Assistance (PDA) refers to activities aimed at supporting project promoters throughout the project development cycle. This policy option would augment it to PDIA. This includes the role of an independent moderator and coach but could also support different forms of PDIA. It would be equivalent to a one-stop shop concept.

Currently, PDA funding is provided by the EU mostly to public authorities/entities via different ELENA (European Local ENergy Assistance) facilities managed by public banks as well as the European Energy Efficiency Fund (EEEF). To increase its impact, PDA funding should be advanced to PDIA funding and extended to housing cooperatives, social housing companies as well as smaller housing companies with limited financial and technical resources. Furthermore, it should entail appropriate risk sharing provisions to convince more risk averse building owners to take advantage of the offer.

Policy design options:

As a medium-term policy option, the COM could add a requirement in Art. 10 of the EPBD for MS to provide PDIA funding with low investor risk, particularly for an independent moderator and coaching role. This would however have to be accompanied with adequate funding options for MS to receive wide political support (see elaboration in previous policy option description). In order to improve the effectiveness of current PDA provision in the short term, a budget extension of the ELENA facilities in combination with an adaption of the eligibility criteria as well as risk sharing provisions (to reduce risk for building owners to have to pay back the PDIA funds) may be an option. Alternatively, the EU may also increase earmarked funding to MS e.g. via the ERDF or EEEF.

Expected impacts:

The policy primarily addresses financial barriers such as the high upfront investment for project development, competing investment decisions and perceived economic risks as well as the informational (difficult access to information/contradicting information) and social barriers (transaction costs/hassle and risk aversion). The impact of implementing this policy option can be assessed as medium, since it will support project development and implementation but will not ensure the latter. It should therefore be combined with financial incentives, such as grants, preferential loans (option 5), cost recovery regulation (option 7), or a novel bonus-malus scheme (option 8).

Estimated policy readiness level: 8 of 9

Good Practice example(s):

The ELENA facilities have been set up to support the achievement of the Intelligent Energy Europe (IEE) Programme objectives of fostering energy efficiency and the rational use of energy resources as well as promoting new and renewable energy sources and support energy diversification. They aim at supporting the preparation and launch of bankable sustainable energy projects or investment programmes. When awarded, the PDA facilities cover a major share of the cost for technical support necessary to prepare, implement and finance the investment projects, (e.g. feasibility and market studies, structuring of programmes, business plans, energy audits, preparation for tendering procedures, etc.). An evaluation of the Facilities in 2016 found that since 2009, the five PDA facilities have funded a total number of 97 projects, granting a total amount of approximately 97 million Euros to project promoters. The expected

investment value is around 5.4 billion Euros, taking into account the leverage factor to be achieved (PwC 2016).

7. Cost recovery regulation

Category: Regulation/Financial incentives and financing

Rationale:

Investment decisions into deep renovation measures are often (though not exclusively) shaped by the prospect of recovering the cost via (increased) building/apartment rents or sale values. Whether all, some or none of the investment costs may be passed on to tenants is subject to national regulation and may in the latter case represent a significant financial barrier for deep building renovation. On the other hand, absence of specific or restrictive regulation may result in gentrification. Currently, there is no provision in the EU legal framework that explicitly requires MS to implement respective regulation in a manner that both enables cost recovery of energy efficiency or renewable energy investments while at the same time protecting financially vulnerable households.

Policy design options:

In order to stimulate deep building renovation activity through cost recovery regulation while achieving both climate and social targets, the COM could in the medium term add a more precise requirement for MS to implement such legislation, conditional on not increasing total rent (basic + energy), in Art. 19 (1) point (a) EED or in the EPBD. Since this would mean for some MS that building owner's ability to pass on costs is restricted, MS should be encouraged and enabled to provide additional financial incentives for deep building renovation to avoid thwarting the dynamic and to respond to political resistance from domestic stakeholders. In the short term, the COM could aim to induce similar MS' action via the governance process on national long-term renovation strategies and CA EPBD/CA EED.

Expected impacts:

The policy primarily addresses the landlord/tenant dilemma and can contribute to at least partly overcome this barrier. The impact of implementing this policy option can be assessed as high, depending on the allowed levels of cost allocation and local housing market characteristics (i.e. ability/willingness-to-pay of tenants).

Estimated policy readiness level: 8 of 9

Good Practice example(s):

The German regulation on building modernisation costs ("modernization component of rents") allows landlords to pass on a specified share of their building investments to their tenants. If a flat is modernised in order to improve energy efficiency or if it was upgraded by (for example) renovating a bathroom or adding a balcony, landlords can allocate 8% of the modernisation costs minus the estimated costs that would have been necessary for maintenance work to the annual rent. In order to avoid social hardship/gentrification, in addition the monthly rent after the modernisation cannot be increased by more than €3 per m² in six years. For flats with a rent of up to €7 per m², it may be increased by only €2 per m². Furthermore, landlords who only modernise flats in order to get tenants to give notice or to cooperate in cancelling the tenancy must pay a fine of up to € 100 000.

8. Tax bonus-malus scheme

Category: Financial incentives and financing

Rationale:

While minimum requirements are a regulatory mechanism to achieve a better energy performance of the building stock, a tax bonus-malus scheme employs negative and positive financial incentives for building owners to invest in deep building renovation. The basic idea of a building efficiency related bonus-malus system is to implement a long-term goal for the building, e.g., by defining a certain energy rating as target for the building stock in the year 2050. The malus can then be designed as a function of the required energy demand/efficiency (energy performance standard EPS) rating that is tightened over the years to come, e.g., in the shape of a long-term "orientation curve" which describes the desired efficiency rating in each year. Buildings above the curve would have to pay a malus and buildings below the curve would receive a reward, either as a yearly re-imbursement, a tax deduction (e.g. property tax) or as a one-off support for renovation. Due to the freedom in the choice of means at least in the early stages of the orientation curve, the owner can, based on a renovation plan, decide how he or she wants to achieve the objectives. Such a system thus provides not only clear incentives but also planning security for building owners. It could thus be an alternative to classical grant schemes (policy option 6), which particularly rewards early action by building owners. Implemented on another level, this instrument could also be able to promote the development of heating networks towards Low-Ex-systems: Digital "LowEx meters" at the houses´ transfer stations and (bonus-malus) price systems incentivise customers to lower their return flow temperatures of their heating system. Low return temperature increases the efficiency and capacity of district heat generation and are vital for the integration of low-temperature heat from renewable sources, waste heat or heat pumps.

Policy design options:

In order to stimulate the implementation of such schemes within MS, the COM could in the medium-term aim to adapt the EPBD by adding a requirement to "consider and report" respective systems in Art. 10. A requirement to implement such schemes would likely to fail to receive political support due to the so far untested nature of the instrument in the building sector. In order to promote the policy option in the short term, the COM could fund the development and pilot implementation of such schemes within the Horizon 2020 Research Programme or the upcoming Life Energy programme.

Expected impacts:

The policy addresses the financial barriers of perceived economic risks and (at least partly) access to funding as well as the legal/institutional barrier of a volatile and/or unpredictable regulatory framework and in consequence also the social barrier of risk aversion among building owners. The impact of implementing this policy option can be assessed as high, depending on the level of payment/reward and the target values for energy performance.

Estimated policy readiness level: 4 of 9

Good Practice example(s):

To date a tax bonus-malus scheme to incentivise deep building renovation has not (yet) been implemented. Thus, no empirical information with regard to its effectiveness and as basis to assess its potential impact on EU level is available. However, the instrument has been successfully tested in other sectors. With its ecological bonus-malus scheme (bonus-malus écologique) France has passed similar

legislation concerning the purchase of vehicles, which "punishes" buyers of vehicles with CO_2 emissions above a certain standard with an extra fee and subsidizes the purchase of vehicles with CO_2 emissions below the set standard. While the dynamics of investment decisions in the two sectors are subject to different factors, the French Bonus-Malus system has been found to be very effective in shifting the vehicle sales distribution towards more environmentally friendly vehicles (Monschauer/Kotin-Förster 2018). The bonus-malus price system, which creates incentives for low return flow temperatures at the customer's site, is already implemented in some Danish district heating networks.

9. Education and training of supply side actors

Category: Capacity Building and Networking

Rationale:

The availability of skilled building professionals to plan, implement and certify deep building renovations is a structural precondition to ensure qualitative and quantitative progress with regard to the low carbon transformation of the EU building stock. It is therefore a necessary complement to all other policy options recommended here. However, a lacking supply of qualified/sufficiently trained supply side actors has been identified within the analysis to be a persistent barrier in this respect. Accordingly, EU policy should aim to induce the establishment of adequate education and training offers within all MS. Furthermore, in order to ensure the quality of energy consultancy and certification services, the establishment of a high standard certification system for energy consultants or other EPC issuers should be required.

Policy design options:

A medium-term policy option to ensure a high quality of education, training and certification measures would be to introduce into the EPBD (e.g. by expanding **Art 20 (3)**) a requirement for MS to ensure such education and training as well as certification of energy consultants or other EPC issuers. In the short term, COM could use the governance process on national long-term renovation strategies and the CA on the EPBD to induce equivalent MS action. Furthermore, already existing EU initiatives aiming at the qualification of builders such as the EU Build Skills Programme should be continued and further focused towards implementation of schemes and roadmaps developed throughout pillar 1 of the initiative (see below).

Expected impacts:

The policy primarily addresses the informational and technical barriers of a low supply of technically skilled workers and lack of awareness of innovative technologies. The impact of implementing this policy option can be assessed as medium, due to its lagged effect on deep building renovation.

Estimated policy readiness level: 9 of 9

Good Practice example(s):

BUILD UP Skills is an EU initiative aimed at the development of education and training schemes for workers in the building sector. Focus of the initiative are skills related to energy efficiency and renewable energies in renovation works concerning high-energy performance housing and nZEB. Between 2011 and 2014, two pillars of the initiative have been implemented: while pillar 1 focused on the development of national qualification platforms and roadmaps in 30 countries incl. EU-28, pillar 2 in a second step supported the implementation of these roadmaps, designing and piloting new training schemes. As a

result 805 training courses were implemented, with 8570 people trained, and an average cost of €638 per trainee (Rademakers et al. 2018).

10. Aggregation of demand for renovation works

Category: Research and Development and BAT promotion

Rationale:

Although innovative solutions for deep building renovations are available, they may not yet be financially competitive resulting in a lack of market uptake. Public entities may support the market penetration of highly efficient building technologies or integrated renovation concepts by aggregating demand via public procurement schemes or other measures to support private bundling of demand (e.g. via soft loans or other financial incentives). Due to the increased demand induced in this way, manufacturers/suppliers of such innovative solutions are enabled to decrease production/supply costs via economies of scale, thus improving attractiveness of their products for other market actors. While there are examples of MS implementing or supporting such aggregation schemes (e.g. Sweden, Netherlands), there currently is no legal provision from the EU requiring MS to do so. In order to stimulate the diffusion of best available technologies (BAT), EU policy should aim to induce MS action in this regard.

Policy design options:

In the medium term, the COM could aim to integrate a provision into the EPBD that requires MS to initiate and support public and private aggregation of demand schemes. As a short-term action, the COM could use the governance process on national long-term renovation strategies and the CA on the EPBD to induce respective MS action. Furthermore, in the meantime it should continue to fund the development and implementation of pilot schemes via the Horizon2020 Research Programme.

Expected impacts:

The policy addresses different financial and technical barriers such as low market demand and high upfront investments as well as lacking supply of (integrated) technical solutions. Furthermore, it can also contribute to lower risk aversion (social) and reduce the lack of awareness of innovative technologies among building professionals (informational). The impact of implementing this policy option can be assessed as high.

Estimated policy readiness level: 7 of 9

Good Practice example(s):

The Swedish Board for Industrial and Technology Development (NUTEK) started technology procurement programmes in Sweden in the late 1980s with the objective to support the market penetration of energy-efficient technologies. NUTEK initiated procurement groups consisting of a group of buyers or potential buyers per technology. Potential suppliers were approached and invited to compete for publicity reasons and for a guaranteed number of sales when winning the competition. BeBo as one of these groups is a network of approximately 24 residential property owners (covering about 70% of Sweden's apartments), whose main purpose is to focus on procurement for deep renovation in multi-dwelling buildings and new technologies. Through the network activity five deep renovation demonstration projects have been realised with achieved energy reductions of approximately 30% (Haugbølle/Vogelius 2016).

The Energiesprong concept was originally developed in the Netherlands as a government-funded innovation programme and follows an integrated approach to promote large scale net zero renovation of

existing buildings (European Construction Sector Observatory 2018). The approach combined aggregation of demand from social housing associations with fast, high quality implementation of building renovations using innovative technical solutions (e.g. standardised thermal insulation systems) and financing concepts (i.e. energy performance contracting). In order to promote the development of technical innovation, the initiative brought together different actors within the supply chain to work on scalable solutions. In terms of impact, the initiative has led to the successful renovation of 5 000 buildings to net zero energy standard, with more than 14 000 additional dwellings planned. Furthermore, the concept has in the meantime spread to other EU countries (France, Italy, Germany, UK), of which particularly in France it has gained momentum.[7]

[7] https://energiesprong.org.

5 Conclusion and recommendations (Step 3)

The challenge of large-scale deep renovation in a multi-building context is closely associated with the specific situation of multi-building owners and the barriers they face. Small or non-professional (i.e. with professions outside of real estate business) multi-building owners often lack the time, knowledge and/or financial resources to initiate sustainable transformation of their buildings. But although professional portfolio owners could be expected to manage their buildings well, they still are often too small to employ sufficiently qualified energy and investment managers to steer deep renovations. Regardless of the organisational capacities, the most important barrier to deep renovation, also in this context, remains that of split incentives (i.e. the landlord/tenant dilemma). In addition, the present analysis has identified a wide range of additional financial, but also technical, informational, legal/institutional and social barriers that impede deep energy renovations in multi-building contexts.

The performed baseline policy framework analysis has identified a large number of existing policy instruments at EU level that aim to address these barriers already. The persisting issues reported in literature as well as by the interviewed stakeholders and experts however also point to remaining gaps in the policy framework itself as well as implementation gaps in the transposition of EU policy within the MS. Some of the gaps identified in the desktop review such as the insufficient provision of PDIA funding to facilitate project development/implementation and to overcome tenant scepticism, the lack of skilled actors on the supply side as well as insufficient financial support to overcome the landlord/tenant dilemma have also been confirmed by stakeholder interviews.

To identify suitable policies to overcome these barriers, an extensive list of potential policy options has been drawn up and analysed along the lines of two main selection criteria: (1) effectiveness for the DREEAM target group and (2) proportionality of EU level policy action. Furthermore, additional aspects such as feasibility as well as coherence with the existing EU policy framework have been considered within the process. As a result, a package of 10 improved or new policy options to address central impediments to deep building renovation has been selected and elaborated, and potential implementation pathways and design options have been described in chapter 4.3. While recommendations are directed towards the COM as initiator of EU policy reform, their proactive implementation by pioneering MS as central actors in the multi-level governance system is explicitly encouraged. Table 8 provides a short overview of the policy options, the barriers they address and their estimated policy readiness level.

Table 8: Overview of prioritized policies to promote deep building renovation.
The options marked in bold: Recommend options by the authors for immediate implementation by COM through working with the Member States in the governance processes on national long-term renovation strategies and NECPs as well as the CA on the EPBD, EED, and RES Directive

No.	Policy option	Addressed barriers	Policy readiness
1	**Support for local and regional energy agencies**	*Legal/institutional:* lack of enforcement/responsible authority *Informational (indirectly):* low awareness of building energy efficiency and its benefits, difficult access to information/contradicting information and low supply of skilled supply side actors *Social (indirectly):* transaction costs/hassle	9 of 9
2	**Strengthened requirements for energy performance and renewable energy share in case of major renovation**	*Legal/institutional:* unclear, complex or insufficient provisions	9 of 9
3	Mandatory renovation and renewable energy requirements	*Financial:* competing investment decisions *Legal/institutional (indirectly):* unclear, complex or insufficient provisions *Social (indirectly):* risk aversion and transaction costs/hassle	2 to 9 of 9
4	**Requirement to develop district heating and cooling concepts**	*Financial:* distorted energy prices and low market demand *Legal/institutional:* volatile and/or unpredictable regulatory framework	9 of 9
5	**Grants for investment in energy efficiency**	*Financial:* landlord/tenant dilemma, lack of cost-effectiveness, and to a lesser extent lack of finance	9 of 9
6	**Financial support for PDIA, moderators and coaches**	*Financial:* high upfront investment, competing investment decisions and perceived economic risks *Informational:* difficult access to information/contradicting information *Social:* transaction costs/hassle and risk aversion	8 of 9
7	**Cost recovery regulation**	*Financial:* landlord/tenant dilemma	8 of 9
8	Tax bonus-malus scheme	*Financial:* perceived economic risks and (at least partly) access to funding *Legal/institutional:* volatile and/or unpredictable regulatory framework *Social:* risk aversion	4 of 9
9	**Education and training of supply side actors**	*Informational:* lack of awareness of innovative technologies among building professionals and low supply of technically skilled workers	9 of 9
10	**Aggregation of demand for renovation works**	*Financial:* low market demand and high upfront investments *Technical:* lacking supply of (integrated) technical solutions *Social:* risk aversion *Informational:* lack of awareness of innovative technologies among building professionals	7 of 9

Based on the analysis, the authors recommend to COM to implement options 1, 2, 4 to 7, 9, and 10 immediately through working with the MS in the governance process on national long-term renovation strategies and NECPs as well as the CA on the EPBD, EED, and RES Directive. They will strengthen existing policies by a well-balanced combination of energy efficiency supporting and information infrastructure (option 1, 6, 9 and 10), planning (option 4), regulation (option 2 and possibly 3), and financial incentives (options 5, 7, possibly 8). In order to facilitate the implementation of these policy options and to increase political support for them within MS, we recommend the COM to also aim to provide more funding to MS for policy implementation, possibly via the European Structural Investment Funds or stricter requirements for earmarking EU ETS revenues. For novel approaches such as option 8, the provision of funding to explore the potential and impacts of the introduction of such schemes via the H2020 Research Programme should be considered.

In the medium term, the COM should aim to amend the EPBD, EED, and RES Directive to include stronger requirements for MS regarding these policy options. This would ensure that appropriate action to address the multiple barriers for deep building renovation is implemented and at the same time provide a stable and conducive action framework for building owners to guide investment decisions. The short-term implementation of policy options via the governance and CA processes may not achieve adoption across all MS but may nevertheless provide empirical evidence with regard to the policies' effectiveness and thus pave the way for amendment of the Directives.

6 Bibliography

Atanasiu, B./Despret, C./Economidou, M./Maio, J./Nolte, I./Rapf, O. (2011). Europe's building under the microscope - A country-by-country review of the energy performance of buildings. Building Performance Institute Europe (BPIE). http://bpie.eu/wp-content/uploads/2015/10/HR_EU_B_under_microscope_study.pdf

Boermans, T./Bettgenhäuser, K./Offermann, M./Schimschar, S. (2012). Renovation tracks for Europe up to 2050. https://www.eurima.org/uploads/ModuleXtender/Publications/90/Renovation_tracks_for_Europe_08_06_2012_FINAL.pdf

Boermans, T./Papaefthymiou, G./Offermann, M./John, A./Comaty, F. (2015). The role of energy efficient buildings in the EUs future power system. Project report on behalf of the European Insulation Manufacturers Association (Eurima). https://www.eurima.org/uploads/ModuleXtender/Publications/128/Ecofys_XII_Report_final_13_10_2015.pdf

Danish Energy Agency (2017). Regulation and planning of district heating in Denmark. Report. https://ens.dk/sites/ens.dk/files/Globalcooperation/regulation_and_planning_of_district_heating_in_denmark.pdf

DECC (2012). The Energy Efficiency Strategy: The Energy Efficiency Opportunity in the UK. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/65602/6927-energy-efficiency-strategy--the-energy-efficiency.pdf

Diefenbach, N./Stein, B./Loga, T./Rodenfels, M./Jahn, K. (2018). Monitoring der KfW-Programme „Energieeffizient Sanieren“ und „Energieeffizient Bauen“ 2017. https://www.kfw.de/PDF/Download-Center/Konzernthemen/Research/PDF-Dokumente-alle-Evaluationen/Monitoring-der-KfW-Programme-EBS-2017.pdf

Duce, E./Grasset, H./Vavallo, M./Pracucci, A./Rathmell, A./Causse, E./Pantelis, S./Biosca, J./Ferreiro Sistiaga, A./Sabatakos, P. (2018). Accelerating Energy renovation solution for Zero Energy buildings and Neighbourhoods. D8.2 1st RenoZEB Market Assessment. https://renozeb.eu/fileadmin/Media/Reports/RenoZEB_Market_Assessment.pdf

European Commission (2017). Better Regulation Toolbox #17. How to identify policy options. https://ec.europa.eu/info/sites/info/files/file_import/better-regulation-toolbox-17_en_0.pdf

European Construction Sector Observatory (2018). Policy measure fact sheet. Netherlands: Energiesprong (Energy Leap). Thematic Objectives 1 & 3. http://www.nweurope.eu/media/3509/2018-03-european-construction-sector-observatory-policybrief.pdf

Haugbølle, K./Vogelius, P. (2016). Evaluating BeBo – the Swedish procurement group for housing. A follow-up analysis. SBi 2016:32, Statens Byggeforskningsinstitut, Aalborg Universitet. https://sbi.dk/Assets/Evaluating-BeBo-the-Swedish-procurement-group-for-housing/SBi-2016-32n.pdf

ICF (2015). Energy Performance of Buildings Directive (EPBD) Compliance Study. Specific Contract No. MOVE/ENER/SRD.1/2012-409-Lot3/ENER/C3/2014-542/S12.701648. https://ec.europa.eu/energy/sites/ener/files/documents/MJ-04-15-968-EN-N.pdf

IEA (2005). Evaluating Energy Efficiency Policy Measures & DSM Programmes. Volume I Evaluation Guidebook. Based on National Case Studies & National and International Experiences. http://www.ieadsm.org/wp/files/Exco%20File%20Library/Key%20Publications/Volume1Total.pdf

IEA (2014). Special Report: World Energy Investment Outlook. https://www.iea.org/publications/freepublications/publication/WEIO2014.pdf

JRC (2015). Energy renovation: The Trump Card for the New Start of Europe. http://publications.jrc.ec.europa.eu/repository/bitstream/JRC92284/eur26888_buildingreport_online_2015-03-25.pdf

Karlsson, A./Lindqvist, C./Wojtczak, E./Stachurska-Kadziak, K./Holm, D./Sornes, K./Schneuwly, P./Tellado, N./Rodriguez, F. (2013). Nearly Zero energy Neighborhoods. Common barriers and challenges in current nZEB practice in Europe. D.1.1. Report https://www.ivl.se/download/18.4b1c947d15125e72dda163a/1449742313543/C38.pdf

Kuckshinrichs, W./Hansen, P. (2015). Wirkungen der KfW-Förderprogramme „Energieeffizientes Bauen“, „Energieeffizient Sanieren“ und „Energieeffiziente Infrastruktur“ auf öffentliche Haushalte im Förderjahr 2011. Short assessment on behalf of the KfW Banking Group. https://www.kfw.de/Download-Center/Konzernthemen/Research/PDF-Dokumente-alle-Evaluationen/STE-Research-Report-Wirkungen-der-F%C3%B6rderprogramme-Energieeffizientes-Bauen-Sanieren-und-Infrastruktur-der-Kfw-auf-%C3%B6ffentliche-Haushalte-2011.pdf

Monschauer, Y./Kotin-Förster, S. (2018). Bonus-Malus Vehicle Incentive Systemin France. Fact sheet. https://www.euki.de/wp-content/uploads/2018/09/fact-sheet-bonus-malus-vehicle-incentive-system-fr.pdf

Pehnt, M./Weiß, U./Fritz, S./Jessing, D./Lempik, J./Mellwig, P./Nast, M./Bürger, V./Kenkmann, T./Zieger, J./Steinbach, J./Lambrecht, K./Jungmann, L. (2018). Evaluation des Erneuerbare-Wärme-Gesetz (EWärmeG). Endbericht im Auftrag des Ministeriums für Umwelt, Klima und Energiewirtschaft Baden-Württemberg. https://um.baden-wuerttemberg.de/fileadmin/redaktion/m-um/intern/Dateien/Dokumente/5_Energie/Neubau_und_Geb%C3%A4udesanierung/Evaluationsbericht_EWaermeG.pdf

Pwc (2016). Evaluation of the Project Development Assistance implemented under the Intelligent Energy Europe. Final Report Specific contract n° ENER/C3/20 1 3-426 under Service Framework Contract ENER A2 360-2010. https://ec.europa.eu/energy/sites/ener/files/documents/dgener_pda_-_final_report_abstract_rev_3.0_rev.pdf

Rademaekers, K./Svatikova, K./Artola, I./Williams, R./Gausas, S./Antanavicius, J. (2018). BUILD UP Skills Pillar II. Overview report. Deliverable D2.10Of the contract EASME/H2020/EE/2015/008 to ‘Support for BUILD UP Skills EU exchanges and analysis on construction skills’ for the Executive Agency for Small and Medium-sized Enterprises (EASME). http://www.buildup.eu/sites/default/files/content/bus_pillar_ii_overviewreport.pdf

Saheb, Y. (2016). Energy Transition of the EU Building Stock. Unleashing the 4th Industrial Revolution in Europe. https://www.openexp.eu/sites/default/files/publication/files/Reports/energy_transition_of_the_eu_building_stock_full_report.pdf

Thomas, S./Aydin, V./Kiyar, D./Hafiz, A./Rasch, J. (2015). Energy efficiency policies for buildings: bigEE's recommended policy package, good practice examples and tips for policy design. http://www.bigee.net/media/filer_public/2015/02/06/bigee_broschuere_energy_efficiency_policy_in_buildings.pdf

Thomas, S./Suerkemper, F./Adisorn, T./Hauptstock, D./Schäfer-Sparenberg, C./Tholen, L./Vondung, F./Becker, D./Tesniere, L./Bourgault, C./Förster, S./Egger, C./Geiss, J./Roth, R./Bayer, L./Schilken, P./Dely, K./Bourges, D./Borg, N. (2016a): Feedback Loop Report. Progress in energy efficiency policies in the EU Member States. Findings from the Energy Efficiency Watch 3 Project. http://www.energy-efficiency-watch.org/fileadmin/eew_documents/EEW3/EEW3_Feedback_Loop_Report_20170302.pdf

Tuominen, P./Klobut, K./Tolman, A./Adjei, A./de Best-Waldhober, M. (2012). Energy savings potential in buildings and overcoming market barriers in member states of the European Union. In: Energy and Buildings, Vol. 51: pp. 48–55. doi:10.1016/j.enbuild.2012.04.015.

7 Annex

7.1 Detailed results of national policy framework screening

Table 9: Policy framework for deep building renovation in Italy

Targets and Concepts	
Integrated National Energy and Climate Plan (NECP)	The NECP contains different targets with regard to energy efficiency and renewable energy. Italy intends to pursue an indicative reduction target for 2030 of 43% for primary energy consumption and of 39.7% for final energy consumption, with respect to the reference PRIMES 2007 scenario. Furthermore, Italy plans to pursue the target of obtaining 30% of gross final consumption of energy from renewable sources in 2030 with the following sectoral distribution: 55.4% renewables share in the electricity sector; 33% renewables share in the heating sector (for heating and cooling); 21.6% with regard to the incorporation of renewables in the transport sector.
National Energy Strategy	Forming part of Italy's decarbonisation roadmap to 2050, the 2017 National Energy Strategy (NES) aims amongst others to reduce final energy consumption by a total of 10 Mtoe, reach a 28% share of renewables in total energy consumption by 2030, and a 55% share of renewables in electricity consumption by 2030 and phasing out the use of coal in electricity generation by 2025.
National action plan for increasing the number of nearly zero-energy buildings	The National Action Plan clarifies the definition of NZEB and examines the energy performance of the various types of NZEB in different end-use sectors and climate zones. It estimates the additional costs – relative to current levels – necessary to construct new NZEB or transform existing buildings into NZEB. It also outlines the national development framework and policies for increasing the number of NZEB through the regulatory and incentive measures available.
Long term renovation strategy	In line with the requirements of the EPBD, Italy has provided an updated long-term renovation strategy. According to an assessment of the JRC a more coherent approach should be followed to describe the different type of buildings that form the national building stock, also a dedicated chapter on forward looking perspective to guide investment decisions of individuals, industry and financial institutions are still missing. Furthermore the cost-effectiveness approach should be improved.
Infrastructure and funding	
Energy Agencies/national authorities	ENEA is the National Agency for New Technologies, Energy and Sustainable Economic Development, a public body aimed at research, technological innovation and the provision of advanced services to enterprises, public administration and citizens in the sectors of energy, the environment and sustainable economic development. In addition, there are several local energy agencies. UTEE is the National Agency for Energy Efficiency operating throughout the national territory with the task of supporting the country to achieve Energy Efficiency. It offers scientific technical support to companies, support the public administration in the preparation, implementation and control of national energy policies and promote training and information campaigns to spread the culture of energy efficiency.
White Certificate Scheme	The White Certificates scheme constitutes a mandatory regime for primary energy saving imposed on electricity and gas distributors (DSOs) with more than 50 000 clients. White Certificates are tradeable assets which attest that a reduction of end-use energy consumption has been attained as a result of interventions and projects to increase energy efficiency including CHP. The current target for the period 2017-2020 has been set to primary energy savings of 36.36 Mtoe.
Eliminating distortions	
Energy and carbon taxes	An excise tax on energy applies to oil products, natural gas and coal and coke across all sectors. Fuels used to generate electricity are also taxed, but at much lower statutory rates. Electricity output is taxed (per MWh) except when used for transport purposes.
Regulation	
Minimum Energy Performance Standards (MEPS) *(EPBD provision)*	The Decree for the new EPC guidelines, enacted on 26 June 2015, includes amongst others minimum energy efficiency requirements for buildings under the law.
Technical systems regulation *(EPBD provision)*	Presidential Decree No 74/2013 established new rules concerning the operation, management, control, maintenance and inspection of heating, cooling and hot water systems in buildings.

Building code	The draft building code approved in November 2016 lays down the general principles and criteria for simplifying and harmonising local building regulations throughout Italy. The building code is divided into two parts: • General building principles and rules: these lay down the standard building practices to apply at a national and regional level; • Local building regulations: these define the regulatory framework for construction under local authority jurisdiction, which, again to ensure the simplification and harmonisation of building standards nationwide, must follow a uniform general structure.
Renewable energy regulation (Legislative Decree No 28/2011) *(RES provision)*	The decree establishes the obligation to include renewable energy sources in new buildings and buildings undergoing major renovations for heat, electricity (share depending on the size of the building) and cooling. Failure to comply with the obligation leads to denial of the building licence.
Energy management obligation	Since 1991 in Italy it is mandatory to appoint an energy manager for every industrial organization with an annual consumption of more than 10 000 toe and for organizations from other sectors above 1 000 toe.
Planning	
Regional Energy and Environmental Plans (REEP)	In Italy, the regions are obligated to develop Regional Energy and Environmental Plans (REEP), which include assessments of the potential for high efficiency CHP and district heating.
Information and advice	
Transparency on energy performance of buildings (EPBD)	Decree-Law No 63/2013 on the energy performance certificate (EPC) introduces the requirement when selling or letting a property to enclose the EPC with the sales or letting agreement.
Transparency of bills regulation (Decision No 501/2014/R/com) (EPBD)	New requirements for the transparency of bills for electricity and/or gas distributed via urban networks to harmonise, rationalise and simplify billing information.
Website on Energy Efficiency (ENEA)	A portal called Obiettivo Efficienza Energetica, Target Energy Efficiency, maintained by UTEE – ENEA has been set up, to provide information on the regulatory framework, incentive mechanisms, technological solutions, training being offered, good practice and simplified methods for achieving energy efficiency improvement targets.
Information and training programme on energy efficiency and saving	Art. 13 of Italian Legislative Decree 102/2014 provides for a three-year broad information and training programme targeted at SMEs, government employees, schools, households in multi-family buildings, banks and financial institutions, ESCOs, energy management experts and service providers, the development of which was conceived by the ENEA involving different parties, including the Regions, consumer associations and ESCO associations and energy service companies.
Financial incentives and financing	
*Tax deductions for energy-efficient retrofitting of buildings (*Law No 449)	Tax deduction for restoration of buildings allows deductions of 65% for measures to reduce energy requirements for heating through overall energy-efficient retrofitting (via thermal insulation) and transformation into NZEBs, installation of solar thermal panels and replacement of winter heating installations (with condensing boilers, heat pumps, hybrid installations, micro-cogenerators, biomass boilers) and electric water heaters (with heat pumps. All taxpayers, individuals, professionals, companies and businesses that incur costs for energy efficient renovations are eligible.
Conto Termico/Thermal Account	The Conto Termico scheme supports both the production of renewable thermal energy and measures by public sector bodies aimed at improving the energy efficiency of buildings and installations via subsidies. Businesses, households and public authorities are eligible to receive up to 65% of their investment costs.
Italian National Fund for Energy Efficiency (150 million)	The Fund is revolving in nature and is divided into two chapters which are designed to ensure (1) the issuing of guarantees to individual financing operations (30% of annual resources) and (2) the provision of subsidised loans (70% of annual resources). The Fund aims amongst others to support energy-efficient measures implemented by companies and public bodies on properties (including energy-efficient retrofitting of buildings) and installations, promoting involvement of financial institutions and private investors on the basis of an adequate division of risk. As regards works on buildings, only supplementary investment costs necessary to achieve a higher level of energy efficiency are eligible.

Capacity building and networking	
Requirements and accreditation criteria for energy professionals issuing EPCs (Presidential Decree No 75/2013)	The Decree provides for training courses leading to professional qualifications, to be offered at national and regional level. It defines the minimum course content and establishes the criteria for checking the quality of service. These include document checks on the Energy Performance Certificates, and assessment of the correspondence of project data or energy audits with the findings of building inspections.
Renewable energy regulation (Legislative Decree No 28/2011)	The Decree sets out the installer qualification rules for the installation and supplementary maintenance of renewable power sources.
Research and development	
Mission Innovation	Multilateral initiative, which aims to promote acceleration of technological innovation to support the energy transition by means of a significant increase in public funding dedicated to clean-tech research.
Energy clusters (Directorial Decree No 1853)	The Ministry of Education, Universities and Research approved the setting-up of public-private research partnerships. The initiative is coordinated by ENEA, and has so far attracted more than 90 public and private entities
Tax credit	This instrument is aimed at stimulating private investments in R&D (amongst others in the energy sector) in order to innovate processes and products and guarantee the future competitiveness of the companies. It consists of a 50% tax credit for incremental Research and Development costs, which may be granted up to a maximum annual amount of €20 million per recipient

Table 10: Policy framework for deep building renovation in the UK

Targets and Concepts	
Integrated National Energy and Climate Plan	The UK NECP does not set national renewable energy nor energy efficiency targets. However, it contains regional targets for Scotland and Wales. Accordingly, 50% of all of Scotland's heat, transport and electricity consumption should be supplied from renewable sources. The Welsh Government has set targets for generating 70% of its electricity consumption from renewable energy by 2030, for 1GW of renewable electricity capacity in Wales to be locally owned by 2030 and for new renewable energy projects to have at least an element of local ownership by 2020.
The Energy Efficiency Strategy (2012)	Launched as first overarching national strategy, the 2012 Energy Efficiency Strategy aims to set the direction and ambition for energy efficiency policy, defines barriers to be addressed, and the additional steps taken to stimulate the energy efficiency market. The saving target was set at the level of 129.2 million tonnes of oil equivalent (mtoe) for final energy consumption. This represented an 18% reduction in final energy consumption, relative to the 2007 BAU projection.
Clean Growth Strategy	The CGS contains a number of policies and proposals, including the development of a long-term trajectory to improve the energy performance standards of privately-rented homes, with the aim of upgrading as many as possible to EPC Band C by 2030 where practical, cost-effective and affordable. Beyond the RHI, the ambition is to phase out the installation of high carbon fossil fuel heating in new and existing off gas grid residential buildings during the 2020s, starting with new homes as these lend themselves more readily to other forms of low carbon heating.
Long term renovation strategy	While UK set a very clear and ambitious overall sectors legally binding target (i.e. cutting carbon emissions by 80% by 2050), specific targets for the building sector are not clearly indicated, except for new buildings (i.e. the introduction of zero carbon homes standards for new homes in England by 2016). Specific targets on building renovations, and in particular on deep renovations are not provided.
Infrastructure and funding	
Agencies/national authority	Department of Energy and Climate Change (DECC) is the main national authority. Agencies exist at local, regional and national level.
Energy Company Obligation (ECO3)	ECO3 (2018-2022) is focused exclusively on households with lower incomes, considered to be in vulnerable situations or living in fuel poverty. Gas and electricity suppliers with more than 250 000 customers are required to deliver ECO. More energy suppliers will have to join in over the next couple of years, until all suppliers with more than 150 000 customers are involved in 2020. Each obligated supplier has to contribute to a certain amount of energy-efficient home improvements, based on its market share.
Renewables Obligation	Sets an annual obligation on electricity suppliers to source a proportion of their generation from renewable sources. UK electricity suppliers have to present a certain number of Renewables Obligation

Certificates (ROC) Scheme / Contracts for Difference (CfD) Scheme	Certificates (ROCs) to Ofgem in respect of each MWh of electricity supplied during an obligation year. Suppliers buy these ROCs from renewable generators (or traders). Generators obtain them free of charge from Ofgem in relation to the renewable electricity they generate. The scheme is paid for by consumers through their energy bills. CfDs will replace Renewable Obligation Certificates (ROCs) which are due to be phased out from 2017. Current policy offers CfD for new capacity through auctions.
Eliminating distortions	
Energy and carbon taxes	The main taxes on energy use in the UK are the following: • The Fuel Duty applies to oil products and natural gas use across all sectors, except when used to generate electricity. • The Climate Change Levy (CCL) applies to LPG, natural gas and coal and coke products outside of the transport sector, except when used to generate electricity. • The Carbon Price Support (CPS) applies to oil products, natural gas and coal and coke products for electricity generation. • Electricity output is taxed at a uniform rate (per mWh).
Regulation	
MEPS (Building Regulations Part L)	The Building Regulations set minimum energy performance standards for new buildings and when people carry out controlled 'building work' to existing properties including extensions, conversions and certain categories of renovation and replacement of windows and boilers.
Private Rented Sector (PRS) Energy Efficiency Regulations	Requirement for any properties rented out in the private rented sector to have a minimum energy performance rating of E on an Energy Performance Certificate (EPC). The regulations will come into force for existing tenancies on 1 April 2020.
National Planning Policy Framework	Sets out how planning should support the transition to a low carbon future. The Framework looks to local councils to, for example, plan new development in locations and ways which reduce greenhouse gas emissions and, when determining planning applications, expect new development to take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption. Local councils in their planning should actively support energy efficiency improvements to existing buildings.
Information and advice	
Energy Saving Trust (EST)	Energy Saving Trust (majority of funding from Government) provides advice to businesses and households (through the Energy Savings Advice Service helpline) and also provides free resources to energy efficiency professionals throughout the UK.
Smart Metering Programme	The smart metering programme aims to replace 53 million meters with smart electricity and gas meters in all domestic properties in Great Britain by the end of 2020.
EPC regulation	EPCs are required when any building is sold, rented out or constructed, and after refurbishment when construction work is undertaken to a building and the modifications change the number of parts designed or altered for separate use and include the provision or extension of any fixed services for heating, hot water, air-conditioning and mechanical ventilation.
Financial incentives and financing	
Renewable Heat Incentive (RHI)	The Domestic RHI is a financial incentive (£4.5 billion between 2016 and 2021) to promote the use of renewable and low carbon heat (such as heat pumps, biomass boilers and solar water heaters). Eligible installations receive quarterly payments for seven years for the amount of renewable heat it is estimated their system produces to cover the additional costs of the low-carbon heating installation. In Northern Ireland, eligible domestic RHI installations receive annual payments.
Energy Efficient Scotland (EES) Programme	In Scotland, the Energy Efficient Scotland (EES) Programme not only targets energy efficiency improvements in buildings, but also seeks to address the decarbonisation of heat in Scotland's buildings.
Capacity building and networking	
Build Up Skills UK project	This project aims to identify skills gaps and implement long-lasting training infrastructure to improve the skills related to the installation and maintenance of building energy efficiency technologies.
Research and development	
Buildings Mission	The mission aims to at least halve the energy use of new buildings by 2030, reduce the cost of retrofitting efficiency measures in existing buildings, and to ensure homes and businesses are heated by clean energy sources. Through the Transforming Construction Industrial Strategy Challenge Fund the Government will invest £170 million - matched by £250 million from industry - to modernise construction processes and techniques.

BEIS's Energy Innovation Programme	The Programme provides up to £505 million to accelerate the commercialisation of innovative clean energy technologies and processes

Table 11: Policy framework for deep building renovation in Germany

Targets and Concepts	
Energy Concept (2010)	The Energy Concept sets the goal of achieving a drop in greenhouse gas emissions of at least 55% by 2030 compared to the baseline year of 1990. This corresponds to a permitted emissions level of 562 million tonnes of CO_2eq. In the long-term Germany intends to achieve a drop in greenhouse gas emissions of at least 70% by 2040, and of 80% to 95% by 2050 (i.e. close to GHG-neutral), compared to the baseline year.
National Energy Efficiency Action Plan (NAPE)	NAPE aims to convince all stakeholders of the need to raise energy efficiency and involve them in these efforts. It seeks to show them the scope and opportunities and provide evidence confirming the benefits of a commitment to energy efficiency. With an intelligent mix of consulting, communication and information about lucrative efficiency measures, funding facilities and standards for new installations, NAPE contains a set of instruments to motivate companies and consumers to raise energy efficiency and take an initial step towards harnessing the enormous potential.
Energy Efficiency Strategy for Buildings	The Federal Government adopted a strategy for the energy transition in the buildings sector which demonstrates how the goal of an almost climate-neutral building stock can be achieved by 2050 through a combination of energy efficiency and the use of renewable energies. According to it, a share of renewables of 25-35% (depending on the transformation pathway) must be achieved in the buildings sector by 2030 in order to achieve the energy and climate goals.
Renewable energy targets (Renewable Energy Sources Act & Energy Concept)	The Renewable Energy Sources Act 2017 outlines targets for renewables growth, tendering quantities and deadlines, and terms and conditions for tendering procedures for the relevant technologies. It provides for a continuous increase in the share of renewables in gross electricity consumption to 40-45% in 2025, 55-60% in 2035, and at least 80% in 2050. The 2010 Energy Concept also sets the goal of increasing the share of renewables to 50% by 2030
Funding strategy for energy efficiency and renewable heat	The primary aim of this process is to increase the funding efficiency, audience reach and clarity of existing funding programmes and leverage and bundle their synergies. Closer integration of existing funding instruments is intended to encourage the combined use of both energy efficiency measures and renewable energies during energy renovations of buildings, for example by prioritising package solutions which combine efficiency measures with the installation of new renewable heat generators.
Infrastructure and funding	
Federal Agency for Energy Efficiency - BfEE	BfEE is responsible for inspecting the achievement of national targets, for preparing the NEEAPs and for ensuring the adoption of an exemplary role by the public sector in the area of energy efficiency. Further tasks are: • Market observation, market valuation and market activation • Maintaining a list of suppliers of energy services, energy audits and energy efficiency measures • Information for the public and market participants • Determination of national savings guideline values and preparation of the NEEAPs • Scientific support for the Federal Ministry for Economics and Technology and representation of Germany in Concerted Action
Federal Energy Agency (dena)	Responsible for issuing energy efficiency measures and programmes, financed by public and private sector. Its focus is on the building, power and transport consumption sectors, as well as on issues relating to energy generation, storage, networking, and digitalisation. dena realises pilot projects, advises politicians, manufacturers and service providers, qualifies multipliers, informs consumers, builds networks, encourages international exchanges and develops future scenarios. In addition, 32 energy and climate protection agencies are organised within the German Federation of Energy and Climate Protection Agencies (eaD).
Energy Efficiency National Fund (2011)	The programmes planned under the Energy Efficiency National Fund play a key role in implementing the National Action Plan on Energy Efficiency. The measures supported to leverage energy and electricity saving potentials range from consumer information and product innovation through to the market launch of energy-efficient products.
Renewable Energy Surcharge	As a central funding instrument for renewable energies in the electricity sector, the Renewable Energy Sources Act safeguards funding (guaranteed compensation, priority feed-in) and the financing of any extra costs incurred as a result of the surcharge under the Renewable Energy Sources Act.

Eliminating distortions	
Phasing out of hard coal subsidies	The phasing out of hard coal subsidies is the most important measure currently being implemented in Germany with a view to eliminating fossil fuel subsidies. Sales subsidies have been paid for the last time in 2018.
Energy and carbon taxes	The main taxes on energy use in Germany are the following: • An energy tax applies to oil products, natural gas and coal and coke products, at rates differing according to whether the product is used as a transport fuel or for heating and process purposes. • Fuels are untaxed when they are used to generate electricity in power stations larger than 2MW or when certain requirements for cogeneration of heat and power are fulfilled. • Electricity output is taxed (per MWh).
Billing regulation	The Heating Costs Order (since 1981) aims to create incentives for the economical use of energy through the consumption-dependent determination and billing of heating and hot water costs in residential multi-family buildings. The consumption-dependent proportion has been increased to 70% in respect of the billing of heating costs for specific buildings.
Regulation	
MEPS	The Energy Saving Order (EnEV) sets minimum requirements for the energy-related quality of the building shell and the system technology for new buildings and for larger renovations of existing buildings. From 2015 onwards, 'constant temperature' boilers have to be decommissioned after 30 years of use (EnEV 2014). Energy efficiency classes for buildings are being introduced into energy performance certificates and property ads to improve transparency in the real estate market.
Heating Costs Order	By exempting buildings reaching the so-called passive house standards (heating requirement less than 15 kWh/m^2) from billing requirements, the order creates an incentive for deep renovations of multi-family buildings.
Obligation Energy Audits	The Act on energy services and other energy efficiency measures obliges all non-SMEs to perform an energy audit by 5 December 2015 and every 4 years thereafter. Companies may alternatively introduce an energy management system (pursuant to DIN EN ISO 50001).
Planning	
No policies or measures	
Information and advice	
Information requirement	The Act on Energy Services and other Energy Efficiency Measures (EDL-G) requires energy companies to inform final customers about the offers available to them and the effectiveness of efficiency measures and to provide them with contractual documents, statements of account or receipts and contact information for operating locations from which they can request further information about energy efficiency offers, final customer comparison profiles and technical specifications for energy-using products.
Energy Performance Certificates	According to the provisions of the Energy Saving Order (EnEV), EPCs are mandatory at time of sale or lease and contain improvement recommendations. However, EPCs must only be shown upon request and are not required in building advertisements. There is no registry of EPCs
House of the Future" motivation and information campaign	The campaign is targeted at house owners, tenants, engineers and architects as well as the construction industry, municipalities and house building companies and aims to inform and motivate consumers, parties involved in building, industry and the public sector about energy-efficient building.
Dena Energy hotline and Internet platform (since 2001)	The free energy hotline and an Internet platform provide end consumers as well as specialists with information about the various kinds of energy production, the rational use of energy and renewable energies. In addition to the general communication of information, the focus is on specific recommended courses of action and practical aids.
Campaign – 'Germany Does It Efficiently'	The information and mobilisation campaign 'Germany Does It Efficiently' is intended to remind all social actors that the energy transition is a joint project and to persuade them of the need to use energy even more efficiently.
BAFA Energy consulting for residential buildings (on-site consulting/individual renovation roadmap)	The Federal Office for Economic Affairs and Export Control BAFA promotes energy consulting for residential buildings, which is targeted at owners of residential buildings (private owners of houses or apartments, residential development companies and commonholders' associations). To support the streamlining of consulting results an individual renovation roadmap tool has been available since 2017. This software-based tool allows energy consultants to produce an easy-to-understand overview of the renovations, which need to be carried out in a building, inter alia so that individual measures, which

	build upon each other can be completed. The roadmap not only flags up energy-saving potentials, but also outlines options for using renewable energies, estimates the necessary investment costs and calculates the potential heating cost and carbon savings.
National efficiency label for old heating installations	The efficiency label scheme for old heating installations allows heating engineers (since 2016) and district chimney sweeps (since 2017) to award efficiency labels, on a gradual basis starting with the oldest boilers. The aim of the measure is to increase the replacement rate for old heating installations by 20% (up to a rate of 3.7% a year) and provide an incentive for consumers to save energy by replacing their boiler.
Financial incentives and financing	
Incentives for renewable energy installations in rental buildings	The Landlord-to-Tenant Electricity Act enshrined eligibility for the funding of landlord-to-tenant models in the Renewable Energy Sources Act 2017. Landlord-to-tenant models involve the generation of electricity using photovoltaic panels on the roof of a residential building and the supply of this electricity to end consumers (in particular tenants) in the same building or in residential buildings and ancillary installations in the immediate geographical vicinity, without transit through a grid. The landlord-to-tenant electricity supplement is funded through the surcharge under the Renewable Energy Sources Act.
Feed-in-Tariff (FiT)	Small RES-E plants up to 100 kW are eligible for feed-in tariff as set out in the Renewable Energy Sources Act. Plant operators must sell their own electricity on the market; in return, they receive a 'sliding premium' from the network operators, which compensates for the difference between the fixed feed-in payment and the monthly average trading price for electricity.
BAFA funding programme for heating optimisation	The aim of the programme is to incentivise the replacement of inefficient heating and hot water circulation pumps with high-efficiency pumps, and the optimisation of existing heating systems by means of hydraulic balancing. The programme also serves as a gateway to more comprehensive energy efficiency measures in buildings.
Mini-CHP incentive program	Mini CHP plants are being funded under certain conditions and up to a capacity of 20 kW since April 2012. This investment allowance granted only once and determined according to the electrical performance of the micro-CHP lies between € 1 500 and € 3 500.
Cogeneration surcharge (Cogeneration Act)	Owners of CHP Systems receive temporary funding (CHP bonus) for the electricity produced by their cogeneration plants provided the conditions for funding are met. Basically, according to the new CHP Act only electricity from cogeneration is entitled to the payment of a surcharge if it is fed into a general supply grid. There are exceptions for small CHP plants with an electrical power up to 100 kW.
Market incentive programme for renewable energies in the heating market	The Market Incentive Programme provides funding for installations which use renewable energies to generate heating and cooling, as well as for certain heat storage facilities and local heat networks, both in residential and non-residential buildings. Almost all installations in existing buildings are eligible for funding. The programme awards investment grants for small installations. Eligible installations include solar thermal collectors, biomass systems and efficient heat pumps.
Energy Efficiency Incentive Programme	The Programme covers three areas of investment: (1) the installation of ventilation systems (ventilation package) in combination with renovation measures involving the building shell with a view to avoiding structural damage (including mould), (2) the replacement of inefficient heating installations with efficient heating installations (heating package), (3) the market launch of stationary fuel cell heating systems in new and existing buildings.
CO_2 Building Modernisation Programme	The programme funds energy-related renovations and high-efficiency new buildings with a view to implementing the long-term renovation strategy for buildings. It is the most generously funded instrument in the field of energy efficiency (EUR 2 billion earmarked for both 2016 and 2017). Low-interest loans, in some cases with redemption subsidies or alternatively with investment grants, are used to fund energy-efficiency measures in the buildings sector.
Capacity building and networking	
No policies or measures	
Research and development	
Seventh Energy Research Programme	The central framework for energy research funding in Germany at a research policy level is the Federal Government's cross- departmental energy research programme, which is a multi-annual programme aimed at steering the funding activities of the various ministries involved.
Funding initiative 'Solar Construction/Energy-Efficient City'	This funding initiative promotes the energy transition in urban buildings. The focus is on building new multi-storey housing or renovating existing building stock of this type, and on large-scale flagship projects at district level which incorporate a systems-based approach. The project was launched in mid-2017 and has a total funding volume of €120 million.

Construction research initiative Efficiency House Plus (since 2011)	The initiative consists of a technology-neutral and future-oriented construction standard combined with a country-wide network of Efficiency House Plus model projects guaranteeing the timely transfer of knowledge from research to practice. The aim of the Efficiency House Plus Standard is the long-term promotion of positive annual figures for primary and final energy demand and the use of renewable energies in the buildings sector.
Funding initiative EnEff.Building.2050	The initiative provides funding for flagship projects which demonstrate widely effective solutions for climate-neutral buildings and districts using innovative technology and concepts, thereby advancing their market launch or widespread implementation. Eligible projects focus on the development of individual key technologies and procedures in the construction of new buildings or the renovation of existing buildings, and therefore also include small-scale research grants ('innovation projects').

7.2 Stakeholder/expert interviews: Approach and results

Approach

Within the DREEAM project 9 interviews with DREEAM pilots and experts were conducted in April and May 2019. These experts provided insights into the existing building renovation market and the legal circumstances in Europe as well as specifically in the UK, Poland, the Netherlands, Italy and Germany. The interviews helped to identify barriers and incentives, which either support or suppress a building refurbishment. The interviews were conducted by Dr. Justus von Geibler. The single interviews were summarized and documented after each interview. The affiliation and names of the interviewees and specific results are not presented, since confidentiality has been guaranteed. The aggregated results are summarized below.

Several questions with regard to the professional background, barriers and drivers as well as future policy options were enquired. To get insights about the professional background of the interviewees, they were asked about the current position they hold in their company, their role in the DREEAM project (if applicable), their context with regard to energy efficiency in building refurbishment as well as the main information sources they use to stay informed about energy efficiency in building refurbishment. Concerning the barriers and drivers the questions referred to the status of the DREEAM pilot case, the main technical issues, possible alternative measures, reasons for not implementing alternative measures and the main stakeholders involved. In addition, more general questions were asked including the main lessons learned, the key challenges for refurbishments at multi-building scale in view of current policies, drivers and barriers for the pilot project as well as important policies that are currently in force. At the end, the interviewees were requested to give recommendations and evaluations of future policy options as well as personally important aspects to be taken into account in the further work. The interview questions are displayed in table 12 below.

Table 12: Interview questions

Part	Questions
Professional background	• What is your professional background/position and main country you are operating in? • What is your professional context with regard to energy efficiency in building refurbishment? Additional questions for DREEAM Partners: • What is the size of the organisation you currently work for professionally and what type of building scale does your organisation manage? • Please describe your role in the DREEAM refurbishment pilot or DREEAM project. • What are the main information sources you personally access to be informed on energy efficient building refurbishment?
Drivers and Barriers	• In view of the current political situation, what key challenges do you see regarding deep refurbishment at multi-building scale? • What are the main drivers and barriers that support or prevent deeper refurbishment option? • What kind of policy instruments do you know about the refurbishment of buildings? Are they useful? If yes/no why? Additional questions for DREEAM Partners: • What is the status of the DREEAM Pilot Case? What have been the main technical measures for the building refurbishment? Have you considered other measures or combinations of measures? If yes, why did you choose not to implement them? How did the process succeed with regard to the 75% energy reduction target? Who have been the key-stakeholders involved? • What are your main lessons learned from the pilot? • Regarding the pilot project, what drivers or barriers have encouraged/stopped you from deeper refurbishment option?
Future policy options	• Who do you think are the key stakeholders involved in multiscale building renovation? Who must be addressed by political instruments/support? • What kind of information is needed to better support building refurbishment towards energy efficiency? • What kind of political support for multiscale building refurbishment would you suggest? What type of political Instruments (legislation, regulation, planning, information, incentives/financing ...) could support it? • Which level (regional/national/european/global) is most important for political support of deep refurbishment? Why? • In the following, the mentioned barriers, drivers, future policy options and relevant stakeholder are summarized to give a quick overview of the current European landscape of energy efficient refurbishments.

Results on barriers

The main barriers mentioned in the interviews were the following: the issue of **split incentives**, **inexpedient business models**, the **lack of skills and education** of all actors involved (e.g. tenants, owners, suppliers), **the lack of awareness of actors about existing technologies and energy consumption**, **the impairment and discomfort of tenants during and after the renovation, financial hindrances** (e.g. lack of funds) as well as **inflexible legislatures and bureaucracy** (e.g. laws regarding monument protection). The following table summarises the barriers mentioned in the interviews.

Table 13: Key findings of the interview assessment regarding the main barriers for deep(er) building renovation

Type	Description of barriers
Technical	• Inability to measure energy consumption due to split responsibilities (tenant pays directly to the energy provider) and privacy issues
Financial	• Lack of financial incentives for the investor due to split incentives • Cap on rents with no exception in case of energy-efficient renovation • Lack of financial mechanisms to speed up the renovation process • Complications in the obtainment of subsidies for a loan due to administrative procedures • Inexpedient business models that expect an unrealistically low life cycle of buildings • Lack of incentives for lenders • Lack of capital to invest for housing associations • Increase of construction costs • Expectations of rent reduction (instead of increase) in the public discourse • Lack of sufficient funding
Informational	• Lack of skills in developing financeable projects • Lack of deep portfolio knowledge due to insufficient data being stored • Lack of skills in the supply chain • Lack of education and capacities of actors on the demand side • Lack of comfort and capacities of tenants • Organisational difficulties • Lack of skills in handling innovative technologies • Lack of awareness of many innovative technologies • Lack of awareness of tenants (e.g. regarding energy consumption) leading to low demand for energy-efficient buildings • Uncertainties about future maintenance costs • Uncertainties about the maturity of innovative technologies
Political	• Inflexible legislatures (e.g., listed buildings, requirements for fireproof staircases, earthquake safety regulations limiting weight of insulation material) • Exclusion of social housing from the UK minimum energy efficiency standards for rented dwellings • Technical and financial difficulties in upgrading older dwellings to conform with the recent amendment of the EPBD
Psychological	• Tenant behavioural routines (e.g. in window ventilation)

Results on incentives/drivers

Within the interviews, the following incentives have been named the most: **financial support** (e.g. ELENA), **public guarantees** to **reduce the risk of investment** and **include the private sector** to set up a public-private-partnership in the renovation sector, **minimum energy efficiency standards** to incentivise building owners to renovate, **comprehensive energy efficiency audits** and **personal interviews with the tenants** before renovation to gain insight into the needs and demands of customers. The following table summarises the drivers mentioned in the interviews:

Table 14: Key findings of the interview assessment regarding the main drivers for deeper refurbishment options

Type	Description of drivers
Technical	• Comprehensive energy audits
Financial	• Project development assistance (PDA) money • Public guarantees to de-risk investment • Possibility to include the private sector for financing
Informational	• Personal interviews conducted with the tenants • Awareness about technological options
Political	• Minimum energy efficiency standards • Possibility to avoid paying property levies by investing in energy efficiency • Basic legal structure for Homeowner Associations
Psychological	• Tenant loyalty through thankfulness for refurbishment work

Results on policy options

The policy options named in the interviews can be categorized into technical, financial, informational and legal future policy options. They include recommendations like **standardisation** of energy audits, of the renovation process or of projects, **financial mechanisms that incentivise** owners of buildings to undertake deep refurbishment, the **improvement of the information flow** towards owners, suppliers and tenants and **legal mechanisms** that result in an increase number of deep refurbishment. The following table summarises policy options mentioned in the interviews:

Table 15: Key findings of the interview assessment regarding recommended future policy options

Type	Description of policy options
Technical	• Standardisation of energy audits • Standardisation of the renovation process • Standardisation of projects
Financial	• Detection of mechanisms that allow more equal risk sharing • Connection of loans to the building instead of the tenants • Municipality functions as the financier of small-scale renovation projects • Possibility of housing associations to increase their rents if energy performance is above a certain standard • Adoption of a rent system that includes the energy bill • Tax incentives to incentivise businesses to rework their business model • Public support for renovations in structurally weak regions • Tax breaks as a solution to split incentives
Informational	• Advanced training on the supply side • Design measures and technologies as simple as possible • One stop shops for the renovation process • Databases on actual performances (best practice sharing) • Databases of building demolitions
Legal	• Minimum energy efficiency standards • Regulations on making renovations mandatory • Reduced frequency of issuing legislations • Autonomy for housing cooperatives in tenancy and building law • Consideration of the legal heterogeneity in the EU

7.3 Detailed criteria-based assessment of policy options long list

Table 16: Long list and assessment of EU policy options to promote deep building renovations (detailed description).
The first priority options are highlighted in light green. With regard to the effectiveness, the options are rated from low (o) over medium (+) to high (++). For policies with indirect effects on multi-building deep renovation, assessment results are put into parentheses. The proportionality assessment ranges from '--' (EU level action not warranted/sensible) to '++' (EU level action sensible and in line with the subsidiarity principle).

Objective	**Category**	**Policy Option**	**Effectiveness** for DREEAM target group with respect to energy efficiency renovation (and renewable energy)	**Proportionality: EU legislation or programme support needed and useful?**	**Any other issues?** (Legal, technical, and political feasibility; Previous policy choices, coherence with other EU policy objectives, and relevance)
Provide long-term technical and policy development certainty to market actors	**Targets and policy strategies**	Building stock long-term energy consumption or climate neutrality **target** (e.g. minus x%; nZEB for all; **EPBD Art. 2a**: "a highly energy efficient and decarbonised building stock by 2050") **Options for EU level policy action:** 1) Include targets for total dwelling/building floor area; 2) Monitoring by using databases of EPC values	0 to + Low to medium: may guide long-term investment planning and behaviour if building owners know about it and take it serious	1) + Target needed and useful to draw MS attention to the need for policy in this area 2) ++ Such databases already exist in MS	
		NECPs, particularly the Long-term renovation strategies according to **EPBD Art. 2a;** these should keep policies predictable, not changing them too frequently (cf. also interview 4) **Options for EU level policy action:** 1) Update EU heating and cooling strategy with concrete targets and transformation pathways 2) Give the European Commission stronger „teeth" to ensure high ambition level in Long-term renovation strategies, the underlying polices, and their implementation	0 to + Low to medium: may guide long-term investment planning and behaviour if building owners know about it and take it serious	1) + This would update an existing policy document and make it stronger 2) – / + This is a strong requirement. It could be retained as an option needed if the procedures under the current governance regulation do not yield sufficient progress in MS' building policies and efficiency levels	Political feasibility for option 2) will depend on linking option 2) to funding options, such as the options 2) under the 'Grants for investment' policy option below, for MS that do not wish to implement EEOS.

Objective	Category	Policy Option	**Effectiveness** for DREEAM target group with respect to energy efficiency renovation (and renewable energy)	**Proportionality: EU legislation or programme support needed and useful?**	**Any other issues?** (Legal, technical, and political feasibility; Previous policy choices, coherence with other EU policy objectives, and relevance)
Provide agencies and funding for implementation of sector- and technology-specific policy instruments	**Infrastructure and funding**	National energy agencies: a) policy development and monitoring b) policy implementation **Options for EU level policy action:** 1) Include a requirement for MS in the **EED** to create national energy agencies of types a) and b) listing their tasks, and a minimum staff and budget requirement depending on MS population 2) Until next EED revision: COM to use Governance process on NECPs and CA on EED to induce increased level of MS' operation of energy agencies. 3) Create funding options for MS: a) Earmarking EU ETS revenues; b) Earmarking EU structural funds c) EU grants to MS? 4) Create a strong EU energy agency of type b) (Assuming DG ENER is a strong agency of type a))	(+) Indirect medium: target group could benefit from programmes and services offered by the agency	1) – / + This is a strong requirement. It could be retained as an option needed if option 2) does not yield sufficient progress in MS' energy agencies; strength of type b) agency needed is also depending on whether a MS has EEOS in place, and their scope and strength 2) ++ This would simply be using existing processes. 3a) and b) + This would only add specificity to the existing earmarking provisions. 3c) - This is not needed in case 3a) or 3b) can be implemented 4) -- The COM is too far away from investors and does not have the resources to build up a strong agency	Political feasibility for option 1) will depend on linking option 1) to funding options 3) 2) will also be more successful if linked to 3) 3c) and 4) would need additional EU budget
		Financial and technical support for Local or Regional energy agencies for implementation of building energy efficiency and renewable energy policies and services at local level (could also be other suitable agencies e.g. for economic development, housing development, consumer protection)	+ to ++ Medium to high (depending on range and intensity of programmes and services offered)	1) – / + This is a strong requirement. It could be retained as an option needed if option 2) does not yield sufficient progress in MS' support to regional and local energy agencies; strength of regional/local agency infrastructure needed is also depending on whether a MS has EEOS in	Political feasibility for option 1) will depend on linking option 1) to funding options 3) 2) will also be more successful if linked to 3) 3c) and 4) would need additional EU budget

Objective	Category	Policy Option	**Effectiveness** for DREEAM target group with respect to energy efficiency renovation (and renewable energy)	**Proportionality: EU legislation or programme support needed and useful?**	**Any other issues?** (Legal, technical, and political feasibility; Previous policy choices, coherence with other EU policy objectives, and relevance)
		Options for EU level policy action: 1) Include a requirement for MS in the **EED** to support regional and local energy agencies, listing their tasks, and a minimum staff and budget requirement depending on MS population 2) Until next EED revision: COM to use Governance process on national energy and climate plans and CA on EED to induce increased level of MS' support of regional and local energy agencies. 3) Create funding options for MS: a) Earmarking EU ETS revenues; b) Earmarking EU structural funds c) EU grants to MS 4) Create a strong EU energy agency of type b) (Assuming DG ENER is a strong agency of type a))		place, and their scope and strength 2) ++ This would simply be using existing processes. 3a) and b) + This would only add specificity to the existing earmarking provisions. 3c) - This is not needed in case 3a) or 3b) can be implemented 4) -- The COM is too far away from investors and does not have the resources to build up a strong agency	Would 3c) in practice be implemented through 3b)?
		Energy efficiency funds to fund policy and programme implementation (**EED Art. 20**), same for Renewable energy funds **Options for EU level policy action:** 1) Strengthen **Art. 20 EED** to require MS to create or augment energy efficiency funds to achieve at least e.g. 10 % of the target according to Art. 7 EED, and a sub-target for the savings from these funds to be achieved in buildings	(+) to (++) medium to high but indirect (from the policies and programmes implemented)	1) – / + This is a strong requirement. It could be retained as an option needed if option 2) does not yield sufficient progress in scope and size of MS' energy efficiency funds and or their Art. 7 target achievement; strength of funds needed is also depending on whether a MS has EEOS in place, and their scope and strength 2) ++ This would simply be using existing processes.	Political feasibility for option 1) will depend on linking option 1) to funding options 3) 2) will also be more successful if linked to 3) 3c) and 4) would need additional EU budget (e.g. MS payments under the **Carbon Action regulation**?) Would 3c) in practice be

Objective	Category	Policy Option	**Effectiveness** for DREEAM target group with respect to energy efficiency renovation (and renewable energy)	**Proportionality: EU legislation or programme support needed and useful?**	**Any other issues?** (Legal, technical, and political feasibility; Previous policy choices, coherence with other EU policy objectives, and relevance)
		2) Until next EED revision: COM to use Governance process on national energy and climate plans and CAon EED to induce increased level of MS' use of energy efficiency and renewable energy funds. 3) Create funding options for MS: a) Earmarking EU ETS revenues; b) Earmarking EU structural funds c) EU grants to MS d) Exemption from financial stability pact for first 2 years of funding for energy efficiency and renewable energy funds? 4) Create strong EU a) energy efficiency and b) renewable energy funds; with the EEEF to provide funding for MS to implement energy efficiency programmes and policies of all kinds, i.a. for buildings		3a) and b) + This would only add specificity to the existing earmarking provisions. 3c) - This is not needed in case 3a) or 3b) can be implemented 3d) ++ This would increase MS' funding flexibility 4a) + This would add to options 3a) and 3b) and enable *national* level programmes. It could also be funded from MS payments under the **Carbon Action regulation**. 4b) ++ This fund already exists (The Union renewable energy financing mechanism, **Art. 33 Governance regulation** (EU) 2018/1999).	implemented through 3b)? 3d) would contradict deeply rooted beliefs in the financial stability pact and debt limits. Although it would in fact help to reduce MS debt (state income or budget savings would very likely exceed the amount of grants, as was shown for the German KfW programmes by STE 2012), political feasibility is very unlikely
		Energy efficiency (**EED Art. 7**) and renewable energy obligations for energy suppliers or DSOs **Options for EU level policy action:** 1) Strengthen **Art. 7 EED** to require MS to create or augment energy efficiency obligation schemes to achieve at least e.g. 10 % of the target according to Art. 7 EED, and a sub-target for the savings from these EEOS to be achieved in buildings	(an alternative to state energy agencies and funds)	1) – / + This is a strong requirement. It could be retained as an option needed if option 2) does not yield sufficient progress in scope and size of MS' energy efficiency obligation schemes and or their Art. 7 target achievement; same for renewable energy 2) ++ This would simply be using existing processes.	There is strong opposition to EEOS in some MS, so political feasibility for 1) is doubtful.

Objective	Category	Policy Option	**Effectiveness** for DREEAM target group with respect to energy efficiency renovation (and renewable energy)	**Proportionality: EU legislation or programme support needed and useful?**	**Any other issues?** (Legal, technical, and political feasibility; Previous policy choices, coherence with other EU policy objectives, and relevance)
		2) Until next EED revision: COM to use Governance process on national energy and climate plans and CA on EED to induce increased level of MS' use of energy efficiency and renewable energy obligations.			
		Promoting the market for building energy efficiency and renewable energy services, e.g. through • Loan guarantees • Project development assistance (PDA) funds (e.g. **ELENA**) • Coaching of potential customers • Aggregation of potential customers **Options for EU level policy action:** 1) Make the provisions of **Art. 18 EED** more explicit on the points listed above and other additional or strengthened MS activities; for PDA funds, see option under category 'Incentives and Financing' below	+ Medium (energy services are proven to work, under certain conditions, for replacement or upgrading and operation of heating systems, but difficult for building shell energy efficiency)	+ This would simply augment existing legislation	

Objective	Category	Policy Option	**Effectiveness** for DREEAM target group with respect to energy efficiency renovation (and renewable energy)	**Proportionality: EU legislation or programme support needed and useful?**	**Any other issues?** (Legal, technical, and political feasibility; Previous policy choices, coherence with other EU policy objectives, and relevance)
Improve general cost effect-tiveness of energy efficiency invest-ments and other energy savings actions; eliminate legal barriers	**Elimi-nating distortions**	Energy or CO_2 taxation (**energy taxation directive**) **Options for EU level policy action:** 1) Increase EU minimum energy taxation levels specified in **energy taxation directive**	o to (+) Low to medium / indirect (the DREEAM target group don't pay the energy bills, but their tenants do; exception: cooperatives – tenants are also owners of the cooperative)	+ This would simply augment existing legislation	This directive requires unanimity. It was last revised in 2003.
		EU ETS (**directive**) **Options for EU level policy action:** 1) Tighten GHG emission pathways specified in the directive	o Low (affects only electricity; and the DREEAM target group don't pay the energy bills, but their tenants do)	+ This would simply augment existing legislation	
		See in category 'Incentives and Financing' below: Bonus-malus payments for building owners based on their building's EPC relative to dynamic target values	*For analysis, see in category 'Incentives and Financing' below*	*For analysis, see in category 'Incentives and Financing' below*	*For analysis, see in category 'Incentives and Financing' below*
		Eliminating legal barriers (such as "barriers in the Italian law system" mentioned in an interview). Cf. **Art. 19 EED**. **Options for EU level policy action:** 1) Make the provisions of **Art. 19 EED** more explicit 2) Until next EED revision: COM to use Governance process on national energy and climate plans and CA on EED to induce increased MS action to eliminate legal barriers	o to ++ Depends on which kinds of barriers may exist	1) + This would simply augment existing legislation 2) ++ This would simply be using existing processes.	

Objective	Category	Policy Option	**Effectiveness** for DREEAM target group with respect to energy efficiency renovation (and renewable energy)	**Proportionality: EU legislation or programme support needed and useful?**	**Any other issues?** (Legal, technical, and political feasibility; Previous policy choices, coherence with other EU policy objectives, and relevance)
(1) Ensure minimum efficiency in case of renovation and in operation (2) possibly: Induce renovation	**Regulation**	Minimum energy performance requirements in case of 'major renovation' (**EPBD Art. 7)** **Options for EU level policy action:** 1) Harmonise nZEB and cost-optimality definitions towards ultra-low energy consumption requirements (**Art. 5, Art. 9 EPBD**) 2) Advance from nZEB to net zero or plus energy buildings (**Art. 9 EPBD**) 3) Require MS to strengthen control and compliance of Minimum energy performance requirements in case of 'major renovation' 4) Until next EPBD revision: COM to use governance process on national long-term renovation strategies and CA on EPBD to induce MS action equivalent to options 1) to 3)	++ High (in case of 'major renovation')	1) and 3) – / + These are strong requirements. They could be retained as an option needed if option 4) does not yield sufficient progress in MS' Minimum energy performance requirements levels and compliance 2) + This would simply augment existing legislation 4) ++ This would simply be using existing processes.	
		Minimum requirements for the share of renewable energies in space and water heating, space cooling (in case of major renovation) **Options for EU level policy action:** 1) Include a strengthened requirement for MS to introduce specific minimum requirements (e.g. 20% of yearly heating demand) in their building legislation, either in the EPBD or the RES	++ High	1) – / + This is a strong requirement. It could be retained as an option needed if option 2) does not yield sufficient progress in MS' policies regarding such requirements 2) ++ This would simply be using existing processes.	1) and 2) There may be stakeholder resistance against such Minimum renewable energy share standards; therefore, this option includes the requirement for MS to provide improved technical and financial support as well

Objective	Category	Policy Option	**Effectiveness** for DREEAM target group with respect to energy efficiency renovation (and renewable energy)	**Proportionality: EU legislation or programme support needed and useful?**	**Any other issues?** (Legal, technical, and political feasibility; Previous policy choices, coherence with other EU policy objectives, and relevance)
		Directive; coupled with improved technical and financial support (*see the relevant policy options below*) to building owners 2) Until next EPBD or RES Directive revision: COM to use governance process on NECPs, particularly national long-term renovation strategies, and CA on EPBD or RES Directive to induce MS action equivalent to options 1)			
		Strong ecodesign requirements for building-related energy-using products (**Ecodesign directive**) **Options for EU level policy action:** 1) Strengthen relevant product **ecodesign regulations**	+ Medium	1) ++ This would simply be using existing processes.	1) There may be stakeholder resistance against more stringent MEPS
		Mandatory energy renovation requirements (at least to the minimum energy performance requirements), e.g. • For 3% of central government buildings per year (**Art. 5 EED**) **Options for EU level policy action:** 1) Introduce a requirement for MS to introduce such further mandatory renovation requirements into the EPBD, coupled with improved technical and financial support (*see the relevant policy options below*) to building owners for the first, second, and fourth option (third	+ to ++ Can be high, depending on scope	1) – / + This is a strong requirement. It could be retained as an option needed if option 2) does not yield sufficient progress in MS' policies regarding such requirements 2) ++ This would simply be using existing processes.	1) and 2) There may be stakeholder resistance against such requirements; therefore, this option includes the requirement for MS to provide improved technical and financial support as well

Objective	Category	Policy Option	**Effectiveness** for DREEAM target group with respect to energy efficiency renovation (and renewable energy)	**Proportionality: EU legislation or programme support needed and useful?**	**Any other issues?** (Legal, technical, and political feasibility; Previous policy choices, coherence with other EU policy objectives, and relevance)
		option should usually be low-cost and cost-effective): • For all existing buildings in certain cases (interview 3) • For all public buildings in the same way as for central government buildings • For insulation of lofts or upper ceilings, heat or cold pipes and ducts (e.g. in Germany) • For the EPC rating of private rented homes (as in Scotland: minimum E from 2020) 2) Until next EPBD revision: COM to use governance process on national long-term renovation strategies and CA on EPBD to induce MS action equivalent to option 1)			
		Requirement to use roofs, either for solar PV, or for solar thermal, or for vegetation (green roof) **Options for EU level policy action:** 1) Introduce into the EPBD a requirement for MS to introduce such requirements, coupled with improved technical and financial support (*see the relevant policy options below*) to building owners 2) Until next EPBD revision: COM to use governance process on national long-term renovation strategies and Coordinated Action on EPBD to induce MS action equivalent to option 1)	+ to ++ Can be high	1) – / + This is a strong requirement. It could be retained as an option needed if option 2) does not yield sufficient progress in MS' policies regarding such requirements 2) ++ This would simply be using existing processes.	1) and 2) There may be stakeholder resistance against such requirements; therefore, this option includes the requirement for MS to provide improved technical and financial support as well

Objective	Category	Policy Option	**Effectiveness** for DREEAM target group with respect to energy efficiency renovation (and renewable energy)	**Proportionality: EU legislation or programme support needed and useful?**	**Any other issues?** (Legal, technical, and political feasibility; Previous policy choices, coherence with other EU policy objectives, and relevance)
		Ban of fossil-fuel heating systems where district heating based on CHP and/or renewable energy is available (as e.g. in Denmark) **Options for EU level policy action:** 1) Introduce – into the EED or RES Directive – a requirement for MS to introduce such bans 2) Until next EED or RES Directive revision: COM to use governance process to induce MS action equivalent to option 1)	o Low (DREEAM target group of building owners can pass heating costs on to tenants)	1) – / + This is a strong requirement. It could be retained as an option needed if option 2) does not yield sufficient progress in MS' policies regarding such bans 2) ++ This would simply be using existing processes.	1) There may be stakeholder resistance against such bans
		Mandatory regular inspection of heating and cooling systems (**Art. 14 and 15 EPBD**) **Options for EU level policy action:** 1) Re-strengthen requirements again	o to + Low to medium (may trigger improved operation, some-times also renovation of the systems, but only if there are deficits)	1) + This would simply augment existing legislation	1) This requirement was only weakened in recent EPBD revision by exempting smaller buildings
		Requirements to base heating and cooling bills on amount of energy used (**Art. 9 to 11 EED**) **Options for EU level policy action:** none	o Low regarding renovation	n/a	n/a
		Law on possibility for landlords/-ladies to increase basic rents to recover costs of energy efficiency renovation (as e.g. in Germany) **Options for EU level policy action:** 1) Add a more precise requirement for MS to implement such legislation, conditional on not increasing total rent	++ Can be high: can partly overcome the landlord/tenant dilemma	1) + This should be implemented in all MS, so EU-level legislation needed and useful; however with flexible and criteria-based (criterion: not increasing total rent) formulation	1) may cause debates on social impacts; therefore, proposal to make it conditional on not increasing total rent; however, this condition may cause trade-off to condition that renovation must be compatible with nZEB long-term target

Objective	Category	Policy Option	**Effectiveness** for DREEAM target group with respect to energy efficiency renovation (and renewable energy)	**Proportionality: EU legislation or programme support needed and useful?**	**Any other issues?** (Legal, technical, and political feasibility; Previous policy choices, coherence with other EU policy objectives, and relevance)
		(basic + energy), in **Art. 19 (1) point (a) EED** or in the EPBD			
		Requirement for larger building portfolio owners to employ an energy manager (as in Italy) or to implement an energy management system (or regular energy audits, **Art. 8 EED**) **Options for EU level policy action:** 1) Add to Art. 8 EED a more precise requirement for MS to require larger building portfolio owners to implement an energy management system, regardless of whether they are SMEs ("larger" = above 2 000 m^2 of heated or cooled buildings? Appropriate threshold will need to be determined); and to provide technical and capacity building support 2) Until next EPBD revision: COM to use governance process on national long-term renovation strategies and CA on EPBD to induce MS action equivalent to option 1)	+ Medium: will only improve the information on renovation possibilities	1) – / + This is a strong requirement. It could be retained as an option needed if option 2) does not yield sufficient progress in MS' policies regarding such requirements 2) ++ This would simply be using existing processes.	1) There may be stakeholder resistance against such requirements; therefore, this option includes the requirement for MS to provide improved technical support as well
		Requirement that rents include energy (such as e.g. in Sweden, Interview 4) A) i.e., that in ads and contracts, total rent is stated and rent benchmarking systems are based on total rents? Or B) that energy is billed as a flat rate? **Options for EU level policy action:**	o to + A) Low to medium for requirement to state total rent in ads, benchmarks, and contracts (may increase value of energy-efficient buildings compared to situation without)	1) + A) Requirement to state total rent in ads, benchmarks, and contracts should be implemented in all MS, so EU-level legislation needed and useful B) may only be useful for nZEB 2) ++	1) B) For the flat rate proposal, contradiction to existing Requirements to base heating and cooling bills on amount of energy used, see above

Objective	Category	Policy Option	**Effectiveness** for DREEAM target group with respect to energy efficiency renovation (and renewable energy)	**Proportionality: EU legislation or programme support needed and useful?**	**Any other issues?** (Legal, technical, and political feasibility; Previous policy choices, coherence with other EU policy objectives, and relevance)
		1) Introduce into the EPBD (or EED Art. 9 to 11) a requirement for MS to introduce such requirements 2) Until next EPBD or EED revision: COM to use governance process on national long-term renovation strategies and CA on EPBD (or EED) to induce MS action equivalent to option 1)	+ to ++ but no priority due to proportionality analysis B) can be high for flat-rate energy bill: will remove landlord/tenant barrier to investment in renovation; but will remove incentive for tenant for energy-intelligent behaviour	This would simply be using existing processes.	

Objective	Category	Policy Option	**Effectiveness** for DREEAM target group with respect to energy efficiency renovation (and renewable energy)	**Proportionality: EU legislation or programme support needed and useful?**	**Any other issues?** (Legal, technical, and political feasibility; Previous policy choices, coherence with other EU policy objectives, and relevance)
Provide opportunities for district heating/ cooling and use of renewable energies	**Planning**	Requirement for local authorities to develop heat and cold supply concepts for districts (possibly as part of SEAPs or local climate change action plans) **Options for EU level policy action:** 1) Introduce into the EED a requirement for MS to require local authorities to develop heat and cold supply concepts for districts or Sustainable Energy Action Plans (SEAPs) including such concepts, and for MS to provide technical and financial assistance to local authorities for development of the concepts or SEAPs 2) Until next EED revision: COM to use governance process to induce MS action equivalent to option 1), and continue to work with the Covenant of Mayors and to support SEAP development through the H2020 and InterReg programmes	+ Medium (may ease connection to high-efficiency heating/cooling systems, such as CHP, and/or renewable energy systems)	1) – / + This is a strong requirement. It could be retained as an option needed if option 2) does not yield sufficient progress in MS' policies regarding such requirements 2) ++ This would simply be using existing processes.	1) There may be local authority resistance against such requirements, hence the proposal includes requirement for MSs to provide technical and financial assistance to local authorities

Objective	Category	Policy Option	**Effectiveness** for DREEAM target group with respect to energy efficiency renovation (and renewable energy)	**Proportionality: EU legislation or programme support needed and useful?**	**Any other issues?** (Legal, technical, and political feasibility; Previous policy choices, coherence with other EU policy objectives, and relevance)
Improve knowledge on deep renovation possibilities and reduce transaction costs for search of information and for project implementation	**Information and advice**	Energy performance certificates (EPCs, **Art. 11 to 13 EPBD**) **Options for EU level policy action:** 1) Require further improvement in the EPBD, e.g. • Requiring that EPCs are based on building energy needs rather than energy consumption • Requiring that energy efficiency recommendations included in EPCs promote deep renovation, or • Requiring MS to create open databases of EPC ratings and recommendations, possibly also of actual energy consumption (interview 6) 2) Until next EPBD revision: COM to use governance process on national long-term renovation strategies and CA on EPBD to induce MS action equivalent to option 1); use H2020 projects under EE-5 (2018/19) call to improve EPCs	o to + Low to medium (may induce tenants to demand renovation if EPC rating is low and/or based on the renovation recommendations)	1) – / + This is a strong requirement. It could be retained as an option needed if option 2) does not yield sufficient progress in MS' policies regarding such requirements 2) ++ This would simply be using existing processes.	1) There may be stakeholder resistance against such requirements
		See above in category 'regulation': Requirement for larger building portfolio owners to employ an energy manager (as in Italy) or to implement an energy management system (or regular energy audits, **Art. 8 EED**)	*For analysis, see above in category 'Regulation'*	*For analysis, see above in category 'Regulation'*	*For analysis, see above in category 'Regulation'*

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		Financial support for building energy concepts and targeted advice in project development; with standardisation and quality control (including training and certification of energy consultants) Individual building deep renovation passports/roadmaps as a result (**Art. 19a EPBD**: optional => make it mandatory) **Options for EU level policy action:** 1) Introduce into the EPBD a requirement for MS to provide such financial support and to introduce Individual building deep renovation passports/roadmaps, possibly as a requirement for building owners 2) Until next EPBD revision: COM to use governance process on national long-term renovation strategies and CA on EPBD to induce MS action equivalent to option 1)	+ Medium: will improve the information on renovation possibilities and help prepare projects	1) – / + This is a relatively strong requirement. It could be retained as an option needed if option 2) does not yield sufficient progress in MS' policies regarding such instruments 2) ++ This would simply be using existing processes.	1) There may be stakeholder resistance against making the Individual building deep renovation passports/roadmaps a requirement; therefore, this option includes the requirement for MS to provide financial support as well
		Good practice examples: Provision of well-structured information on these, including on tenant contentment and financial outcome for housing company as well as actual vs. designed energy consumption/ performance (interview 6) **Options for EU level policy action:** 1) Introduce into the EPBD a requirement for MS to provide and advertise a	o to + Low to medium: may mitigate scepticism	+ Such a database should exist in every MS. It should have the same structure and types of data. Option 1) would be better in creating MS ownership and advertisement, but need more coordination from the EU level and possibly seed funding. Option 2) would be easier in harmonising structure and types of data but may compete with existing MS	

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		database of Good practice examples with the info mentioned above 2) Build up an EU-wide database of that kind		databases and struggle with data availability	
		Financial support for coaching through renovation projects (support in tendering, problem-solving, quality control), e.g. KfW **Options for EU level policy action:** 1) Introduce into the EPBD a requirement for MS to provide such financial support 2) Until next EPBD revision: COM to use governance process on national long-term renovation strategies and CA on EPBD to induce MS action equivalent to option 1)	+ Medium: will reduce project transaction costs and may mitigate fear of risks	1) – / + This is a relatively strong requirement. It could be retained as an option needed if option 2) does not yield sufficient progress in MS' policies regarding such instruments 2) ++ This would simply be using existing processes.	
		Financial support (up to 100%) for an independent moderator and coaching role, involving both landlords and tenants from the beginning and all through the project, to create trust, reduce scepticism on all sides, and solve problems (=> also one type of one-stop-shop solution) **Options for EU level policy action:** 1) Introduce into the EPBD a requirement for MS to provide such financial support 2) Until next EPBD revision: COM to use	+ to ++ Can be high	1) – / + This is a relatively strong requirement. It could be retained as an option needed if option 2) does not yield sufficient progress in MS' policies regarding such instruments 2) ++ This would simply be using existing processes.	

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		governance process on national long-term renovation strategies and CA on EPBD to induce MS action equivalent to option 1); fund pilot projects through H2020 programme			
		Standard calculations and contracts for renovation projects to facilitate appraisal and hence lending by banks (also for appraisal by investors) (e.g. KfW scheme) **Options for EU level policy action:** 1) Introduce into the EPBD a requirement for MS to provide such tools, best if linked to EPCs and or Individual building deep renovation passports/roadmaps 2) Until next EPBD revision: COM to use governance process on national long-term renovation strategies and CA on EPBD to induce MS action equivalent to option 1)	o to ++ Can be high in countries, in which banks are not familiar with, or risk-averse in relation to energy renovations	+ Such tools should exist in every MS.	
		Communicate multiple benefits of energy efficiency and renewable energy **Options for EU level policy action:** 1) COM to work with MS in CA on EPBD, on harmonised set of methods and data	o to + Low, except if convincing data or examples of increased building value or reduced conflicts and their costs can be demonstrated	+ This should be done in any case.	

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Facilitating investments: (1) Improve cost effectiveness / mitigate landlord/tenant dilemma (2) overcome financial restrictions	**Incentives and Financing**	Grants for *investment* in deep renovation (**Art. 10 EPBD**) possibly differentiated by region (interview 7) or type of housing/tenants **Options for EU level policy action:** 1) Changing requirements of Art. 10 EPBD from "consider and report" to "implement" investment grants and loans for deep renovation/towards nZEB (either directly or via EE obligations – EEOS – for energy companies) would be useful; with a minimum rate of deep renovations to be supported (e.g. 1.5% per year, with stepwise increases to 2.0 or 2.5) 1b) Alternative option sectoral target under Art. 7 EED However, no obligation to use grants or financing to achieve target. 2) Funding options for MS: a) Earmarking EU ETS revenues; b) Exemption from financial stability pact for first 2 years? c) EU grants to MS? 3) Alternative: EU grant programme directly to investors 4) Until next EPBD revision: COM to use governance process on national long-term renovation strategies and Coordinated Action on EPBD to induce increased level of MS' grant programmes.	++ 1) and 3) can be highly effective (depending on grant level): addresses landlord/tenant dilemma, lack of cost-effectiveness, and to a lesser extent also lack of finance barriers 2) is a precondition for 1) 4) is more uncertain (to which extent will MS introduce or improve grants?)	1) – / + This is a strong requirement. It could be retained as an option needed if option 4) does not yield sufficient progress in MS' grant schemes 1b) o This would simply advance an existing EED article. However, sectoral targets would reduce MS' flexibility in achieving their overall targets. 2a) + This would only add specificity to the existing earmarking provisions. 2b) ++ This would increase MS' funding flexibility 2c) - This is not needed in case 2a) or 2b) can be implemented 3) -- The COM is too far away from investors and does not have the staff resources to operate such schemes 4) ++ This would simply be using existing processes.	Political feasibility for option 1) will depend on linking option 1) to funding options 2) for MS that do not wish to implement EEOS. This may be the reason why Art. 10 EPBD in its current version only requires MS to "consider and report". This previous policy choice, however, does not appear cast in stone. 4) Will also be more successful if linked to 2) 2b) Would contradict deeply rooted beliefs in the financial stability pact and debt limits. Although it would in fact help to reduce MS debt (state income or budget savings would very likely exceed the amount of grants, as was shown for the German KfW programmes by STE 2012), political feasibility is very unlikely 2c) and 3) would need additional EU budget For 2c), a reallocation of structural funds could be an option

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		Any differentiation by region or type of housing/tenants would be up to the MS			
		Soft loans (combined with grants) (**Art. 10 EPBD**) **Options for EU level policy action:** same as for policy option 'Grants for investment'	o to ++ Can be high in case of financial restrictions, depending on conditions	Same as for policy option 'Grants for investment'	Same as for policy option 'Grants for investment'
		Loans connected to the building not the owner **Options for EU level policy action:** 1) Add a requirement to "consider and report" in Art. 10 EPBD 2) Fund development and implementation of pilot schemes via H2020	o to ++ Depends on national situation in the banking sector and the individual rating of the building owner	1) + This would just be a small adder to existing legislation 2) ++ This would simply be using the existing programmes.	None (Idea not tested yet, so no requirement to implement but rather consider and report.)
		Tax reductions, e.g. through direct reductions or accelerated depreciation rules **Options for EU level policy action:** 1) Mention in a requirement for policy option 'Grants for investment' in Art. 10 EPBD that this could be an additional or alternative way to provide financial incentives to investments in deep renovation	+ Depends on existing rules in a MS and financial situation of a housing company – typically medium?	Same as for policy option 1) under 'Grants for investment' above	Same as for policy option 1) under 'Grants for investment' above
		See above in category 'Regulation': Law on possibility for landlords/-ladies to increase basic rents to recover costs of energy efficiency renovation (e.g. Germany, Netherlands)	*For analysis, see above in category 'Regulation'*	*For analysis, see above in category 'Regulation'*	*For analysis, see above in category 'Regulation'*

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		PDIA funding, with appropriate risk sharing **Options for EU level policy action:** 1) Increase and reform ELENA facility (e.g. advance PDA to comprise implementation support as well (→PDIA); reduce risk for building owner to have to pay back the PDA funds?) 2) In Art. 10 EPBD, add a requirement for MS to provide PDIA funding with low investor risk 3) Increase/earmark EU funding to MS?	+ Medium (will support project development and implementation but may not ensure the latter)	1) + This would simply advance an existing instrument; however, questionable if the COM is too far away from investors and has the staff resources to operate a significantly larger scheme 2) - / + Same as for policy option 1) under 'Grants for investment' above 3) + Same as for policy option 2a) under 'Grants for investment' above	1) and 3) Availability of EU funds would be a limitation 2) Same as for policy option 1) under 'Grants for investment' above
		State or municipality financing of incremental costs for energy renovation projects instead of the building owner, repayment from tenants via a fee or tax (interview 2: idea from the Netherlands) **Options for EU level policy action:** 1) Add a requirement to "consider and report" in Art. 10 EPBD 2) Clarify seed funding options for MS and or their municipalities 3) Fund development and implementation of pilot schemes via H2020	++ Could be very high through overcoming landlord/tenant dilemma, if landlord agrees to this scheme	1) + This would just be a small adder to existing legislation 2) + Same as for policy option 2a) under 'Grants for investment' above 3) ++ This would simply be using the existing programmes.	Political feasibility will depend on linking option 1) to funding options 2) for MS that do not wish to implement EEOS. (Idea not tested yet, so no requirement to implement but rather consider and report.)
		Bonus-malus payments for building owners based on their building's EPC relative to dynamic target values	++ Can be high, depending on level of payment and target values	1) + This would just be a small adder to existing legislation	Idea not tested yet, so no requirement to implement but rather consider and report.

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		Options for EU level policy action: 1) Add a requirement to "consider and report" in Art. 10 EPBD 2) Fund development and implementation of pilot schemes via H2020		2) ++ This would simply be using the existing programmes.	Also, requiring MS to implement this policy option may be seen as a taxation policy, which would require unanimous adoption in the Council.

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(1) Ensure availability of skilled suppliers/ contractors at reasonable cost **(2) Improve knowledge on deep renovation possibilities and reduce transaction costs**	**Capacity Building and Networking**	Education and training (**Build Up Skills programme**) with certification of energy consultants **Options for EU level policy action:** 1) Introduce into the EPBD (e.g. by expanding **Art 20 (3)**) a requirement for MS to ensure such education and training as well as certification of energy consultants / EPC issuers 2) Until next EPBD revision: COM to use governance process on national long-term renovation strategies and CA on EPBD to induce MS action equivalent to option 1) 3) Continue Build Up Skills programme	+ Medium	1) – / + This is a relatively strong requirement. It could be retained as an option needed if option 2) does not yield sufficient progress in MS' policies regarding such instruments 2) ++ This would simply be using existing processes.	
		Local actor networks on energy efficiency renovation at building and district scale, bundling exchange of information between actors and communication to public, and providing a one-stop-shop contact point (facilitated e.g. by local energy agencies) **Options for EU level policy action:** 1) Introduce into the EPBD a requirement for MS to initiate and support such networks 2) Until next EPBD revision: COM to use governance process on national long-term renovation strategies and	o Low (more important for private owner-occupiers or landlords with only one or a few dwellings to rent out)	1) – / + This is a relatively strong requirement. It would, however, be useful in any case 2), 3) ++ This would simply be using existing processes and programmes.	

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		CA on EPBD to induce MS action equivalent to option 1) 3) Fund development and implementation of pilot schemes via H2020			
		Regional peer networks of building portfolio owners on energy and environment, with a facilitator **Options for EU level policy action:** 1) Introduce into the EPBD a requirement for MS to initiate and support such networks 2) Until next EPBD revision: COM to use governance process on national long-term renovation strategies and CA on EPBD to induce MS action equivalent to option 1) 3) Fund development and implementation of pilot schemes via H2020	o Low (may mitigate scepticism but also increase it)	1) – / + This is a relatively strong requirement. In addition, its usefulness and conditions for positive impacts would need to be analysed further, including through option 3) 2) and 3) ++ This would simply be using existing processes and programmes.	
		Voluntary agreements between government and building portfolio owners (and possibly others) on energy renovations, e.g. “Meer Met Minder” (“More With Less”) in the Netherlands **Options for EU level policy action:** 1) Introduce into the EPBD a requirement for MS to initiate and support such agreements 2) Until next EPBD revision: COM to use	o Low	1) – / + This is a relatively strong requirement. In addition, its usefulness and conditions for positive impacts would need to be analysed further, including through option 3) 2) and 3) ++ This would simply be using existing processes and programmes.	

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		governance process on national long-term renovation strategies and CA on EPBD to induce MS action equivalent to option 1) 3) Fund development and implementation of pilot schemes via H2020			

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(1) Techno-logy developm ent: improve energy and resource efficiency, reduce costs, make technologi es simpler to install (2) improve market uptake of innovative solutions	**Research and Developm ent and BAT promotion**	Financial support for RD&D projects (**H2020 programme**) on e.g. • Deep renovation technologies or integrated solutions, • Industrial renovation solutions (such as prefabrication, "2nd skin"), • Good practice examples of cost-effective deep whole-building renovations **Options for EU level policy action:** 1) (Continue to) Fund development and implementation of pilot schemes via H2020	o to + Low to medium (medium if the company participates in a project such as DREEAM)	1) ++ This would simply be using existing programmes.	
		Technology or best practice solution competitions **Options for EU level policy action:** 1) Fund development and implementation of competitions via H2020	o Low for this target group / indirectly if cost-effective energy efficiency innovation emerges	1) ++ This would simply be using existing programmes.	
		Aggregation of demand for • Deep renovation technologies (e.g. 'technology procurement' projects Sweden/EU) • Integrated building renovation projects (e.g. 'Energiesprong' in the Netherlands) **Options for EU level policy action:** 1) Introduce into the EPBD a requirement for MS to initiate and support such aggregation schemes	o to ++ Can be high, if renovation cost can be significantly reduced	1) – / + This is a relatively strong requirement. It would, however, be useful in any case 2), 3) ++ This would simply be using existing processes and programmes.	

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		2) Until next EPBD revision: COM to use governance process on national long-term renovation strategies and CA on EPBD to induce MS action equivalent to option 1) 3) (Continue to) Fund development and implementation of pilot schemes via H2020			
		Regulations or national programmes on public procurement to lead by example **Options for EU level policy action:** *1) See mandatory renovation requirements for all public buildings under category 'regulation'* 2) Require MS action in an appropriate Directive or regulation 3) Cooperate with MS to induce similar action	+ Medium but only for public housing companies	*1) for analysis, see above in category 'Regulation'* 2) – / + This is a relatively strong requirement. It could be retained as an option needed if option 3) does not yield sufficient progress in MS' policies regarding such instruments 3) ++ This would simply be using existing processes.	*1) For analysis, see above in category 'Regulation'*