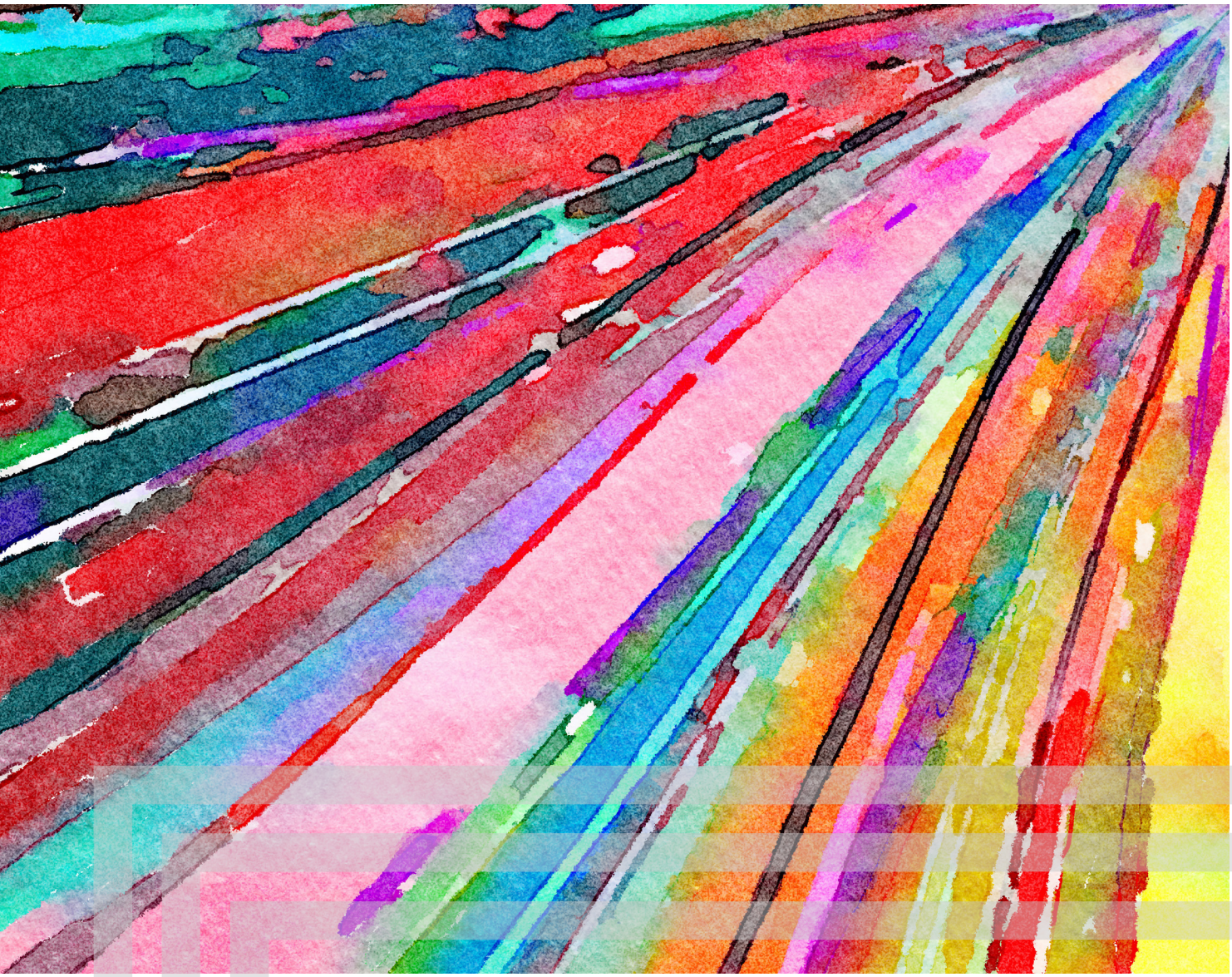
ePANACEA

Smart European Energy Performance Assessment & Certification

This project has received funding
from the European Union's HORIZON 2020
research and innovation programme
under grant agreement No 892421



Pathways of Energy Performance Certificates (EPCs) related policy framework

Version 2, January 2023

TU Wien – Technische Universität Wien
www.epanacea.eu

Published and produced by: TU WIEN with support from ePANACEA implementing countries

Author(s): Iná Eugenio Noronha Maia and Lukas Kranzl (TU WIEN)
Theresa Urbanz, Susanne Bruner-Lienhart, Ingrid Mayrhofer (EAST)
Elpida Polychroni, Maria Bololia, Andreas Androutsopoulos (CRES)
Krzysztof Klobut and Teemu Vesanen (VTT)
Jan Verheyen, Irena Kondratenko and Maarten De Groote (VITO)
Laura Muhr (IZES)
Inés Díaz Regodón and María Fernandez Boneta (CENER)
Aitor Domínguez Martín (IDAE)

Reviewer(s): Laura Muhr (IZES)

Layout: SYMPRAXIS

Cover image: livejournalist.guseff.gmail.com via depositphotos.com

Dissemination level: Public

Website: www.epanacea.eu

Project duration: June 2020 – May 2023

Grant Agreement: 892421 – ePANACEA – H2020-LC-SC3-2018-2019-2020 / H2020-LC-SC3-EE-2019

Coordinator:

CENER
NATIONAL RENEWABLE ENERGY CENTRE
ADItech

Project Partners:

efinovatic
VTT
TU WIEN TECHNISCHE UNIVERSITÄT WIEN Vienna | Austria
ΚΑΠΕ CRES
vito
ENERGIE AGENTUR Steiermark
izes gGmbH Institut für ZukunftsEnergie- und Stoffstromsysteme
MINISTERIO PARA LA TRANSICIÓN ECOLÓGICA Y EL RETO DEMOGRÁFICO
IDAE Instituto para la Diversificación y Ahorro de la Energía
TEAM sympraxis

HISTORY OF CHANGES

Version	Month Year	Organisation	Comments
V1	08.2022	TUW	First draft ideas with open questions to be clarified/answered/discussed in the next REB and interviews
V2	1.2023	TUW	Draft final version for revision
V2.1	24.01.2023	IZES	Revision of draft final version
V2.2	31.01.2023	TUW	Final version for layout

TABLE OF CONTENTS

ePANACEA PROJECT

After 10 years of track record, the current EPC schemes across the EU face several challenges which have led to a not full accomplishment of their initial objectives: lack of accuracy, a gap between theoretical and real consumption patterns, absence of proper protocols for inclusion of smart and novel technologies, little convergence across Europe, lack of trust in the market and very little user awareness related to energy efficiency.

The objective of the ePANACEA project is to develop a holistic methodology for energy performance assessment and certification of buildings that can overcome the above-mentioned challenges. The vision of ePANACEA is to become a relevant instrument in the European energy transition through the building sector.

ePANACEA comprises the creation of a prototype (the Smart Energy Performance Assessment Platform) making use of the most advanced techniques in dynamic and automated simulation modelling, big data analysis and machine learning, inverse modelling or the estimation of potential energy savings and economic viability check.

A relevant part of the project is to have a fluent dialogue with European policy makers, certification bodies, end-users and other stakeholders through two types of participatory actions: a feedback loop with policy makers, carried out through the so-called Regional Exploitation Boards (REBs) covering EU-27+UK+Norway on the one hand, and dialogue with end-users, established by means of specific thematic workshops, on the other.

Thanks to these participatory actions, the acceptance of the ePANACEA approach will be tested and validated in order to become aligned with and meet the needs of national public bodies, end-users and other stakeholders..

ePANACEA will demonstrate and validate reliability, accuracy, user-friendliness and cost-effectiveness of its methodology through 15 case studies in 5 European countries.

EXECUTIVE SUMMARY

This document is part of the work package that analyses ePANACEA's Dissemination, exploitation and replication potential. This document builds on the project report "Description of current EPC related policy framework in implementing countries" [1], where the current state of policy framework in the five ePANACEA pilot countries plus Germany are presented. The focus countries are Austria (focus Styria), Belgium (focus Flanders), Finland, Germany, Greece and Spain. In this past report, the current state of different selected topic areas were described based on literature review and expert interview. This material prepared the ground for the present report. In addition, we performed internet research on EPCs issued upon real estate transactions to build an EPC database and provide an exploratory analysis. Finally, the current state and pathways of two different scenarios: moderate uptake and high uptake are described. This is the main contribution of the present report, which will have a follow up report "The potential impact of innovative EPC methods on energy savings and related investments".

[1] Available at the ePANACEA website (https://epanacea.eu/results/) and the project Zenodo Community: Description of current Energy Performance Certificates (EPCs) related policy framework in implementing countries | Zenodo

1. EPC POLITICAL CONTEXT AND ePANACEA CONTRIBUTION

The Energy Performance Certificates (EPCs) were introduced by the Member States of the European Parliament into Energy Performance of Buildings Directive 2002/91/EC (EPBD) in the article 11. The main objectives of the EPCs as instruments by that time were; firstly, to provide correct information to a prospective building (or building unit) buyer, owner or tenant about the energy performance of the building and, secondly, to provide practical advice on improving such performance. The main motivation behind was that by increasing transparency and easily accessible information about the building, it would be a driver to trigger energy renovation of buildings. Consequently, leading to a double effect: reducing the greenhouse gas emissions of the building sector, while stimulating the retrofitting sector to compensate the fall of the market in the building industry at that time.

Although the EPC has been in force for twenty years, the objectives have not been fully accomplished, so it is needed to design and develop a new generation of EPC which is, more reliable, user-friendly, and cost-effective, in order to inspire trust in the market and stimulate investments in energy efficient buildings.

The ePANACEA project contributes to the next-generation of EPCs in different forms, as it can be seen in Figure 1 below. The present report is related to the future impacts of the project outcomes. Then, the next-generation of EPC design and future uptake are also affected by the policy setting and choices.

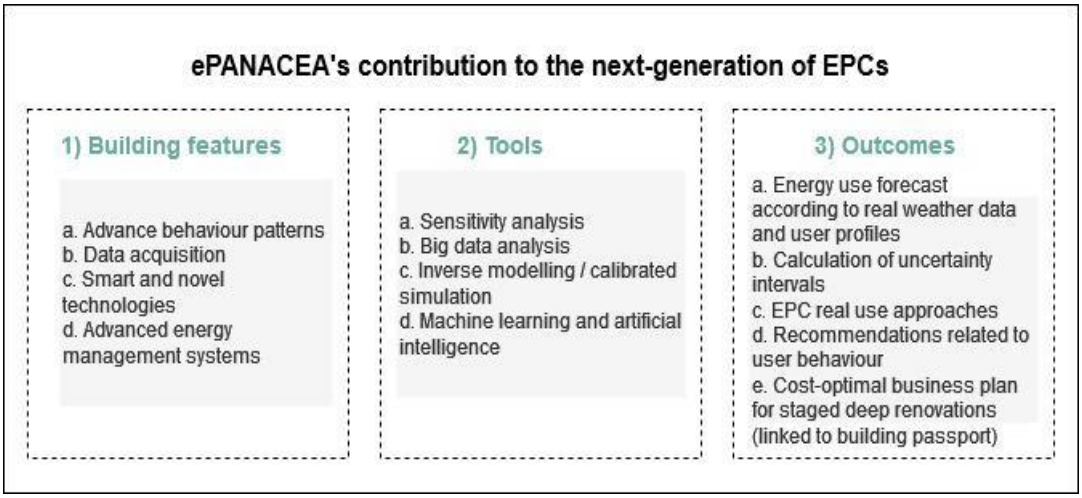


Figure 1: ePANACEA's contribution to the next-generation of EPCs

The present report builds on the previous report "Description of current EPC related policy framework in implementing countries" [2], where different political aspects of the EPC environment were described – including the current state in the five different implementing countries Austria, Belgium, Greece, Finland and Spain , and also Germany. Then, here the different possible pathways are described to strengthen EPCs' role on the building stock decarbonisation by supporting buildings' renovation activities. Therefore, this report explores possible future developments in form of scenarios. This work prepares the ground for the next report "The potential impact of innovative EPC methods on energy savings and related investments", where the replications will be assessed through quantitative analysis. To enable an estimation, this report presents an exploratory data analysis of real estate transaction data collected in the different countries. The data was collected through internet research – see more details in the next chapter 2.

[2] DOI:10.5281/ Zenodo.4982801: Description of current Energy Performance Certificates (EPCs) related policy framework in implementing countries | Zenodo

2. REAL-ESTATE TRANSACTIONS: OVERVIEW OF EPCs IN THE IMPLEMENTING COUNTRIES

Unfortunately for the present project, it was not possible to have access to the EPC databases in the implementing countries. In general, in Europe only a few countries have open access databases, which does not mean that all data can be downloaded at once. For example, in Denmark the users can consult a certain EPC only if they have the serial number of the EPC. Without this information it is not possible to access the information. From an end-user perceptive this is an important service that allows transparency and long-term access to EPC data. However, for building stock analysis and research it is not helpful. Then, with internet research and screening of real-estate websites, we were able to build an EPC database and assess the current information.

An exploratory data analysis was carried out on about 820 thousand EPCs in the five ePANACEA pilot countries (Spain, Austria, Belgium, Finland and Greek) and also Germany. Next, the EPC information acquired through the database per country and building type (residential and non-residential) is presented. Figure 2 shows the number of EPCs acquired per country. Among the six countries, the highest number of EPCs acquired was in Germany. The difference regarding the numbers of EPCs may have several reasons: the availability of the information online (on the real-estate companies' websites), the format of the information in the website platform (not directly on the website but as pdf format downloadable), language barrier, not enough access to big real estate companies, etc.

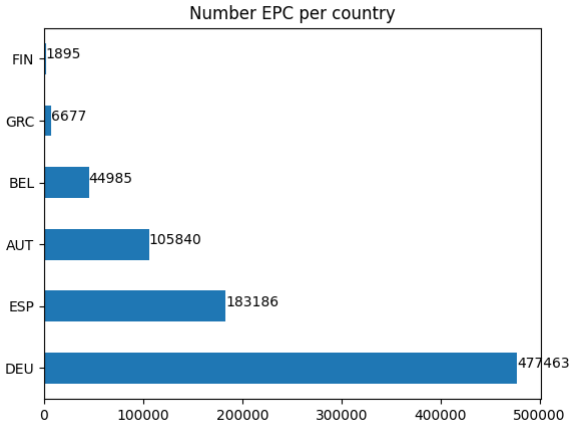


Figure 2: Number of EPCs per country

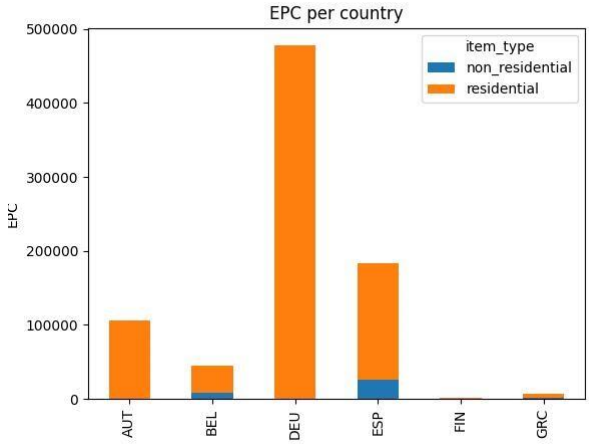


Figure 3: Number of EPCs per country and building type category (residential and non-residential)

Then, Figure 3 shows the number of EPCs per country and building type category (residential and non-residential). The large majority of EPCs was issued for real-estate transactions in the residential sector. Only in Belgium and Spain non-residential building EPCs were registered – however in very small percentage of less than 3%.

Figure 4 shows the number of EPCs per building type category (residential and non-residential) and sub-category. The residential building EPCs were grouped in apartment and house after a data preparation process. Then, the original categories for residential buildings found in the database were apartment (or flat), detached house, row house/terraced house, semi-detached house, villa and holiday house. The same was performed for the non-residential building EPCs. For this building type, the categories were hotel/pension, industrial, land property, office and others. For example, under the category "others" garage, gallery and not specific are included.

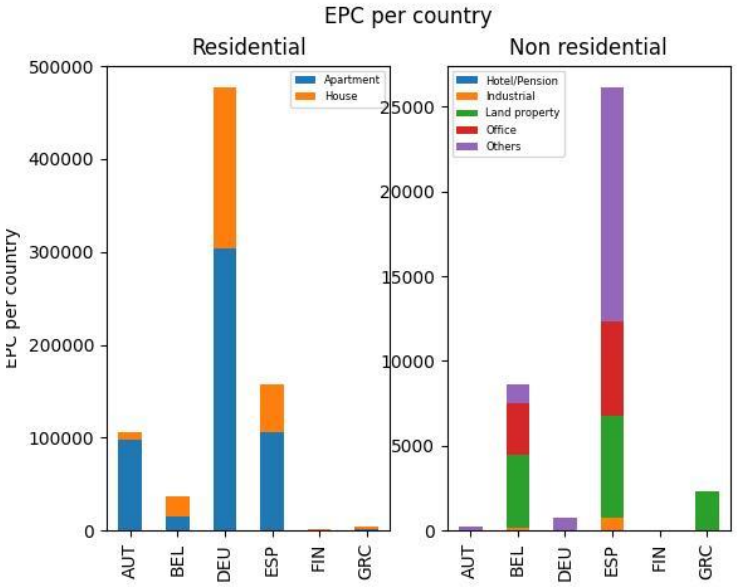


Figure 4: Number of EPCs per country, building type category and sub-category

Then, the next step was to analyse the energy class of these buildings/building units. Figure 5 shows the general distribution of energy classes per building type category. It is visible that the highest number of residential buildings were rated class A, while the highest number of non-residential buildings were rated G. Unfortunately, the energy classes were not available from the German data base for residential buildings, as the well as not for non-residential buildings in Austria, Germany and Greece – as it can be seen in Figure 6.

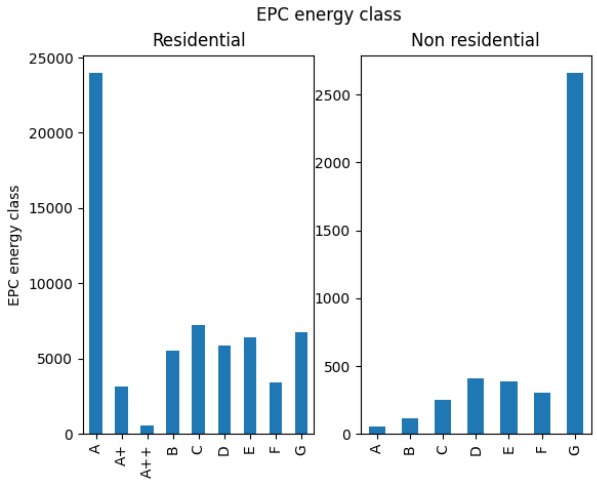


Figure 5: Number of EPCs per energy class

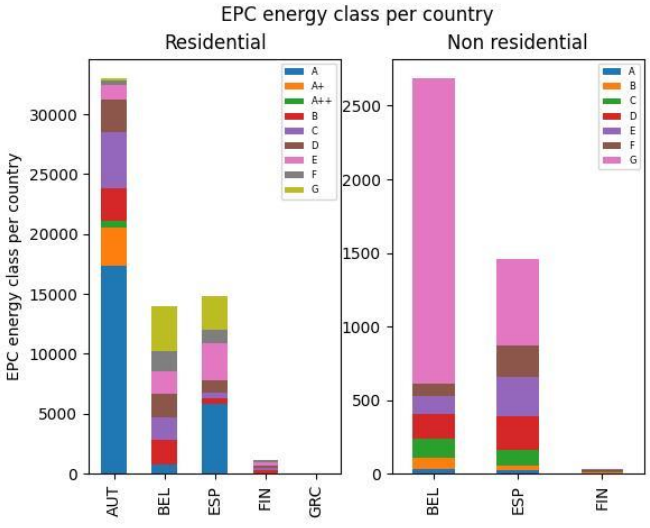


Figure 6: Number of EPCs per energy class and country

Figure 7 and Figure 8 show the number of EPCs and real estate transaction according to the real estate transaction sale/buy or rent, for residential and non- residential buildings respectively. In Austria the share of rent EPCs rent is higher than those for sale, differently to the other countries, as in Germany the higher share of sale EPCs is, while in Belgium, Spain, Finland and Greece there were sale EPCs.

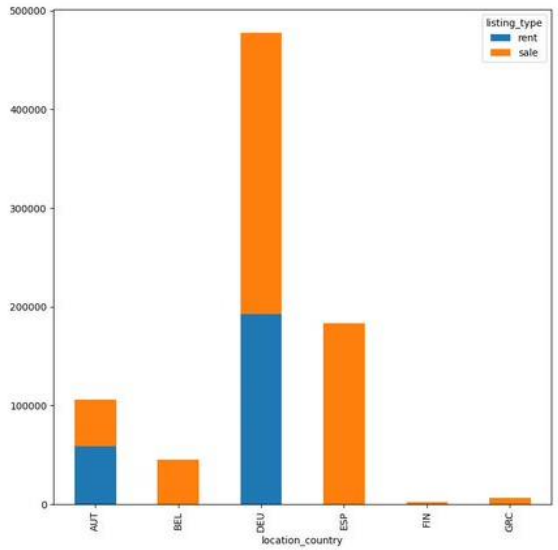


Figure 7: Number of EPCs for residential buildings and real estate transaction per country

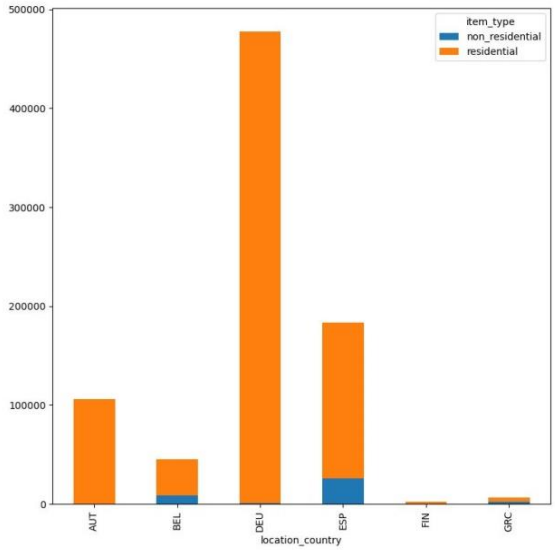


Figure 8: Number of EPCs for non-residential buildings and real estate transaction per country

Figure 9 and Figure 10 present the dwelling/building price (price amount) according to the energy class per country (according to the available data), respectively for residential and non-residential buildings. For residential buildings, Spain and Belgium have the highest number of outliers, showing a heterogeneous price market. While in Austria and Finland the prices are more homogenous. There is no data available for Germany. For non-residential buildings, there is data available for Spain, Belgium and Finland. In general, the non-residential buildings are also heterogeneous in term of price versus energy class.

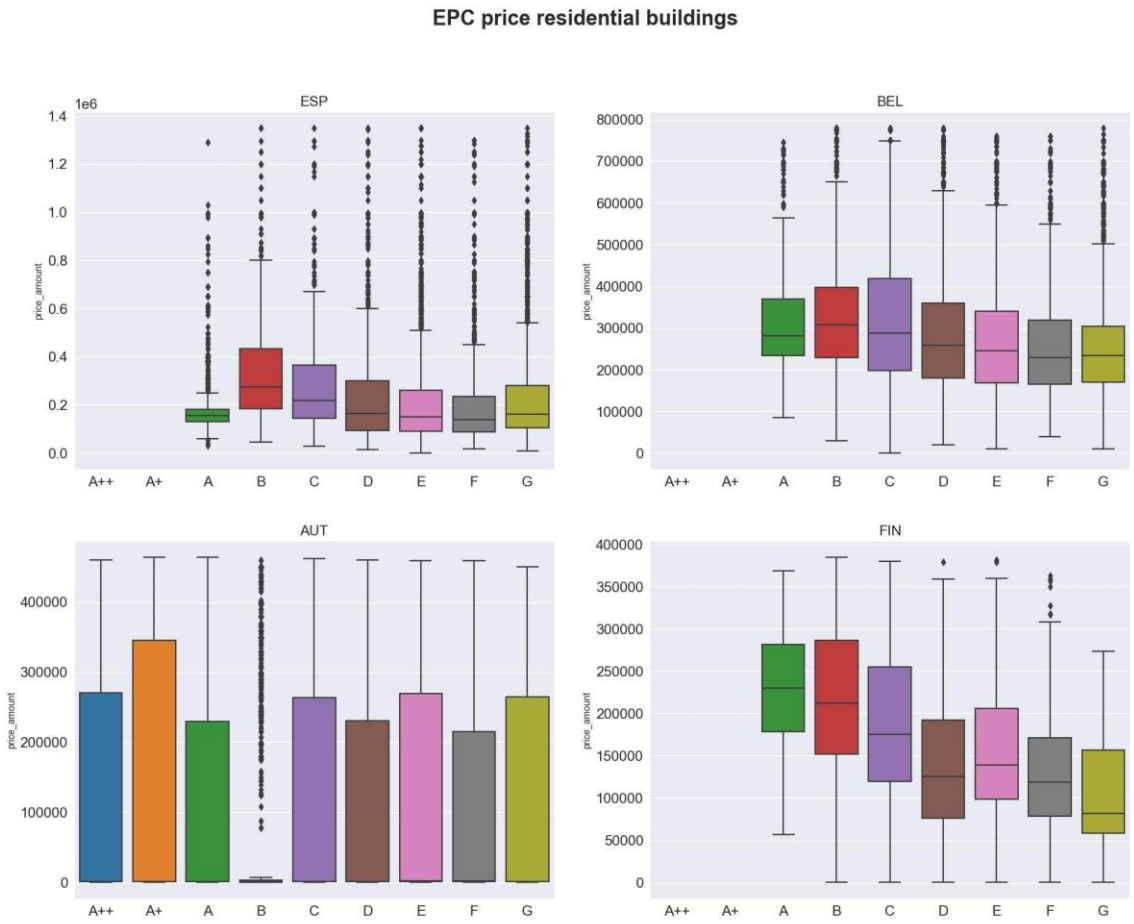


Figure 9: EPC energy class versus price per country (residential buildings)

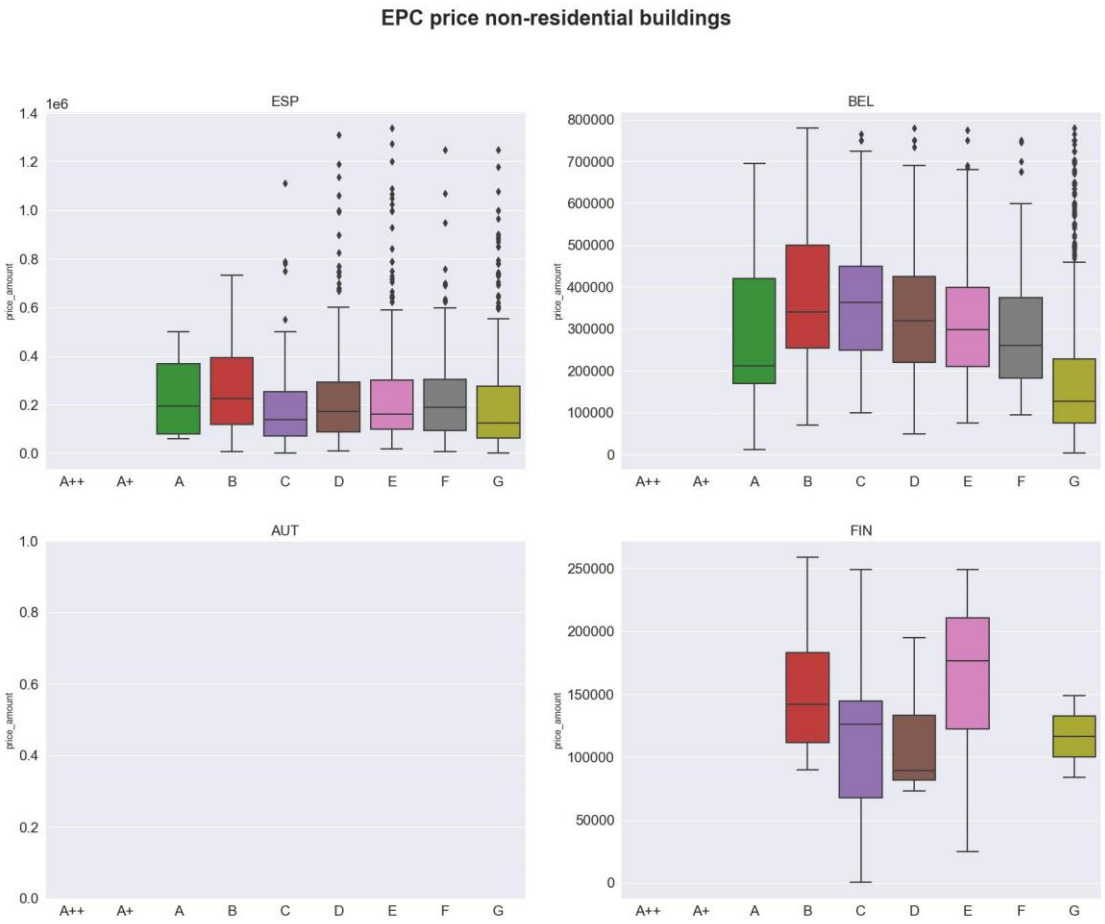


Figure 10: EPC energy class versus price per country (non-residential buildings)

3. CURRENT POLICY FRAMEWORK OF EPC SCHEMES IN EUROPE

In the report "Description of current EPC related policy framework in implementing countries" [3] the current policy framework of EPCs and their current state in the five ePANACEA pilot countries are presented; Austria (focus Styria), Belgium (focus Flanders), Finland, Greece and Spain and also Germany. In the same report, EPC relevant topic areas were identified (listed below), and are considered to have an influence on the EPC issuing. Because when they are well-implemented, they guarantee a positive structure and environment for the EPC issuing process, increase of end-user awareness and more reliable building energy performance information. Consequently, this may support the increase of renovation activities.

In this context, the EPC databases have the role to store reliable and useful building information, and make it easily accessible through machine readable EPC formats, enabling benchmarking of different building types and building stock analysis. Well established EPC databases may also be interoperable with other registers (as for example income tax, incentive schemes, etc.). Nowadays, however, GDPR is representing a legal obstacle in some MSs for turning EPC data publicly available.

The topic areas are:

- energy assessment;
- validity of EPC;
- ownership status;
- recommendations;
- quality assurance and control;
- end-user perception.

3.1 Energy assessment

The main contribution of the ePANACEA project is on the innovative assessment of building's energy performance calculation. Figure 11 shows the overall methodological concept of the project.

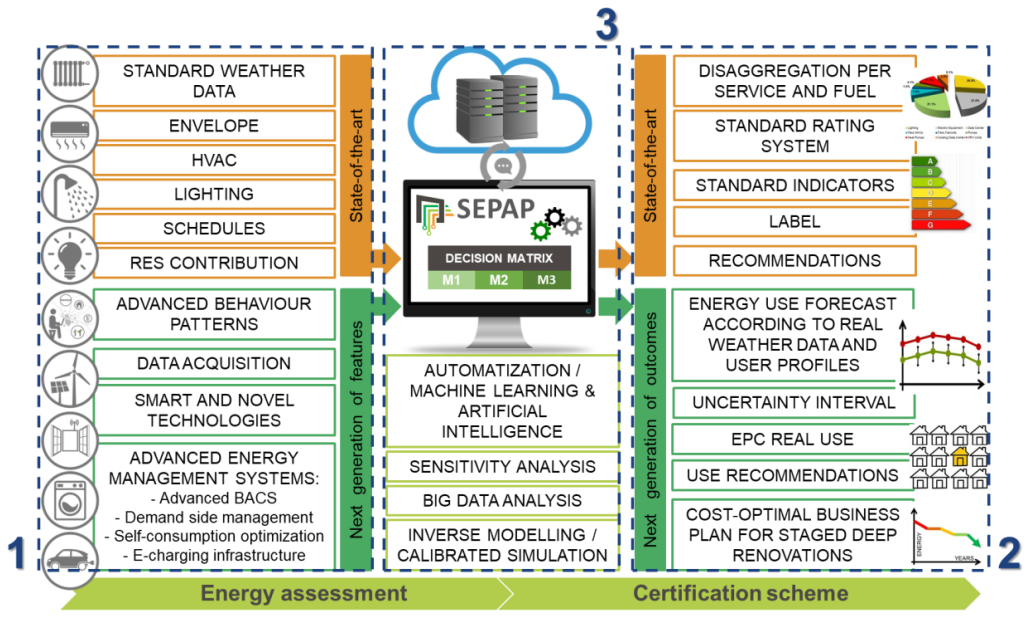


Figure 11: Overall concept of ePANACEA's methodology

[3] DOI:10.5281/Zenodo.4982801: Description of current Energy Performance Certificates (EPCs) related policy framework in implementing countries | Zenodo

After an interview with the pilots countries, following difficulties and gaps in the energy assessment and calculation procedures in each country were identified that may affect the issuing process of EPCs:

- Quality of the required data: this aspect was mentioned as an important topic in Styria, because of the increase costs for on-site visits
- Energy performance calculation and the time versus intensity of required input data was raised and discussed in Flanders and Germany
- Use of dynamic or static models (discussed in Finland, Spain and Greece). These topics are key for the harmonization of energy performance indicator but at the same time very different in all countries. Between the possible trends for the use of dynamic building simulation, use of methods to calibrate building simulation results, use of measurement data, use of actual building operation data and inclusion of energy consumption data, there was no common topic that is being now discussed in all countries.

3.2 Validity of EPC

Validity is seen as trigger for EPC issuing, therefore a long validity is counterproductive, as the building's energy performance may not be improved for a long time or the EPC may remain outdated. The EU Member States should enable updates of EPCs which are free of charge for buildings that achieve a certain level of CO_2 emission and/or energy savings after implementation of energy efficiency measures. At least, it should be possible for building owners (especially of single-family houses) to update the document without having to pay the fees again. These are instruments to maintain the EPC as a dynamic document, that is more constantly updated. Differently from what is happening today in almost all countries – the EPC issued remains outdated for a long period. In general, the validity of EPC in all countries is 10 years. However, since the EPBD revision proposal in 2022 a new validity, especially for low rated buildings was proposed. In Spain, it has been reduced to 5 years for worst rated buildings (class G).

3.3 Ownership status

Together with the validity of the EPCs, the ownership status of the building or building unit is an indication for the frequency of how often the EPC may be updated. The dynamic update may be easier to implement in EPCs issued for real estate transactions (sale or rental) than in owner-occupied dwellings. Because, by changing the tenant (especially in countries with short-time contracts), there is also an opportunity to update the document. In this context, the country's ownership rate may serve as an indicator. Finland has a high ownership rate of 63% meaning that most Finns live in an owner-occupied house or apartment. And living in an apartment represents mostly in a housing cooperative – where decisions on renovating have to be agreed upon between all involved parts. So, in Finland, the probability that the EPCs stays outdated for a longer period is higher. In Spain, this rate is 77%, however different than in Finland, whereas 70% of Spanish live in multi-family houses. In Spain it is possible to issue an EPC for an apartment whereas in Finland an EPC can only be issued for a whole building.

3.4 Recommendations

Currently, EPC recommendations are provided in most countries in a standardized and generic form – for example, based on a list. However, they are the most important link to achieve building stock decarbonisation targets. In all ePANACEA implementing countries, the recommendations are provided with the same software as the one used to issue EPCs. Also, the provision of accurate recommendations is dependent on the available building-related information. The on-site visit is a mandatory aspect to gather the building data in all implementing countries besides Germany. However, the mandatory on-site visits and complexity of calculations may directly affect the EPC costs. Therefore, there is a trade-off between accurate and specified recommendations and standardised recommendations. In terms of future perspectives, three possible types of recommendations were analysed: climate tailored (recommendations linked to the long-term renovation strategies (LTRS) with

a stronger focus on carbon emission reduction), end-user tailored (considering end-users behaviour) and staged renovation recommendations or building renovation roadmaps part of the building renovation passports (BRP). The last one has the highest chance to be implemented in all countries. For example, in Finland, it appears to be the most appropriate solution for the high number of owner-occupied single-family houses. And in Germany, it is under discussion to combine EPC recommendations and BRP. Climate tailored recommendations were implemented in the EPC schemes in Flanders, while end-user tailored recommendations are provided in Styria (Austria). Another aspect to link EPC recommendations is the availability of incentives. For example, in Greece, Austria, and in Spain, the EPC is a mandatory document to get access to incentives.

3.5 Quality assurance and control

EPCs quality assurance and control routines play a relevant role on assuring that the EPCs have correctly calculated. Through these routines and feedback interactions with energy auditors and EPC issuers, it can be firstly guaranteed that wrong EPCs are corrected and secondly, that errors are not repeated. Then, both as very important aspects for the reliability of EPCs.

All countries perform quality control routines – as it is also obliged in the EPBD. However, the penalties for not complying are not consequently performed. Unfortunately, future perspectives are still not going in a direction to change it. However, this is an important aspect that has also to be linked to the training of experts – to improve the learning process and avoid repetition of mistakes. This is a way to promote a long-term improvement of the quality and reliability of EPCs.

3.6 End-user perception

Studies have recognized that end-users play an important role in performing building renovation. However, until now EPCs have had a stronger technical focus and innovative EPC indicators may even become turn it more complex. Therefore, there is a need to provide new end-user targeted indicators and information. In the ePANACEA project, end-user consultation workshops were organised in order to better understand end-users perception and awareness of EPCs. Besides in Flanders, no recent studies are aiming to understand end-users perception and awareness about EPCs. In most countries, because EPCs are mandatory, the end-user may “accept” the EPC, but do not interact with or understand it. Therefore, the increase of public communication, campaigns, advertisements and workshops to raise understanding is very important – and especially in Spain, many strategies have been defined in this direction (as defined in the LTRS).

Although the end-users perception and awareness are key in the renovation process, there is still no indication that by increasing the end-user’s perceptions, necessarily the issuing of EPCs or even carrying out renovation measures will occur. Further studies should analyse follow up activities after a new EPC issuing (with other recommendations) or energy auditing consultancy. Then, the literature is leaking of studies that focus of building owners’ renovation behaviour. Due to these uncertainties, it was decided that the end-user perception would not be considered in the described scenario pathways.

4. OUTLINING PATHWAYS FOR EPCs

The previous chapters presented the current state of EPC based on internet research, literature research and expert interviews, a) Based on EPCs issued upon real-estate transaction, an exploratory data analysis was carried out analysing the numbers of EPCs according to the building types and other building characteristics such as price for EPC and energy class and, b) the current policy framework and topic of EPC schemes areas, where improvements and changes would also affect the number of issues EPCs. Based on the information collected and aspect identified as important, the present chapter describes the possible pathways and dimensions along which the EPC schemes could evolve and develop in the future. These policy pathways will serve as an input to develop policy recommendations for further exploitation of project results.

For defining the possible pathways following questions are posed: how can the current policy framework be enhanced so that innovative EPCs can contribute to building stock decarbonisation? How can higher numbers of issued EPCs contribute to the building stock decarbonisation?

The decarbonisation of the building sector has the enormous challenge of evolving many different actors as building end-users and building owners (in owner-occupied buildings these actors are coupled in one), public-authorities, craftsmen, installers and etc. Then, when defining the policy scenario, it is also important to define the target group. Table 1 below shows two possible scenarios: moderate uptake (scenario B) and high uptake (scenario C). For each scenario it is foreseen a difference development of topic areas explained in chapter 3. Furthermore, different pathways of each topic area are also considered in the table below.

Table 1: Topic areas and scenarios of innovative EPCs development

Topic area	Scenario A – current state	Scenario B – moderate uptake	Scenario C – high uptake
Energy assessment	Current method	ePANACEA Method 1 and 2	ePANACEA Method 3
Recommendations	Standardized, generic recommendations (*)	Automated, Standardized, automated, asset based recommendations	Tailored recommendations, user/behaviour based recommendations
Validity of EPC	10 years	Worst performing building 5 years, other buildings 10 years	5 years including incentives for updating the EPCs
Quality assurance and control	Min. 5% of the database, manual random selection	Quality verification before entering the database through pre-defined rules	Automatised risk-based selection of EPCs and quality verification before entering the database
Target group (as representative of the ownership status)		Real-estate transaction (sell-buy or rent)	House owner/ Owner-occupied dwellings (houses or apartments)

(*) country specific differences

For the development of the topic areas, also external conditions such as policy settings and market structures have an influence on the evolvement. Then for example, by keeping EPCs mandatory or market regulated. Also, the introduction of new instruments as the building renovation passports and one-stop-shops may also be taken into account in the future scenarios. Now a days, in a summarized form, EPCs are mandatory when issued for real-estate transaction (sale/rental) and for new buildings. The main discussed disadvantage of that, is that there is no market-oriented trigger that leads to an improvement or overcoming of the current barriers for raising end-user' interest on EPC. And, in this case, the improvements have to be exclusively driven by the public authorities. Therefore, for increasing the market penetration of EPCs further scenarios for external conditions are described:

Scenario 1: EPC remain strongly/exclusively underlined on the political framework

- EPC remain mandatory for some purposes: for instance for new buildings and deep renovation
- Regulated under the EPBD
- Active rule of public authorities to stimulate the increase of EPC penetration through incentives, instrument design, dialogue with relevant stakeholders, etc.

Scenario 2: EPC remain underlined on the political framework, however with market driven elements

1. Hybrid pathway: policy based instrument with some market driven elements
2. "Advanced" EPCs with more functionalities and features (but also higher prices), also oriented on other building certification schemes
   2.1. End-user tailored solutions
   2.2. More complex / accurate calculation methodologies

In the context of the end-users workshops performed during the project, end-users' acceptance and perception of EPCs were discussed. In general, because it is a mandatory document, most end-users have a "passive" position related to EPCs. It means, that the document is issued due to the obligatoriness and that it is not used by the end-user as a trustful and reliable information source. The ePANACEA workshops explored different possibilities for making the EPC document layout more user-friendly, which may affect the acceptance. However, increased acceptance does not necessarily mean that the behaviour will be changed (i.e. that EPCs will be actually used to initiate energy efficiency measures or will be taken into account in decision making upon purchase/rental of a dwelling/house). Therefore, for driving future scenarios about the issuing process and quantification of the potential energy and CO_2 emissions impacts, this aspect of end-user behaviour will be qualitatively assessed in the next project report, were the impacts will be quantitatively assessed.

5. CONCLUSIONS AND NEXT STEPS

The exploratory data analysis showed that in most countries, most issued EPC are for residential buildings – both existing and new ones. Consequently, these are categories for which the quantification of impacts will be more accurate. While others will have to include more assumptions.

The future report will consider the pathways designed in the present deliverable to provide an estimation of the future replication potential of EPC results and the corresponding impact. We aim to quantify these scenarios for implementing countries in terms of :

a. Number of EPCs issued
b. Overall budget spent for EPCs (EPC-market in €)
c. Savings triggered trough improved recommendations and end-user acceptance

FIGURES

TABLE