



# Deliverable 3.2

## White Paper on good practice in EPC assessment, certification, and use

QualDeEPC H2020 project

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DATE: 21/07/2021

PUBLIC

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Project **QualDeEPC**

“High-quality Energy Performance Assessment and Certification in Europe  
Accelerating Deep Energy Renovation”

Grant Agreement no. 847100

H2020-LC-SC3-EE-2018

Table 1 Document Factsheet

Document Factsheet	
<b>Project duration</b>	From September 2019 to August 2022
<b>Project website</b>	<a href="http://www.qualdeepc.eu">www.qualdeepc.eu</a>
<b>Document</b>	D 3.2: White Paper on good practice in EPC assessment, certification, and use, including the drafts for the enhanced EPC assessment scheme and the concept for the Deep Renovation Network Platforms as well as for the tools
<b>Work Package</b>	WP 3: Development of enhanced EPC schemes
<b>Task</b>	Task 3.5: Assemble the improved EPC assessment and certification schemes and tools in draft version ( <b>Green Paper</b> ) and revise to White Paper, based on feedback from pilot cases (WP4) and Task 3.4  Content has been developed in Task 3.1, 3.2, and 3.3 of the project.
<b>Version</b>	1 [By default version 1 when only 1 version is submitted to EC]
<b>Version date</b>	21/07/2021
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<b>Contributors</b>	QualDeEPC project partners: BME, CRES, dena, EAP, EKODOMA, ENERGIACLUB, ESCAN, CIT ENERGY MANAGEMENT AB
<b>Reviewers</b>	Project coordinator: Dr. Stefan Thomas; all project partners
<b>Type of deliverable</b>	Report
<b>Dissemination level</b>	PU

Table 2 Document Status

Document Status	
<b>Review status</b>	<input type="checkbox"/> Draft <input type="checkbox"/> WP leader accepted <input checked="" type="checkbox"/> Coordinator accepted
<b>Action requested</b>	<input type="checkbox"/> To be revised by partners <input type="checkbox"/> For approval by the WP leader <input type="checkbox"/> For approval by the Project Coordinator <input checked="" type="checkbox"/> To be delivered to the Commission

Table 3 Document History

Document History			
Version	Date	Main modification	Entity
Draft 1	02/07/2021	-	dena
Draft 2 – Consolidated	09/07/2021	Spelling, Grammar, additions by partners	all
Final	20/07/2021	Formatting	E-P-C



## ABBREVIATIONS

**DHW:** Domestic hot water

**EBPD:** Energy performance of buildings directive

**EPC:** Energy performance certificate

**GHG:** Green house gas

**HVAC:** Heating, ventilation, and air conditioning

**nZEB:** nearly zero energy building

**RES:** Renewable energy sources

## PROJECT PARTNERS

**WI:** Wuppertal Institut für KLIMA, UMWELT, ENERGIE gGMBH

**CRES:** Centre for renewable energy sources and saving

**DENA:** Deutsche Energie-Agentur GmbH (dena)

**EAP:** Energy agency of Plovdiv Association

**EKODOMA**

**ENERGIACLUB:** Energiaklub Szakpolitikai Intezet Modszertani Kozpont Egyesulet

**E-P-C:** EPC Project Corporation Climate. Sustainability. Communications. mbH

**FEDARENE:** Federation europeenne des agences et des regions pour l'énergie et l'environnement

**ESCAN:** Escan SL

**CIT ENERGY MANAGEMENT AB**

**BME:** Budapest University of Technology and Economics



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## PUBLISHABLE SUMMARY

This document presents the White Paper on good practice in EPC assessment, certification, and use, which is the advanced version of the Green Paper on good practice in EPC assessment, certification, and use (Veselá et al. 2020). It provides detailed analyses, policy proposals and descriptions of tools on the seven areas that the QualDeEPC project has identified as its priorities for the development of enhanced EPC schemes:

- Improving the recommendations for renovation, which are provided on the EPCs, towards deep energy renovation
- Online tool for comparing EPC recommendations to deep energy renovation recommendations
- Creating Deep Renovation Network Platforms
- Regular mandatory EPC assessor training (on assessment and renovation recommendations) required for certification/accreditation and registry
- High user-friendliness of the EPC
- Voluntary/mandatory advertising guidelines for EPCs
- Improving compliance with the mandatory use of EPCs in real estate advertisements

For each topic, the situations in the partner countries were evaluated and best practice examples were described in the Green Paper. Based on this and further analyses, generally applicable measures for improvements are suggested. The enhancements drafted in the Green Paper were evaluated by national stakeholder workshops (see D3.4 Report on feedback from Task 3.4 Workshops (Veselá et al. 2021)) and tested on pilot buildings and discussed with their representatives (see D4.4 and D4.5 (Zogla et al. 2021)). The major outcomes are:

- A text-based list of deep energy renovation recommendations,
- The concept for the online tool development,
- The concept for a Deep Renovation Network Platform,
- A universal, enhanced user-friendly EPC form template and background on the proposed content
- A detailed policy proposal for regular mandatory EPC assessor training, and
- A general policy proposal for advertisement guidelines and for actions to improve the compliance with the mandatory use of EPCs in real estate advertisements.

The suggested improvements on EPC schemes in the White Paper will be the basis for the country-specific adaptation, discussion, and to the extent possible, implementation of the developed policy proposals in WP5.



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# 1 INTRODUCTION

The QualDeEPC project is aiming to both improve quality and cross-EU convergence of Energy Performance Certificate schemes, and the link between EPCs and deep renovation: High-quality Energy Performance Assessment and Certification in Europe Accelerating Deep Energy Renovation. The objective of the project is to improve the practical implementation of the assessment, issuance, design, and use of EPCs as well as their renovation recommendations, in the participating countries and beyond.

Work package 3 of the QualDeEPC project aims to develop practical concepts, proposals, and tools for an enhanced EPC scheme linked to deep renovation based on the selected priorities of the Development Strategy Plan (D2.4). The seven priorities selected in D2.4 are:

- A) Improving the recommendations for renovation provided on the EPCs towards deep energy renovation
- B) Online tool for comparing EPC recommendations to deep energy renovation recommendations
- C) Creating Deep Renovation Network Platforms
- D) Regular mandatory EPC assessor training on assessment and recommendations required for certification/accreditation and registry
- E) High user-friendliness of the EPC
- F) Voluntary/mandatory advertising guidelines for EPCs
- G) Improving compliance with the mandatory use of EPCs in real estate advertisements

Generally, the White Paper summarizes the analyses and assembles the results for each priority. Since the priorities A), B), C) and E) depend on the definition of “deep energy renovation”, chapter 2 and Annex A on pages 79ff. assesses the proposals by the European Commission and develops a refined proposal that would take specific national situations into account and could therefore be more universally applied.

Chapter 3, firstly, summarizes the available information on renovation recommendations that can be found on EPCs across the partner countries. Secondly, it compares in more detail typical, legal and improved renovation recommendations for different building components and aspects given on EPC forms in each partner country (Annex B). The White paper builds on this information to present text-based proposals for enhanced recommendations targeting deep energy renovations for a variety of components of the building envelope and the technical systems. Country-specific values for these recommendations will have to be developed in WP5.

The concept, content and user interface of the online tool is described in Chapter 4. In this part, the general structure, the input parameters of building components and systems as well as the results (outputs) of the tool are thoroughly presented. The tool is aiming to be used by all users and in particular the homeowners to calculate an estimation of the current energy characteristics of their home, and also to acquire knowledge on the available technical solutions and the steps need to be taken in the future to improve the energy efficiency and proceed with a deep energy renovation of their home.

The Deep Renovation Network Platforms are part of the project structure of the entire QualDeEPC project. The main objective is creating concepts for platforms providing one-stop-shops for deep renovation linked to EPCs, including administrative, energy advice, financial, and supply-side information to building owners. The developed concepts in Chapter 5 are adapted to project partner country circumstances and partners’ possibilities. The basic version includes an online platform providing a one-stop-shop for information and other services for seven different topics. The project partners, support-



ers and other stakeholders could further enhance the basic platform as an extended platform depending on the national situation and resources. Which service elements are needed and feasible in each country will be analysed in detail in WP5.

The cross-country comparison of training guidelines for EPC assessors is summarized in Chapter 6. Best practices examples by Hungary and Sweden are described. Furthermore, a detailed policy proposal on regular mandatory training is provided as a basis for the discussion with national stakeholders.

A detailed analysis of the EPC forms about user-friendliness for all partner countries is shown in Chapter 7. Twelve elements of improvement have been identified. A detailed assessment of each of these elements led to seven elements that are implemented in the enhanced EPC form by this project.

Chapter 8 and 9 hold the analysis and proposals regarding the last two areas of enhanced EPC schemes, Voluntary/mandatory advertising guidelines for EPCs (Chapter 8) and Improving compliance with the mandatory use of EPCs in real estate advertisements (Chapter 9). The former is also one possible action to improve the use of EPCs in real estate advertisements. Chapter 8 starts with an overview of whether there are advertising guidelines in the seven countries represented in QualDeEPC. Annex E includes the legal requirements to present EPCs and the relevant data in the QualDeEPC partner countries. Based on a good example found in Sweden and examples from other EU Member States, a general policy proposal for the contents and formats of advertisement guidelines is derived, and a text proposal for countries wishing to make the use of these guidelines mandatory is provided in addition.

Chapter 9 discusses how to improve compliance with the mandatory use of EPCs in real estate advertisements. For the direct actions identified, appointment of a nodal authority with the competences and resources to control and enforce the use of EPCs in advertisements, and penal provisions for non-compliance, a policy proposal is presented, taking into account the current situation in QualDeEPC partner countries. Annex E shows if and how these direct actions and also several indirect actions have already been implemented in the QualDeEPC partner countries.

The White Paper will be the basis for the country-specific adaptation, discussion, and to the extent possible, implementation of the developed policy proposals in WP5.



## 2 DEFINING ‘DEEP ENERGY RENOVATION’ – A PROPOSAL FROM QUALDEEPC

Based on the analysis of existing proposals for defining ‘deep energy renovation’ (cf. Annex A), QualDeEPC proposes a modified nZEB-based approach for defining deep energy renovation, based on the following four staged criteria:

1. For those member states that have their objective or legal *nZEB definitions/ standards for existing buildings*, QualDeEPC proposes to link deep energy renovation with these definitions of nZEB; and define deep energy renovation as ‘renovation achieving *component energy standards* equal to at least those that are usually required to meet nZEB requirements for existing buildings’.
2. For countries that only have nZEB definitions for new build but not existing buildings, and in which the *nZEB requirements for new build* are not so ambitious and *would be achievable through renovation*, QualDeEPC proposes to define deep energy renovation as ‘renovation achieving *component energy standards* equal or close to those that are usually required to meet nZEB requirements for new buildings’.
3. In countries that only have nZEB definitions for new build but not existing buildings, and in which the *nZEB requirements for new build* are *too ambitious to reach through renovation*, QualDeEPC proposes to define deep energy renovation as ‘renovation achieving component energy standards close to nZEB requirements for new buildings, when possible’. QualDeEPC partners have been asked to present values for improved component energy standards that are better than the legal requirements in case of a major renovation, and are often proposed in practice by energy consultants. It can be assumed that these are somewhat accepted and available in the market, and not considered too far outside of cost-effectiveness considerations. They could be adopted as component energy standards for deep renovation.
4. In countries *without* current availability of such improved component energy standards or *with very lax nZEB definitions*, QualDeEPC recommends adopting best practices and component improvements in deep energy renovation from other member states with similar climates, and where such standards exist.

As additional guidance, a definition of deep energy renovation could *recommend* aiming for values for *non-renewable primary energy savings*<sup>1</sup> above 60%, if the original building energy performance of existing buildings is at levels achieved before building energy standards or with early historic building energy standards. Such savings can usually only be achieved through a full renovation of all parts of a building and its technical systems (**whole-building renovation**). For a **staged approach** according to a Building Renovation Passport with a deep energy renovation roadmap for a building, the **component energy efficiency levels** that are legally required or usually necessary to achieve deep energy renovation in the above nZEB-based definition would apply.

In any case, where this is feasible for a building, it is always recommendable to install renewable energy systems in addition to deep energy renovation.

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<sup>1</sup> A more precise definition of this metric will be needed, since primary energy factors e.g. for district heat or electricity already take renewable energy shares into account.



### 3 IMPROVING THE RECOMMENDATIONS FOR RENOVATION PROVIDED ON THE EPCS TOWARDS DEEP ENERGY RENOVATION

This chapter summarizes renovation recommendations in the current EPC practice and then, proposes renovation recommendations that are focused on deep energy renovation (see chapter 2). The aim of QualDeEPC regarding the renovation recommendations is to make them consistent and ambitious to stimulate deep energy renovation, which is needed to reach the EU's energy and climate targets. Moreover, lock-in effects need to be avoided that would be the consequence of suboptimal recommendations focussing on low-cost renovations with lower energy efficiency levels.

#### 3.1 Summary of renovation recommendations in current EPC practice for residential buildings

This section summaries the renovation recommendations in the current EPC practice. The display of the recommendations is discussed in the analysis of the EPC forms (see chapter 7). In the project, the focus is set on residential buildings. However, most renovation recommendations are applicable also for non-residential buildings. A more in-depth analysis of the current renovation recommendations typically suggested in the EPC process is given in the Development Strategy Plan of this project (D2.4) and the Green Paper (D3.1).

Currently, the renovation recommendations in EPCs in most European countries are oriented towards the minimum legal requirements. Additionally, the actions recommended are often low-cost options, but not necessarily the most cost-effective ones, or actions that are not low-cost but could be cost-effective in the longer term may not be recommended at all. The specific renovation recommendations selected by EPC assessors/issuers differ by country. This observation can be explained by specific climate zones, national requirements and building standards, but also by the uncertainty about the interpretation of "cost-effectiveness". Often "typical" values are hard to specify because no official documentation about renovation recommendations exist. Hence, mostly the minimum legal requirement is proposed, if an action is recommended at all. Similarly, "improved" values are not always available or are taken from other sources such as funding programs.

Considering the renovation recommendations of the pilot buildings, similarities between the countries can be found. In most cases, it is recommended to add thermal insulation to external walls, the roof or ground floor and/ or replace the windows. For technical systems, often the replacement of a boiler by a highly efficient one or a highly efficient heat pump is suggested. For renewable energies, photovoltaic or solar thermal heating systems are often proposed.

#### 3.2 Proposed renovation recommendations towards 'deep energy renovation'

Based on the findings in the strategy plan (D2.4) and Green paper (D3.1) summarized in chapter 3.1, we can conclude that there is an important need to create guidance on (1) which renovation actions should usually be recommended on EPCs, and (2) what should then be their energy efficiency or rating levels, so that the renovations will be consistent with 'deep energy renovation', even when implemented step by step according to an individual renovation roadmap. The project team, therefore, developed a proposal for such a set of renovation recommendations, based on the definition of 'deep energy renovation' developed in chapter 2.



Table 4 summarizes the proposed deep energy renovation recommendations. Since the specific values differ by country and climate zone, it was decided to use text-based recommendations in WP 3 for this White Paper and then provide country-specific values in WP 5. For illustration purposes, country-specific values are exemplarily shown for Germany in the rightmost column of Table 4. The recommendations are not sorted in any ranking order, but rather by theme. Also, the EPC issuer can and should also use additional recommendations which are in line with ‘deep energy renovation’ and suitable for the renovated building.

In the cases of added insulation at the external walls and roof as well as for the replacement of windows and doors, two categories for deep energy renovation options are proposed. Firstly, “enhanced” insulation, which should be consistent with deep energy renovation according to the approach defined in Chapter 2, so with nZEB standards in renovation. Therefore, it should be at least as or even more energy-efficient than the legal standard required in case of major renovation. Secondly, “exceptional” insulation, which might also be described as the “most energy-efficient option available”, and may be required for reaching nZEB standards in new buildings. These “exceptional” values might be just economically feasible or may require financial incentives to be economically feasible. For the insulation of the ground floor, the project partners agreed on “reinforced” insulation, because it is mostly only used if no insulation was present. For windows, the best available options, depending on the country, are either double glazed low-emissivity windows with sun films or triple glazed windows, and window frames with reduced thermal bridges for the windows frames.

In more and more countries, also the use of shading is or becomes important to reduce the cooling load during summer. Here, the most efficient option is to add shading externally, either using Venetian blinds, shutters or awnings or to add fixed horizontal/vertical shading devices, such as overhangs or louvers. Another option is the use of vegetation for shading.

Mechanical ventilation systems help to supply the needed air exchange efficiently, especially in otherwise airtight buildings. Hence, these systems should either be newly installed or replaced by energy-efficient options. An exemption could be made if natural ventilation works sufficiently well. For deep energy renovation, it is proposed to either use an exhaust fan system with an exceptionally low need for electrical power or a ventilation system with at least 80 or 90% heat recovery and very low or low electrical power consumption of the fans, respectively.

For the heating, cooling and DHW systems, a large variety of options is available on the market. Moreover, the specific choice depends on the system that was already installed and environmental conditions (i.e. climate zone). Hence, it was found difficult to list the best options for deep energy renovation. However, for all of these technical systems, an EU energy label is available. This label provides detailed requirements and calculation methods. Thus, a category A or above of this label is suggested for deep energy renovation.

For some partner countries, the lighting is also evaluated in residential buildings. LED lighting and the installation of dimmers are chosen as deep energy renovation options.

Similarly to the HVAC systems, also building automation systems are ranked from D (worst) to A (best) according to EN 15232. Whereas the current minimal standard corresponds to category C, we suggest to aim for Category B or A for deep energy renovation, which means that heating and cooling systems consider a given temperature profile and the occupancy of the building.



It also should be mentioned that some renovation recommendations rely on, or are a consequence of other recommendations. This observation is especially true for the options “reducing thermal bridging”, “air tightness”, “integration of renewable energy sources”, and “insulation of pipes”. The first two options rely mainly on the external wall, roof and ground floor insulation as well as on the window replacement. The integration of renewable energy sources, as well as the insulation of pipes, might already be covered by installing or replacing HVAC systems. Nevertheless, these elements should be listed as criteria for deep energy renovation, since also stand-alone options are available.

Even though the recommendations should be generally applicable in all partner countries and climate zones, there might be specific conflicting requirements. For example, in most partner countries, lighting is not relevant for residential buildings. These elements will be evaluated further for country-specific purposes in WP5.

Country specific values should be defined as follows: In general, our proposal is to make them consistent with deep energy renovation. Adopting our definition suggested in Chapter 2, deep energy renovation would be consistent with nZEB standards, and these, in turn, are based on an analysis of what is cost-optimal. Therefore, setting national values for the improved renovation recommendations consistent with nZEB requirements would fulfil the requirements of the EPBD:

According to the EPBD, all suggested actions on the EPC should be “cost-optimal or cost-effective improvements of the energy performance of a building or building unit” (EPBD, Article 11, 2.). The definition for ‘Cost-optimal level’ is “ [...] the energy performance level which leads to the lowest cost during the estimated economic lifecycle, where:

(a) the lowest cost is determined taking into account energy-related investment costs, maintenance and operating costs (including energy costs and savings, the category of building concerned, earnings from energy produced), where applicable, and disposal costs, where applicable; and L 153/18 Official Journal of the European Union 18.6.2010 EN

(b) the estimated economic lifecycle is determined by each Member State. It refers to the remaining estimated economic lifecycle of a building where energy performance requirements are set for the building as a whole, or to the estimated economic lifecycle of a building element where energy performance requirements are set for building elements.”

The terminology of ‘cost-effective’ is not directly defined.-In Article 11, 3., the EPBD states that EPCs “[...] may provide an estimate for the range of payback periods or cost-benefits over its economic lifecycle” and 4. that “... cost effectiveness shall be based on a set of standard conditions, such as the assessment of energy savings and underlying energy prices and a preliminary cost forecast.”

Keeping the definitions and descriptions for ‘cost-optimal’ and ‘cost-effective’ in mind, the ‘enhanced’ thermal insulation values based on national nZEB definitions would be cost-optimal. However, it should be kept in mind and communicated to EPC assessors, building owners and other users of the EPC that this is based on *only* “taking into account *energy-related* investment costs, maintenance and operating costs (including energy costs and savings, the category of building concerned, earnings from energy produced)” (highlighting in italics by the authors of this White Paper). It will be best to even mention this on the EPC. It means that most recommended insulation investments will be cost-effective in case of major renovation scheduled anyway, but not immediately before such major renovation is done anyway, unless there are high financial incentives. This also highlights the need to present the recommendations in useful combinations and a staged approach, similar to a Building Renovation Passport, on the enhanced EPC template, cf. Chapter 7.



The implementation of the 'exceptional' thermal insulation measures in existing buildings might not currently be cost-optimal and cost-effective in most cases. However, with regard to the European goal of climate neutrality in 2050 and the rising CO<sub>2</sub>-/GHG-emission prices, the 'exceptional' option might still be the better one in the long term. Additionally, better thermal insulation may also come with added benefits for thermal, acoustical and visual comfort. To support the 'exceptional' renovation choice, European governments are often providing financial incentives or subsidized loans to cover part of the investment costs.



Table 4 Deep energy renovation recommendations by QualDeEPC

Specific recommendation		Example value (Germany)
External wall insulation	Wall with enhanced thermal insulation properties (nZEB for renovation standard or similar)	U=0.2 W/(m²K) [funding program]
	Wall with exceptional thermal insulation properties (nZEB for new buildings standard or similar)	U=0.15 W/(m²K) [quality requirement passive house]
Roof insulation	Roof with enhanced insulation	U=0.2 W/(m²K) [Reference building]
	Roof with exceptional thermal insulation properties	U=0.14 W/(m²K) [funding program]
Insulation of ceiling of an unheated basement/ ground floor	Floor connected to the unheated basement or ground floor with reinforced insulation	U=0.25 W/(m²K) [funding program]
Window replacement	Window with enhanced insulation properties: e.g. Double glazed window equipped with thick argon or krypton thermal break and low-emissivity glass	U <sub>w</sub> =1.3 W/(m²K) (g=0.6) [new building]
	Window with exceptional insulation properties, e.g. triple glazed window	U <sub>w</sub> =0.95 W/(m²K) (g=0.6) [funding program]
Door replacement	Door with enhanced insulation properties	U = 1.8 W/(m²K) [new building]
	Door with exceptional insulation properties	U=1.3 W/(m²K) [funding program]
Replacement/ Installation of shading	External blinds (Venetian, shutters or awning)	Funded in combination with the exchange of windows
	Fixed horizontal/vertical shading devices, such as overhangs, louvers	
Replacement/ installation of the mechanical ventilation system	Ventilation system (no heat recovery) with an exceptionally low electrical power requirement	P <sub>el</sub> <0.2W/(m³/h)
	Ventilation system with heat recovery of min. 80% and very low electrical power consumption	η>80%, P <sub>el</sub> <0.45W/(m³/h)
	Ventilation system with heat recovery of min. 90% and low electrical power consumption	
Replacement/ modernization of the heating system	Generally: heating systems with EU energy label Cat. A or above, for example:	
	Condensing gas boiler in combination with solar thermal collectors	
	Geothermal heat pump	
	Reversible inverter air-air heat pump	

	Specific recommendation	Example value (Germany)
	District heating	Hydraulic balance required
Replacement/ modernization of the cooling system	Generally: cooling system with EU energy label Cat. A or above	
	Geothermal heat pump	
	Reversible inverter air-air heat pump	
Replacement/ modernization of the DHW system	Generally: DHW system with EU energy label Cat. A or above	
	Combination with the heating system through storage	
	Energy-efficient boiler with solar thermal collectors	
Integration of renewable energy sources	significant extent of energy demand/ consumption should be covered by renewable energy sources; <i>alternatively</i> , all external walls, the roof and ground floor should be insulated with exceptional thermal insulation	
	photovoltaic system (including for self-use)	
Lighting	LED	
	Dimmers	
Reduction of thermal bridging	Reduced thermal bridging for non-structural building elements, such as balconies, terraces, dormers, and fixed shading devices	
Increased air tightness	Air exchange rate of $1.5 \text{ h}^{-1}$ or lower at 50 Pa pressure difference OR Air tightness according to new building standard	$n_{50} \leq 1.5 \text{ h}^{-1}$
Building automation	Building automation system Cat. B or above according to EN 15232	Cat. B as in DIN V 18599 [funding programme]
Others	Insulation of all pipes	
	Replacement of circulation pumps that meet minimum requirement of ErP label	
	Hydraulic balance optimisation for water-based heating systems	



## 4 ONLINE TOOL FOR COMPARING EPC RECOMMENDATIONS TO DEEP ENERGY RENOVATION RECOMMENDATIONS

### 4.1 Objectives and general structure of the QualDeEPC Master tool input parameters

The Master<sup>2</sup> tool developed for QualDeEPC is the general version of a broad user-friendly platform for users, who want to be informed about the energy demand, rating and CO<sub>2</sub> emissions of their residential building. It is easy to use, allowing homeowners to simulate their dwellings, through the input of their building's necessary characteristics (typology – selecting one of 10 building types, geographical area, floor area, characteristics of building shell and heating/ cooling systems, etc.) in only 14 steps. In addition, the user can receive recommendations for improving the energy efficiency of their home to high levels (equivalent to deep energy renovation) for the walls, roof, floor, windows, shading, heating, cooling, DHW, and RES, and see the results and the indicative cost of the potential renovation activities. These recommendations could be compared to those of an EPC, or be used to prepare a discussion with an energy consultant or EPC issuer. The tool is as accurate as it can be, but is not meant to replace a professional calculation of the energy demand and potential savings as well as a detailed energy advice by an expert energy consultant. Therefore, the tool will advise the user to obtain a professional energy advice to understand the options for improving energy efficiency of the home and their benefits and costs better.

### 4.2 Master tool structure

The Master tool structure was designed to use the necessary information in order to run an appropriate software for energy building calculations and building energy classification, and is adapted for the purpose of QualDeEPC. Special care was given, however, to provide a general result in order not to be regarded as an official Energy Performance Certificate. Compared to the Greek Home Energy Check tool, the Master version of the tool for the QualDeEPC project introduces additional building typologies and selection options for other building components and systems.

Another feature will be a statement that informs whether the deep renovation criteria have been met or not<sup>3</sup>. Finally, a recommendations list will be prepared and proposed for every case and presented in a hierarchical list.

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<sup>2</sup>The master tool is based on the Greek Home Energy Check tool - <http://www.cres.gr/energyhubforall/HEC.html>

<sup>3</sup> Based on the concept of QualDeEPC definition of deep energy renovation, and its variants for the partner countries



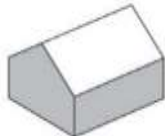






## 4.3 Input parameters




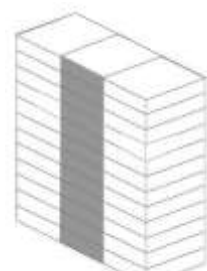
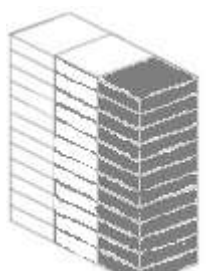
### 4.3.1 List of building types

The master tool provides a list of building types that can be used as input by the user. They are all residential buildings, from fully detached houses to multifamily buildings. Table 5 shows the building types covered.

Table 5 Greek HEC Building types

Building Type			
a/a	Type	Vicinity	Shape
1	1 storey single house	detached	
2	2 storey single house	detached	
3	3 storey single house	detached	
4	Flat in multifamily building	In touch with the ground	
5	Flat in multifamily building	Intermediate floor	



Building Type			
6	Flat in multifamily building	Upper floor	
7	2 storey single house	Terraced	
8	Multifamily building	Whole building	
9	Multifamily building attached in both side-elevations - Terraced	Whole building - Terraced	
10	Multifamily building attached in one side - Corner	Whole building	


#### 4.3.2 Geographical area/climate zone and floor area of the building

In the second screen, the climatic conditions are determined by the selection of the geographical area where the building is located (see Figure 1). The selection in the master tool comprises data from all regions of Greece. Another selection is whether the building is located at an altitude higher than 500 meters. Also, the total floor area of the house/ building must be given, either by stating the exact floor area (in m<sup>2</sup>) or by selecting the area from 3 choices: < 100 m<sup>2</sup>, between 100 and 150 m<sup>2</sup>, and between 150 and 200 m<sup>2</sup>. In the former case, the exact value must be stated.



### Select place and residential area

Click on map to select area



Located at an altitude of over 500 meters? ☐

How many square meters is your home?

<100

101-150

151-200

I want to enter the exact square meters:

Back

Next

Figure 1 Geographical area selection, floor area and selection of altitude of the house location.

### 4.3.3 Selection of building components and technical systems

Then the user has to provide information about the building envelope, and technical systems installed. Ten categories are available (see Figure 2 and *ANNEX B: Specification of building components and technical systems for the online tool* for details).

1. Walls
2. Roof
3. Floor
4. Windows
5. Shading
6. Heating systems
7. Cooling systems
8. Mechanical ventilation
9. Hot water equipment
10. Renewable energy sources



Figure 2 Information about the building envelope and installed equipment.

Based on the inputs from the partners, the master tool provides various choices for input parameters for various building components and technologies.

The user also has the choice not to provide any information and proceed to the calculations of the current situation. In that case, default values for all building systems are taken which, however, are the worst-case scenarios.

## 4.4 Results

All inputs are used to run the software, which calculates the current energy situation of the house/building in energy consumption figures and energy category. It provides the results for the yearly final energy consumption for heating, cooling and hot water production (see Figure 3). Then, the user has the possibility to apply energy efficient solutions for many building systems. A recommendation list is offered to the user to help him or her choose, which is given in hierarchical order (see Table 6).

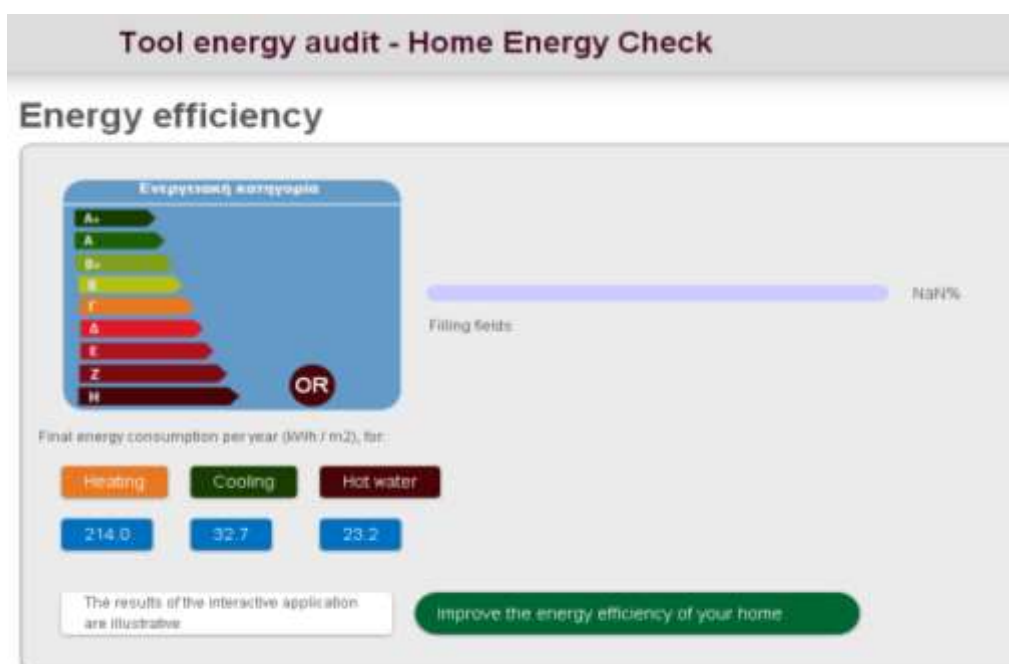


Figure 3 Current house energy consumption.

Table 6 Tool recommendations

a/a	Recommendations	
1	Roof insulation	Roof with exceptional thermal insulation properties
2	Window replacement	Window with enhanced insulation properties which fulfil nZEB requirements
3	Installation of shading	Fixed horizontal/vertical shading devices or Venetian, shutters or awning to decrease cooling needs
4	External wall insulation	Wall with enhanced thermal insulation properties which fulfils nZEB requirements
5	Replacement/ modernization of the heating system	Energy efficient devices i.e. heat pumps, condensing boilers with A energy category label
6	Replacement/ modernization of the cooling system	Use of efficient cooling systems (A energy label), geothermal heat pump, reversible inverter air-air heat pump, etc.
7	Utilization of renewable energy sources	Use of solar collectors, biomass boiler, PVs for heating and electricity production purposes
8	Energy efficient DHW production	Use of solar thermal collectors or energy category A heat pumps.

Then, improvements can be performed for the ten main fields of building systems (see Figure 4).

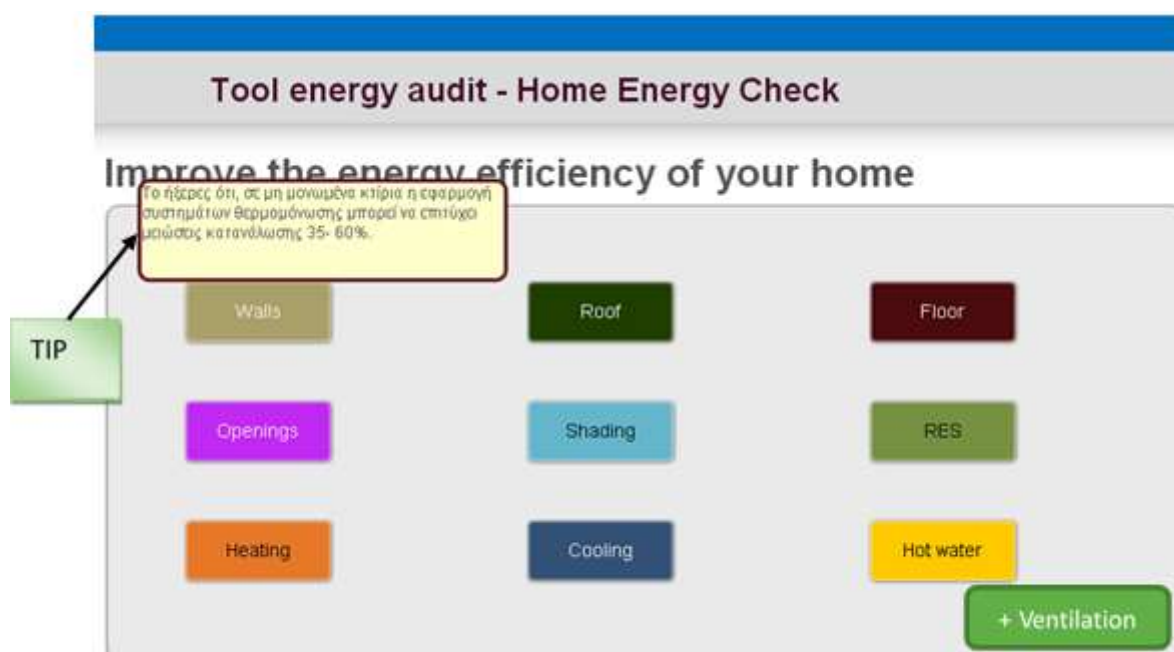


Figure 4 Improvements selection

Note however, that in the existing Greek tool, which is the basis for the master tool, the improvement measure or measures can be compared with the current energy figures of the house only once. In case someone wishes to check more options, he or she has to repeat the input values.

#### 4.4.1 Renovation recommendations

The recommendations are mainly attributed to the various selections the user is free to choose according to the energy measure. The renovation recommendations will be based on the list provided by Table 6 on page 29. The detailed values for each measure are currently based on Greek tool, but may be adjusted to country specific needs in WP5.

#### 4.4.2 Comparison between existing and renovation case; and deep energy renovation checkmark

Finally, the results from the comparison between the current and energy improved case are given. Additionally, the new energy class of the house is given together with the achieved energy conservation (in %), the CO<sub>2</sub> emissions reduction (in %) and an estimation of the cost for the improvement measures tested (refer to Figure 5).

From the moment the input data are completed, an .xlm file is produced and run by the software for the energy efficiency of buildings. The software is used again to test the selected energy improvements and all results are shown in the last screen of the tool (Figure 5 and Figure 6).

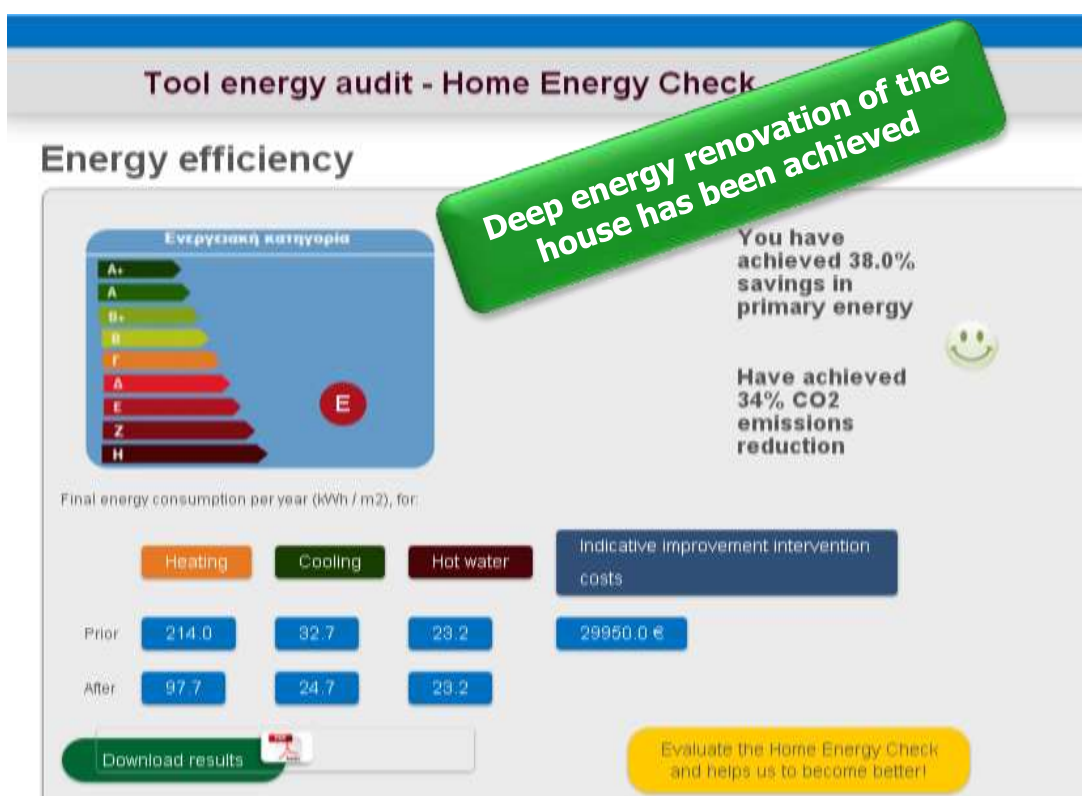


Figure 5 Comparison of results

An extra message states if Deep energy Renovation criteria have been reached (see Figure 5).

Deep energy renovation of the house/building has been achieved. Or

Deep energy renovation of the house/building has not been achieved.

### Output of recommendations

In the report for the test conducted by the user, recommendations will be available regarding which energy efficiency technology should take place first and in what order (see Figure 7).

The recommendations hierarchy (prioritization) is based on construction restrictions.

The rationale behind the prioritization of measures towards deep renovation is based on the following pillars:

#### Pillar I: the commonly accepted engineering / scientific approach

1<sup>st</sup>: improve the performance of the envelope components so as **to reduce the energy demand of the building**

2<sup>nd</sup>: **improve the efficiency of the Technical Systems**, the dimensioning of which will be based on the 'reduced energy demand', after implementation of Step 1

3<sup>rd</sup>: **install Renewable energy technologies**, which are meant to cover a % of the energy demand resulting after the implementation of Steps 1 and 2.

#### Pillar II: Implementation of energy retrofit measures towards Deep Renovation

When considering the improvement of the envelope performance, attention should be paid to the order of measures to be implemented so as to avoid either **lock-in effects** or **damages** on previously implemented technologies/materials.





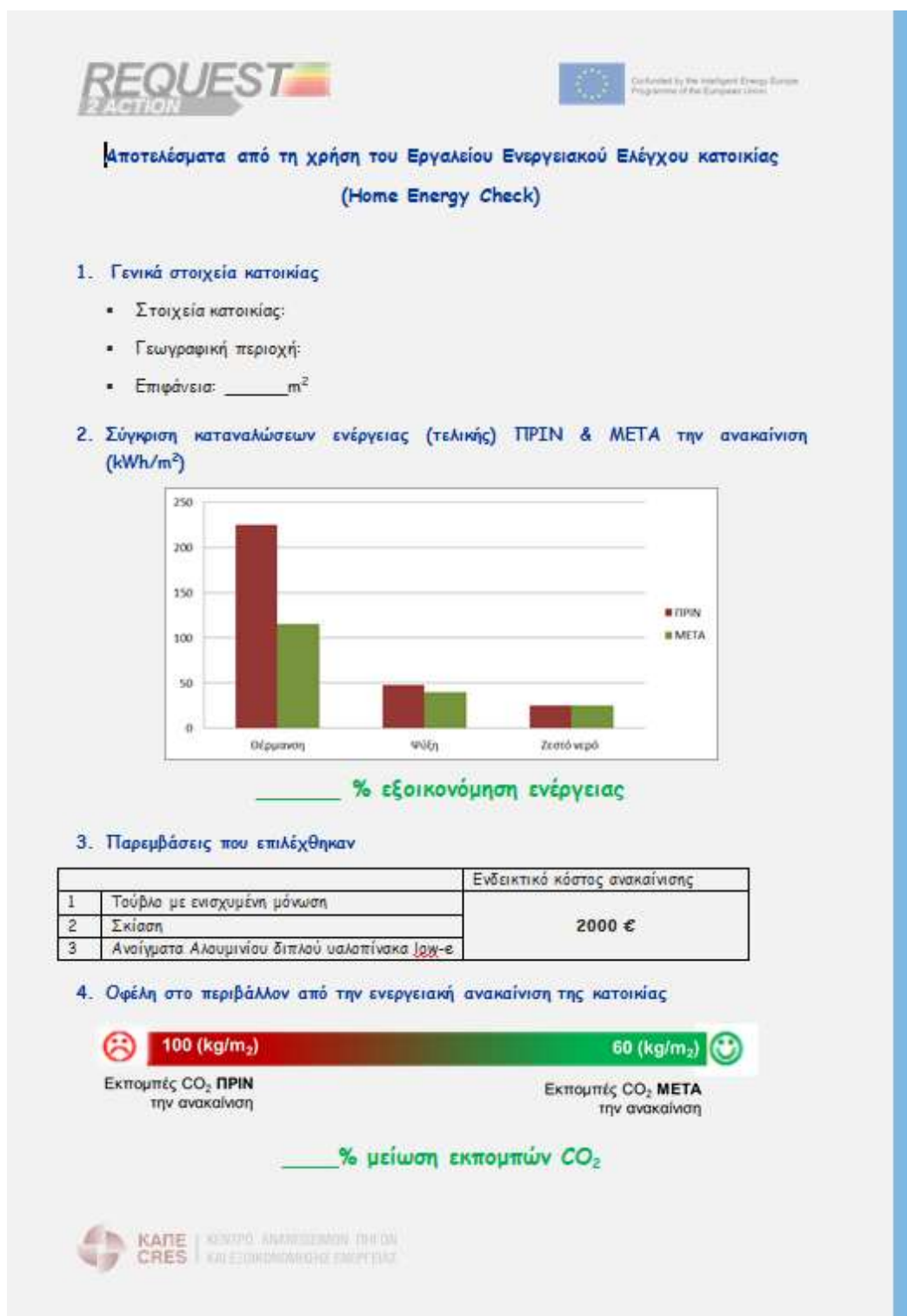


Figure 6 Tool results report layout (current version)

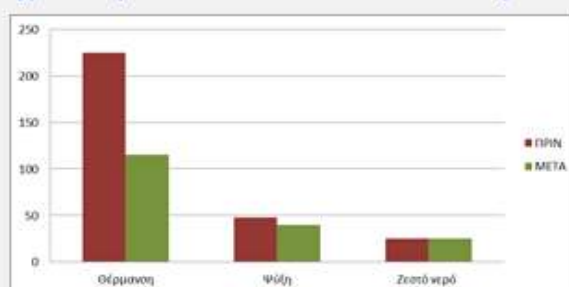


## Home Energy Check tool results

### 1. Home/flat/building general data

- Home type:
- Geographical area:
- Floor area: \_\_\_\_\_ m<sup>2</sup>

### 2. Final energy consumption BEFORE and AFTER renovation (in kWh/m<sup>2</sup>)



\_\_\_\_\_ % energy saving

### 3. Energy measures selected

		Indicative renovation cost
1	Brick Wall with reinforced thermal insulation	2000 €
2	Shading	
3	Low-e double glazed aluminum Windows	

### 4. Environmental benefits



\_\_\_\_\_ % CO<sub>2</sub> emissions decrease

### 4. Recommendations for taking up energy measures (hierarchically)

- Thermal insulation of wall [in title only or with explanations]
- Shading
- Installation of energy efficient windows



This project has received funding from the European Union's Horizon 2020 programme

Figure 7 Tool results report layout (upgraded version)

Finally, the tool will advise the user to obtain a professional energy advice to understand the options for improving energy efficiency of the home and their benefits and costs better.

## 5 CREATING DEEP RENOVATION NETWORK PLATFORMS

### 5.1 Objectives for developing concepts for deep renovation network platforms

The concept, or rather several differentiated concepts for Deep Renovation Network Platforms are part of the project structure within the four phases of the entire QualDeEPC project. The basis for this task is the Development Strategy Plan created in WP2 (Kostova et al. 2020), which includes information on existing good practice, including on Deep Renovation Network Platforms, and has been guiding the development of next-generation EPC schemes in WP3 of the QualDeEPC project.

The main objective of Task 3.2 was creating concepts for Deep Renovation Network Platforms. These are providing one-stop-shops (OSS) for deep renovation linked to EPCs, including administrative, energy advice, financial, and supply-side information to building owners, and are combining these OSS with active marketing of deep renovation and EPCs, and coordinating supply-side actors and supporting their marketing, training, and quality.

The concepts were developed to be easily adapted to project partner country circumstances and partners' possibilities. The basic version includes an online platform providing a one-stop-shop for information and other services for seven different topics.

Under this basic version, a minimal version is defined by the column "minimum version" in Table 7. It is the minimal concept that project partners would aim to implement in each of the seven countries of QualDeEPC.

The Development Strategy Plan outlined two versions – basic and extended, defined by the type of services offered, and five potential subtypes, with a combination of services and the organisation as a nation-wide online platform or a local/regional physical hub of Deep Renovation Network Platforms. This chapter outlines these versions and subtypes, develops a policy recommendation and finally offers detail on the services that could be included in each of these versions and subtypes, the users addressed, and examples, in Tables # to #.

**NOTE: A One-Stop-Shop** should offer all the products and services that customers need. Depending on the initial situation in each sector and country, the product range for a complete solution can look very different.

In most cases, the task is to relieve the customer of research, design, or bureaucratic processes. In extended cases, the One-Stop-Shop may perform the implementation on behalf of the customer, or even provide the financing.

### 5.2 Deep renovation network platforms: versions and subtypes

#### 5.2.1 Basic platform

The basic platform will be a web platform that provides a one-stop-shop including all relevant information<sup>4</sup>. This will also either include an adaptation of the central tool to be developed in Task 3.3 or of similar existing tools, which will offer improved recommendations for residential buildings matching

<sup>4</sup> This is equivalent to subtype 1) a. discussed in the Development Strategy Plan and below.



deep renovation standards, as a tool for both EPC assessors, building owners, and potential buyers and tenants.

If such a tool already exists in a country, it will be checked whether it can be extended to the full functionality that is required for the basic platform.

The basic platform consists of seven services/products shown and described in Table 7 Basic part of the DRNP below. All services will be offered by the provider of the platform itself, but possibly often in co-operation with partners, particularly for the last four services. Besides, if an existing tool is connected to the service of an online renovation calculator and tool, it may be provided by a third party. The basic version of the services is shown in Table 7 Basic part of the DRNP.

### 5.2.2 Extended platform

The project partners, supporters and other stakeholders could further enhance the basic platform depending on the current national situation and resources that can be committed. Which service elements are needed and feasible in each country will be discussed in Task 3.4 and will be analysed in detail in WP5. To the extent that partners can't be implemented in the course of the QualDeEPC project, this extended concept can be understood as a policy proposal, as outlined below.

The platform can be expanded to create a platform for suppliers to organize one-stop supply offers for renovation. Furthermore, the platform could be extended together with regional partners to become more than a website. A network of partners could provide a (virtual or even physical) hub for active marketing and connecting stakeholders, professional training and further necessary services.

The platforms can be adapted to country needs, and several services can be proposed or prepared and organised. Intended services are e.g. step-by-step guidance for deep renovation projects, or the use and linking or expansion of existing training and learning platforms to maintain specialist knowledge and sector capacities. The extended services can be found in Table 8 Extended part of the DRNP.

### 5.2.3 Typology of platforms

A typology of such platforms could include the following **subtypes**:

#### 1. an online platform:

**1a)** an online platform including information only by a One-Stop-Shop (OSS) such as the Greek [www.energyhubforall.eu](http://www.energyhubforall.eu) .

**1b)** an online platform like the Danish BetterHome (including an OSS for information and implementation) <https://www.betterhome.today>

#### 2. a local or regional physical hub

i.e. a network of partners providing a hub for active marketing and connecting stakeholders, professional training, or whatever is needed, and also a 'physical' OSS with energy advisors. This could take the forms of

**2a)** OSS hub for information only, or

**2b)** OSS hub for information and coordination (guiding/coaching through implementation), e.g. proKlima in Hannover (<https://www.proklima-hannover.de>) or

**2c)** OSS hub for information and implementation.



Subtypes could also be combined. For example, a combination of a 1a) national online platform and a network of several or many 2b) or even 2c) physical hubs may be best to advance deep renovation.

However, it should be noted that physical hubs involve higher costs than online-only solutions. Both types may need funding from the national or regional government to local/regional agencies implementing the hub, and support and coordination from the national or regional energy agency.

For each subtype and service/product, the potential service provider, description of services, and end-users addressed are shown in Table 9 Subtypes.

#### 5.2.4 QualDeEPC policy recommendations

Based on the above analysis and the detailed concepts presented in the following tables, QualDeEPC recommends the following actions to national and/or regional governments competent for implementing energy efficiency policies for buildings and particularly EPC schemes.

Each EU Member State should operate a combination of two types of Deep Renovation Network Platforms:

1. An online platform at the national level, including a One-Stop Shop at least for information (subtype 1a), i.e. all information services 1. to 5. of the basic version.  
It should also be endowed with sufficient resources to perform the two further services of the basic version: 6. Active marketing of deep renovation and its benefits and costs and 7. Network (platform) for learning, exchange and cooperation (local/regional/ national). The networking could also be expanded to interregional or international networking (service 8. of the extended platform concept).  
Out of the extended concept, services 9. Capacity building and training, 11. Monitoring the implementation of the renovation project(s), and 14. Carrying out a deep renovation demonstration project(s) could also be linked to this platform or be implemented by the operator of the platform, particularly if the operator is a national energy agency or similar.
2. A network of local or regional physical hubs with combined core funding from the national level and income from some of the services. These hubs could offer most of the services of an extended platform, including coordination of renovation projects (guiding/coaching through implementation, service 10.), which would be (subtype 2b), or even implementation (service 13.), which would be subtype 2c). They would be part of a national network within the central platform (see above) and receive technical and financial support from the national level for their information, active marketing, training, and other agreed activities.

Table 7 Basic part of the DRNP

Services/products	Description of services	Details of Services offered	Users addressed (examples)	Examples	Minimum version
<b>1. Information on renovation actions</b> <b>1.1 General information</b>	<ul style="list-style-type: none"> <li>Providing general information and other benefits due to renovation</li> <li>Providing information on principles of insulation, heating, cooling, and ventilation systems, renewable energies</li> <li>descriptive texts and graphics on the website with information</li> <li>text and graphic documents downloadable as pdf-documents</li> </ul>	<p>General information on renovation actions</p> <ul style="list-style-type: none"> <li>energy consulting/advice</li> <li>deep (full) renovation</li> <li>building insulation</li> <li>air tightness</li> <li>windows</li> <li>shading</li> <li>ventilation</li> <li>heating system</li> <li>cooling system</li> <li>domestic hot water</li> <li>lighting</li> <li>renewables</li> <li>monitoring</li> <li>best practice</li> <li>quality management</li> </ul> <ul style="list-style-type: none"> <li>The information should be in line with the concrete proposal by QualDeEPC for Improving the EPC recommendations towards deep energy renovation</li> <li>The above list should be made consistent with the renovation actions, for which we develop the improved recommendations</li> </ul>	<ul style="list-style-type: none"> <li>Building owners</li> <li>Prospective buyers</li> <li>Tenants</li> <li>Possibly EPC assessors</li> </ul>	<p><a href="https://www.energie-experten.org/bauen-und-sanieren/altbausanierung/dachsani-erung.html">https://www.energie-experten.org/bauen-und-sanieren/altbausanierung/dachsani-erung.html</a></p> <ul style="list-style-type: none"> <li>Roof renovation: measures at a glance</li> <li>Which technical measures are part of the roof renovation?</li> <li>Which advantages and disadvantages do they bring?</li> <li>When is a roof renovation worthwhile?</li> <li>When does it make sense to combine different renovation measures for the roof?</li> </ul> <p><a href="https://www.energiesparen.be/bouwen-en-verbouwen">https://www.energiesparen.be/bouwen-en-verbouwen</a></p> <p><a href="http://translate.google.com/translate?sl=nl&amp;tl=en&amp;u=https%3A%2F%2Fwww.energiesparen.be%2FEPB-burgers">http://translate.google.com/translate?sl=nl&amp;tl=en&amp;u=https%3A%2F%2Fwww.energiesparen.be%2FEPB-burgers</a></p> <ul style="list-style-type: none"> <li>Insulation and airtightness</li> <li>Glazing and windows</li> <li>Heating</li> <li>Domestic hot water</li> <li>Ventilation</li> <li>Lighting</li> <li>Electrical devices</li> <li>Green energy</li> </ul> <p><a href="https://www.greenmatch.co.uk/">https://www.greenmatch.co.uk/</a></p>	<p>General information on:</p> <ul style="list-style-type: none"> <li>building insulation</li> <li>windows</li> <li>ventilation</li> <li>heating system</li> <li>renewables</li> <li>deep renovation</li> </ul>



Services/products	Description of services	Details of Services offered	Users addressed (examples)	Examples	Minimum version
<b>1.2 Information on potential savings, costs and other benefits</b>	Providing general information on costs of renovation for deep renovations, building components, building services, renewable energy, potential energy savings, cost savings and co-benefits	<p>Information on renovation costs and savings, benefits</p> <ul style="list-style-type: none"> <li>energy consulting/advice</li> <li>deep (full) renovation</li> <li>building insulation</li> <li>windows</li> <li>ventilation</li> <li>heating system</li> <li>renewables</li> <li>monitoring</li> <li>best practice</li> <li>quality management</li> <li>energy prices</li> <li>co-benefits (e.g. comfort, noise reduction, air improvement, image, value enhancement, external appearance)</li> </ul> <p>Same list as for 1.1</p> <p>Link to the calculator for energy cost savings, possibly included in the tool (1.3)</p>	<ul style="list-style-type: none"> <li>Building owners</li> <li>Prospective buyers</li> <li>Tenants</li> <li>Possibly EPC assessors</li> </ul>	<p><a href="https://www.energie-experten.org/bauen-und-sanieren/altbausanierung/dachsani-erung/kosten.html">https://www.energie-experten.org/bauen-und-sanieren/altbausanierung/dachsani-erung/kosten.html</a></p> <p>Roof renovation: measures and costs at a glance</p> <ul style="list-style-type: none"> <li>What does it cost?</li> <li>Energy savings?</li> </ul> <p><a href="https://www.energiesparen.be/ener-giewinst">https://www.energiesparen.be/ener-giewinst</a></p> <p>Calculation of the profit for the replacement of an old boiler (&gt; 20 years old) with a condensing boiler in 5 steps</p> <p>Good practice examples with feedback from homeowners on realised energy-efficient renovation projects to motivate undecided people.</p>	<p>Information on renovation typical costs and savings for:</p> <ul style="list-style-type: none"> <li>building insulation</li> <li>windows</li> <li>ventilation</li> <li>heating system</li> <li>renewables</li> </ul>
<b>1.3 Linking with renovation tools</b>	Links to specific renovation tools and calculators which clearly outline the costs of renovation, potential energy savings and	Integration or linking of/to renovation tools in QualDeEPC partner countries, this would be the online tool for comparing EPC	<ul style="list-style-type: none"> <li>Building owners</li> <li>Prospective buyers</li> <li>Tenants</li> <li>EPC assessors</li> </ul>	<a href="https://www.energiesparen.be/ener-giewinst">https://www.energiesparen.be/ener-giewinst</a>	Integration to renovation tools or linking of existing tools in QualDeEPC partner countries.



Services/products	Description of services	Details of Services offered	Users addressed (examples)	Examples	Minimum version
	other benefits due to renovation (QualDeEPC priority B )	recommendations to deep energy renovation recommendations developed in Task 3.3 or information will be provided, how these existing tools can be expanded in this regard.			This would be the online tool for comparing EPC recommendations to deep energy renovation recommendations developed in Task 3.3
<b>2.1 Linking with Energy Performance Certificates</b>	<ul style="list-style-type: none"> <li>Providing detailed information on EPC assessment purposes/uses, procedure, tools and assessors</li> <li>Comprehensive information on EPCs, including EPC obligations, registry of EPC assessors (with a link), explaining EPCs in terms of nZEB and national energy targets</li> </ul>	<p>Information on EPCs answering the following questions:</p> <ul style="list-style-type: none"> <li>Who needs an EPC and for which purpose?</li> <li>When is an EPC required?</li> <li>How long is an EPC valid?</li> <li>Read &amp; understand the EPC.</li> <li>Who can issue EPCs, where can I find issuer?</li> <li>What types of EPCs existing?</li> <li>Where EPCs are regulated?</li> <li>Content of EPCs and for what it is useful.</li> <li>Content of the renovation recommendations, incl improved recommendations (T.3.1)</li> <li>Samples of EPCs</li> <li>Linking to EPC-assessor and energy expert databases, regulations etc.</li> <li>What to present in advertisements</li> </ul> <p>Links to</p>	<ul style="list-style-type: none"> <li>Building owners</li> <li>Prospective buyers or tenants</li> <li>EPC assessors</li> <li>Citizens</li> <li>Public authorities</li> </ul>	<p>Information on EPCs – FAQs:</p> <ul style="list-style-type: none"> <li>What is an EPC?</li> <li>Which energy efficiency classes are there?</li> <li>What does an EPC cost?</li> <li>Consumption &amp; demanded based EPC what is the difference?</li> <li>Where can I apply for an energy certificate?</li> <li>When is an EPC required?</li> <li>How long is an EPC valid?</li> <li>Read &amp; understand the EPC.</li> </ul> <p><a href="https://www.co2online.de/modernisiert-und-bauen/energieausweis">https://www.co2online.de/modernisiert-und-bauen/energieausweis</a></p> <ul style="list-style-type: none"> <li>The EPC guide will help you on your way!</li> <li>An EPC tailored to your building</li> <li>Questions about the EPC?</li> <li>Investigations into the EPC</li> </ul> <p><a href="https://www.energiesparen.be/energieprestatiecertificaten">https://www.energiesparen.be/energieprestatiecertificaten</a></p>	<p>Detailed information on</p> <ul style="list-style-type: none"> <li>EPC in general and purposes/uses/duties</li> <li>EPC assessment procedure</li> <li>EPC forms and types</li> <li>Renovation recommendations</li> <li>issue energy certificates and where this is regulated</li> <li>Links to</li> <li>The online renovation calculator tool (1.3)</li> <li>The deep renovation recommendations (1.1)</li> <li>Advertising guidelines for EPCs</li> </ul>



Services/products	Description of services	Details of Services offered	Users addressed (examples)	Examples	Minimum version
		<ul style="list-style-type: none"> <li>The online renovation calculator tool (1.3)</li> <li>The deep renovation recommendations (1.1)</li> <li>Advertising guidelines for EPCs</li> </ul>			
<b>2.2 Linking with building deep renovation roadmap and possibly a passport</b>	<ul style="list-style-type: none"> <li>Linking EPC information to detailed analysis to upgrade it to a Building deep renovation roadmap</li> <li>Possibly development of the content and form of the "Building Passport" for bringing together the history of a building and the information tied to it (roadmap, energy audits, energy-saving works and/or restoration works)</li> </ul>	<p>Information on building renovation roadmap and passport</p> <ul style="list-style-type: none"> <li>What is it?</li> <li>How can the EPC be a starting point?</li> <li>Benefit of the renovation roadmap and passport: why is it useful?</li> <li>The methodology of the building renovation roadmap and passport</li> <li>Energy efficiency of buildings (link to 1.1)</li> <li>costs of the roadmap or passport and existing subsidy measures</li> </ul> <p>Links to</p> <ul style="list-style-type: none"> <li>A list of energy consultants who can develop a Building deep renovation roadmap, and link to grants offered for it (if available)</li> <li>If available, a list of energy consultants entitled to issue a</li> </ul>	<ul style="list-style-type: none"> <li>Building owners</li> <li>Prospective buyers or tenants</li> <li>EPC assessors</li> <li>Public authorities</li> </ul>	<ul style="list-style-type: none"> <li><a href="http://translate.google.com/translate?sl=de&amp;tl=en&amp;u=https%3A%2F%2Fwww.febs.de%2Fberaten-finanzieren%2Fisfp">http://translate.google.com/translate?sl=de&amp;tl=en&amp;u=https%3A%2F%2Fwww.febs.de%2Fberaten-finanzieren%2Fisfp</a></li> <li>Woningpas <a href="https://woningpas.vlaanderen.be/over-woningpas">https://woningpas.vlaanderen.be/over-woningpas</a></li> <li>Passeport Efficacité Énergétique <a href="https://theshiftproject.org/en/experience-p2e-2">https://theshiftproject.org/en/experience-p2e-2</a></li> <li>Individueller Sanierungsfahrplan <a href="https://www.febs.de/beraten-finanzieren/isfp">https://www.febs.de/beraten-finanzieren/isfp</a></li> </ul>	<p>Information on building renovation roadmap and passport</p> <ul style="list-style-type: none"> <li>What is it?</li> <li>How can the EPC be a starting point?</li> <li>Benefit of the renovation roadmap and passport: why is it useful?</li> <li>Methodology of the building renovation roadmap and passport</li> <li>Links to further information about the roadmap/passport</li> <li>Energy efficiency of buildings (link to 1.1)</li> </ul> <p>Links to</p> <ul style="list-style-type: none"> <li>Links to subsidy programmes</li> <li>The online renovation calculator tool (1.3)</li> </ul>





Services/products	Description of services	Details of Services offered	Users addressed (examples)	Examples	Minimum version
		Building Passport, and/or link to a software for creating such a passport <ul style="list-style-type: none"> <li>Links to further information about the roadmap/passport</li> <li>Links to subsidy programmes</li> <li>The online renovation calculator tool (1.3)</li> </ul>			
<b>3. Information on building contractors/ technicians and energy-efficient-experts</b> <b>Support with finding experts and building contractors/ technicians</b>	<ul style="list-style-type: none"> <li>Providing information regarding energy-efficient-experts, building contractors/ technicians/ installers</li> <li>Providing a search engine or a databases of energy-efficiency experts/ contractors / technicians/ installers/ technical supervisors</li> <li>Requesting various renovation offers/quotes from contractors/ technicians and comparing them so that the end-user can make an informed choice</li> </ul>	<ul style="list-style-type: none"> <li>Information provided regarding:</li> <li>Consultation of qualified experts and companies in the building sector</li> <li>Instructions on how to find and recognize reputable and well-qualified companies and what to watch out for.</li> <li>List of companies with authorised consultants</li> <li>Link to the database of energy-efficient-experts and EPC assessors</li> <li>How to use the service for requesting offers/quotas</li> <li>Which EPC data could be the basis for requesting an offer</li> </ul>	<ul style="list-style-type: none"> <li>Building owners</li> </ul>	Find your professional <a href="https://www.energiesparen.be/bouwen-en-verbouwen">https://www.energiesparen.be/bouwen-en-verbouwen</a> → find your professional <a href="https://translate.googleusercontent.com/translate_c?depth=1&amp;pto=aue&amp;rurl=translate.google.com&amp;sl=nl&amp;sp=nmt4&amp;tl=en&amp;u=https://www.buildy-ourhome.be/nl&amp;usg=ALkJrhgpJFfgnCyt-O6mQmbSSkrR3BBw0Q">https://translate.googleusercontent.com/translate_c?depth=1&amp;pto=aue&amp;rurl=translate.google.com&amp;sl=nl&amp;sp=nmt4&amp;tl=en&amp;u=https://www.buildy-ourhome.be/nl&amp;usg=ALkJrhgpJFfgnCyt-O6mQmbSSkrR3BBw0Q</a> → find your contractor <a href="https://translate.googleusercontent.com/translate_c?depth=1&amp;pto=aue&amp;rurl=translate.google.com&amp;sl=nl&amp;sp=nmt4&amp;tl=en&amp;u=">https://translate.googleusercontent.com/translate_c?depth=1&amp;pto=aue&amp;rurl=translate.google.com&amp;sl=nl&amp;sp=nmt4&amp;tl=en&amp;u=</a>	<ul style="list-style-type: none"> <li>Information regarding energy-efficient-experts, building contractors/ technicians/ installers</li> <li>Instructions on how to find and recognise reputable and well-qualified companies (contractors/ craftsman) and what to watch out for.</li> </ul>



Services/products	Description of services	Details of Services offered	Users addressed (examples)	Examples	Minimum version
				<a href="https://www.vinduwaanne-mer.be/&amp;usg=ALkJrh-VoCwKqhc3GzZer2sipL8U5PVo5g">https://www.vinduwaanne-mer.be/&amp;usg=ALkJrh-VoCwKqhc3GzZer2sipL8U5PVo5g</a>  Find your energy-expert:  <a href="https://www.energie-experten.org/bauen-und-sanieren/altbausanierung/dachsani-erung/kosten.html#c18593">https://www.energie-experten.org/bauen-und-sanieren/altbausanierung/dachsani-erung/kosten.html#c18593</a>	
<b>4. Information on material or product manufacturers/suppliers</b>	<ul style="list-style-type: none"> <li>Provides information on product manufacturers /suppliers required for deep renovation</li> <li>Alternatively or in addition, could also link to information provided by associations of manufacturers or distributors e.g. of insulation materials, with appropriate indication that this may be commercial information</li> </ul>	Information on the currently most frequently used materials and technologies and their manufacturers and suppliers <ul style="list-style-type: none"> <li>building insulation</li> <li>windows</li> <li>HVAC systems</li> <li>renewables</li> <li>etc.</li> </ul> Links to further independent lists and databases for materials, products, manufacturers, suppliers	<ul style="list-style-type: none"> <li>Building owners</li> <li>Building contractors/ technicians/ installers</li> </ul>	Compare insulation prices from independent providers for free!  <a href="https://www.daemmen-und-sanieren.de/daemmung/hersteller">https://www.daemmen-und-sanieren.de/daemmung/hersteller</a>  Lists of manufacturers:  <a href="https://www.energie-experten.org/bauen-und-sanieren/daemmung/daemmstoffe/hersteller.html">https://www.energie-experten.org/bauen-und-sanieren/daemmung/daemmstoffe/hersteller.html</a>  <a href="https://www.carmen-ev.de/in-fothek/branchenadressen/301-adresslisten-aus-datenbank/933-hersteller-von-natur-daemmstoffen">https://www.carmen-ev.de/in-fothek/branchenadressen/301-adresslisten-aus-datenbank/933-hersteller-von-natur-daemmstoffen</a>  <a href="https://aislaconpoliuretano.com/normativa/">https://aislaconpoliuretano.com/normativa/</a>  Database of products:	



Services/products	Description of services	Details of Services offered	Users addressed (examples)	Examples	Minimum version
				<a href="https://www.greenbuildingproducts.eu/?lang=en">https://www.greenbuildingproducts.eu/?lang=en</a> <a href="http://reecl.org/en/eligible-installers">http://reecl.org/en/eligible-installers</a>	
<b>5. Information on financing opportunities for deep renovation</b>	<ul style="list-style-type: none"> <li>Provide information about financial incentives, loans, and subsidies or third party financing</li> </ul>	<p>Information on funding programmes for energy-efficient buildings</p> <ul style="list-style-type: none"> <li>overview of programs for energy-efficient renovations</li> <li>database of programmes for energy-efficient renovations, with links to programme websites</li> <li>link to the database of energy-efficient-experts</li> <li>How to use the service for help with applying for funding</li> <li>Which EPC data could be the basis for applying for funding</li> <li>Links to funding programmes</li> </ul>	Building owners	<p>Loans &amp; credits: <a href="https://www.energiesparen.be/leningen">https://www.energiesparen.be/leningen</a></p> <p>Information on Support programs and database for experts:</p> <p><a href="https://www.deutschland-machts-effizient.de/KAE-NEF/Redaktion/DE/Standardartikel/foerderprogramme-hauseigentuemer.html">https://www.deutschland-machts-effizient.de/KAE-NEF/Redaktion/DE/Standardartikel/foerderprogramme-hauseigentuemer.html</a></p> <p><a href="https://www.energie-effizienz-experten.de/">https://www.energie-effizienz-experten.de/</a></p>	<p>Information on existing support programs for energy-efficient buildings</p> <ul style="list-style-type: none"> <li>Links to subsidy programmes</li> </ul>
<b>6. Active marketing of deep renovation and its benefits and costs</b>	<ul style="list-style-type: none"> <li>Using all kinds of media and events to promote deep renovation and its benefits and costs to building owners and investors, involving supply-</li> </ul>	<p>Marketing instruments:</p> <ul style="list-style-type: none"> <li>Media releases</li> <li>Events for the public</li> </ul>	<ul style="list-style-type: none"> <li>Building owners</li> <li>Citizens</li> <li>Building contractors/ technicians/ installers</li> <li>City/Municipality</li> </ul>	<a href="https://translate.googleusercontent.com/translate_c?depth=1&amp;pto=aue&amp;rurl=translate.google.com&amp;sl=nl&amp;sp=nmt4&amp;tl=en&amp;u=">https://translate.googleusercontent.com/translate_c?depth=1&amp;pto=aue&amp;rurl=translate.google.com&amp;sl=nl&amp;sp=nmt4&amp;tl=en&amp;u=</a>	<ul style="list-style-type: none"> <li>Showing advantages of energy renovation measures and co-benefits</li> <li>Promotion of deep renovation network platform</li> </ul>



Services/products	Description of services	Details of Services offered	Users addressed (examples)	Examples	Minimum version
	<ul style="list-style-type: none"> <li>side actors in the media work, events, and funding</li> <li>Using demonstration projects to show enhanced „quality of life through insulation and energy-saving“ by bringing together various stakeholders listed in the next column</li> </ul>	<ul style="list-style-type: none"> <li>Events for stakeholders and experts</li> <li>Content for the marketing: e.g., Showing advantages of different energy renovation measures and co-benefits</li> <li>Showing potential savings of energy and costs → linking to 1.2 Information on potential savings and costs</li> <li>Promotion of deep renovation network platform</li> <li>Showing Best Practice and Pilot projects</li> <li>Linking to a database of efficient homes/ buildings</li> <li>Providing information material of benefits of various renovation measures on the building envelope as well as of various efficient heating and hot water technologies</li> <li>Linking to 1. Information on renovation actions</li> </ul>	<ul style="list-style-type: none"> <li>local housing companies</li> <li>the social credit agencies</li> <li>Professional buildings and developers</li> <li>Architects</li> </ul>	<p><a href="https://www.energiesparen.be/ikBENOver/10reden&amp;usg=ALkJrhi3sZt6DLipStAQ2GfY7VsyXlUiAg">https://www.energiesparen.be/ikBENOver/10reden&amp;usg=ALkJrhi3sZt6DLipStAQ2GfY7VsyXlUiAg</a></p> <ul style="list-style-type: none"> <li>10 reasons to BENOver now</li> <li>Download the 'I BENOver' campaign material</li> </ul> <p>dena Database of efficient homes:</p> <p><a href="https://effizienzhaus.zukunft-haus.info/effizienzhaeuser/">https://effizienzhaus.zukunft-haus.info/effizienzhaeuser/</a></p> <p><a href="https://www.greenmatch.co.uk/">https://www.greenmatch.co.uk/</a></p>	through media releases and in own events (which may be organised anyway for other purposes)



Services/products	Description of services	Details of Services offered	Users addressed (examples)	Examples	Minimum version
<b>7. Network (platform) for learning, exchange and co-operation (local/regional/ national)</b>	<ul style="list-style-type: none"> <li>Discussing active marketing activities and involving supply-side actors, city administration, energy companies, financial institutions etc., in the media work, events, and funding</li> <li>Discussing training needs and the organizing of training</li> </ul>	<p>Information and activities provided:</p> <ul style="list-style-type: none"> <li>List or database of training providers</li> <li>List of network partners</li> <li>Workshops on cross-disciplinary topics and/ or cooperation with workshop providers</li> <li>Creation and maintenance of a training calendar with events, seminars, workshops in cooperation with training providers, consumer organisations and energy agencies etc.</li> <li>(Online) Platform for exchange between professionals, e.g. EPC issuers</li> </ul>	<ul style="list-style-type: none"> <li>Building contractors/ technicians/ installers</li> <li>City/Municipality</li> <li>local housing companies</li> <li>the social credit agencies</li> <li>Professional buildings and developers</li> <li>Architects</li> <li>Financial institutions</li> <li>Energy companies</li> </ul>	<p>Info: The training calendar for energy efficiency experts offers you an overview of training courses throughout Germany, in which content from the training catalogues of the list of energy efficiency experts is taught.--&gt; <a href="https://www.fortbildungskalender.de/termine">https://www.fortbildungskalender.de/termine</a></p> <p><a href="https://www.energieagentur.nrw/veranstaltungen">https://www.energieagentur.nrw/veranstaltungen</a></p>	<ul style="list-style-type: none"> <li>List of existing renovation platforms, involving supply-side actors, city administration, energy companies, financial institutions etc,</li> <li>List of training providers for EPC assessors</li> <li>Link to lists of workshops and seminars</li> </ul>



Table 8 Extended part of the DRNP

Services/products	Description of services	Users addressed (examples)	Examples of organisations that could act as providers
<b>8. Network (platform) for learning, exchange and cooperation (interregional/ transnational)</b>	<ul style="list-style-type: none"> <li>Establishing interregional/transnational learning networks between project partners, stakeholders and complementary EU projects for enhancing mutual learning; exchange platform for good practice, innovation and expertise; and stimulating future partnerships</li> <li>An exchange platform for EU member states best practises and learning paths, including those of the projects LIFE BE REEL! - via events and workshops on best practices and renovation expertise and via a digital platform.</li> <li><b>Examples:</b> a nucleus for such networks and exchange platforms between national policy-makers and energy agencies are the Coordinated Action (CA) EPBD and working groups of the EnR network of the national energy agencies. Between actors at the regional and local level, EU networks such as FEDARENE, Energy Cities, and the Covenant of Mayors serve similar functions. However, we are not aware of a thematic network for energy efficiency in buildings systematically connecting all these actors and projects in the EU.</li> </ul>	<ul style="list-style-type: none"> <li>Construction and financial sector including sector federations, contractors, builders, renovation consultants, banks, financial institutions</li> <li>All cities</li> </ul>	<ul style="list-style-type: none"> <li>Platform facilitator itself</li> <li>Energy Agency</li> <li>Professional associations/ federations of energy assessors</li> </ul>
<b>9. Capacity building and training</b>	<ul style="list-style-type: none"> <li>This service would implement the trainings that may be agreed under service 7. The training events organised here would be included in the training or event calendar under service 7.</li> <li>Training and learning platform to obtain expertise and sector capacity</li> <li>Dissemination of expert-knowledge on specific promising retrofitting topics to assure that the knowledge, best practices and techniques can be picked up by a large number of professional actors</li> </ul>	<ul style="list-style-type: none"> <li>Sector/professional federations</li> <li>Training organizations</li> <li>Professional buildings</li> <li>Architects</li> <li>Contractors</li> </ul>	<ul style="list-style-type: none"> <li>Platform facilitator itself</li> <li>Energy Agency</li> <li>Other third parties</li> </ul>
<b>10. Step-by-step guidance for renovation project from start to end</b>	<ul style="list-style-type: none"> <li>Offering step-by-step guidance documents including monitoring of renovation project from start to end</li> <li>Possibly: Requesting various renovation offers/quotes from contractors/technicians and comparing them so that the end user can make an informed choice</li> <li>Full inspection of home and proposal for a renovation plan and quality control after renovation works</li> <li>Possibly: Hotline in case of questions during decision-making and implementation of works</li> <li>Drawing up a measurement report with an overview of costs and energy savings</li> </ul>	<ul style="list-style-type: none"> <li>Building owners</li> <li>Prospective buyers</li> </ul>	<ul style="list-style-type: none"> <li>Platform facilitator itself</li> <li>Energy Agency</li> <li>Third party (Network partners from the platform with a network of companies of craftsmen, planners and constructions workers)</li> </ul>



Services/products	Description of services	Users addressed (examples)	Examples of organisations that could act as providers
<b>11. Monitoring the implementation of the renovation project(s)</b>	<ul style="list-style-type: none"> <li>Monitoring works including, editing of financing files, preparation of the renovation works, monitoring of the site during the renovation work through site meetings and visits and reception of the works and closing of the financing</li> <li>Follow-up of the renovation works</li> <li>Making the citizens aware of the energy-saving potential of their property and to encourage them to renovate while becoming "energy" ambassador citizens among their peers.</li> </ul>	<ul style="list-style-type: none"> <li>Owners</li> <li>Trustees</li> <li>Building professionals</li> <li>EPC assessors</li> <li>Communities</li> <li>Social landlords</li> <li>Third-party investors</li> <li>Renewable energy professionals</li> </ul>	<ul style="list-style-type: none"> <li>City/Municipality</li> <li>Platform facilitator itself</li> <li>Energy Agency</li> <li>Financial institution</li> <li>Third-party (Network partners from the platform with a network of companies of craftsmen, planners and constructions workers)</li> </ul>
<b>12. Operating a physical network hub and information centre</b>	<ul style="list-style-type: none"> <li>A location that serves as an information centre and physical OSS for the public, and hosts the team facilitating the network platform for all services, including for supply-side actors</li> </ul>	<ul style="list-style-type: none"> <li>Building owners and/or investors</li> <li>Building professionals</li> <li>All end-user groups</li> </ul>	<ul style="list-style-type: none"> <li>Platform facilitator itself</li> </ul>
<b>13. Carrying out renovation project(s)</b>	<ul style="list-style-type: none"> <li>Implementation of the works (Qualified energy advice, financing planning, renovation planning and professional construction supervision, choice of suitable craft businesses, correct acceptance of work and handover</li> <li>Possibly providing the finance for the works</li> </ul>	<ul style="list-style-type: none"> <li>Building owners and/or investors</li> </ul>	<ul style="list-style-type: none"> <li>Financial institution</li> <li>Third-party (Network partners from the platform with a network of companies of craftsmen, planners and constructions workers)</li> <li>Platform facilitator itself (if it is a construction company or similar)</li> </ul>
<b>14. Initiation and coordinating deep renovation demonstration project(s)</b>	<ul style="list-style-type: none"> <li>Undertaking deep renovation demonstration projects (in their city or region): „Undertaking collective renovation demonstration projects in their city including renovation residences to nZEBs, including installing roof, façade and floor insulation and installing super-insulating glazing in renovation demonstration projects“</li> </ul>	<ul style="list-style-type: none"> <li>Building professionals</li> <li>Building owners and/or investors</li> <li>Third-party investors</li> </ul>	<ul style="list-style-type: none"> <li>City/ Municipality</li> <li>Platform facilitator itself</li> <li>Energy Agency</li> <li>Financial institution</li> <li>Third-party (Network partners from the platform with a network of companies of craftsmen, planners and constructions workers)</li> </ul>



Services/products	Description of services	Users addressed (examples)	Examples of organisations that could act as providers
<b>15. Aggregation of building renovation projects</b>	<ul style="list-style-type: none"> <li>Aggregation of building renovation projects, Implementation of serial renovation solutions for affordable, climate-friendly living, digitised construction process, high-quality, standardised solutions with serially prefabricated elements and a long-term performance promise (Example: Energiesprong).</li> </ul>	<ul style="list-style-type: none"> <li>Building owners and/or investors</li> </ul>	<ul style="list-style-type: none"> <li>Platform facilitator itself</li> <li>Energy Agency</li> <li>Third party (Network partners from the platform)</li> </ul>





Table 9 Subtypes

Subtype	Subtype 1a.	Subtype 1b.	Subtype 2a.	Subtype 2b.	Subtype 2c.
Subtype provider	National energy agency private company	Private company	Local/regional energy agency private company with public support	Local/regional energy agency private company with public support	local/regional energy agency and private company private company with public support
General information on: 1.1 renovation actions 1.2 potential savings and costs					
1.3 Linking with Renovation tool					
Linking with 2.1 Energy Performance Certificates					
Linking with 2.2 Building deep renovation roadmap and possibly a passport					
				link to local providers	link to local providers
3. Information on building contractors/technicians;					
support with finding building contractors/technicians, e.g. through obtaining three competitive offers (this may also be part of service #10)					
		online		in person	in person



Subtype	Subtype 1a.	Subtype 1b.	Subtype 2a.	Subtype 2b.	Subtype 2c.
Subtype provider	National energy agency private company	Private company	Local/regional energy agency private company with public support	Local/regional energy agency private company with public support	local/regional energy agency and private company private company with public support
<b>4. Information on material or product manufacturers/ suppliers</b>					
<b>5. Information on financing opportunities for deep renovation</b>					
<b>Help with applying for loan and grant programmes or third party financing</b>					
		online		in person	in person
<b>6. Active marketing of deep renovation and its benefits and costs</b>					
	general media, online; possibly with local partners	general media, online; possibly with local partners	local and general media, physical events and online; with local partners	local and general media, physical events and online; with local partners	local and general media, physical events and online; with local partners
<b>7. Network (platform) for learning, exchange and cooperation (local/regional/national)</b>					
	national; possibly local/regional with the partner network	national; possibly local/regional with the partner network	local/regional; possibly partner in the national network	local/regional; possibly partner in the national network	local/regional; possibly partner in the national network



Services/products	Subtype 1) a.	Subtype 1) b.	Subtype 2) a.	Subtype 2) b.	Subtype 2) c.
Subtype provider:	national energy agency; private company	private company	local/regional energy agency; private company with public support	local/regional energy agency; private company with public support	local/regional energy agency and private company; private company with public support
8. Network (platform) for learning, exchange and cooperation (interregional/ transnational)		possibly			
9. Capacity building and training					
	nation-wide	may be limited to implementation partners	local/regional; possibly partner in the national network	local/regional; possibly partner in the national network	local/regional; possibly partner in the national network
10. Step-by-step guidance for renovation project from start to end		as part of the implementation service		as a special service	as part of the implementation service
11. Monitoring the implementation of the renovation project(s)	possibly				X
		probably limited to own projects			probably limited to own projects
12. Operating a physical network hub and information centre					
13. Carrying out the renovation project(s)					
14. Initiation and coordinating deep renovation demonstration project(s)					
15. Aggregation of building renovation projects					
Explanation	Relevant for the subtype	Comments	Not relevant		



## 6 REGULAR MANDATORY EPC ASSESSOR TRAINING

EPC assessors should undergo mandatory training on EPC assessment and providing recommendations for being certified as an EPC assessor and included in the registry. Such training should also enable them to avoid common mistakes. Therefore, this chapter summaries the analysis on the current status for the EPC assessor training by D2.4 Development Strategy Plan. Moreover, examples of regular mandatory EPC assessor training are described. A short policy proposal is included, which will be the base for the discussion in the national workshops, where more specific content can be developed.

### 6.1 Analysis of the current status of EPC assessor training

#### 6.1.1 Summary of country-specific information on EPC assessor training (from D2.1 and D2.4)

A mandatory training requirement for EPC assessors is available in 14 EU member states, including three QualDeEPC partner countries – Bulgaria, Hungary and Latvia. Besides, mandatory *periodic* training for *maintaining* certification and registration as an EPC assessor after the validity period of current certification is required only in eight member states, none of which are QualDeEPC partner countries. However, in many countries without the requirements for mandatory training, there are opportunities for voluntary training, and most often candidates should pass an examination for certification, undergoing mandatory training on EPC assessment and providing recommendations for being certified as an EPC assessor and included in the registry, which also enables EPC assessors to avoid common mistakes. The current status of the QualDeEPC partner countries is given in Table 10.

Table 10 Overview of EPC issuer training in the partner countries

	Bulgaria	Germany	Greece	Hungary	Latvia	Spain	Sweden
Basic qualification of EPC assessors							
University degree in architecture or engineering B.Sc. or above	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Secondary technical education in the field of building works (e.g. technicians)	Yes	Yes	Yes	No	No	No	Yes
National regulations/ guidelines on							
Initial mandatory training	Yes	Yes	No	No	Yes	No	No
Regular mandatory training		No	No	Yes	No	No	No
Initial voluntary training	Yes	No	Yes	Yes	No	No	Yes
Regular voluntary training		No	No	Yes	Yes	No	Yes
Initial exams	Yes	No	No	Yes	Yes	No	Yes
Regular exams		No	No	No	No	No	Yes
Training content	Yes	Yes	No	Yes	No	No	Yes
Registration of qualified EPC assessors							

	Bulgaria	Germany	Greece	Hungary	Latvia	Spain	Sweden
National database or certification body	Yes	No	Yes	Yes	Yes	No	Yes
Other databases		No	No	No	No	No	No
Special training content							
Deep renovation recommendations	Yes	No	No	No	No	No	No
Common mistakes in EPCs	No	No	No	Yes	No	No	No

### 6.1.2 Summary of official training content today, including deep renovation recommendations

In the partner countries Bulgaria, Germany, Hungary, and Sweden, official training content for the initial training of EPC assessors is described in the official Building Performance Act or referenced regulations. In contrast, there is no official training content available in Greece, Latvia and Spain. For regular trainings (after the initial one), regulations and training content is officially available in Hungary, and in Sweden initial and regular trainings are available given by commercial training organisations (see section 6.1.3).

The trainings include, for example, the assessment of the building envelope and the technical systems, calculation methods for energy demand or consumption, minimum energy requirements for buildings, issuance of EPCs as well as modern materials and technologies. The basics for providing energy renovation recommendations are also usually covered. However, there is usually no special emphasis on deep energy renovation recommendations.

### 6.1.3 Examples of implemented regular mandatory EPC assessor training

#### 6.1.3.1 Hungary

From 1 January 2020, the obligation of regular mandatory trainings exists. It concerns both legal and technical trainings, and it is mandatory once in every five years. It is regulated in Government Decree 266/2013.

Mandatory trainings are organised by the Hungarian Chamber of Engineers. EPC Experts must take a legal training every 5 years and a professional training practically every 5 years. Both are relatively short, less than one day (the professional training takes 6\*45 mins long, the legal training is an online e-material) which is not sufficient for a deep training. As the formulation of recommendations is not specifically addressed within the trainings, there is a need to add this topic to the trainings, emphasizing recommendations towards deep renovations.

#### 6.1.3.2 Sweden

For EPC assessors (certified energy expert), relevant technical education and documented experience of practical work (at least 5 years, of which 2 years should be related to energy and indoor climate in the corresponding category of buildings) is needed. Furthermore, to become a certified assessor it is mandatory to pass a theoretical test. It is not mandatory to do any specific training before this test. The certificate is valid for 5 years. After that, it needs to be renewed with a new theoretical test. The recertification test is less comprehensive than the first certification test. Between certification and



recertification, regular training is not required. However, the EPC assessor needs to report the number of performed assignments and any updating of skills and send in assessed EPCs to the national certification body once a year.

#### 6.1.4 Advantages and disadvantages of regular mandatory EPC assessor training

##### Advantages

- EPC assessors gain knowledge on the latest developments in the field of building services and renovation recommendations
- Building representatives can select highly trained EPC assessors

##### Disadvantages

- Registry/ database for EPC issuers may be required (bureaucracy), so that building representatives can be informed of qualified experts
- Regular mandatory training might be
  - expensive for the EPC assessors, especially if there issue a relatively small number of EPCs
  - time-consuming (during the courses, the expert cannot do their actual work)
  - not tailored for the expert's specific knowledge gaps

## 6.2 General policy proposal

### 6.2.1 General framework

The project QualDeEPC proposes a regular, mandatory training for EPC assessors to maintain a high quality of issued EPCs. Based on established systems (e.g. section 6.1.3), the period between trainings is suggested to be 3-5 years. The regular training can be based on an initial training, which should have a larger workload than the regular training sessions. Moreover, the workload and content of the initial training should depend on the previous qualification (University degree or secondary technical education). The regular mandatory training might be a combination of training courses, participation to workshops or seminars, and the verification of the high quality of a random sample of issued EPCs. In each category, the workload for the EPC assessors should be specified on a national level.

Making the regular trainings mandatory aims to ensure that the EPC issuers have the most recent knowledge to issue high-quality EPCs. Similarly, it might also be an option to replace the regular mandatory training by voluntary training and a mandatory exam.

### 6.2.2 Training content for regular training workshops or seminars

In contrast to the initial training of the EPC issuers, the training content for regular training workshops or seminars should not contain basics on EPC issuance (this should be covered by the initial training), unless there are major changes in the basics. The regular training should rather focus on the following information:

- changes in national or European Building Performance Acts,
- state-of-the-art technologies,
- deep energy renovation recommendations,
- common mistakes or errors in EPCs,



- funding programs for renovation and their technical requirements,
- consumer information and communication,
- contract design,
- further (soft) skills for EPC assessors.

The first five points are essential to the work of EPC assessors and therefore, should be mandatory in each training cycle (i.e. every 3-5 years). The latter three points might be optional.

#### 6.2.2.1 Changes in national or European Building Performance Acts

National and European Building Performance Acts are regularly reviewed and updated. For the EPC assessors, it is important to know the current laws and regulations, and when to apply which version of the Building Performance Acts. Therefore, this topic should be addressed in seminars or workshops on a regular basis. The emphasis should be placed on the changes and include practice examples.

#### 6.2.2.2 State-of-the-art technologies

Building HVAC systems and components of the building envelope are constantly evolving. Using state-of-the-art technology will contribute to the energy efficiency of the building. Moreover, secondary issues such as sustainability, and thermal, acoustic and visual comfort may be improved. However, these building components may not be as cost-efficient as established technologies. Hence, the workshop or seminar should include the information on physics of the technologies, but also inform about costs and cost-benefits, also considering available financial incentives.

#### 6.2.2.3 Deep energy renovation recommendations

As discussed in chapter 3, EPCs in practice do not always provide deep energy renovation recommendations. To sensitise and guide EPC assessors in this area, seminars or workshops should be provided where concepts of deep energy renovation are explained and appropriate recommendations (types of action, energy efficiency levels, useful combinations) are showcased. If the EPC form is enhanced, as proposed in the next chapter, the training will cover the types of information to fill in for the recommendations and how to develop it.

It could also be possible to provide a combined workshop on state-of-the-art technologies and deep energy renovation recommendations.

#### 6.2.2.4 Common mistakes or errors in EPCs

The regulations on issuing EPCs may not always be clear in all details and, especially, on special cases. Therefore, mistakes and errors can be made by EPC assessors. The data could be collected through control institutions by the state and the proposed quality control in the training (section 6.2.3). These findings should be evaluated, summarized and anonymously published to inform the EPC assessors. In workshops and seminars, the most common errors and mistakes can then be shown and discussed.

#### 6.2.2.5 Funding programs for renovation and their technical requirements

Funding programs usually promote more ambitious energy renovations than are required by the Building Performance Acts. This means that a subsidy is paid to the building owner to implement more energy efficient but more costly measures to increase the overall efficiency of the building. In knowing



the most recent conditions of funding programs, EPC assessors can already suggest more energy efficient renovation recommendations on the EPC forms and inform the building owners about the supportive programs.

#### 6.2.2.6 Consumer information and communication

EPC assessors issue EPCs for building owners or representatives. Therefore, they need to communicate effectively and transfer their knowledge to these non-professionals in an understandable way. A workshop on this topic can help to achieve this premise. Moreover, good and understandable communication might encourage building owners and representatives to implement the suggested renovation recommendation or even to perform an energy audit.

#### 6.2.2.7 Contract design

Since most EPC assessors are not trained in contract law and work as freelancers or in small companies, there is a need to enable them to draft well written and legally solid contracts. Moreover, the uncertainty of legal matters may prevent EPC assessors to recommend ambitious renovation recommendations. An optional workshop with a trained lawyer in contract design may help to draft a usable model of contract that the EPC assessors use for most assignments. Being legally safe may also encourage EPC assessors to provide high quality EPCs and ambitious renovation recommendations.

#### 6.2.2.8 Further (soft) skills for EPC assessors

Next to the already mentioned topics, other themes that are relevant for EPC assessors may arise. Examples are the training of a specific software, changes to other regulations or laws (than Building Performance Acts), changes/ introduction of standards related to building energy efficiency or similar.

### 6.2.3 *Quality control of issued EPCs for learning*

Alongside the control of issued EPCs by the state, EPC assessors should hand in a list of issued EPCs, of which a random sample is analysed on its quality. The EPC assessor would then receive personalized feedback on errors from a trainer or a peer assessor and be given a chance to correct them. In a consecutive seminar or workshop these mistakes could be anonymously presented (see section 6.2.2.4) to achieve a wider awareness of these issues. Ideally, common errors might also be mirrored to the responsible authority for clarification.





## 7 HIGH USER-FRIENDLINESS OF THE EPC

### 7.1 Analysis of EPC forms

The energy performance certification (EPC) forms are the central information element of the EPC process in all partner countries. Ideally, they are the link between the detailed analysis done by the EPC issuers and the building owners as well as potential buyers or tenants. Besides, third parties, such as building financial advisors or administrative officers, need to find relevant information. Thus, the EPC forms have to satisfy three main functions:

1. Verify compliance with legal requirements on the energy performance of the building.
2. Inform the building owner and potential buyers or tenants about the current energy performance of a building and what renovations might be needed to increase the energy efficiency and decrease of CO<sub>2</sub> emissions of the building.
3. Encourage (current or future) building owners to implement energy-efficient renovation options, which should lead to 'deep energy renovation'.

In order to achieve all three functions, the EPC forms require high user-friendliness for experts, building owners and users, and other potential users (e.g. administrative officers, financiers). However, the analysis of QualDeEPC in WP2 showed that user-friendliness is still an issue for most EPC forms in EU- and especially the project's partner countries. To fill this gap, this chapter firstly analyses the current EPC forms of the project's partner countries. Secondly, it includes elements for enhancement that have been analysed and prioritized.

#### 7.1.1 Summary of findings

The EPC forms in the partner countries consist of 1 to 5 pages. The shorter EPCs usually provide a 1 -2 page(s) summary and a supplementary annex with the detailed data on the building and the renovation recommendations. Other countries have a modular approach, i.e. each page is dedicated to a topic such as general building data, energy performance, renovation recommendations, etc. However, this design approach does not necessarily correspond to the amount of content provided.

For the most relevant EPC form elements, Table 25 in ANNEX C: Overview of EPC elements in EPC forms of partner countries on pages 91ff. shows if they are implemented on the country-specific EPC form. The general data of the EPC itself (e.g. registry number, date of validity) and the provided building data is mostly the same in all partner countries. Two difference can be found: 1) a checkmark for achieving nearly zero energy building standard and 2) the building area used for calculations and reference. A checkmark for nZEB standard is already provided in the Bulgarian, Hungarian, and Latvian EPC form, but missing in der German, Greek, Swedish and Spanish one. For Greece and Sweden, the nZEB is indirectly conveyed with an energy class that relates to the nZEB standard. The area of the building is given as total, floor, heated/ cooled or net used area.

The energy classification of a building is provided in all EPCs with colored bars or scales, which have 6 to 12 classes. All countries provide energy usage in kWh/m<sup>2</sup>yr. However, the basis for the classification is different in every country. The energy usage is given as the final or primary energy demand or consumption or in percent of a reference building. In addition, region and climate-specific correction factors are used in some cases. Some EPCs provide reference values of typical building types, which are



given in the best practice examples. Furthermore, the classification chart in some partner countries shows a possible improved class, if a specific set of renovation recommendations are implemented.

The description of the building's envelope and HVAC system varies among the partner countries. Only the main energy source and information on the usage of renewable energies is provided in all EPCs. Detailed information is given in EPC form itself in Spain and Sweden, in an annex in Bulgaria, Greece, Latvia and Hungary. However, the latter might not be generally understandable by the building representatives.

Renovation recommendations are stated in all EPC forms, but with differences in detail. In Germany, Hungary and Sweden the required recommendations consist of a brief description and a cost estimation, which is optional in the German and Hungarian EPC. More detail is provided in the other partner countries. Here, the approach is more systematic.

The stakeholder feedback on the current EPC forms is diverse and in some cases contradictory. The feedback represents the usage of the EPCs and their requirements. For example, financial advisors often would like more details on the renovations needed including costs without having to engage an external advisor. On the other hand, building associations prefer a simple EPC form to fulfil legal requirements. In some countries, the issue arises that there might be a competition between the EPC issuers and energy consultants.

The building representatives mostly state that the language used and presentation of the energy performance of the building is clearly shown in the EPC form. Some building owners would like some explanations on the specific terms used in the EPC form. Moreover, in most countries, there is a need for further explanation or details on the renovation recommendations.

All in all, twelve elements for improvement can be identified as follows. The next section provides an analysis for the selection of priority elements that should be included in the enhanced EPC forms.

1. Checkmark for achieving nZEB standard
2. Inclusion of typical classification of specific building types for reference
3. Inclusion of past (metered) total annual energy consumption
4. Details on the efficiency of building envelope and building HVAC system incl. renewable energies
5. Display of improved classifications and energy performance for a specific set of renovation recommendations
6. No. 5 + energy savings in kWh/year
7. Deep energy renovation recommendations by component and influence on components energy efficiency + cost estimation
8. Information on a useful combination of renovations or possibility for stepwise implementation
9. General information about EPC and their usage (regulatory basis)
10. Link to a deep renovation network platform
11. Glossary of most important terms
12. Link/ information on funding programs



## 7.2 EPC elements for enhancement and selection evaluation

Table 11 summarizes the conclusions of the detailed analysis of the proposed EPC form elements.

Table 11 Summary of evaluation of proposed EPC form elements

No.	Element	Implementation in enhanced EPC form template to be developed by QualDeEPC	Generally recommended for enhanced EPC form templates	Not recommended on EPC
1	Checkmark for nZEB standard			X
2	References for energy usage of typical building categories		X*	
3	Inclusion of past metered and/or modelled total energy consumption per year	X		
4	Details on building envelope and building HVAC system	X		
5	Display of improved classifications and energy performance	X		
6	No. 5 + energy savings in kWh/year	X		
7	Detailed renovation recommendations by component + cost estimation	X	(X)	
8	Useful combination of renovations and stepwise implementation (as an empty text field)	X		
9	General information about EPC		X*	
10	Link to Deep Renovation Network Platform	X	(X)	
11	Glossary of most important terms		X*	
12	Link/ information on funding programs		(X*)	X

\* These elements are indirectly included in the Deep Renovation Network Platform.

() A simplified version can be implemented. More details can be elaborated in the general recommendations.

## 7.3 Template for EPC form

Based on the analysis in section 7.1 and 7.2, a template for an enhanced and more user-friendly EPC form has been developed. This form will contain the following elements:

1. General data and building specification (standard requirement)
2. Energy performance and classification (standard requirement)
3. Past metered or modelled yearly total energy consumption
4. Details on building envelope and building HVAC system
5. Display of improved classifications and energy performance



6. Potential energy savings (in kWh/yr)
7. Detailed renovation recommendations by component
8. Useful combination of renovations and stepwise implementation
9. Link to Deep Renovation Network Platform

Furthermore, the following changes to the EPC form are implemented based on the deliverable *D3.4 Report on feed-back from Task 3.4 Workshops (Veselá et al. 2021)* and *D4.5 (Zogla, 2021)* :

- Statement/ paragraph that U-value might not be as relevant to building owners as to experts that may also utilize the EPC
- Place for CO<sub>2</sub>/ GHG emissions and savings on the 1<sup>st</sup> page of EPC form template
- Change of the label of the picture to „Current picture of building“
- Box and check mark for nZEB standard on the first page of the EPC form template
- Paragraph on smart readiness indicator and corresponding traffic light system with a cross-reference to the sister projects
- An (optional) 5th page to the EPC form to include the visualization and further space for national adaptation
- Footnote on the date of validity
- Discuss the possibilities to display an economic result of the main renovation option on the EPC template
- A paragraph on the development of a Guidebook or Tutorial on how to fill in the Enhanced EPC template added to this chapter.

The detailed description of the form and design of the element as well as details on how to acquire the needed input data is given in the following sections. The images of the form are available in section 7.3.11.

This proposal for a more user-friendly EPC form was developed with a view to include both the data required by the EPBD (nos. 1 and 2) and the additional data that we selected in section 7.2 (no. 3 to 9). It is thus meant to be universally applicable, but will still need to be adapted to county-specific requirements and needs in WP 5. The information that either needs to be adjusted to the country-specific requirements or needs further input by the EPC issuer is marked with writing in italics.

### 7.3.1 General data and building specification

As shown in Table 25 on page 94, all EPC forms in the partner countries contain background information on formalities of the EPC, the data of the considered building and information on the EPC issuer including the date and signature. These formalities are included on page 1 of the template as follows:

- A title stating “EPC form” that should be translated into the national language and might be followed by a short subtype of EPC or other description,
- a short reference to the national law that describes the energy performance certification process,
- the registry or serial number of the issued EPC,
- the date of validity including a footnote on the length of the validity,
- the EPC type, if more than one type is issued in the country,
- optional space for other country-specific requirements, e.g. checkmark for nZEB standard, calculation method, etc.
- a space for the address of the EPC issuer, as well as
- a space for the date of issuance and signature of the EPC issuer.



To provide an overview of the considered building, the most important building data is given in the table “Building data” on page 1 of the EPC template. For all partner countries, the type of the building, the address, the year of construction and a building area used for calculation should be included. Two additional descriptions of the building as required by the national law can be integrated. Moreover, an up-to-date picture of the building should be included.

### 7.3.2 Energy performance and classification

As a standard requirement, all EPCs need to state the (main) energy class and value(s) of the energy performance of the building. The table on page 1 of the EPC form template can be used by all partner countries, but the number of lines needs to be adjusted to the corresponding number of energy classes in the national regulations. As a minimum, the defining value of the energy class (“1<sup>st</sup> value”) and the estimated improved energy performance by the ‘Main Option’ considering a specific set of renovation recommendations should be displayed in the columns. There is also room to add a second or third relevant. For better visibility of the current and future energy class, it is recommended to use a left pointing arrow in the same color as the respective energy class with the specific energy value written inside (see Figure 8). Furthermore, the current CO<sub>2</sub> or Greenhouse gas (GHG)-emissions should be included in the last row of the value that defines the energy class. Again, the resulting CO<sub>2</sub>-emissions considering the main renovation options can be placed in the last row in the ‘Main option’ column.

Energy classification and performance					
min Value [kWh/m <sup>2</sup> ·yr]	max Value [kWh/m <sup>2</sup> ·yr]	Energy class	1 <sup>st</sup> value, e.g. Primary energy [kWh/m <sup>2</sup> ·yr]	2 <sup>nd</sup> value, e.g. final energy [kWh/m <sup>2</sup> ·yr]	“Improved value” for Main Option [kWh/m <sup>2</sup> ·yr]
		A+			
		A			
		B			234
		C			
		D			
		E			
		F	987		
		G			
		H			

Figure 8 Example of displaying the specific energy value of the current and potential energy class

### 7.3.3 Display of improved classifications and energy performance and potential energy as well as CO<sub>2</sub> savings

The improved classification is based on a specific set of renovation recommendations termed the ‘Main Option’, which are marked in the tables on page 3 of the EPC template (see section 7.3.6). The resulting energy performance is indicated in the table of the energy classification on page 1.

For calculation based EPCs, the improved energy performance can most probably be calculated using the same software as for the original values. In this case, the renovation recommendations are selected before the re-calculation.

In case of operational rating EPCs (based on measured consumption), the EPC issuers may have to rely on average effects of the renovation recommendations on the energy consumption. An official collec-



tion of tables with resulting energy performance values based on typical combinations of recommendations and original values of the energy performance may be useful to support EPC issuers and ensure good quality of the EPCs.

The potential energy savings are calculated as the difference between the original energy performance and the improved energy performance multiplied by the relevant building area. Similarly, the savings of CO<sub>2</sub>-emissions can be calculated. We recommend the display these values per year, but it is also possible to display them per year and square meter. Both values might be displayed either on page 1 under the table for energy performance and classification or on page 3 under the tables for the renovation recommendations of the EPC form template. The best will be to include both options, if the space available on the adjusted national forms allows. In the template displayed in section 7.3.11, this is the case.

### 7.3.4 *Past metered or modelled yearly total energy consumption*

For the past metered or modelled yearly total energy consumption, a table is provided on page 2 of the EPC form template. The table is designed to contain the energy consumption of the last three years or measuring periods. In addition, the (main) energy source and total consumption for hot water and space heating should be provided. If possible, the energy consumption for hot water and space heating can be listed separately. Moreover, two additional columns can be used, for example, for the metered electricity (if not mandatory) or climate factors.

This table fulfils two purposes:

1. For consumption-based (operational rating) EPCs, the table can be used to document the relevant data sets.
2. For EPCs based on calculations, this table can provide additional information on the performance of the building under operational conditions.

In case 1, the table is mandatory, since the overall energy rating is based on this data. For the second case, the table might be considered optional, if the national regulations do not include a similar table.

In both cases, obtaining the detailed measured data can prove difficult depending on the system installed. Hence, the data might also be modelled. If the data was measured or modelled can be marked at the element.

### 7.3.5 *Details on building envelope and building HVAC system*

The most important parts of the building envelope and the technical system are considered in two tables on page two of the EPC form template. In general, the components should be given a green, yellow or red symbol, to indicate the following:

- Green: Exceeds significantly the minimum standards of Building Energy Act (e.g. as suggested by funding programs)
- Yellow: Reaches or minimally exceeds the minimum standard of Building Energy Act (e.g. current regulations/ laws)
- Red: Lower than standard of Building Energy Act

These explanations might be placed under the tables on page 2 of the template. This indicator is referred to as 'energy rating'. The exact values or conditions need to be defined by the national partners.



They must be consistent with the improved recommendation renovations proposed in Chapter 3, i.e. components that already meet these recommendations would be rated ‘green’.

For the building envelope, the energy rating should preferably be based on the average U-value of the specific building parts. Thus, for each component, a range of U-values for the three performance options should be prescribed. Since these values might not be possible to determine in all partner countries, a description-based evaluation might be possible. Moreover, a description may also help building owners that are not familiar with U-values to understand the rating and difference to the renovation recommendation.

For the technical components, the preferred evaluation option would be the EU ErP energy label. Since older systems might not be labelled, the label criterion might be complemented with a list of typical technologies.

### 7.3.6 Detailed renovation recommendations by component

On page three of the EPC form template, the renovation recommendations by the component are given in two tables. The recommendations should be based on the QualDeEPC recommendations as developed in Chapter 3. The evaluation of the Energy rating for a recommendation is based on the same values or descriptions as for the evaluation of the current component performance in section 7.3.5. A recommendation meeting the standards of the QualDeEPC recommendations would usually be rated ‘green’. For the thermal insulation actions, the ‘exceptional’ standards would receive ‘green’, whereas the ‘enhanced’ standards would be rated ‘yellow’. These would be the minimum to recommend, but EPC assessors should be advised to actively consider recommending the ‘exceptional’ standards. If the current components energy rating is already “green” or no reasonable recommendation can be given, the EPC issuer may leave the respective row empty or marking it with “none”. Further information can then be provided on the fourth page (see section 7.3.7).

In the tables, it is indicated if a recommendation is included in the “Main Option” renovation concept, which is described in section 7.3.7.

An optional column for the evaluation of cost, cost-effectiveness and/or payback time might be added. At the current stage, no hard criteria for estimating the cost-effectiveness could be identified. The topic was discussed with the stakeholders in the 3<sup>rd</sup> round of national workshops. The same considerations as discussed in chapter 3 apply: most technical systems recommended in the QualDeEPC set of renovation recommendations and the ‘enhanced’ thermal insulation levels should be cost-effective in case of major renovation scheduled anyway, and this should be mentioned along with the recommendations on the EPC by the issuer. For the ‘exceptional’ standards, they may only be cost-effective with financial incentives.

Overall requirements such as reaching nZEB requirements in case of renovation (for countries, in which these exist), air tightness, reduced thermal bridging and percentage of renewable energies are listed separately since they depend on the combination of selected renovation options. Additionally, it could also be marked if the building reaches or can reach the legal requirements for existing buildings.

### 7.3.7 Useful combination of renovations and stepwise implementation

For the description of useful combinations of renovation options and stepwise implementation, two text fields are provided on page 4 of the EPC form template. The first text field is reserved for the





detailed description of “Main option”, which is used to calculate the improved performance (classification) and energy savings. Since not all building components are listed in the tables on page 3, additional options might be described. Moreover, an implementation plan might be laid out. Here, the economic result of this option may be placed, too.

In the second text field, additional renovation options or options that might be implemented later can be described.

### *7.3.8 Link to Deep Renovation Network Platform*

At the end of page 4 of the EPC form template, a text field is reserved to integrate the link to a national Deep Renovation Network Platform, official websites on energy performance certification or other relevant links.

### *7.3.9 Visualisation of energy performance and energy potential*

On the currently optional fifth page, it is possible to include some visualization of the current and future energy performance in the national adaptation. Another option would be to include a graphic on typical energy classes and performance data of similar buildings.

### *7.3.10 Placeholder for further information*

In most partner countries, further mandatory information is required to be present on an EPC form. These items can be placed in the additional space on the fifth page of the EPC form template. In any case, it should be kept in mind that the template should not be overloaded but kept as clear as possible.

As an example, stakeholders indicated that the “smart readiness indicator” should be embedded on the EPC form, e.g. with a traffic light system. This topic is being discussed and developed by the sister projects X-tendo and U-Cert of QualDeEPC and, therefore, we refrained from introducing such an indicator at the current stage.





### 7.3.11 Resulting template for an enhanced and more user-friendly EPC form

EPC form <i>for residential buildings</i>					
in accordance with Building Energy ACT XYZ					
Registry no.: 123456789		Valid until: DD/MM/YYYY*		EPC type: e.g. asset rating	
other requirement(s), e.g. nZEB standard, calculation method					
<b>Building data</b>					
Type of building	e.g. multi-family home,		Current picture of building		
Address					
Additional specification of building	e.g. nine apartments;				
Year of construction					
Area					
Additional value					
<b>Energy classification and performance</b>					
minValue [kWh/m <sup>2</sup> /yr]	maxValue [kWh/m <sup>2</sup> /yr]	Energy class	1 <sup>st</sup> value, e.g. Primary energy [kWh/m <sup>2</sup> /yr]	2 <sup>nd</sup> value, e.g. final energy [kWh/m <sup>2</sup> /yr]	"improved value" for Main Option* [kWh/m <sup>2</sup> /yr]
		A+			
		A			
		B			234
		C			
		D			
		E			
		F	987		
		G			
		H			
CO <sub>2</sub> -/GHG-emissions [kg CO <sub>2</sub> /(m <sup>2</sup> /yr)]:					
* The underlying renovation recommendations and implementation scheme for the Main option are given on p. 3 & 4.					
Potential final energy savings for renovation according to the Main Option:				XYZ kWh/yr	
Potential savings of CO <sub>2</sub> -/ GHG-emissions according to the Main Option:				ABC kg CO <sub>2</sub> / yr	
Issuer			Date		
e.g. address, telephone no., registry no.			Signature		

Figure 9 First page of the enhanced EPC form template

## EPC form *for residential buildings*

In accordance with *Building Energy Act XYZ*




### Details on the current energy performance of the building

Energy consumption**		measured:		modelled***:			
No.	Period of measurement (from – to)	Energy source	Energy consumption for space-heating and domestic hot water (DHW) [kWh/yr]			Electricity [kWh/yr]	Other:
			Total	Heating	DHW		
1							
2							
3							

\*\*measured energy consumption depends on the use of heating, cooling, ventilation system (incl. windows) and domestic hot water system of building occupants, as well as the number of occupants. Also, the weather conditions during the period of measurement;  
 \*\*\*modelled energy consumption may differ from actual use

2




### Assessment of building envelope and technical system

Building envelope	Area [m <sup>2</sup> ]	Description or Avg. U-value [W/m <sup>2</sup> K]	Energy rating**
Roof or ceiling to attic			
External walls			
Windows			
Doors/Gates			
Ground floor or floor to unheated basement			

Technical systems	Year of construction/ installation	Energy source, provided power, EU energy label	Energy rating**
Heating system			
Domestic hot water			
Ventilation system			
Cooling system			
Renewable energies			
Lighting			

\*\* Meaning of energy rating:

-  Exceeds significantly the minimum standards of Building Energy Act (e.g. as suggested by funding programs)
-  Reaches or minimally exceeds the minimum standards of Building Energy Act (e.g. current regulations/ laws)
-  Lower than standards of Building Energy Act



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3

Figure 10 Second page of the enhanced EPC form template

## EPC form *for residential buildings*

In accordance with *Building Energy ACT XYZ*

### Renovation recommendations – component evaluation

Building envelope	Recommendation	"new" avg. U-value [W/m <sup>2</sup> K]	New Energy rating <sup>a</sup>	Cost effectiveness (e.g. pay-back time)	Included in Main option?
Roof or attic					<input type="checkbox"/>
External walls					<input type="checkbox"/>
Windows					<input type="checkbox"/>
Doors/Gates					<input type="checkbox"/>
Ground floor or floor to unheated basement					<input type="checkbox"/>

3

Technical systems	Recommendation	Energy source provided: power, EU energy label	New Energy rating <sup>a</sup>	Cost effectiveness (e.g. pay-back time)	Included in Main option?
Heating system					<input type="checkbox"/>
Domestic hot water					<input type="checkbox"/>
Ventilation system					<input type="checkbox"/>
Cooling system					<input type="checkbox"/>
Renewable energies (outside of other systems)					<input type="checkbox"/>
Other: e.g. Lighting					<input type="checkbox"/>

Potential final energy savings for renovation according to the Main Option: XYZ kWh/yr

Potential savings of CO<sub>2</sub>-/GHG-emissions according to the Main Option: ABC kg CO<sub>2</sub>/ yr



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Figure 11 Third page of the enhanced EPC form template

## EPC form *for residential buildings*

in accordance with Building Energy ACT XYZ

### Renovation recommendations – renovation concepts

Description of useful combination of renovations and stepwise implementation for the Main option:

4

Economic result (e.g. payback time, *optional*):

Main option meets requirements for:

Nearly zero energy buildings in case of renovation:	<input type="checkbox"/>
Air tightness:	<input type="checkbox"/>
Reduced thermal bridging:	<input type="checkbox"/>
Min. 50% RES or equivalent measures:	<input type="checkbox"/>

Description of useful combination of renovations and stepwise implementation for further renovation options not included in the Main option:

### Further information

The following link(s) provide further information on energy performance certification, use of EPCs and renovations to improve energy performance including financial assistance programmes:

- Website A
- Website B
- Website C



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Figure 12 Fourth page of the enhanced EPC form template

## EPC form *for residential buildings*

In accordance with *Building Energy ACT XYZ*

### Graphical visualisation of energy performance *(optional)*

*Placeholder for visualisation of energy performance*

5

### Further information *(optional)*

*Here any further information can be presented which might be required or interesting on a national level, e.g. comparison to energy demand/ consumption of similar buildings, explanation of terms, ...*



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Figure 13 Fifth page of the enhanced EPC form template

### *7.3.12 Guidebook or Tutorial for EPC assessors on how to fill in the enhanced EPC form*

A guidebook or tutorial for EPC assessors on how to fill in the enhanced EPC form is needed to ensure the envisaged quality of the EPC. Some of the explanations provided in sections 7.3.1 to 7.3.10 above could be used for this purpose, but more detail and guidance would probably be needed. The guiding needed is primarily needed for the evaluation of the building components and technical systems – with nationally adapted values for the determination of the green, yellow, or red energy rating – as well as for the renovation recommendations for deep energy renovation. Here, the nationally adapted recommendations from chapter 3 will be included, along with guidance on how to calculate and present cost-effectiveness (see also section 7.3.6): for example, which metric to use (e.g. pay-back time or present values of investments and savings), whether investments for renovation planned anyway should be excluded from the cost-effectiveness calculation and how to present these cases to the user, or which interest rates and lifetimes to use. It could also be made clear whether different aspects that may affect the profitability calculation (e.g. reduced maintenance, reduced costs for tap water, reduced costs for power tariffs, potential subsidies) or other added values (e.g., improved indoor climate) should be considered or not. And should it be indicated on the EPC if these aspects are considered or not. How to decide which recommendations to combine to the 'Main Option', and how to write the sections on 'renovation concepts' on p.4 was also mentioned as an issue needing further guidance.

Additionally, short descriptions of all other components of the enhanced EPC form will enable the EPC assessors to fill in the EPC form correctly. The overall structure of the guidebook would preferably be the same in all countries, and the structure might be based on the order of EPC form elements as they occur in the form.





## 8 VOLUNTARY/MANDATORY ADVERTISING GUIDELINES FOR EPCS

In all EU member states, it should be mandatory to display the energy class of the EPC and/or the energy performance included in the EPC in selling or renting advertisements, since this is required in the EPBD, but the compliance in the markets varies (see Chapter 9 Improving compliance with the mandatory use of EPCs in real estate advertisements).

A potential way to improve compliance is to provide sellers, landlords and letting agencies with concrete and voluntary or even mandatory guidelines for the use and presentation of EPCs and the legally required data in advertisements of sales and rentals of buildings. This will make it easier for these target groups to comply with the advertisement requirements. Such guidelines issued by energy agencies/public authorities are already available in some member states. For example in Ireland, a detailed guideline plus the respective energy class artwork files are available for download and use (SEAI, 2013). Similar guidelines are available in the QualDeEPC partner country Sweden. In France, examples of adverts are available, which comply with the mandate that at least, the energy class label should be presented (Ministère de la Transition écologique et solidaire, 2018).

There are certainly also other ways to improve compliance with the display requirements for EPCs or energy-related EPC data in advertisements for buildings. These are discussed in Chapter 9. They share the same precondition, i.e. the legal requirement to display the energy class of the EPC and/or the energy performance included in the EPC in selling or renting advertisements, with the advertising guidelines discussed in this section. Annex E holds a compilation of the legal requirements for the mandatory use of EPCs or energy-related EPC data in real estate advertisements in QualDeEPC partner countries.

This chapter starts by looking at whether advertising guidelines for presenting EPCs in real-estate advertisements during sale and rental of buildings exist in the partner countries, followed by good practice examples of such guidelines. Based on these, the section concludes with QualDeEPC's proposal for the aspects to be covered by such advertising guidelines, and for a legal text to make them mandatory.

### 8.1 Summary of country-specific information on the existence of advertising guidelines

Today, only Sweden has mandatory advertising guidelines. Germany only has a guide for finding the information in EPCs issued before 1 May 2014. All other countries do not have such guidelines available, see Table 46 below, and the following detailed information.



Table 12 Existing voluntary or mandatory guidelines for use of EPCs in real estate advertisements in QualDeEPC partner countries

	Bulgaria	Germany	Greece	Hungary	Latvia	Spain	Sweden
Existence of advertising guidelines							
Voluntary	no	no Only a guide for finding the information in EPCs issued before 1 May 2014 see details below	no	no	no	no	no
Mandatory	no	no	no	no	no	no	Yes. See details below.

## 8.2 Good practice examples of advertising guidelines for presenting EPCs in real-estate advertisements during the sale and rental of buildings

### 8.2.1 BER Advertising Requirements Guidelines: Ireland

In Ireland, the Sustainable Energy Agency of Ireland (SEAI) publishes concrete guidelines for how to comply with the Building Energy Rating (BER) advertising requirement (<https://www.seai.ie/publications/BER-Advertising-Guidelines-Issue-2-.pdf>). The content that should be provided, depending on the medium of advertisement, includes

- BER alphanumeric rating (energy efficiency class) and its motif
- BER number
- Energy performance indicator that indicates the energy required for space heating and cooling, water heating, ventilation and lighting, and is expressed in kWh/m<sup>2</sup>/yr.

Detailed guidelines on the requirements for artwork specifying the size, clearance zone, background, colours, and typeface, including samples of softcopy are provided. Besides, exhaustive medium-specific guidelines are provided, such as for advertisements in newspaper and magazines (broad ads with pictures and small text ads), display boards, radio, television, print and electronic mail, estate agent listing and brochure. Furthermore, several example advertisements are also provided.

### 8.2.2 Decree No. 2010-1662 of 28 December 2010 relating to the mention of the energy classification of buildings in real estate ads: France

In France, Decree No. 2010-1662 by the Ministry of Ecology, of sustainable development, transportation and housing (<https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000023317142?r=nJvzIU2BKA>)





mandates the mention of the energy classification of buildings in real estate announcements. It provides requirements for the content of the EPC to be displayed in various forms of communications, such as print (text), and brochures, electronic. In print, at least the alphabet corresponding to the energy class should be displayed in a font size no less than the remaining text in the advertisement. In electronic and colour brochures, the entire label should be displayed, in specified colours, pixels, and display area. The Ministry for the environment published a few examples of advertisements obeying these requirements ([https://www.ecologie.gouv.fr/sites/default/files/DGALN\\_Exemples\\_annonces\\_immobilieres.pdf](https://www.ecologie.gouv.fr/sites/default/files/DGALN_Exemples_annonces_immobilieres.pdf)).

### 8.2.3 *Manual for advertising based on Energy declarations made from 1 January 2014: Sweden*

In Sweden, the National Board of Housing and Building Planning provides the guidelines for the use of EPC content in real estate advertisements. In advertisements, the energy performance of a building must be symbolised by a house with a colour (green to red) and letter (A to G) that matches the energy classification. There are detailed guidelines of what this symbol should look like, e.g. regarding size, colour, placing, position, background and font. This symbol can be displayed with or without subtitles. When advertising in commercial printed media, it is enough to use the letter only.

The guidelines are on the homepage of the National Board of Housing Building and Planning and are easy to find by brokers or building owners in Sweden. Brokers are well informed that the EPC is mandatory, and there is nearly always a link to the EPC in each ad on the internet. However, the guide to clearly show the grade (A-F) with a symbol is seldom used in ads.

## 8.3 QualDeEPC proposal for concrete advertising guidelines for presenting EPCs in real-estate advertisements during the sale and rental of buildings

To improve the use of EPCs and energy-related EPC data for presenting them in real-estate advertisements during sale and rental of buildings, QualDeEPC has developed a proposal for advertising guidelines, and for legislation for making their use mandatory. The drafts for both proposals are presented in the following two subsections.

### 8.3.1 *Proposal for voluntary advertising guidelines and their use*

The following table shows aspects that should be considered while framing advertising guidelines for all QualDeEPC partner countries. Depending on the discussion between partners and with stakeholders in the next phase of the project, the project team may develop further universally applicable detail or tools (such as graphical and text examples of advertisements for various media). A good idea may be to require EPC assessors to hand over a leaflet with the guidelines and respective links, as well as the legal requirements, to building owners together with the EPC, particularly if using the guidelines is made mandatory (section 8.3.2).



Table 13 Proposal for guidelines for displaying EPCs (or its contents) in real estate advertisements

Content-related guidelines	Publication -related guidelines
Specify EPC content that should be displayed across all mediums, which includes at least energy classification class, colour, and specific energy consumption (primary or final as displayed on the EPC); in some countries also CO <sub>2</sub> emissions	Provide publication parameters for displaying the EPC content such as size, colours, background, pixels, and typography.
Specify medium-specific EPC content that should be displayed in various mediums, such as print (especially small text in newspapers and magazines; potential limitations in printed media should be considered, e.g. less content requirement in printed media), digital and internet, audio-visual.	Provide softcopies of the EPC content, especially for digital media
URL to the EPC or EPC number should be provided, when possible, especially if EPCs are in public domain	Provide graphical and text examples of advertisements for various media
The entire energy label that shows the building's energy class concerning the entire spectrum of energy classification should be shown, when possible, especially in digital media	

### 8.3.2 Proposal for legislation making their use mandatory

The following text may be included in the national legislation for making the use of concrete guidelines for display of the legally required EPC content in real-estate advertisements during sale and rental of buildings *mandatory*:

“In order to comply with these requirements, the guidelines for advertisements that are provided by the *#name of the national certification body or other authority competent for this task#* must be followed.”



## 9 IMPROVING COMPLIANCE WITH THE MANDATORY USE OF EPCS IN REAL ESTATE ADVERTISEMENTS

### 9.1 Objective and overview

By requirement of the EPBD, it is mandatory to present key data from the EPCs in real estate advertisements. However, the level of compliance with this requirement is varying, and data available to us are inconclusive to ascertain how many countries are actively controlling and enforcing this legal requirement. This is also the case for the QualDeEPC partner countries.

Compliance can be improved directly, such as by appointing and providing sufficient resources to designated authorities, so that they can both inform the target groups of their duties and monitor and enforce compliance, and by penal provisions for non-compliance.

In addition, acquiring an EPC for a building is a pre-requisite for its use in real estate advertisements. Increasing the number of existing EPCs is therefore one way to indirectly improve compliance with the advertisement provisions. Only in few member states, such as the Netherlands, for existing buildings, private homeowners receive a provisional EPC (based on information the authorities have about the house) automatically and can convert it online into a definite EPC (low cost). In most other member states, typically, when an EPC is not already present, building owners are only required to procure an EPC when there is a sale or rental of a building. In such cases, legislation and compliance activities regarding the procurement and presentation of an EPC during sale and rental of a building can directly ensure or indirectly nudge the procurement and usage of EPCs in real estate advertisements. One such activity is voluntary or mandatory guidelines for how to present the EPC data in advertisements, which make it easier for building owners to comply. This tool is developed in another priority (see chapter 8). This chapter deals with other instruments and processes to improve compliance.

Annex E presents information on the level, processes, and instruments of control of implementation of the mandatory use of EPCs in real estate advertisements in QualDeEPC partner countries, as provided by the partners for Deliverable D2.4 and this Green paper. Thereafter, Annex E presents information on the status of indirect compliance measures.

This chapter presents suggestions proposed by QualDeEPC for direct compliance measures and available information on good practice. Developing further, indirect compliance measures is beyond the scope of the project.

### 9.2 Direct measures for ensuring compliance with the mandatory use of EPCs in real estate advertisements by effectively controlling and enforcing: Policy proposal and Good practice examples

A direct way of ensuring compliance is to appoint an authority that is responsible for carrying out inspections and control checks of the real estate advertisements, such as in Croatia, Cyprus, Slovakia and Sweden, and provide this authority with sufficient resources. Further, guidelines for compliance checking and methods of enforcement should be laid out including, the measures necessary for raising awareness for compliance and imposing penal sanctions for non-compliance. The following table describes key ways to improve compliance. In general, for increasing compliance levels and acceptance



of EPCs and the need to use them in advertisements, it will be advisable to ensure a higher number of compliance checks and use rather low penalties or even a warning only in case of a first offence than to sanction right away at high levels, but do only few checks.

*Table 14 Ways to improve compliance with the mandatory use of EPCs in real estate advertisements by an effective controlling and enforcing*

Way to improve compliance	Description	Good practice examples
Appointment of nodal authorities	In all member states, EPCs are randomly checked for quality control. A pragmatic way could be to appoint the same nodal authorities for compliance verification with the mandatory use of EPCs in real estate advertisements.	Ministry of Economy - market inspectorate in Croatia The National Board of Housing, Building and Planning in Sweden Ministry of Energy, Commerce, Industry and Tourism (MECIT) in Cyprus
Resources and competences	Adequate financial resources and manpower should be provided.	
Check advertisements for compliance	A random checking mechanism, similar to quality control of EPCs, could be adopted. This includes conducting random checks in popular real-estate portals, real-estate advertising columns/sections/pages in registered newspapers and magazines.	
Methods of enforcement (passive): raising awareness	Awareness campaigns should be conducted targeting various stakeholder groups to sensitize them regarding the mandatory use of EPCs in real-estate advertisements and appraise them of the guidelines for advertising, and penal provisions for non-compliance, such as: <ul style="list-style-type: none"> <li>Marketing and advertising departments of real-estate portals, newspapers and magazines etc. to not accept advertisements that do not adhere to mandatory guidelines</li> <li>Housing finance companies, banks etc.</li> <li>Real-estate companies, letting agencies, property management firms etc.</li> <li>Building owner associations etc.</li> </ul>	
Methods of enforcement (active): penal provisions	Levy staged penalties for non-compliance, starting from re-sensitizing, warning, and up to monetary penalties, depending on the relative importance of the stakeholder group and their reach.  In most of the member states, including 5 QualDeEPC countries, there are sanctions for building owners missing to obtain/present an EPC during the sale and rental of the building.	In Croatia, penalties are imposed when owners/brokers fail to indicate the energy class in sale advertisements published in the media, in the range of 700 EUR to 4,000 EUR. This obligation is commonly followed and no fines have been issued so far  In Cyprus, Non-compliance has led to penalties in 22 cases. This has led to a higher rate of EPC display in advertisements  In Ireland, non-compliance of the regulations is liable on summary conviction to a class A fine



## 10 CONCLUSIONS

The *White Paper on good practice in EPC assessment, certification and use* (D3.2) finalises the policy proposals on the priorities identified in the *D2.4 Development Strategy Plan* (Kostova et al. 2020). It advances the *Green Paper on good practice in EPC assessment, certification and use* (D3.1) by taking into account the feedback of the stakeholders (Veselá et al. 2021) and building owners (Zogla et al. 2021). The major outcome at this stage are:

- A text-based list of deep energy renovation recommendations,
- The concept for the online tool development,
- The concept for a Deep Renovation Network Platform,
- A universal, enhanced user-friendly EPC form template and background on the proposed content,
- A detailed policy proposal for regular mandatory training, and
- A general policy proposal for advertisement guidelines and for actions to improve the compliance with the mandatory use of EPCs in real estate advertisements.

Moreover, the White paper will be the basis for the country-specific adaptation, discussion, and to the extent possible, implementation of the developed policy proposals in WP5. Any further improvements to the concepts and tools included in this White Paper that are found to be useful in general, also for other countries, will be included in the Guidebook for improved EPCs (Deliverable 5.3) that will be developed in the next phase of the project.



## 11 REFERENCES

Kostova, D.; Dr. Thomas, S.; Gokarakonda, S. (2020) D2.4 Development Strategy Plan for the development of next generation EPC schemes, QualDeEPC, [https://qualdeepc.eu/wp-content/uploads/2020/07/QualDeEPC\\_D2.4-Development-Strategy-plan\\_200630\\_final.pdf](https://qualdeepc.eu/wp-content/uploads/2020/07/QualDeEPC_D2.4-Development-Strategy-plan_200630_final.pdf)

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## 12 ANNEXES

Annex A: Further information on “Defining ‘deep energy renovation’ – a proposal from QualDeEPC”

Annex B: Specification of building components and technical systems for the online tool

Annex C: Overview of EPC elements in EPC forms of partner countries

Annex D: Potential elements for enhancement of the EPC form and selection evaluation

ANNEX E: Current regulations on use of EPC data in real-estate advertisements and activities for compliance in QualDeEPC countries

### 12.1 Annex A: Further information on “Defining ‘deep energy renovation’ – a proposal from QualDeEPC”

#### 12.1.1 Different approaches to Deep energy renovation found in literature and policy

The first mention of ‘deep renovation’ can be found in the Energy Efficiency Directive (EED; Directive 2012/27/EU of 25 October 2012. Article 4(c) of the EED already required the Member States to ensure that their Long-Term Renovation Strategies encompass “policies and actions to stimulate cost-effective deep renovation of buildings, including staged deep renovation”. Recital 16 of the EED stated that these strategies “should address cost-effective deep renovations which lead to a refurbishment that reduces both the delivered and final energy consumption of a building *by a significant percentage* compared with the pre-renovation levels leading to *a very high energy performance*. Such deep renovations could also be carried out in stages.” (*highlighting in italics added by the authors of this report*)

In the Staff Working Document (SWD(2013) 143 final), the European Commission provided a more concrete definition of the significant efficiency improvements resulting from deep renovation, by indicating that “deep renovations (are) leading to significant (typically more than 60 %) efficiency improvements.” Here, a concrete number – *more than 60%* - was introduced.

Commission Recommendation (EC) 2019/786 of 8 May 2019 on building renovation reiterated the definition from the EED and related again to this SWD: “According to the staff working document accompanying the Commission’s 2013 report on Financial support for energy efficiency in buildings <https://eur-lex.europa.eu/legal-content/GA/TXT/?uri=CELEX:32019H0786> - [nr9-L 2019127EN.01003701-E0009](#), ‘deep renovation’ can be considered as a renovation that leads to significant (typically more than 60 %) efficiency improvements.”

The recent Communication from the Commission: ‘A Renovation Wave for Europe – greening our buildings, creating jobs, improving lives’ (SWD(2020) 550 final) of 14 October 2020 relates to the Recommendation (EC) 2019/786 and speaks of “deep renovations that reduce energy consumption by at least 60%”.

It can be noted that now, energy consumption should be reduced by 60%, whereas before it was more than 60 % of efficiency improvements, but it now is unclear whether this is delivered, final, or primary energy.



The ‘Comprehensive study of building energy renovation activities and the uptake of nearly zero-energy buildings in the EU’ (EC, 2019) aims to create a more concrete definition of the 60%. It distinguishes the following:

‘The determination of renovation rates and depths requires a clear common understanding of what renovation “rate” and “depth” mean. To reduce uncertainty about definitions, this study proposes and applies clear definitions for different renovation depths, relating them to non-renewable primary energy savings achieved in a specific calendar year:

- Below threshold ( $x < 3\%$  savings)
- Light renovations ( $3\% \leq x \leq 30\%$  savings)
- Medium renovations ( $30\% < x \leq 60\%$  savings)
- Deep renovations ( $x > 60\%$  savings)’

Therefore, *non-renewable primary energy savings achieved in a specific calendar year* would be the metric for measuring whether deep renovation has been achieved or not.

This is the starting point for our analysis of what could be an even more concrete and universally applicable definition of deep energy renovation that guides our further work in developing enhanced EPC schemes and can be operationalized for renovation recommendations, training, etc. The most important question in this respect is, whether a target of at least 60% of non-renewable primary energy savings is universally achievable and appropriate. This will be analysed in the next subchapter.

*Note:* In our work, we will speak of ‘deep energy renovation’, although the official documents always use the term ‘deep renovation’. It must be noted, however, that there are countries, in which ‘deep renovations’ are also defined based on the extent of renovation *overall*, i.e., the quantity and quality of work undertaken for the renovation of a building’s interior and exterior, not only for energy efficiency. In order not to create confusion, we use ‘deep energy renovation’.

And deep energy renovation should also not be confused with ‘major renovation’ according to the EPBD, which triggers the legal requirement to renovate the whole part of the building shell that is subject to the planned renovation according to legal standards for component energy efficiency in the renovation. Such major renovations are defined based on the extent of energy renovation, i.e., the quantity of work undertaken for energy renovation, e.g., as a certain percentage of total building shell area or area of walls, roof, windows etc.

### 12.1.2 Appropriateness of a 60% savings threshold for defining deep energy renovation and conclusion on the preferred approach

It is clear from above that the ‘significant percentage of energy savings’ is not strictly defined and only provides an indication of a statistical percentage of resulting savings. Besides, discussion among QualDeEPC project partners revealed that the above indication by the European Commission that deep energy renovation should ‘typically’ lead to more than 60% energy savings is not fitting all countries well. While it may be useful in many countries particularly in central Europe, there are warmer climate zones, in which humidity may make it difficult to achieve this 60% target or mild climates that would even enable 100% of savings on the energy demand relevant for EPCs in residential buildings (no heating or cooling needed any more). On the other hand, Sweden has had energy efficiency regulations for new buildings for many decades, so that in most buildings only 20 to 40 % of further savings are both feasible and needed to achieve low-energy building performance levels.





Respecting this condition, it seems more adequate **to build** our working definition of ‘deep energy renovation’ **on target values for the energy performance of a building that should be reached by a ‘deep’ energy renovation**. It would seem natural to take the definition of nZEB that all EU Member States have had to create by end of 2020 as such a level. However, the level defined as ‘nZEB’ varies between the Member States even in the same climate zone. And nZEB levels achievable for new buildings may not be achievable in building renovation, as e.g. the geometry and orientation towards the sun of existing buildings usually can’t be changed. For example, the Latvian partner estimates that the ambitious nZEB levels for new buildings in Latvia are usually impossible to reach through renovation. In addition, nZEB definitions involve the use of renewable energies, while deep energy renovation aims at improving energy efficiency only. This is reflected in the above proposal to use *non-renewable primary energy savings achieved in a specific calendar year* as the metric for measuring whether deep renovation has been achieved or not. Since the deep renovation in this sense can be achieved by appropriate insulation levels (U-values), energy-efficient heating or cooling systems and other highly energy-efficient components, our conclusion is to use component efficiency levels consistent with nZEB requirements as the basis for our working definition of ‘deep energy renovation’.





## 12.2.2 Specifications of the building systems: Roofs (screen 5, Figure 15)

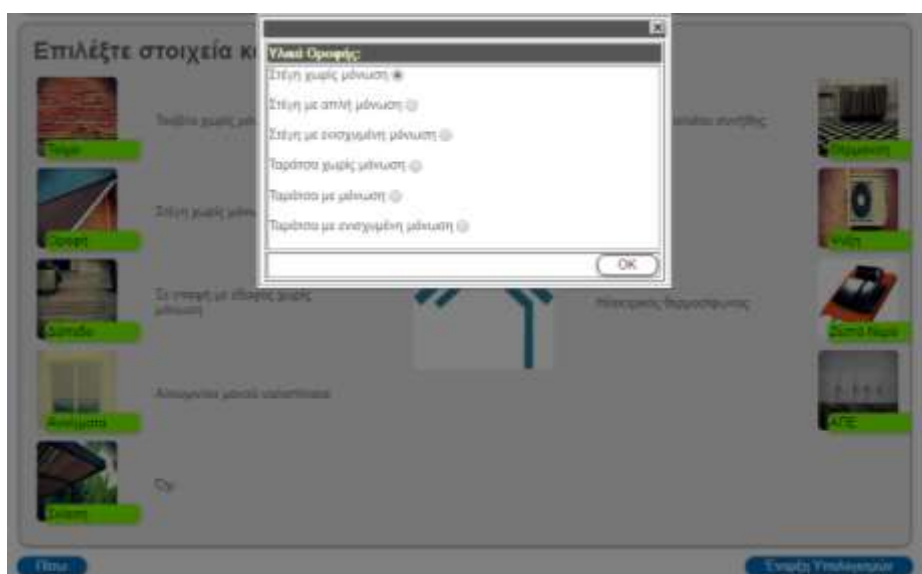


Figure 15 Roof categories

The roof construction can be selected from 7 alternatives as shown in Table 16.

Table 16 Input selection for heat transmission coefficients in  $W/m^2K$  for roof or attic insulation (in residential buildings)

Construction type	U-value (examples for Greece, may need to be adapted to national situation)
Uninsulated Pitched roof	4.25 $W/(m^2K)$
Pitched roof with insulation	0.5 $W/(m^2K)$
Pitched roof with reinforced insulation	0.5, 0.45, 0.4 and 0.35 $W/(m^2K)$ according to the climatic zone
Flat roof without insulation	3.05 $W/(m^2K)$
Flat roof with typical insulation	0.5, 0.45, 0.4 and 0.35 $W/(m^2K)$ according to the climatic zone
Flat roof with reinforced insulation	$U=0,2 W/(m^2K)$
Other type (i.e exceptional thermal insulation properties)	n/a

More options could be included in the adaptation phase of the project in the national contexts.

### 12.2.3 Specifications of the building systems: Floors (screen 6, Figure 16):

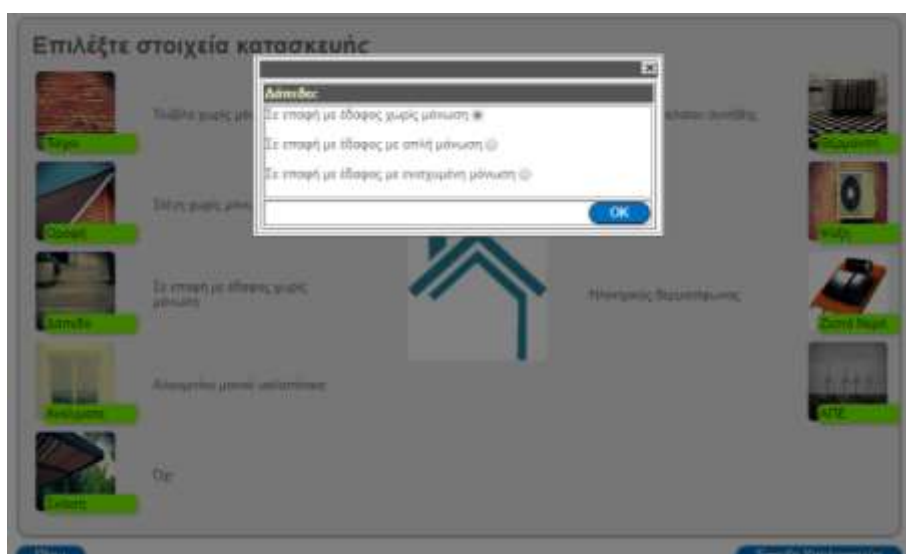


Figure 16 Floor alternatives

Similarly, for floor construction 5 alternatives can be selected as shown in Table 17.

Table 17 Input selection for heat transmission coefficients in  $W/m^2K$  for insulation of ceiling of an unheated basement (in residential buildings)

Construction type	U-value (examples for Greece, may need to be adapted to national situation)
Floor in contact with the ground without insulation	3.1 $W/(m^2K)$
Floor in contact with the ground with insulation	3, 1.9, 0.8 and 0.8 $W/(m^2K)$ , according to the climatic zone
Floor in contact with the ground with reinforced insulation	1.2, 0.9, 0.75 and 0.7 $W/(m^2K)$ , according to the climatic zone
Ground floor in contact with unheated basement without insulation	2.00
Ground floor in contact with unheated basement with insulation	0.80

#### 12.2.4 Specifications of the building systems: Windows (screen 7, Figure 17):

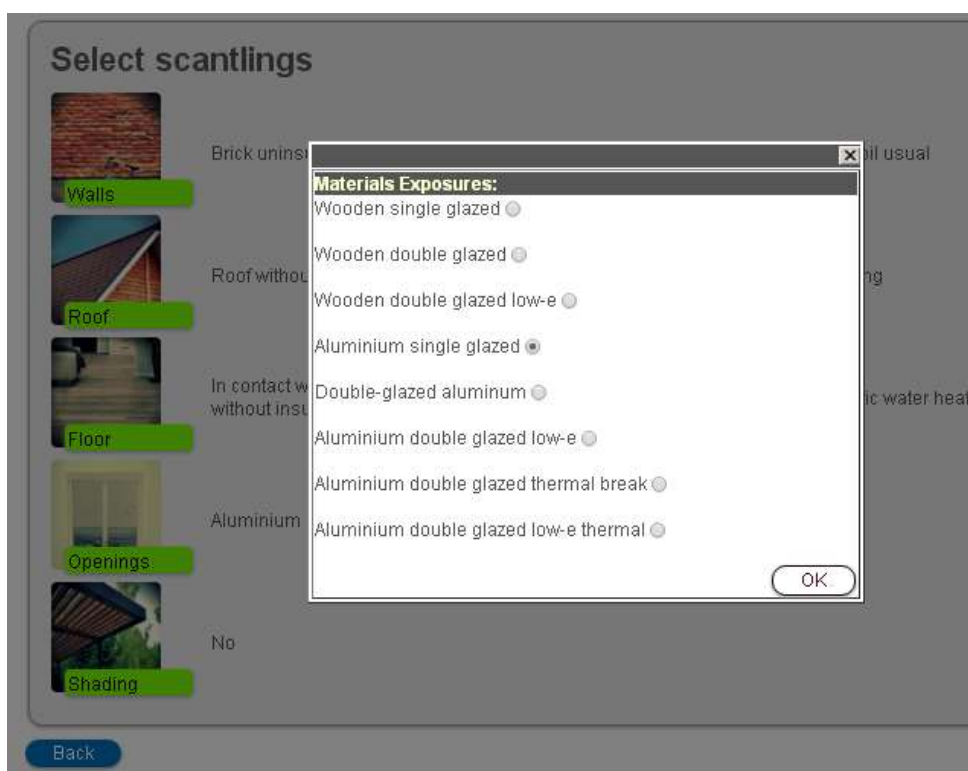


Figure 17 Windows energy characteristics

Regarding the windows the user can find 11 choices as shown in Table 18.

Table 18 Input selection for heat transmission coefficients in  $W/m^2K$  for standard windows (in residential buildings)

Construction type	U-Value (examples for Greece, may need to be adapted to national situation)
Wooden frame single glazed windows	5 $W/(m^2K)$
Wooden frame double glazed windows	2.9 $W/(m^2K)$
Wooden frame double glazed low-e (low-emissivity) windows	2.1 $W/(m^2K)$
Aluminium frame single glazed windows	6 $W/(m^2K)$
Aluminium frame double glazed window	3.7 $W/(m^2K)$
Aluminium frame with double low-e glazing	3 $W/(m^2K)$
Aluminium frame with thermal break and double glazing	2.9 $W/(m^2K)$
Aluminium frame with thermal break and double low-e glazing	2.3 $W/(m^2K)$
Synthetic frame single glazed windows	5.0 $W/(m^2K)$
Synthetic frame double glazed windows	3.0 $W/(m^2K)$
Aluminium frame double glazed equipped with thick argon or krypton thermal break and low-e glass	1.5 $W/(m^2K)$

Construction type	U-Value (examples for Greece, may need to be adapted to national situation)
Synthetic or wooden frame double glazed with thick argon or krypton thermal break and low-e glass	1.2 W/(m <sup>2</sup> K)
Other window type with very low U-value (e.g. triple glazed, vacuum gap)	$U < 0.9 \text{ W/(m}^2\text{K)}$

### 12.2.5 Specifications of the building systems: Shading (screen 8, Figure 18)

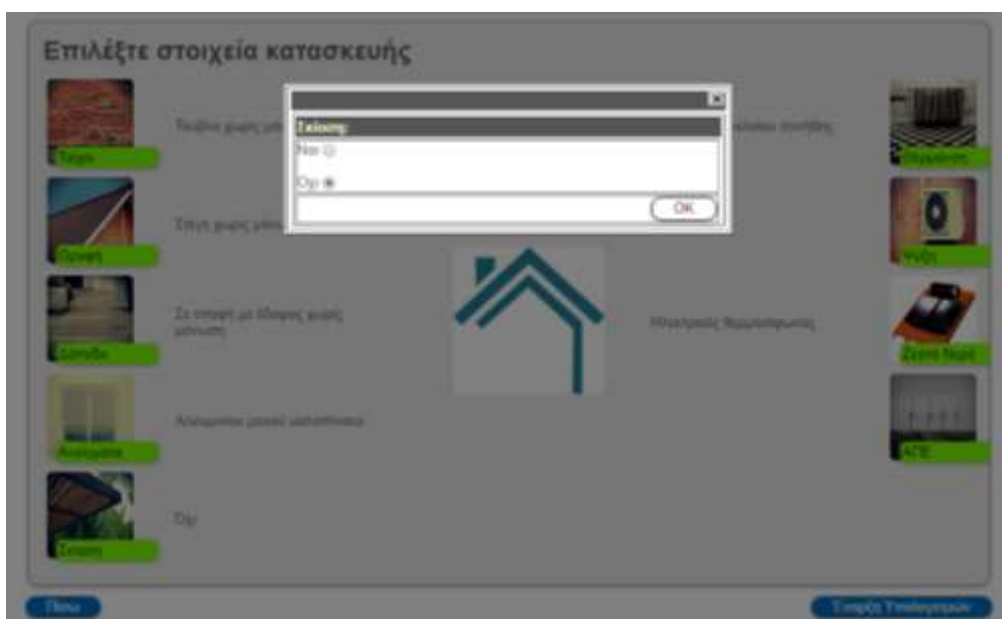


Figure 18 Shading choices

Table 19 Input selection for shading (in residential buildings)

Shading type	Value
Shading not present	Shading coefficients: $F_{hor}=0.91, F_{on}=0.93, F_{fin}=0.46$
Shading present (shading covering 30% of the facade)	0.2/0.3 according to the orientation of the building component Shading coefficients: $F_{hor}=0.86, F_{on}=0.73, F_{fin}=0.28$
Shading present (shading covering 70% of the facade)	Shading coefficients: $F_{hor}=0.91, F_{on}=0.93, F_{fin}=0.46$

## 12.2.6 Specifications of the building systems: Heating systems (screen 9, Figure 19)

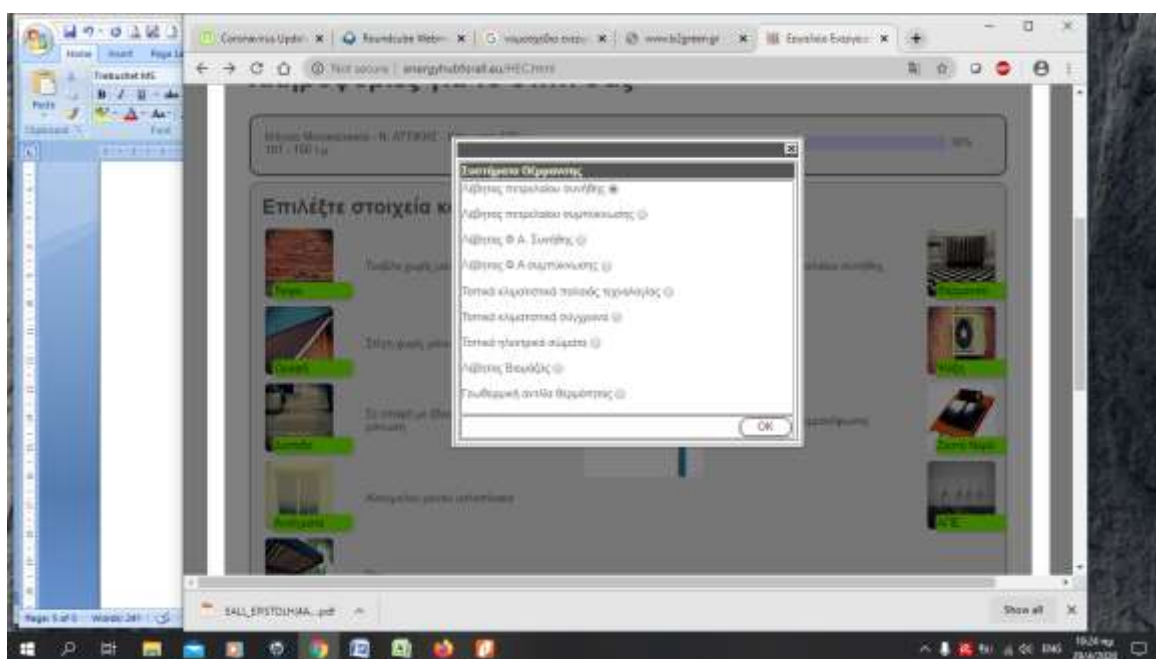


Figure 19 Heating systems selection

Table 20 Input selection for heating systems (in residential buildings)

Heating system type	Efficiency (examples for Greece, may need to be adapted to national situation)
Conventional fuel oil boiler	0.84
Condensing fuel oil boiler	0.97
Conventional Gas boiler	0.90
Condensing gas boiler	0.97
Conventional air conditioning unit – (old technology)	2.00
Air conditioning unit (with inverter)	3.20
Local electrical units	1.00
Biomass boiler	0.95
Biomass pellet boiler	0.95
Geothermal heat pump	4.80
Air-to-water heat pump	n/a
Air-to-air heat pump	n/a
Exhaust air heat pump	n/a
Stove	0.57
District heating	0.98
Small-scale CHP unit	0.75



### 12.2.7 Specifications of the building systems: Cooling systems (screen 10, Figure 20)

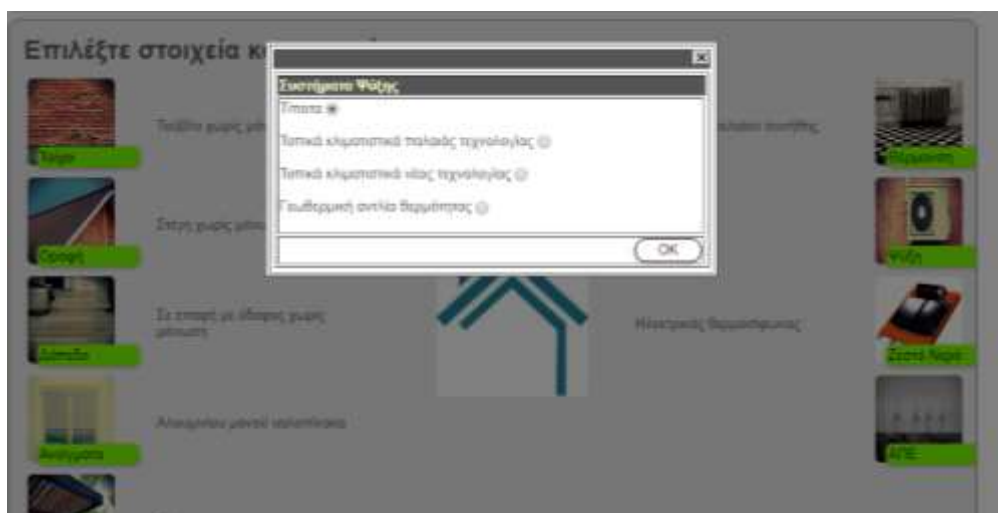


Figure 20 Cooling systems selection

Table 21 Comparison of measures to improve cooling systems (in residential buildings)

Cooling system type	Efficiency (examples for Greece, may need to be adapted to national situation)
No cooling system	-
Local air conditioning units – (old tech)	2.2
Local air conditioning units – ( with inverter)	3.3
AC units with inverter driven technology (VRF/VRV)	3.5
Geothermal heat pump	4
District cooling system	n/a
Central cooling system	3.5

### 12.2.8 Specifications of the building systems: Ventilation (screen 11, Table 22)

Table 22 Mechanical Ventilation system options for heating and cooling systems

System Type	Mechanical Ventilation
Heating System	<input type="checkbox"/> or <input checked="" type="checkbox"/>
Cooling System	<input type="checkbox"/> or <input checked="" type="checkbox"/>



### 12.2.9 Specifications of the building systems: DHW (Screen 12, Figure 21)



Figure 21 Hot water production systems selection.

Table 23 Selection input for DHW systems (in residential buildings)

Hot water system type	Efficiency (examples for Greece, may need to be adapted to national situation)
Boiler	0.88, 0.9/0.97 according to the boiler type
Electrical resistance heater (instantaneous)	1
Electrical resistance storage heater	n/a
Boiler and solar collector	0.88, 0.9, 0.97 according to the boiler type (flat solar collector)
Electrical resistance storage heater and solar collector	1 (flat solar collector)
Geothermal heat pump	n/a
Domestic hot water heat pump	n/a
Exhaust air heat pump	n/a
District heating	0.98

## 12.2.10 Specifications of the building systems: RES (Screen 13, Figure 22)



Figure 22 Renewable energy sources selection

In case of the RES system selection, if made, the software takes into account the total floor area of the building unit considered, calculates the demand and the dimensioning of the system and finally the heat or electricity produced. The solar collector (for DHW) is a conventional flat type one with a utilization factor of 0.332 (for the Greek case). The PV system consists of monocrystalline cells with an efficiency of 16%.

Table 24 Comparison of measures to integrate renewable energy sources (in residential buildings)

RES type	Description (examples for Greece, may need to be adapted to national situation)
Solar Thermal collector (for DHW)	0.5
Geothermal Heat Pump (for space heating & DHW)	4.8
Biomass boiler (for space heating & DHW)	1
Solar photovoltaic (monocrystalline efficiency 16%)	efficiency 16%
Solar thermal collector for space heating	0.9
Solar photovoltaic (Polycrystalline and thin film PVs)	efficiency 19%

## 12.3 ANNEX C: Overview of EPC elements in EPC forms of partner countries

Element	Bulgaria	Germany	Greece	Hungary <sup>5</sup>	Latvia	Spain	Sweden
<b>General data</b>							
Legal basis	No	Yes	Yes	Yes		Yes	Yes
Registry/ Serial number/ ID number	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Reason for issuance	No	Yes	Yes	Yes	Yes	No	No
Type of EPC (demand or consumption)	Yes	Yes	Yes	Yes	Yes	Not relevant	Yes
Date of validity	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Checkmark for compatibility with nZEB requirements	Yes	No	No, but there is an NZEB energy class	Yes	Yes	No	No, but there is an nZEB energy class
<b>General building data</b>							
Address	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Picture of building	Yes	yes	Yes	Yes	Yes	Yes	No
Type of building (residential/ non- residential)	Yes	yes	Yes	Yes	Yes	Yes	Yes
Number of apartments (in case of residential buildings)	No	Yes	No	No	No		Yes
Year of construction	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<b>Building area</b>							
Total area		No	Yes	No	Yes	No	
Floor area/ Living space	Yes	No	Yes (as 'useful area')	No (only in calculation annex)	Yes	Yes	Yes
Heated area	Yes	No		Yes	No	No	Yes (conditioned area)
Cooled area	Yes, cooled volume	No	Yes (as 'useful area')	No (only in calculation annex)	No	No	Yes (conditioned area)
Net used area	No	Yes, might be calculated from the floor area		No	No	No	No

<sup>5</sup> In Hungary, an improved EPC is under legal procedure. The new form possibly contains all asked information of Table 1. However, no publication date is known.



Element	Bulgaria	Germany	Greece	Hungary <sup>5</sup>	Latvia	Spain	Sweden
Energy classification							
Calculation method for energy demand	Yes	Yes	Yes	Yes (Software)		Yes	Yes
Total primary energy demand/ consumption [kWh/m <sup>2</sup> yr]	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Total final energy demand/ consumption [kWh/m <sup>2</sup> yr]	Yes	Yes	Yes	No	Yes	No	Yes
Primary energy demand/ consumption for heating and warm water [kWh/m <sup>2</sup> yr]	Yes	separate value only for non-residential buildings	Yes	No (only in calculation annex)	No	Yes it is separated one data for heating and one data for warm water	No
Primary energy demand/consumption for electricity [kWh/m <sup>2</sup> yr]	Yes		Yes	No (only in calculation annex)	No	Yes	No
Final energy demand/ consumption for heating and warm water [kWh/m <sup>2</sup> yr]	Yes		Yes	No	Yes	No	Yes
Final energy demand/consumption for electricity [kWh/m <sup>2</sup> yr]	No		Yes	No	Yes (lighting, ventilation, cooling)	No	Yes
Energy class							
Based on primary energy	Yes	No	Yes	Yes	No	Yes	Yes
Based on final energy	No	Yes		No	Yes (space heating only)		No
Based on a reference building	No (Yes, only for a new building)	No	Yes	Partly (other buildings)	No		No
CO <sub>2</sub> -Emissions	Yes	Optional, required by October	Yes	No	Yes	Yes, with classification	No
References for comparing energy demand/ consumption/ class	No	Yes, for final energy demand/ consumption	No	Yes	Yes (for apartment buildings, offices and educational buildings)	No	Yes with new regulations (n-zeb requirements) and similar buildings.



Element	Bulgaria	Germany	Greece	Hungary <sup>5</sup>	Latvia	Spain	Sweden
<b>Past energy consumption</b>							
Details on past energy consumption	Only for the selected base year	Yes, if EPC is based on consumption; last 36 months	Included in the EPC but not mandatory to fill-in	No	Yes (if data available)		No
<b>Building HVAC<sup>6</sup> system incl. renewable energies</b>							
Installation year of heating systems/ boiler	Only in Annex 2 Summary	Yes	Not in the EPC form <sup>7</sup>	No	Yes (in annex of EPC)	No	No
Energy sources	Yes	Yes	Yes	No	Yes	Yes	Yes
Usage of renewable energy	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Alternative measures instead of renewable energy	Yes	Yes	Yes (included as 'other source')	No			
Type of ventilation system	Only in Annex 2 Summary	Yes	Not in the EPC form	No	Yes (in annex of EPC)	Yes	Yes
Type of heating system	Only in Annex 2 Summary	Yes	Not in the EPC form	No	Yes (in annex of EPC)	Yes	Yes
Type of cooling system	Only in Annex 2 Summary	Yes	Not in the EPC form	No	Yes (in annex of EPC)	Yes	Yes
Technical details on a ventilation system	Only in Annex 2 Summary	No	Not in the EPC form	No	Yes (in annex of EPC)	Yes	Yes
Technical details on a heating system	Only in Annex 2 Summary	No	Not in the EPC form	No	Yes (in annex of EPC)	Yes	Yes
Technical details on a cooling system	Only in Annex 2 Summary	No	Not in the EPC form	No	Yes (in annex of EPC)	Yes	Yes
<b>Building envelop</b>							
Checkmark or similar for met energy efficient requirements	No	Yes	No	No	Yes		No
Technical details on components of building envelop	Yes – Area, U-value	No	Not in the EPC form	No	Yes (in annex of EPC)	Yes	No

<sup>6</sup> Heating, ventilation and air conditioning

<sup>7</sup> "Not in the EPC form": This information is included in a xml file which is uploaded in the platform for the calculation of the EPC class and EPC issuance.



Element	Bulgaria	Germany	Greece	Hungary <sup>5</sup>	Latvia	Spain	Sweden
<b>Conducted measures</b>							
Information on conducted measures since last issued EPC	No Only in Annex 2 Summary	No	Not in the EPC form	No	No (energy assessor has to show what measures have been done in the building since it was built)		Yes
<b>Renovation recommendations</b>							
Type/ Description of measure	Yes, only the name	yes	Yes	Yes	Yes	Yes	Yes
Amortisation time	No	optional	Yes	No	No	No	No
Estimate of cost	Yes	optional	Yes	No	Yes		Yes
Primary energy demand/ consumption after renovation	Yes, the total value for all the measures	No, new EPC required	No, only 'potential energy class improvement'	Yes	Yes	No, new EPC required	Yes
Final energy demand/ consumption after renovation	Yes	No, new EPC required	Not in the EPC	No	Yes	No, new EPC required	Yes
<b>Additional information</b>							
General information about EPC and their usage	No	Yes	Yes	No		No	No
Glossary	No	Yes	No	No		No	No
Links to the (online) platform or tools for further information	No	No	No	No	No	No	No, Link to the National Board of Housing Building and Planning
Links to detailed energy audits	The certificate is an integral part of the energy audit	No, but remark to contact energy consultant for renovation purposes	No	No	The certificate is an integral part of the energy audit.	No	No, Link to the National Board of Housing Building and Planning
Link/ information for real estate advertisements	No	Yes	No	No	No	No	Yes, Link to the National Board of Housing Building and Planning

Table 25 Overview of EPC elements in EPC forms of partner countries



## 12.4 ANNEX D: Potential elements for enhancement of the EPC form and selection evaluation

This section firstly defines selection criteria for the EPC elements that should be available in all EPCs and can be developed within QualDeEPC. Secondly, each element is analysed on the possibility of implementation, the availability of data, the benefits for the different target groups, a rating overview and a conclusion. Finally, an overview is presented on the elements that can be implemented within QualDeEPC, that are generally recommended for an advanced EPC form and that are not recommended for implementation on a EPC form.

### 12.4.1 Selection criteria

The decision on the EPC elements for enhancement is based on a short selection procedure.

Criteria:

- Included in the current EPC forms of the partner countries
  - Yes
  - Partially (yes/no-fraction)
  - No
- Ease of development for an EPC template by QualDeEPC
  - Easy to develop
  - Development possible, but work required
  - Not possible to develop within the scope of QualDeEPC
- Availability of required data/ information
  - available
  - Partially available
  - No data available
- Relevance for existing buildings needing renovation
  - Relevant
  - Somewhat relevant
  - Not relevant
- Workload for EPC issuers (especially the ones working for WP4)
  - High
  - Medium
  - Low
- Development need for a specific target group

*Does the target group benefit from the element and/or marked this element as important in the questionnaires?*

- Target groups:
  - current building owners or associations (or as represented by consumer protection agencies)
  - future building owners or tenants or tenant associations (or as represented by consumer protection agencies)
  - energy consultants and their associations
  - national policymakers or certification body
  - Financial advisors or institutions



### 12.4.2 Element 1: Checkmark for achieving nZEB standard

#### Development and data availability

The checkmark or similar notation is already included in 4 out of 7 partner countries. If a building's energy performance meets the nZEB standard, can mostly be concluded by comparing the energetic values from the EPC to the definition of the nZEB standard. Hence, it can easily be developed. From 2021 onwards, all new buildings have to be built as nZEB buildings or better according to the European Building Performance Directive (EBPD). Hence, the checkmark might be obsolete in these cases. For existing buildings, the achievability of nZEB standard depends on the definition and on how ambitious it is. In any case, the information may be provided by a yes or no answer field in the form. An example is given in Figure 23.

Figure 23 Checkmark for the achievement of nZEB standard as provided in the Bulgarian EPC form

#### Benefits for the target group

If a specific building's energetic performance meets the nZEB requirements, is somewhat important for current and future building owners and financial advisors, since it might be linked to the market value of the building. For national policymakers and certification bodies, a statistic of nZEB buildings in the country can be important concerning national energy-saving goals. Existing buildings usually do not achieve this standard before renovation and might not be achievable. For EPC issuers, the completion of the nZEB checkmark has a low workload, since calculated energetic performance only needs to be compared to a few target values.

#### Rating

Table 26 Rating of the proposed "Checkmark for achieving nZEB standard" for the improved EPC form

Element	Rating
Included in EPC forms	Partially (4 out of 7)
Ease of development	Easy to develop
Data availability	Available
Relevance for existing buildings	Not relevant
Workload for EPC issuers	Low
Development need for	
current building owners or associations or consumer protection	Somewhat important need
future building owners or tenants or tenant associations (or consumer protection)	Somewhat important need
energy consultants and their associations	Not important
national policymakers or certification body	Important need
Financial advisors or institutions	Somewhat important need





## Conclusion

A checkmark for nZEB standard might be generally recommended. However, for new buildings, the checkmark will become obsolete by 2021. Moreover, the nZEB standard might not be achievable by existing buildings. Hence, it does not need to be implemented in an EPC template by this project as a priority.

### 12.4.3 Element 2: Inclusion of typical classification of specific building types for reference

#### Development and data availability

In most countries, the typical energy usage of specific building types is available in the literature. Examples might be the nZEB standard to be applied from 2021, the current (2020) minimum requirement for newly built single and multiple family homes, or the average of the entire residential building stock. A disadvantage might be that the values can change over time, due to market development and the revision of standards. They also depend on buildings, due to the reference building approach. Hence, exact numbers should be avoided and replaced by a bandwidth.

The German and Latvian EPC form provide references for the energy usage of typical buildings. The German version is located in a separate information box on the same page as the primary and final energy demand or consumption of the actual building. On the Latvian EPC, this information is given on the same scale as the energy usage of the evaluated building (Figure 24).

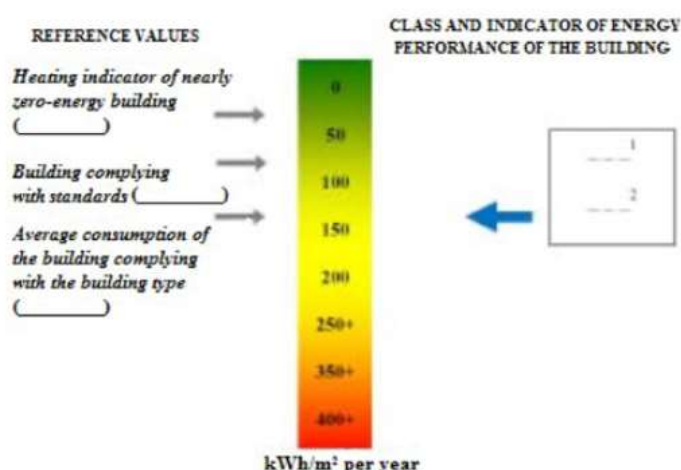


Figure 24 Reference values of building types in current Latvian EPC

#### Benefits for the target group

Reference values for the energy usage of typical building types help current and future building owners to identify the current energetic state of their building compared to buildings that comply with specific standards. Similarly, it might also be useful to financial advisors in judging the value of the real estate. For energy consultants, this information might be somewhat relevant, when explaining the results to their customers. National policymakers or the certification bodies do not have direct advantages from this element for use in monitoring or statistics, but policymakers will benefit indirectly if it induces renovations.



Since the reference scale would be an informative part of the EPC form, and therefore, not be changed or edited by the EPC issuers, there is no additional workload for the EPC issuers.

## Rating

Table 27 Rating of the proposed “Inclusion of typical classification of specific building types for reference” for the improved EPC form

Element	Rating
Included in EPC forms	Partially (2 out of 7)
Ease of development	Development possible
Data availability	Available
Relevance for existing buildings	Relevant
Workload for EPC issuers	Low
Development need for	
current building owners or associations or consumer protection	Important need
future building owners or tenants or tenant associations (or consumer protection)	Important need
energy consultants and their associations	Somewhat important need
national policymakers or certification body	Not important need
Financial advisors or institutions	Somewhat important need

## Conclusion

The inclusion of typical energetic classification of specific building types or categories can be beneficial to some target groups. However, the development of a similar scale for all partner countries and the country-specific values might hold some challenges. Moreover, the reference values can change over time, which is a disadvantage for the validity time of up to 10 years of the EPC forms. Hence, an alternative could be to integrate such references in an information platform, where the values can be explained and updated regularly, and to include a link to this platform on the EPC.

### 12.4.4 Element 3: Inclusion of past metered and/or calculated total annual energy consumption in all EPCs

#### Development and data availability

The energy performance value in kWh/m<sup>2</sup>/yr is not intuitive for potential buyers or tenants of a building, since it will need to be multiplied with the m<sup>2</sup> to find out about the total annual energy consumption as the basis for calculating the energy costs. In modelling-based (asset rating) EPCs, this information is lacking, and mostly no information is provided on the actual real-life annual energy consumption by the current building occupants. In consumption-based (operational rating) EPCs, this information is usually provided in a simple table stating the period, energy source, primary energy factor as well as the metered consumption for heating and DHW for last year up to five years. Annotations should be provided stating that the consumption is dependent on the user profile and weather conditions.



The data availability depends on the metering system installed in the building. For multi-family homes, the actual consumption for a single unit might only be an estimate depending on the floor area. Moreover, in some cases, it might be difficult to differentiate between energy use for heating, cooling, and domestic hot water.

Metered consumption of heating and domestic hot water							
Period		Energy source	Primary energy factor	Energy consumption heating + DHW [kWh]	Energy consumption heating [kWh]	Energy consumption DHW [kWh]	Climate factor
from	to						
01.01.2011	31.12.2011	Erdgas H	1,10	106268	19128	87140	1,16
01.01.2012	31.12.2012	Erdgas H	1,10	114826	20669	94157	1,07
01.01.2013	31.12.2013	Erdgas H	1,10	109422	19696	89726	1,03

Figure 25 Example table for noting annual energy consumption (German EPC)

### Benefits for the target group

For EPCs based on modelling the building, future building owners and tenants often ask for this information, since it relates to the energy costs that can be expected. Similarly, financial advisors can use this information to estimate energy costs. For current building owners or energy consultants, this information might be somewhat beneficial, when analysing energy saving potentials. No direct benefits are provided for national policy and certification bodies.

Depending on the metering system installed in the building and its accessibility, the workload for EPC issuers might be at a low or medium to a high level.

### Rating

Table 28 Rating of the proposed “Inclusion of past metered and/or calculated total annual energy consumption in all EPCs” for the improved EPC form

Element	Rating
Included in EPC forms	Partially / in some countries or types of EPCs
Ease of development	Development possible
Data availability	Somewhat available
Relevance for existing buildings	Relevant
Workload for EPC issuers	Low/Medium to high
Development need for	
current building owners or associations or consumer protection	Somewhat important need
future building owners or tenants or tenant associations (or consumer protection)	Important need
energy consultants and their associations	Somewhat important need
national policymakers or certification body	Not so important need
Financial advisors or institutions	Somewhat important need

### Conclusion



A simple table for the past annual energy consumption and/or the modelled total annual energy consumption will be developed in this project. Exchange with the U-Cert project will be sought.

#### 12.4.5 Element 4: Details on current energy efficiency levels for building envelope and building HVAC system incl. renewable energies

##### Development and data availability

As mention in section 7.1.1, most EPCs do not include detailed information on the building envelope and HVAC system. For existing buildings, this information is especially relevant to identify the strengths and weaknesses of the building. In some partner countries, this information is included in the annexes to the EPC, which might not be generally understandable. A systematic approach can be found in a past German project called “dena Gütesiegel” and in the current EPC renewal process in Hungary. Here, the components of the building envelope and technical system are rated from “bad” to “good” using color-coded information. The availability of boundary values for evaluating several building components varies among the partner countries. A general template and a simple country-specific version of this component evaluation can be done in this project, but all partners need to do some research.

##### Benefits for the target group

Detailed information on the building components is especially relevant for current and future building owners as well as financial advisors to estimate the value of a real estate and the need for investments. In countries, where the EPC issuers are not necessarily highly qualified energy consultants and no detailed energy audit has been required for issuing an EPC until now, this evaluation might compete a detailed energy audit. However, a first evaluation might also be beneficial for future energy audits.

The detailed evaluation might also be somewhat important for the national policymakers to gain a more precise insight into the building stock.

For EPC issuers, this element can result in a high workload, if details of the building components are not easily available and/or on-site visits are not possible. For example, in consumption-based (operational rating) EPCs, the information needed may not be required and collected for EPC issuance in current schemes.

##### Rating

Table 29 Rating of the proposed “Details on current energy efficiency levels for building envelope and building HVAC system incl. renewable energies” for the improved EPC form

Element	Rating
Included in EPC forms	Partially
Ease of development	Development possible but work required
Data availability	Partially available
Relevance for existing buildings	Relevant
Workload for EPC issuers	High
Development need for	
current building owners or associations or consumer protection	Somewhat important need
future building owners or tenants or tenant associations (or consumer protection)	Important need



energy consultants and their associations	Somewhat important need
national policymakers or certification body	Somewhat important need
Financial advisors or institutions	Somewhat important need

## Conclusion

This project can develop a simple version of a systematic approach to evaluating building components. This version might then be extended on a national level.

### 12.4.6 Element 5: Display of improved classifications and energy performance for a specific set of renovation recommendations

#### Development and data availability

Most EPC issuers use a software to calculate the energy usage of a building, which then translates to the energy class. In the software, the renovation recommendations mostly will be implemented and result in a new value for energy performance and hence, energy class. The set of renovation recommendations should be kept within a cost-effective frame, according to the EPBD.

#### Benefits for the target group

For current and future building owners and financial advisors, the display of a possibly higher energy class is highly beneficial, since it shows the potential of the building when renovated. Also, the national policymakers could use the information to check if energy saving goals can realistically be reached.

For EPC issuers, the related workload corresponds to the usability of the software, and whether the data for calculating the new classification and energy performance is available.

#### Rating

*Table 30 Rating of the proposed “Display of improved classifications and energy performance for a specific set of renovation recommendations” for the improved EPC form*

Element	Rating
Included in EPC forms	Partially
Ease of development	Easy to develop in asset rating EPC schemes, may be more complex in operational rating scheme
Data availability	Available in asset rating EPC schemes may be more difficult in the operational rating scheme
Relevance for existing buildings	Relevant
Workload for EPC issuers	Medium to high
Development need for	
current building owners or associations or consumer protection	Important need
future building owners or tenants or tenant associations (or consumer protection)	Important need
energy consultants and their associations	Not so important need
national policymakers or certification body	Important need



Financial advisors or institutions	Important need
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## Conclusion

The project can develop this element.

### 12.4.7 Element 6: Element 5 + energy savings in kWh/year

#### Development and data availability

In element 5, improved energy performance is calculated for a set of renovation recommendations. The difference between the original and improved value can be translated into energy saving in kWh/year using the provided area of the building. Since this energy-saving value is an estimation, which also depends on the number and user profile of the building's occupants, a remark on this issue should be added as a footnote or similar.

#### Benefits for the target group

The display of possible energy savings is especially important for current and future building owners and financial advisors. Similar to element 5, national policymakers could gain a more realistic view of the energy-saving potential of the building stock.

The workload for EPC issuers might be low to medium depending on the developed method, particularly if element 5 is already introduced.

## Rating

Table 31 Rating of the proposed "Element 5 + energy savings in kWh/year" for the improved EPC form

Element	Rating
Included in EPC forms	Partially (1 out of 7)
Ease of development	Possible within the scope of QualDeEPC, if element 5 is developed
Data availability	Partially available
Relevance for existing buildings	Relevant
Workload for EPC issuers	Low to medium
Development need for	
current building owners or associations or consumer protection	Important need
future building owners or tenants or tenant associations (or consumer protection)	Important need
energy consultants and their associations	Not so important need
national policymakers or certification body	Somewhat important need
Financial advisors or institutions	Important need

## Conclusion

The information about potential energy savings in kWh per year can be developed within the scope of QualDeEPC.



### 12.4.8 Element 7: Deep energy renovation recommendations by component and influence on components energy efficiency + cost estimation

#### Development and data availability

A systematic approach for presenting deep energy renovation recommendations is missing in the EPC forms of the project's partner countries. As these recommendations are already part of this project, also the respective element of the EPC form should be advanced. Similarly to Element 4, examples can be found in a German project called "dena Gütesiegel" and in the EPC renewal process in Hungary. Specific values for the target values of each building component need to be researched and are dependent on the country and climate zone.

An estimation of the costs could be presented as a "category of expense", e.g. ranging from "low" to "moderate" to "expensive" investment. However, this estimation is difficult to obtain.

#### Benefits for the target group

This element will provide current and future building owners and financial advisors with more detailed information on renovation options with high impact on overall energy usage and an estimation of cost categories.

Depending on the availability of the individual building details, the workload for EPC issuers can be medium to high. If specific target values are generally given, the workload can be kept lower.

#### Rating

Table 32 Rating of the proposed "Deep energy renovation recommendations by component and influence on components energy efficiency + cost estimation" for the improved EPC form

Element	Rating
Included in EPC forms	No (may soon be introduced in Hungary)
Ease of development	Development possible, but work required
Data availability	Partially available
Relevance for existing buildings	Relevant
Workload for EPC issuers	Medium to high
Development need for	
current building owners or associations or consumer protection	Somewhat important need
future building owners or tenants or tenant associations (or consumer protection)	Important need
energy consultants and their associations	Not so important need
national policymakers or certification body	Somewhat important need
Financial advisors or institutions	Important need

#### Conclusion

This project can develop a simple version of a systematic approach for presenting deep renovation recommendations by component.



### 12.4.9 Element 8: Information on a useful combination of renovations or possibility for stepwise implementation

#### Development and data availability

On most currently available EPC forms, there is no dedicated space for the information on useful renovation combinations or the stepwise implementation. This information would advance the EPC to a simple form of an individual building renovation roadmap. Since this information will depend on the individual project, an empty field for this purpose will be integrated.

#### Benefits for the target group

The information on the useful combination of renovations and the possibility for stepwise implementation is an important need for (current and future) building owners and financial advisors. Energy consultants that perform a detailed energy audit might use this information as a basis for their work.

The workload for EPC issuers will be high if the renovation recommendations have to be evaluated for the specific building for this element alone. If they are already developed for another element or in the existing schemes, the additional workload for their combination and assessment as to stepwise implementation will be low.

#### Rating

Table 33 Rating of the proposed “Information on the useful combination of renovations or possibility for stepwise implementation” for the improved EPC form

Element	Rating
Included in EPC forms	Partially
Ease of development	Easy to develop
Data availability	Available
Relevance for existing buildings	Relevant
Workload for EPC issuers	Low or High
Development need for	
current building owners or associations or consumer protection	Important development need
future building owners or tenants or tenant associations (or consumer protection)	Important development need
energy consultants and their associations	Somewhat important need
national policymakers or certification body	Not so important need
Financial advisors or institutions	Important development need

#### Conclusion

A dedicated field in the EPC form for the information on useful combinations of renovations and the possibility for a stepwise implementation will be developed in this project.





#### 12.4.10 *Element 9: General information about EPC and their usage (regulatory basis)*

##### **Development and data availability**

The description of the EPC process and form is usually provided in national regulation text, which is not generally understandable. The formulation of this information in an easily understandable language might require some work for all partners. The whole glossary can then be issued in an information box or on a separate page of the EPC form, or by a link to a Deep Renovation Network Platform.

##### **Benefits for the target group**

Current and future building owners and tenants can gain a better understanding of the EPC and its purpose. Energy consultants and other professionals usually obtain this information through their education. For national policymakers, it might be important that the users of EPCs understand the content for high acceptability of EPCs.

##### **Rating**

Table 34 *Rating of the proposed “General information about EPC and their usage (regulatory basis)” for the improved EPC form*

Element	Rating
Included in EPC forms	Partially
Ease of development	Easy to develop
Data availability	Available
Relevance for existing buildings	Somewhat relevant
Workload for EPC issuers	None
Development need for	
current building owners or associations or consumer protection	Important need
future building owners or tenants or tenant associations (or consumer protection)	Important need
energy consultants and their associations	Not so important need
national policymakers or certification body	Important need
Financial advisors or institutions	Somewhat important need

##### **Conclusion**

The implementation of an information box about the EPC in general on the EPC form is recommended. In QualDeEPC, this information will be covered by the link to the Deep Renovation Network Platform, for which this information will be developed.

#### 12.4.11 *Element 10: Link to Deep Renovation Network Platform*

##### **Development and data availability**

In the EPCs of the project’s partner countries, there is no link to a deep renovation network platform. If a platform is available, then the link can be easily implemented in the EPC forms using a simple web link or QR-code. However, since the EPCs are usually valid for 10 years, the platform would be required to be maintained in the long term.

##### **Benefits for the target group**



For (future) building owners, an official link to validated information is highly beneficial to obtain detailed knowledge building components, their renovation and costs. Besides, for financial advisors, and up-to-date information platform can be important for the same reasons. Building owners and energy consultants can connect more easily via such a platform. National policymakers and the certification body could use the platform to place updates on the regulations.

## Rating

Table 35 Rating of the proposed “Link to Deep Renovation Network Platform” for the improved EPC form

Element	Rating
Included in EPC forms	Partially
Ease of development	Easy to develop
Data availability	Partially available
Relevance for existing buildings	Relevant
Workload for EPC issuers	None
Development need for	
current building owners or associations or consumer protection	Somewhat important need
future building owners or tenants or tenant associations (or consumer protection)	Important need
energy consultants and their associations	Somewhat important need
national policymakers or certification body	Somewhat important need
Financial advisors or institutions	Somewhat important need

## Conclusion

An overview of national links to already existing information platforms will be developed in this project and implemented in the enhanced EPC form. At the end of this project, these links might be substituted for the link to the Deep Renovation Network Platforms developed in this project.

### 12.4.12 Element 11: Glossary of the most important terms

#### Development and data availability

The terms and definitions used in the EPC form are usually provided in the national regulations and standards. The formulation of this information in an easily understandable language might require some work for all partners. The whole glossary can then be issued on an extra page of the EPC form as is done in Germany.

#### Benefits for the target group

For (future) building owners, it is important to understand the EPC form and its content to make an informed decision on the necessity and extent of an energy-efficient renovation. Energy consultants and other professionals usually obtain this information through their education. For national policymakers, it might be important that the users of EPCs understand the content for high acceptability of EPCs.

## Rating



Table 36 Rating of the proposed “Glossary of most important terms” for the improved EPC form

Element	Rating
Included in EPC forms	Partially (1 out of 7)
Ease of development	Possible, work required
Data availability	Available
Relevance for existing buildings	Somewhat relevant
Workload for EPC issuers	None
Development need for	
current building owners or associations or consumer protection	Important need
future building owners or tenants or tenant associations (or consumer protection)	Important need
energy consultants and their associations	Not so important need
national policymakers or certification body	Important need
Financial advisors or institutions	Somewhat important need

## Conclusion

The implementation of a glossary in the EPC form is generally recommended. In QualDeEPC, this information will be covered by the link to the Deep Renovation Network Platform.

### 12.4.13 Element 12: Link/ information on funding programs

#### Development and data availability

Funding programs help building owners to implement energy-efficient measures in a building that might otherwise have long payback times. In most cases, funding programs are promoted on a large scale, hence the data is usually easily available. A link to an official website could be easily implemented on the EPC form via QR-code or similar. However, funding programs change their conditions regularly and are largely depending on the current political goals.

#### Benefits for the target group

The primary target group for funding programs are (current and future) building owners. Additionally, the information about funding possibilities is also relevant to financial advisors to decide on possible loans and their conditions. For national policymakers, the promotion of funding programs aims to reach the national energy-saving goals. Energy consultants have to stay up-to-date on funding programs, but obtain this knowledge through training or specialized websites.



## Rating

Table 37 Rating of the proposed “Link/ information on funding programs” for the improved EPC form

Element	Rating
Included in EPC forms	No
Ease of development	Easy to develop
Data availability	Available
Relevance for existing buildings	Relevant
Workload for EPC issuers	None
Development need for	
current building owners or associations or consumer protection	Somewhat important need
future building owners or tenants or tenant associations (or consumer protection)	Important need
energy consultants and their associations	Somewhat important
national policymakers or certification body	Important need
Financial advisors or institutions	Somewhat important need

## Conclusion

Because of the changeability of funding programs, it is not recommended to implement a direct link to national funding programs on the EPC. This information might be rather provided on the Deep Renovation Network Platform, which would be subject to regular maintenance. Moreover, energy consultants (including most EPC issuers) are usually required to obtain knowledge about the latest funding programs.

## 12.5 ANNEX E: Current regulations on use of EPC data in real-estate advertisements and activities for compliance in QualDeEPC countries

### 12.5.1 Legal requirements for the mandatory use of EPCs or energy-related EPC data in real estate advertisements in QualDeEPC partner countries

The following table summarizes information on the requirements in the national legislation with regards to mandatory use of EPCs (or its contents) to be published in real estate advertisements in QualDeEPC partner countries, provided by the partners for Deliverables D2.1/D2.4 and this Green paper. Except in Latvia, it is mandatory to use specified content of the EPCs in real estate advertisements in all other QualDeEPC partner countries. However, except in Sweden, there do not appear to be concrete advertising guidelines, such as the format of display of EPCs (or its contents). This lack may make it hard to include or find EPCs related information in the advertisements. Furthermore, the displayed information varies in each country.



Table 38 Existing legal requirements for mandatory use of EPCs in real estate advertisements in QualDeEPC partner countries

QualDeEPC partner country	Existing legal requirements for mandatory use of EPCs in real estate advertisements	Concrete advertising requirements (e.g., which elements of the EPC are to be displayed)
Bulgaria	The Energy Efficiency Act states that the specific annual primary energy consumption indicator - kWh/m <sup>2</sup> , indicated in the energy performance certificate, shall be indicated in all advertisements, as per the existing Energy Efficiency Act.	<ul style="list-style-type: none"> <li>Specific annual primary energy consumption indicator in kWh/m<sup>2</sup></li> </ul>
Germany	Due to the implementation of a requirement from the EPBD, sellers and landlords are obliged to include certain information from the energy performance certificate in advertisements in commercial media under § 87 of the GEG.	<ul style="list-style-type: none"> <li>The type of energy certificate ('demand'/asset rating or 'consumption'/operational rating certificate)</li> <li>The final energy demand/consumption in kWh/m<sup>2</sup>/year</li> <li>The essential energy source</li> <li>For residential buildings only: the year of construction of the building</li> <li>For residential buildings only: the efficiency class</li> <li>In the case of non-residential buildings, the energy performance parameter for electricity</li> </ul>
Greece	According to the national legislation (L.4122/2013, Transposition of the DIRECTIVE 2010/31/EU on the energy performance of buildings), it is described that it is required to present the energy efficiency index (energy classification) resulting from the energy performance certificate, in case that it is available, in all commercial advertisements and listings when putting up for sale or renting a building or building unit.	<ul style="list-style-type: none"> <li>Energy efficiency index (energy classification)</li> </ul>
Hungary	In Hungary (decree 176/2008) there is a requirement in the regulation that states <i>"When a building or apartment unit is offered for sale or rent, the advertisement shall indicate the EPC rating of the building or apartment unit if a certificate is available."</i>	<ul style="list-style-type: none"> <li>EPC rating of the building or apartment unit</li> </ul>
Latvia	In the legislation, the mandatory use of EPCs in real estate advertisements is required.	<ul style="list-style-type: none"> <li>In the advertisement regarding the sale, rent or lease of the building or building unit shall indicate the energy performance indicators of the building or building unit, if certification of the energy performance of the building has been performed under the procedures specified in Law On the Energy Performance of Buildings</li> <li>The purchaser, tenant or lessee of an existing building or building unit or the purchaser of a building to be designed is entitled to become acquainted with the energy performance certificate of the building or the temporary energy performance certificate of the building if certification of the energy performance of the building is anticipated for the relevant building or building unit under the requirements</li> </ul>



QualDeEPC partner country	Existing legal requirements for mandatory use of EPCs in real estate advertisements	Concrete advertising requirements (e.g., which elements of the EPC are to be displayed)
		of Law On the Energy Performance of Buildings
Spain	According to the new modifications of RD 235/2013 of 31/07/2019 the article 14, for all advertised buildings for putting for sale or renting, the public information must include information of energy classification according to the energy certification of the building. Also indicating the energy label of the building should be included in the promotion, advertisement and publicity: web, catalogues, press. Information can be available in text, image, visual, audio and audio-visual.	The energy label of the apartment, house, or building: <ul style="list-style-type: none"> <li>• Energy classification</li> <li>• Coloured arrows</li> <li>• Energy class</li> <li>• Energy consumption primary non-renewable energy (kWh/m<sup>2</sup>/yr)</li> <li>• CO<sub>2</sub> Emissions (kg CO<sub>2</sub>/m<sup>2</sup>/yr)</li> </ul>
Sweden	In advertisements, the energy performance of a building must be symbolised by a house with a colour (green to red) and letter (A to G) that matches the energy classification.	<ul style="list-style-type: none"> <li>• Energy classification from the EPC</li> </ul>

### 12.5.2 Controlling and enforcing the mandatory use of EPCs in real estate advertisements in QualDePC partner countries: direct compliance measures

A direct way of increasing compliance is to appoint and provide sufficient resources to designated authorities and awarding penalties for non-compliance. Section 9.3 below provides more detail on these two potential measures.

Table 39 shows the status of existing nodal authorities, penal provisions and remarks on the existing level, processes, and instruments of control of implementation of the national requirements.

Table 39 Controlling and enforcing the mandatory use of EPCs in real estate advertisements in QualDePC partner countries: direct compliance measures

QualDeEPC partner country	Nodal authority	Penal provisions	Remarks on the existing level, processes, and instruments of control of implementation of the national requirements
Bulgaria	Sustainable Energy Development Agency is the EPC control body.	No available information	No available information
Germany	The control and enforcement of the provisions of the Building Energy Act (GEG) is the responsibility of the federal states. The federal states regulate which authorities are responsible for administrative offenses. The competent authorities	If the mandatory information is not or not completely included in the real estate advertisement, this constitutes an administrative offense and can be punished under the GEG with a fine of up to 15,000 Euros.	No recent available information



QualDeEPC partner country	Nodal authority	Penal provisions	Remarks on the existing level, processes, and instruments of control of implementation of the national requirements
	in the federal states are obliged to investigate any administrative offenses reported.		
Greece	The body responsible for the monitoring of implementation and compliance control with the regulation in force is the Hellenic Ministry of Environment and Energy	No penal provisions are in force up to date	This provision of the Law is inactive in terms of everyday real estate practice. Furthermore, according to Hellenic NECP submitted to the EC, the enforcement provision mentioned in table 1 will be enforced by 01.01.2021. No specific advertising guidelines are available.
Hungary	There is no nodal body nominated for the task.	No penal provisions are in force up to date	In practice advertisements are not checked and - without any legal consequences - in most advertisements, there are no EPC ratings included.
Latvia	The supervision and control of the performance of duties shall be performed by the Consumer Rights Protection Center (CRPC) in compliance with the regulatory enactments regulating advertising and consumer rights protection	In theory, a monetary fine can be applied.	In the legislation, the mandatory use of EPCs in real estate advertisements is required. In real life, this system does not work at all. Based on information from CRPC there have been no cases when consumers have complained about missing EPCs when renting or buying a property (building or an apartment with individual heat metering). According to CRPC active enforcement of the requirement to show the EPC or energy performance indicator in advertisements will only happen when a complaint from a consumer is received.
Spain	The control of implementation is managed by the Regional Governments. The sanctions are also managed by them.	<p>The legislation at national level states 3 types: high, medium and low according to RD 235/2013 and RD 7/2015 and RD2013.</p> <p>Fines can be 601-1,000 Euros if no information on the label is given in the household sale or renting advertisement.</p> <p>If the data of the energy class is false or the class there is but the EPC is missing - not done neither registered -this is considered by law as serious and the penalties are 1,001 to 6,000 €.</p>	The levels of controls are different between the Regional Governments. In general, due to lack of resources very few compliance actions are carried out.
Sweden	The National Board of Housing Building and Planning is the surveillance authority.	The National Board of Housing Building and Planning can issue fines if the requirements is not followed.	The most important instrument is the advertisement guidelines. They are on the homepage of the National Board of Housing Building and Planning and are easy to find



QualDeEPC partner country	Nodal authority	Penal provisions	Remarks on the existing level, processes, and instruments of control of implementation of the national requirements
			by brokers or building owners in Sweden. Brokers are well informed that the EPC is mandatory, and there is nearly always a link to the EPC to each ad on the internet, and the EPC is distributed at the showing. Generally, the brokers go through all documents regarding the building, including the EPC, and the buyers should sign that they have received this information.
	Information available		
	Information unavailable		

### 12.5.3 Controlling and enforcing the mandatory use EPCs in real estate advertisements in QualDePC partner countries: indirect compliance measures<sup>8</sup>

In most of the EU member states, and all QualDeEPC partner countries, the EPBD has been transposed, so that national law mandates that EPC be displayed in the sale or rental process of a building. This requirement to *possess* an EPC and to *present it* to potential buyers or tenants of a building or parts of it can be seen as measures indirectly supporting the compliance with the requirement to *include EPC data in advertisements*. Furthermore, procedures for verification and sanctions for non-compliance are put in place to ensure the compliance of this provision. The following table shows the current provisions for verification and sanctions for non-compliance for obtaining and showing EPC during the sale and rental of buildings in QualDeEPC countries.

#### 12.5.3.1 Sanctions for building owners missing to obtain/present an EPC are in place

The use of EPCs in building markets can be improved by placing sanctions for building owners for missing to obtain/present an EPC. This may be combined with rewards for compliance and creating market demand/pressure for presenting an EPC (which should be of high quality), in order to improve compliance further, since the control of compliance may not be easy. Regarding market pressure, an example from Austria was found: If no energy certificate is presented and the building does not have an overall energy efficiency corresponding to its age and type, the buyer or tenant can make warranty claims (in the case of rentals this means a reduction in rent). The sanctions for building owners for missing to obtain/present an EPC are often defined in the legislation governing EPCs, but the degree of control and implementation may vary between member states. In most of the member states, there are sanctions for building owners failing to own or present an EPC, when required/on-demand. Among QualDeEPC countries, such sanctions are present at least in Bulgaria and Hungary.

<sup>8</sup> Only direct compliance measures are in the scope for improvement under the QualDeEPC project. Indirect compliance measures are provided only for information purposes, as they are related to the direct measures, and for the attention of the relevant stakeholders





### 12.5.3.2 Presenting EPC to official building sales bodies or permit authorities as an obligatory/mandatory measure

Another way to improve compliance with the requirement to own an EPC when selling a property is to make it obligatory/mandatory to present the EPC to official building sales bodies, such as notaries when selling buildings or parts thereof, as practiced in Greece, Hungary and Sweden, as well as several other EU member states, and while applying for a building permit during new construction.

### 12.5.3.3 A public database of EPCs

Most EU member states have implemented databases of all issued EPCs. The general public can access many of them, but sometimes the access is limited for special groups like energy advisors etc. The ways to access databases are also different across the countries. Sometimes inserting the street plus housing number is sufficient (like in the UK), sometimes the EPC number has to be inserted (like in Ireland). Furthermore, the amount of data accessible from a public database is different. In some of the countries, a full EPC along with the recommendations can be accessed, while in the others, the publicly available information is limited to key values, such as EPC rating class, energy consumption and the full EPC is only available for the building owner (like in the Netherlands). Among QualDeEPC countries, databases of EPCs exist in all of them except Germany.

### 12.5.3.4 Verification of the accuracy of EPCs (quality control of EPCs)

In most countries, accuracy control is based on the sample of EPCs, i.e., a statistically significant percentage of EPCs is verified. However, in few countries such as France and the Czech Republic, control is based on EPC assessors, i.e., a statistically significant percentage of EPC assessors/all EPC assessors are verified, periodically. Either way, practically, in the majority of the member states, both EPCs and assessors are controlled. Quality checks on EPCs include accuracy of the input data and results, calculation methodology used. Quality checks on assessors include their certification, history of errors, and quality of recommendations. However, the basis of quality checks might vary across member states. Among QualDeEPC countries, measures for quality control of both EPCs and assessors are in place in Bulgaria, Greece, Latvia, Spain and Sweden; while measures for quality control of EPCs are in place in Germany and Hungary.

Achieving C or C\* level control of EPC assessments for the sample according to EPBD further ensures quality control of EPCs. The C level check includes a full check of input data, calculation results, and recommendations; the C\* level includes an additional check through an on-site visit if C level has shown major deviations. The majority of the member states have C level controls. Among QualDeEPC partner countries, Bulgaria, Germany, Greece, and Hungary have C\* level controls, while available information suggests Latvia and Spain have neither C nor C\* level controls.



Table 40 Controlling and enforcing the mandatory use EPCs in real estate advertisements in QualDePC partner countries: indirect compliance measures

	Bulgaria	Germany	Greece	Hungary	Latvia	Spain	Sweden
Sanctions for building owners missing to obtain/present an EPC are in place							
Presentation of EPCs to official building sales bodies, such as notaries, is mandatory for sales of buildings							
Existence of a public database of EPCs							
Verification of the accuracy of EPCs (quality control of EPCs)							
	Available						
	Unavailable						

