D5.3 Guidebook for improved EPCs presenting the project's proposal for an enhanced and converging EPC assessment and certification scheme

Consolidated results

QualDeEPC H2020 project

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Table 3: Document History

ABBREVIATIONS

DHW: Domestic hot water

DRNP: Deep Renovation Network Platform

EBPD: Energy performance of buildings directive

EPC: Energy performance certificate

HVAC: Heating, ventilation, and air conditioning

MS: Member State

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

ENERGIAKLUB: Energiaklub Szakpolitikai Intezet Modszertani Kozpont Egyesulet

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

FEDARENE: Federation euopeenne des agencies et des regions pour l'energie et l'environnement

ESCAN: Escan SL

CIT ENERGY MANAGEMENT AB

BME: Budapest University of Technology and Economics

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PUBLISHABLE SUMMARY

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.

This report serves as a compilation of the project's proposal for an enhanced and converging EPC assessment and certification scheme. It aims to provide a detailed description on the set of practical concepts, policy proposals, and tools for an enhanced EPC scheme towards deep renovation, developed by the QualDeEPC project. The project's substantial proposals both on EU and national level are presented in a comprehensive and rational way, guiding the relevant stakeholders, in particular the policy makers and competed bodies, on which steps need to be followed so as the proposals to be adapted and how the specific values can be determined in MSs. Furthermore, this report includes the project's proposal for defining "Deep Energy Renovation" based on a modified nZEB-based approach.

The project's priorities A) to G) addressed are presented in the following order in this document, reflecting the importance of the enhanced EPC template form and the training of EPC assessors in such schemes:

A) Improving the recommendations for renovation, which are provided on the EPCs, towards deep energy renovation;
E) High user-friendliness of the EPC, by way of an enhanced EPC template form, including an introduction of the proposed "Energy Rating" indicator;
D) Regular mandatory EPC assessor training or examination on assessment and renovation recommendations, required for certification/accreditation and registry;
B) Online tool for comparing EPC recommendations to deep energy renovation recommendations;
C) Creating Deep Renovation Network Platforms (DRNPs);
F) & G) Voluntary/mandatory advertising guidelines for EPCs and Improving compliance with the mandatory use of EPCs in real estate advertisement.

TABLE OF CONTENTS

1 INTRODUCTION 13

2 QUALDEEPC GUIDANCE FOR IMPROVED EPCS AT EU LEVEL 15

2.1 QualDeEPC proposal for defining 'deep energy renovation' 15

2.2 Improving the recommendations for renovation provided on the EPCs towards deep energy renovation 16

2.3 High user-friendliness of the EPC 19

2.3.1 Resulting template for an enhanced and more user-friendly EPC form 21

2.3.2 High user-friendliness of the EPC – proposed template – results of testing 27

2.4 Regular mandatory EPC assessor training 31

2.4.1 General Policy Proposal and framework 31

2.4.2 Training content for regular training workshops or seminars 31

2.4.3 Quality control of issued EPCs for learning 33

2.5 Online tool for comparing EPC recommendations to deep energy renovation recommendations 34

2.5.1 Input parameters 34

2.5.2 Results 49

2.6 Creating Deep Renovation Network Platforms (DRNPs) 58

2.6.1 QualDeEPC general policy recommendations 72

2.7 Voluntary/mandatory advertising guidelines for EPCs & Improving compliance with the mandatory use of EPCs in real estate advertisements 73

2.7.1 Proposal for voluntary advertising guidelines and their use 73

2.7.2 Proposal for legislation making their use mandatory 74

2.7.3 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 74

3 QUALDEEPC GUIDANCE FOR IMPROVED EPCS AT NATIONAL LEVEL 76

3.1 Bulgaria 76

3.1.1 Defining 'Deep Energy Renovation' in Bulgaria in the framework of QualDeEPC 79

3.1.2 Adopting the Recommendations for renovation provided in the EPCs towards deep energy renovation 79

3.1.3 High User-Friendliness Of The EPC - Adapted enhanced EPC form in Bulgarian context 82

3.1.4 Regular Mandatory EPC Assessor Training 85

3.1.5 Online tool for comparing EPC recommendations to deep energy renovation recommendations 86

3.1.6 Deep Renovation Network Platform 87

3.1.7 Voluntary/mandatory advertising guidelines for EPCs & Improving compliance with the mandatory use of EPCs in real estate advertisements 88

3.2 Germany 90

3.2.1 Defining 'Deep Energy Renovation' in Germany in the framework of QualDeEPC 91

3.2.2 Adopting the Recommendations for renovation provided in the EPCs towards deep energy renovation 92

3.2.3 High User-Friendliness Of The EPC - Adapted enhanced EPC form in German context 94

3.2.4 Regular Mandatory EPC Assessor Training 97

3.2.5 Online tool for comparing EPC recommendations to deep energy renovation recommendations 99

3.2.6 Deep Renovation Network Platform 100

3.2.7 Voluntary/mandatory advertising guidelines for EPCs & Improving compliance with the mandatory use of EPCs in real estate advertisements 101
3.3 Greece 103
3.3.1 Defining 'Deep Energy Renovation' in Greece in the framework of QualDeEPC 104
3.3.2 Adopting the Recommendations for renovation provided in the EPCs towards deep energy renovation 105
3.3.3 High User-Friendliness Of The EPC - Adapted enhanced EPC form in Greek context 108
3.3.4 Regular Mandatory EPC Assessor Training 111
3.3.5 Online tool for comparing EPC recommendations to deep energy renovation recommendations 112
3.3.6 Deep Renovation Network Platform 112
3.3.7 Voluntary/mandatory advertising guidelines for EPCs & Improving compliance with the mandatory use of EPCs in real estate advertisements 114
3.4 Hungary 116
3.4.1 Defining 'Deep Energy Renovation' in Hungary in the framework of QualDeEPC 117
3.4.2 Adopting the Recommendations for renovation provided in the EPCs towards deep energy renovation 118
3.4.3 High User-Friendliness Of The EPC - Adapted enhanced EPC form in Hungarian context 121
3.4.4 Regular Mandatory EPC Assessor Training 126
3.4.5 Online tool for comparing EPC recommendations to deep energy renovation recommendations 127
3.4.6 Deep Renovation Network Platform 133
3.4.7 Voluntary/mandatory advertising guidelines for EPCs & Improving compliance with the mandatory use of EPCs in real estate advertisements 135
3.5 Latvia 138
3.5.1 Defining 'Deep Energy Renovation' in Latvia in the framework of QualDeEPC 139
3.5.2 Adopting the Recommendations for renovation provided in the EPCs towards deep energy renovation 139
3.5.3 High User-Friendliness Of The EPC - Adapted enhanced EPC form in Latvian context 142
3.5.4 Regular Mandatory EPC Assessor Training 145
3.5.5 Online tool for comparing EPC recommendations to deep energy renovation recommendations 147
3.5.6 Deep Renovation Network Platform 148
3.5.7 Voluntary/mandatory advertising guidelines for EPCs & Improving compliance with the mandatory use of EPCs in real estate advertisements 149
3.6 Spain 150
3.6.1 Defining 'Deep Energy Renovation' in Spain in the framework of QualDeEPC 152
3.6.2 Adopting the Recommendations for renovation provided in the EPCs towards deep energy renovation 153
3.6.3 High User-Friendliness of the EPC - Adapted enhanced EPC form in Spanish context 158
3.6.4 Regular Mandatory EPC Assessor Training 164
3.6.5 Online tool for comparing EPC recommendations to deep energy renovation recommendations 165
3.6.6 Deep Renovation Network Platform 166
3.6.7 Voluntary/mandatory advertising guidelines for EPCs & Improving compliance with the mandatory use of EPCs in real estate advertisements 168
3.7 Sweden 170
3.7.1 Defining 'Deep Energy Renovation' in Sweden in the framework of QualDeEPC 170
3.7.2 Adopting the Recommendations for renovation provided in the EPCs towards deep energy renovation 171
3.7.3 High User-Friendliness Of The EPC - Adapted enhanced EPC form in Swedish context 174
3.7.4 Regular Mandatory EPC Assessor Training 180

3.7.5 Online tool for comparing EPC recommendations to deep energy renovation recommendations 181
3.7.6 Deep Renovation Network Platform 181
3.7.7 Voluntary/mandatory advertising guidelines for EPCs & Improving compliance with the mandatory use of EPCs in real estate advertisements 182

4 CONCLUSIONS 183

5 REFERENCES 184

6 ANNEXES 185
Annex 1: DRNP Policy Proposal for Bulgaria 186
Annex 2: DRNP Policy Proposal for Germany 190
Annex 3: DRNP Policy Proposal for Greece 193
Annex 4: DRNP Policy Proposal for Hungary 198
Annex 5: DRNP Policy Proposal for Latvia 201
Annex 6: DRNP Policy Proposal for Spain 204
Annex 7: DRNP Policy Proposal for Sweden 208

INDEX OF TABLES

Table 1: Document Factsheet 2
Table 2: Document Status 2
Table 3: Document History 3
Table 4: Deep energy renovation recommendations by QualDeEPC 19
Table 5: List of residential building types available in the QualDeEPC mastertool 36
Table 6: Input selection for heat transmission coefficients in W/m²K for insulation of ceiling of an unheated basement (in residential buildings) 39
Table 7: Input selection for external wall 40
Table 8: Input selection for heat transmission coefficients in W/m²K for roof or attic insulation (in residential buildings) 41
Table 9: Input selection for heat transmission coefficients in W/m²K for standard windows (in residential buildings) 43
Table 10: Input selection for heating systems (in residential buildings) 44
Table 11: Comparison of measures to improve cooling systems (in residential buildings) 45
Table 12: Mechanical Ventilation system options for heating and cooling systems 46
Table 13: Selection input for DHW systems (in residential buildings) 47
Table 14: Input selection for shading (in residential buildings) 48
Table 15: Comparison of measures to integrate renewable energy sources (in residential buildings) 48
Table 16: QualDeEPC Mastertool recommendations towards deep renovation 51
Table 17: Basic part of the DRNP 60
Table 18: Extended part of the DRNP 69
Table 19: Proposal for guidelines for displaying EPCs (or its contents) in real estate advertisements 74
Table 20: Ways to improve compliance with the mandatory use of EPCs in real estate advertisements by an effective controlling and enforcing 75
Table 21: Overview of the different aspects for adapting QualDeEPC Deep Energy Renovation Recommendations policy proposal in Bulgaria 76
Table 22: Deep Energy Renovation Recommendations and specific values for Bulgaria 82
Table 23: Specified values for the "energy rating" indicator in Bulgaria (residential buildings) 84
Table 24: Suggested main content for the regular mandatory trainings in Bulgaria 86
Table 25: Overview of the different aspects for adapting QualDeEPC Deep Energy Renovation Recommendations policy proposal in Germany 91
Table 26: Adapted Deep Energy Renovation Recommendations and specific values for Germany 94
Table 27: Specified values for the "energy rating" indicator in Germany (residential buildings) 97
Table 28: Training content further to the existing proposed for regular training workshops or seminars in Germany 99
Table 29: Summary of ways the compliance can be improved 102
Table 30: Overview of the different aspects for adapting QualDeEPC Deep Energy Renovation Recommendations policy proposal in Greece 104
Table 31: Deep Energy Renovation Recommendations and specific values for Greece 107
Table 32: Specified values for the "energy rating" indicator in Greece (residential buildings) 110
Table 33: Proposed training content for training workshops or seminars in Greece 112
Table 34: Overview of the different aspects for adapting QualDeEPC Deep Energy Renovation Recommendations policy proposal in Hungary 117
Table 35: Deep Energy Renovation Recommendations and specific values for Hungary 120
Table 36: Specified values for the "energy rating" indicator in Hungary (residential buildings) 124
Table 37: Proposed training content for training workshops or seminars in Hungary 127

Table 38: Overview of the different aspects for adapting QualDeEPC Deep Energy Renovation Recommendations policy proposal in Latvia 138
Table 39: Deep Energy Renovation Recommendations and specific values for Latvia 142
Table 40: Specified values for the "energy rating" indicator in Latvia (residential buildings) 145
Table 41: Proposed training content for training workshops or seminars in Latvia 147
Table 42 Overview of the different aspects for adapting QualDeEPC Deep Energy Renovation Recommendations policy proposal in Spain 152
Table 43: Deep Energy Renovation Recommendations and specific values for Spain 157
Table 44: Specified values for the "energy rating" indicator in Spain 163
Table 45: Main content that is proposed for the training of EPC assessors 164
Table 46: Overview of the different aspects for adapting QualDeEPC Deep Energy Renovation Recommendations policy proposal in Sweden 170
Table 47: Deep Energy Renovation Recommendations and specific values for Sweden 173
Table 48: Specified values for the "energy rating" indicator in Sweden 179

INDEX OF FIGURES

Figure 1: First page of the enhanced EPC form template 21
Figure 2: Second page of the enhanced EPC form template 22
Figure 3: Third page of the enhanced EPC form template 23
Figure 4: Fourth page of the enhanced EPC form template 24
Figure 5: Fifth page of the enhanced EPC form template 25
Figure 6: Energy rating indicator as presented on the template of the enhanced EPC form 26
Figure 7: Energy rating indicator as defined by the QualDeEPC project 27
Figure 8: Enhanced vs Standard EPC templates compared by country 28
Figure 9: Comparison of total number of recommendations between standard EPCs and enhanced EPCs 29
Figure 10: Comparison of potential energy savings between standard EPCs and enhanced EPCs 29
Figure 11: Screenshot of the welcome page of the QualDeEPC master tool 35
Figure 12: Screenshot of the initial screen of the Master Tool 35
Figure 13: Screenshot of available building typologies 36
Figure 14: Geographical area/climate zone selection 37
Figure 15: Input parameter- Floor area 37
Figure 16: Overview of the building components and technical systems included in QualDeEPC Mastertool 38
Figure 17: Selection of altitude where the residential building is located 38
Figure 18: Floor types available in the QualDeEPC Mastertool 39
Figure 19: Wall types choices 40
Figure 20: Roof type alternatives as presented in the Mastertool 41
Figure 21: Screenshot of the available systems for windows included in the QualDeEPC tool 42
Figure 22: Screenshot- Selection of heating systems 43
Figure 23: Cooling systems selection 45
Figure 24: Available selections regarding the ventilation system 46
Figure 25:Hot water production systems selection. 46
Figure 26: Shading choices 47
Figure 27: Renewable energy sources selection 48
Figure 28 Screenshot of the estimated current energy consumption of the residential building 49
Figure 29: Improvements selection 50
Figure 30: Info about the rationale of the measures (example Walls) 51
Figure 31:: Results comparison 52

Figure 32: QualDeEPC tool results report layout (page1) 54
Figure 33: QualDeEPC tool results report layout (page 2) 55
Figure 34: QualDeEPC tool results report layout (page 3) 56
Figure 35: The adapted enhanced EPC form in Bulgarian 83
Figure 36: Screenshot of the homepage 88
Figure 37: Adapted German EPC template 96
Figure 38: The adapted enhanced EPC form in Greek 109
Figure 39: Screenshot of existing platform 113
Figure 40: The adapted enhanced EPC form in Hungarian 122
Figure 41: The flowchart of the building selection process. 128
Figure 42: Input data for the opaque building structures. 129
Figure 43: Input data for the windows and ventilation options. 129
Figure 44: Heating system selection process for single family buildings. 130
Figure 45: DHW system selection process for single family buildings. 131
Figure 46: Heating system selection process for multifamily buildings. 132
Figure 47: DHW system selection process for multifamily buildings. 133
Figure 48: Screenshot of existing platform 134
Figure 49: The adapted enhanced EPC form in Latvian 143
Figure 50: The adapted enhanced EPC form in Spanish 158
Figure 51: The adapted enhanced EPC form in Swedish 175

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.

The WP5 "Roadmap to convergence and action towards deep renovation" focuses on adapting the enhanced EPC assessment and certification schemes and tools as well as Deep Renovation Network Platforms to country needs. These tools and policy proposals were developed during the implementation of WP3 "Development of enhanced EPC schemes" and tested in WP4 "Testing the applicability through pilot cases". Moreover, the implementation of the adapted policy proposals and concepts at national level to the extent possible and the organization of dialogue on further convergence, and a potential roadmap towards it, at national and EU level, are also objectives of the WP5.

This report serves as a compilation of the project's proposal for an enhanced and converging EPC assessment and certification scheme. It aims to provide a detailed description on the set of practical concepts, policy proposals, and tools for an enhanced EPC scheme towards deep renovation, developed by the QualDeEPC project. The project's substantial proposals both on EU and national level are presented in a comprehensive and rational way, guiding the relevant stakeholders, in particular the policy makers and competed bodies, on which steps need to be followed so as the proposals to be adapted and how the specific values can be determined in MSs. Furthermore, this report includes the project's proposal for defining "Deep Energy Renovation" based on a modified nZEB-based approach.

The project's priorities A) to G) addressed are presented in the following order in this document, reflecting the importance of the enhanced EPC template form and the training of EPC assessors:

A) Improving the recommendations for renovation, which are provided on the EPCs, towards deep energy renovation;
E) High user-friendliness of the EPC, by way of an enhanced EPC template form, including an introduction of the proposed "Energy Rating" indicator;
D) Regular mandatory EPC assessor training or examination on assessment and renovation recommendations, required for certification/accreditation and registry;
B) Online tool for comparing EPC recommendations to deep energy renovation recommendations;
C) Creating Deep Renovation Network Platforms (DRNPs);
F) & G) Voluntary/mandatory advertising guidelines for EPCs and Improving compliance with the mandatory use of EPCs in real estate advertisement.

The chapter 2 includes the QualDeEPC project's proposals and how these could be implemented at EU level and MS level in general. Moreover, the technical details of the developed tools and concept, to the extent possible, are included.

The chapter 3 covers the adaptation to the 7 participating countries' context and presents technical details of the adapted practical concepts, proposals, and tools for an enhanced EPC scheme towards deep energy renovation.

Finally, chapter 4 presents the conclusions and next steps in WP 5.

2 QUALDEEPC GUIDANCE FOR IMPROVED EPCS AT EU LEVEL

This chapter presents the practical concepts, policy proposals, and tools for an enhanced EPC scheme towards deep renovation, which the QualDeEPC project developed under its seven priorities, in **general** form. This may be used by other Member States and EU-level policy-makers to gain inspiration on how EPC schemes could be enhanced and made more convergent. The presentation here is based on the Deliverable D3.2, the White paper on good practice in enhanced EPC assessment, certification, and use (Veselá et al., 2021), and has been slightly updated. As a basis for the seven development priorities, which are presented in chapters 2.2 to 2.7, the project also proposed a definition of 'deep energy renovation' (chapter 2.1).

2.1 QualDeEPC proposal for defining 'deep energy renovation'

The priorities A), B), C) and E) depend on the definition of "deep energy renovation", therefore the QualDeEPC project assessed the proposals by the European Commission and developed a refined proposal that would take specific national situations into account and could therefore be more universally applied. Based on the analysis of existing proposals for defining 'deep energy renovation' (White Paper (Veselá et al. 2021 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. (Veselá et al. 2021)

The following chapters include the outcomes of the development phase of the project on the selected priorities for an enhanced EPC scheme linked to deep energy renovation. The priorities are presented in an order that facilitates the rationale towards the practical implementation of the assessment, issuance, design, and use of EPCs as well as their renovation recommendations, in the participating countries and in other EU MS.

2.2 Improving the recommendations for renovation provided on the EPCs towards deep energy renovation

In the course of the QualDeEPC project, it was recognized that the renovation recommendations included in the current EPC practice cannot support the Deep Energy Renovation of the building stock. The policy proposal on improving the recommendations for renovation, which are provided on the EPCs, towards deep energy renovation, was developed and presented in the project's QualDeEPC White Paper (Veselá et al., 2021). It provides guidance on the renovation measures that should usually be included in the EPCs, accompanied by specifications about the energy efficiency level or rating they should satisfy, in order to be consistent with deep energy renovation, and taking into account a stepwise approach in terms of implementing the renovation.

The project team developed a proposal for such a set of renovation recommendations, based on the definition of 'deep energy renovation' as illustrated 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, cf. chapter 3. 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.

If other Member States wish to adopt this proposal, and their Long-Term Building Renovation Strategies contain technical specifications for renovations that are in line with the definition of `deep energy renovation proposed above, these MS could use the technical specifications from their Long-Term Building Renovation Strategies.

As a general rule of application, the EPC assessor should be required to:

1) include all potential recommendations needed to achieve deep energy renovation,
2) clarify
i) whether the recommendations are cost-effective on their own or only with financial incentives existing at the time of issuance of the EPC, and
ii) whether the measures and their costs are independent of, or carried out in connection to, a major renovation of the building envelope or technical building system or systems that is scheduled anyway[1] (meaning that cost-effectiveness will always be based on *energy-related* renovation costs only, as it is already specified in the EPBD).

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.

	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_W=1.3 W/(m²K) (g=0.6) [new building}
	Window with exceptional insulation properties, e.g. triple glazed window	U_W=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	Ventilation system (no heat recovery) with an exceptionally low electrical power requirement	P_{el}<0.2W/(m³/h)

	Specific recommendation	Example value (Germany)
mechanical ventilation system	Ventilation system with heat recovery of min. 80% and very low electrical power consumption	η>80%, P_{el}<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	
	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; *alternatively*, 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 h^{-1} or lower at 50 Pa pressure difference OR Air tightness according to new building standard	$n_{50} \leq 1.5 h^{-1}$
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	

2.3 High user-friendliness of the EPC

QualDeEPC advocates that the EPC forms are the core element of the EPC scheme for obtaining information in the seven counties represented in the project, thus they need to satisfy three main functions:

1. Verify compliance with legal requirements on the energy performance of the building.
2. Provide information to the building owner, potential buyers or tenants and third parties on the current energy performance and the type of renovation(s) that might be needed to significantly improve the energy efficiency and decrease of CO_2 emissions of the building.
3. Encourage (current or future) building owners to implement energy-efficient renovation options, which should lead to 'deep energy renovation'. For this function, presenting information on the energy savings and CO_2 emissions reductions possible through the renovation recommendations, and their cost-effectiveness will be important.

In the framework of WP3, a policy proposal related to the "High user-friendliness of the EPC" was developed, and a template for an enhanced and more user-friendly EPC form has been created and tested in WP 4. A detailed description of the form and design of the elements as well as details on how to acquire the needed input data are provided in the "White Paper on good practice in EPC assessment, certification, and use"[1] available online at QualDeEPC project website. The elements of the proposed EPC form, which is presented overleaf, can be summarized as follows:

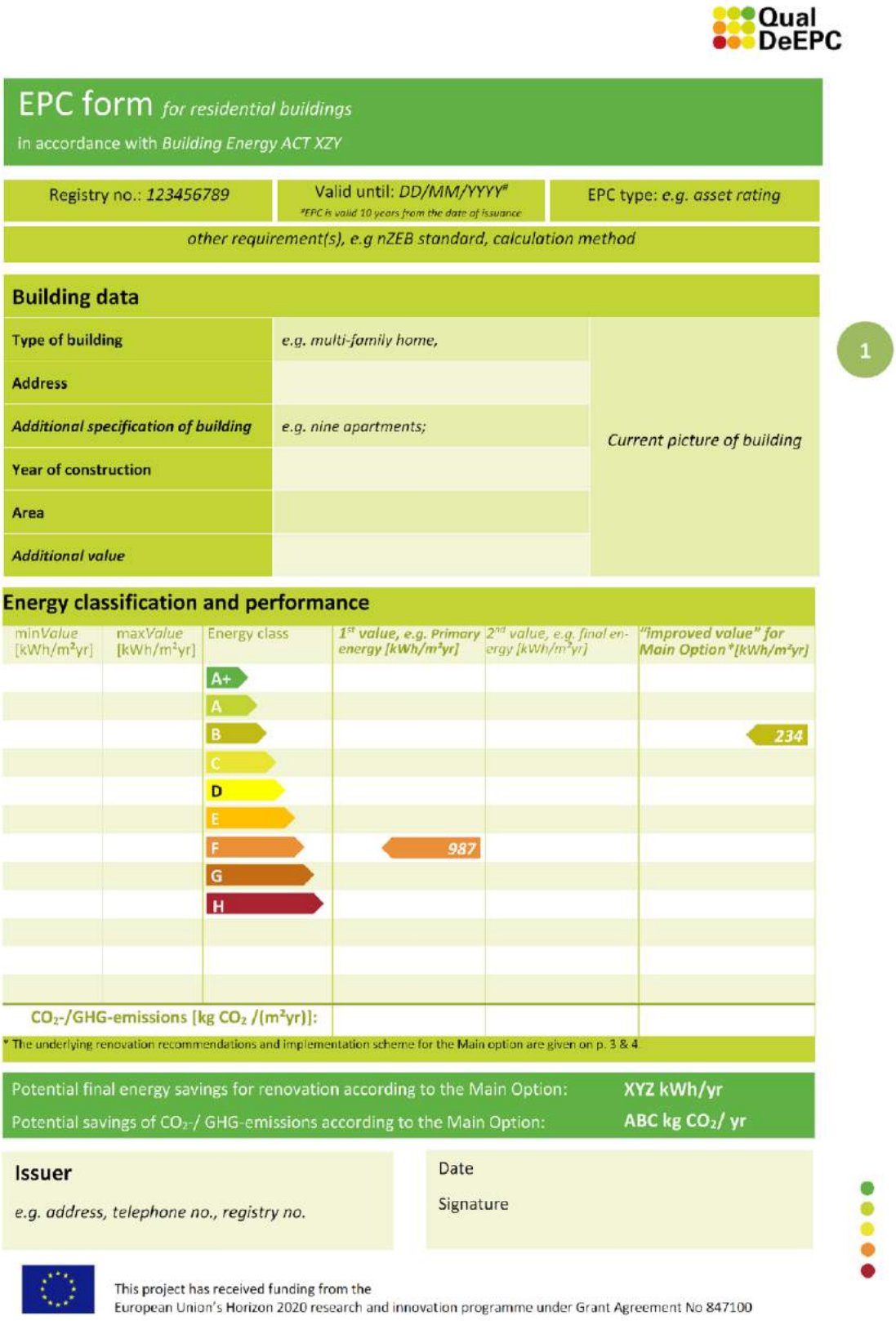
1. General data and building specification (standard requirement) (p.1 of the EPC form template)
2. Current picture of building (p.1)
3. Box and check mark for nZEB standard or smart readiness indicator (p.1)
4. Energy performance and classification (current and after implementation of 'main option' for energy renovation: standard requirement) (p.1)
5. Potential energy savings (in kWh/yr) (p.1 and p.3)
6. Place for CO2/ GHG emissions and savings (p.1 and p. 3)
7. Past metered or modelled yearly total energy consumption (p.2)
8. Details on building envelope and building HVAC system in current status (p.2)
9. Detailed renovation recommendations by component (p.3)
10. Useful combination of renovations and stepwise implementation (p.4)
11. Link to Deep Renovation Network Platform (p.4)
12. An (optional) 5th page to the EPC form to include the visualization and further space for national adaptation
13. Footnote regarding validity date.

In order to raise awareness for the potentials of deep energy renovation, it is not only necessary that the number and technical specifications of the renovation recommendations are sufficient to achieve deep energy renovation when implemented. It will also be important to clearly display the results to the user. This is done through

[1] https://qualdeepc.eu/public-project-deliverables

- the definition of the ‘main option’, a combination of recommendations that would lead to deep energy renovation,
- the display of the improved energy performance and classification after implementation of the ‘main option’ on p.1 of the EPC form (no. 4)
- the total amount of energy savings (in kWh/yr) and GHG emissions reductions on p.1 (no. 5 and 6)
- the traffic light system showing the energy efficiency levels of building and system components in green, yellow, and red, both for the current state (8. And the renovation recommendations (no. 9)
- and the useful combination of renovations and stepwise implementation, enabling a staged renovation that will nevertheless lead to deep energy renovation when fully implemented.

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



EPC form *for residential buildings*

in accordance with *Building Energy ACT XZY*

Registry no.: *123456789*	Valid until: *DD/MM/YYYY** **EPC is valid 10 years from the date of issuance*	EPC type: *e.g. asset rating*

other requirement(s), e.g nZEB standard, calculation method

Building data

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		

1

Energy classification and performance

min*Value* [kWh/m²yr]	max*Value* [kWh/m²yr]	Energy class	*1st value, e.g. Primary energy [kWh/m²yr]*	*2nd value, e.g. final energy [kWh/m²yr]*	*"improved value" for Main Option* [kWh/m²yr]*
		A+			
		A			
		B			234
		C			
		D			
		E			
		F	987		
		G			
		H			
CO_2-/GHG-emissions [kg CO_2 /(m²yr)]:					

* 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_2-/ GHG-emissions according to the Main Option:	**ABC kg CO_2/ yr**

Issuer

e.g. address, telephone no., registry no.

Date

Signature

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No 847100

Figure 1: First page of the enhanced EPC form template

EPC form *for residential buildings*

in accordance with *Building Energy ACT XZY*

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 (inkl. 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 [m²]	*Description or Avg. U-value [W/m²K)*	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*

This project has received funding from the
European Union's Horizon 2020 research and innovation programme under Grant Agreement No 847100

Figure 2: Second page of the enhanced EPC form template

Qual DeEPC

EPC form *for residential buildings*

in accordance with *Building Energy ACT XZY*

Renovation recommendations – component evaluation

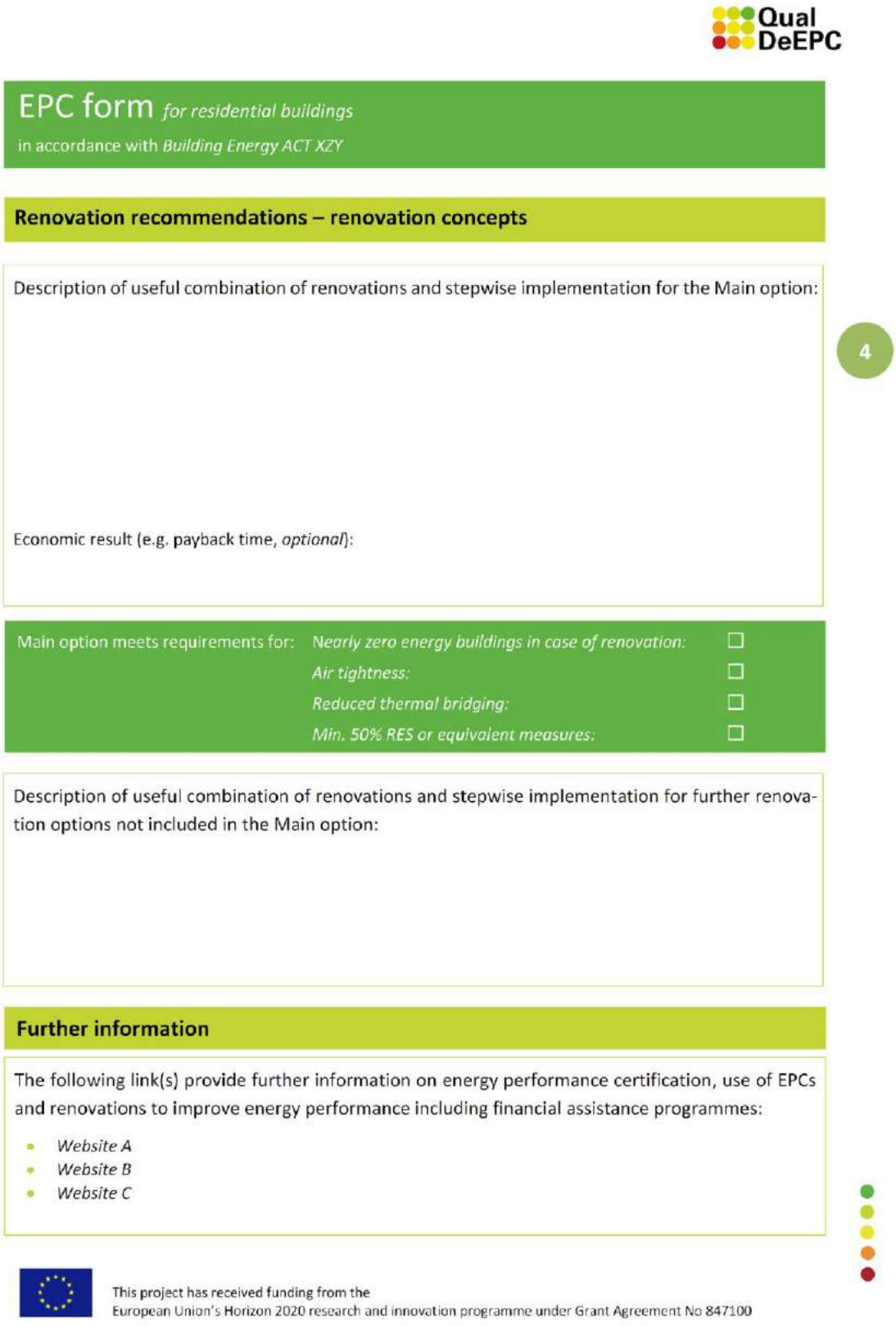
Building envelope	Recommendation	"new" avg. U-value [W/m²K]	New Energy rating[a]	*Cost effectiveness (e.g. payback time)*	Included in Main option?
Roof or attic					☐
External walls					☐
Windows					☐
Doors/Gates					☐
Ground floor or floor to unheated basement					☐

Technical systems	Recommendation	Energy source, provided power, EU energy label	New Energy rating[a]	*Cost effectiveness (e.g. payback time)*	Included in Main option?
Heating system					☐
Domestic hot water					☐
Ventilation system					☐
Cooling system					☐
Renewable energies (outside of other systems)					☐
Other: e.g. Lighting					☐

Potential final energy savings for renovation according to the Main Option:	**XYZ kWh/yr**
Potential savings of CO2-/ GHG-emissions according to the Main Option:	**ABC kg CO2/ yr**

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No 847100

Figure 3: Third page of the enhanced EPC form template



EPC form *for residential buildings*

in accordance with *Building Energy ACT XZY*

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:*	☐
	Air tightness:	☐
	Reduced thermal bridging:	☐
	Min. 50% RES or equivalent measures:	☐

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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European Union's Horizon 2020 research and innovation programme under Grant Agreement No 847100

Figure 4: Fourth page of the enhanced EPC form template

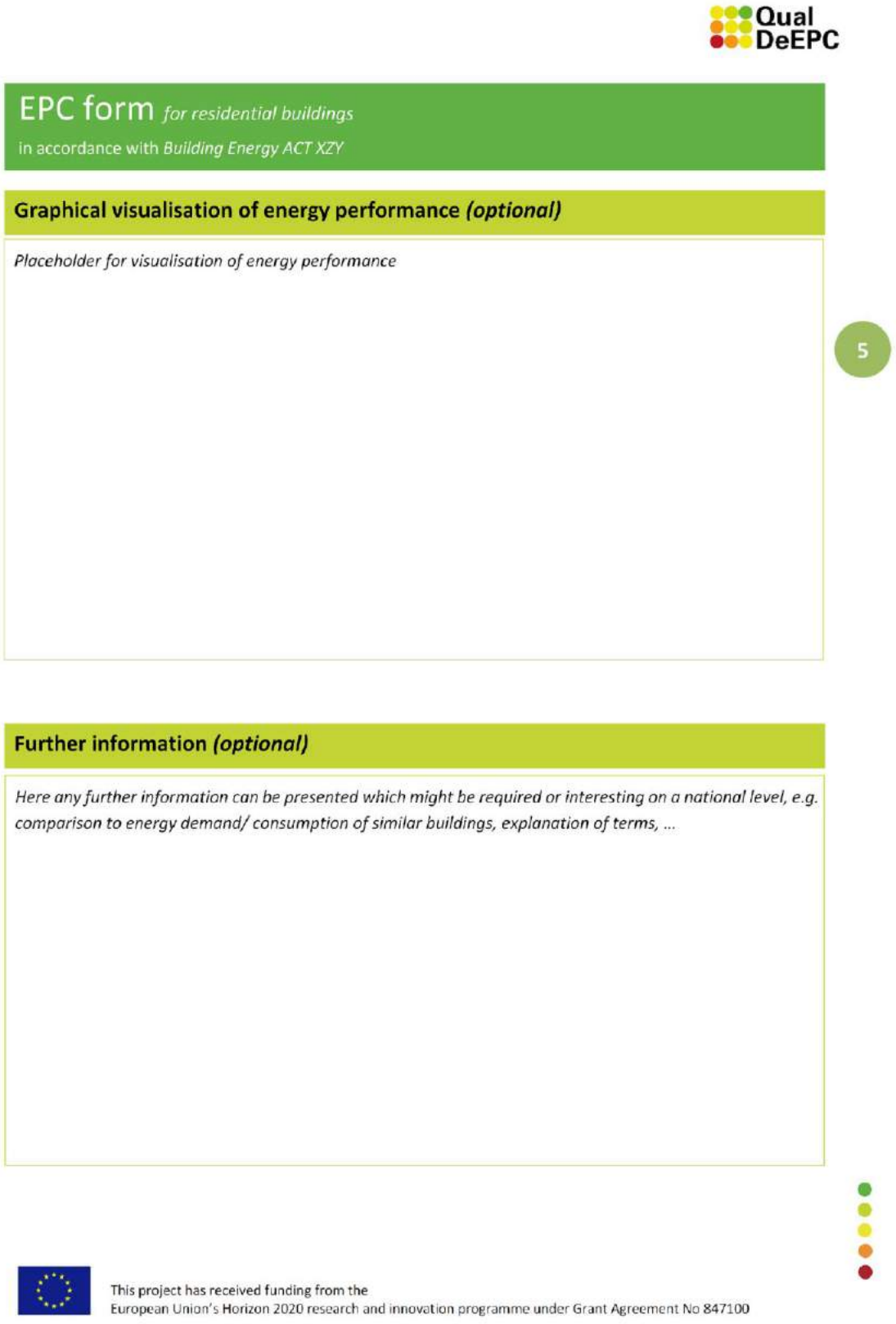
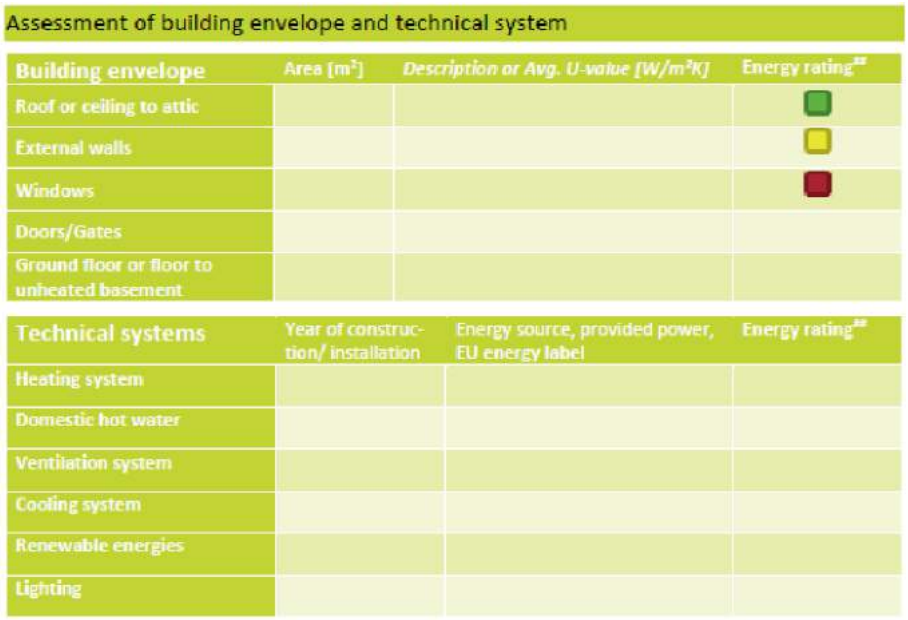


Figure 5: Fifth page of the enhanced EPC form template

"Energy Rating" indicator

It has to be noted that an important indicator has been included in page 2 of the proposed EPC form. The indicator is referred to as "energy rating"[2] and provides information about the energy performance of the building envelope components and technical systems, by using three coloured symbols (green, yellow, red).



Assessment of building envelope and technical system			
Building envelope	Area [m²]	*Description or Avg. U-value [W/m²K]*	Energy rating**
Roof or ceiling to attic			
External walls			
Windows			
Doors/Gates			
Ground floor or floor to unheated basement			
Technical systems	Year of construc-tion/ installation	Energy source, provided power, EU energy label	Energy rating**
Heating system			
Domestic hot water			
Ventilation system			
Cooling system			
Renewable energies			
Lighting			

Figure 6: Energy rating indicator as presented on the template of the enhanced EPC form

The same rating and indicator values are also applied to the state of energy efficiency that a building component would achieve after implementing the energy renovation recommendations on p.3 of the enhanced EPC form. The three coloured symbols (green, yellow, red) are linked to the following levels of energy rating, depending on whether the current national minimum energy efficiency standards for buildings or their components are considered ambitious (upper scale) or not so ambitious (lower scale):

[2] D3.2 "White Paper on good practice in EPC assessment, certification, and use", section 7.3.4

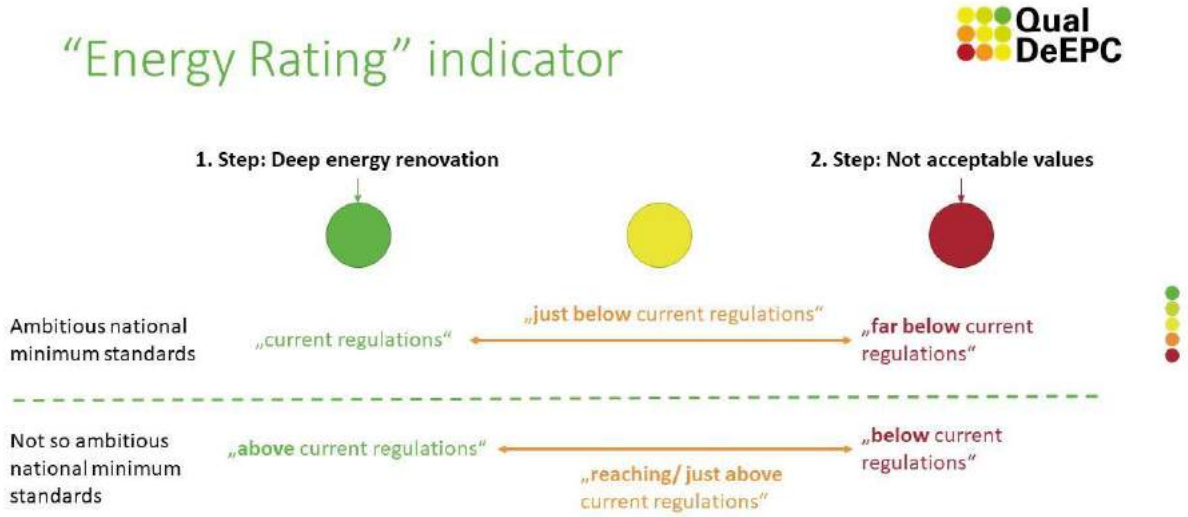


Figure 7: Energy rating indicator as defined by the QualDeEPC project

A. In case of ambitious national minimum standards already in force, the energy rating indicator and values could stand as follows:

- ***Green**: Reaches the minimum standards set by the national the regulation/ legislation*
- ***Yellow**: Just below the minimum standards set by the national the regulation/ legislation*
- ***Red**: Significantly below the minimum standards set by the national the regulation/legislation*

B. In case of less ambitious national minimum standards in force, the energy rating indicator and values could stand as follows:

- ***Green**: Exceeds the minimum standards set by the national the regulation/ legislation*
- ***Yellow**: Reaching or slightly exceeding the minimum standards set by the national the regulation/ legislation*
- ***Red**: Below the minimum standards set by the national the regulation/legislation*

The exact values and/or conditions differ in the participating countries, therefore the country-specific definition of the values/ ranges for the 'energy-rating" indicator, is provided in Chapter 3 and the dedicated section for each participating country, of this report. These must be consistent with the improved renovation recommendations proposed i.e., components that already meet the energy efficiency levels of these recommendations, or would meet them after implementing an actual recommendation included on an EPC, would be rated 'green'. In case such a definition is not possible, a description-based evaluation is provided.

2.3.2 High user-friendliness of the EPC – proposed template – results of testing

The comparison of the standard EPC form and the enhanced EPC template was implemented during the testing phase of the project (WP4). These forms were produced for each pilot building. The forms and a questionnaire including 17 questions on user-friendliness of both standard EPC and Enhanced EPC template were sent out to all building representatives in order to collect their opinion.

Analysis for high user friendliness of the EPC template by country but on the average of the 17 questions is shown in Figure 8.

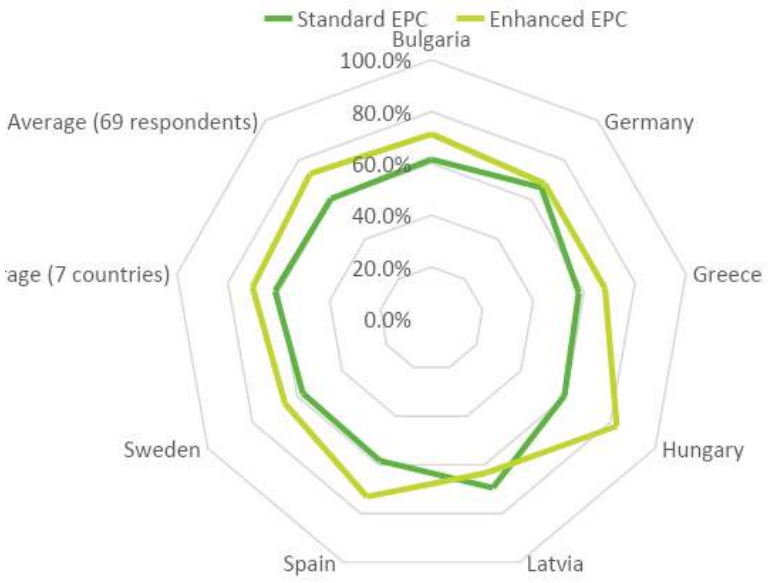


Figure 8: Enhanced vs Standard EPC templates compared by country

In all countries except of Latvia the Enhanced EPC template was evaluated higher (i.e., more user friendly) than Standard EPC.

In Latvia, the Standard EPC was evaluated higher than Enhanced EPC. This can be explained by the fact that in Latvia the Standard EPC actually contains all the information showed in the Enhanced EPC. Only the Enhanced EPC *template* looks different from the Standard EPC. And in cases where you have to choose between familiar and non-familiar things, you perceive the familiar things easier to comprehend (more user friendly because you are used to it).

The following figure presents the comparison between the number of recommendations presented in the standard and enhanced EPCs of all pilot buildings in various QualDeEPC partner countries. There is a significant improvement in the number of recommendations in the enhanced EPC compared to the standard EPCs in Germany, Greece and Hungary, while there is marginal improvement in Spain and Sweden. In Bulgaria and Latvia, the EPCs are based on a detailed energy audit and the recommendations in the standard EPCs are usually exhaustive, and therefore, the number remains same in both the standard and enhanced EPCs.

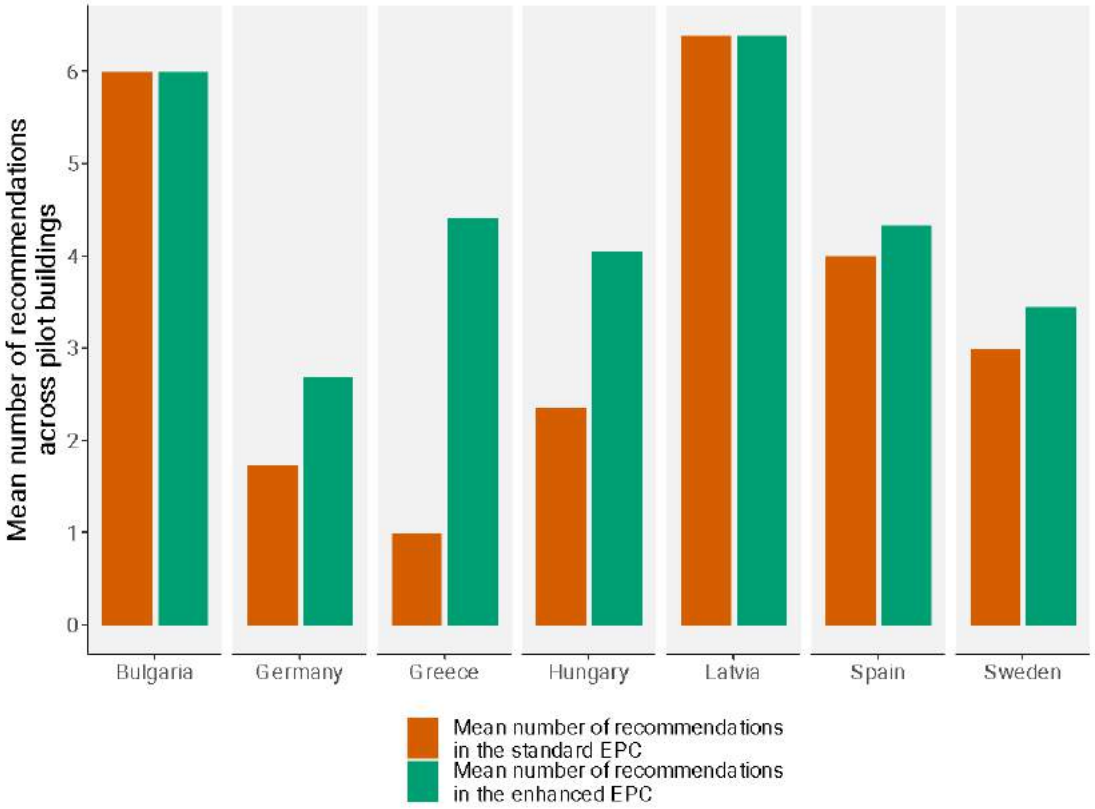


Figure 9: Comparison of total number of recommendations between standard EPCs and enhanced EPCs

The Figure 10 shows comparison of potential energy savings between the standard EPCs and the enhanced EPCs if their recommendations are implemented. Compared to the recommendations in the standard EPCs, the enhanced EPCs show significantly higher potential for energy savings in Greece and Spain, and a low to marginal additional potential in Sweden.

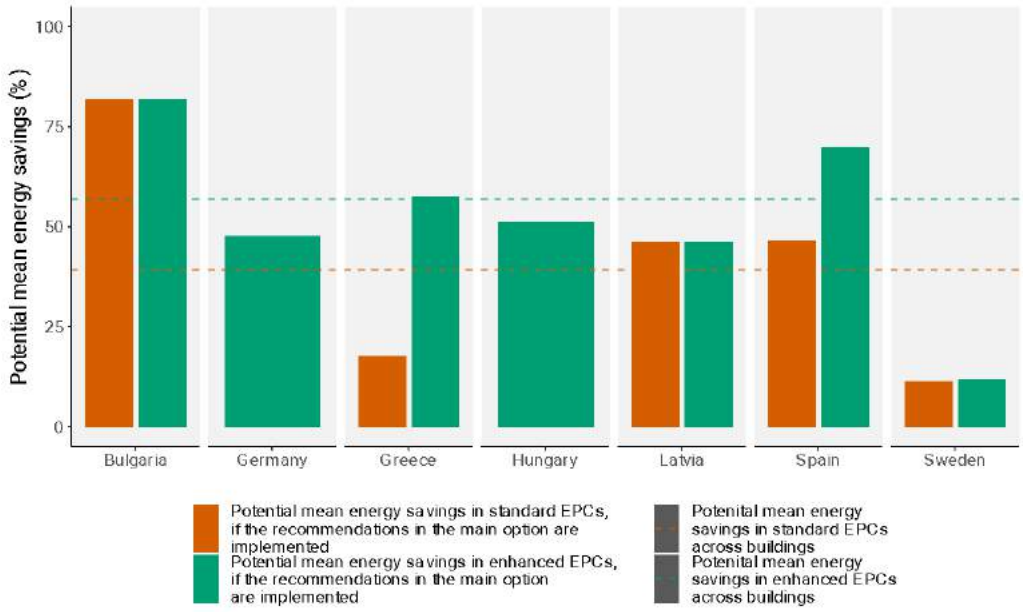


Figure 10: Comparison of potential energy savings between standard EPCs and enhanced EPCs

In Greece, the reason for this result is that the standard EPC allows for a maximum number of three recommendations to be included in the field dedicated to recommendations. In Bulgaria and Latvia, the reason for this result seems to be that the standard EPC is already based on a detailed energy audit, and the EPC comes with detailed information on the recommendations. In the case of Sweden, cautious interpretation of cost-effectiveness of the recommendations is required.

In Germany and Hungary, potential energy savings are not provided in the standard EPC, but the energy savings that could be achieved when implementing the recommendations in the enhanced EPC are quite high, in the range of 40 to 50 percent on average.

Detailed information on the evaluation of the testing phase implemented, can be found in the D4.5 "Summary evaluation report of pilot building tests" available on the QualDeEPC website.

2.4 Regular mandatory EPC assessor training

2.4.1 General Policy Proposal and framework

The project QualDeEPC proposes **a regular, mandatory training for EPC assessors** to maintain qualification and high quality of issued EPCs. This is a **policy proposal**, not a tool, taking into account that it has to be implemented by policymakers or authorities in charge of national EPC schemes. Based on established systems, reviewed in the framework of the project's development phase (WP3), the frequency of the trainings is proposed to be every 3-5 years.
The regular training can be based on an initial training, which should have a larger duration than the regular training sessions that serve for refreshment and updating of knowledge and skills. Moreover, the curriculum of the initial training should vary so as to be suitable for all eligible qualifications at national level (University degree or secondary technical education). The regular mandatory training might be a combination of training courses, participation in workshops or seminars, and the verification of the high quality of a random sample of issued EPCs. In each category, the curriculum for the EPC assessors should be specified on a national level.

By proposing the regular trainings to be mandatory, QualDeEPC aims to ensure that the EPC issuers acquire the most recent knowledge to issue high-quality EPCs. Additionally, it might be **an option** to substitute the regular mandatory training **by voluntary training and a mandatory examination**.

2.4.2 Training content for regular training workshops or seminars

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.

2.4.2.1 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.

2.4.2.2 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.

2.4.2.3 Deep energy renovation recommendations

In practice EPCs 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.

2.4.2.4 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. 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.

2.4.2.5 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.

2.4.2.6 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.

2.4.2.7 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.

2.4.2.8 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.

2.4.3 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 to achieve a wider awareness of these issues. Ideally, common errors might also be mirrored to the responsible authority for clarification.

2.5 Online tool for comparing EPC recommendations to deep energy renovation recommendations

The development of a user-friendly online tool for comparing EPC recommendations to deep energy renovation recommendations, was identified as a priority by QualDeEPC project, for further analysis, development, and adaption to national contexts. Such a tool addresses the needs of end-users, i.e., building owners, in order to receive an estimation of their dwelling's or building unit's energy efficiency performance at building's elements and technical systems level. Moreover, they can receive information on possible energy efficiency measures with enhanced or even exceptional energy performance presented in hierarchical manner so as to support a step-by-step implementation approach towards deep energy renovation.
During the development phase of QualDeEPC project (WP3), the main concept of an online tool was developed and a Master online tool version was implemented. The QualDeEPC Master tool developed stands as the general version of a broad user-friendly platform for users, who want to be informed about the energy demand, rating and CO_2 emissions of their residential building. The building owners are able to simulate their dwellings, through inputting their building's main characteristics by selecting them from pre-defined lists, in only 13 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 investment 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 clearly states that its results are only indicative and recommends to obtain an energy audit.

The QualDeEPC Mastertool is available at :
https://www.buildingcert.gr/qualdeepc_tools/master_tool/.

The Master tool structure was designed to use the necessary information in order to run an appropriate software for energy performance calculations and building energy classification, and is adapted for the purpose of the QualDeEPC project. Special care was given, however, to provide a general result in order not to be interpreted as an official Energy Performance Certificate.

2.5.1 Input parameters

The following sections include detailed information on the input parameters of the QualDeEPC master tool.

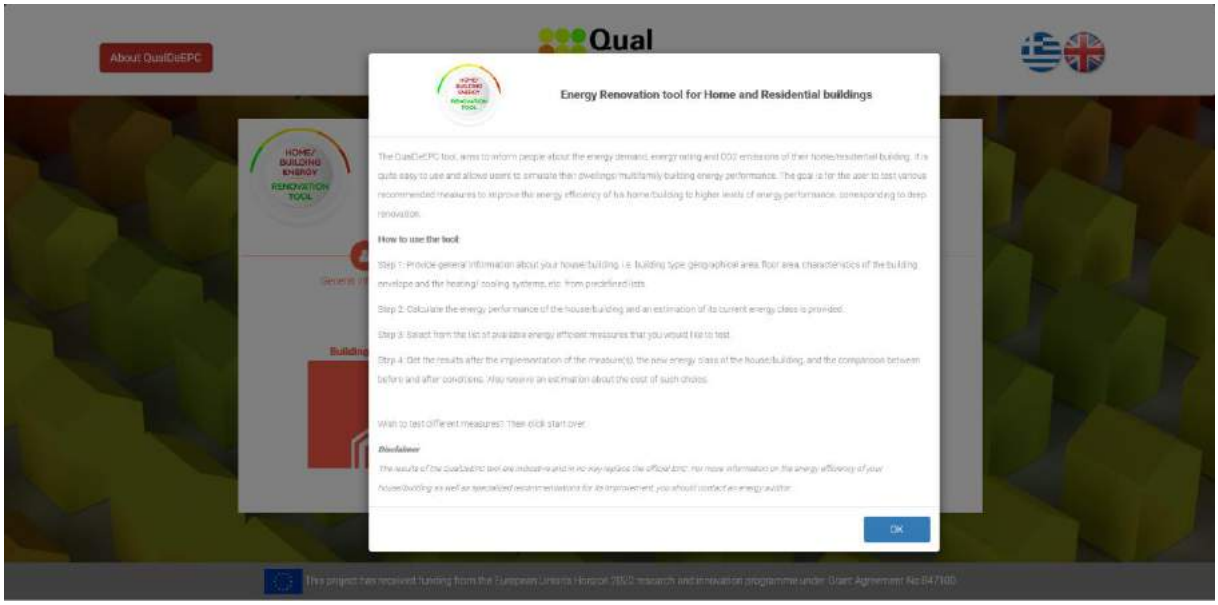


Figure 11: Screenshot of the welcome page of the QualDeEPC master tool

2.5.1.1 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, ranging from fully detached houses to multifamily buildings.

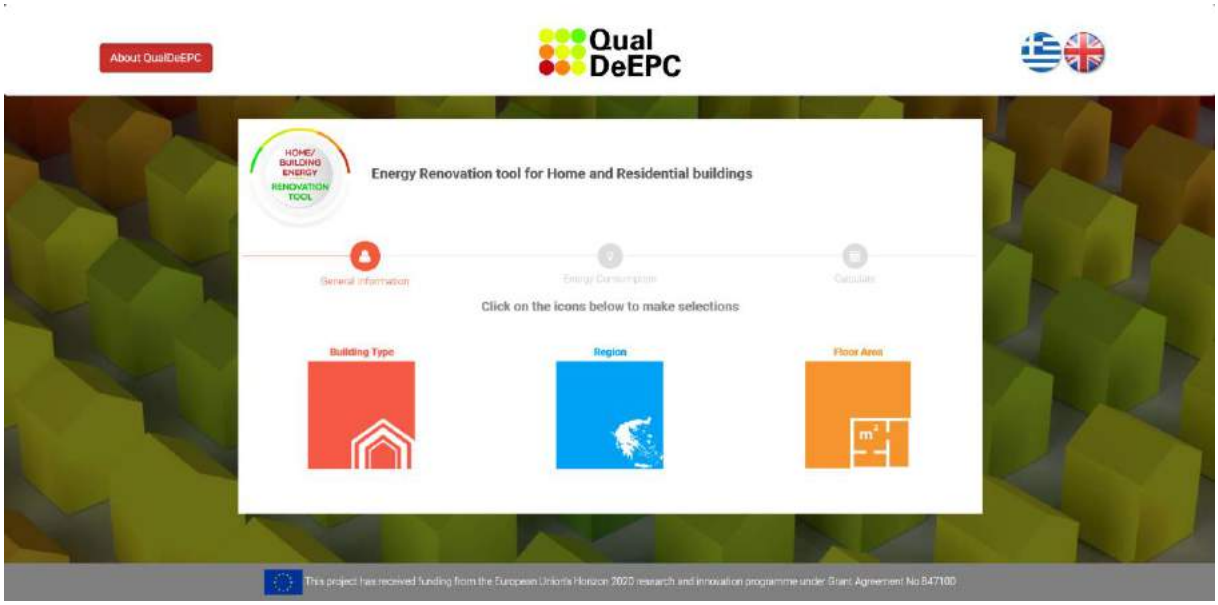


Figure 12: Screenshot of the initial screen of the Master Tool

Figure 13: Screenshot of available building typologies

The building typologies included in the Master tool are presented in the following table.

	Building Type	Vicinity
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
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

Table 5: List of residential building types available in the QualDeEPC mastertool

2.5.1.2 Geographical area/climate zone and floor area of the building

The user is called to select where the building is located in order the climatic conditions (climatic zones) to be determined. The climatic zones considered in this phase are the ones of the Greek climate zoning classification. The selection in the master tool comprises data from all regions of Greece related to the 4 climatic zones. The geographical areas are presented at NUTS 3 level for end-users convenience.

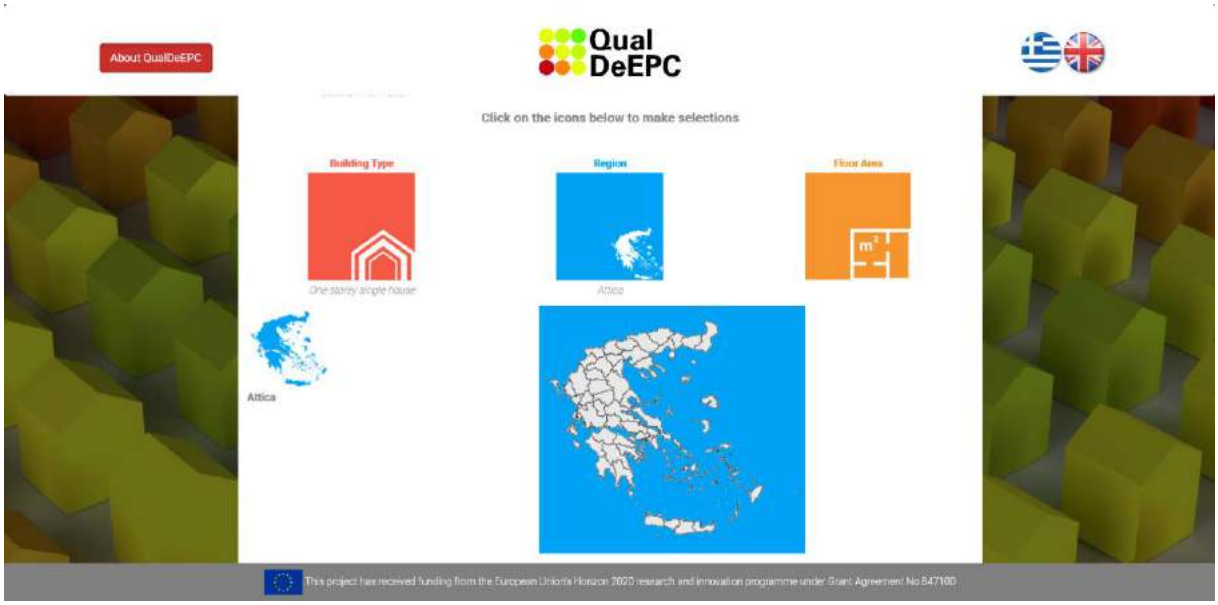


Figure 14: Geographical area/climate zone selection

Furthermore, the user needs to insert the total floor area of the house/ building, either by stating the exact floor area (in m²) or by selecting the area from 3 choices: < 100 m², between 100 and 150 m², and between 150 and 200 m² (see Figure 16).

Figure 15: Input parameter- Floor area

2.5.1.3 Selection of building envelope components and technical systems

In order to proceed with the estimation of the current energy consumption and energy classification of the building, the end-user can select the envelope components and technical systems from predefined lists available in each category. It has to be noted that the lists include various components, systems and technologies that are commonly used in the QualDeEPC project partner countries.

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 as the lower values in terms of energy performance and are automatically introduced.

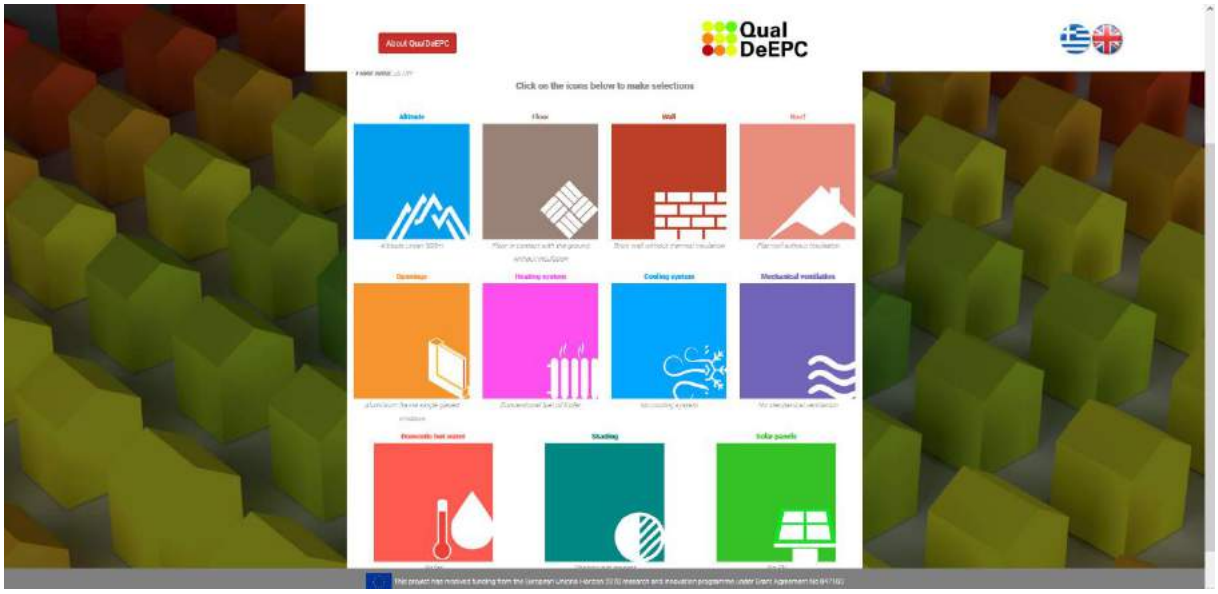


Figure 16: Overview of the building components and technical systems included in QualDeEPC Mastertool

Moreover, the user should state whether the building is located at an altitude higher than 500 meters; in such a case the climate data introduced are the ones of the immediately higher (cooler) climate zone.

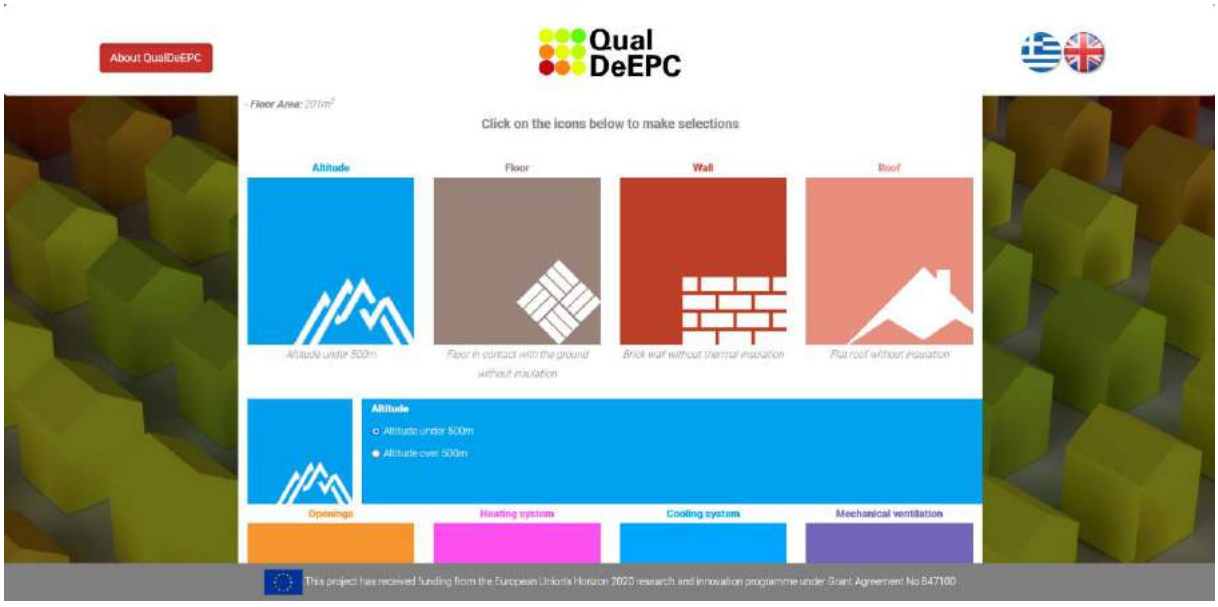


Figure 17: Selection of altitude where the residential building is located

2.5.1.4 Specifications of the building components and systems: Floor

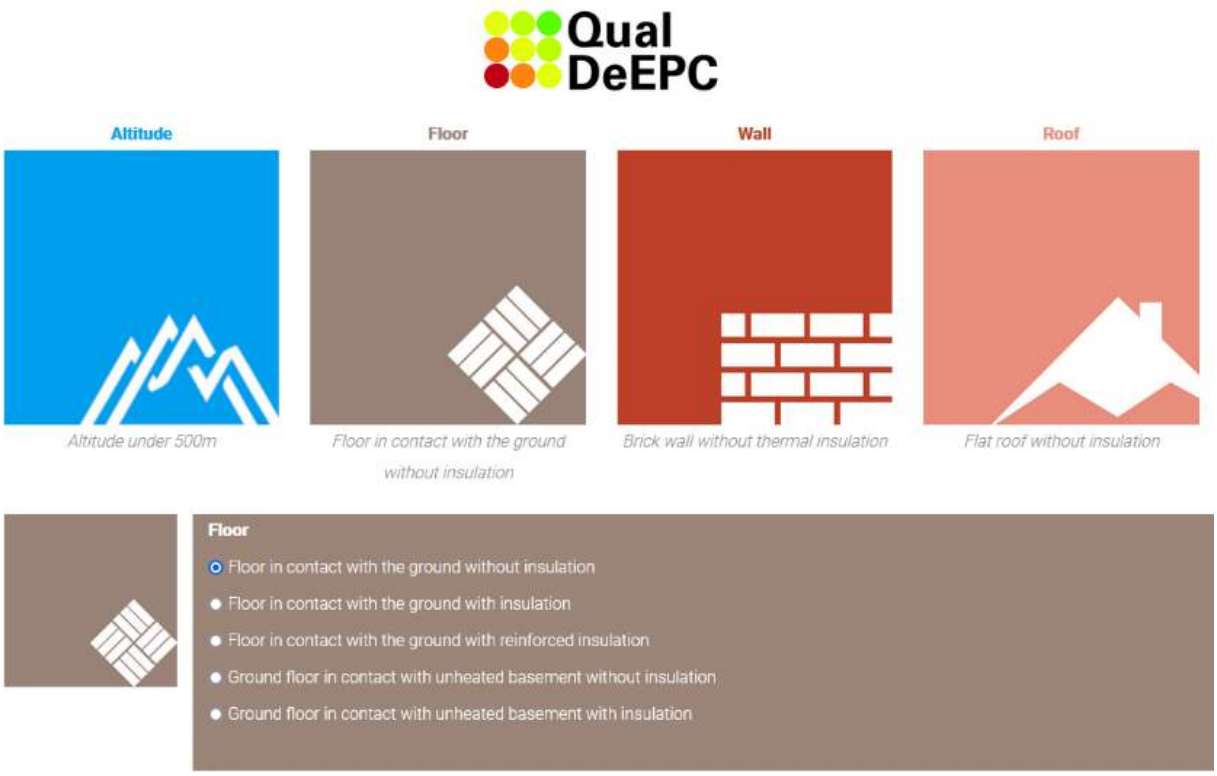


Figure 18: Floor types available in the QualDeEPC Mastertool

As regards floor type, five alternative options can be selected as shown in Table 5.

Construction type	U-value (examples for Greece)
Floor in contact with the ground without insulation	3.1 W/(m2K)
Floor in contact with the ground with insulation	3, 1.9, 0.8 and 0.8 W/(m2K), according to the climatic zone
Floor in contact with the ground with reinforced insulation	1.2, 0.9, 0.75 and 0.7 W/(m2K), 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

Table 6: Input selection for heat transmission coefficients in W/m²K for insulation of ceiling of an unheated basement (in residential buildings)

2.5.1.5 Specifications of the building components and systems: Wall

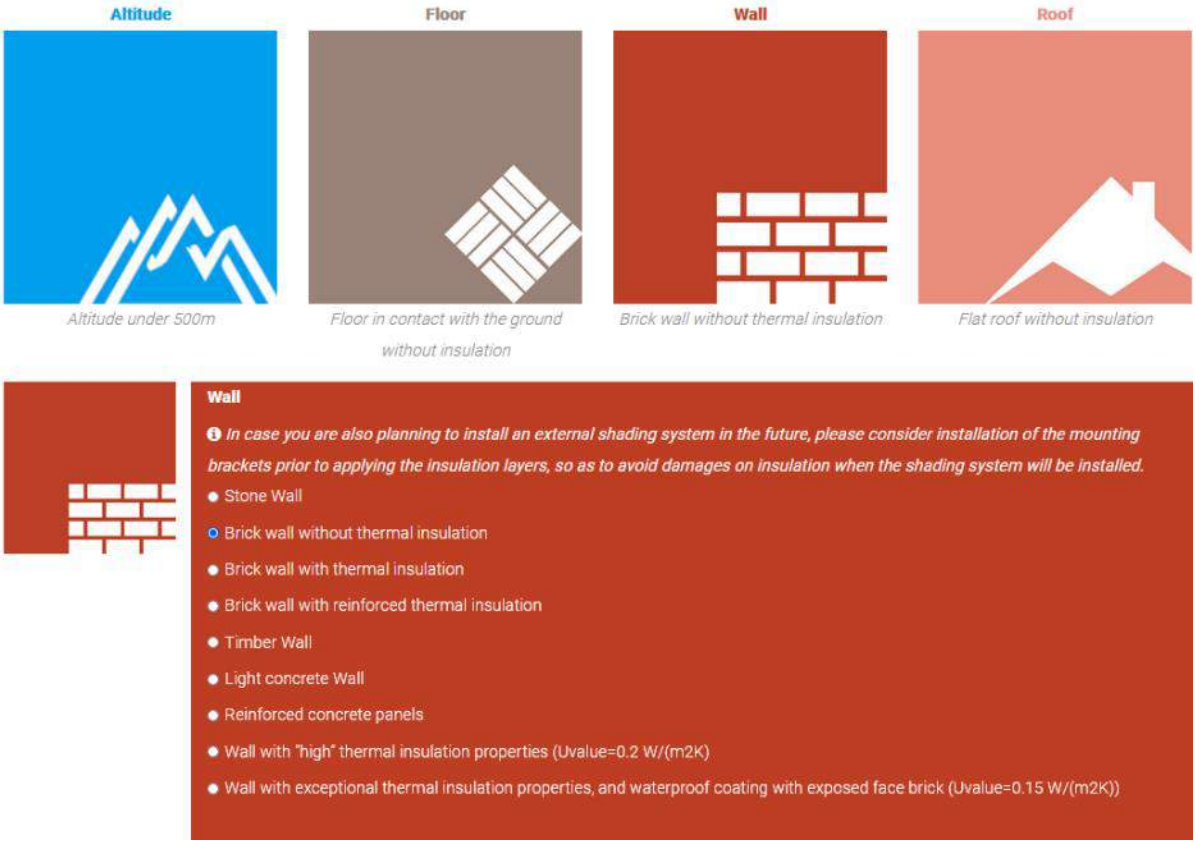


Figure 19: Wall types choices

Regarding the external walls, the user is provided with the following options to select as show in Table 6.

Construction type	U-value (examples for Greece)
Stone Wall	4.25 W/(m2K)
Brick wall without thermal insulation	2.5 W/(m2K)
Brick wall with thermal insulation	0.7 W/(m2K)
Brick wall with reinforced thermal insulation	0.6, 0.5, 0.45 and 0.4 W/(m2K) according to the climatic zone where the building is located
Timber Wall	n/a
Light concrete Wall	n/a
Reinforced concrete panels	n/a
Any wall with “high” thermal insulation properties	[e.g. U=0,2 W/(m²K)]
Other type (i.e exceptional thermal insulation properties, reinforced concrete, waterproof coating with exposed face brick)	0.15 W/(m2K)

Table 7: Input selection for external wall

2.5.1.6 Specifications of the building components and systems: Roofs

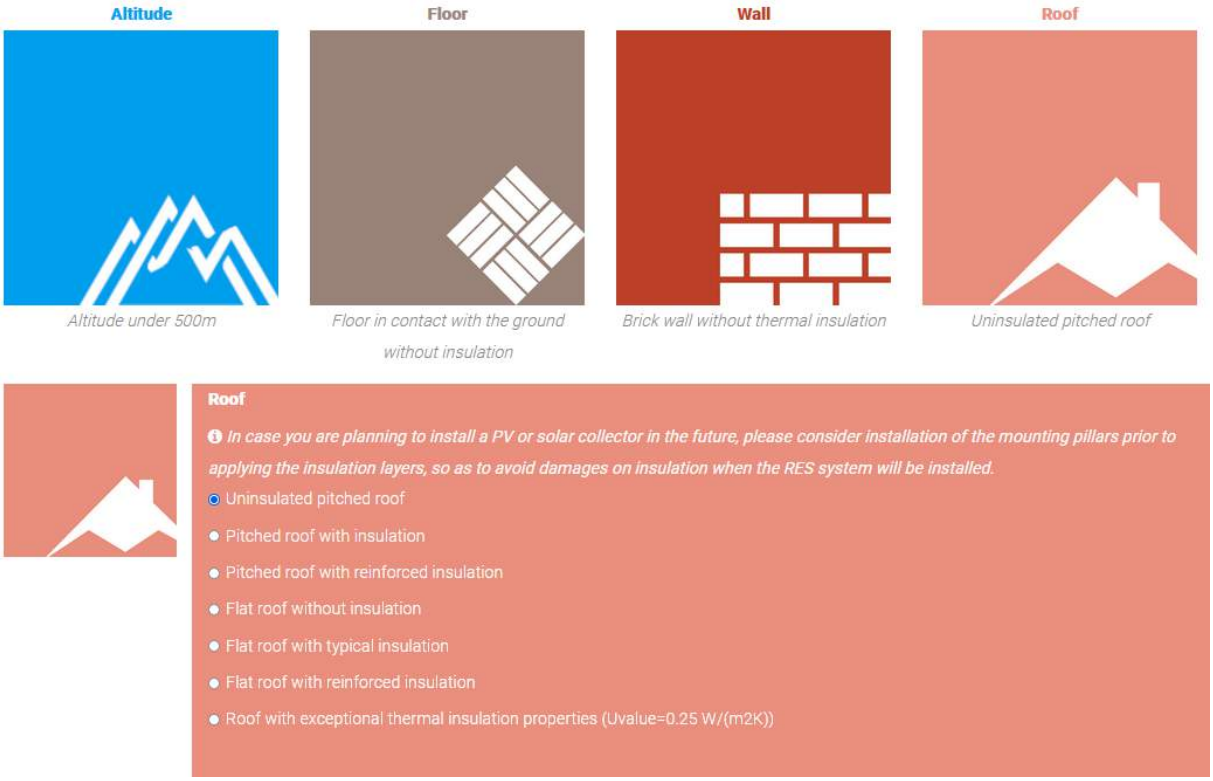


Figure 20: Roof type alternatives as presented in the Mastertool

The roof type can be selected from a menu of 7 alternative options as shown in Table 7.

Construction type	U-value (examples for Greece)
Uninsulated Pitched roof	4.25 W/(m²K)
Pitched roof with insulation	0.5 W/(m²K)
Pitched roof with reinforced insulation	0.5, 0.45, 0.4 and 0.35 W/(m²K) according to the climatic zone
Flat roof without insulation	3.05 W/(m²K)
Flat roof with typical insulation	0.5, 0.45, 0.4 and 0.35 W/(m²K) according to the climatic zone
Flat roof with reinforced insulation	U=0,2 W/(m²K)
Other type (i.e exceptional thermal insulation properties)	*0.25 W/(m2K)*

Table 8: Input selection for heat transmission coefficients in W/m²K for roof or attic insulation (in residential buildings)

2.5.1.7 Specifications of the building components and systems: Openings

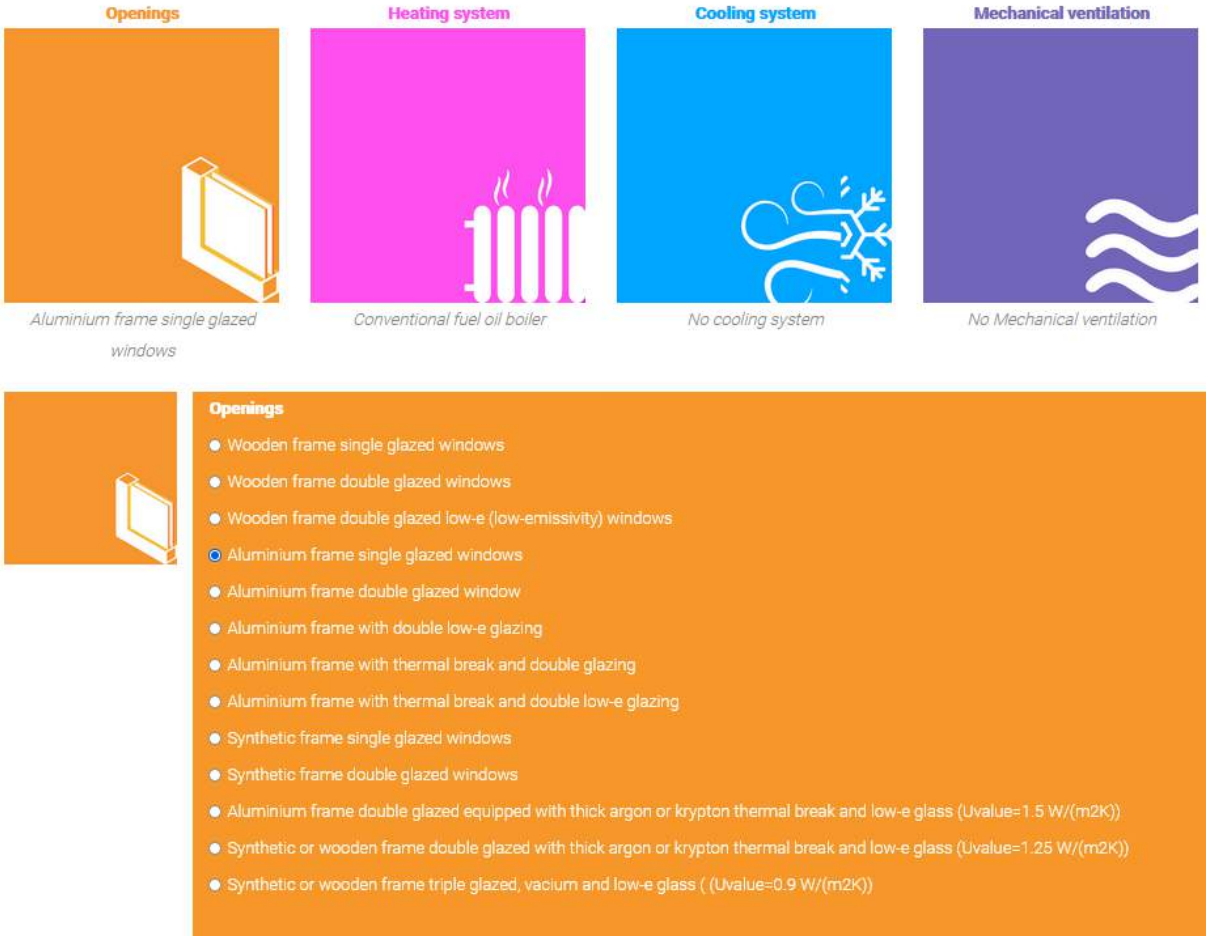


Figure 21: Screenshot of the available systems for windows included in the QualDeEPC tool

Regarding the windows, the user can find 11 choices as shown in Table 8.

Construction type	**U-Value** (examples for Greece, may need to be adapted to national situation)
Wooden frame single glazed windows	5 W/(m²K)
Wooden frame double glazed windows	2.9 W/(m²K)
Wooden frame double glazed low-e (low-emissivity) windows	2.1 W/(m²K)
Aluminium frame single glazed windows	6 W/(m²K)
Aluminium frame double glazed window	3.7 W/(m²K)
Aluminium frame with double low-e glazing	3 W/(m²K)
Aluminium frame with thermal break and double glazing	2.9 W/(m²K)
Aluminium frame with thermal break and double low-e glazing	2.3 W/(m²K)
Synthetic frame single glazed windows	5.0 W/(m²K)

Construction type	**U-Value** (examples for Greece, may need to be adapted to national situation)
Synthetic frame double glazed windows	3.0 W/(m²K)
Aluminium frame double glazed equipped with thick argon or krypton thermal break and low-e glass	1.5 W/(m²K)
Synthetic or wooden frame double glazed with thick argon or krypton thermal break and low-e glass	1.25 W/(m²K)
Other window type with very low U-value (e.g. triple glazed, vacuum gap)	U < 0.9 W/(m²K)

Table 9: Input selection for heat transmission coefficients in W/m²K for standard windows (in residential buildings)

2.5.1.8 Specifications of the building components and systems: Heating systems

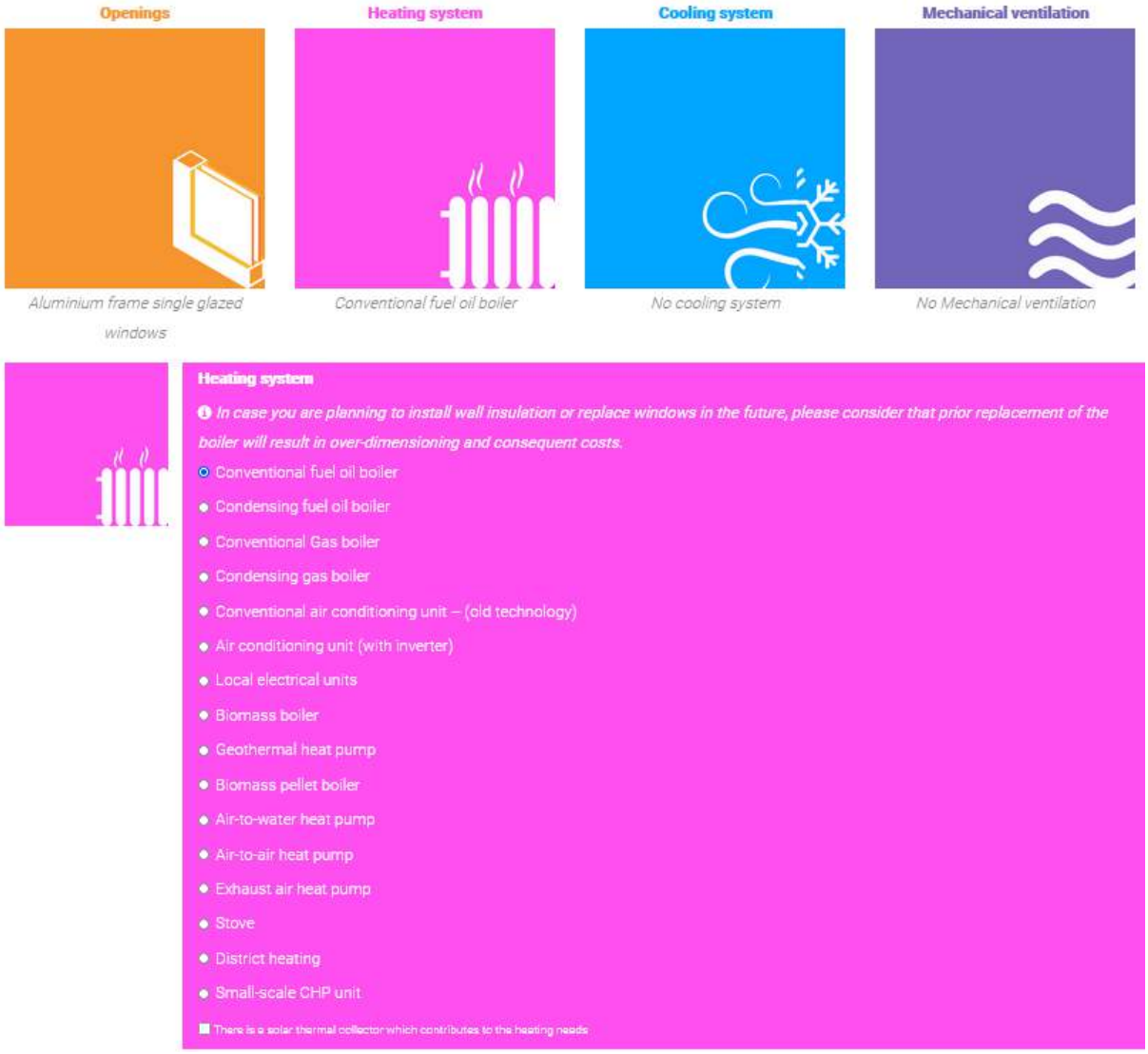


Figure 22: Screenshot- Selection of heating systems

Heating system type	Efficiency (examples for Greece),
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

Table 10: Input selection for heating systems (in residential buildings)

2.5.1.9 Specifications of the building components and systems: Cooling systems

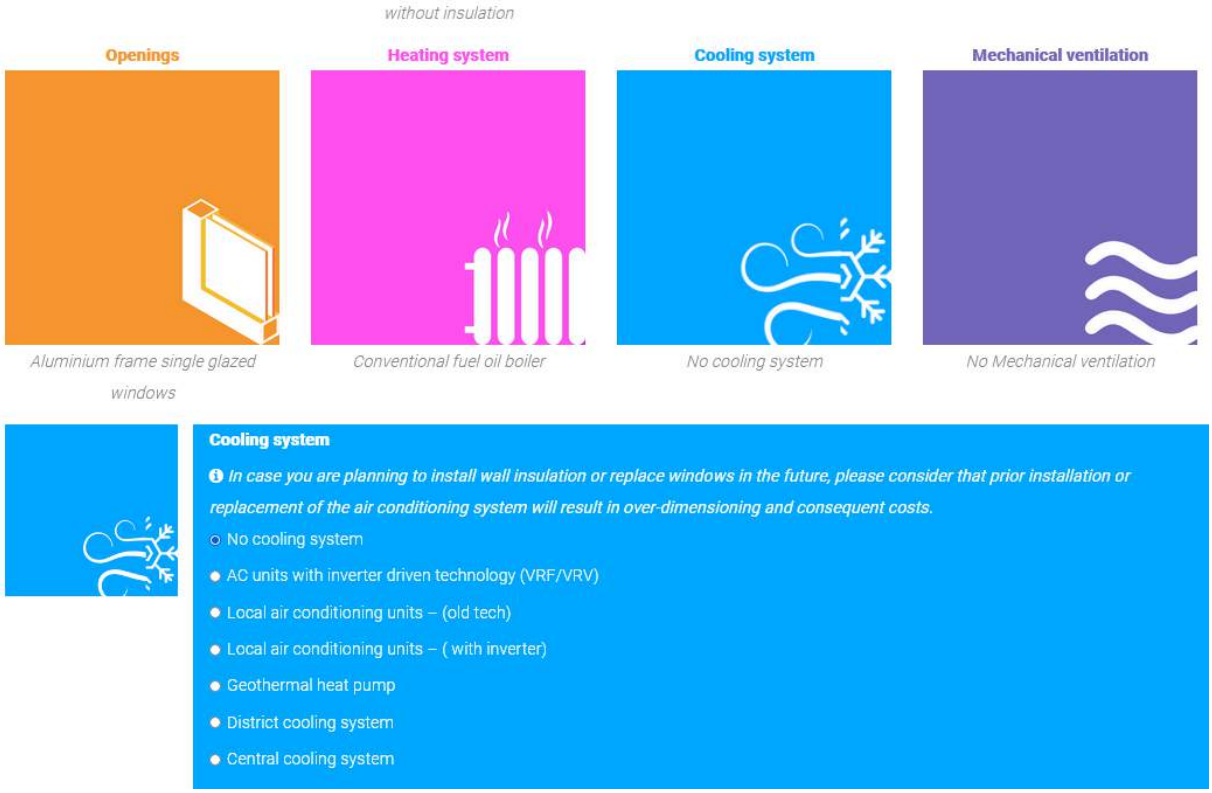


Figure 23: Cooling systems selection

Cooling system type	**Efficiency** (examples for Greece)
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

Table 11: Comparison of measures to improve cooling systems (in residential buildings)

2.5.1.10 Specifications of the building components and systems: Ventilation

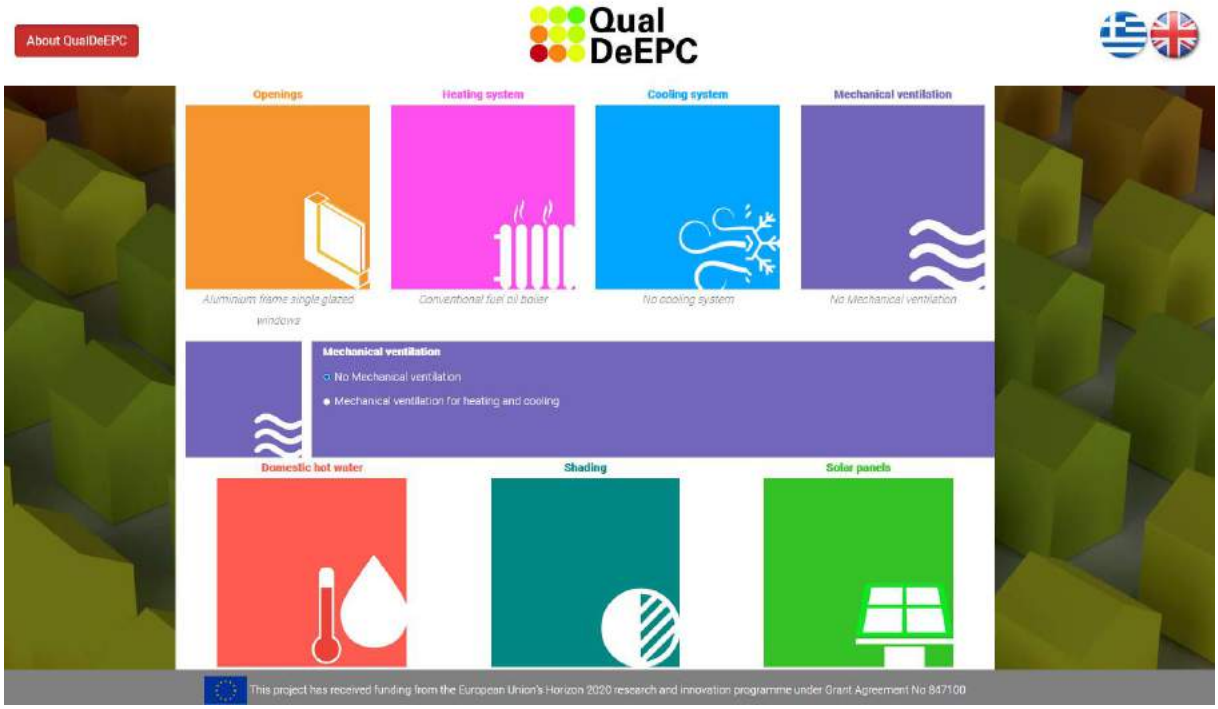


Figure 24: Available selections regarding the ventilation system

System Type	Mechanical Ventilation
Heating System	☐ or ☑
Cooling System	☐ or ☑

Table 12: Mechanical Ventilation system options for heating and cooling systems

2.5.1.11 Specifications of the building components and systems: DHW

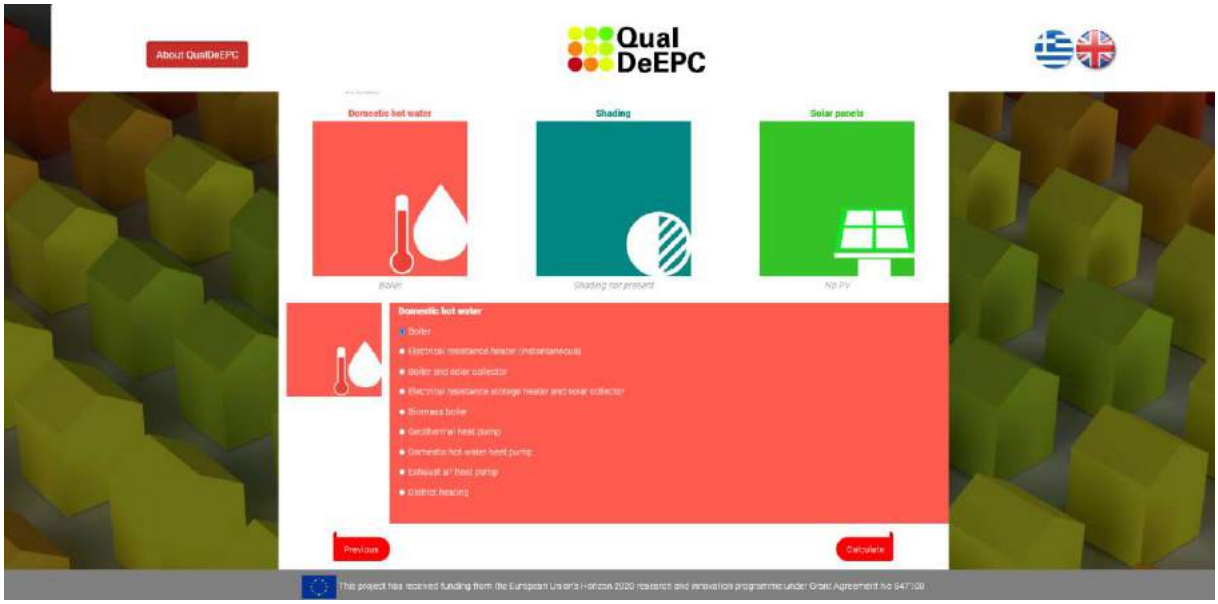


Figure 25:Hot water production systems selection.

Hot water system type	Efficiency (examples for Greece), s
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

Table 13: Selection input for DHW systems (in residential buildings)

2.5.1.12 Specifications of the building components and systems: Shading

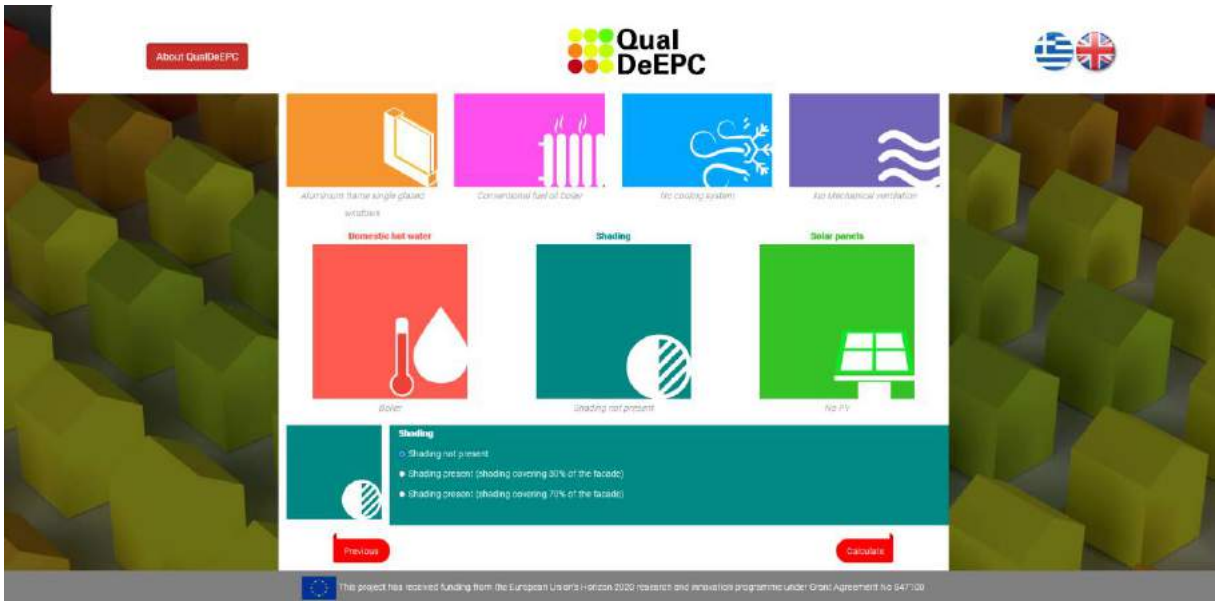


Figure 26: Shading choices

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

Table 14: Input selection for shading (in residential buildings)

2.5.1.13 Specifications of the building systems: RES

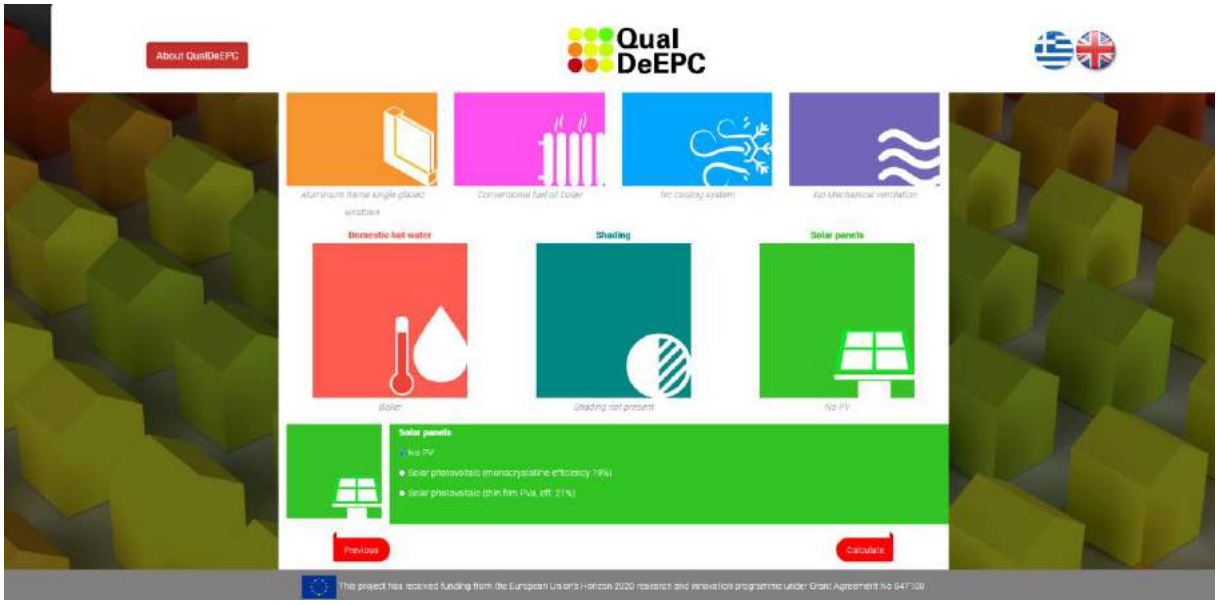


Figure 27: Renewable energy sources selection

In case of the RES system selection, if made, the software tool 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%.

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%

Table 15: Comparison of measures to integrate renewable energy sources (in residential buildings)

2.5.2 Results

2.5.2.1 Estimation of current energy consumption

All inputs provided by the user are used to run the software tool, which provides an estimate of the current energy consumption of the building in energy figures as well as an estimate of the energy class which is indicated on the energy classification scale shown on screen. The results are provided for the yearly final energy consumption for heating, cooling and domestic hot water production.

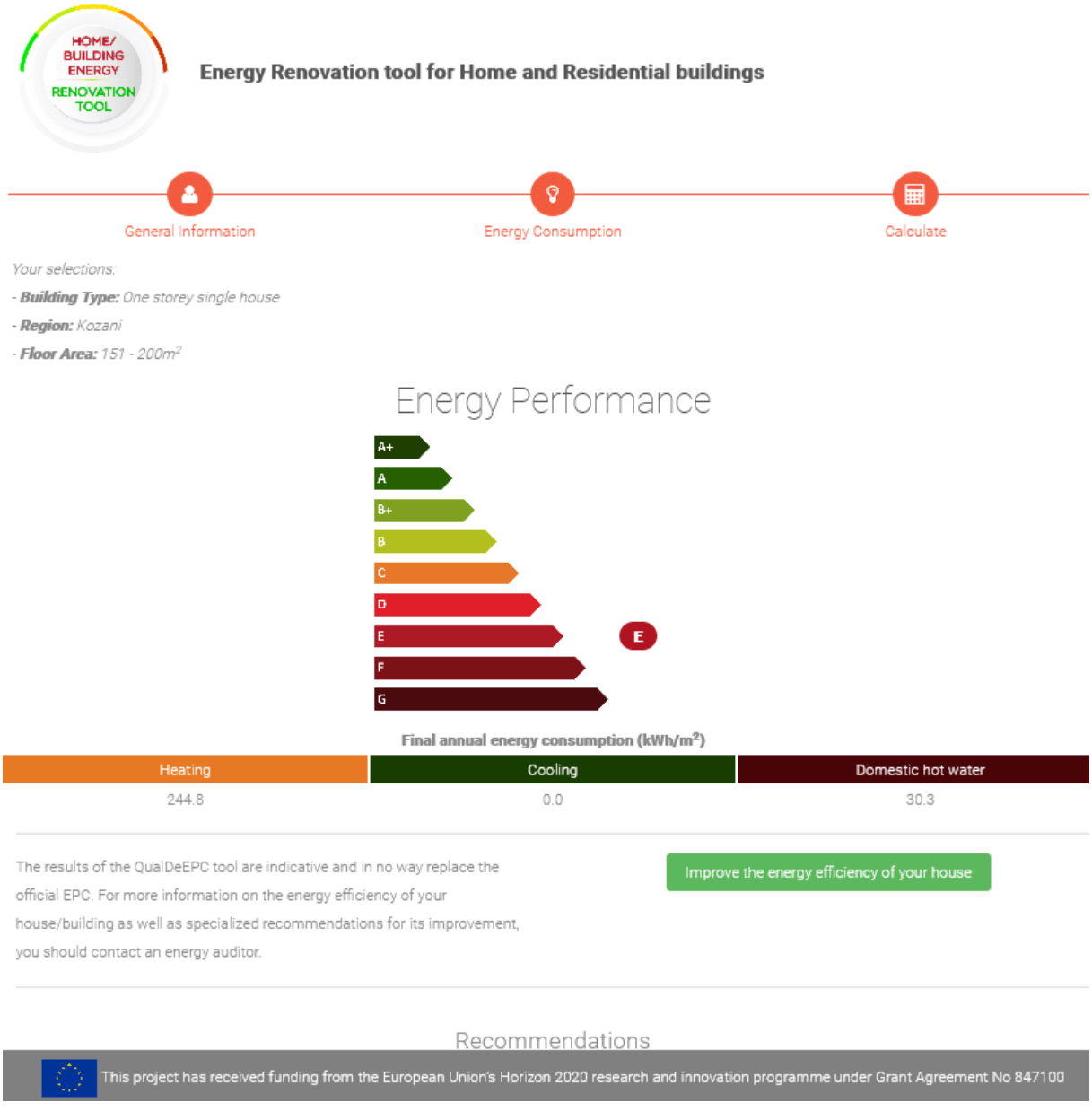


Figure 28 Screenshot of the estimated current energy consumption of the residential building

2.5.2.2 Selecting renovation recommendations

The user can select the renovation measures which will be tested by clicking on the "Improve the energy efficiency of your house" button. Then, the user has the possibility to apply energy efficient

solutions for building systems and components. In order to procceed, the user should select at least one improvement of the building components or systems.

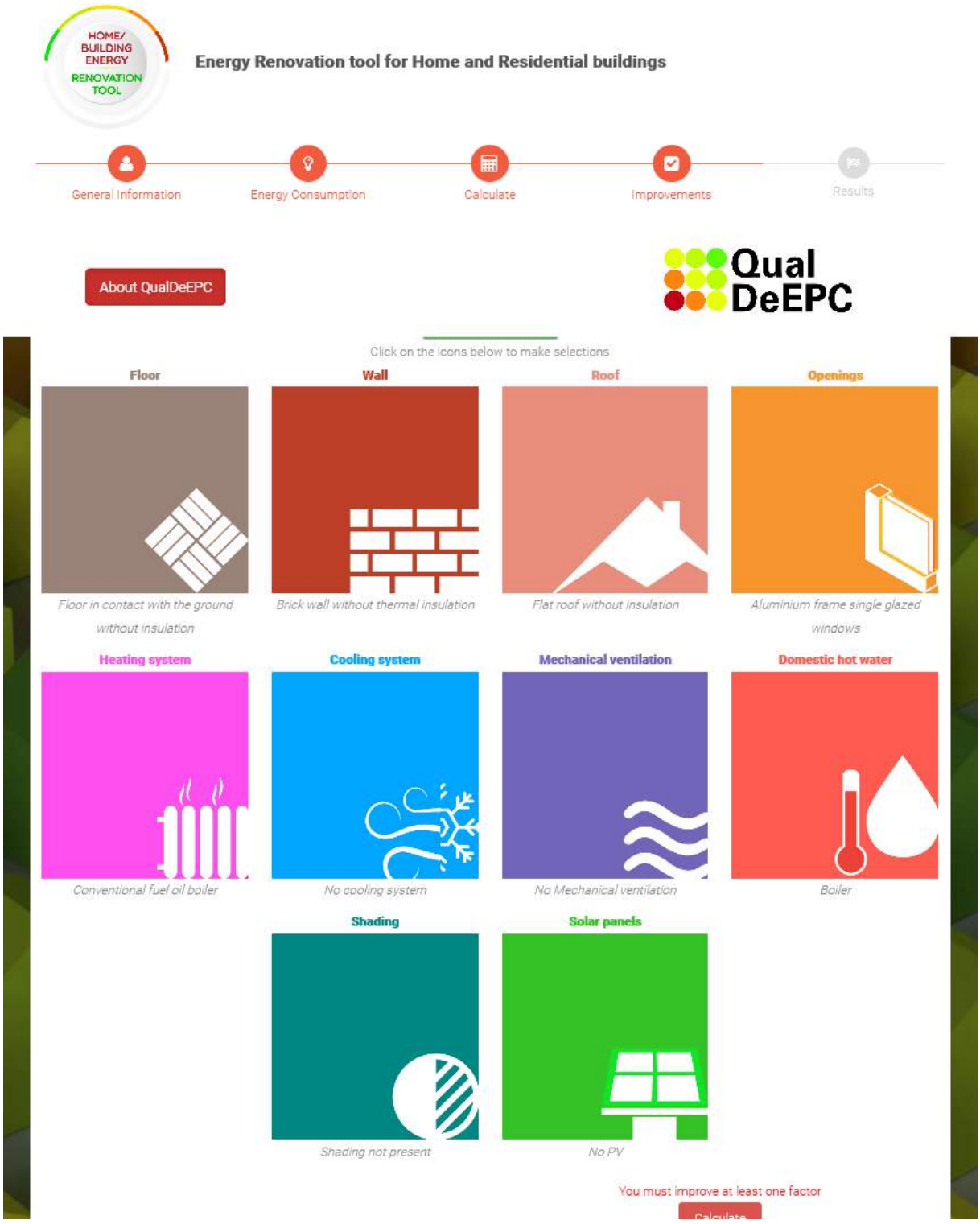


Figure 29: Improvements selection

The same screen includes information about the QualDeEPC proposed set (see Table 16) of renovation recommendations consistent with the “deep energy renovation”. The proposed recommendations are

presented in a prioritized manner and included in the relevant lists for improving energy efficiency, so as the user to get familiar with the typical order of implementing such measures avoiding any damages of the systems in the future or lock-in effects.

#	Type	Action
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	Floor insulation	Floor area with enhanced thermal insulation properties which fulfils nZEB requirements
6	Replacement/ modernization of the heating system	Energy efficient devices i.e. heat pumps, condensing boilers with A energy category label
7	Replacement/ modernization of the cooling system	Use of efficient cooling systems (A energy label), geothermal heat pump, reversible inverter air-air heat pump, etc.
8	Utilization of renewable energy sources	Use of solar collectors, biomass boiler, PVs for heating and electricity production purposes
9	Energy efficient DHW production	Use of solar thermal collectors or energy category A heat pumps
10	Mechanical ventilation	Utilisation of energy efficient mechanical ventilation equipment (fans, controls, etc.)

Table 16: QualDeEPC Mastertool recommendations towards deep renovation

Furthermore, information about the engineering approach (see section 2.5.2.3) when considering the improvement of the envelope performance is provided in the selection lists of the systems and components (see Figure 31).

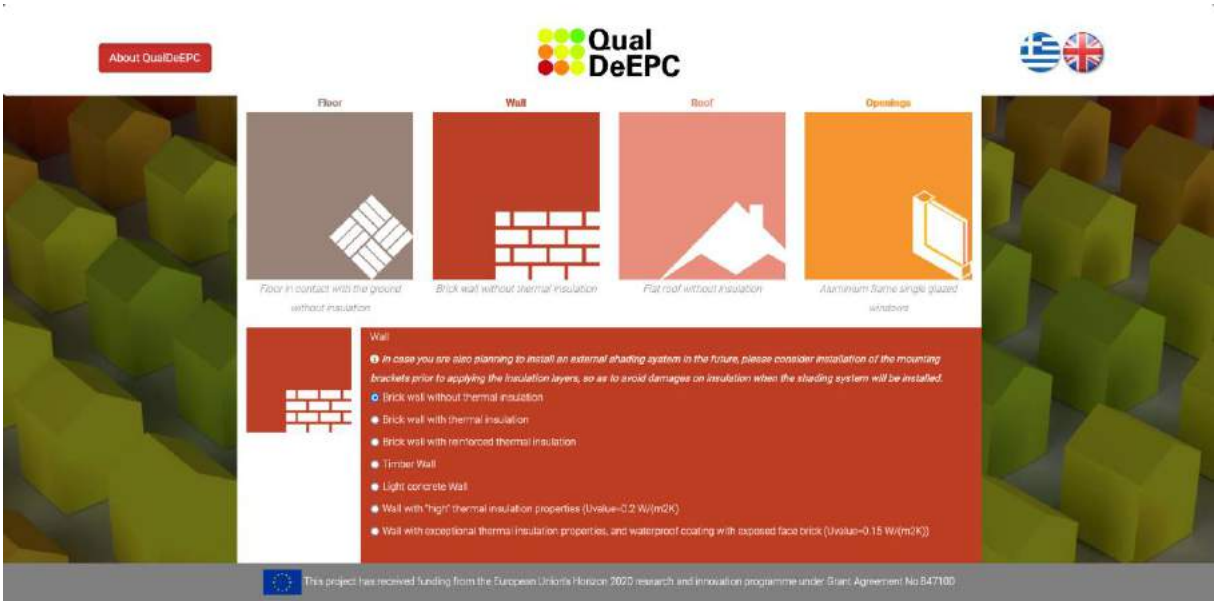


Figure 30: Info about the rationale of the measures (example Walls)

It has to be noted that the improvement measure or measures can be compared with the current energy figures of the house only once. In case the user wishes to check more options, he has to re-enter the input values.

2.5.2.3 Comparison between existing and renovation case; and deep energy renovation checkmark

Finally, the results from the comparison between the current and energy renovated case are given. Additionally, the new energy class of the house is given together with the achieved energy savings (in %), the CO_2 emissions reduction (in %) and an estimate of the investment required for the improvement measures tested (see Figure 32).

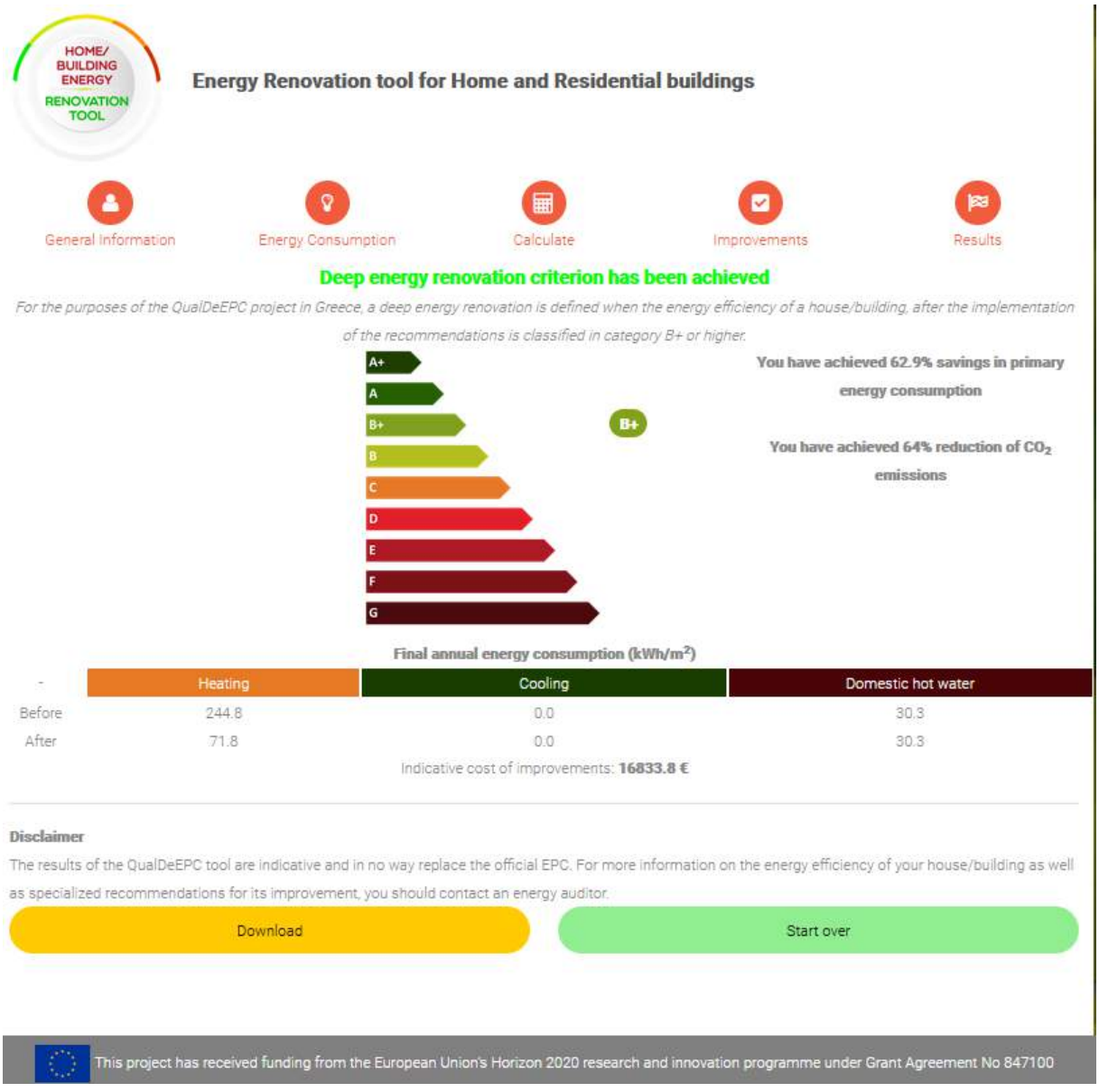


Figure 31: Results comparison

An extra message states if Deep energy Renovation criteria have been achieved (see Figure 32).

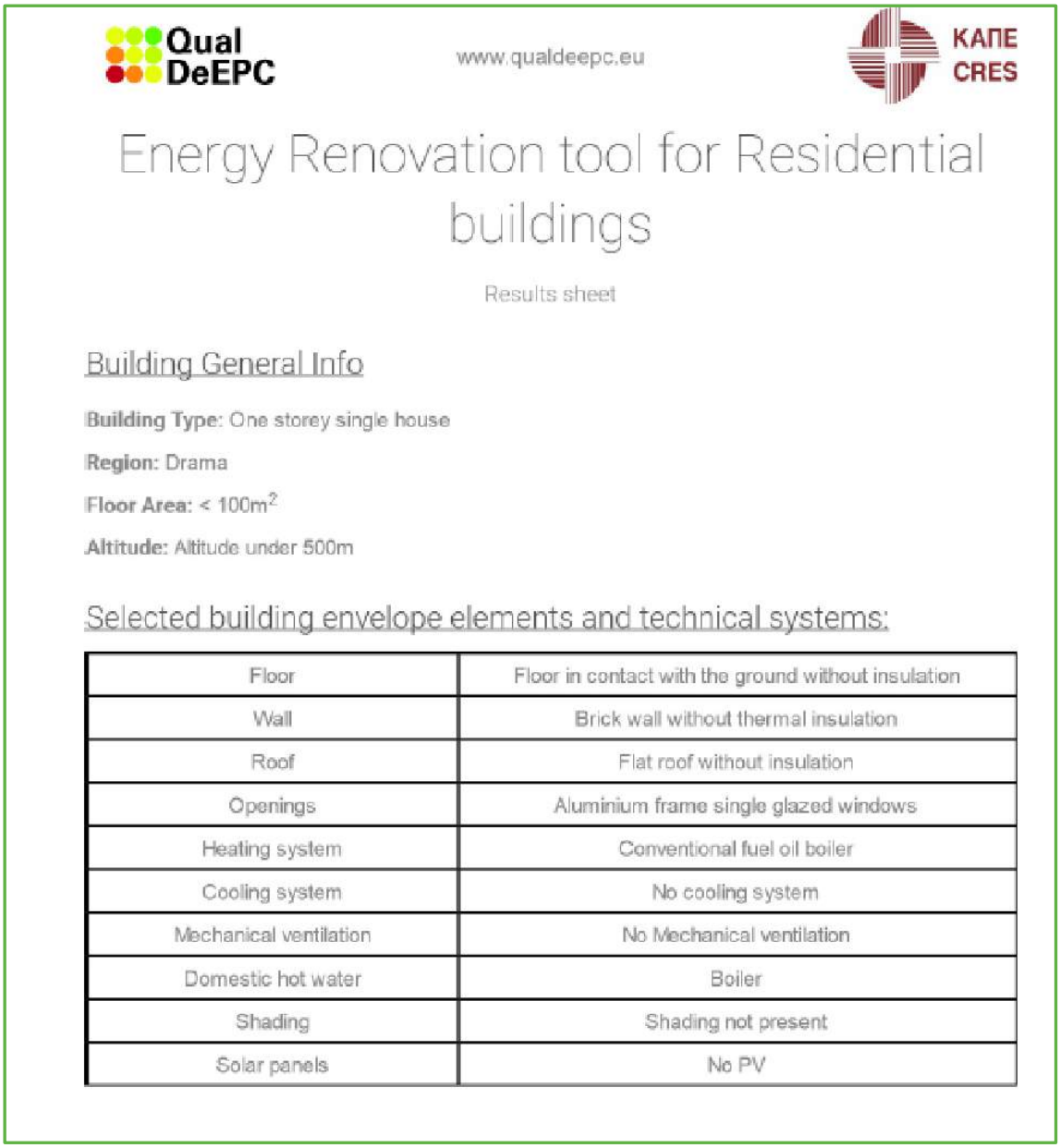
- Deep energy renovation of the house/building will be achieved when fully implementing the recommendations or
- Deep energy renovation of the house/building will not be achieved when fully implementing the recommendations.

Output of recommendations

The user has the option to download the report for the current test. In the report (in pdf format) for the test conducted by the user, the following information is available:

Page 1

- Building general information
- Selected building envelop components and technical systems



Qual DeEPC www.qualdeepc.eu ΚΑΠΕ CRES

Energy Renovation tool for Residential buildings

Results sheet

Building General Info

Building Type: One storey single house

Region: Drama

Floor Area: < 100m^2

Altitude: Altitude under 500m

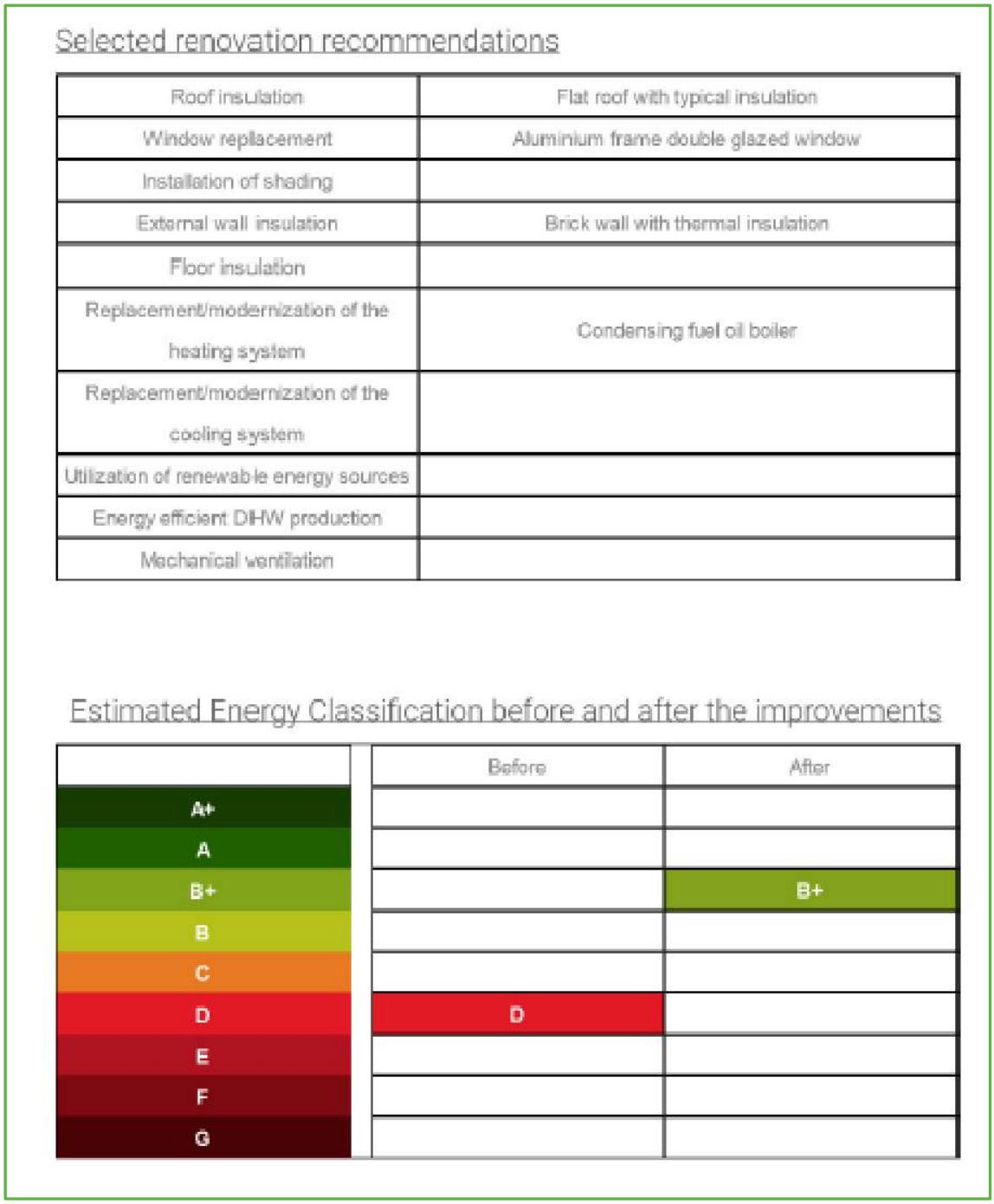
Selected building envelope elements and technical systems:

Floor	Floor in contact with the ground without insulation
Wall	Brick wall without thermal insulation
Roof	Flat roof without insulation
Openings	Aluminium frame single glazed windows
Heating system	Conventional fuel oil boiler
Cooling system	No cooling system
Mechanical ventilation	No Mechanical ventilation
Domestic hot water	Boiler
Shading	Shading not present
Solar panels	No PV

Figure 32: QualDeEPC tool results report layout (page1)

Page 2

- Selected renovation recommendations listed in a prioritized manner regarding which energy efficiency technology should take place first and in what order (see Figure 34).
- Estimated energy classification before and after the improvements



Selected renovation recommendations

Roof insulation	Flat roof with typical insulation
Window replacement	Aluminium frame double glazed window
Installation of shading	
External wall insulation	Brick wall with thermal insulation
Floor insulation	
Replacement/modernization of the heating system	Condensing fuel oil boiler
Replacement/modernization of the cooling system	
Utilization of renewable energy sources	
Energy efficient DHW production	
Mechanical ventilation	

Estimated Energy Classification before and after the improvements

	Before	After
A+		
A		
B+		B+
B		
C		
D	D	
E		
F		
G		

Figure 33: QualDeEPC tool results report layout (page 2)

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

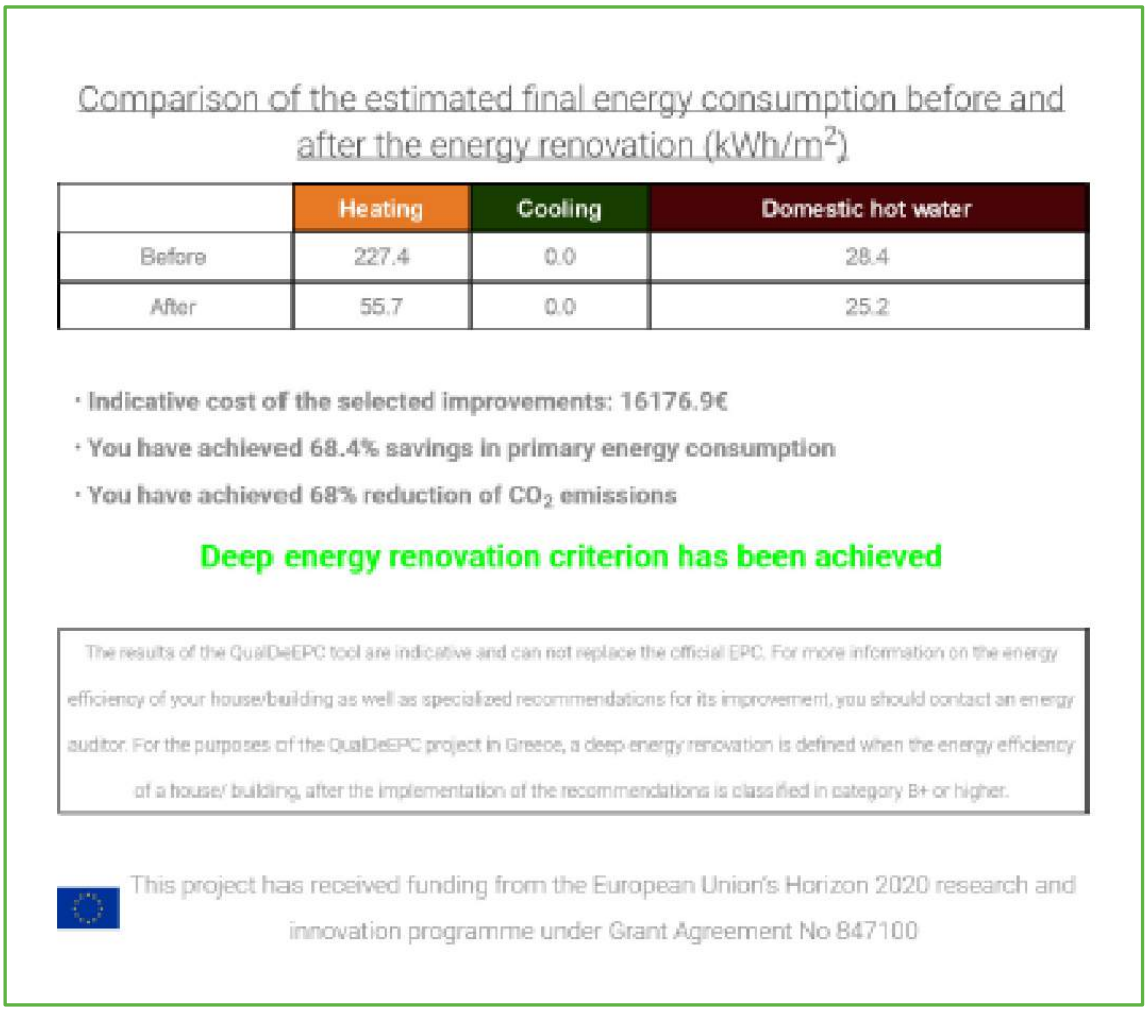
Pillar I: the commonly accepted engineering / scientific approach

1st: improve the performance of the envelope components so as **to reduce the energy demand of the building**
2nd: **improve the efficiency of the Technical Systems,** the dimensioning of which will be based on the 'reduced energy demand', after implementation of Step 1

3rd: **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



Comparison of the estimated final energy consumption before and after the energy renovation (kWh/m^2)

	Heating	Cooling	Domestic hot water
Before	227.4	0.0	28.4
After	55.7	0.0	25.2

- **Indicative cost of the selected improvements: 16176.9€**
- **You have achieved 68.4% savings in primary energy consumption**
- **You have achieved 68% reduction of CO_2 emissions**

Deep energy renovation criterion has been achieved

The results of the QualDeEPC tool are indicative and can not replace the official EPC. For more information on the energy efficiency of your house/building as well as specialized recommendations for its improvement, you should contact an energy auditor. For the purposes of the QualDeEPC project in Greece, a deep energy renovation is defined when the energy efficiency of a house/ building, after the implementation of the recommendations is classified in category B+ or higher.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No 847100

Figure 34: QualDeEPC tool results report layout (page 3)

Page 3

- Estimated final energy consumption before and after energy renovation (kWh/m^2) for space heating and cooling as well as domestic hot water.
- Indicative cost of the selected renovation recommendations – improvements
- Estimated savings in primary energy consumption and CO_2 emissions
- Statement if the deep energy renovation criterion has been achieved

Moreover, the final page of the report includes information on the definition of "Deep Energy Renovation" (example for Greece) and the following disclaimer: *The results of the QualDeEPC tool are indicative and in no way replace the official EPC. For more information on the energy efficiency of your*

house/building as well as specialized recommendations for its improvement, you should contact an energy auditor.

2.6 Creating Deep Renovation Network Platforms (DRNPs)

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 concepts for Deep Renovation Network Platforms created 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 16. 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 (see Table 16) and extended (see Table 17), 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.

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.

The proposed sub-types can be summerized as follows:

1. **an online platform:**
   1a) an online platform including information only by a One-Stop-Shop (**OSS**) such as the Greek 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 presented in Table 17 and Table 18.

Table 17: Basic part of the DRNP

Services/products	Description of services	Details of Services offered	Users addressed (examples)	Examples	Minimum version
1. Information on renovation actions **1.1 General information**	• Providing general information and other benefits due to renovation • Providing information on principles of insulation, heating, cooling, and ventilation systems, renewable energies • descriptive texts and graphics on the website with information • text and graphic documents downloadable as pdf-documents	General information on renovation actions • energy consulting/advice • deep (full) renovation • building insulation • air tightness • windows • shading • ventilation • heating system • cooling system • domestic hot water • lighting • renewables • monitoring • best practice • quality management • The information should be in line with the concrete proposal by QualDeEPC for Improving the EPC recommendations towards deep energy renovation • The above list should be made consistent with the renovation actions, for which	• Building owners • Prospective buyers • Tenants • Possibly EPC assessors	https://www.energie-experten.org/bauen-und-sanieren/altbausanierung/dachsanierung.html • Roof renovation: measures at a glance • Which technical measures are part of the roof renovation? • Which advantages and disadvantages do they bring? • When is a roof renovation worthwhile? • When does it make sense to combine different renovation measures for the roof? https://www.energiesparen.be/bouwen-en-verbouwen http://translate.google.com/translate?sl=nl&tl=en&u=https%3A%2F%2Fwww.energiesparen.be%2FEPB-burgers • Insulation and airtightness • Glazing and windows • Heating • Domestic hot water • Ventilation • Lighting • Electrical devices • Green energy	General information on: • building insulation • windows • ventilation • heating system • renewables • deep renovation

Services/products	Description of services	Details of Services offered	Users addressed (examples)	Examples	Minimum version
		we develop the improved recommendations		https://www.greenmatch.co.uk/	
1.2 Information on potential savings, costs and other benefits	Providing general information on costs of renovation for deep renovations, building components, building services, renewable energy, potential energy savings, cost savings and co-benefits	Information on renovation costs and savings, benefits • energy consulting/advice • deep (full) renovation • building insulation • windows • ventilation • heating system • renewables • monitoring • best practice • quality management • energy prices • co-benefits (e.g. comfort, noise reduction, air improvement, image, value enhancement, external appearance) Same list as for 1.1 Link to the calculator for energy cost savings, possibly included in the tool (1.3)	• Building owners • Prospective buyers • Tenants • Possibly EPC assessors	https://www.energie-experten.org/bauen-und-sanieren/altbausanierung/dachsanierung/kosten.html Roof renovation: measures and costs at a glance • What does it cost? • Energy savings? https://www.energiesparen.be/energiewinst Calculation of the profit for the replacement of an old boiler (> 20 years old) with a condensing boiler in 5 steps Good practice examples with feedback from homeowners on realised energy-efficient renovation projects to motivate undecided people.	Information on renovation typical costs and savings for: • building insulation • windows • ventilation • heating system • renewables

Services/products	Description of services	Details of Services offered	Users addressed (examples)	Examples	Minimum version
1.3 Linking with renovation tools	Links to specific renovation tools and calculators which clearly outline the costs of renovation, potential energy savings and other benefits due to renovation (**QualDeEPC priority B)**)	Integration or linking of/to renovation tools in QualDeEPC partner countries, this would be the online tool for comparing EPC 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.	• Building owners • Prospective buyers • Tenants • EPC assessors	https://www.energiesparen.be/energiewinst	Integration to renovation tools or linking of existing tools in QualDeEPC partner countries. This would be the online tool for comparing EPC recommendations to deep energy renovation recommendations developed in Task 3.3
2.1 Linking with Energy Performance Certificates	• Providing detailed information on EPC assessment purposes/uses, procedure, tools and assessors • Comprehensive information on EPCs, including EPC obligations, registry of EPC assessors (with a link), explaining EPCs in terms of nZEB and national energy targets	Information on EPCs answering the following questions: • Who needs an EPC and for which purpose? • When is an EPC required? • How long is an EPC valid? • Read & understand the EPC. • Who can issue EPCs, where can I find issuer? • What types of EPCs existing? • Where EPCs are regulated? • Content of EPCs and for what it is useful. • Content of the renovation recommendations, incl improved recommendations (T.3.1) • Samples of EPCs	• Building owners • Prospective buyers or tenants • EPC assessors • Citizens • Public authorities	Information on EPCs – FAQs: • What is an EPC? • Which energy efficiency classes are there? • What does an EPC cost? • Consumption & demanded based EPC what is the difference? • Where can I apply for an energy certificate? • When is an EPC required? • How long is an EPC valid? • Read & understand the EPC. • https://www.co2online.de/modernisiert-und-bauen/energieausweis • The EPC guide will help you on your way! • An EPC tailored to your building • Questions about the EPC?	Detailed information on • EPC in general and purposes/uses/duties • EPC assessment procedure • EPC forms and types • Renovation recommendations • issue energy certificates and where this is regulated • Links to • The online renovation calculator tool (1.3) • The deep renovation recommendations (1.1) • Advertising guidelines for EPCs

Services/products	Description of services	Details of Services offered	Users addressed (examples)	Examples	Minimum version
		• Linking to EPC-assessor and energy expert databases, regulations etc. • What to present in advertisements Links to • The online renovation calculator tool (1.3) • The deep renovation recommendations (1.1) • Advertising guidelines for EPCs		• Investigations into the EPC https://www.energiesparen.be/energieprestatiecertificaten	
2.2 Linking with building deep renovation roadmap and possibly a passport	• Linking EPC information to detailed analysis to upgrade it to a Building deep renovation roadmap • • 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) •	Information on building renovation roadmap and passport • What is it? • How can the EPC be a starting point? • Benefit of the renovation roadmap and passport: why is it useful? • The methodology of the building renovation roadmap and passport • Energy efficiency of buildings (link to 1.1) • costs of the roadmap or passport and existing subsidy measures	• Building owners • Prospective buyers or tenants • EPC assessors • Public authorities	http://translate.google.com/translate?sl=de&tl=en&u=https%3A%2F%2Fwww.febs.de%2Fberaten-finanzieren%2Fisfp • Woningpas • • https://woningpas.vlaanderen.be/over-woningpas • • Passeport Efficacité Énergétique • • https://theshiftproject.org/en/experience-p2e-2 •	Information on building renovation roadmap and passport • What is it? • How can the EPC be a starting point? • Benefit of the renovation roadmap and passport: why is it useful? • Methodology of the building renovation roadmap and passport • Links to further information about the roadmap/passport • Energy efficiency of buildings (link to 1.1) Links to

Services/products	Description of services	Details of Services offered	Users addressed (examples)	Examples	Minimum version
		Links to • A list of energy consultants who can develop a Building deep renovation roadmap, and link to grants offered for it (if available) • If available, a list of energy consultants entitled to issue a Building Passport, and/or link to a software for creating such a passport • Links to further information about the roadmap/passport • Links to subsidy programmes • The online renovation calculator tool (1.3)		• Individueller Sanierungsfahrplan • https://www.febs.de/beraten-finanzieren/isfp	• Links to subsidy programmes • The online renovation calculator tool (1.3)
3. Information on building contractors/ technicians and energy-efficient-experts **Support with finding experts and building contractors/ technicians**	• Providing information regarding energy-efficient-experts, building contractors/ technicians/ installers • Providing a search engine or a databases of energy-efficiency experts/ contractors / technicians/ installers/ technical supervisors • Requesting various renovation offers/quotes from contractors/ technicians and comparing them so that the	• Information provided regarding: • Consultation of qualified experts and companies in the building sector • Instructions on how to find and recognize reputable and well-qualified companies and what to watch out for. • List of companies with authorised consultants • Link to the database of energy-efficient-experts and EPC assessors	• Building owners	Find your professional https://www.energiesparen.be/bouwen-en-verbouwen ☐ find your professional https://translate.googleusercontent.com/translate_c?depth=1&pto=aue&rurl=translate.google.com&sl=nl&sp=nmt4&tl=en&u=https://www.buildyourhome.be/nl&usg=ALkJrhgpJFfgnCyt-O6mQmbSSkrR3BBw0Q ☐ find your contractor	• Information regarding energy-efficient-experts, building contractors/ technicians/ installers • Instructions on how to find and recognise reputable and well-qualified companies (contractors/ craftsman) and what to watch out for.

Services/products	Description of services	Details of Services offered	Users addressed (examples)	Examples	Minimum version
	• end-user can make an informed choice	• How to use the service for requesting offers/quotas • Which EPC data could be the basis for requesting an offer		https://translate.googleusercontent.com/translate_c?depth=1&pto=aue&rurl=translate.google.com&sl=nl&sp=nmt4&tl=en&u=https://www.vinduwaannemer.be/&usg=ALkJrhhVoCwKqhc3GzZer2sipL8U5PVo5g Find your energy-expert: https://www.energie-experten.org/bauen-und-sanieren/altbausanierung/dachsanierung/kosten.html#c18593	
4. Information on material or product manufacturers/ suppliers	• Provides information on product manufacturers /suppliers required for deep renovation • 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	Information on the currently most frequently used materials and technologies and their manufacturers and suppliers • building insulation • windows • HVAC systems • renewables • etc. Links to further independent lists and databases for materials, products, manufacturers, suppliers	• Building owners • Building contractors/ technicians/ installers	Compare insulation prices from independent providers for free! https://www.daemmen-und-sanieren.de/daemmung/hersteller Lists of manufacturers: https://www.energie-experten.org/bauen-und-sanieren/daemmung/daemmstoffe/hersteller.html https://www.carmen-ev.de/infothek/branchenadressen/301-adresslisten-aus-datenbank/933-hersteller-von-naturdaemmstoffen https://aislaconpoliuretano.com/normativa/	

Services/products	Description of services	Details of Services offered	Users addressed (examples)	Examples	Minimum version
				Database of products: https://www.greenbuildingproducts.eu/?lang=en http://reecl.org/en/eligible-installers	
5. Information on financing opportunities for deep renovation	• Provide information about financial incentives, loans, and subsidies or third party financing	Information on funding programmes for energy-efficient buildings • overview of programs for energy-efficient renovations • database of programmes for energy-efficient renovations, with links to programme websites • link to the database of energy-efficient-experts • How to use the service for help with applying for funding • Which EPC data could be the basis for applying for funding • Links to funding programmes	Building owners	Loans & credits: https://www.energiesparen.be/leningen Information on Support programs and database for experts: https://www.deutschland-machts-effizient.de/KAENEF/Redaktion/DE/Standardartikel/foerderprogramme-hauseigentuemer.html https://www.energie-effizienz-experten.de/	Information on existing support programs for energy-efficient buildings • Links to subsidy programmes
6. Active marketing of deep renovation and its benefits and costs	• Using all kinds of media and events to promote deep renovation and its benefits and costs to building owners and investors, involving supply-side actors in the	Marketing instruments: • Media releases • Events for the public	• Building owners • Citizens • Building contractors/	https://translate.googleusercontent.com/translate_c?depth=1&pto=aue&rurl=translate.google.com&sl=nl&sp=nmt4&tl=en&u=https://www.energiesparen.be/ikBENOveer/1	• Showing advantages of energy renovation measures and co-benefits • Promotion of deep renovation network platform

Services/products	Description of services	Details of Services offered	Users addressed (examples)	Examples	Minimum version
	media work, events, and funding • Using demonstration projects to show enhanced „quality of life through insulation and energy-saving“ by bringing together various stakeholders listed in the next column	• Events for stakeholders and experts Content for the marketing: e.g., Showing advantages of different energy renovation measures and co-benefits • Showing potential savings of energy and costs linking to 1.2 Information on potential savings and costs • Promotion of deep renovation network platform • Showing Best Practice and Pilot projects • Linking to a database of efficient homes/ buildings • Providing information material of benefits of various renovation measures on the building envelope as well as of various efficient heating and hot water technologies • Linking to 1. Information on renovation actions	technicians/ installers • City/Municipality • local housing companies • the social credit agencies • Professional buildings and developers • Architects	0redenen&usg=ALkJrhi3sZt6DLjpSTaQ2GfY7VsyXlUiAg • 10 reasons to BENOver now • Download the 'I BENOveer' campaign material dena Database of efficient homes: https://effizienzhaus.zukunft-haus.info/effizienzhaeuser/ • https://www.greenmatch.co.uk/ •	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
7. Network (platform) for learning, exchange and cooperation (local/regional/ national)	• Discussing active marketing activities and involving supply-side actors, city administration, energy companies, financial institutions etc., in the media work, events, and funding • Discussing training needs and the organizing of training	Information and activities provided: • List or database of training providers • List of network partners • Workshops on cross-disciplinary topics and/ or cooperation with workshop providers • Creation and maintenance of a training calendar with events, seminars, workshops in cooperation with training providers, consumer organisations and energy agencies etc. • (Online) Platform for exchange between professionals, e.g. EPC issuers	• Building contractors/ technicians/ installers • City/Municipality • local housing companies • the social credit agencies • Professional buildings and developers • Architects • Financial institutions • Energy companies	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.--> https://www.fortbildungskalender.de/termine https://www.energieagentur.nrw/veranstaltungen	• List of existing renovation platforms, involving supply-side actors, city administration, energy companies, financial institutions etc, • List of training providers for EPC assessors • Link to lists of workshops and seminars

Table 18: Extended part of the DRNP

Services/products	Description of services	Users addressed (examples)	Examples of organisations that could act as providers
8. Network (platform) for learning, exchange and cooperation (interregional/ transnational)	• 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 • 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. • **Examples**: 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.	• Construction and financial sector including sector federations, contractors, builders, renovation consultants, banks, financial institutions • All cities	• Platform facilitator itself • Energy Agency • Professional associations/ federations of energy assessors
9. Capacity building and training	• 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. • Training and learning platform to obtain expertise and sector capacity • 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	• Sector/professional federations • Training organizations • Professional buildings • Architects • Contractors	• Platform facilitator itself • Energy Agency • Other third parties
10. Step-by-step guidance for renovation project from start to end	• Offering step-by-step guidance documents including monitoring of renovation project from start to end • Possibly: Requesting various renovation offers/quotes from contractors/technicians and comparing them so that the end user can make an informed choice • Full inspection of home and proposal for a renovation plan and quality control after renovation works	• Building owners • Prospective buyers	• Platform facilitator itself • Energy Agency • Third party (Network partners from the platform with a network of companies of craftsmen, planners and constructions workers)

Services/products	Description of services	Users addressed (examples)	Examples of organisations that could act as providers
	• Possibly: Hotline in case of questions during decision-making and implementation of works • Drawing up a measurement report with an overview of costs and energy savings		
11. Monitoring the implementation of the renovation project(s)	• 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 • Follow-up of the renovation works • 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.	• Owners • Trustees • Building professionals • EPC assessors • Communities • Social landlords • Third-party investors ◦ Renewable energy professionals	• City/Municipality • Platform facilitator itself • Energy Agency • Financial institution • Third-party (Network partners from the platform with a network of companies of craftsmen, planners and constructions workers)
12. Operating a physical network hub and information centre	• 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	• Building owners and/or investors • Building professionals • All end-user groups	• Platform facilitator itself
13. Carrying out renovation project(s)	• 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 • Possibly providing the finance for the works	• Building owners and/or investors	• Financial institution • Third-party (Network partners from the platform with a network of companies of craftsmen, planners and constructions workers) • Platform facilitator itself (if it is a construction company or similar)
14. Initiation and coordinating deep renovation demonstration project(s)	• 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“	• Building professionals • Building owners and/or investors • Third-party investors	• City/ Municipality • Platform facilitator itself • Energy Agency • Financial institution

Services/products	Description of services	Users addressed (examples)	Examples of organisations that could act as providers
			• Third-party (Network partners from the platform with a network of companies of craftsmen, planners and constructions workers)
15. Aggregation of building renovation projects	• 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).	• Building owners and/or investors	• Platform facilitator itself • Energy Agency • Third party (Network partners from the platform)

2.6.1 QualDeEPC general policy recommendations

Based on the analysis and the detailed concepts presented in the White Paper, 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.

2.7 Voluntary/mandatory advertising guidelines for EPCs & Improving compliance with the mandatory use of EPCs in real estate advertisements

The EPBD requires *that **the energy performance indicator** of the energy performance certificate of the building or the building unit, as applicable, **is stated in the advertisements in commercial media*** when they are offered for sale or rent (DIRECTIVE 2010/31/EU, recast 2018, art.12).

QualDeEPC recognized that the level of compliance with this provision varies among the Member States as well as in the represented countries in the project, therefore, a set of concrete advertising guidelines presenting EPCs in real-estate advertisements was developed. This policy proposal was developed as such a tool for building owners, real estate agents, or specialized websites for real estate advertisements to ease compliance with the legal requirements for display of EPCs or the energy performance information, or to offer additional energy performance information on a voluntary basis. The policy proposal consists of:

1. A Proposal for voluntary advertising guidelines and their use
2. A Proposal for legislation making their use mandatory if Member States wish to do so

Furthermore, QualDeEPC analyzed other potential measures for improving compliance with the mandatory use of EPCs in real estate advertisements, which are presented in chapter 2.7.3.

2.7.1 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.

Table 19: 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_2 emissions • 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. • URL to the EPC or EPC number should be provided, when possible, especially if EPCs are in public domain • 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	• Provide publication parameters for displaying the EPC content such as size, colours, background, pixels, and typography. • Provide softcopies of the EPC content, especially for digital media • Provide graphical and text examples of advertisements for various media

2.7.2 *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."

2.7.3 *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 20: 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: • Marketing and advertising departments of real-estate portals, newspapers and magazines etc. to not accept advertisements that do not adhere to mandatory guidelines • Housing finance companies, banks etc. • Real-estate companies, letting agencies, property management firms etc. • Building owner associations etc.	
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

3 QUALDEEPC GUIDANCE FOR IMPROVED EPCS AT NATIONAL LEVEL

3.1 Bulgaria

The enhanced and converging EPC assessment and certification scheme adapted to the Bulgarian context cover the seven priorities developed by QualDeEPC project. One of the major improvements in the Bulgarian case is related to the focus on the deep energy renovation and the related recommendations.

In addition, the identified aspects/barriers grouped in 5 different categories were analyzed and some measures reflecting all the aspects of for all priorities were proposed in the table below. The measures cover amendments proposal of several legislative documents as well as technical guides, better use and promotion of the DRNP which can provide information on technical, financial and training aspects. An online tool which compares specific recommendations including technical information, costs, indicative saving has been also developed.

We have as well, developed some proposal for a regulatory mandatory training of the assessors, a training program including the training topics and some advertising guidelines and recommendations.

Table 21: Overview of the different aspects for adapting QualDeEPC Deep Energy Renovation Recommendations policy proposal in Bulgaria

Aspect	Description	Proposed measure(s)
Legislative and regulatory aspect	- insufficient requirements for deep renovation in buildings	- introduction of higher requirements for the deep renovation by the amendment of the Energy Efficiency Act and Ordinance 7
	- complexity of the energy efficiency legislation	- review and harmonization of the technical standards, if possible, collection of the requirement in a specific document referring to the other legislative documents- Introduction of special provisions to ensure optimal characteristics of the buildings and the installations. Include the legislation topics in the regular mandatory trainings for the assessors
	- lack of restrictions on the use of environment unfriendly fuels	-restriction of the environmental unfriendly fuels and promotion of ecological sources of heating and cooling

Aspect	Description	Proposed measure(s)
Financial aspect	- low energy prices, which make the investments in Deep Renovation less attractive - lack of market mechanisms (financial aid for deep renovation- grants only) - limited access to finance - insufficient market mechanisms - risk perception by funding institutions - energy efficiency projects rarely meet the risk assessment criteria of the banks - energy poverty of the homeowners and financial inability to invest in deep renovation - high cost of the innovative technologies	- financial measures for improvement of energy efficiency in building renovation linked with targeted/achieved energy savings -development of financial instruments and facilitation of the access to them - development of different funding programs for renovation - introduction of separate measures with different intensity of the grant depending on the program -use the financial tools information on the DRNP
Expert capacity	- insufficient awareness of the benefits of the deep renovations - lack of accessible and quality consultations on the deep renovation process - insufficient qualified and experienced staff in the overall process of deep renovation	- rising awareness campaigns at national and local level; include the topic in the regular mandatory training for assessors - Deep Renovation Network Platform could be used to enhance the overall process - training campaigns for capacity building at local level - municipality, energy consultants, branch chambers -promote the DRNP which contain information related to trainings, technologies, other tools

Aspect	Description	Proposed measure(s)
Technical aspect	- lack of unified technical database - creates difficulties for the planning of the renovations - lack of systematic maintenance of the buildings - leads to huge investments for renovation and EE - insufficient preparation of the construction sector	- establishment of unified digital technical database for the different building categories - support for pilot projects as an example project and dissemination of the results - at the financial planning stage, take in consideration the overall condition of the buildings and the provision for deep renovation financial resources - encouragement and promotion of the use of good quality materials and RES - digitization of building technical passports and creation of database and connected interinstitutional systems - development of replicable package solutions -organize tailored trainings on design and installation of the solutions -promote the DRNP which contains information on trainings, demo buildings, technologies, online tools
Social aspect	- ownership in residential buildings - different social, financial, age and psychological profile of the occupants - large percentage of unoccupied dwellings e.g., small number of owners makes the investment in the renovation inefficient	- different financial participation, proportional to the needs and capacities of the owners, ensuring the optimal use of the financial resources - improved legal framework for the owners' association - increased requirements to the owners related to the maintenance, including unoccupied properties - increased control and empowerment of the local authorities -promotion of the use of efficient and environmentally friendly sources for heating and hot water -Promote the DRNP which offers information on the Deep Energy renovation, online tool for comparing the EPC recommendations

3.1.1 *Defining 'Deep Energy Renovation' in Bulgaria in the framework of QualDeEPC*

In Bulgaria, there is no official definition if the term "Deep Energy Renovation". We propose that it is defined **as 'renovation achieving component energy standards equal to at least those that are usually required to meet nZEB requirements for existing buildings'**. "Nearly zero energy building" in Bulgaria, as per the Energy Efficiency Act, is defined as a building that meets both of the following conditions: a) the energy consumption of the building, defined as primary energy, meets Class A of the scale of energy classes for the type of buildings; b) not less than 55 per cent of the consumed (supplied) energy for heating, cooling, ventilation, hot water and lighting is energy from renewable sources located on site at the building level or near the building.

In addition, deep energy renovation is leading to refurbishment that reduces both the delivered and final energy consumption of a building by a significant percentage compared with pre-renovation levels, leading to very high energy performance. For example, according to the staff working document accompanying the Commission's 2013 report on financial support for energy efficiency in buildings, 'deep renovation' can be considered as renovation that leads to significant (typically more than 60 %) efficiency improvements. Such savings may also be achieved in Bulgaria

Proposed revisions in the existing laws, regulations and standards incorporating the policy proposal

If the suggested definition for "Deep Energy Renovation" is accepted it should be adopted in an amendment of the Energy Efficiency Act of 12.03.2021 and all the related regulations and acts.

3.1.2 *Adopting the Recommendations for renovation provided in the EPCs towards deep energy renovation*

The following table illustrates the adapted values of the specific recommendations towards deep energy renovation in Bulgaria. The recommendations and specific values indicated could serve both for residential and non-residential buildings.

	Specific recommendation	Value	Source of information
External wall insulation	Wall with enhanced thermal insulation properties (nZEB for renovation standard or similar)	max. 0,28-W/m^{2}K	Ordinance 7 for Energy Efficiency in Buildings; National plan for NZEB 2015-2020
	Wall with exceptional thermal insulation properties (nZEB for new buildings standard or similar)	max. 0,22 W/m^{2}K	Ordinance 7 for Energy Efficiency in Buildings; National plan for NZEB 2015-2020

	Specific recommendation	Value	Source of information
Roof insulation	Roof with enhanced insulation	max. 0,25 W/m^{2}K	Ordinance 7 for Energy Efficiency in Buildings; National plan for NZEB 2015-2020
	Roof with exceptional thermal insulation properties	max. 0,22 W/m^{2}K	Ordinance 7 for Energy Efficiency in Buildings; National plan for NZEB 2015-2020
Insulation of ceiling of an unheated basement/ ground floor	Floor connected to the unheated basement or ground floor with reinforced insulation	max. 0,5 W/m^{2}K	Ordinance 7 for Energy Efficiency in Buildings; National plan for NZEB 2015-2020
Window replacement	Window with enhanced insulation properties: e.g., Double glazed window equipped with thick argon or krypton thermal break and low-emissivity glass	max. 1,4 W/m^{2}K	Ordinance 7 for Energy Efficiency in Buildings; National plan for NZEB 2015-2020
	Window with exceptional insulation properties, e.g., triple glazed window	max. 1,1 W/m^{2}K	Ordinance 7 for Energy Efficiency in Buildings; National plan for NZEB 2015-2020
Door replacement	Door with enhanced insulation properties	max. 1,4 W/m^{2}K	Ordinance 7 for Energy Efficiency in Buildings; National plan for NZEB 2015-2020
	Door with exceptional insulation properties	max. 1,1 W/m^{2}K	Ordinance 7 for Energy Efficiency in Buildings; National plan for NZEB 2015-2020
Replacement/ Installation of shading	External blinds (Venetian, shutters or awning)	Min 0,25 $F_{sh,gl}$	Ordinance 7 for Energy Efficiency in Buildings; National plan for NZEB 2015-2020
	Fixed horizontal/vertical shading devices, such as overhangs, louvers	Min 0,4 $F_{sh,gl}$	Ordinance 7 for Energy Efficiency in Buildings; National plan for NZEB 2015-2020
Replacement/ installation of the mechanical ventilation system	Ventilation system (no heat recovery) with an exceptionally low electrical power requirement	to be considered; no specific requirements	

	Specific recommendation	Value	Source of information
	Ventilation system with heat recovery of min. 80% and very low electrical power consumption	Min 70%	Ordinance 7 for Energy Efficiency in Buildings; National plan for NZEB 2015-2020
	Ventilation system with heat recovery of min. 90% and low electrical power consumption	to be considered; no specific requirements	
Replacement/ modernization of the heating system	Generally: heating systems with EU energy label Cat. A or above, for example:	EU energy label Cat. A or above	
Replacement/ modernization of the cooling system	Generally: cooling system with EU energy label Cat. A or above	EU energy label Cat. A or above	
Replacement/ modernization of the DHW system	Generally: DHW system with EU energy label Cat. A or above	EU energy label Cat. A or above	
Integration of renewable energy sources	significant extent of energy demand/ consumption should be covered by renewable energy sources;	Min 55%	Ordinance 7 for Energy Efficiency in Buildings; National plan for NZEP 2015-2030
	alternatively, all external walls, the roof, and ground floor should be insulated with exceptional thermal insulation	to be considered; no specific requirements	
	photovoltaic system (including for self-use)	to be considered; no specific requirements	
Lighting	LED	70%	
	Dimmers	to be considered; no specific requirements	
Reduction of thermal bridging	Reduced thermal bridging for non-structural building elements, such as balconies, terraces, dormers, and fixed shading devices	yes; no specific requirements	

	Specific recommendation	Value	Source of information
Increased air tightness	Air exchange rate of 1.5 h^{-1} or lower at 50 Pa pressure difference	max. 1,5h^{-1}	
	OR		
	Air tightness according to new building standard	yes; no specific requirements	
Building automation	Building automation system Cat. B or above according to EN 15232	B or above for new buildings	BDS-EN 15232
Others	Insulation of all pipes	to be considered; no specific requirements	
	Replacement of circulation pumps by pumps that meet minimum requirement of ErP label	EEI<0.2	EU Regulation No 641/2009
	Hydraulic balance optimisation for water-based heating systems	Yes, without any specific requirements	

Table 22: Deep Energy Renovation Recommendations and specific values for Bulgaria

Proposed revisions in the existing laws, regulations and standards for incorporating the policy proposal

In addition to the suggested amendment of the Energy Efficiency Act of 12.03.2021, a set of amendments should be done to:

- Ordinance 7 for Energy Efficiency in Buildings which should include some more requirements related to the technical systems, building automation
- Ordinance 15 of 22.01.2016 for the technical rules and norms for design, construction and operation of sites and facilities for production, transmission and distribution of heat.
- Ordinance 3 of 09.06.2004 on the structure of electrical installations and power lines from 09.06.2004
- Technical rules and norms for design

3.1.3 High User-Friendliness Of The EPC - Adapted enhanced EPC form in Bulgarian context

The figure below presents the adapted enhanced EPC form for Bulgaria in Bulgarian.

As the template is quite similar to the standard EPC template for Bulgaria, if this template is adopted, the assessors can easily fill it without any additional guidance.

Figure 35: The adapted enhanced EPC form in Bulgarian

The enhanced EPC offers the following improvements in comparison to the standard EPC form:

- simplified and shortened in comparison to the standard EPC
- more space to describe the recommendations
- new field for description of the combination of the suggested renovations
- new clear representation of some energy performance of the components is introduced via the “Energy rating” indicator (traffic light representation)

The 3-scale scheme related to the “Energy rating” indicator for the Bulgarian context can be defined as follows:

Green: Reaches the minimum standards set by the national the regulation/ legislation

Yellow: Just below the minimum standards set by the national the regulation/ legislation

Red: Significantly below the minimum standards set by the national the regulation/legislation

	Red		Yellow			Green	
Building envelope	**Minimum Value**	**U-value**	**Minimum Value**	**Maximum Value**	**U-value**	**Maximum Value**	**U-value**
Roof or ceiling to attic	>0,35	[W/m²K]	0,22	0,35	[W/m²K]	<0,22	[W/m²K]
External walls	>0,5	[W/m²K]	0,22	0,5	[W/m²K]	<0,22	[W/m²K]
Windows and Doors/Gates	>2,0	[W/m²K]	1,1	2,0	[W/m²K]	<1,1	[W/m²K]
Ground floor or floor to unheated basement	>0,5	[W/m²K]	0,25	0,5	[W/m²K]	<0,25	[W/m²K]
Technical systems	**Minimum Value**	**Energy source, provided power, EU energy label**	**Minimum Value**	**Maximum Value**	**Energy source, provided power, EU energy label**	**Maximum Value**	**Energy source, provided power, EU energy label**
Heating system	D	EU energy label	B	C	EU energy label	A	EU energy label
Domestic hot water	D	EU energy label	B	C	EU energy label	A	EU energy label
Ventilation system	D	EU energy label	B	C	EU energy label	A	EU energy label
Cooling system	D	EU energy label	B	C	EU energy label	A	EU energy label
Renewable energies (outside of other systems)			B	C			
Other: e.g., Lighting	D	EU energy label	B	C	EU energy label	A	EU energy label

Table 23: Specified values for the "energy rating" indicator in Bulgaria (residential buildings)

Proposed revisions in the existing laws, regulations and standards for incorporating the policy proposal

The adoption of the enhanced EPC template in the Bulgarian legislation requires an amendment of the following documents and all the related technical guides:

- Ordinance Е-РД-04-1 of 22.01.2016 energy efficiency assessment, certification and assessment of energy savings of buildings
- Ordinance 7 for Energy efficiency of buildings of 15/05.2015

- Ordinance 15 of 22.01.2016 for the technical rules and norms for design, construction and operation of sites and facilities for production, transmission and distribution of heat.
- Ordinance 3 of 09.06.2004 on the structure of electrical installations and power lines from 09.06.2004
- All the related Technical guides for design

3.1.4 Regular Mandatory EPC Assessor Training

A regular training of EPC assessors for their certification and including in the official register is not mandatory in Bulgaria. Only the initial training is mandatory. The regulatory framework for the certified assessors training is defined in ORDINANCE № E-RD-04-1 of 3 January 2018 of circumstances subject to entry in the registers under the Energy Efficiency Act, listing and obtaining information from these records TERMS AND CONDITIONS FOR ACQUISITION OF QUALIFICATION OF CONSULTANTS IN ENERGY EFFICIENCY.

Responsible for the energy assessors' training are universities, training in specialities in the field of higher education 'Engineering' professional fields, "Energy", "Electronics and Automation" and "Architecture, Civil Engineering and Geodesy" accredited under the Higher Education Act.

The best option for Bulgaria would be to have regular mandatory trainings, which will help to maintain the qualification of the EPC assessors and the quality of the issued EPCs. These trainings should be concluded by a successfully passed exam. Its content should differ from the content and the framework of the initial educational training. This training should be followed 2-3 years after the completion of the initial educational program.

The adoption of the policy proposal for regular mandatory trainings for the certified EPC assessors requires an amendment of ORDINANCE № E-RD-04-1 of 3 January 2018 of circumstances subject to entry in the registers under the Energy Efficiency Act.

The table below includes the suggested main content of these trainings.

Type of Content	Included in the existing training programmes	Needs for development
Changes in national or European Building Performance Acts	Partially (at the moment of the training, but do not include the changes)	The initial training focuses on the actual at the moment of the training legislation, local and European. The regular mandatory trainings should focus on the recent changes of the national and European Acts related to the building and EE. If the suggestions for amendments in the Acts related to the definition of the "Deep Energy Renovation", this content should be also included in the training.
State-of-the-art technologies	YES	As the state-of-art technologies are developed very quickly, a year or two after the initial training they are not any more state-of-art, so an update should definitely be included in the regular trainings

Type of Content	Included in the existing training programmes	Needs for development
Deep energy renovation recommendations	YES	These recommendations also change together with the development of the technologies, so the updates on them and their assessment must be part of the trainings. With regards to the suggested amendments the training should focus on: -the amendments of the Technical guides for design -the enhanced EPC form
Common mistakes or errors in EPCs- Quality control of issued EPCs for learning	NO	This topic is missing in the initial training, but is very important and useful and should be included in the regular training. Moreover, a creation of database with the common mistakes and lesson learned might be very useful and appreciated.
Funding programs for renovation and their technical requirements	NO	This important information is missing in the initial training. Any actual available funding possibilities should be presented to the trainees as well as some exampled for their application.
Consumer information and communication	NO	This part is missing in the initial training. Effective customer information and interaction should be included.
Contract design	NO	Some basic information on the contact should be included.
Further (soft) skills for EPC assessors	NO	Training on the EPC and the deep renovation software
Other		

Table 24: Suggested main content for the regular mandatory trainings in Bulgaria

3.1.5 Online tool for comparing EPC recommendations to deep energy renovation recommendations

The initial intention for the implementation of the online tool for comparing EPC recommendations to deep energy renovation for Bulgaria was to update the existing tool "Simplified calculator for assessment of energy savings" hosted on the Sustainable Energy Development Agency website.

This user-friendly tool is designed for homeowners and is a simplified version of the professional tool used by the energy assessors, which makes it suitable to address the needs of both professionals and non-professionals.

After investigation further this possibility two major problems were discovered. First the source code of the tool is not open and cannot be modified. Second this is not an online tool and in order to be used it should be first downloaded and installed.

Within the framework of the project, the easiest and fastest way to develop this tool was to embed it in the Deep Renovation Network Platform (DRNP) for Bulgaria which is called Qualrenovate. The approach follows the Spanish tool adapted for the Bulgarian context.

The user is given the possibility to choose among a list of recommendations for Deep Renovation, specific recommendations and to make a selection.

Climate zone	Recommendation for Deep Renovation	Specific recommendation	Select
all	External wall insulation	Wall with enhanced thermal insulation properties (nZEB for renovation standard or similar)	☒
all	External wall insulation	Wall with exceptional thermal insulation properties (nZEB for new buildings standard or similar)	☐

After the confirmation of the selection, the tool redirects the user to another screen which presents a printable table with the country-specific values as per "Priority A Improving the recommendations for renovation provided on the EPCs towards deep energy renovation". The table contains information about the selection- Deep Renovation recommendation, specific recommendations, value, indicative costs in the local currency (BGN), energy savings in per cents, source of the information.

Climate zone	Recommendation for Deep Renovation	Specific recommendation	Value	Indicative unit cost, BGN	Indicative savings, %	Source
all	External wall insulation	Wall with enhanced thermal insulation properties (nZEB for renovation standard or similar)	0.28 W/m^2K	100-120 BGN/m^2	50-52% heat savings	Market research

3.1.6 Deep Renovation Network Platform

In the case of Bulgaria, it was decided to create a new DRNP platform, together with partners, based on a joint concept of Qualrenovate DRNPs.

A Spanish software company undertakes the software development and includes all the necessary and relevant information concerning the deep renovation process, taking into consideration the national requirements. The platform is created in Bulgarian language, so that it is an easy and user-friendly tool. It can be classified as 1a) subtype- online information DRNP and its target groups are mainly homeowners.

This new platform includes several services such as information on the deep energy renovation, the EPC, the available and recommended building professionals, and system suppliers as well as information on the possible financing and subsidiary programmes. In addition, the platform promotes the deep energy renovation by offering a list of the available events on this topic, presents demonstration buildings which were renovated, offer the possibility to search and find trainings related to the deep energy renovation, as well as links to other energy renovation platforms and online tools.

The DRNP of Bulgaria is operated by EAP with the support of the software developer. After the end of the project the platform will be hosted by EAP on its server. The launching of this platform is scheduled for June 2022.

Figure 36: Screenshot of the homepage

The policy proposal for the further development of the platform for the Bulgarian case is to transform it into physical One-stop-shop of subtype 2b One-Stop Shop with support, operated by the Energy Agencies, or the Municipalities or these two entities in collaboration (see Annex 1: DRNP Policy Proposal for Bulgaria).

3.1.7 Voluntary/mandatory advertising guidelines for EPCs & Improving compliance with the mandatory use of EPCs in real estate advertisements

3.1.7.1 Adapted guidelines for displaying EPCs (or its contents) in real estate advertisements in Bulgaria

As per the Energy Efficiency Act, it is mandatory in Bulgaria to indicate the energy performance indicators in the real estate advertisements. Unfortunately, the major part of the population is not familiar with these national requirements. This obligation is not even known to the actors of the real estate market. For this reason, the control of the advertising sector for the real estate should be higher and some penal provisions should be established (see chapter 3.1.7.2). In addition, the authorities should provide advertisement guidelines with the content listed in the following table.

Content-related guidelines	Publication -related guidelines
• The EPC content that should be displayed across all mediums is the energy classification class, colour, annual energy demand in kWh, specific primary energy consumption in kWh/m^2, if the building meets the nZEB standard • URL to the EPC or EPC number should be provided, when possible, especially if EPCs are in public domain	• Provide publication parameters for displaying the EPC content such as size, colours, background, pixels, and typography. • Provide softcopies of the EPC content, especially for digital media

	• Provide graphical and text examples of advertisements for various media

We recommend making the use of the guideline mandatory, so that the advertisements follow the legal obligations and to ensure the correct competitiveness between the different real estate on the basis of technical performance in terms of energy efficiency.

Proposed revisions in the existing laws, regulations and standards for incorporating the policy proposal

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 Sustainable Energy Development Agency must be followed."

3.1.7.2 Other policy proposals for improving compliance with the mandatory use of EPCs in real estate advertisements

Way to improve compliance	Description
Appointment of nodal authorities	In Bulgaria, EPC conformity is checked by the Sustainable Energy Development Agency on a regular basis. Similar mechanism for real estate advertisement should be set. The Chamber of Real Estate Agencies, Brokers, and Agents could be in charge of this verification.
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: • Marketing and advertising departments of real-estate portals, newspapers, and magazines etc. to not accept advertisements that do not adhere to mandatory guidelines • Housing finance companies, banks etc. • Real-estate companies, letting agencies, property management firms etc. • Building owner associations etc.
Methods of enforcement (active): penal provisions	Set penal provisions as it is done for any administrative non-compliance- starting from fine up to more severe penalties, depending on the importance of the non-compliance and the repetitiveness of the non-compliance in case of a real estate agency.

3.2 Germany

The enhanced and converging EPC assessment and certification scheme adapted to the German context cover the seven priorities developed by QualDeEPC project. One of the major improvements in the German case is related to the increased user friendliness, and the focus on the deep energy renovation in the recommendation section of the EPC.

In addition, the identified aspects/barriers grouped in 5 different categories were analyzed and some measures reflecting all the aspects of all priorities were proposed in the table below. The measures cover amendments proposal of several legislative documents as well as technical guides, better use and promotion of the DRNP which can provide information on technical, financial and training aspects.

Aspect	Description	Proposed measure(s)
Legislative and regulatory aspect	The German Building Energy Performance Act (GEG) should be amended to include more ambitious minimum requirements for new and existing buildings.	Re-evaluate energy performance quality of components of the reference building Higher minimum standards for building components and technical systems Define NZEB standard for existing buildings or 'deep energy renovation' For EPCs: The GEG should **clarify that in the EPC**, the EPC assessor should **1) include all potential recommendations** needed to achieve NZEB standards for existing buildings or 'deep energy renovation', **2) clarify whether they are cost-effective with or without financial incentives** existing at the time of issuance of the EPC, or in **connection to renovation works** that are scheduled anyway (i.e., based on *energy-related* costs only)
Financial aspect	In Germany, funding programs to encourage deep energy renovations are already implemented. However, the rules are difficult to understand for the general public. Moreover, the process of applying for funding is lengthy. Costs for building materials have increased generally in 2021	Better availability of the advisors of administrative institution(s) of the funding program(s) Shorter response times to questions and applications
Expert capacity	More highly qualified energy efficiency experts, who are trained in promoting deep	An official job description of "Energy expert/ consultant for buildings"

	energy renovations and required funding	Availability of training on funding options Availability of funding institutions for questions and clarifications
Technical aspect	Currently, it is difficult to schedule technical staff for building renovations, especially for smaller buildings. This issue is further stressed by the lengthy funding application process.	Reliable funding process with deadlines/ known response times
Social aspect	Multiple ownership status of multifamily buildings requires unanimous or majority decision for deep renovation recommendations affecting common use infrastructures (i.e. whole building envelope, replacement of central heating-cooling systems etc). Limited knowledge of the general public about deep energy renovation technical solutions	Specifically targeted financial incentives to further support the whole building renovation decisions. Training for EPC assessors to deal with multiple ownership buildings DRNPs and relevant content could be used to raise awareness on the available technologies combined with a targeted dissemination campaign.

Table 25: Overview of the different aspects for adapting QualDeEPC Deep Energy Renovation Recommendations policy proposal in Germany

3.2.1 Defining 'Deep Energy Renovation' in Germany in the framework of QualDeEPC

In Germany, the nZEB is universally defined as reaching 75% of the annual primary energy usage (Q_p,ref) as compared to a reference building (German Building Energy Performance Act 2020). Hence, this is the minimum standard for new buildings. The minimum requirement for existing buildings according to the German Building Energy Performance Act is the achievement of 140% of the primary energy consumption of the reference building. However, this condition is not referred to as nZEB for existing buildings. In practice, the nZEB standard (75% of Q_p,ref) might be reachable for some existing buildings but not feasible for others. Hence**, 'deep energy renovation'** might be described **as "renovation achieving component energy standards equal or close to those that are usually required to meet nZEB requirements for new buildings" (Category 2) or "renovation achieving component energy standards close to nZEB requirements for new buildings, when possible" (Category 3)** as described by the White paper (Veselá et al., 2021). These definitions are also verified by the current energy efficiency requirements of the German funding programs, where categories for the renovation of existing buildings towards energy efficient houses above and below the nZEB definition are found.

It is suggested that the funding program and Building Energy Performance Act might be adjusted in the future to contain a clear definition of 'deep energy renovation' to avoid the mixture of two categories.

3.2.2 *Adopting the Recommendations for renovation provided in the EPCs towards deep energy renovation*

The following table illustrates the adapted values of the specific recommendations towards deep renovation in Germany. The recommendations and specific values indicated, serve mainly for residential buildings. Through the German funding program "Bundesförderung effiziente Gebäude" (BEG) most recommendations are already covered. Furthermore, the program is constantly revised and improved. Hence, we do not have specific suggestions at this point.

	Specific recommendation	Value	Source of information
External wall insulation	Wall with enhanced thermal insulation properties (nZEB for renovation standard or similar)	max. 0.2 W/(m²K)	funding program BEG*
	Wall with exceptional thermal insulation properties (nZEB for new buildings standard or similar)	max. 0.15 W/(m²K)	quality requirement passive house
Roof insulation	Roof with enhanced insulation	max. 0.2 W/(m²K)	Reference building (GEG#)
	Roof with exceptional thermal insulation properties	max. 0.14 W/(m²K)	funding program BEG*
Insulation of ceiling of an unheated basement/ ground floor	Floor connected to the unheated basement or ground floor with reinforced insulation	max. 0.25 W/(m²K)	funding program BEG*
Window replacement	Window with enhanced insulation properties: e.g. Double glazed window equipped with thick argon or krypton thermal break and low-emissivity glass	max. 1.3 W/(m²K) (g=0.6)	requirement of GEG# for new buildings
	Window with exceptional insulation properties, e.g. triple glazed window	max. 0.95 W/(m²K) (g=0.6)	funding program BEG*
Door replacement	Door with enhanced insulation properties	max. 1.8 W/(m²K) (g=0.6)	New building requirement of GEG
	Door with exceptional insulation properties	max. 1.3 W/(m²K)	funding program BEG*
Replacement/ Installation of shading	External blinds (Venetian, shutters or awning)	Compliance with the minimum requirements for summer thermal insulation	funding program at exchange of windows (BEG*), DIN 4108-2: 2013-02
	Fixed horizontal/vertical shading devices, such as overhangs, louvers	Compliance with the minimum requirements for summer thermal insulation	List of technical FAQs - funding program BEG*, DIN 4108-2: 2013-02

	Specific recommendation	Value	Source of information
Replacement/ installation of the mechanical ventilation system	Ventilation system (no heat recovery) with an exceptionally low electrical power requirement	P_{el}≤0.2W/(m³/h)	funding program BEG*
	Ventilation system with heat recovery of min. 80% and very low electrical power consumption	η≥80%, P_{el}≤0.45W/(m³/h)	funding program BEG*
	Ventilation system with heat recovery of min. 75% and very low electrical power consumption	η≥75%, P_{el}≤0.35W/(m³/h)	funding program BEG*
Replacement/ modernization of the heating system	Generally: heating systems with EU energy label Cat. A or above	EU energy label Cat. A or above	EU efficiency directive
Replacement/ modernization of the cooling system	Generally: cooling system with EU energy label Cat. A or above	EU energy label Cat. A or above	EU efficiency directive
Replacement/ modernization of the DHW system	Generally: DHW system with EU energy label Cat. A or above	EU energy label Cat. A or above	EU efficiency directive
Integration of renewable energy sources	significant extent of energy demand/ consumption should be covered by renewable energy sources;	min. 55%	funding program BEG*
	alternatively, all external walls, the roof and ground floor should be insulated with exceptional thermal insulation	according to GEG	GEG
	photovoltaic system (including for self-use)	to be considered; no specific requirements	
Lighting (non-residential buildings)	LED	min. 140 Lumen per watt	funding program BEG*
	Dimmers	to be considered; no specific requirements	
Reduction of thermal bridging	Three variants are permissible for the consideration of additional heat losses due to thermal bridges: consideration without concrete proof with a lump-sum surcharge, a proof of equivalence or an individually detailed calculation.	Flat-rate surcharge of 0.1 W/(m² K) or 0.05 W/(m² K) in the case of an equivalence verification or individually via a detailed calculation.	Information sheet funding program BEG*
Increased air tightness	Air exchange rate of 1.5 h^{-1} or lower at 50 Pa pressure difference	n50≤1.5h^{-1}	Information sheet funding program BEG*

	Specific recommendation	Value	Source of information
	OR		
	Air tightness according to new building standard		Information sheet funding program BEG*
Building automation	Building automation system Cat. B or above according to EN 15232	B or A	GEG
Others	Insulation of all pipes	according to GEG	GEG
	Replacement of circulation pumps by pumps that meet minimum requirement of ErP label	EEI≤0.2 (regulation (EU) 641/2009)	BEG
	Hydraulic balance optimization for water-based heating systems	Yes, but no specific requirements	Information sheet funding program BEG*

* Bundesförderung effiziente Gebäude (BEG). Further information are available here: **https://www.deutschland-machts-effizient.de/KAENEF/Redaktion/DE/FAQ/FAQ-Uebersicht/Richtlinien/bundesfoerderung-fuer-effiziente-gebaeude-beg.html**

Gebäudeenergiegesetz/ German Building Energy Performance Act (GEG)

Table 26: Adapted Deep Energy Renovation Recommendations and specific values for Germany

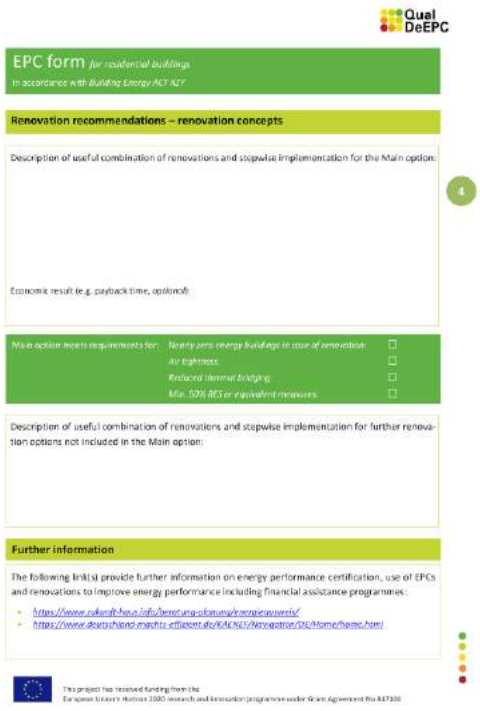
3.2.3 *High User-Friendliness Of The EPC - Adapted enhanced EPC form in German context*

The EPC form template by QualDeEPC as published in the White paper (Veselá et al. 2021) was adjusted to the national requirements and translated. The form is meant for residential buildings. It would need further adaptation for non-residential buildings, since currently no energy classes for these are defined in Germany. The final form is available in German and English. Figure 39 shows the final form in German.

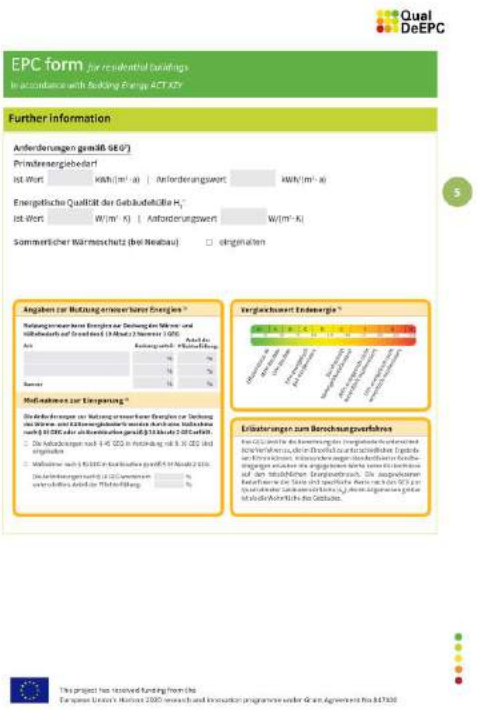
a) First page

b) Second page

c) Third page



d) Fourth page



e) Fifth page

Figure 37: Adapted German EPC template

All in all, the German enhanced EPC template by QualDeEPC is very close to the originally developed general template as published in the White paper. There were no significant changes, but some specifications of values required by the German Building Energy Performance Act. Additional information as required by the German Building Energy Performance Act of 2020 was added to the fifth pages. An unaddressed issue is the specific values of the energy rating, since there is not enough space on the form to include them in a compact fashion. These parameters (see Table 27) may be published in an additional guideline or Annex.

Compared to the current German EPC for residential buildings, the version by QualDeEPC has one major change: The energy performance of the building is not only evaluated as one total number, i.e. the final energy demand or consumption, but also the building components and technical systems are rated. This information may help the EPC issuers to include more specific renovation recommendations. An additional guideline may also inform and stress deep energy renovation measures. A further change is the integration of the demand and consumption based (i.e., asset and operational rating) types of EPCs. Generally, it is recommended to use the calculated energy usage (asset rating) over the consumption-based value (operational rating). However, the latter one will provide valuable information for tenants or future owners, if the energy usage profile is similar to average profiles.

Table 25 shows the specified minimum and maximum values for the “energy rating” indicator for the main components of the building envelope and the technical systems.

For the building components, an average U-value is calculated over all elements (e.g. all outer walls, all windows incl. doors) of a type of component. The best average U-value or maximum of the green category is based on the current requirements by the German funding program “Bundesförderung für

effiziente Gebäude – BEG". The upper limit of the yellow category is leaned on the requirements for buildings of Energy Saving Ordinance of 2004 (EnEV 2004). This way it can be shown that also these 10 to 15 year old buildings may have the potential to be improved. All U-values which are lower than the requirements by EnEV 2004 are sorted into the red category.

All technical systems are evaluated by the EU energy label. For heating and domestic hot water systems, the label should be available for all systems. However, the label is not yet fully implemented for ventilation and cooling systems. Independent of this issue, the green category is always given to EU labels of A or above (A+, etc.), the yellow category contains the labels B and C, and the red category is selected for all EU energy labels below D (E, F, etc.). Renewable energies and lighting are not evaluated in this scheme for Germany. For renewable energies, there is an increased financial incentive available, if they provide 55% or more of the total energy sources. Hence, these values may provide the benchmark for the green category. Lighting is not evaluated in Germany for residential buildings. Anyhow, the EU energy label may also be applicable for non-residential buildings in the same fashion as described before.

	Red		Yellow			Green	
Building envelope	**Value**	**Unit**	**Minimum Value**	**Maximum Value**	**Unit (U-value [W/m²K])**	**Value**	**Unit**
Roof or ceiling to attic	>0,40	W/m²K	0,14	0,40	W/m²K	<0,14	W/m²K
External walls	>0,45	W/m²K	0,20	0,45	W/m²K	<0,20	W/m²K
Windows and Doors/ Gates	>1,80	W/m²K	0,95	1,80	W/m²K	<0,95	W/m²K
Ground floor or floor to unheated basement	>0,40	W/m²K	0,25	0,40	W/m²K	<0,25	W/m²K
Technical systems	**Minimum Value**	**Energy source, provided power, EU energy label**	**Minimum Value**	**Maximum Value**	**Energy source, provided power, EU energy label**	**Threshold Value**	**Energy source, provided power, EU energy label**
Heating system	D	EU energy label	C	B	EU energy label	A	EU energy label
Domestic hot water	D	EU energy label	C	B	EU energy label	A	EU energy label
Ventilation system	D	EU energy label	C	B	EU energy label	A	EU energy label
Cooling system	D	EU energy label	C	B	EU energy label	A	EU energy label
Renewable energies (outside of other systems)						minimum 55%	

Table 27: Specified values for the "energy rating" indicator in Germany (residential buildings)

To comply with the suggested EPC forms by QualDeEPC the German Energy Performance Act would have to be changed accordingly. However, introducing the traffic light system may create a large overlap with the current "Sanierungsfahrplan" (German building renovation passport). Hence, there should be some discussion on whether to include this information in the EPC or not and if yes, to what extent.

3.2.4 Regular Mandatory EPC Assessor Training

In Germany, EPC issuers have to comply with the requirements of the German Energy Performance Act for Buildings (GEG). The law states that EPC issuers can have either a University degree or a technical education. In the case of a University degree, the program should include a focus on energy efficient

buildings, or related experiences by work experience of minimum 2 years have to be proven. For technicians, the education has to be in the field of (energy efficient) buildings, and additional requirements such as the official registration as an autonomous technician or a master craftsmanship have to be met. Most persons are also required to take part in a training, which focuses on the issuance of EPCs. This training is usually divided into courses for residential and non-residential buildings. However, there are no mandatory regular trainings prescribed in the law.

For EPC assessors, no mandatory regular training is established. However, a mandatory regular training concept is already introduced for "energy efficiency experts", who can provide an official and financially supported building energy roadmap ("individueller Sanierungsfahrplan", equivalent to a Building Renovation Passport) and are officially allowed to prepare applications for financial incentives for the renovation measures of their clients. The training can be done for residential and non-residential buildings separately. EPC assessors might already be enlisted in this program. Because this system is already established, it could be the basis for a mandatory training of EPC issuers as well.

The established training for energy efficiency experts consists of an initial training and a regular training. The hours for the initial training differ between participants having a University degree and a technical education. Also, the courses are divided into training for residential and non-residential buildings. In both cases, initial exams are mandatory. After the successful completion of the training, the energy expert is listed in the system. Every 3 years, the listing has to be renewed by a mandatory regular training. This training consists of a 24 times 45 minutes of training courses (courses, seminars, workshops, etc.) for each category (residential/ non-residential buildings) and the upload of a documented reference building for each category. However, the training courses may be replaced by a teaching activity, and the references may be replaced by a special practical course of 32 times 45 hours. Exams are required for some training courses, but not for all.

For the general framework, it is suggested to integrate the training for EPC assessors in the already existing training for energy efficiency experts. Moreover, the EPC assessors could then also be publically listed as "energy efficiency experts".

In the regular mandatory training for energy efficiency experts, experts can freely choose training courses of the following topics (example list, some courses are separated for residential and non-residential buildings):

- Courses from the initial training
    - Current legal regulations
    - Practical application of the German Energy Act for Buildings
    - Inner and outer insulation of walls, roofs, etc.
    - Heat protection
    - Assessment of technical systems
    - Funding programs
    - Constructional supervision
- Legal basics
- European law, e.g. EPBD and EED
- Structural damage in connection to heat and moisture insulation
- Indoor climate
- Sustainable building
- Assessment of technical systems
- Innovative technical systems

- Renewable energy systems and heat storage
- Building automation systems
- Dynamic simulations of buildings
- Thermography and blower door tests
- Soft skills for consulting (consumer information and communication, contract design, etc.)

This content of the described regular training for energy efficiency experts covers already most and even further aspects that are also important for issuing an EPC. Hence, the training content may have to be focused for the EPC issuers of residential and/ or non-residential buildings. For the initial training, the courses could be oriented on the already established content for EPC issuers (see above). Details on additional, mandatory regular training courses are covered in Table 26. The required reference could be specified to be one or more issued EPCs or an equivalent training course.

Type of Content	Included in the existing training programmes	Needs for development
Changes in national or European Building Performance Acts	partially	Developments at the EU level Mandatory course, when large changes in regulations are published.
State-of-the-art technologies	yes	For EPC assessors: focus on deep energy renovation options
Deep energy renovation recommendations	Partially: Renovation options are discussed but not always with focus on "deep energy renovations"	Renovation options discussed should focus on "deep energy renovations"
Common mistakes or errors in EPCs- Quality control of issued EPCs for learning	yes	
Funding programs for renovation and their technical requirements	yes	
Consumer information and communication	limited	More courses required
Contract design	limited	More courses required
Further (soft) skills for EPC assessors	limited	More courses required
Other		

Table 28: Training content further to the existing proposed for regular training workshops or seminars in Germany

3.2.5 Online tool for comparing EPC recommendations to deep energy renovation recommendations

In Germany, the Master online tool will not be implemented, since sufficient tools are already available. For the "Sanierungskonfigurator" (https://www.sanierungskonfigurator.de/), dena and WI have initiated contact and discussed possible areas of improvement. In the following paragraphs, the areas of improvement are identified. At the time of writing this report, the possibilities and plans for

their implementation are being concretised in order to obtain an offer for implementation by the service provider.

Since QualDeEPC focuses on deep energy renovations, our suggestion are focused on this area. A detailed analysis was performed and handed in to the Federal Ministry of Economic Affairs and Climate Action in German. The following paragraph provides a summary of these proposals that were agreed with the Ministry.

In general, the tool needs to be updated to today's standards, since the Energy Saving Ordinance (EnEV) was replaced by the German Energy Act for Buildings (GEG) in 2020. Also, the time periods for the year of construction of the building itself, heating systems and other components might be supplemented by the period of 2005 to 2014/ 16 and then 2014/2016 and newer. Furthermore, the graphical presentation of the efficiency of the building's components could be completed by the total efficiency and the current energy class.

For the building envelope, the default suggestions are currently based on the measures to reach the regulation requirements described in the Energy Saving Ordinance from 2014/16. Also, one example of an improved option is described. At this point, further options could be included, which represent the different requirements of the current German Energy Act for Buildings and current funding programs, i.e. include measures on the building envelope as well as the systems technology, such as renewable heating and hot water systems and residential ventilation systems with heat recovery. This possibility might be implemented by using different check marks corresponding to insulation thicknesses and/or thermal insulation value(s) or drop-down menus for the selection of the corresponding system technology.

If technically possible within the available budget, information on ventilation in the current status of the building, and recommendations related to it will be included.

Finally, the energy class on an EPC in the current state and after the selected renovations could be added in the results.

3.2.6 Deep Renovation Network Platform

Several OSS or Deep Renovation Network platforms exist in Germany, (www.co2online.de, www.gebaeudeforum.de, energiewechsel.de, www.eza-allgaeu.de/energietipps). There are a few such platforms similar to the Deep Renovation Platform that are online-based platforms. Since the platforms are aimed either at final consumers or at professionals in the field of energy-efficient construction and renovation, it will be most effective to retain these platforms for the individual target groups. The German partner Dena will therefore seek to collaborate with at least one of these platforms to enhance their content through targeted additions. This additional content would fill gaps to enhance the platforms towards the full content of the basic platform.

In order to prepare an agreement with the platform operators, the German partners intend to perform the following steps: Based on the concept developed with the seven basic services for the DRNP, the existing platforms can be compared with the QualDeEPC basic concept. Proposals are currently being developed for two of the existing platforms on how they could be expanded with the services that are still missing. One platform targeting mostly building owners and users, the energiewechsel.de, was only launched in June 2022. The other candidate is a platform for professionals,

www.gebaeudeforum.de. The German partners will then decide, which of the two they would approach for discussion, or both. The platform operator(s) could then implement these suggestions. The policy proposal for the case of Germany and the relevant subtypes and needs for services are presented in Annex 2: DRNP Policy Proposal for Germany.

3.2.7 Voluntary/mandatory advertising guidelines for EPCs & Improving compliance with the mandatory use of EPCs in real estate advertisements

Since 01.11.2020 the Building Energy Act (GEG) makes parts of EPCs' contents mandatory for the display in real estate advertisements. Additionally, the GEG provides information on violations and fines. The following information is mandatory (§87 GEG):

- the type of the EPC ('demand'/asset rating or 'consumption'/operational rating certificate)
- The final energy demand / consumption for space and water heating in kWh/m2/year
- The essential energy source
- For residential buildings only: the year of construction of the building
- For residential buildings only: the efficiency class
- In the case of non-residential buildings, the energy performance parameter for electricity in kWh/m2/year

Consumer protection organisations in particular would be in favour of measures, including more specific guidelines, to improve compliance. However, as property advertisements come at a cost, this is a disincentive to provide more information. Online platforms for property sales and rentals require the input of energy performance data, but some allow this requirement to be circumvented through an "Energy Performance Certificate will be issued later" button.

As most online platforms do not allow advertisements without EPC information, newspaper advertisements are more critical. These are often charged per character, and long texts lead to high prices. Therefore, abbreviations are a popular method to keep the costs low. However, an official list of abbreviations does not exist in the EPC context, which means that abbreviations cannot be used with legal certainty. This problem could be solved through publication of official advertisement guidelines.

If a real estate advertisement is published non-commercially, for example on a notice board in a public building, the information from the EPC may even be omitted.

Therefore, the authorities should provide advertisement guidelines with the content listed in the following table.

Content-related guidelines	Publication -related guidelines
• 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. Specify official and legal abbreviations for short real estate advertisements in print 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	• Provide publication parameters for displaying the EPC content such as size, colours, background, pixels, and typography. • Provide softcopies of the EPC content, especially for digital media • Provide graphical and text examples of advertisements for various media (e.g. including official abbreviations for short advertisements)

Compliance with the mandatory use of EPCs in real estate advertisements is not checked by an authority in Germany today. However, most online portals do not allow advertisements without the mandatory EPC information. Additionally, there is the possibility to threaten a fine if mandatory information is not provided, violations in the issuance or use of an energy certificate can be punished with a fine of up to 10,000 Euros. However, it is difficult to estimate how great the risk of a fine is in the case of omitted information. There is little evidence that the authorities have issued corresponding notices to sellers or landlords.

Way to improve compliance	Description
Appointment of nodal authorities	In Germany, EPCs are randomly checked for quality control by the administrations of the Federal States (Länder). A pragmatic way could be to appoint the same nodal authorities for compliance verification with the mandatory use of EPCs in real estate advertisements. This should be specified in the GEG. The Federal government should appoint a co-ordinator of the EPC scheme to supervise the Länder in implementing their duties.
Resources and competences	Adequate financial resources and manpower should be provided. The level of adequacy should be specified in the GEG and supervised by the co-ordinator in the Federal administration.
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 and real-estate advertising columns/sections/pages in registered newspapers and magazines. The general rules would have to be added to the German Energy Performance Act for Buildings.
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: ● Marketing and advertising departments of real-estate portals, newspapers and magazines etc. to not accept advertisements that do not adhere to mandatory guidelines ● Housing finance companies, banks etc. ● Real-estate companies, letting agencies, property management firms etc. ● Building owner associations etc.
Methods of enforcement (active): penal provisions	Since fines already exist and can be set quite high, no change seems needed in Germany in this respect.

Table 29: Summary of ways the compliance can be improved

3.3 Greece

The enhanced and converging EPC assessment and certification scheme adapted to the Greek context cover the seven priorities developed by QualDeEPC project. Introducing the energy rating indicator and the focus on deep energy renovation in the recommendation section of the EPC, could be considered as a significant improvement for the Greek case. Moreover the proposal for adopting a regular training scheme that will consist of voluntary attendance of the training courses followed by a mandatory exam for the EPC assessors to maintain their status consider that currently there is no obligation for initial or regular mandatory training in Greece, could be a significant improvement of the EPC scheme based on relevant stakeholders comments.

In addition, the identified aspects/barriers grouped in 5 different categories were analyzed and some measures reflecting all the aspects of all priorities were proposed in the table below. The measures cover amendments proposal of several legislative documents as well as technical guides, better use and promotion of the DRNP which can provide information on technical, financial and training aspects.

Aspect/Barrier	Description	Proposed measure(s)
Legislative and regulatory aspect	- Need for amendment of specific Laws and/or regulations in order to implement deep energy renovation requirements in buildings. - lack of restrictions of the use of the environment unfriendly fuels	- introduction of more ambitious requirements for the deep renovation in Law 4685/2020 (Energy Efficiency In Buildings) - introduction of more ambitious minimum requirements for building components and technical systems - promotion of the use of environmentally friendly sources for heating, cooling and hot water production
Financial aspect	- In Greece, funding programs to encourage building energy renovations are implemented. However, they should get targeted for deep energy renovation measures. - high investment cost of the innovative technologies - energy poverty of the homeowners and financial inability to invest in deep energy renovation technologies	- financial measures for improvement of energy efficiency in building renovation linked with targeted/achieved energy savings - development of different funding programs for deep energy renovation
Expert capacity	- insufficient awareness of the benefits of the deep renovations	- Include tailored content in the training programmes of the EPC assessors - DRNPs for advice on the overall process

Aspect/Barrier	Description	Proposed measure(s)
	- Insufficient knowledge of the EPC issuers on innovative technologies	- targeted training campaigns for capacity building at regional level for relevant stakeholders (Municipalities, energy consultants, ESCOs)
Technical aspect	- Insufficiently qualified and experienced technical staff to install the proposed technical solutions. - Historical and cultural heritage buildings require a special treatment regarding deep renovation actions.	- Design and implement training courses focused on the technical and installation specifications of the technologies proposed, by the respective professionals' associations. - Development of pilot projects to show good examples of transformation of historical and cultural heritage buildings to deep energy renovated ones. - dissemination of the above results/examples
Social aspect	- Multiple ownership status of multifamily buildings requires unanimous or majority decision for deep renovation recommendations affecting common use infrastructures (i.e., whole building envelope, replacement of central heating-cooling systems, etc). - limited knowledge of the general public about deep energy renovation technical solutions	- specifically targeted financial incentives to further support the whole building renovation decisions - Dissemination of the benefits of deep energy renovation to the general public - Utilization of DRNPs and Online tool for comparing EPC recommendations (see chapters 3.3.5 & 3.3.6)

Table 30: Overview of the different aspects for adapting QualDeEPC Deep Energy Renovation Recommendations policy proposal in Greece

3.3.1 Defining 'Deep Energy Renovation' in Greece in the framework of QualDeEPC

An official definition of the term 'Deep Energy Renovation' is not available in Greece; for the purposes of the QualDeEPC project, the requirements for deep energy renovation are closely linked to the nZEB ones. So it was adopted that the term **'deep energy renovation'** is defined as **"renovation achieving component energy standards equal or better to those that are required to meet nZEB requirements for existing buildings".** An existing building meets the nZEB standard when it reaches energy category B+ or higher (ministerial decision YPEN/DEPEA/85251/242-FEKB_5447/2018).

Proposed revisions in the existing laws, regulations and standards for incorporating the policy proposal

If the proposed definition is adopted then an amendment of the law in force "Energy Efficiency in Buildings" (Law 4685/2020) would be required in order to introduce Deep Energy Renovation in Greece.

3.3.2 Adopting the Recommendations for renovation provided in the EPCs towards deep energy renovation

This section provides guidance on the renovation measures that should be included in the EPCs, accompanied by specifications about the energy efficiency level or rating they should satisfy, in order to be consistent with deep energy renovation. The Greek partner adapted the policy proposal on the enhanced renovation recommendations to the Greek context.

	Specific recommendation	Value	Source of information
External wall insulation	Wall with enhanced thermal insulation properties	max. 0.2 W/(m²K)	Market research
	Wall with exceptional thermal insulation properties	max. 0.15 W/(m²K)	Market research
Roof insulation	Roof with enhanced insulation	max. 0.45, 0.4, 0.35 and 0.3 W/(m²K) according to the climatic zone	Market research
	Roof with exceptional thermal insulation properties	max. 0.25 W/(m²K)	Market research
Insulation of floor	Floor connected to unheated basement or ground floor with reinforced insulation	max. 1.0, 0.8, 0.70 and 0.60 W/(m2K), according to the climatic zone	Market research
Window replacement	Window with enhanced insulation properties: e.g., Double glazed window equipped with thick argon or krypton thermal break and low-emissivity glass	max. 1.5 W/(m²K)	Market research
	Window with exceptional insulation properties, e.g., triple glazed window	max. 0.9 W/(m²K)	Market research
Door replacement	Door with enhanced insulation properties	max. 2.0 W/(m²K)	Market research
	Door with exceptional insulation properties	Not available in Greece	Market research
Replacement/ Installation of shading	External blinds (venetian, shutters or awnings)	Shading coefficients (70% façade shading): F_{hor}=0.91 F_{on}=0.93, F_{fin}=0.46	Market research

	Specific recommendation	Value	Source of information
		(F_{hor} shading correction coefficient for the horizon, F_{on} shading coefficient for overhangs, F_{fin} shading correction factor for fins)	
	Fixed horizontal/vertical shading devices, such as overhangs, louvers		
Replacement/ installation of the mechanical ventilation system	Ventilation system with heat recovery of min. 50%, and 60% of fresh air inlet, and very low electrical power consumption	$\eta \geq 50\%$, $P_{el}=1kW/(m^3/s)$	Regulation for energy efficiency of buildings 2017
Replacement/ modernization of the heating system	Generally: heating systems with EU energy label Category A or better	EU energy label Cat. A	market research
Replacement/ modernization of the cooling system	Generally: cooling system with EU energy label Cat. A or better	EU energy label Cat. A	market research
Replacement/ modernization of the DHW system	Generally: DHW system with EU energy label Cat. A or above Energy-efficient boiler with solar thermal collectors	EU energy label Cat. A	market research
Integration of renewable energy sources	significant extent of energy demand/ consumption should be covered by renewable energy sources;	yes	Especially RES for DHW min 60%
	photovoltaic system (including for self-use)	yes; no specific requirements	market research
Lighting	LED	yes; no specific requirements	market research
	Dimmers	yes; no specific requirements	market research
Reduction of thermal bridging	Reduced thermal bridging for non-structural building elements, such as balconies,	yes; no specific requirements	

	Specific recommendation	Value	Source of information
	terraces, dormers, and fixed shading devices		
Increased air tightness	Infiltration is controlled according to the openings characteristics.	5.5 m^3/hr per m^2 of window or better	Regulation for energy efficiency of buildings 2017
Building automation	Building automation system Cat. B or above according to EN 15232	B or higher	
Others	Insulation of all pipes	Yes; according to national regulation	Regulation for energy efficiency of buildings 2017
	Hydraulic balance optimisation for water-based heating systems	Yes; according to national regulation	Regulation for energy efficiency of buildings 2017
	Replacement of circulation pumps by pumps that meet minimum requirement of ErP label	yes	

Table 31: Deep Energy Renovation Recommendations and specific values for Greece

Proposed revisions in the existing laws, regulations and standards for incorporating the policy proposal

Further to the amendment of the law for the "Energy Efficiency in Buildings" (Law 4685/2020), a set of **amendments needs to be implemented to the national regulations and the technical guides** in order to introduce:

- More ambitious requirements for the deep energy renovation in Law 4685/2020 (Energy Efficiency In Buildings);
- More ambitious minimum requirements for building components and technical systems.

The respective national regulation in force is the "Regulation for Energy Efficiency of Buildings" (KENAK).

The energy efficiency of buildings is calculated based on a methodology defined in the Regulation for Energy Efficiency of Buildings (KENAK) that includes, the thermal insulation characteristics of the building envelope components and other factors that have an important impact on the energy performance of the building, namely the characteristics of the technical systems for space heating / cooling and domestic hot water production, the use of renewable energy sources, passive heating and cooling elements, shading, indoor air quality, adequate natural light and building design.

The energy efficiency calculation methodology is based on the relevant European standards. The Regulation **determines the minimum requirements for the energy efficiency** of the building structural elements and technical systems**.** These requirements have been set in order to achieve the optimal cost-balance between the relevant investments and the energy costs saved throughout the life cycle of the building.

The national regulation is accompanied by the following set of the **Technical Guides of the Technical Chamber of Greece:**

- ΤΟΤΕΕ 1 (ΔΕΠΕΑ/οικ. 182365/17.10.2017, Official Gazette ΦΕΚ Β' 4003)
- ΤΟΤΕΕ 2 (ΔΕΠΕΑ/οικ. 182365/17.10.2017, Official Gazette ΦΕΚ Β' 4003)
- ΤΟΤΕΕ 3 (οικ.2618/23.10.2014, Official Gazette ΦΕΚ Β' 2945)
- ΤΟΤΕΕ 4 (ΔΕΠΕΑ/οικ. 182365/17.10.2017, Official Gazette ΦΕΚ Β' 4003)
- ΤΟΤΕΕ 5 (ΔΕΠΕΑ/οικ. 182365/17.10.2017, Official Gazette ΦΕΚ Β' 4003)
- Error Corrections ΤΟΤΕΕ (Official Gazette ΦΕΚ Β' 4108/2017)

3.3.3 High User-Friendliness Of The EPC - Adapted enhanced EPC form in Greek context

The enhanced EPC form as developed by QualDeEPC and published in the White Paper (Veselá et.al 2021) was adapted to the national requirements and is available in English and Greek. In the following figure, the final adapted template in Greek is presented.

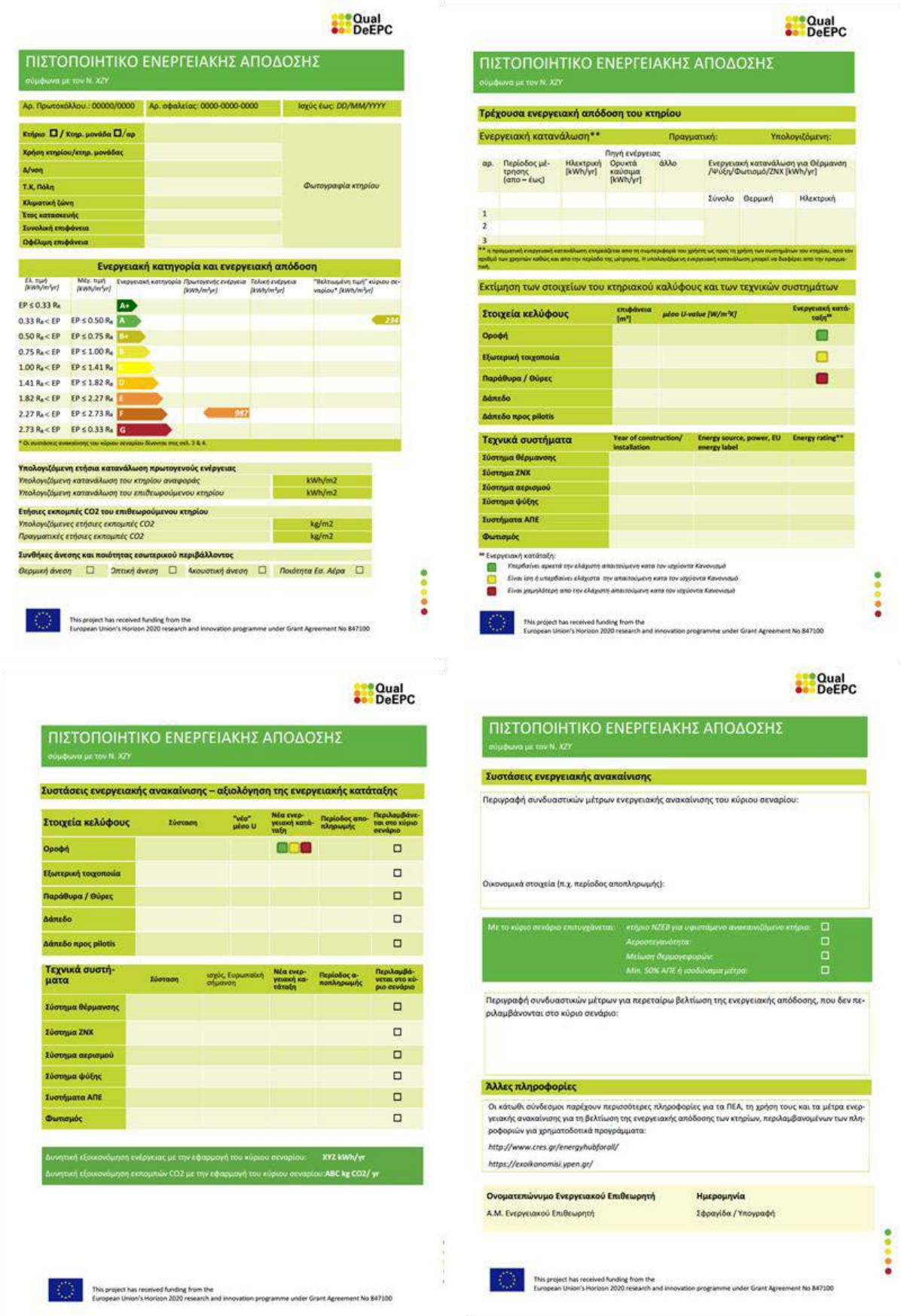


Figure 38: The adapted enhanced EPC form in Greek

Compared to the current standard EPC, the proposed enhanced version is enriched with the following elements:

- The energy classification based on final energy is also presented, further to the one based on primary energy of the current standard EPC. This information may help the issuers to include more specific renovation recommendations.
- The building envelope components and the technical systems are evaluated in terms of energy performance. The '"Energy rating" indicator (traffic light system) adopted provides a clear representation of the energy performance aspects of the building components and may help owners to have a fast and easy understanding of the actual conditions of the building as well a good understanding of the proposed measures.

The 3 scale scheme related to the "Energy rating" indicator for the Greek context can be defined as follows:

- *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 performance than standards of Building Energy Act*

	Red		Yellow			Green	
Building envelope	**Value**	**Unit**	**Minimum Value**	**Maximum Value**	**Unit (U-value [W/m²K])**	**Value**	**Unit**
Roof or ceiling to attic	>0,5	W/m²K	0,3	0,5	W/m²K	<0,3	W/m²K
External walls	>0.6	W/m²K	0,4	0,6	W/m²K	<0,4	W/m²K
Windows	>2.8	W/m²K	1,5	2,8	W/m²K	<1,5	W/m²K
Doors	>2.8	W/m²K	2,2	2,8	W/m²K	<2,2	W/m²K
Ground floor or floor to unheated basement	>1,1	W/m²K	0,6	1,1	W/m²K	<0,6	W/m²K
Technical systems	**Threshold Value**	**Energy source, provided power, EU energy label**	**Minimum Value**	**Maximum Value**	**Energy source, provided power, EU energy label**	**Threshold Value**	**Energy source, provided power, EU energy label**
Heating system	<0,85	Efficiency	0,85	3,2	Efficiency	>3,2	Efficiency
Domestic hot water	<0,85	Efficiency	0,85	just not achieving the level of Energy Label A class	Efficiency	A	EU energy label
Ventilation system	D	EU energy label	C	B	EU energy label	A	EU energy label
Cooling system	2,2	Efficiency	2,2	-	Efficiency	A	EU energy label
Renewable energies (outside of other systems)				0,9 efficiency (solar thermal)		Minimum efficiency 16% (PVs)	Efficiency

Table 32: Specified values for the "energy rating" indicator in Greece (residential buildings)

Proposed revisions in the existing laws, regulations and standards for incorporating the policy proposal

For the adoption of the proposed enhanced EPC in the national legislation, an amendment of the Regulation for Energy Efficiency of Buildings" (KENAK) should be implemented (Article 14) as well as

an amendment of the relevant Technical Guide of the Technical Chamber of Greece and the respective Ministerial Decree, should be issued for defining the new form.

3.3.4 Regular Mandatory EPC Assessor Training

Currently, there is no obligation for initial or regular mandatory training in Greece, despite the fact that in the first period of implementation of the EPBD in Greece (2011), EPC issuers' training was mandatory and was provided by Vocational centres and Academic Institutions as well as the Technical Chamber of Greece.
Based on the stakeholder interviews, workshops and round table implemented as well as on the analysis of the needs in the framework of QualDeEPC project, it **is proposed to adopt a regular training scheme that will consist of voluntary attendance of the training courses followed by a mandatory exam for the EPC assessors to maintain their status.** The process could be repeated every 3 or 4 years.

The adoption of this policy proposal at national level requires an amendment of the legislative and regulatory framework in force: i.e. Presidential Decree 100/2010: Energy auditors for buildings, boilers and HVAC systems (official gazette ΦΕΚ 177/A/6.10.2010)

The content of the former training for energy assessors covers already all possible (and even more) aspects that are important for issuing an EPC. However, additional information should be included in the training courses in order to further improve the quality of the EPCs issued as well as to be aligned with the requirements of "Deep Energy Renovation".

The following table includes the main content that should be added or revised.

Type of Content	Included in the existing training programmes[3]	Needs for development
Changes in national or European Building Performance Acts	No	Recent developments at the EU level Mandatory course, when large changes in regulations are published. In case the 'Deep Energy Renovation' is introduced by law, specific training content should be added to include: ● The new legislation and regulation aligned to deep renovation
State-of-the-art technologies	Yes	For EPC assessors: focus on deep energy renovation options
Deep energy renovation recommendations	Partially; Various renovation options are covered, but not with focus on "deep energy renovations"	Renovation options should be covered with focus on "deep energy renovation". In case the 'Deep Energy Renovation' is introduced by law, specific training content should be developed focusing on:

[3] Currently only on voluntary basis

Type of Content	Included in the existing training programmes[3]	Needs for development
		• The amended technical guides of the Technical Chamber of Greece related to deep energy renovation • The new features of the updated national official software to support deep renovation • The new enhanced EPC form
Common mistakes or errors in EPCs- Quality control of issued EPCs for learning	No	A Q&A should be developed with common mistakes and how to avoid them
Funding programs for renovation and their technical requirements	No	An informative document with existing funding programs should be prepared and distributed to energy auditors
Consumer information and communication	Limited	More courses are required
Contract design	No	A training part in courses is required
Further (soft) skills for EPC assessors	limited	More courses are needed
Other	no	

Table 33: Proposed training content for training workshops or seminars in Greece

3.3.5 *Online tool for comparing EPC recommendations to deep energy renovation recommendations*

In the context of Task 3.3, the QualDeEPC project developed the online QualDeEPC tool that performs building energy performance calculations and provides recommendations towards deep renovation (master tool). The Mastertool version was based on the existing Greek Home Energy check tool enriched with the new features in terms of elements, systems and recommendations, as they are thoroughly described in chapter 2.5. The QualDeEPC tool was adapted to the national regulations and conditions for the Greek case, and it is available in English and Greek at https://www.buildingcert.gr/qualdeepc_tools/master_tool/.

3.3.6 *Deep Renovation Network Platform*

As regards the adaptation and implementation of this project priority, CRES will build upon an existing platform developed and operated by CRES; the platform 'EnergyHUBforALL[4]' can be classified as 1a) subtype. The existing platform includes information and recent developments on:

- the issue of Building Energy Performance Statistical and other data on building stock,
- energy consumption in buildings,
- energy saving options and measures,
- National and European legislation on building energy performance and NZEB,

[4] http://www.energyhubforall.eu/ (only in Greek)

- statistical data on EPCs (residential),
- database of energy efficient products providers,
- existing financing tools and
- an online tool for estimating the potential improvements of residential buildings' energy performance (HEC tool).

The target group addressed by this platform is mainly residential building owners and any other individuals interested in renovating or improving the energy performance of their buildings.

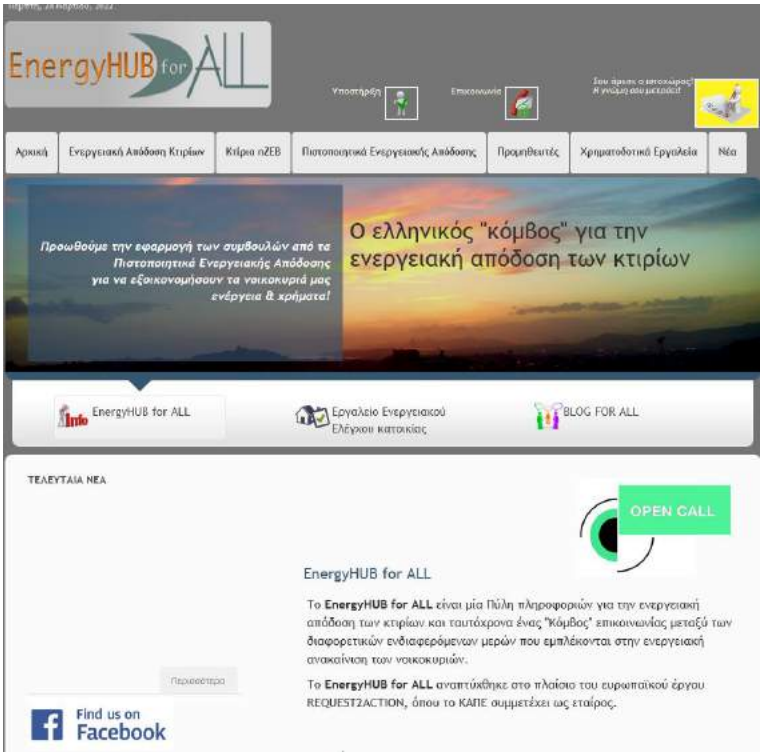


Figure 39: Screenshot of existing platform

Currently CRES project team is working on enhancing the existing platform in terms of content so as to be aligned with QualDeEPC project DRNP concept. The launching of the upgraded version of the platform is scheduled for June 2022.

Furthermore, in the course of QualDeEPC project a policy proposal for physical One-Stop Shop, has been adapted for the Greek case. The proposal refers to a network of physical hubs that could be created in order to further support the Deep Energy Renovation at regional level. The network could be developed supported by the Regional Authorities (technical departments), the regional branches of the Hellenic Technical Chamber and the National Energy Agency. This type of network could be categorized under the sub-type 2b and the services provided, are described in detail in Annex 3: DRNP Policy Proposal for Greece.

3.3.7 *Voluntary/mandatory advertising guidelines for EPCs & Improving compliance with the mandatory use of EPCs in real estate advertisements*

3.3.7.1 Adapted guidelines for displaying EPCs (or its contents) in real estate advertisements in Greece

According to the national legislation (L.4122/2013, Transposition of the DIRECTIVE 2010/31/EU on the energy performance of buildings), sets out the requirement to present the energy efficiency index (energy classification) resulting from the energy performance certificate, if available, in all commercial advertisements and listings when putting up for sale or renting a building or building unit. For these cases the energy efficiency index (energy classification) should be displayed in all types of advertisements. In particular:

- Real estate agencies can undertake a brokerage order provided that before any advertising and registration (press, internet, even in posts and catalogues at their headquarters) they will have the details of a valid EPC.
- Advertisers, newspapers and portals will not receive advertisements for publication that do not have an energy class declaration.

Although, as per 01.01.2021, all advertisements should include the energy efficiency index, according to the latest legislative piece, no concrete guidelines are provided about how this should be displayed. Therefore, the authorities should provide advertisement guidelines with the content listed in the following table.

Content-related guidelines	Publication -related guidelines
• Specify EPC content that should be displayed across all mediums, which includes at least the energy classification index. • 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, audiovisual.	• Provide publication parameters for displaying the EPC content such as size, colours, background, pixels, and typography. • Provide softcopies of the EPC content, especially for digital media • Provide graphical and text examples of advertisements for various media • Provide general/indicative guidelines for buildings owners-users related to the legal requirements when advertising to media.

Proposed revisions in the existing laws, regulations and standards for incorporating the policy proposal

The following text may be included in the national legislation for making the use of concrete guidelines for displaying 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 Ministry for Environment and Energy must be followed."

3.3.7.2 Other policy proposals for improving compliance with the mandatory use of EPCs in real estate advertisements

In 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, but no penal provisions are in force up to date.

Way to improve compliance	Description
Appointment of nodal authorities	Already appointed, no changes are needed.
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 and 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: ● Marketing and advertising departments of real-estate portals, newspapers, and magazines etc. to not accept advertisements that do not adhere to mandatory guidelines ● Housing finance companies, banks etc. ● Real-estate companies, letting agencies, property management firms etc. ● Building owner associations etc.
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.

3.4 Hungary

Aspect/Barrier	Description	Proposed measure(s)
Legislative and regulatory aspect	- Need for amendment of specific Laws and/or regulations in order to implement deep energy renovation requirements in buildings. - lack of restrictions of the use of the environment unfriendly fuels	- introduction of more ambitious requirements for the deep renovation in Law 7/2006. (V. 24) Decree about Determination of Energy Efficiency of Buildings (further on referred as *7/2006 decree*) - introduction of more ambitious minimum requirements for building components and technical systems - priority on added thermal insulation and heat recovery ventilation
Financial aspect	- In Hungary, funding programs to encourage building energy renovations are implemented. More focus should be given to added thermal insulation as it is currently not sufficiently supported compared to renewable systems. However, they should get targeted for deep energy renovation measures. - high investment cost of the innovative technologies - energy poverty of the homeowners and financial inability to invest in deep energy renovation technologies	- financial measures for improvement of energy efficiency in building renovation linked with targeted/achieved energy savings - development of different funding programs for deep energy renovation - development of different funding programs for step-by-step renovation
Expert capacity	- insufficient awareness of the benefits of the deep renovations - Insufficient knowledge of the EPC issuers on step-by-step renovation	- Include tailored content in the training programmes of the EPC assessors - DRNPs for advice on the overall process - targeted training campaigns for capacity building at regional level for relevant stakeholders (Municipalities, energy consultants, ESCOs)

Aspect/Barrier	Description	Proposed measure(s)
Technical aspect	- Insufficiently qualified and experienced technical staff to install the proposed technical solutions. - Historical and cultural heritage buildings require a special treatment regarding deep renovation actions.	- Design and implement training courses focused on the technical and installation specifications of the technologies proposed, by the respective professionals' associations. - Development of pilot projects to show good examples of transformation of historical and cultural heritage buildings to deep energy renovated ones. - dissemination of the above results/examples
Social aspect	- Multiple ownership status of multifamily buildings requires unanimous or majority decision for deep renovation recommendations affecting common use infrastructures (i.e., whole building envelope, replacement of central heating-cooling systems, etc). - limited knowledge of the general public about deep energy renovation technical solutions and step-by-step renovation	- specifically targeted financial incentives to further support the whole building renovation decisions - Dissemination of the benefits of deep energy renovation to the general public - Utilization of DRNPs and Online tool for comparing EPC recommendations

Table 34: Overview of the different aspects for adapting QualDeEPC Deep Energy Renovation Recommendations policy proposal in Hungary

3.4.1 Defining 'Deep Energy Renovation' in Hungary in the framework of QualDeEPC

An official definition of the term 'Deep Energy Renovation' is not available in Hungary; for the purposes of the QualDeEPC project, the requirements for deep energy renovation are closely linked to the nZEB ones. So it was adopted that the term **'deep energy renovation'** is defined as **"renovation achieving component energy standards equal or better to those that are required to meet nZEB requirements for existing buildings".** An existing building meets the nZEB standard when it reaches energy category BB or higher (*7/2006 decree*).

Proposed revisions in the existing laws, regulations and standards for incorporating the policy proposal

If the proposed definition is adopted then an amendment of the law in force 7/2006. (V. 24) Decree about Determination of Energy Efficiency of Buildings would be required in order to introduce Deep Energy Renovation in Hungary.

3.4.2 *Adopting the Recommendations for renovation provided in the EPCs towards deep energy renovation*

This section provides guidance on the renovation measures that should be included in the EPCs, accompanied by specifications about the energy efficiency level or rating they should satisfy, in order to be consistent with deep energy renovation. The Hungarian partner adapted the policy proposal on the enhanced renovation recommendations to the Hungarian context.

	Specific recommendation	Value	Source of information
External wall insulation	Wall with enhanced thermal insulation properties (nZEB for renovation standard or similar)	max. U=0.24 W/m^{2}K	7/2006 (24 May 2006) ministerial decree on energy performance of buildings
	Wall with exceptional thermal insulation properties (nZEB for new buildings standard or similar)	max. U=0.16 W/m^{2}K	Proposal on recast of 7/2006 decree (2021)
Roof insulation	Roof with enhanced insulation	max. U=0.17 W/m^{2}K	7/2006 decree…
	Roof with exceptional thermal insulation properties	max. U=0.12 W/m^{2}K	Proposal on recast of 7/2006 decree (2021)
Insulation of ceiling of an unheated basement/ ground floor	Floor connected to the unheated basement or ground floor with reinforced insulation	max. U=0.30 W/m^{2}K	7/2006 decree…
Window replacement	Window with enhanced insulation properties: e.g., Double glazed window equipped with thick argon or krypton thermal break and low-emissivity glass	max. U=1.15 W/m^{2}K	7/2006 decree…
	Window with exceptional insulation properties, e.g., triple glazed window	max. U=0.8 W/m^{2}K	Proposal on recast of 7/2006 decree (2021)
Door replacement	Door with enhanced insulation properties	max. U=1.45 W/m^{2}K	7/2006 decree…
	Door with exceptional insulation properties	max. U=1.30 W/m^{2}K	Proposal on recast…
	External blinds (Venetian, shutters or awning)	shading factor < 0.2	market research

	Specific recommendation	Value	Source of information
Replacement/ Installation of shading	Fixed horizontal/vertical shading devices, such as overhangs, louvers	shaded between 10.00 and 16.00 in June	market research
Replacement/ installation of the mechanical ventilation system	Ventilation system (no heat recovery) with an exceptionally low electrical power requirement	P_{el}<0.2W/(m³/h)	market research
	Ventilation system with heat recovery of min. 80% and very low electrical power consumption	P_{el}<0.45W/(m³/h) η>80%	market research
	Ventilation system with heat recovery of min. 75% and very low electrical power consumption	η≥75%, P_{el}≤0.35W/(m³/h)	market research
Replacement/ modernization of the heating system	Generally: heating systems with EU energy label Cat. A or above, for example:	Generally: max. 95% / 70% of reference heating system efficiency *	Proposal on recast of 7/2006 decree (2021)
	Condensing gas boiler in combination with solar thermal collectors		
	Geothermal heat pump		
	Reversible inverter air-air heat pump		
	District heating		
Replacement/ modernization of the cooling system	Generally: cooling system with EU energy label Cat. A or above	Generally: max. 95% / 80% of reference cooling system efficiency**	Proposal on recast of 7/2006 decree (2021)
	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	DHW system efficiency***	Proposal on recast of 7/2006 decree (2021)
	Combination with the heating system through storage		
	Energy-efficient boiler with solar thermal collectors		

	Specific recommendation	Value	Source of information
Integration of renewable energy sources	indirect requirement on non-renewable primary energy, CO2 and heating, DHW, cooling etc. requirements		Proposal on recast of 7/2006 decree (2021)
Lighting	LED	Generally: max. 85% of reference lighting system efficiency****	Proposal on recast of 7/2006 decree (2021)
	Dimmers		
Reduction of thermal bridging	Reduced thermal bridging for non-structural building elements, such as balconies, terraces, dormers, and fixed shading devices	requirement on specific heat loss coefficient	7/2006 decree (2021)
Increased air tightness	Highest air tightness category can be applied in case of blower door test result	V ≤1500 m^3 natural vent. n50 ≤ 2.0 h-1 mech. vent. n50 ≤ 1.0 h-1 V > 1500 m^3 natural vent. q50 ≤ 3.0 h-1 mech. vent. q50 ≤ 2.0 h-1	Proposal on recast of 7/2006 decree (2021) MSZ EN ISO 9972
Building automation	Building automation system Cat. B or above according to EN 15232	only for new buildings	EN 15232
Others	Insulation of all pipes	insulation of pipes and instruments of common and unheated spaces	Proposal on recast of 7/2006 decree (2021)
	Replacement of circulation pumps by pumps that meet minimum requirement of ErP label	yes	European Directive ErP, 01-08-2015, for new circulation pumps after 01-01-2020.
	Hydraulic balance optimisation for water-based heating systems	yes	7/2006 decree (2021)

Table 35: Deep Energy Renovation Recommendations and specific values for Hungary

** (E_H/$Q_{H,net}$)/($E_{H,REF}$/$Q_{H,net,REF}$) < good: 95%; excellent: 70%; reference system: condensing boiler (incl. detailed system specification)*
*** (E_C/$QC_{,net}$)/($E_{C,REF}$/$Q_{C,net,REF}$) < good: 95%; excellent: 80%; reference system: in case of air-to-water HP: SEER=3,7*
**** E_{DHW}/$Q_{DHW,REFF}$ < good: 90%; excellent: 50%; reference system: condensing boiler (incl. detailed system specification)*
***** $E_{lighting}$/$E_{lighting,REF}$ < 85%; reference system: LED without dim, with manual switch*

Proposed revisions in the existing laws, regulations and standards for incorporating the policy proposal

Further to the amendment of the law "7/2006. (V. 24) Decree about Determination of Energy Efficiency of Buildings" a set of **amendments needs to be implemented to the national regulations and the technical guides** in order to introduce:

- Definition of requirements for the deep energy renovation;
- Definition of step-by-step renovation;
- More ambitious minimum requirements for building components and technical systems.

The revision of Governmental Decree 176/2008 (VI. 30.) on Building Energy Certification is necessary as well. **The enhanced EPC form should be included, terms and definitions should be updated. The system component evaluation scheme should be introduced.**

3.4.3 High User-Friendliness Of The EPC - Adapted enhanced EPC form in Hungarian context

The enhanced EPC form as developed by QualDeEPC and published in the White Paper (Veselá et.al 2021) was adapted to the national requirements and is available in English and Hungarian. In the following figure, the final adapted template in Hungarian is presented.

Figure 40: The adapted enhanced EPC form in Hungarian

Compared to the current standard EPC, the proposed enhanced version is enriched with the following elements:

- The energy classification based on final energy is also presented, further to the one based on primary energy of the current standard EPC. This information may help the issuers to include more specific renovation recommendations.
- The building envelope components and the technical systems are evaluated in terms of energy performance. The '"Energy rating" indicator (traffic light system) adopted provides a clear representation of the energy performance aspects of the building components and may help owners to have a fast and easy understanding of the actual conditions of the building as well a good understanding of the proposed measures.

The 3 scale scheme related to the "Energy rating" indicator has been modified for the Hungarian context into a 5 scale scheme and can be defined as follows:

Exceeds significantly the minimum standards of Building Energy Act (7/2006 Decree)

Reaches or minimally exceeds the minimum standards of Building Energy Act (7/2006 Decree)

Reaches or minimally exceeds the minimum requirements in force between 2006 and 2017 standards of Building Energy Act (7/2006 Decree)

Does not reach the minimum requirements in force between 2006 and 2017 standards of Building Energy Act (7/2006 Decree)

Lower performance than building stock average

Table 36: Specified values for the "energy rating" indicator in Hungary (residential buildings)

	Red		Orange			Yellow			Yellow-green			Green	
Building envelope	**Value**	**Unit**	**Minimum Value**	**Maximum Value**	**Unit (U-value [W/m²K])**	**Minimum Value**	**Maximum Value**	**Unit (U-value [W/m²K])**	**Minimum Value**	**Maximum Value**	**Unit (U-value [W/m²K])**	**Value**	**Unit**
Roof or ceiling to attic	>0.70	W/m²K	0.30	0.70	W/m²K	0.17	0.30	W/m²K	0.12	0.17	W/m²K	<0.12	W/m²K
External walls	>0.90	W/m²K	0.45	0.90	W/m²K	0.24	0.45	W/m²K	0.16	0.24	W/m²K	<0.16	W/m²K
Windows	>3.00	W/m²K	1.60	3.00	W/m²K	1.10	1.60	W/m²K	0.80	1.10	W/m²K	<0.80	W/m²K
Doors/Gates	>3.00	W/m²K	1.80	3.00	W/m²K	1.45	1.80	W/m²K	1.30	1.45		<1.30	W/m²K
Ground floor or floor to unheated basement	>0.90	W/m²K	0.50	0.90	W/m²K	0.26	0.20	W/m²K	0.20	0.26	W/m²K	<0.20	W/m²K
Technical systems	**Minimum Value**	**Energy source, provided power, EU energy label**	**Minimum Value**	**Maximum Value**	**Energy source, provided power, EU energy label**	**Minimum Value**	**Maximum Value**	**Energy source, provided power, EU energy label**	**Minimum Value**	**Maximum Value**	**Energy source, provided power, EU energy label**	**Maximum Value**	**Energy source, provided power, EU energy label**
Heating system*	130%		105%	130%		95%	105%		70%	95%		70%	
Domestic hot water***	120%		105%	120%		90%	105%		55%	90%		55%	
Ventilation system	Natural ventilation only		exhaust air ventilation with manual control or no control			exhaust air ventilation with automatic control by comfort parameters or heat recovery ventilation below 70% efficiency			ventilation above 70% efficiency			heat recovery ventilation above 85% efficiency	
Cooling system**	120%		105%	120%		90%	105%		50%	90%		50%	

Renewable energies (outside of other systems)	-		-	-		-	-		-	-		-	
Lighting**	800%		250%	800%		115%	250%		85%	115%		85%	

** (E_H/$Q_{H,net}$)/($E_{H,REF}$/$Q_{H,net,REF}$) < good: 95%; excellent: 70%; reference system: condensing boiler (incl. detailed system specification)*

*** (E_C/$QC_{,net}$)/($E_{C,REF}$/$Q_{C,net,REF}$) < good: 95%; excellent: 80% reference system: in case of air-to-water HP: SEER=3,7*

**** E_{DHW}/$Q_{DHW,REFF}$ < good: 90%; excellent: 50%; reference system: condensing boiler (incl. detailed system specification)*

***** $E_{lighting}$/$E_{lighting,REF}$ < 85%; reference system: LED without dim, with manual switch*

Proposed revisions in the existing laws, regulations and standards for incorporating the policy proposal

For the adoption of the proposed enhanced EPC in the national legislation, an amendment of "7/2006. (V. 24) Decree about Determination of Energy Efficiency of Buildings" should be implemented as well as an amendment of "Governmental Decree 176/2008 (VI. 30.) on Building Energy Certification", should be issued for defining the new form.

3.4.4 Regular Mandatory EPC Assessor Training

In Hungary, the EPC experts' license related procedures are regulated by 266/2013. (VII. 11.) Governmental decree. The decree covers all licenses of construction engineering activities based on unified principles. Therefore, when specific requirements for EPC licenses are defined, the generic rules must be considered. One important generic rule is that once an expert is accredited, no further exams can be prescribed to upgrade its license.

To become an accredited expert, an exam has to be taken at the Hungarian Chamber of Engineers or at the Hungarian Chamber of Architects. For licensed experts, mandatory legal training is prescribed every 5 years and a professional training each year. However, experts with more licenses need to take only one course annually selecting one course from different activity areas, and theoretically it is possible that they take a professional EPC training only once in five years.

It is recommended to change the rule so that EPC experts should take a professional training each year in any case or at least when legislation changes take place. Additional information should be included in the training courses in order to further improve the quality of the EPCs issued as well as to be aligned with the requirements of "Deep Energy Renovation". Guidance on step-by-step renovation should also be included.

The following table includes the main content that should be added or revised.

Type of Content	Included in the existing training programmes	Needs for development
Changes in national or European Building Performance Acts	The information relevant for experts are already included in the curricula.	Deep renovation, step-by-step renovation and smart readiness indicator (SRI) should be included in the training content.
State-of-the-art technologies	There is a registered voluntary course on NZEB and smart buildings offered for EPC experts.	Specific courses should be offered for experts with different professional background. E.g., technical building system solutions for architects and building shell technologies for building service engineers.
Deep energy renovation recommendations	Not included.	Recommendations to achieve deep renovation solutions. Also including best practices and real building's renovations towards nZEB.
Common mistakes or errors in EPCs- Quality control of issued EPCs for learning	Included in the course organised by the Chamber of Engineers.	Should be included in the course organised by the Chamber of Architects.

Type of Content	Included in the existing training programmes	Needs for development
Funding programs for renovation and their technical requirements	Not included.	Collection of European, National and, Regional funding programmes for deep energy renovation of buildings should be incorporated into the course curricula.
Consumer information and communication	There are detailed information materials addressed to end users.	The available materials should be promoted to end users. Shorter (5-10 pages long) guidelines should be elaborated as well.
Contract design	Not included.	Not relevant for EPC experts.
Further (soft) skills for EPC assessors	Not included.	Legal aspects on GDPR, data handling, privacy rights and obligations during site visits should be educated.
Other		

Table 37: Proposed training content for training workshops or seminars in Hungary

3.4.5 Online tool for comparing EPC recommendations to deep energy renovation recommendations

For the Hungarian context a recently developed calculation tool will be further enhanced to meet the aims of the QualDeEPC project. In the RenoHUB project, which is a sister project to the QualDeEPC, a website is being developed. On the RenoHUB website a know-how is presented for renovation and a calculation tool will be available. The website is already accessible from the following link: https://renopont.hu/.

The website is only available in Hungarian, and it is created for building owners and representatives to perform preliminary calculations to see the approximate energy rating of their building. The calculator will be placed at the following link: https://renopont.hu/felujitanek/cikk/nekem-is-erdemes-felujitanom-kalkulator.

The input parameters for the calculation tool can be categorized in the following groups:

1. Building type selection
2. Building envelope characteristics & ventilation strategies
3. Heating system selection
4. DHW system selection
5. Solar systems (solar collectors and PV)

The building type will be determined based on the building time, constructional materials and nr. of flats. The Hungarian building typology, which is used for the calculation tool has 23 building types and are statistically representative for the building stock of Hungary.

The building components (additional insulation of the building envelope, window type, ventilation and HVAC systems) can be selected from drop-down lists.

The calculation outputs will include the following:

1. Final energy demand of the building by energy carrier types.
2. Non-renewable primary energy demand of the building.
3. Renewable primary energy demand of the building.
4. CO_2 emission of the building.
5. Category of the building.
6. Rating of the building envelope by components (e.g. external walls, attic slab etc.).
7. Rating of the HVAC systems (heating, DHW, etc.).
8. Information of the building if it meets the requirements for NZEB buildings.

The tool will be developed by the IT company developing the website of the RenoHUB project. Currently the negotiations are ongoing to make a contract with BME regarding the work. The contract for the development of the tool shall be made by the end of April and the tool shall be ready latest by the end of August 2022.

3.4.5.1 Input data for the Online calculation tool:

Building type selection:

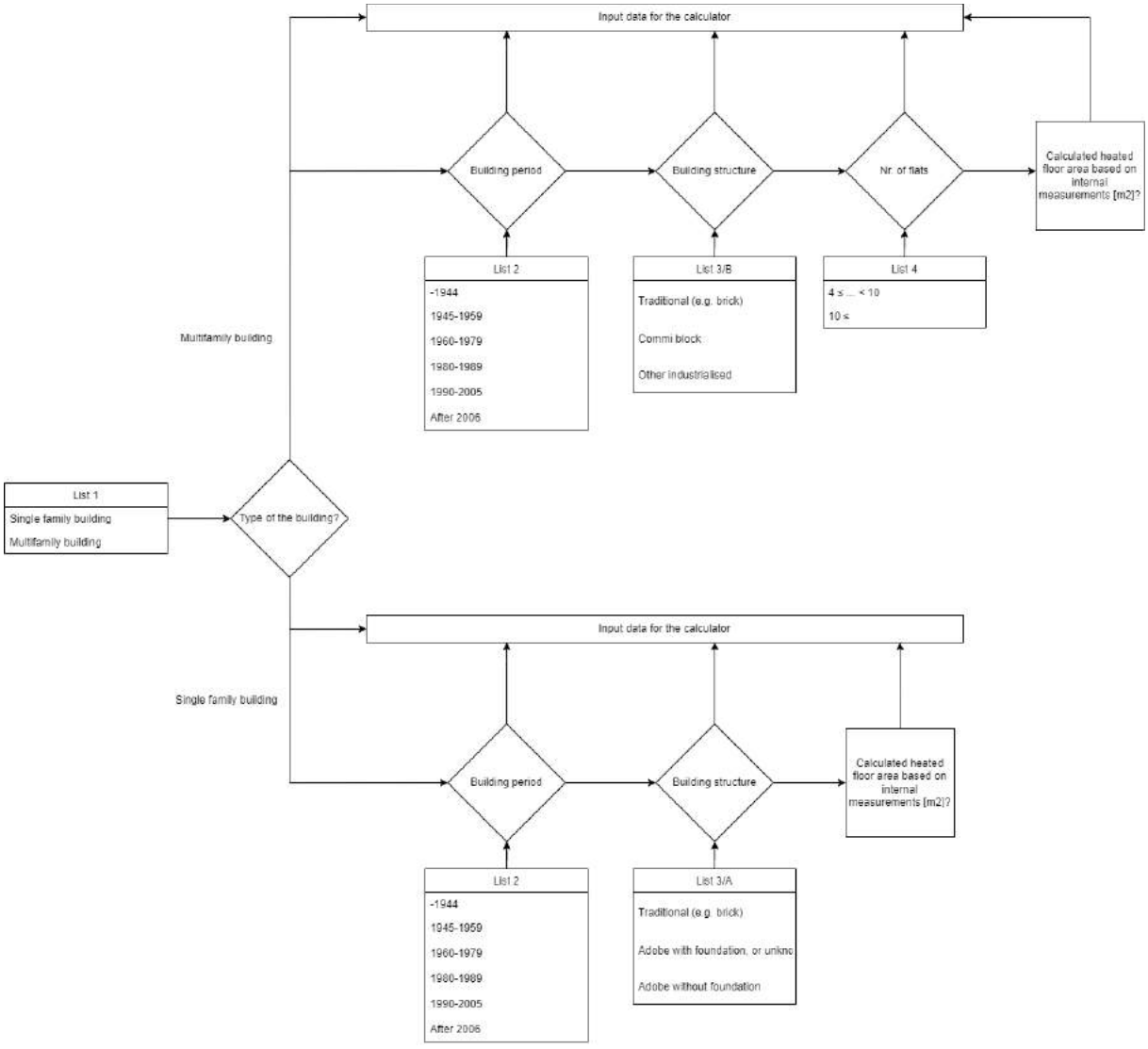


Figure 41: The flowchart of the building selection process.

Building structures:

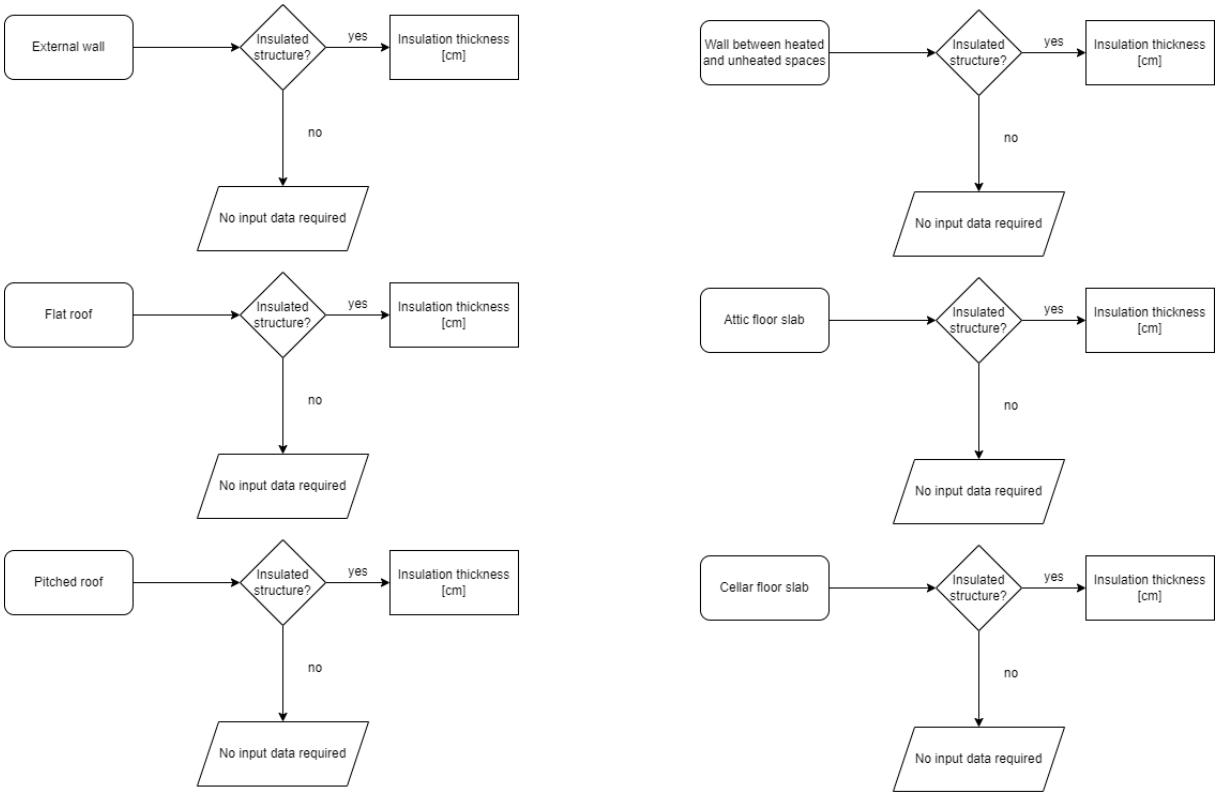


Figure 42: Input data for the opaque building structures.

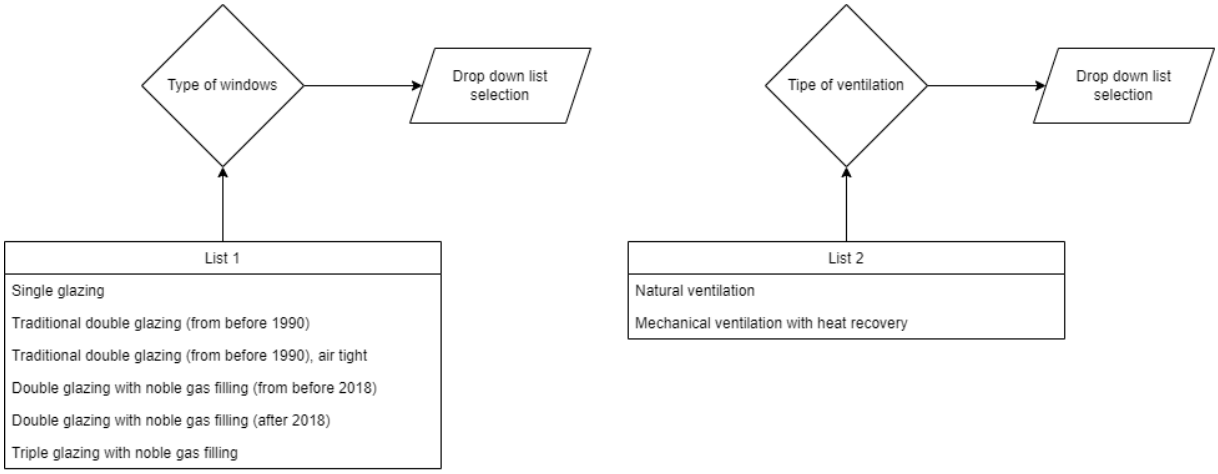


Figure 43: Input data for the windows and ventilation options.

HVAC system selection:

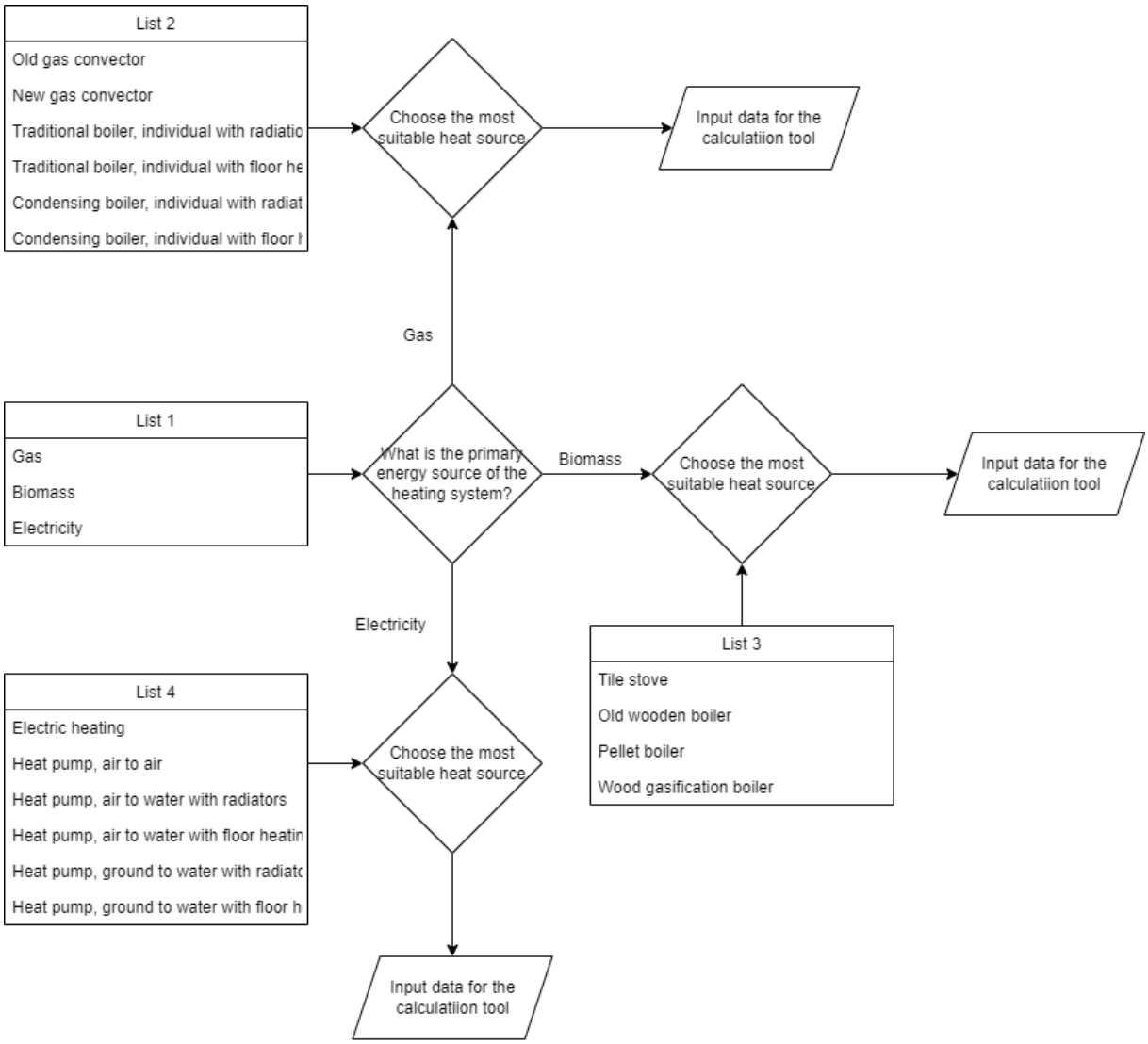


Figure 44: Heating system selection process for single family buildings.

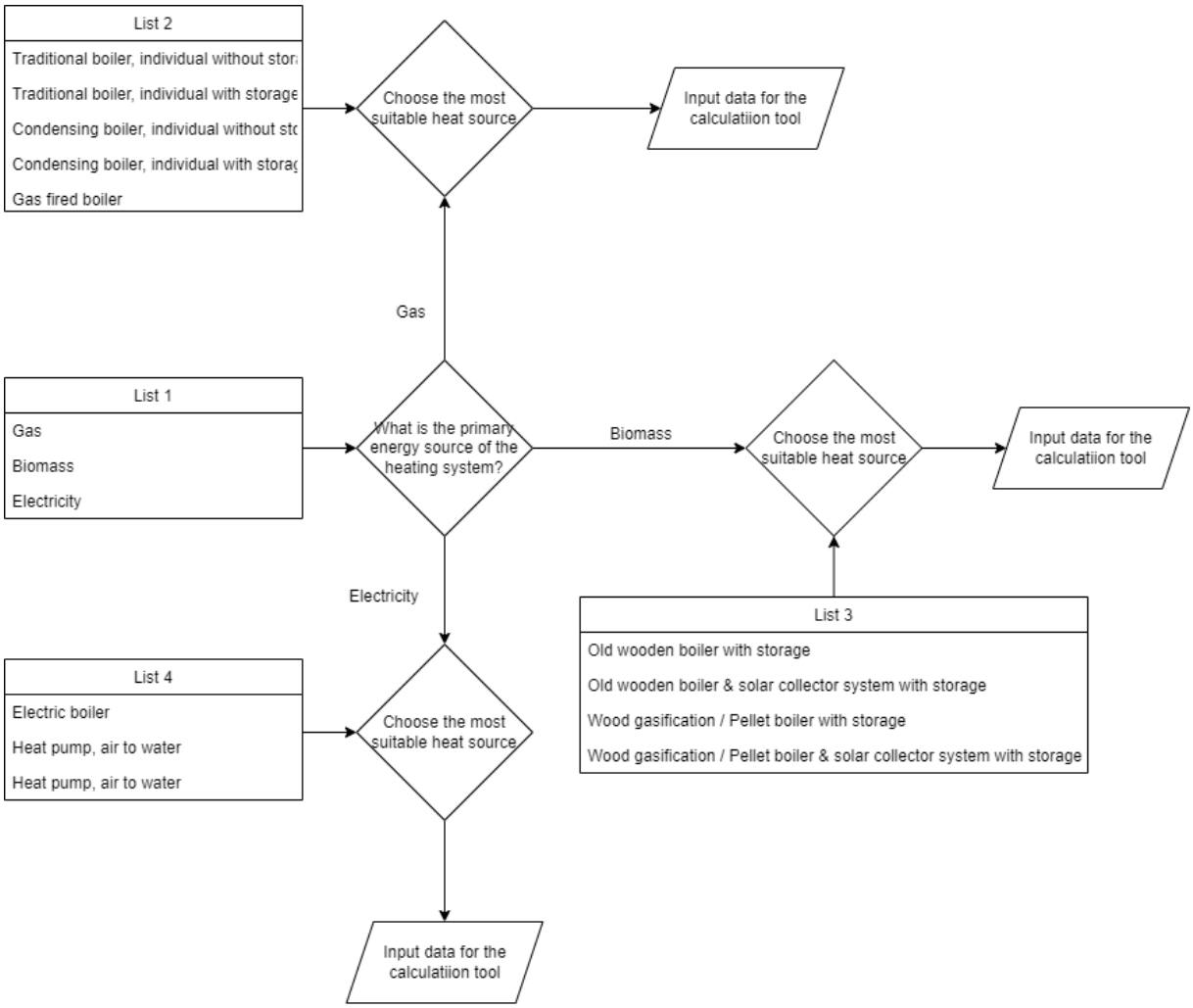


Figure 45: DHW system selection process for single family buildings.

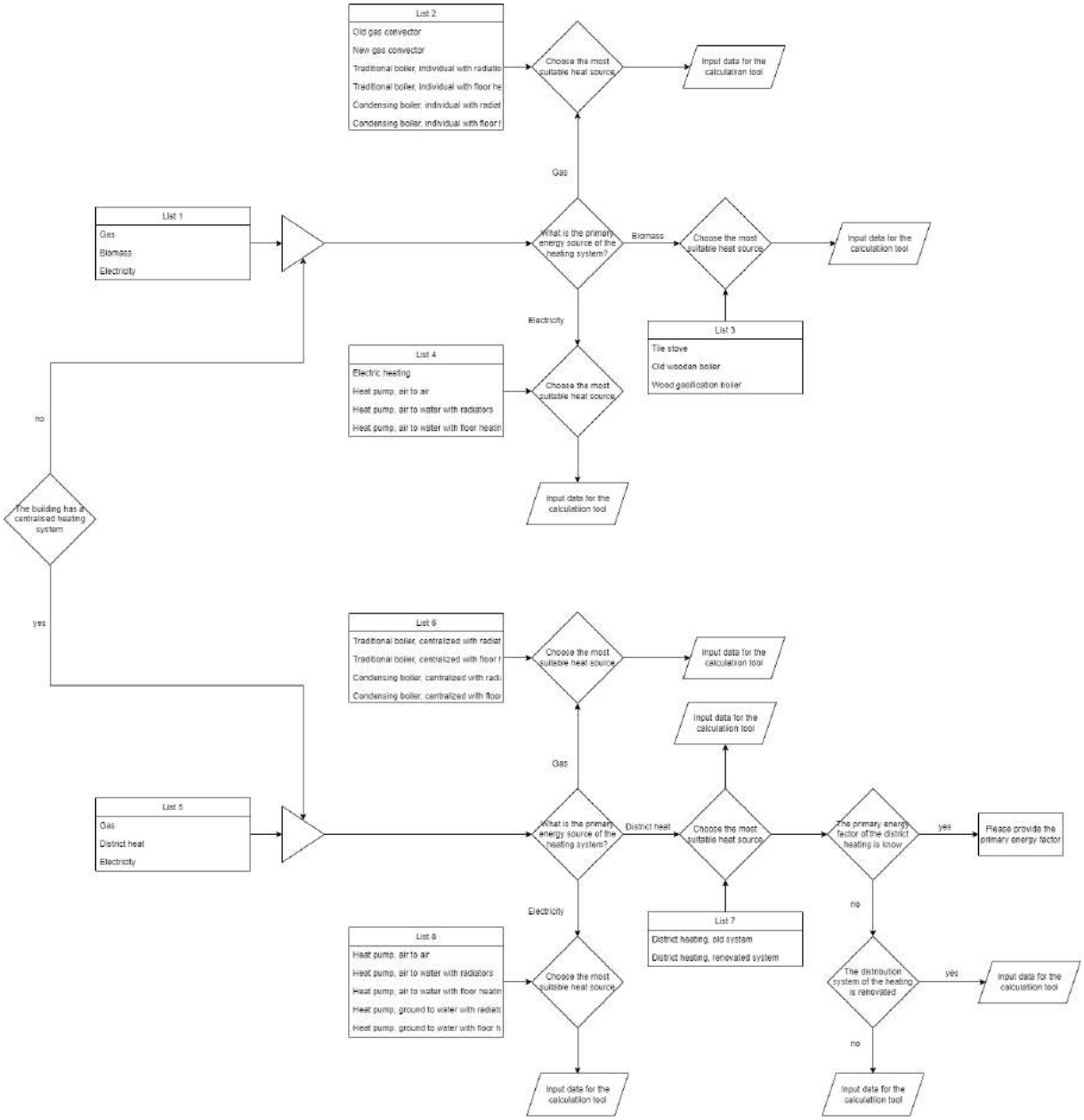


Figure 46: Heating system selection process for multifamily buildings.

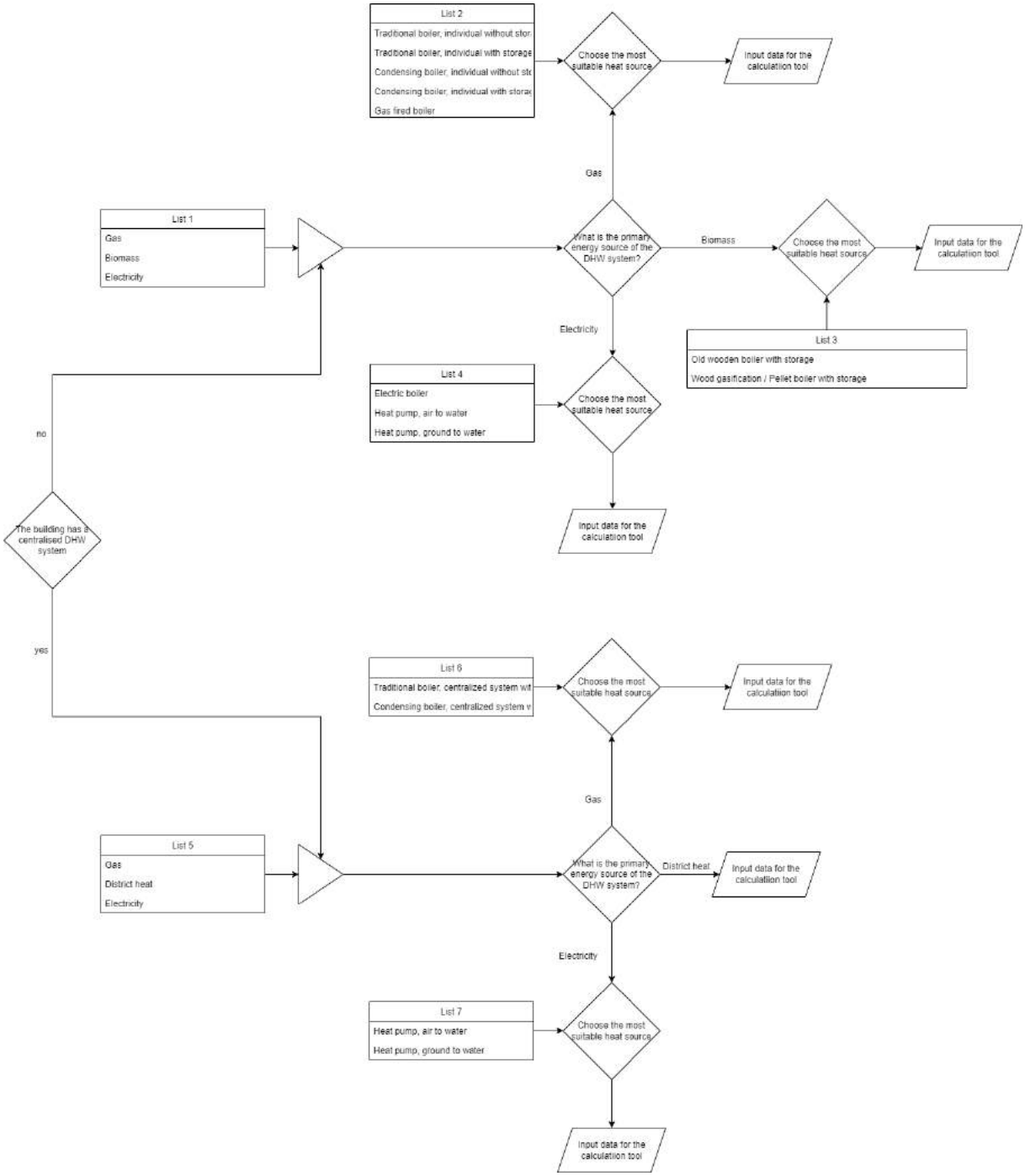


Figure 47: DHW system selection process for multifamily buildings.

3.4.6 Deep Renovation Network Platform

As regards the adaptation and implementation of this project priority, the Hungarian partners will build upon an existing platform developed and operated by Energiaklub and MEHI; the platform 'RenoPont[5]'

[5] https://renopont.hu/ (only in Hungarian)

can be classified as 1a) subtype. The existing platform includes information and recent developments on:

- the issue of Building Energy Performance Statistical and other data on building stock,
- energy consumption in buildings,
- energy saving options and measures,
- National and European legislation on building energy performance and NZEB,
- statistical data on EPCs (residential),
- database of energy efficient products providers,
- existing financing tools and
- an online tool for estimating the potential improvements of residential buildings' energy performance.

The target group addressed by this platform is mainly residential building owners and any other individuals interested in renovating or improving the energy performance of their buildings.

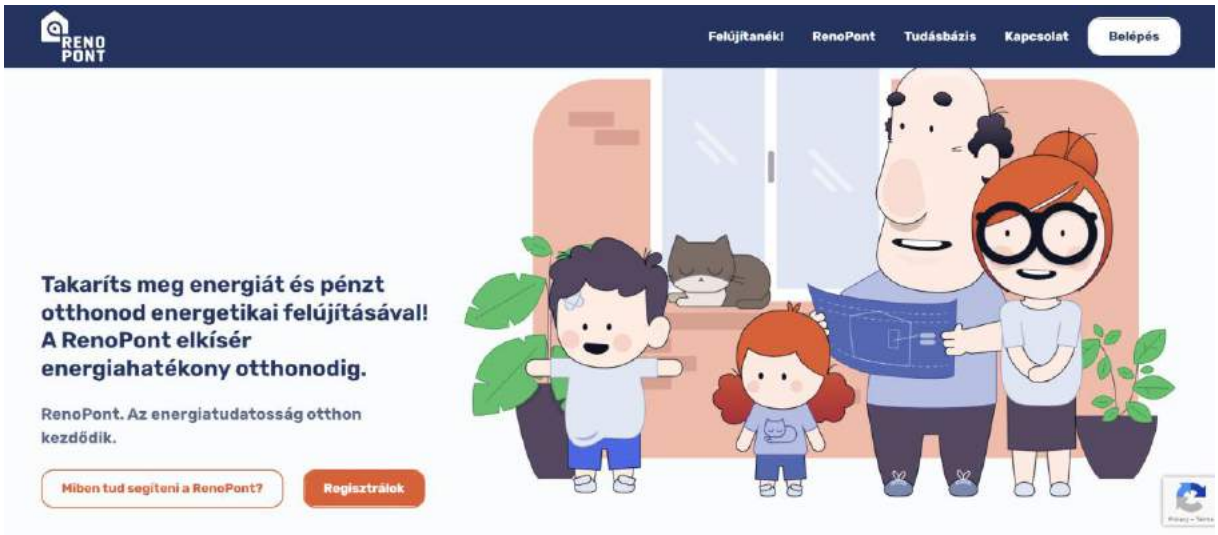


Figure 48: Screenshot of existing platform

Currently BME project team is working on enhancing the existing platform in terms of content so as to be aligned with QualDeEPC project DRNP concept. The launching of the upgraded version of the platform is scheduled for August 2022. The platform will be maintained after the project end by Energiaklub, partner both in RenHUB and in QualDeEPC and MEHI, partner of RenoHUB project and. The new contextual parts from QualDeEPC will be developed mainly by BME.

In addition the the web platform a physical One-Stop Shop model is already in test phase with 5 offices (Sopronkövesd, Nagykanizsa, Budapest city council and districts 8 and 3) and further extension is intended. It was launched within the RenoHUB project, but their concept is further developed to meet the QualDeEPC requirements. The network of physical hubs are created in order to further support the Deep Energy Renovation at regional level. This type of network could be categorized under the sub-type 2b and the services provided, are described in detail in Annex 4: DRNP Policy Proposal for Hungary.

3.4.7 Voluntary/mandatory advertising guidelines for EPCs & Improving compliance with the mandatory use of EPCs in real estate advertisements

3.4.7.1 Adapted guidelines for displaying EPCs (or its contents) in real estate advertisements in Hungary

In Hungary (governmental decree 176/2008) there is a requirement in the regulation that states "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." However, the implementation framework is not set: there is no nominated controlling authority, responsibilities are not defined, neither sanctions. No detailed advertising guidelines or examples are available in addition to the legal requirement. As a consequence, it is rarely applied in practice.

We recommend changing the regulatory text as follows to make the legislation coherent with the EPBD requirement: “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."

Furthermore, the authorities should provide advertisement guidelines with the content listed in the following table.

Content-related guidelines	Publication -related guidelines
• The contents of the energy label should be displayed across all mediums, which includes at least energy classification class, colour, and specific indicators (non-renewable primary energy as displayed on the EPC, CO_2 emission, renewable energy share). • 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. • URL to the EPC or EPC number should be provided, when possible, especially if EPCs are in public domain • 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	• Provide publication parameters for displaying the EPC content such as size, colours, background, pixels, and typography. • Provide softcopies of the EPC content, especially for digital media • Provide graphical and text examples of advertisements for various media

Proposed revisions in the existing laws, regulations and standards for incorporating the policy proposal

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 National Media And Infocommunications Authority (NMHH) must be followed."

3.4.7.2 Other policy proposals for improving compliance with the mandatory use of EPCs in real estate advertisements

In Hungary, the body responsible for the monitoring of implementation and compliance control with the regulation in force is the Ministry for Innovation and Technology, but no penal provisions are in force up to date.

Way to improve compliance	Description
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. In Hungary, the responsible authority could be the National Media And Infocommunications Authority.
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 (2,5% of all issued EPCs controlled, that of 0,5% on-site), could be adopted. This includes conducting random checks (our recommendation: 0,5% of all advertisements) in popular real-estate portals, real-estate advertising columns/sections/pages in registered newspapers and magazines.

Way to improve compliance	Description
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: ● Marketing and advertising departments of real-estate portals, newspapers, and magazines etc. to not accept advertisements that do not adhere to mandatory guidelines ● Housing finance companies, banks etc. ● Real-estate companies, letting agencies, property management firms etc. ● Building owner associations etc.
Methods of enforcement (active): penal provisions	Level staged penalties for non-compliance, starting from re-sensitizing, warning, and up to monetary penalties, 50 to 4,000 Euro depending on the relative importance of the stakeholder group.

3.5 Latvia

The enhanced and converging EPC assessment and certification scheme adapted to the Latvian context covers the seven priorities developed by QualDeEPC project. In general in Latvia the EPC scheme has to be enhanced in all of the seven priorities. As we see these improvements can be achieved and enforced with relatively small effort.

Aspect	Description	Proposed measure(s)
Legislative and regulatory aspect	Modification of existing legislation regarding energy efficiency aspects in buildings (especially deep energy renovation)	Introduction of deep energy renovation definition and requirements when a building has to perform deep energy renovation instead of achieving minimal energy efficiency requirements for renovation of buildings should be developed (Law on the energy Performance of Buildings and Cabinet Regulation No.280 "Regulations Regarding the Latvian Construction Standard LBN 002-19, Thermotechnics of Building Envelopes" Update of the existing EPC template (Cabinet Regulation No.222 "Building energy efficiency calculation methods and building energy certification rules")
Financial aspect	To elaborate a financial programme for supporting the deep energy renovation	Financial programme for residential and non-residential building focused on the deep energy renovation
Expert capacity	Training professionals about the recommendations towards deep energy renovation	Organize several online workshops for professionals about the recommendations towards deep energy renovation
Technical aspect	Deeper analysis on using solar energy in residential buildings Introduction of typical solutions in Soviet type multi-apartment buildings to ensure deep energy renovation has been met	Analysis with aim to understand the optimal size of solar systems to be installed in residential buildings Detailed energy audits in typical soviet time multi-apartment buildings in order to clarify what are exact energy efficiency measures which will ensure that building after renovation reaches deep energy renovation status.
Social aspect	Information campaign about the recommendations towards deep energy renovation	National and local campaigns for building users about deep energy recommendations. Financial support for low-income population in case if energy bills make up a certain percentage of income

Table 38: Overview of the different aspects for adapting QualDeEPC Deep Energy Renovation Recommendations policy proposal in Latvia

3.5.1 *Defining 'Deep Energy Renovation' in Latvia in the framework of QualDeEPC*

In Latvian legislation a definition of nZEB exists only in case of new building construction. All new buildings have to be nZEB. The main requirements that a building has to meet to be called nZEB:

- Residential buildings
  - Energy consumption for space heating under 40 kWh/m^2 per year (60 kWh/m^2 per year for small sized residential buildings);
  - Primary non-renewable energy consumption under 95 kWh/m^2 per year (110 kWh/m^2 per year for small sized residential buildings);
- Non residential buildings
  - Energy consumption for space heating under 45 kWh/m^2 per year;
  - Primary non-renewable energy consumption under 110 kWh/m^2 per.

In case of building renovation, in Latvian legislation minimal requirements for space heating consumption have been defined:

- Residential multi-apartment buildings: energy consumption for space heating ≤80 kWh/m^2 per year;
- Residential one-apartment or two-apartment buildings: energy consumption for space heating ≤90 kWh/m^2 per year;
- Non-residential buildings, which are in the ownership of the State or local government and in the possession of the authorities and where the State or local government authorities are located: energy consumption for space heating ≤90 kWh/m^2 per year;
- Other non-Residential apartment buildings: energy consumption for space heating ≤100 kWh/m^2 per year;

In the context of "deep energy renovation" there is no definition approved in legislation. Based on findings during energy auditing the pilot buildings in QualDeEPC project, we would suggest that **a deep energy renovation in Latvia should be defined as renovation, by which at least 60% of existing energy consumption for space heating is saved**. This amount of energy savings exceeds energy savings of typical building renovation in Latvia by up to 10%, but these missing savings can be gained by improving ventilation and heating system efficiencies (a thing that quite often is not done during building renovation in Latvia).

3.5.2 *Adopting the Recommendations for renovation provided in the EPCs towards deep energy renovation*

The following table illustrates the adapted values of the specific recommendations towards deep energy renovation in Latvia. The recommendations and specific values indicated could serve both for residential and non-residential buildings.

	Specific recommendation	Value	Source of information
External wall insulation	Wall with enhanced thermal insulation properties	max. U=0,23 W/m^{2}K	Regulations Regarding the Latvian Construction Standard LBN 002-19,

	Specific recommendation	Value	Source of information
			Thermotechnics of Building Envelopes (LBN 002-19)
	Wall with exceptional thermal insulation properties	max. U=0,16 W/m^{2}K	Best practice examples, best available technologies in market
Roof insulation	Roof with enhanced insulation	max. U=0,20 W/m^{2}K	LBN 002-19
	Roof with exceptional thermal insulation properties	max. U=0,12 W/m^{2}K	Best practice examples, best available technologies in market
Insulation of ceiling of an unheated basement/ ground floor	Floor connected to the unheated basement or ground floor with reinforced insulation	max. U=0,25 W/m^{2}K	LBN 002-19
Window replacement	Window with enhanced insulation properties: e.g. Double glazed window equipped with thick argon or krypton thermal break and low-emissivity glass	max. U=1,10 W/m^{2}K	LBN 002-19
	Window with exceptional insulation properties, e.g. triple glazed window	max. U=0,80 W/m^{2}K	Best practice examples, best available technologies in market
Door replacement	Door with enhanced insulation properties	max. U=1,60 W/m^{2}K	LBN 002-19
	Door with exceptional insulation properties	max. U=1,20 W/m^{2}K	Best practice examples, best available technologies in market
Replacement/ Installation of shading	External blinds (Venetian, shutters or awning)	For public building renovation external blinds for Southern facades (in special cases also for Eastern and Western facades) if window area is larger than 25% of façade area	Best practice examples

	Specific recommendation	Value	Source of information
	Fixed horizontal/vertical shading devices, such as overhangs, louvers	n/a	
Replacement/ installation of the mechanical ventilation system	Ventilation system heat recovery (enhanced properties)	η>70%, Pel<0.45W/(m³/h)	Typical solution when energy efficient renovation in building is done
	Ventilation system heat recovery (exceptional properties)	η>85%, Pel<0.2W/(m³/h)	Best practice examples, best available technologies on market
Replacement/ modernization of the heating system	Generally: heating systems with EU energy label Cat. A or above, for example:	Efficiency of biomass boilers >85% Efficiency of gas boilers>93% COP for heat pumps >3.5	Best available technologies on market
	District heating		
	Heat pumps		
	High efficiency biomass or gas boilers		
Replacement/ modernization of the DHW system	Insulated pipes with at least 50 mm insulation	-	Best practice examples
	Combination with the heating system through storage		
	Energy-efficient boiler with solar thermal collectors		
Integration of renewable energy sources	Solar thermal for DHW	indirect requirement in EP, CO_2 and heating, DHW, cooling etc. requirements	Best practice examples
	Solar electric for electricity consumption for self use		
	Biomass boiler if not connected to district heating		
Lighting	LED	At least 100 lm/W Generally: 85% of reference lighting	Best available technologies on market

	Specific recommendation	Value	Source of information
	Dimmers	system specific consumption	
Reduction of thermal bridging	Reduced thermal bridging for non-structural building elements, such as balconies, terraces, dormers, and fixed shading devices	requirement on specific heat loss coefficient	
Increased air tightness	Air permeability of 1.5 $m^3/(m^2xh)$ or lower at 50 Pa pressure difference (for buildings with mechanical ventilation)	Yes	LBN 002-19
	Air permeability of 3.0 $m^3/(m^2xh)$ or lower at 50 Pa pressure difference (for buildings without mechanical ventilation)	yes	LBN 002-19
Building automation	Building automation system Cat. B or above according to EN 15232	only for new buildings Individual heat metering for apartment buildings	Cabinet regulations No 730 "Minimal energy efficiency requirements for existing buildings"
Others	Insulation of all pipes	insulation of pipes and instruments of common and unheated spaces with thickness of at least 50 mm	Best practice examples
	Replacement of circulation pumps by pumps that meet minimum requirement of ErP label	yes	
	Hydraulic balance optimisation for water-based heating systems	yes	

Table 39: Deep Energy Renovation Recommendations and specific values for Latvia

3.5.3 *High User-Friendliness Of The EPC - Adapted enhanced EPC form in Latvian context*

The figure below presents the adapted enhanced EPC form for Latvia in Latvian.

As the template is quite similar to the standard EPC template for Latvia, if this template is adopted, the assessors can easily fill it without any additional guidance.

Figure 49: The adapted enhanced EPC form in Latvian

Compared to the Latvian EPC form for residential buildings, which was in force during developing the Enhanced EPC template, the version by QualDeEPC has one major change: The energy performance of the building is not only evaluated as one total number, i.e. the final energy demand or consumption, but also the building components and technical systems are rated. This information may help the EPC issuers to include more specific renovation recommendations.

Table below shows the specified minimum and maximum values for the "energy rating" indicator for the main components of the building envelope and the technical systems.

This rating was developed with help of different stakeholders and energy experts. The main reasoning behind the development of the values for the rating – the rating has to realistically represent the situation in the building based on available technologies. It means that the values in the rating scale should be updated from time to time in order to represent the advances in technologies and renovation approaches.

The 3 scale scheme related to the "Energy rating" indicator for the Latvian context can be defined as follows:

- ***Green**: Reaches the minimum standards set by the national the regulation/ legislation*
- ***Yellow**: Just below the minimum standards set by the national the regulation/ legislation*
- ***Red**: Significantly below the minimum standards set by the national the regulation/legislation*

Building envelope	Red		Yellow			Green	
	Value	Unit	Minimum Value	Maximum Value	Unit (U-value [W/m²K])	Value	Unit
Roof or ceiling to attic	>0,80	W/m²K	0,25	0,80	W/m²K	<0,25	W/m²K
External walls	>0,8	W/m²K	0,30	0,8	W/m²K	<0,30	W/m²K
Windows and Doors/ Gates	>2,10	W/m²K	1,20	2,10	W/m²K	<1,20	W/m²K
Ground floor or floor to unheated basement	>0,70	W/m²K	0,30	0,70	W/m²K	<0,30	W/m²K

Technical system	Description (red)	Description (yellow)	Description (green)
Heating	Original system built together with building construction	Insulated, hydraulically balanced existing system with new radiators with thermostatic valves	New two pipe heating system (EU energy label class A or better) with insulated pipes (at least 50 mm), radiators with thermostatic valves, individual heat meters
Domestic hot water	Original system built together with building construction	Insulated DHW system with heat insulation of at least 30 mm	New DHW system (EU energy label class A or better) with minimized

			length of circulation loop; insulated pipes with at least 50 mm
Ventilation	Natural ventilation system	Mechanical ventilation system with heat recovery of no more than 65% or no heat recovery at all	Mechanical ventilation system with heat recovery of more than 65%
Cooling	Split type chillers in some of rooms in the building or centralized cooling system in all building with no intentionally implemented measures for decreasing cooling load	Split type chillers in some of rooms in the building or centralized cooling system in all building with a few intentionally implemented measures for decreasing cooling load or No cooling system	Building built or renovated in such way that there is no overheating risk during summer
Lighting	Incandescent, halogen	Luminescent, fluorescent	LED
Renewable energy	No renewable energy systems installed	All heat needed for space heating and hot water preparation produced with renewable sources or Solar PV or wind energy generation installed	All heat needed for space heating and hot water preparation produced with renewable sources and Solar PV or wind energy generation installed

Table 40: Specified values for the "energy rating" indicator in Latvia (residential buildings)

3.5.4 Regular Mandatory EPC Assessor Training

In Latvia, EPC issuers have to comply with the requirements described in Cabinet regulations No. 531 "Regulations Regarding Assessment of the Competence of Independent Experts and Monitoring of Professional Activity Thereof in the Field of Energy Performance of Buildings". The law states that a person willing to become a EPC issuer 1) has acquired higher vocational or academic education of the first or second level, provided the relevant educational programme provides acquiring knowledge of the following - heat engineering of building envelope, technical building systems (heating, cooling, ventilation, air conditioning, water supply, lighting), building climatology and the indoor climate, assessment of energy performance and calculation methodology -; and 2) has at least two years of practical work experience in assessing the energy performance of buildings by working under supervision of an independent expert with a certified competence in the field of assessing energy performance of an existing building or its unit and issuing energy performance certificate of a building, as well as assessing the planned energy performance of new buildings to be designed, buildings or

their units to be reconstructed, or renovated, and issuing a temporary energy performance certificate of a building. Once these criteria have been met the person has to pass an exam to become EPC issuer.

At the moment, the certificate of an EPC issuer has no term of validity – it is valid forever. EPC issuers do undergo monitoring of professional activity. This means that EPC issuers are periodically checked and their certificate can be annulled if an EPC issuer has got enough penalty points. There are some points in the existing legislation regarding regular trainings of EPC issuers, but these points in legislation are laid out in a way that it is not possible to understand whether these trainings are mandatory and what is the expected amount and periodicity of these trainings.

We would suggest to clearly state in legislation the amount and periodicity of mandatory trainings which an EPC issuer has to undergo. We would suggest to have a re-examination of EPC issuers at least once per five-year period. If re-examination of EPC issuers is introduced, then the trainings could be voluntary, because the results of exams would show whether the person is qualified enough to be a EPC issuer.

The proposed content of the training is included in next table; some of the contents are already implemented in some workshops or conferences of energy efficiency in buildings.

In the regular mandatory training for energy efficiency experts, experts can freely choose training courses of the following topics (example list, some courses are separated for residential and non-residential buildings):

- Courses from the initial training
  - Current legal regulations
  - Inner and outer insulation of walls, roofs, etc.
  - Indoor thermal comfort and air quality
  - Assessment of technical systems (ventilation, cooling, lighting, DHW)
  - Funding programs
- Legal basics
- EU Energy Performance of Buildings Directive
- Structural damage in connection to heat and moisture insulation
- Indoor climate
- Sustainable building
- Assessment of technical systems
- Innovative technical systems
- Renewable energy systems and heat storage
- Building automation systems
- Dynamic simulations of buildings
- Thermography and blower door tests
- Soft skills for consulting (consumer information and communication, contract design, etc.)
- Most frequent mistakes in issuing EPC
- Other training materials according to national situation in EPC field

This content of the described regular training for energy efficiency experts covers already most and even further aspects that are also important for issuing an EPC. Hence, the training content may have to be focused for the EPC issuers of residential and/ or non-residential buildings. For the initial training, the courses could be oriented on the already established content for EPC issuers (see above).

Type of Content	Included in the existing training programmes	Needs for development
Changes in national or European Building Performance Acts	Not included	To include European Directives, Regulations and their future updates focused in deep energy renovation; If a new legislative document is issued or comes into force – a mandatory training should be held.
State-of-the-art technologies	Included in workshops and seminars held by technology suppliers	Approach to different technologies should be unified in training in such way that these technologies can be evaluated by EPC assessors in the same way
Deep energy renovation recommendations	Informative seminars and workshops held with irregular intervals	Energy efficiency recommendations to achieve deep energy renovation status. Best practice examples for real building's renovation
Common mistakes or errors in EPCs- Quality control of issued EPCs for learning	Not included	The training could include common errors and mistakes of the entire EPC procedure
Funding programs for renovation and their technical requirements	Seminars held by bodies responsible of implementation of funding programs	Collection of European, National and, Regional funding programmes for deep energy renovation of buildings
Consumer information and communication	Not included	To elaborate guidelines for the communication of technical issues to consumers
Contract design	Not included	Different types of contracts – FIDIC, ESCO, e.t.c.
Further (soft) skills for EPC assessors	Not included	To include the training on specific software for EPCs and recommendations for deep energy renovation of buildings
Other		

Table 41: Proposed training content for training workshops or seminars in Latvia

3.5.5 Online tool for comparing EPC recommendations to deep energy renovation recommendations

In Latvia, a simple tool should be developed where non expert users can fill in information in order to get the results on energy renovation in buildings. Most important, this tool would be for multi-apartment buildings, since these are the buildings with largest energy savings potential and these are the buildings, which need to be renovated because they are nearing to the end of their expected lifetime.

In Latvia an existing tool on multi-apartment building renovation will be updated (since the existing tool has been made more than a decade ago). This tool will be developed as a downloadable tool executed in MS Excel with user interface programmed in Visual Basic. The tool includes the most important information on energy savings potential, CO2 savings potential as well as it includes an economical calculation part which allows to plan the investments for building renovation. The tool should be available for use by the end of September 2022.

3.5.6 Deep Renovation Network Platform

In the case of Latvia, it was decided to create a new DRNP platform, together with partners, based on a joint concept of Qualrenovate DRNPs.

A Spanish software company undertakes the software development and includes all the necessary and relevant information concerning the deep renovation process, taking into consideration the national requirements. The platform is created in Bulgarian language, so that it is an easy and user-friendly tool. It can be classified as 1a) subtype- online information DRNP and its target groups are mainly homeowners.

This new platform includes several services such as information on the deep energy renovation, the EPC, the available and recommended building professionals, and system suppliers as well as information on the possible financing and subsidiary programmes. In addition, the platform promotes the deep energy renovation by offering a list of the available events on this topic, presents demonstration buildings which were renovated, offer the possibility to search and find trainings related to the deep energy renovation, as well as links to other energy renovation platforms and online tools.

The DRNP of Latvia is operated by Ekodoma with the support of the software developer. The launching of this platform is scheduled for June 2022 The policy proposal for the further development of the platform for the Latvian case is to transform it into physical One-stop-shop of subtype 2c One-Stop Shop with support, operated by the Ministry of Economics or Local or regional Energy Agencies. (see Annex 5: DRNP Policy Proposal for Latvia).

3.5.7 Voluntary/mandatory advertising guidelines for EPCs & Improving compliance with the mandatory use of EPCs in real estate advertisements

3.5.7.1 Adapted guidelines for displaying EPCs (or its contents) in real estate advertisements in Latvia

There are no mandatory or voluntary guidelines for presenting EPCs in real-estate advertisements during the sale and rental of buildings in Latvia. At the moment there is a requirement to provide an EPC for a building which is being sold or rented. But in reality, nobody is asking or showing this EPC during real-estate transactions.

Consumer protection organisations in particular would be in favour of creating such guidelines.

The next table indicates the contents and the how this information could be shown, specific guidelines about the publication-related guidelines

Content-related guidelines	Publication -related guidelines
• 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. Specify official and legal abbreviations for short real estate advertisements in print 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	• Provide publication parameters for displaying the EPC content such as size, colours, background, pixels, and typography. • Provide softcopies of the EPC content, especially for digital media • Provide graphical and text examples of advertisements for various media (e.g. including official abbreviations for short advertisements)

3.5.7.2 Other policy proposals for improving compliance with the mandatory use of EPCs in real estate advertisements

Compliance with the mandatory showing of EPCs in real estate advertisements in real life is not checked by an authority in Latvia today. In legislation this task has been assigned to Consumer Rights Protection Centre of Latvia (CRPCL) https://www.ptac.gov.lv/en) without assigning financing to do this task. In order to enable the functionality of checking the use of EPCs in real estate market, CRPCL should receive financing for this activity. Representatives of CRPCL admitted that they would react only if they would receive a complaint from a consumer about the missing EPC during renting or selling of a building. CRPCL has yet to receive such a complaint. So in Latvia the main step would be to kickstart the process of actually issuing EPCs when buildings are getting sold or rented. This could be done by a nation-wide information campaign describing the benefits of knowing your buildings energy performance prior to making the decision of buying a property.

3.6 Spain

The enhanced and converging EPC assessment and certification scheme adapted to the Spanish context cover the seven priorities developed by QualDeEPC project. The elaboration of the qualrenovate Deep Renovation Network Platform as the first national information tool for deep energy renovation an certification as one of the main results; also the user friendliness and the data of the recommendations in the enhanced EPC model with the focus on the deep energy renovation is very well welcomed

In addition, the identified aspects/barriers grouped in 5 different categories were analysed and some measures reflecting all the aspects of all priorities were proposed in the table below. The measures cover amendments proposal of several legislative documents as well as technical guides, better use and promotion of the DRNP which can provide information on technical, financial and training aspects.

Aspect/Barrier	Description	Proposed measure(s)
Legislative and regulatory aspect	- New regulations/laws or amendment of specific Laws and/or regulations in order to implement deep energy renovation requirements in buildings.	- Include definition for deep energy renovation in buildings. - Introduction of more ambitious minimum requirements for building components and technical systems. - Continuation of the DRNP renovate after the end of this project - Compliance of the legislation and regulation with more information, control and verification in real states agencies

Aspect/Barrier	Description	Proposed measure(s)
Financial aspect	- Funding programs to encourage building energy renovations are implemented. However, they should get targeted for deep energy renovation measures. - High investment cost of the insulations, some new HVAC technologies and some installations and acquisition of renewable systems so economic support is necessary - Energy poverty of some homeowners and financial inability to invest in deep energy renovation technologies	- Financial measures for improvement of energy efficiency in building renovation linked with targeted/achieved energy savings towards NZEBs - Next generation funds are now available for different purposes; one of them it is for buildings renovation, but the time to expend the budget is very short
Expert capacity	- Insufficient knowledge of the EPC issuers (some of them about innovative technologies, other about new buildings insulations) - Insufficiently qualified and experienced technical staff to install some of the proposed solutions.	- Include tailored content in the training programmes of the EPC assessors - DRNPs for advice on the overall process - Targeted training campaigns for capacity building at regional level for relevant stakeholders (Municipalities, energy consultants, ESCOs)
Technical aspect	- The market of materials for insulation and HVAC technologies advances and changes with efficient, good quality materials and products (also not good ones). Sometimes the new	- Dissemination of good examples of deep renovations with data of investments and paybacks (there is very few available public data on it)

Aspect/Barrier	Description	Proposed measure(s)
	products are not known by users neither professionals and they recommend not so efficient products (mainly because they are more expensive) - The EPC is based on models and not on real data that should be obtained with energy audit.	
Social aspect	- Multiple ownership status of multifamily buildings requires unanimous or majority decision for deep renovation recommendations affecting common use infrastructures (i.e., whole building envelope, replacement of central heating-cooling systems, etc). - limited knowledge of the general public about deep energy renovation technical solutions	- Dissemination of the benefits of deep energy renovation to the general public - Utilisation of DRNPs and Online tool for comparing and implementation EPC recommendations to deep energy renovation

Table 42 Overview of the different aspects for adapting QualDeEPC Deep Energy Renovation Recommendations policy proposal in Spain

3.6.1 Defining 'Deep Energy Renovation' in Spain in the framework of QualDeEPC

The definition of "Deep energy renovation" is not developed in Spain and the partner has considered for those renovations that are towards achieving NZEBs. In Spain, the nZEB definition is mainly focused on new buildings (built after June 2017) and major renovations (2019), and in which the nZEB requirements for new build are not so ambitious and would be achievable through renovation; QualDeEPC proposes different approaches to define deep energy renovation**, for Spain it could be described as "renovation achieving component energy standards equal or close to those that are usually required to meet nZEB requirements for new buildings"**.

The Order of the Ministry of Public Works FOM/588/2017 modifies the Building Technical Code, CTE and it includes "those new buildings that comply with this Code are considered as NZEBs".

Policy proposal: The approach would be a specific and detailed definition for Deep energy renovation to be included in the legislation.

3.6.2 Adopting the Recommendations for renovation provided in the EPCs towards deep energy renovation

After analysis and data collection of the values of the specific recommendations we did elaborate a table; it includes parameters for `enhanced' and `exceptionally' insulations and technologies towards deep energy renovation that were preliminarily differentiated for residential and non-residential buildings. As many of them are the same measure with similar values, we include in the next table the values for residential sector considering that the values for some are very similar

	Specific recommendation	Value Residential Sector	Source of information
External wall insulation	Wall with enhanced thermal insulation properties (nZEB for renovation standard or similar)	max. 0.4 W/m2K	Market research of several insulation distributors; the pilot buildings insulate recommendations; CTE, Building Technical Code 2019
	Wall with exceptional thermal insulation properties (nZEB for new buildings standard or similar)	max. 0.3 W/m2K	Market research of several insulation distributors; pilot building; example Ecosate; CTE, Building Technical Code 2019
Roof insulation	Roof with enhanced insulation	max. 0.35 W/m2K	CTE 2019 and market research https://www.isover.es/productos/alphatoit
	Roof with exceptional thermal insulation properties	max. 0.25 W/m2K	Market research of several insulation distributors; the pilot buildings insulate recommendations; CTE, Building Technical Code 2019
Insulation of ceiling of an unheated basement/ ground floor	Floor connected to the unheated basement or ground floor with reinforced insulation	max. 0.91 W/m2K	Market research of several insulation distributors; the pilot buildings insulate recommendations; CTE, Building Technical Code 2019

	Specific recommendation	Value Residential Sector	Source of information
Window replacement	Window with enhanced insulation properties: e.g., Double-glazed window equipped with argon and low-emissivity glass	max. 2.0 W/m2K	Residential buildings, financial programme new windows, Windows Replace Plan, *Plan Renove Ventanas*
	Window with exceptional insulation properties, e.g., double glazed, PVC frame-3 cameras, low-emissivity glass	max. 1.2 W/m^2K	To be considered; no specific requirements. Considering market research and pilot buildings
Door replacement	Door with enhanced insulation properties	max. 3.0 W/m^2K for glass doors; 2.2 W/m^2K for wooden doors	CTE, Building Technical Code 2019 considers doors/gates (more than 50% of surface is glass and doors/gates made of wood)
	Door with exceptional insulation properties	max. 2.3 W/m2K for glass doors; 1.8 W/m^2K for wooden doors	CTE, Building Technical Code 2019 considers Doors/Gates (more than 50% of surface is glass and Doors/Gates (wood)
Replacement/ Installation of shading	External blinds (Venetian, shutters or awning)	yes	CTE, Building Technical Code 2019
	Fixed horizontal/vertical shading devices, such as overhangs, louvers	yes	CTE, Building Technical Code 2019
Replacement/ installation of the mechanical ventilation system	Ventilation system (no heat recovery) with an exceptionally low electrical power requirement	Min. 900 ppm CO_2 in each room Extraction-kitchen 50 litre/s	Residential buildings: CTE, Building Technical Code 2019 Non-residential buildings: Regulation of Buildings Thermal Installations, RITE 2007 and their updates
	Ventilation system with heat recovery of min. 80% and very low electrical power consumption	Not mandatory	Non-residential buildings: Regulation of Buildings Thermal Installations, RITE 2007 and their updates.

	Specific recommendation	Value Residential Sector	Source of information
			Technical Guidebook of Climatization installations with autonomous equips National Energy Agency
	Ventilation system with heat recovery of min. 90% and low electrical power consumption	Not mandatory	Non-residential buildings: Regulation of Buildings Thermal Installations, RITE 2007 and their updates. Technical Guidebook of Climatization installations with autonomous equips National Energy Agency
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	η =0.97 Nominal/1.05 seasonal (cat. A) of gas boiler	Market research. CTE 2019. QualDeEPC pilot building
	Geothermal heat pump	COP = 4.8 (A++ heating)	Market research. CTE 2019. QualDeEPC pilot building.
	Inverter air-air heat pump	Min. SCOP = 5.1 (A+++ heating mode)	Market research
	District heating		to be considered; no specific requirements
Replacement/ modernization of the cooling system	Generally: cooling system with EU energy label Cat. A or above		Market research. CTE 2019. QualDeEPC pilot building.
	Geothermal heat pump	Min. EER = 5.6 (A++ cooling)	Market research, geothermal installation for residential is not only for cooling demand.
	Inverter air-air heat pump	SEER = 6.1 (A++ cooling mode)	Considering market research and QualDeEPC pilot buildings.
Replacement/ modernization of the DHW system	Generally: DHW system with EU energy label Cat. A or above:		
	Combination with the heating system through storage	Min. η =0,97 Nominal	Market research. CTE 2019. QualDeEPC pilot building.

	Specific recommendation	Value Residential Sector	Source of information
		performance (A energy label)	
	Energy-efficient boiler with solar thermal collectors	Min. η =0,97 Nominal performance/ 1,05 seasonal performance(A)	Market research. CTE 2019. QualDeEPC pilot building.
Integration of renewable energy sources	Significant extent of energy demand/ consumption should be covered by renewable energy sources;	Minimum 60% of RES contribution for hot water and pool heating if demand <5000 l/day	
	alternatively, all external walls, the roof, and ground floor should be insulated with exceptional thermal insulation		
	photovoltaic system (including for self-use)	If rehabilitation of more than 25% envelope, PV parameter, q solar ≥4 kWh/ m^2month	CTE 2019
Lighting	LED	If building surface> 1000 m^2 and renovations of more than 25% of lighting surface: VEEIim= 3 W/m2 at offices	For non-residential buildings: Guia CTE 2019
	Dimmers	Lighting control devices and natural light use	For non-residential buildings: Guia CTE2019
Reduction of thermal bridging	Reduced thermal bridging for non-structural building elements, such as balconies, terraces, dormers, and fixed shading devices		This is suggested but no specific requirements

	Specific recommendation	Value Residential Sector	Source of information
Increased air tightness	Air exchange rate of 1.5 h^{-1} or lower at 50 Pa pressure difference		
	OR		
	Air tightness according to new building standard	0.70 W/m^2K if V/S ≥ 4	CTE, Código Técnico de la Edificación 2019
Building automation	Building automation system Cat. B or above according to EN 15232	Not applicable	UNE 15232, 2018
Others	Insulation of all pipes		to be considered; no specific requirements
	Replacement of circulation pumps by pumps that meet minimum requirement of ErP label	IEE <0.23	European Directive ErP, 01-08-2015, for new circulation pumps after 01-01-2020.
	Hydraulic balance optimisation for water-based heating systems		

Table 43: Deep Energy Renovation Recommendations and specific values for Spain

After the analysis of all the recommendations, it is relevant to point out the reflection that the legislation should follow the new technologies, materials that provide better buildings after the renovations.
It is necessary to review the legislation and to adjust and include the required information, data specifications etc for the deep energy renovations; the main legislative papers and norms relevant to that are:

- ✓ CTE and RITE for the systems of HVAC and renewables new systems
- ✓ CTE for the structures, materials, components of the building envelope
- ✓ Real Decreto 390/2021, June 1st about the procedure of energy performance certification of buildings (*por el que se aprueba el procedimiento básico para la certificación de la eficiencia energética de los edificios).*

3.6.3 High User-Friendliness of the EPC - Adapted enhanced EPC form in Spanish context

Figure 50: The adapted enhanced EPC form in Spanish

Compared to the current official EPC the proposed enhanced model of EPC is enriched with the next elements:

The scale related to the “energy rating” indicator for the Spanish EPC
The new enhanced EPC model includes an indicator for the measures that helps to understand the energy efficiency proposed measures of the certificate

The values are better than the minimum of normative (CTE, RITE)

The values are according to the normative (CTE, RITE)

The values are not according to normative (CTE, RITE)

"Energy rating" indicator- Definition for the Spanish case for building envelope components and technical systems

	Red			Yellow			Green		
Building envelope	**Minimum Value**	**Maximum Value**	**Unit**	**Minimum Value**	**Maximum Value**	**Unit (U-value [W/m²K])**	**Minimum Value**	**Maximum Value**	**Unit**
Roof or ceiling to attic	>0.6	2.17	W/m²K	>0.35	0.6	W/m²K		0.35	W/m²K
Walls insulation	>0.8	2.38	W/m²K	>0.41	0.8	W/m²K		0.41	W/m²K
Windows	>2.8		W/m²K	>1.8	2.8	W/m²K		1.8	W/m²K
Doors/Gates									
Doors/Gates (more than 50% of surface is glass)			W/m²K	>5.7				5.7	W/m²K
Doors/Gates (wood)			W/m²K	>2.2				2.2	W/m²K
Ground floor or floor to unheated basement									
Ground floor without garage	>0.91	2.5	W/m²K	>0.65	0.91	W/m²K		0.65	W/m²K
In contact with unheated area (garage)	>0.91	2	W/m²K	>0.65	0.91	W/m²K		0.65	W/m²K
Technical systems	**Minimum Value**	**Maximum Value**	**Energy source. provided power. EU energy label**	**Minimum Value**	**Maximum Value**	**Energy source. provided power. EU energy label**	**Minimum Value**	**Maximum Value**	**Energy source. provided power. EU energy label**
Heating system									
Standard oil boiler	η = 0.7	η =0.89 Nominal		η =0.9 Nominal			N.A. (0)		
Condensing oil boiler	η <0.95 Nominal	η <0.95 Nominal		η =0.95 Nom/1.02 Seasonal			N.A. (0)		
Standard NG/LPG boiler	η =0.7	η =0.89 Nominal	NG LPG	η = 0.9 Nominal			N.A.(0)		
Condensing NG/LPG boiler	η <0.95 Nominal	η <0.95 Nominal	NG LPG	η =0.95 Nom/1.02 Seasonal			η =0.97 Nominal/ 1.05 Seasonal (Label A)		
Joule electric boiler	η= 1 Nominal/Seasonal	η= 1 Nominal/Seasonal	Electricity	N.A.					
Individual Joule electric heater	η= 1 Nominal/Seasonal	η= 1 Nominal/Seasonal	Electricity	N.A.			N.A.		
Electric radiator. performance 100% (heating)	η= 1 Nominal/Seasonal	η= 1 Nominal/Seasonal		N.A.			N.A.		

Air to air heat pump- heating cycle (no inverter)	1.5 SCOP	1.5 SCOP	SCOP	3.4 SCOP (label A)			N.A.(3) NO SYSTEMS IN THE MARKET		
(i) Inverter air to air heat pump -heating and cooling	N.A. (4)	N.A. (4)		3.4 SCOP (label A)			> SCOP 4.0 heat (label A+)		
Air-to-water heat pump- heating	1.5 SCOP	1.5 SCOP	SCOP	3.4 SCOP (label A)			No systems in market		
Inverter air-to-water heat pump - heating and cooling	N.A. (5)	N.A.		3.4 SCOP (label A)			> SCOP 4.0 heat (label A+)		
(ii)Inverter GHP air-to-water heat pump (geothermal)- heating, cooling, DHW	N.A. (6)	N.A.		N.A.	N.A.		> 1.5 + Residual heat for DHW A++ heating and A+ cooling		
District heating, heating and DHW									
Domestic hot water (additionally to the previous ones)									
Standard NG/LPG individual DHW heater	η= 0.9 Nominal/0.6 Real			η =0.9 Nominal			N.A.(1)		
Joule electric heater	η= 1 Nominal			N.A. (2)			N.A. (2)		
Electric resistance heater (instantaneous)									
Standard mixed NG/LPG boiler for heating and DHW	η= 0.9 Nominal/0.6 Real			η = 0.9 Nominal			N.A.(1)		
Condensing NG/LPG boiler for heating and DHW	η >0.95 Nom/1.02 Seasonal			η =0.95 Nom/1.02 Seasonal			η =0.97 Nominal/ 1.05 Seasonal (A label)		
Heat pump individual heater							COP 2.5		
Air-to-water heat pump (mixed)for heating and DHW	1.5 SCOP			3.4 SCOP (A class)			NO IN THE MARKET		

Inverter air-to-water heat pump (mixed)for heating and DHW	N.A.(4)			3.4 SCOP (A class)			> SCOP 4.0 heat (label A+)		
(ii)Inverter GHP air-to-water heat pump (geothermal)-DHW	N.A.(6)	N.A.(6)	0	N.A.(6)	N.A.(6)	0	> 1.5 + Residual heat for DHW		
Ventilation system									
Without heat recovery-residential	No label	No label	Electricity	No label	No label	Electricity	No label	No label	Electricity
With heat recovery-mainly non-residential building				< 85% Performance		Performance	>= 85%		Performance
Cooling system (additionally to the previous ones)									
Air conditioning, split, cooling	SEER 1.5	SEER 1.6		SEER 3.4 (A label)	SEER 3.4 (A label)		No in the market		
(i) Inverter air to air heat pump-cooling				SEER 3.4 (A label)			SEER 5.6 (A+ label)		
(ii)GHP air-to-water heat pump (geothermal)-cooling							SEER =4		
Renewable energies (outside of other systems)									
SOLAR THERMAL				UP TO 25% Final E contribution consumed			> 25% Final E contribution consumed		
SOLAR PHOTOVOLTAIC				UP TO 25% Final E contribution consumed			> 25% Final E contribution consumed		
GEOTHERMAL				UP TO 25% Final E contribution consumed			> 25% Final E contribution consumed		
AEROTHERMAL				UP TO 25% Final E contribution consumed			> 25% Final E contribution consumed		

BIOMASS				UP TO 25% Final E contribution consumed			> 25% Final E contribution consumed		
Other:									
Lighting- LED							LED		

Table 44: Specified values for the "energy rating" indicator in Spain

The policy proposal is to include the enhanced EPC form in the national normative-legislation, therefore suggestion of an amendment of *Real Decreto 235/2013, de 5 de abril, por el que se aprueba el procedimiento básico para la certificación de la eficiencia energética de los edificios*. Also to be updated the CTE *Código Técnico de Edificación and Reglamento de Instalaciones Térmicas de Edificios, RITE*.

3.6.4 Regular Mandatory EPC Assessor Training

The law indicates that the EPC assessors are those who have finalised a degree in Engineering or Architecture basically. The fact that a mandatory training

Based on the stakeholders' interviews, workshops and analysis of the needs in the framework of this project it is proposed to adopt a regular training scheme and or mandatory exams for EPC assessors; the adoption of this policy proposal at national level will require an amendment in legislation and regulatory framework in force.

The next table indicates the main content that is proposed for the training of EPC assessors

Type of Content	Included in the existing training programmes	Needs for development
Changes in national or European Building Performance Acts	There are some conferences and workshops about this content	To include European Directives, Regulations and their future updates focused on deep energy renovation; the new modifications of CTE, RITE, relevant building normative and further modifications.
State-of-the-art technologies	Few workshops are focused on technologies	Updated contents for the assessment of building envelope and technical systems because usually innovative materials and technologies will emerge in the market
Deep energy renovation recommendations	Not included	To analyse recommendations to achieve nZEB standard. Also including best practices and real building's renovations towards nZEB
Common mistakes or errors in EPCs- Quality control of issued EPCs for learning	Not included	The training could include common errors and mistakes of the entire EPC procedure; for that it is necessary that the EPC registries will be public
Funding programs for renovation and their technical requirements	Some workshops about funding programmes	Collection of European, National and, Regional funding programmes for deep energy renovation of buildings
Consumer information and communication	Not included	To elaborate guidelines for the communication of technical issues to consumers
Contract design	Not included	May be just some general information about this contract design.
Further (soft) skills for EPC assessors	Not included	To include the training on specific software for EPCs and recommendations for deep energy renovation of buildings
Other	Tool to perform certificates	The training should include at least 2 official tools that perform the certificates

Table 45: Main content that is proposed for the training of EPC assessors

3.6.5 *Online tool for comparing EPC recommendations to deep energy renovation recommendations*

ESCAN professionals, in cooperation with software experts, have analysed the Spanish official tools to perform EPCs and that provide Recommendations. All of them have the same limitations: (1) The software code is not open, it cannot be modified by third parties and free of charge, nor is that software published together with the executable version; (2) The use of these tools is free of charge, but it does not run in the cloud (from the Internet) but is a software for local installation and use (off-line).

The development of these analysis about Spanish official tools has required an effort in hours-man and in budget much higher than the budgets assigned to QualDeEPC Task 5.2, so developing a new tool within the framework of QualDeEPC is beyond the budgetary limits.

ESCAN, in cooperation with experts, analysed and updated an excel file, which is currently not official, to include calculations (indicative values) for the performance of EPCs. The Excel file proposes different building types, efficient technologies, efficiency parameters etc. This was aimed at providing information to improve the EnergyHub4All-CRES tool.

ESCAN designed and developed a simple tool embedded in the QualdeEPC Deep Renovation Network Platform (DRNP, D5.2), in sub-section 2.1.2. Deep renovation. Recommendations. The tool allows (1) to search for Recommendations for Deep renovation, (2) to search for Specific recommendations, (3) to select some specific recommendations (click in the recommendation) and view "Country-specific values" for such recommendation from the table-Priority A: Improving the recommendations for renovation provided on the EPCs towards deep energy renovation.

As an example:

Recommendations for Deep renovation	Specific recommendation	click here your priorities
External wall insulation	Wall with enhanced thermal insulation properties (nZEB for renovation standard or similar)	X

	Country-specific values		
Specific recommendation	**Value**	**Indicative unit cost**	**Indicative savings**
Wall with enhanced thermal insulation properties (nZEB for renovation standard or similar)	maximum 0.8 W/m^{2}K	85-100 €/m^2	80% heating savings; insulation termal system ETICS with mineral wool 5 cm and extruded polystyrene (XPS).

In Spain, ESCAN implements the Deep Renovation Network Platform (DRNP, see D5.2) itself and embed the calculation tool

This QualdeEPC DRNP tool, as it is embedded in the national QualdeEPC DRNPs, will be developed and used not only for Spain but for all partner countries that use this version of the DRNP: Bulgaria, Latvia, thus increasing its impact.

This tool can be used by owners, retailers and EPC assessors, even anyone who would like to know differences between recommendations to improve his home. It is already in Spanish and Bulgarian DRNPs.

3.6.6 Deep Renovation Network Platform

The analysis and searching of online web platforms that provide information of deep renovation did lead that the founded platforms are commercial based websites that provides information on products to sell; much information is available on the websites but we did not find a unique online website with all contents we did require.

So Escan decided to elaborate a totally new DRNP and some other country partners; the preliminary result is a web-based tool with the contents of deep renovation that have been identified and agreed between all partners; other partners decided to enhance an actual website and include the common contents in the partner language.

The contents are structured in several pages with information on welcome, Services and products contact countries; the technical contents are included in the page of Services and products Servicios y productos.

The page of Servicios y productos includes eight topics of deep renovation:

- Rehabilitación profunda
- Certificación E de edificios
- Profesionales y empresas de
- equipos para rehabilitación
- Programas de financiación
- Promoción de la rehabilitación
- de edificios
- Oportunidades de rehabilitación
- Plataformas

The platform allows not only to show the information but also the possibility to include specific information on financing, training, buildings, etc

All this information is available https://qualrenovate.eu/es/

The policy proposal will be the maintenance of this online website “qualrenovate” for medium-long term and the creation and maintenance of a National physical one-stop-shop that will provide information for the improvement of certification and deep renovation of the buildings mainly for the owners, tenants, and professionals. Not only for creation but also for maintenance of the one stop shop, budget line is required. (see Annex 6: DRNP Policy Proposal for Spain).

3.6.7 *Voluntary/mandatory advertising guidelines for EPCs & Improving compliance with the mandatory use of EPCs in real estate advertisements*

The new legislation RD 390/2021 indicates the data of the energy label that should be included in the sales and renting of a new building or renovation of buildings, if more than 25% building envelope renovation or if replacement of thermal installation that requires an installation project according to RITE 2007 or if more than 10% building surface increasement.

The next table indicates the contents and the how this information could be shown, specific guidelines about the publication-related guidelines

Content-related guidelines	Publication -related guidelines
• The contents of the energy label should be displayed across all mediums, which includes at least building data, energy classification class, colour, energy label date and specific energy consumption (primary or final as displayed on the EPC) also CO2 emissions. • URL to the EPC or EPC number should be provided, when possible, especially if EPCs are in public domain. • According to RD 390/2021 Art. 15/2 one content to be shown should be: if the energy label is of a building project, a finished work or an existing building.	• Provide publication parameters for displaying the EPC label such as size, colours, background, pixels, and typography. • Provide softcopies of the energy label content, especially for digital media • Provide graphical and text examples of advertisements for various media

Proposal for legislation making their use mandatory, if policy-makers wish to do so

The following text may be included in the national legislation for making the use of concrete guidelines for display of the legally required label 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 Ministry of Transport, Mobility and Urban Agenda must be followed."

We did elaborate an informative 5 pages document:

¿Qué información debe mostrar la Agencia inmobiliaria al público?

El certificado de eficiencia energética es obligatorio en la venta y alquiler por lo tanto el agente in mobiliario debe tener constancia de que esa vivienda dispone de un certificado energético registrad en la Comunidad Autónoma correspondiente. Es conveniente que el agente inmobiliario tenga una copia del certificado y de su correspondiente etiqueta energética

La emisión de la etiqueta energética se realiza después que el certificado es registrado en la Comuni dad Autónoma correspondiente.

Se propone que la información de la **etiqueta energética** este incluida en la venta y alquiler de una vivienda para que el futuro propietario/inquilino conozca el consumo de energía anual por cada me tro cuadrado y lo pueda comparar con otros. También las emisiones de CO_2 anuales por metro cua drado que emite la vivienda o el edificio que desea adquirir o alquilar.

Las Comunidades Autónomas gestionan un registro de certificados energéticos y en la mayoría de los casos las etiquetas son de carácter público. Por ejemplo, en la Comunidad de Madrid se puede des cargar la etiqueta de una vivienda o edificio en el siguiente enlace:
https://gestiona3.madrid.org/reee_etiqueta/showBuscadorEtiqueta.jsf

En el caso de que el comprador quiera ver el certificado de eficiencia energética (varias páginas) la inmobiliaria pueda mostrárselo, pero no tiene la obligación de entregarlo hasta que se formalice la compra.

Sugerencias y ejemplos de visualización

En la venta y alquiler de viviendas la información de la etiqueta energética debe mostrarse para que el comprador/inquilino conozca el comportamiento energético del inmueble y así poder elegir una vivienda más eficiente y que contribuya menos al calentamiento global (menos emisiones de CO_2).

El tamaño y los colores de la etiqueta energética:

La etiqueta energética original se puede imprimir fácilmente en tamaño DIN-A4 o descargarse como archivo PDF.

Los colores de esta varían en la clasificación, siendo el rojo para la clasificación G menos eficiente y de más consumo de energía y el color verde oscuro correspondiente a la clasificación A más eficiente y de menor consumo energético.

Se sugiere que el tamaño y los colores de la etiqueta energética en escaparates, periódicos, revistas, folletos publicitarios o en formato online de páginas web deben tener un tamaño adecuado y calidad visual fácilmente entendibles para el público.

Los colores, pixel y tipografía vienen definidos en la etiqueta original.

Ejemplo para venta online

En el caso de la venta online de una vivienda o edificio de viviendas se sugiere el siguiente formato a modo de ejemplo:

FOTO	DATOS VIVIENDA	DATOS Y ENLACE A ETIQUETA
	VENTA/ALQUILER VIVIENDA SITUADA EN CALLE XXX NUMERO XXX POBLACION XX EXTERIOR CON XXM2 DISPONE DE AIRE ACONDICIONADO, ASCENSOR Y TERRAZA PRECIO: XXX €	E 147 kWh/m²año D 31 kgCO₂/m²año

Al pinchar en D se puede descargar e imprimir la etiqueta energética con los datos, colores y tamaño entendible. Lo más adecuado sería que se pudiera descargar la etiqueta original.

Ejemplo para venta en escaparate

Para el caso de la venta de una vivienda o edificio usando promoción en escaparate se sugiere el siguiente formato a modo de ejemplo:

DATOS VIVIENDA, CONSUMO ENERGÉTICO Y EMISIONES CO_2	FOTOS Y ETIQUETA ENERGÉTICA
VENTA / ALQUILER EN ZONA XXX VIVIENDA SITUADA EN CALLE XXX NUMERO XX POBLACION XX EXTERIOR CON XX M² REFORMADO RECIENTEMENTE PARA ENTRAR A VIVIR ASCENSOR PORTERO AUTOMÁTICO LOCAL PARA REUNIONES TERRAZA PLAZA DE GARAJE OPCIONAL PARA ALQUILER CONSUMO ENERGÉTICO: E 147 kWh/m²año EMISIONES CO_2: D 31 kgCO₂/m²año PRECIO: XXXX €	

3.7 Sweden

Aspect	Description	Proposed measure(s)
Legislative and regulatory aspect	n/a	n/a
Financial aspect	The deep energy renovation recommendations might be considered too expensive compared to outcome, thus homeowners might hesitate to undertake the proposed recommendations.	Link the deep energy renovation recommendations with the specific financial incentives, targeted renovation programmes etc.
Expert capacity	Insufficient knowledge of the EPC issuers on innovative technologies, and forming packages of measures	Include tailored content in the training programmes for EPC issuers.
Technical aspect	1. There might be challenges related to procurements of complete packages of measures (e.g. including building envelope, HVAC systems and control system), where several disciplines are needed. 2. In some buildings, cultural values will need to be considered. This will affect the possibilities of carrying out deep energy renovation, and may be associated with specific technical challenges.	1. Targeted campaigns for encouraging entrepreneurs to cooperate and submit joint tenders. 2. Good examples of how cultural values can be handled prior to and within an energy renovation project.
Social aspect	1. Housing cooperatives may not have the competence required to interpret suggested measures. 2. With extensive renovation in multi-family buildings there is always a risk for increased rents and related social problems. Not all tenants may be able to stay in their apartments after a major renovation.	1. Targeted campaigns to increase the knowledge for decision making. 2. Targeted campaigns to raise awareness and knowledge of social responsibility related to renovation of multi-family buildings, as well as tenant-adapted renovations strategies. Financial incentive program for energy renovation in multi-family buildings.

Table 46: Overview of the different aspects for adapting QualDeEPC Deep Energy Renovation Recommendations policy proposal in Sweden

3.7.1 Defining 'Deep Energy Renovation' in Sweden in the framework of QualDeEPC

An official definition of the term 'Deep Energy Renovation' is not available in Sweden. For the purposes of the QualDeEPC project, the requirements for deep energy renovation are closely linked to the nZEB ones.

In the Swedish building regulations, the basic requirement for renovation is to fulfil the construction regulations for new buildings (nZEB, class C), provided that other quality requirements can be met. However, if energy performance for a new construction is not fulfilled, there are specific requirements of for example U-values of renovated components that are corresponding with new construction standards.

For the QualDeEPC project, it was adopted that the term 'Deep Energy Renovation' is defined as 'renovation achieving component energy standards close to those that are usually required to meet nZEB requirements for new buildings, as much as is technically and economically feasible'.

Proposed revisions in the existing laws, regulations and standards for incorporating the policy proposal

If the proposed definition is adopted and regulations need to refer to the definition, then an amendment of the Planning and Building Ordinance, PBF (2011:338) would be required.

3.7.2 Adopting the Recommendations for renovation provided in the EPCs towards deep energy renovation

This section provides guidance on the renovation measures that should be included in the EPCs, accompanied by specifications about the energy efficiency level or rating they should satisfy, in order to be consistent with deep energy renovation. The Swedish partner adapted the policy proposal on the enhanced renovation recommendations to the Swedish context.

	Specific recommendation	Value	Source of information
External wall insulation	Wall with enhanced thermal insulation properties	max. U = 0,18 W/m2K	Boverket's building regulations (BBR)
	Wall with exceptional thermal insulation properties	max. U = 0,14 W/m2K	25% better than enhanced
Roof insulation	Roof with enhanced insulation	max. U = 0,13 W/m2K	BBR
	Roof with exceptional thermal insulation properties	max. U = 0,1 W/m2K	25% better than enhanced
Insulation of ceiling of an unheated basement/ ground floor	Floor connected to the unheated basement or ground floor with reinforced insulation	max. U = 0,15 W/m2K	BBR
Window replacement	Window with enhanced insulation properties: e.g. Double glazed window equipped with thick argon or krypton thermal break and low-emissivity glass	max. U = 1,2 W/m2K	BBR
	Window with exceptional insulation properties, e.g. triple glazed window	max. U = 0,9 W/m2K	25% better than enhanced

	Specific recommendation	Value	Source of information
Door replacement	Door with enhanced insulation properties	max. U = 1.2 W/m2K	BBR
	Door with exceptional insulation properties	max. U = 0.9 W/m2K	25% better than enhanced
Replacement/ Installation of shading	Shading devices. For example external blinds (venetian, shutters or awning), fixed horizontal/vertical devices (overhangs, louvers) or movable devices.	Solar heat load value per tempered floor area (shading taken into account) summer half-year: Residential: ≤ 29W/m2 Non-residential: ≤ 32W/m2	the Sweden Green Building Council system Miljöbyggnad (voluntary environmental certification system): level Silver
Replacement/ installation of the mechanical ventilation system	Ventilation system (no heat recovery) with an exceptionally low electrical power requirement	Exhaust and supply system: SFP ≤1,1 kW/(m3/s) (without cooling) Exhaust system: SFP ≤0,5 kW/(m3/s)	BBR
	Ventilation system with heat recovery of min. 80% and very low electrical power consumption	Exhaust and supply system: SFP ≤1,5 kW/(m³/s) (1,6 with cooling) Exhaust system: SFP ≤0,75 kW/(m³/s)	BBR
	Ventilation system with heat recovery of min. 90% and low electrical power consumption	Exhaust and supply system: SFP ≤1,5 kW/(m³/s) (without cooling) Exhaust system: SFP ≤ 0,75 kW/(m³/s)	BBR
Replacement/ modernization of the heating system	Generally: heating systems with EU energy label Cat. A or above:	EU energy label Cat. A	
	Heat pump		
	District heating		
Replacement/ modernization of the cooling system	Generally: cooling system with EU energy label Cat. A or above.	EU energy label Cat. A	
	Geothermal heat pump		
	District cooling	Recommendation: check what energy sources are used in the district cooling.	
	Generally: DHW system with EU energy label Cat. A or above	EU energy label Cat. A	

	Specific recommendation	Value	Source of information
Replacement/ modernization of the DHW system	Heat pumps		
	District heating		
Integration of renewable energy sources	On-site renewable energy sources, for example:	If feasible, part of energy demand/ consumption should be covered by on-site renewable energy sources	Building regulations
	Solar thermal system		
	Solar photovoltaic system		
Lighting	Energy efficient lighting	General requirement	BBR
	Presence or daylight control	Recommended for non-residential buildings, where suitable.	BBR
Reduction of thermal bridging	Reduced thermal bridging for non-structural building elements, such as balconies, terraces, dormers, and fixed shading devices	Should be considered	
Increased air tightness	Sealing around windows and doors as well as any openings/penetrations of the building climate shell.	It is recommended to aim at an air exchange rate of 0,5 l/s,m^2 or lower at 50 Pa pressure difference.	
Building automation	Building automation system.	Class. B or above according to EN 15232	
Others	Insulation of pipes and ducts	Insulation should be added where useful	
	Replacement of circulation pumps by pumps that meet minimum requirement of ErP label	Need for replacement of pumps should be evaluated and considered	
	Hydraulic balance optimisation for water-based heating systems	Need for balancing should be considered	
	Balancing of ventilation system	Need for balancing should be considered	

Table 47: Deep Energy Renovation Recommendations and specific values for Sweden

Proposed revisions in the existing laws, regulations and standards for incorporating the policy proposal

The level for enhanced renovation can be considered already implemented in existing laws, since the basic requirement for renovation is to fulfil the construction regulations for new buildings (nZEB). However, there might be a need for changes in the guidance regarding room for adaptation and deviations from this requirement, which is given in the Swedish building regulations (BBR). Today, the building owner must *strive to* fulfill the building component requirements corresponding to NZEB level. In short, this means that the requirements should be fulfilled given that the renovation can be carried

out at a reasonable cost and without other negative consequences. Possibly, more detailed guidance with a wide enough definition of reasonable cost (e.g. including a long term perspective for energy efficient measures) could be advantageous. This recommendation could be included in BBR or in accompanying guidelines.

Also, the level 'exceptional' could be added to the guidance for renovation given in BBR, or accompanying guidelines.

3.7.3 High User-Friendliness Of The EPC - Adapted enhanced EPC form in Swedish context

The enhanced EPC form as developed by QualDeEPC and published in the White Paper (Veselá et.al 2021) was adapted to the national requirements and is available in English and Swedish. In the following figure, the final adapted template is presented.

Elements required by the current national EPC form that are considered to be useful enough to remain were listed in an additional section (F).

Energideklaration
i enlighet med BBR XZY

C. Byggnadens nuvarande energiegenskaper

Energianvändning* Mätning ☒ Beräkning ☐

* Verklig energianvändning påverkas av hur byggnaden används, antal personer som vistas i byggnaden, och vädret under den aktuella mätperioden. För beräkning av byggnadens energiprestanda korrigeras därför nedanstående värden till normal användning och normalt klimat (normalår).

Uppmätt energianvändning

Mätperiod (ÅÅMM, från–till)	Köpt el [kWh/år] Fastighet	Hyresgäster/ boende	Totalt	Köpt värme [kWh/år] Fjärrvärme	Biobränsle	Egen produktion [kWh/år] Solvärme	Sol-/vindel
1901-1912	22 358			194 530			

Uppmätt energianvändning fördelad på användningsområde

Energi för uppvärmning, tappvarmvatten och kyla [kWh/år] Energikälla	Värme	Tappvarm-vatten	Kyla	Elanvändning [kWh/år] Fastighetel	Verksamhet-/hushållsel*	Övrigt [kWh/år] Tvättstuga*
Fjärrvärme	151 013	43 517		16 608		5 750

* Ingår ej i byggnadens energiprestanda

Bedömning av energieffektivitet hos byggnadsdelar och tekniska system

Byggnadsdel	Area [m²]	Beskrivning (t.ex. isolertjocklek, U-värde)	Bedömning*
Yak eller vindsbjälklag		Kallvind. Isolertjocklek okänt (trägolv med förråd)	
Yttervägg	650	1.5 sten tegel U-värde ca 1.1. Putsad. Källarväggar av betong.	3
Fönster		3-glas med kopplade bågar	2
Ytterdörr		Entréport: Aluminiumparti med glas	2
Golv mot mark eller uppvärmd källare		Grundmurar av betong till berg	2

Tekniskt system		Installationsår	Beskrivning (t.ex. energikälla, installerad effekt (> 70kW?), EU energy label)	Bedömning*
Uppvärmning	Produktion	2001	Fjärrvärme.	1
	Distribution		Vattenradiatorer.	1
Tappvarmvatten			Fjärrvärme.	1
Ventilation			Frånluftsystem. Åtgärdat sedan föregående ED enl. OVK.	2
Kyla			Nej	n/a
Egen förnybar produktion			Nej	n/a
Belysning			Åtgärdat sedan föregående ED: Byter successivt belysningen i trapphus till LED.	2

* 1. Grön = god energieffektivitet, 2. Gul = acceptabel energieffektivitet, 3. Röd = låg energieffektivitet

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D. Åtgärdsförslag

Åtgärdsförslag – bedömning för enskild byggnadsdel eller tekniskt system

Byggnads-del	Rekommenderad åtgärd	Ny bedömning	Energi-besparing [kWh]	Investerings-kostnad [SEK]	Internränta (eller pay off-tid)	Ingår i åtgärds-paket
Yak eller vindsbjälklag						☐
Yttervägg	Tilläggsisolering fasad 95 mm och fasadskiva	2	33 800 kWh/år	1 495 000 SEK	Payoff vid renoverings-behov: 22 år (Annars 44 år)	☒
Fönster						☐
Ytterdörr						☐
Golv mot mark eller uppv-rymd källare						☐

Tekniskt system	Rekommenderad åtgärd	Ny bedömning	Energi-besparing [kWh]	Investerings-kostnad [SEK]	Internränta (eller pay off-tid)	Ingår i åtgärds-paket
Uppvärmning						☐
Tappvarm-vatten						☐
Ventilation						☐
Kyla						☐
Egen förnybar produktion	Installation av solceller på taket, mot väster. Förslaget baserat på en 5 kW anläggning.		Produktion: 6 300 kWh/år Besparing: 3 400 kWh/år Överproduktion (såld el): 900 kWh/år	80 000 SEK inkl. bidrag och moms	Payoff: 16 år	☒
Belysning						☐
Annat	Sänkning av temperaturen i trapphus, från 20 till 15 °C.		800 kWh/år	0 SEK	Payoff: 0 år	☒

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Energideklaration
i enlighet med BBR XZY

Åtgärdspaket
Förslag på kombinationer av renoveringsåtgärder

Åtgärdsförslag 1:

Beskrivning: Sänkning av temperaturen i trapphus, från 20 till 15 grC genom avstängninga av radiatoterna. Antag att omgivande lägenhetsväggar värmer trapphuset.
Besparing: U*A*grDh, 1,1*27*(80-53) = 800 kWh/år, ca 800 SEK/år
Investering:0 SEK Livslängd/kalkyltid - PayOff =0, inv.(SEK)/Besp. (SEK/år) (med 0% ränta) Kostnad per sparad kWh =0
Inv.(SEK)/Besp.(kWh/år)xLivslängd(år) (med 0% ränta)

Åtgärdsförslag 2:

Beskrivning: Solceller på taket mot väster. 5 kW ger 20% överproduktion.
Besparing: Besparing kWh/år*(egenförbrukning*elpris + överprod*säljpris=4325 * (0,8*1,2 + 0,2*1,0)=5000 SEK/år investering: 80 000 SEK inkl. bidrag och moms
Livslängd/kalkyltid: 25 år PayOff =80 000/5000=16 år, inv.(SEK)/Besp. (SEK/år) (med 0% ränta)
Kostnad per sparad kWh =80 000/4325/25=0,74 SEK/kWh inv.(SEK)/Besp. (kWh/år)xLivslängd(år) (med 0% ränta)

Åtgärdsförslag 3:

Beskrivning: Tilläggsisolering fasad 95 mm och fasadskiva
Besparing: (Utföre-Uefter)*A*grDh, (1,1-0,25)*1*80=52 kWh/m2,år, ca 52 SEK/m2år *650m2-> 33 800 SEK
Investering:1830 SEK/m2 enligt sektionsfakta ROT 7.028. *1,25=2300 SEK/m2 inkl. moms *650m2-> 1 495 000 SEK Livslängd/kalkyltid: 40 år PayOff =2300/52=44 år, inv.(SEK)/Besp. (SEK/år) (med 0% ränta)
Kostnad per sparad kWh =2300/52/40=1,1 SEK/kWh inv.(SEK)/Besp. (kWh/år)x Livslängd(år)med 0% ränta).
Om renoveringsbehov föreligger och endast 50% av investeringen belastar "energieffektivisering" fås istället: PayOff=22 år och 0,55 kr/kWh.

Åtgärdsförslag summa:

Total energibesparing (80% av solelen används i byggnaden): 33 800 + 0,8*4500 + 800 = 38 000 kWh
Total kostnadsbesparing (1kr/kWh) : 33 800 + 4300 + 800= 38 900 kr
Total investering om samtidig fasadrenovering (inkl. Moms): 1 495 000/2 + 80 000 + 0 = 828 000 kr
Pay off-tid (0% ränta): 828 000/ 38 900 = 21 år

Potentiell besparing av köpt energi för åtgärdspaketet: 38 000 kWh/år
Pay off-tid för åtgärdspaketet: 21 år

Energirenovering enligt åtgärdsförslaget uppfyller BBR gällande:
Närnollenergibyggnader (energiklass C) ☐
U-värden för enskilda byggdelar (inkl. köldbryggor) ☐

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Energideklaration
i enlighet med BBR XZY

Beskrivning av åtgärdsförslag som inte ingår i åtgärdspaketet

E. Övrig information

Följande länkar ger vidare information kring energideklarationer och renovering för förbättring av energiprestanda, samt rådgivning och aktuella bidrag:

- www.boverket.se/sv/energideklaration/
- https://www.boverket.se/sv/byggande/bygg-och-renovera-energieffektivt/energihushallnings-krav-vid-andring/
- https://www.energimyndigheten.se/energieffektivisering/jag-vill-energieffektivisera-hemma/stod-bidrag-och-radgivning/

F. Additional

Additional elements required by the current national EPC form that are considered to be useful enough to remain:

- A reference value for comparison with similar buildings.
- Energy renovation measures implemented since the previous EPC. This is important in order to enable follow-up.
- Energy consumption adjusted to normal use and climate normal. The climate normal correction should be done automatically when the template is filled in.
- Obligatory ventilation control (OVK).
- Radon measurement
- Ventilation air flow rate
- Mandatory inspection of ventilation and heating system

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Figure 51: The adapted enhanced EPC form in Swedish

Compared to the current standard EPC, the proposed enhanced EPC form is enriched with the following elements:

- The building envelope components and the technical systems are evaluated in terms of energy performance. The '"Energy rating" indicator (traffic light system) adopted provides a clear representation of the energy performance aspects of the building components and may help owners to have a fast and easy understanding of the actual conditions of the building as well a good understanding of the proposed measures.
- The EPC assessor is encouraged to suggest and describe combinations of measures.
- A summarizing table of all renovation recommendations, including key figures for cost, savings and profitability.
- A summary of potential energy savings and possible energy performance if suggested measures are implemented. A warning regarding the display of these figures is that it may either have an encouraging or discouraging effect.
- Measured energy use before correction to normal use and the climatological normal year. This is considered a positive addition to the standard EPC. However, normalized figures should still also be included.
- A picture of the building is included in the first page of the EPC.

Other additional elements compared to the standard EPC:

- Visualization of the rating scale and energy efficiency rate differs from the current EPC.
- Energy class limits are presented.

The 5-scale scheme related to the "Energy rating" indicator for the Swedish context can be defined as follows:

- ***Green:*** *Significantly exceeds the minimum standards set by the national regulations. Maximum U-values about 25% lower than requirements for new buildings. (Very good energy properties.)*
- ***Yellow-green****: Reaches, or slightly exceeds the minimum standards set by the national regulations. (Good energy properties.)*
- ***Yellow****: Just below the minimum standards set by national regulations. Maximum U-values about 50% higher than requirements for new buildings. (Acceptable energy properties.)*
- ***Orange****: Below minimum standards set by the national regulations. Maximum U-values about 150% higher than requirements for new buildings. (Energy properties might be acceptable or not, depending on circumstances.)*
- ***Red****: Significantly below the minimum standards set by national regulations. (Poor energy properties.)*

Proposed revisions in the existing laws, regulations and standards for incorporating the policy proposal

A template for the first page (a summary) of the current Swedish EPC form is included in an appendix to the Regulation (2006:1592) on energy performance certificates for buildings (BED). Thus, additional information and other changes to the first page of the EPC form requires an update of this appendix.

Any additional element or other changes to the Swedish EPC require changes in the electronic EPC form designed and handled by the Swedish National Board of Housing, Building and Planning.

	Red		Orange			Yellow			Yellow-green (BBR)			Green	
Building envelope	**Minimum**	**Unit**	**Maximum Value**	**Minimum Value**	**Unit (U-value)**	**Maximum Value**	**Minimum Value**	**Unit (U-value)**	**Maximum Value**	**Minimum Value**	**Unit (U-value)**	**Maximum Value**	**Unit**
Roof or ceiling to attic	> 0,4	W/m²K	≤ 0,4	> 0,24	W/m²K	≤ 0,24	> 0,16	W/m²K	≤0,16	> 0,1	W/m²K	≤ 0,1	W/m²K
External walls	> 0,45	W/m²K	≤ 0,45	> 0,27	W/m²K	≤ 0,27	> 0,18	W/m²K	≤0,18	> 0,14	W/m²K	≤ 0,14	W/m²K
Windows	> 3,0	W/m²K	≤ 3,0	> 1,8	W/m²K	≤ 1,8	> 1,2	W/m²K	≤1,2	> 0,9	W/m²K	≤ 0,9	W/m²K
Doors/Gates	> 3,0	W/m²K	≤ 3,0	> 1,8	W/m²K	≤ 1,8	> 1,2	W/m²K	≤1,2	> 0,9	W/m²K	≤ 0,9	W/m²K
Ground floor or floor to unheated basement	> 0,38	W/m²K	≤ 0,38	> 0,23	W/m²K	≤ 0,23	> 0,15	W/m²K	≤0,15	> 0,11	W/m²K	≤ 0,11	W/m²K

	Red	Yellow	Green
Technical systems	**Energy source, provided power, EU energy label**	**Energy source, provided power, EU energy label**	**Energy source, provided power, EU energy label**
Heating system			
Heat source	Oil, gas, direct electricity, electrical heater	Heat pump or bio mass boiler with low efficiency	District heating, high efficiency bio mass boiler or heat pump

Production system	Poor design, improper operation, change of system parts needed	Acceptable, but potential for improvement	Well designed, well-functioning
Distribution system	Inefficient distribution, poor design, pipe insulation missing, need for balancing or change of components needed	Potential for improvement, e.g. by adding automatic control	Automatic control, efficient heat distribution, well-functioning
Domestic hot water			
Heat source	Oil, gas, direct electricity, electrical heater	Heat pump or bio mass boiler with low efficiency	District heating, high efficiency bio mass boiler or heat pump
System	Poor design, improper operation, change of components needed	Acceptable, but potential for improvement	Well designed, well-functioning, efficient distribution
Ventilation system			
In general	Poor design, improper operation, change of components or balancing needed	Acceptable, but potential for improvement	Well designed, well-functioning, efficient distribution
System type	Depend on circumstances	Depend on circumstances	Supply and exhaust system with heat recovery
SFP	Very high SFP	SFP higher, but near BBR	SFP lower than BBR
Heat recovery	No heat recovery (where relevant)	Heat recovery with low efficiency	Heat recovery with very high efficiency (>90%)
Fans	No variable speed fans	Fans partly replaced with variable speed fans	Variable speed fans
System control (in relation to benefitial level)	CAV, and VAV would be beneficial	Simple VAV and potential for improvement with DCV *or* CAV but little potential with VAV	DCV system *or* simple VAV with no potential for improvement with DCV
Cooling system			
Source	Depend on circumstances	Depend on circumstances	Free cooling
System	Poor design, improper operation, change of components or balancing needed	Acceptable, but potential for improvement	Well designed, well-functioning, efficient production and distribution
Renewable energies (outside of other systems)			
	No renewable energy system, but good conditions	Renewable energy system with potential for improvement *or* No renewable energy system, but no good conditions	Well-functioning renewable energy system (on site)
Lighting			
In general	<20% energy efficient lighting	lighting partly replaced with efficient lighting	100% energy efficient lighting

Lighting in non-residential buildings	No light fixtures equipped with presence or daylight control	Some light fixtures equipped with presence or daylight control	All light fixtures equipped with presence or daylight control (where relevant)

Table 48: Specified values for the "energy rating" indicator in Sweden

3.7.4 Regular Mandatory EPC Assessor Training

In Sweden, there are no requirements on mandatory training for EPC assessors, but voluntary initial and regular training courses are available, given by commercial organizations.

Detailed knowledge (competence) requirements are listed in regulation CEX, in addition to relevant education and work experience. The fulfilment of knowledge requirements is tested in compulsory tests for EPC assessor certification and recertification. There are two levels of certification: one for simple buildings and one that also includes complex buildings. The later requires additional knowledge.

In addition to existing training content (based on knowledge requirements in regulation CEX and content of voluntary courses), the following training elements are proposed for voluntary regular training sessions, workshops or seminars:

Type of Content	Included in the existing training programmes	Needs for development
Changes in national or European Building Performance Acts	Yes	No
State-of-the-art technologies	No	It may be a good idea to present and discuss such examples at workshops or seminars.
Deep energy renovation recommendations	Yes	Encouragement and training in combining different measures into a deep renovation package (e.g. https://totalconcept.se/) is not yet sufficient, and could be included in workshops or seminars.
Common mistakes or errors in EPCs- Quality control of issued EPCs for learning	No	It may be a good idea to present and discuss such examples at workshops or seminars.
Funding programs for renovation and their technical requirements	No	It may be a good idea to give information regarding current funding programs at workshops or seminars.
Consumer information and communication	Partly	Further training in workshops or training sessions may be a good idea.
Contract design	No	No
Further (soft) skills for EPC assessors		
Other		

Table 45 Proposed training content for training workshops or seminars in Sweden (further to existing)

3.7.5 Online tool for comparing EPC recommendations to deep energy renovation recommendations

The building owners and other stakeholders participating in the project see no, or little need to develop an online tool for homeowners and/or EPC assessors. In particular, they are doubtful that a tool with limited input parameters, and simple enough to be used without prior knowledge, would still give results accurate enough to be useful to the building owner.

The Swedish project partner has therefore chosen to present useful examples of energy renovation measures that are considered representative for different building types. At first, this is done for multi-family buildings, for which it is possible to define representative building types. Second, typical renovation measures for single-family buildings will be presented. However, for single-family buildings it is not easy to define representative building types, making it difficult to produce useful examples. For the same reason, it is very difficult to develop a useful general online tool with calculations based on limited input data.

Presenting examples of different measures instead of offering a free calculation tool likely makes it more clear to the building owner that the result will vary with building specific parameters and local conditions. With a simple online tool, where the building owner should fill in some of the input data, it is easy to be misled that the results are more accurate for the specific building than they actually are. It could therefore be argued that it is better for an impartial national actor to present examples, clearly valid under specific circumstances, than offering building owners a simple tool.

3.7.6 Deep Renovation Network Platform

As regards the adaptation and implementation of this project priority, the Swedish project partner has initially built a new platform, with the intention to later merge the content to a national governmental information platform that will be reopened later this year.

The platform can be classified as 1a) subtype and includes information on:

- energy consumption in buildings
- energy performance certificates
- energy saving measures
- general information on deep renovation
- recommended measures and good examples of deep renovation
- National and European legislation on building energy performance and NZEB
- advice on how to find and choose energy consultants, building contractors, product suppliers etc.
- current financing opportunities and subsidy programs
- upcoming events and courses related to deep energy renovation
- existing tools for calculation of energy consumption and savings

The target group addressed by this platform is mainly residential (both single- and multifamily) building owners and any other individuals interested in renovating or improving the energy performance of buildings.

Policy proposal: In Sweden, physical hubs with energy advisors are today facilitated by Regional Energy Agencies. These might be used as a platform for stronger dissemination of information, focusing more on deep energy renovation. This needs further investigation.

3.7.7 Voluntary/mandatory advertising guidelines for EPCs & Improving compliance with the mandatory use of EPCs in real estate advertisements

3.7.7.1 Adapted guidelines for displaying EPCs (or its contents) in real estate advertisements in Sweden

Guidelines for advertisement already exist in Sweden and adapted guidelines (proposed in White paper 8.3.1) are not necessary. It is mandatory to use the guidelines.

3.7.7.2 Other policy proposals for improving compliance with the mandatory use of EPCs in real estate advertisements

The Swedish National Board of Housing, Building and Planning is the appointed nodal authority for compliance verification with the mandatory use of EPCs in real estate advertisements in Sweden.

Way to improve compliance	Description
Appointment of nodal authorities	Already appointed. No changes are needed.
Resources and competences	Complaints regarding compliance with the mandatory use of EPCs in real estate advertisements can be reported to the appointed authority.
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 are not needed.
Methods of enforcement (active): penal provisions	For building owners missing to obtain/present an EPC during the sale or rental of the building, the appointed authority can command the owner to fulfil the requirements. This could also be combined with sanctions.

4 CONCLUSIONS

This report *"D5.3 Guidebook for improved EPCs presenting the project's proposal for an enhanced and converging EPC assessment and certification scheme- Consolidated results"* aims at presenting the consolidated results of the project's proposal for an enhanced and converging EPC assessment and certification scheme both on EU and national level, by taking into account the national context of the seven countries represented in QualDeEPC project.

The project's tools and policy proposals developed during the implementation of WP3 "Development of enhanced EPC schemes" and tested in WP4 "Testing the applicability through pilot cases, were adapted to the participating countries context, as presented in detail in *D5.1 Report on the 7 nationally adapted enhanced assessment and certification schemes.*

The report illustrates the policy proposals and tools in a rational way in order to serve as a guide to the policy makers and competed bodies on the necessary steps need to be followed for adapting the proposed tools and concept as well as to define the specific values. The project's priorities A) to G) addressed are presented in different to D5.1 order in this document, reflecting the importance of the enhanced EPC template form and the training of EPC assessors:

The main outcomes of the 3rd and 4th round of national workshops, as well as the results of the implementation phase at national level, currently in progress, phase will be included in the final version of the D5.3 scheduled at the end of the project.

5 REFERENCES

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6 ANNEXES

Annex 1: DRNP Policy Proposal for Bulgaria

Subtypes and needs for services

Subtype	Subtype 1a.	Subtype 1b.	Subtype 2a.	Subtype 2b.	Subtype 2c.
Subtypes needed in your country (YES/NO)	YES	NO	NO	YES	NO
Reasons for which subtypes are needed	To provide easily accessible online information to the stakeholders			To provide information, coordination, trainings, coaching, technical support	
Potential subtype providers	National energy agency Local/regional energy agency private company private company with public support Other: (explain)	National energy agency Local/regional energy agency private company private company with public support Other: (explain)	National energy agency Local/regional energy agency private company private company with public support Other: (explain)	National energy agency Local/regional energy agency private company private company with public support Other: (explain)	National energy agency Local/regional energy agency private company private company with public support Other: (explain)

Who would be most appropriate to operate the needed services?	Local/regional energy agency			Local/regional energy agency; alternative option: Municipalities together with National energy agency	
Potential funding sources	Public National Public local/regional Private Public-private Other: (explain)	Public National Public local/regional Private Public-private Other: (explain)	Public National Public local/regional Private Public-private Other: (explain)	Public National Public local/regional Private Public-private Other: (explain)	Public National Public local/regional Private Public-private Other: (explain)
How could the funding be secured?	Public national or public-private			Public national, public local/regional, public-private	
Needs for services	**Subtype 1a.**	**Subtype 1b.**	**Subtype 2a.**	**Subtype 2b.**	**Subtype 2c.**
General information on: 1.1 renovation actions 1.2 potential savings and costs	X			X	
1.3 Linking with Renovation tool	X			X	

Linking with 2.1 Energy Performance Certificates	**X**			**X**	
Linking with 2.2 Building deep renovation roadmap and possibly a passport	**X**			**X**	
3. Information on building contractors/technicians;	**X**			**X**	
4. Information on material or product manufacturers/ suppliers	**X**			**X**	
5. Information on financing opportunities for deep renovation	**X**			**X**	
Help with applying for loan and grant programmes or third-party financing				**X**	
6. Active marketing of deep renovation and its benefits and costs				**X**	
7. Network (platform) for learning, exchange, and cooperation (local/regional/ national)				**X**	
8. Network (platform) for learning, exchange, and cooperation (interregional/ transnational)				**X**	

9. Capacity building and training				X	
10. Step-by-step guidance for renovation project from start to end				X	
11. Monitoring the implementation of the renovation project(s)					
12. Operating a physical network hub and information centre				X	
13. Carrying out the renovation project(s)					
14. Initiation and coordinating deep renovation demonstration project(s)					
15. Aggregation of building renovation projects					

Subtypes and needs for services

Subtype	Subtype 1a.	Subtype 1b.	Subtype 2a.	Subtype 2b.	Subtype 2c.
Subtypes needed in your country (YES/NO)	YES	NO	YES	YES	possibly
Reasons for which subtypes are needed	To provide easily accessible online information to the stakeholders		To provide information, coordination, trainings, coaching, technical support, active marketing	To provide information, coordination, trainings, coaching, technical support, active marketing	To provide an implementation one-stop shop in addition to subtype 2b services. However, this would be commercial and could compromise the perceived independence of the services of subtype 2b
Potential subtype providers	Department of social media, public relations at the BMWK* Local/regional energy agency private company private company with public support		Local/regional energy agency private company private company with public support	Local/regional energy agency private company private company with public support	private company
Who would be most appropriate to operate the needed services?	BMWK and Federal Ministry of Construction in cooperation with network of local/regional energy agencies		Local/regional energy agency	Local/regional energy agency	
Potential funding sources	Public national (for preferred option) Public local/regional Private		Public national (financial support to basic structure and specific services) Public local/regional	Public National (financial support to basic structure and specific services) Public local/regional	

	Public-private		**Private Public-private**	**Private Public-private**	
How could the funding be secured?	**Public national or public-private**		**Public national plus Public local/regional, public-private**	**Public national plus Public local/regional, public-private**	
Needs for services	**Subtype 1a.**	**Subtype 1b.**	**Subtype 2a.**	**Subtype 2b.**	**Subtype 2c.**
General information on: 1.1 renovation actions 1.2 potential savings and costs	**X**		**X**	**X**	
1.3 Linking with Renovation tool	**X**		**X**	**X**	
Linking with 2.1 Energy Performance Certificates	**X**		**X**	**X**	
Linking with 2.2 Building deep renovation roadmap and possibly a passport	**X**		**X**	**X**	
3. Information on building contractors/technicians;	**X**		**X**	**X**	
4. Information on material or product manufacturers/ suppliers			**X**	**X**	
5. Information on financing opportunities for deep renovation	**X**		**X**	**X**	
Help with applying for loan and grant programmes or third-party financing	**X**		**X**	**X**	
6. Active marketing of deep renovation and its benefits and costs	**Possibly:** general media, online. possibly with local partners		**X**	**X**	
7. Network (platform) for learning, exchange, and cooperation (local/regional/ national)	Could take national coordinator role		**X**	**X**	

8. Network (platform) for learning, exchange, and cooperation (interregional/ transnational)	**X**				
9. Capacity building and training	Could take national coordinator role		**X**	**X**	
10. Step-by-step guidance for renovation project from start to end				**X**	
11. Monitoring the implementation of the renovation project(s)	Could take national coordinator role			possibly	
12. Operating a physical network hub and information centre			**X**	**X**	
13. Carrying out the renovation project(s)					
14. Initiation and coordinating deep renovation demonstration project(s)	Could take national coordinator role		possibly	possibly	
15. Aggregation of building renovation projects				possibly	

*BMWK - Federal Ministry for Economic Affairs and Climate Protection

Annex 3: DRNP Policy Proposal for Greece

Subtypes and needs for services

Subtype	Subtype 1a.	Subtype 1b.	Subtype 2a.	Subtype 2b.	Subtype 2c.
Subtypes needed in your country (YES/NO)	**YES**	**NO**	**NO**	**YES**	**NO**
Reasons for which subtypes are needed	Further exploitation and upgrade of an existing OSS aiming at "Deep Renovation". The existing platform 'EnergyHUB forALL[6]' has been developed and operated by CRES.			**To provide information, coordination, trainings, coaching, technical support**	
Potential subtype providers	**National energy agency Local/regional energy agency private company private company with public support Other: (explain)**	**National energy agency Local/regional energy agency private company private company with public support Other: (explain)**	**National energy agency Local/regional energy agency private company private company with public support Other: (explain)**	**National energy agency Local/regional energy agency private company private company with public support Other: (explain)**	**National energy agency Local/regional energy agency private company private company with public support Other: (explain)**
Who would be most appropriate to operate the needed services?	**National Energy Agency**			**Regional Authorities (technical department) with the support of National Energy Agency and regional branches of**	

[6] http://www.cres.gr/energyhubforall/ (available only in Greek)

				the Hellenic Technical Chamber	
Potential funding sources	**Public National Public local/regional Private Public-private Other: (explain)**	**Public National Public local/regional Private Public-private Other: (explain)**	**Public National Public local/regional Private Public-private Other: (explain)**	**Public National Public local/regional Private Public-private Other: (explain)**	**Public National Public local/regional Private Public-private Other: (explain)**
How could the funding be secured?	**Public National and European funds could be utilized**			**Public National Public local/regional Private Public-private**	
Needs for services	**Subtype 1a.**	**Subtype 1b.**	**Subtype 2a.**	**Subtype 2b.**	**Subtype 2c.**
General information on: 1.1 renovation actions 1.2 potential savings and costs	Information on renovation typical costs and savings for: ● building insulation ● windows ● ventilation ● heating system ● renewables. The existing content will be updated and oriented towards Deep energy renovation recommendations as identified by the QuaDeEPC project			X	
1.3 Linking with Renovation tool	The online tool developed by the QuaDeEPC project will be embedded/ linked with DRNP			X	
Linking with 2.1 Energy Performance Certificates	Information will be provided for: ● EPC in general and purposes/uses/duties			X	

	● EPC assessment procedure ● EPC forms and types ● issue energy certificates and where this is regulated Links to ● The online renovation calculator tool (1.3) ● The deep renovation recommendations (1.1) Moreover, the platform will include link for the National Energy Inspectors Registry and EPC Registry (https://www.buildingcert.gr/) .				
Linking with 2.2 Building deep renovation roadmap and possibly a passport	● What is it? ● How can the EPC be a starting point? ● Benefit of the renovation roadmap and passport: why is it useful? ● Links to further information about the roadmap/passport ● energy efficiency of buildings (link to 1.1). Links to ● subsidy programmes ● The online renovation calculator tool (1.3).			X	
3. Information on building contractors/technicians;	General information on trained and /or certified contractors / technicians/ installers will be available by linking professional associations websites			X	

4. Information on material or product manufacturers/ suppliers	General information on material or product manufacturers/ suppliers will be provided by linking professional associations websites			X	
5. Information on financing opportunities for deep renovation	Information on existing support programs for energy-efficient buildings will be included by linking with the relevant official websites			X	
Help with applying for loan and grant programmes or third-party financing	n/a				
6. Active marketing of deep renovation and its benefits and costs	Promotion of deep renovation network platform through media releases and in own events (which may be organised anyway for other purposes)			X	
7. Network (platform) for learning, exchange, and cooperation (local/regional/ national)	• List of training providers for EPC assessors • Link to lists of workshops and seminars			X	
8. Network (platform) for learning, exchange, and cooperation (interregional/ transnational)	n/a				
9. Capacity building and training	**The platform will include information on capacity building and training courses/programme provided by the Technical Chamber of Greece as well as the Universities**			**X**	
10. Step-by-step guidance for renovation project from start to end	**n/a**			**X**	
11. Monitoring the implementation of the renovation project(s)	**n/a**				

12. Operating a physical network hub and information centre	**n/a**			**X**	
13. Carrying out the renovation project(s)	**n/a**				
14. Initiation and coordinating deep renovation demonstration project(s)	**n/a**				
15. Aggregation of building renovation projects	**n/a**				

Subtypes and needs for services

Subtype	Subtype 1a.	Subtype 1b.	Subtype 2a.	Subtype 2b.	Subtype 2c.
Subtypes needed in your country (YES/NO)	YES	NO	NO	YES	NO
Reasons for which subtypes are needed	To provide easily accessible online information to the stakeholders			To provide information, coor-dination, trainings, coaching, technical support.	
Potential subtype providers	National energy agency Local/regional energy agency private company private company with public support Other: (explain)	National energy agency Local/regional energy agency private company private company with public support Other: (explain)	National energy agency Local/regional energy agency private company private company with public support Other: (explain)	National energy agency Local/regional energy agency private company private company with public support Other: (explain)	National energy agency Local/regional energy agency private company private company with public support Other: (explain)
Who would be most appropriate to operate the needed services?	Energiaklub and Hungarian Energy Efficiency Institute (MEHI) (Alternatives: Lechner Tudásközpont, the Hungarian Chamber of Engineers, the Hungarian Energy and Public Utility Regulatory Authority (HEA), ÉMI Non-profit Lld.)			Energiaklub and Hungarian Energy Efficiency Institute (MEHI) (Alternatives: Lechner Tudásközpont, the Hungarian Chamber of Engineers, the Hungarian Energy and Public Utility Regulatory Authority (HEA), ÉMI Non-profit Lld.)	

Potential funding sources	Public National Public local/regional Private Public-private Other: (explain)	Public National Public local/regional Private Public-private Other: (explain)	Public National Public local/regional Private Public-private Other: (explain)	Public National Public local/regional Private Public-private Other: (explain)	Public National Public local/regional Private Public-private Other: (explain)
How could the funding be secured?	Public national or public-private			Public national or public-private	
Services	**Subtype 1a.**	**Subtype 1b.**	**Subtype 2a.**	**Subtype 2b.**	**Subtype 2c.**
General information on: 1.1 renovation actions 1.2 potential savings and costs	X			X	
1.3 Linking with Renovation tool	X			X	
Linking with 2.1 Energy Performance Certificates	X			X	
Linking with 2.2 Building deep renovation roadmap and possibly a passport	X			X	
3. Information on building contractors/technicians;	X			X	
4. Information on material or product manufacturers/ suppliers	X			X	
5. Information on financing opportunities for deep renovation	X			X	
Help with applying for loan and grant programmes or third-party financing				X	
6. Active marketing of deep renovation and its benefits and costs	X			X	
7. Network (platform) for learning, exchange, and cooperation (local/regional/ national)	X				

8. Network (platform) for learning, exchange, and cooperation (interregional/ transnational)	X				
9. Capacity building and training	X				
10. Step-by-step guidance for renovation project from start to end	X			X	
11. Monitoring the implementation of the renovation project(s)				X	
12. Operating a physical network hub and information centre				X	
13. Carrying out the renovation project(s)					
14. Initiation and coordinating deep renovation demonstration project(s)					
15. Aggregation of building renovation projects					

Subtypes and needs for services

Subtype	Subtype 1a.	Subtype 1b.	Subtype 2a.	Subtype 2b.	Subtype 2c.
Subtypes needed in your country (YES/NO)	YES	NO	NO	NO	YES
Reasons for which subtypes are needed	Provide easy access to online information				This would be a real physical one stop shop enabling faster building renovation process
Potential subtype providers	National energy agency Local/regional energy agency private company private company with public support Other: (explain)	National energy agency Local/regional energy agency private company private company with public support Other: (explain)	National energy agency Local/regional energy agency private company private company with public support Other: (explain)	National energy agency Local/regional energy agency private company private company with public support Other: (explain)	National energy agency Local/regional energy agency private company private company with public support Other: (explain)
Who would be most appropriate to operate the needed services?	Ministry of Economics Local/regional energy agencies				Ministry of Economics Local/regional energy agencies Private companies
Potential funding sources	Public National Public local/regional Private Public-private Other: (explain)	Public National Public local/regional Private Public-private Other: (explain)	Public National Public local/regional Private Public-private Other: (explain)	Public National Public local/regional Private Public-private Other: (explain)	Public National Public local/regional Private Public-private Other: (explain)

How could the funding be secured?	National funding				National funding
Needs for services	**Subtype 1a.**	**Subtype 1b.**	**Subtype 2a.**	**Subtype 2b.**	**Subtype 2c.**
General information on: 1.1 renovation actions 1.2 potential savings and costs	X				X
1.3 Linking with Renovation tool	X				X
Linking with 2.1 Energy Performance Certificates	X				X
Linking with 2.2 Building deep renovation roadmap and possibly a passport	X				X
3. Information on building contractors/technicians;	X				X
4. Information on material or product manufacturers/ suppliers	X				X
5. Information on financing opportunities for deep renovation	X				X
Help with applying for loan and grant programmes or third-party financing					X
6. Active marketing of deep renovation and its benefits and costs	X				X
7. Network (platform) for learning, exchange, and cooperation (local/regional/ national)					X
8. Network (platform) for learning, exchange, and cooperation (interregional/ transnational)					X
9. Capacity building and training	X				X

10. Step-by-step guidance for renovation project from start to end					**X**
11. Monitoring the implementation of the renovation project(s)	X				X
12. Operating a physical network hub and information centre					X
13. Carrying out the renovation project(s)					X
14. Initiation and coordinating deep renovation demonstration project(s)					X
15. Aggregation of building renovation projects					X

Subtypes and needs for services

Subtype	Subtype 1a.	Subtype 1b.	Subtype 2a.	Subtype 2b.	Subtype 2c.
Subtypes needed in your country (YES/NO)	YES	NO	NO	YES	NO
Reasons for which subtypes are needed	To provide easily accessible online information to the stakeholders			To provide information and technical support	
Potential subtype providers	National energy agency Local/regional energy agency private company private company with public support Other: (explain)	National energy agency Local/regional energy agency private company private company with public support Other: (explain)	National energy agency Local/regional energy agency private company private company with public support Other: (explain)	National energy agency Local/regional energy agency private company private company with public support Other: (explain)	National energy agency Local/regional energy agency private company private company with public support Other: (explain)
Who would be most appropriate to operate the needed services?	National energy agency/regional energy governments			National government together with regional governments	

Potential funding sources	Public National Public local/regional Private Public-private Other: (explain)	Public National Public local/regional Private Public-private Other: (explain)	Public National Public local/regional Private Public-private Other: (explain)	Public National Public local/regional Private Public-private Other: (explain)	Public National Public local/regional Private Public-private Other: (explain)
How could the funding be secured?	Public national or public-private			Public national or public-private	
Needs for services	**Subtype 1a.**	**Subtype 1b.**	**Subtype 2a.**	**Subtype 2b.**	**Subtype 2c.**
General information on: 1.1 renovation actions 1.2 potential savings and costs	X			X	
1.3 Linking with Renovation tool	X			X	
Linking with 2.1 Energy Performance Certificates	X			X	
Linking with 2.2 Building deep renovation roadmap and possibly a passport	X			X	
3. Information on building contractors/technicians;	X			X	

4. Information on material or product manufacturers/ suppliers	X			X	
5. Information on financing opportunities for deep renovation	X			X	
Help with applying for loan and grant programmes or third-party financing				X	
6. Active marketing of deep renovation and its benefits and costs	X			X	
7. Network (platform) for learning, exchange, and cooperation (local/regional/ national)					
8. Network (platform) for learning, exchange, and cooperation (interregional/ transnational)					
9. Capacity building and training	X				
10. Step-by-step guidance for renovation project from start to end				X	
11. Monitoring the implementation of the renovation project(s)	X				
12. Operating a physical network hub and information centre				X	
13. Carrying out the renovation project(s)					

14. Initiation and coordinating deep renovation demonstration project(s)					
15. Aggregation of building renovation projects					

Note: Escan developed qualrenovate subtype 2.a with information of the rows in green colour

Annex 7: DRNP Policy Proposal for Sweden

Subtypes and needs for services

Subtype	Subtype 1a.	Subtype 1b.	Subtype 2a.	Subtype 2b.	Subtype 2c.
Subtypes needed in your country (YES/NO)	Yes	No	Yes	No	No
Reasons for which subtypes are needed	Several information platforms already exist, but it would be useful with a platform with a compilation of information that fully covers different aspects of deep energy renovation.		Physical hubs with energy advisors are today facilitated by Regional Energy Agencies. These might be used as a platform for stronger dissemination of information, focusing more on deep energy renovation. This needs further investigation.		
Potential subtype providers	National energy agency Local/regional energy agency private company private company with public support Other: (explain)	National energy agency Local/regional energy agency private company private company with public support Other: (explain)	National energy agency Local/regional energy agency private company private company with public support Other: (explain)	National energy agency Local/regional energy agency private company private company with public support Other: (explain)	National energy agency Local/regional energy agency private company private company with public support Other: (explain)
Who would be most appropriate to operate the needed services?	A national, impartial actor, e.g., the National Board of Housing, Building, and planning		Regional Energy Agencies	Networks financed by the Swedish Energy Agency	Companies, non-profit organisations, trade organisations.

	or the Swedish Energy Agency, or other organization on representing a broad participation of companies.				
Potential funding sources	**Public National Public local/regional Private Public-private Other: (explain)**	**Public National Public local/regional Private Public-private Other: (explain)**	**Public National Public local/regional Private Public-private Other: (explain)**	**Public National Public local/regional Private Public-private Other: (explain)**	**Public National Public local/regional Private Public-private Other: (explain)**
How could the funding be secured?	**National funding.**				
Needs for services	**Subtype 1a.**	**Subtype 1b.**	**Subtype 2a.**	**Subtype 2b.**	**Subtype 2c.**
General information on: 1.1 renovation actions 1.2 potential savings and costs	Yes		Yes		
1.3 Linking with Renovation tool	Yes				
Linking with 2.1 Energy Performance Certificates	Yes		Yes		
Linking with 2.2 Building deep renovation roadmap and possibly a passport	Yes		Yes		
3. Information on building contractors/technicians;	No, but general advice could be included				
4. Information on material or product manufacturers/ suppliers	No				
5. Information on financing opportunities for deep renovation	Yes				

Help with applying for loan and grant programmes or third-party financing	No				
6. Active marketing of deep renovation and its benefits and costs	Yes		Yes		
7. Network (platform) for learning, exchange, and cooperation (local/regional/ national)	Yes		Yes		
8. Network (platform) for learning, exchange, and cooperation (interregional/ transnational)	No				
9. Capacity building and training	Yes		Yes		
10. Step-by-step guidance for renovation project from start to end	No			No. However, a possible way to give guidance in individual projects could be to offer support in the form of group meetings between experts and several building owners, where questions may be asked and answered.	
11. Monitoring the implementation of the renovation project(s)	No			No. Only monitoring of *demonstration projects* and dissemination of results for increased knowledge	
12. Operating a physical network hub and information centre	N/A		Already exists.		
13. Carrying out the renovation project(s)	No				
14. Initiation and coordinating deep renovation demonstration project(s)	No				No. Only initiation, monitoring and evaluation of demonstration projects.
15. Aggregation of building renovation projects	No, but a compilation of good examples.				