ePANACEA

Smart European Energy Performance Assessment & Certification

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1st REBs conclusion report

Minutes of Meetings of the Northern, Western, Central, Southwestern and Southeastern Regional Exploitation Boards (REBs)

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OVERVIEW OF THE ePANACEA PROJECT

After 10 years of track record, the current EPCs schemes across the EU face several challenges which have led to not fully accomplish 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 EU schemes, 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 is ePANACEA becoming 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: on the one hand a feedback loop with policy makers will be carried out through the so-called Regional Exploitation Boards (REBs) covering EU-27+Norway+UK, and the dialogue with the end-users will be established by means of specific thematic workshops. Thanks to these participatory actions we will ensure that ePANACEA approach is aligned with and meets the needs of national public bodies, end-users, and other stakeholders with a view to test the acceptance and to validate the methodology developed.

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

EXECUTIVE SUMMARY

The Regional Exploitation Boards (REBs) represent an important pillar of ePANACEA. The project aims to establish a fluent dialogue with different European stakeholders with special focus on national/regional policy makers and certification bodies, which are directly involved in the implementation of the different EPC schemes and are responsible for energy regulations development in their own regions/countries. Therefore, the REBs are composed of these important regional European stakeholders, as well as consumer associations, building products manufacture associations, professional associations, etc. The dialogue is moderated by the ePANACEA project partners.

This document summarizes the content of the first five Regional Exploitation Board meetings which took place in November and December 2020. In total, 48 highly relevant institutions with 52 representatives from 23 different countries discussed innovative features, smart and novel technologies and increasing user friendliness of EPCs.

New and innovative features have been discussed based on a catalogue of 41 features, elaborated with the purpose to include most important ones in the next generation of energy performance assessment under the ePANACEA approach. All findings are summarized in a public report “Implementation of innovative Certification Schemes”, which is available at the ePANACEA webpage. The highest potential for trust improvement and already mandatory in some EPC schemes is assigned to resilient tailored recommendations. Well prepared recommendations have a high added value for end- users, but it may be difficult for them to identify the quality of the recommendations. The highest contribution to increase accuracy of national EPCs is seen for the feature of dynamic building simulation. It is already mandatory in Estonia (except SFH) and it works out well.

Based on the report “Inventory of smart and novel technologies”, which is available at the ePANACEA webpage, five selected technologies were discussed (BACS; EV battery & EV charging infrastructure; Collective self-consumption; Centralized heat pump; Cooperant at an energy community). The meeting participants were asked how relevant the technologies are in the current energy policies of their countries and how the presence of these technologies is in their current EPC schemes. This elaboration led to a priorization of the technologies. For these technologies, a methodology will be developed within ePANACEA project to assess the impact on the building energy performance (or the wider energy system), which can be incorporated in simplified energy balance calculations of existing energy performance certification schemes.

The third session revolved around discussing a new EPC layout and stakeholders of EPC. The proposed ePANACEA EPC layout was perceived as well structured and very clear and the majority of the REB members think that target group-oriented summary pages increase usability and user-friendliness of EPC.

It is highlighted that this document provides an evaluation on different subjective opinions from several experts from different member states. The conclusions summarize valuable feedback for the upcoming project activities related to the ePANACEA methodology development.

GLOSSARY

Actual consumption data, measurement data – measured energy (derived from monitoring data or energy bills) without any correction for standard climate and use

Actual operational conditions – use of actual operational conditions like room temperature, usage type, actual weather data

Building automation and control system (BACS) – system comprising all products, software and engineering services that can support energy efficient, economical and safe operation of technical building systems through automatic control and by facilitating the manual management of those technical building systems

Calibration of building simulation – Adjusting selected simulation parameters to obtain the best fit between the simulation results and actual data/measurement data

Collective self-consumption - A legal instrument that allows the at least two participants within the same building to share a common PV installation (or other renewable generation system).

Cooperant at and energy community - Through investment in an energy community a building owner can substitute local renewable energy production on his property by renewable energy produced with the energy community's generation units.

Dynamic building simulation - Use of a computer program to model the time-varying behaviour of a dynamical system in contrast to stationary simulation for one certain point in time.

Energy community - New energy concept based on the EU Clean Energy Package: Specifically, “renewable energy communities” (defined in the REDII) and “citizen energy communities” (defined in the EMDII),allow citizens to collectively organise their participation in the energy system and produce and share their “own” energy.

Fixed reference value – The reference value which allows the scale definition is fixed. It could be calculated as an average of simulation results based on the current characteristics of the building stock. For instance: In Spain, the reference values for residential typologies are fixed according to the climate zones

Reference value – standard legal or calculated value against which an energy indicator is compared

Standard energy performance – energy performance using actual data for a building and a standard use and climate data set (if calculated) or corrected for deviating conditions (if measured)

Tailored energy performance – calculated energy performance using actual data for a building and actual climate and occupancy data

Tailored recommendations – recommendations in order to meet a specific target

Variable reference value - The reference value is a variable numeric value tailored to the specific characteristics of each individual project. For instance: It is the case in Spain for tertiary sector.

1. INTRODUCTION

The **Regional Exploitation Boards (REBs)** represent an important pillar of ePANACEA. The project aims to establish a fluent dialogue with different European stakeholders with special focus on national/regional policy makers and certification bodies, which are directly involved in the implementation of the different EPC schemes and are responsible for energy regulations development in their own regions/countries. Therefore, the REBs are composed of these important regional European stakeholders, as well as consumer associations, building products manufacture associations, professional associations, etc. The dialogue is moderated by the ePANACEA project partners.

The REB members will be involved in the definition of the energy assessment methodology, in its validation and evaluation, and in supporting local dissemination actions. This feedback loop will allow ePANACEA to develop an upgraded EPC methodology, suitable for national requirements of the stakeholders.

The REBs are organised based on their geographical location. In total, there will be five REBs established, in order to cover all EU Member States (EU27+Norway+UK). The following Figure 1 gives an overview on the five different REBs. Each REB is led by one ePANACEA project partner.

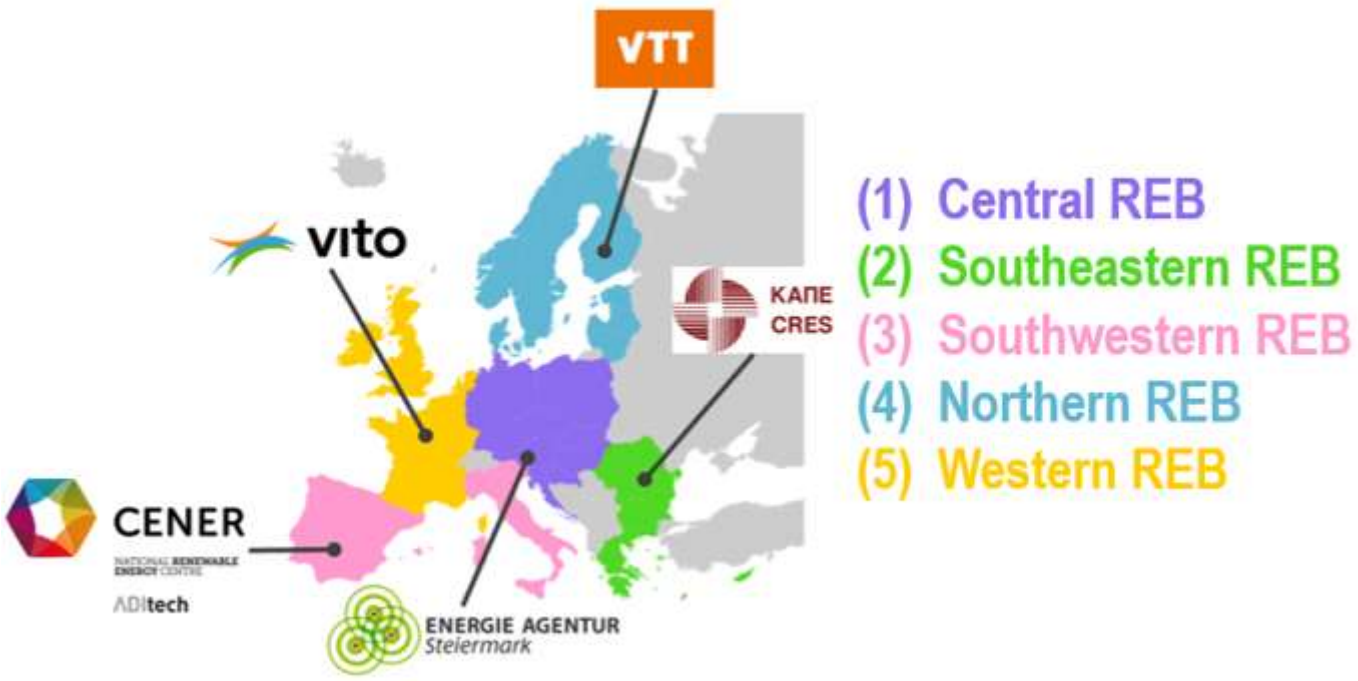

Figure 1: overview on the REB structure

Each REB will meet three times during the project lifetime. The first meetings took place in November and December 2020, as specified below:

- **Western REB**, led by VITO (Vlaamse Instelling voor Technologisch Onderzoek N.V) **on 27th November 2020**
- **Southwestern REB**, led by CENER (National Renewable Energy Centre of Spain) **on 30th November 2020**
- **Central REB**, led by EASt (Energy Agency of Styria) **on 1st December 2020**
- **Southeastern REB**, led by CRES (Centre for Renewable Energy Sources and Saving) **on 3rd December 2020**
- **Northern REB**, led by VTT (Technical Research Centre of Finland) **on 9th December 2020**

2. PARTICIPANTS OF THE 1ST REB MEETINGS

The following table and figure give an overview on meeting participants and their structure. In total, 48 highly relevant institutions with 52 representatives from 23 different countries discussed innovative features, smart and novel technologies and increasing user friendliness of EPC during the five online meetings. A list with participating organisations is provided in the annex.

REB	Participating institutions (including project partners PPs)	Countries	Total participants
Western REB	6 (2 PPs)	4	7
Southwestern REB	12 (4 PPs)	4	15
Central REB	12 (2 PPs)	7	15
Southeastern REB	12 (2 PPs)	5	16
Northern REB	6 (1 PPs)	4	9
Total	**48**	**24 (23 different)***	**52**

*Table 1: Overview on participating REB institutions, *Austrian partners participated in 4/5 meetings*

Approx. 27 % were policy makers and certification bodies, followed by EPC experts and different professional associations. Other stakeholder types include financial service providers, national energy agencies or BACs system providers. The variety of participating stakeholders ensured fruitful discussions, bringing up several interesting perspectives and statements. The main conclusions from the discussions will be provided in the next chapter.

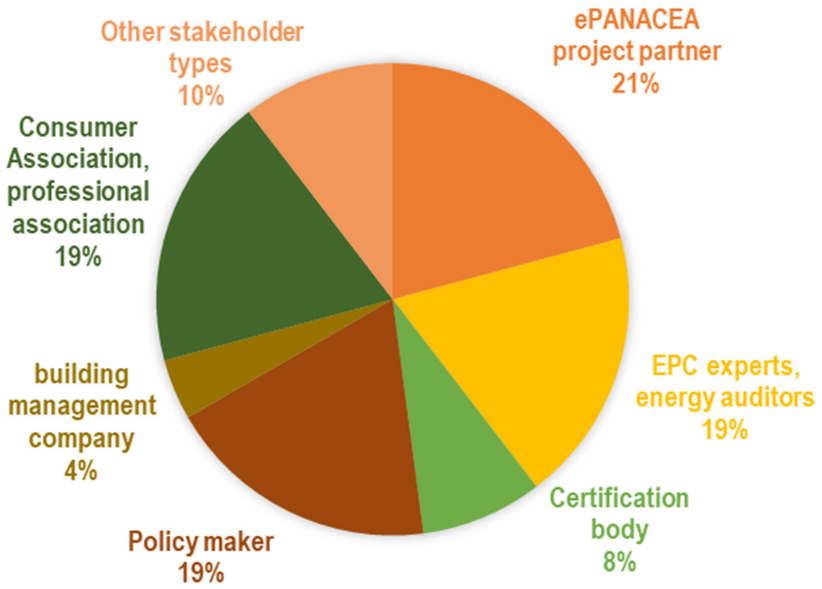

Figure 2: overview on participants' structure among the five REB meetings

3. CONCLUSIONS OF THE FIVE REB MEETINGS

The first meetings of the ePANACEA Regional Exploitation Boards (REBs) mainly revolved around the following discussion points:

(1) Innovative features for energy performance certificates (EPC)
(2) Smart & novel technologies to be included in EPC schemes
(3) User-need analysis for EPC and new layout of EPC

The following chapter will provide an overview on the main meeting conclusion. Some chosen statements from REB members, which were done by the meeting participants, are displayed in the figure below. It gives a shallow summary on different perspectives and opinions of the REB members and shows the broad variety of the discussions.

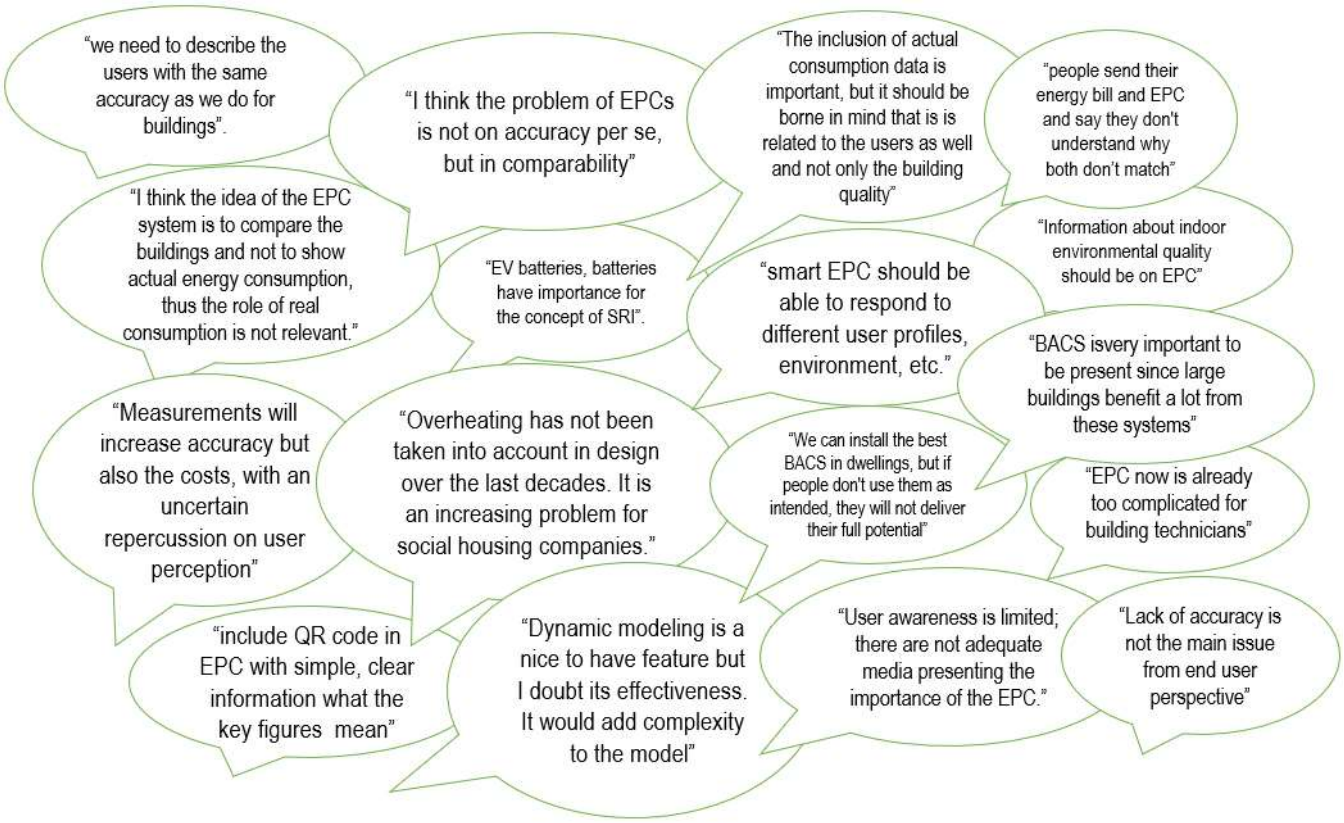

Figure 3: overview on some chosen statements from REB members during the meetings

3.1. Discussion 1 – new innovative features

New and innovative features have been discussed based on a catalogue of 41 features, elaborated with the purpose to include most important ones in the next generation of energy performance assessment under the ePANACEA approach. The following materials served as starting points for the identification of important features:

- Review of other international certification schemes and methodologies, e.g. BREEAM, LEED, PHPP, ENERGY STAR…. as well as literature review, findings of other research projects
- Evaluation of EPC schemes in ePANACEA pilot countries (Austria, Belgium, Finland, Greece, Spain)
- Results of interviews conducted in September/October 2020 with end users and stakeholders

All findings are summarized in a public report "Implementation of innovative Certification Schemes", which is available at the ePANACEA webpage. It describes the state-of-the-art for the European and international certification schemes, followed by a more detailed description of each key aspect to be taken into account within a building certification process. The review is mainly based on three pillars: (i) Current certification schemes in the five ePANACEA's pilot countries, (ii) International certification schemes and (iii) Standardized energy audit methodologies. This report aims to propose new feasible features for being implemented within current EPCs schemes with the objective of overcoming the EPCs' challenges at the moment. The new and innovative features proposed, as well as the features that have been included in the assessment for harmonization purposes across the EU, have been already evaluated across the five pilot countries of ePANACEA plus Germany. A weighted methodology has been implemented in order to prioritize the combination of the most suitable features to be implemented into the next generation of energy assessment and certification under the ePANACEA approach. The internal assessment was carried out by evaluating different aspects, in line with the ePANACEA project objectives:

- Harmonization (20%): Do you consider the feature helpful to meet the EPC's harmonization target at EU level?
- Implementation feasibility (10%): Do you think the implementation of this new feature within the current EPC scheme at your Member State is feasible?
- Innovation level (10%): Do you think this new feature is innovative?
- Trust (20%): Do you think this new feature could contribute to instil trust in the market regarding the EPC and incite investments in energy efficient buildings?
- User friendliness (40%)

  (20%) Do you think this new feature improves the energy auditor's work in terms of user friendliness and quality?

  (20%) Do you think this new feature could contribute to user friendliness (better understanding of EPC and motivate decisions regarding energy efficiency) from the building end user point of view?

Based on these first evaluation results, an interactive rating and discussion of 9 most relevant features based on their potential to improve trust and accuracy was implemented (Table 2) during the REB meetings. A brief explanation of these features can be found in the public report or in the glossary.

TRUST IMPROVEMENT of end users	ACCURACY IMPROVEMENT of calculation results
Use of **actual consumption data** and energy costs (energy bills) as additional information and for benchmarking	Use of **measurement data**
Use of **actual operational conditions**	**Dynamic building simulation**
Fixed reference value for energy performance rating (e.g. fixed values per building class…)	**Calibration** of building simulation (static, dynamic) **with measurement data**
Variable reference value for energy performance rating (e.g. comparison with reference building)	Use of **actual operational conditions**
Mandatory on site visit	**Mandatory on site visit**
Tailored recommendations for user behaviour, nZEB renovation, etc.	

Table 2: overview on discussed features during the REB meetings

For this purpose, the interactive whiteboard tool MURAL was used. The MURAL tool allowed the meeting participants to rate each feature (as seen in Figure 4) according to its contribution to trust improvement and accuracy improvement as well as the implementation feasibility in national EPC schemes. In addition, some written questions were also asked to the meeting participants.

Due to lack of time, this rating wasn't done during the meetings of the Western REB and Southeastern REB.

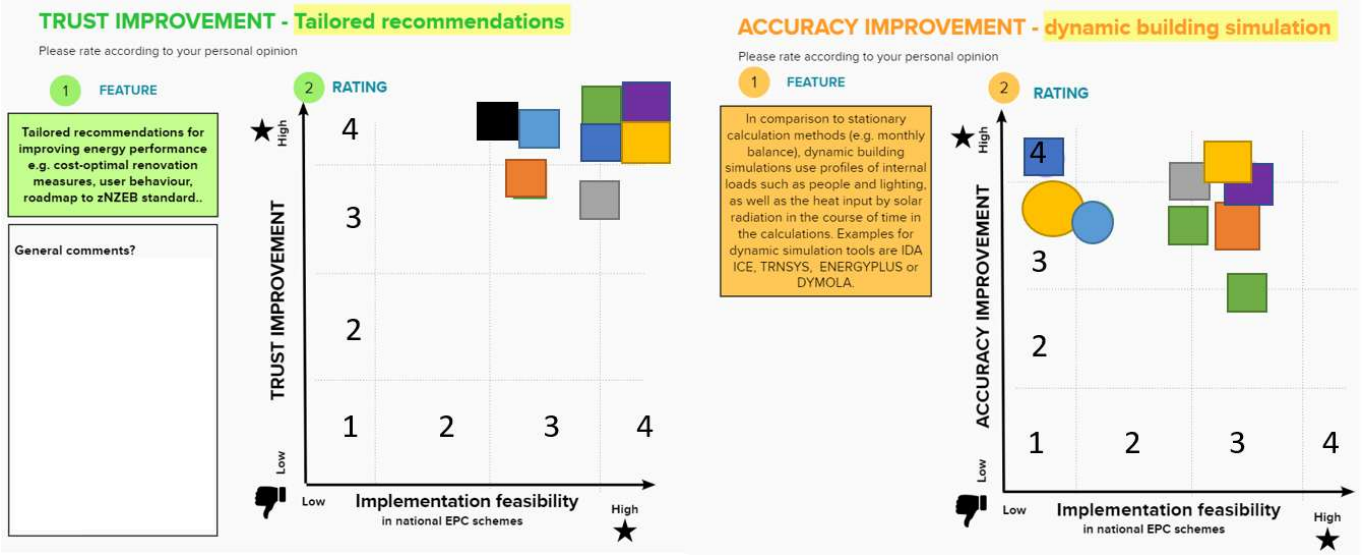

Figure 4: two examples of interactive rating scheme during the REB meetings

The results of these rating activities and discussions are summarized in Figure 5 and Figure 6. As shown in Figure 4 each rating scale (trust or accuracy improvement on Y-axis and implementation feasibility on X-axis) is divided into four boxes (1 = low potential, 4 = high potential). This allows to combine the rating results from all meetings in a quantitative manner. A vote in between two "lines" is considered with 1.5, 2.5 or 3.5 points.

To improve trust of the end users into the EPC schemes, the results of the rating and discussions can be summarized as the following:

1. **Tailored recommendations:**
    a. Highest potential for trust improvement and already mandatory in some EPC schemes, therefore also high potential related to the implementation feasibility
    b. Perceived as highly valuable information for end users and probably most relevant, the "core" of a good EPC and can be combined with a "roadmap to nZEB"
    c. Good recommendations are costly and need to be issued by experts (higher qualification needed), however difficult for end users to decide if recommendations are trustworthy or not
2. **Mandatory on-site visit:**
    a. Quite high potential for trust improvement and already mandatory in some EPC schemes (e.g. Spain), therefore also high potential related to the implementation feasibility
    b. Would probably increase costs for issuing EPCs and therefore seen sceptical from consumer associations
    c. Seen as essential for high quality EPCs but in some cases not necessary (e.g. with good building plans, pictures)
3. **Actual consumption data:**
    a. Could contribute to increase trust but has a low implementation feasibility in national EPC schemes
    b. Difficult to apply in new buildings and for benchmarking purposes
    c. For end users the information about actual consumption and energy costs are very relevant
    d. Original purpose of official EPC is to compare buildings and actual consumption data strongly dependent on user-behaviour and not necessarily on the building quality

e. Could be provided as supplementary information to end users but not to base national EPC schemes on it

4. **Variable reference values:**
   a. High implementation feasibility in national EPC schemes and medium contribution to trust improvement
   b. A variable reference value makes it possible to describe and compare buildings and eliminate user behaviour but could make interpretation overly complex
5. **Fixed reference values:**
   a. Comparably low contribution to trust improvement and medium implementation feasibility in national EPC schemes perceived
   b. Several building typologies needed
   c. It could be easier for interpretation if the reference value is fixed, e.g. the status of the building in reference to the average building stock
6. **Actual operational conditions (without correction to standardized room temperature, user behaviour…) :**
   a. Lowest rating in terms of trust improvement and implementation feasibility
   b. The use of actual operational condition complicates the interpretation of results for consumers because the building's quality isn't comparable any more
   c. Difficult to apply for large buildings with several units and different operational conditions
   d. Needs to be a separate evaluation besides national EPC schemes because it complicates comparability

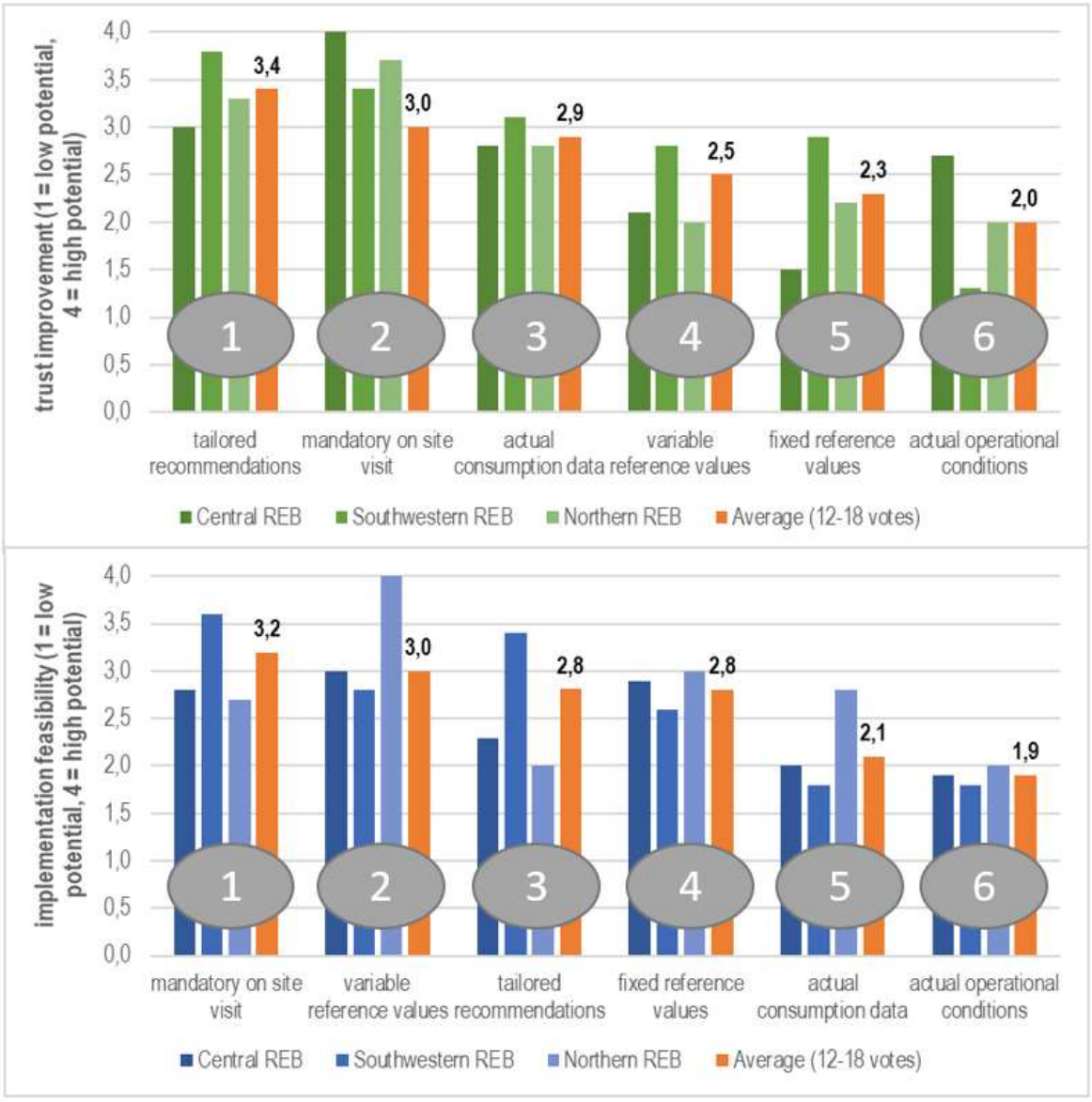

Figure 5: results of assessment of certain features (ranked from 1-5) related to trust improvement and implementation feasibility; average rating scores for Central REB, Southwestern REB and Northern REB and average of all votes (4 = highest score to achieve)

To improve accuracy of the calculation, the results of the rating and discussions can be summarized as the following:

1. **Dynamic building simulation:**
    a. Seen as feature with highest potential to increase accuracy and medium implementation feasibility
    b. Perceived as not necessary for single family houses (SFH) but could be useful for larger buildings
    c. would increase costs for issuing EPC and high expertise for issuing EPC
    d. easier to implement for new buildings than to existing buildings
    e. Mandatory in Estonia (except for SFH) and has proven as very useful
    f. May have special relevance for countries with mild climate to correctly assess passive energy saving measures (solar gains, cooling, overheating...)
2. **Mandatory on-site visit:**

   a. Would increase accuracy in terms of erasing "cheap EPCs from non-experts" with good implementation feasibility
   b. Doubts, how the contribution to accuracy improvement could be quantified and if this is really one major reason for lack of accuracy

3. **Calibrated building simulation:**
   a. Medium potential to increase accuracy with low implementation feasibility
   b. Basically, a good idea, but might lead to some corrections which are unknown. Very good measurement data is necessary in terms to know why some consumption is higher or lower than the calculated one
   c. Perceived as not necessary for SFH
   d. Would increase costs
   e. Most variability comes from use conditions which are not stable, and even not comparable between users, therefore the accuracy gains could be overrated in many cases.
4. **Use of measurement data:**
   a. Low potential to increase accuracy with low implementation feasibility
   b. Concerns only existing buildings and quite difficult to implement but may result in higher acceptance of EPCs for end users
   c. Measurements will increase accuracy but also the costs, with an uncertain repercussion on user perception
   d. high variability of uses and the necessary long period of analysis to make it robust makes it highly unfeasible, or only useful for very specific uses (like in Belgium for public buildings)
   e. idea of the EPC system is to compare the buildings and not to show actual energy consumption, thus the role of real consumption is not relevant
   f. in Germany EPCs can be prepared in both ways for certain use cases, but the problem is that the result between calculation and measurement is (sometimes) quite different. Even if there are two types of EPCs, only calculated energy rating is allowed when applying for building permissions
5. **Use of actual operational conditions:**
   a. Low potential to increase accuracy with low implementation feasibility
   b. Makes comparing of different buildings impossible

The **highest potential for trust improvement** and already mandatory in some EPC schemes is assigned **to resilient tailored recommendations**. Well prepared recommendations have a high added value for end users, but it may be difficult for them to identify the quality of the recommendations. **Mandatory on-site visits** as well as use of **actual consumption data** could also increase trust, but the framework conditions of consumption data (measurement period, operational conditions, users…) need to be given as well, which complicates comparability for non-experts.

The **highest contribution to increase accuracy** of national EPCs is seen for the feature of **dynamic building simulation**. It is already mandatory in Estonia (except SFH) and it works out well.

To completely base national EPC schemes on **measurement data and actual operational conditions** is widely perceived as **not applicable and with low implementation feasibility** because comparability of different buildings will be more complicated. Especially during the Central REB meeting and also mentioned in other REB meetings it was highlighted that the idea of the EPC system is to compare the buildings and not to show actual energy consumption, thus the role of real consumption is not relevant and doesn't necessarily show the building's energy quality. A way to **integrate the "end user dimension"** (consumption data, actual operational conditions) and already **included in the ePANACEA approach** is to provide it as **supplementary information to the end users**, e.g. on a separate summary sheet.

In addition, using **more complex models and calculation methodologies** would **increase costs** for issuing EPCs and expert knowledge from EPC issuers is necessary. Some countries mentioned that the current EPC calculation methodology is already

very complex and additional requirements may overstrain EPC issuers. For this reason, a **good education of EPC issuers is without alternative.**

Some meeting participants stated that **accurate calculated EPCs** (especially for new buildings) already provide a **very realistic forecast of energy consumption** and expected costs. In addition, it was highlighted from Estonian meeting participant that there is a **fundamental flaw in EPC concept - it is expressed per square meter whilst the user is a human not a square meter**. Without accurately describing a user it is hard to achieve more accurate result. Another recommendation was that higher accuracy will be achieved by improving the modelling methodology with regards to default values, level of simplification, occupancy schedules, etc.

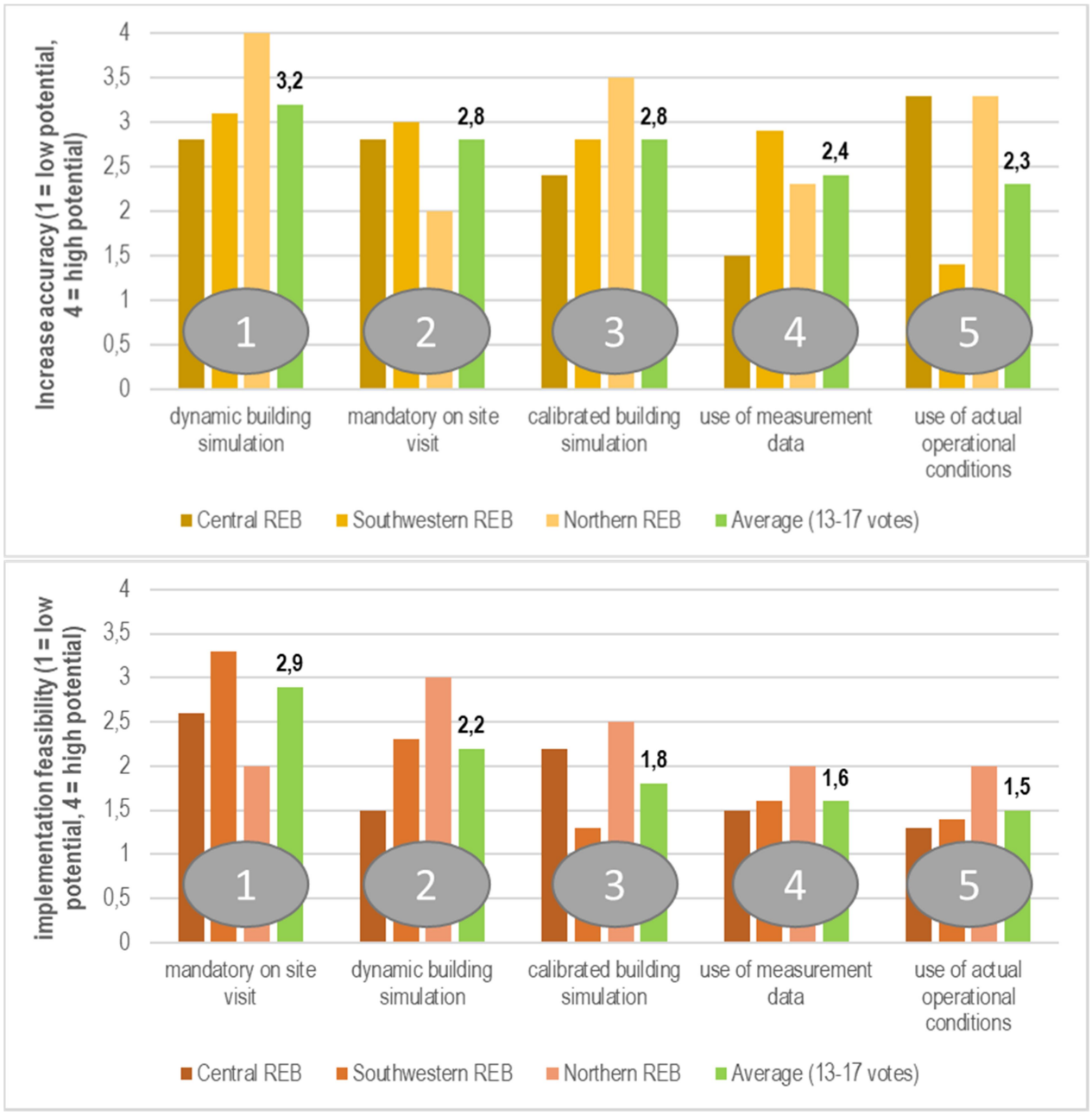

Figure 6: results of assessment (ranked from 1-5) of certain features related to accuracy improvement and implementation feasibility; average rating scores for Central REB, Southwestern REB and Northern REB and average of all votes (4 = highest score to achieve)

3.2. Discussion 2 – inclusion of smart and novel technologies

In September and October 2020, an inventory of smart and novel technologies was developed within the ePANACEA project with the purpose of identifying the most relevant technologies. For these technologies, a methodology will be developed to assess the impact on the building energy performance (or the wider energy system), which can be incorporated in simplified energy balance calculations of existing energy performance certification schemes.

The inventory consists of 45 technologies in 10 categories, which are listed and described in the public report "Inventory of smart and novel technologies".

Five of these 45 technologies were pre-selected by the consortium through an internal priorization based on:

- Impact on building energy performance and energy system
- Feasibility to integrate in EPC
- Technology maturity
- Relevance for energy policy (low/medium/high)
- Presence in current national EPC schemes

The **five** selected technologies are shown in Figure 7. These technologies have been discussed during the five regional exploitation board meetings.

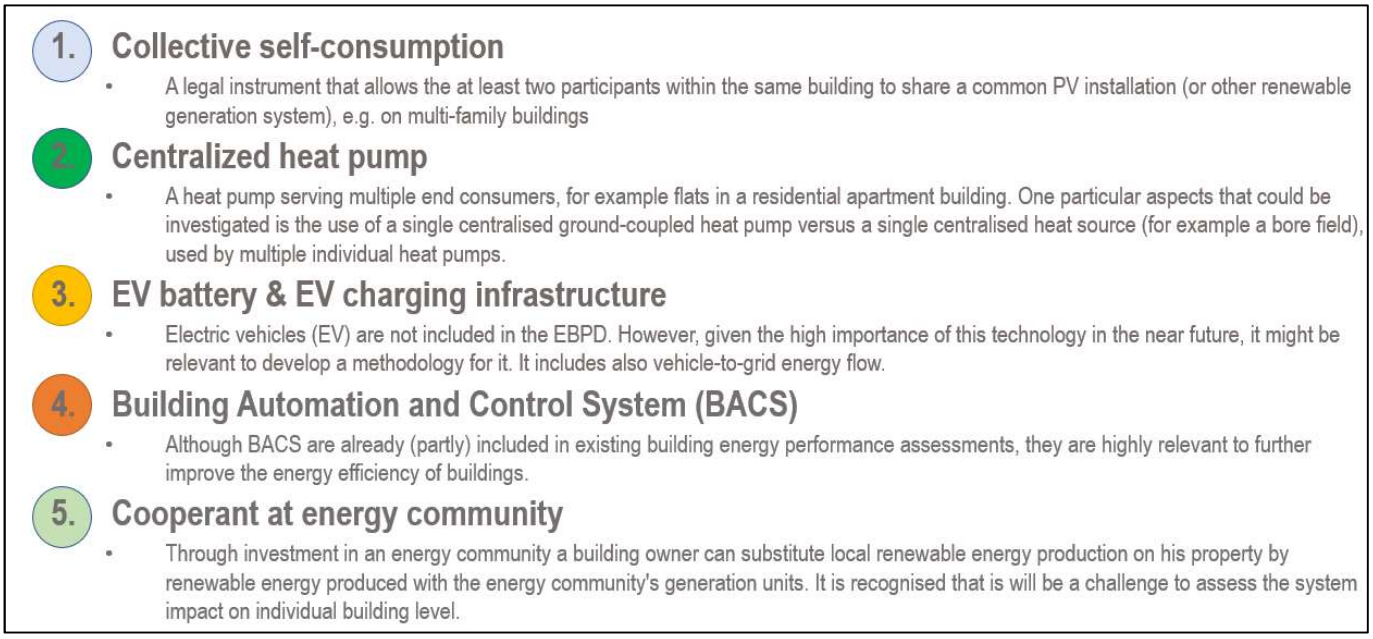

Figure 7: overview on five selected technologies

Two questions were evaluated into detail with the REB meeting participants:

1. WHY/WHY NOT are the selected 5 technologies important for the energy policy in your country?
2. How is the presence of the selected 5 technologies in the current EPC schemes of your countries?

The answers to these questions were used for prioritizing the five technologies. As example, if a technology is already quite present and mature in most of the countries, it is assumed to be less important within the ePANACEA project.

Based on this qualitative evaluation, the importance of the features for EPC methodology development can be ranked as the following:

1. **BACS** (because of high relevance in all countries and lack of presence in current EPC schemes)
2. **EV battery & EV charging infrastructure** (because of lack of presence in current EPC schemes and fast technology deployment)
3. **Collective self-consumption** (because of lack of presence in current EPC schemes and will be relevant for most countries if legal framework is defined)
4. **Centralized heat pump** (already present in most of the national EPC schemes)
5. **Cooperant at an energy community** (relevant in national policies but there are doubts that it should be included in national EPC schemes because it is mainly outside of the building's system borders)

Below, a summary of the results about the discussion of smart and novel technologies is given. More detailed information is also provided in Table 3 and Figure 8.

Figure 8 shows the presence of these five technologies among the meeting participants' countries. Especially collective self-consumption, EV battery & charging infrastructure as well as cooperant at energy community aren't present in most of the REB countries. BACS is perceived as partially present whereas centralized heat pumps are present in the majority of the national EPC schemes. This evaluation proofs that the chosen technologies need to be further investigated.

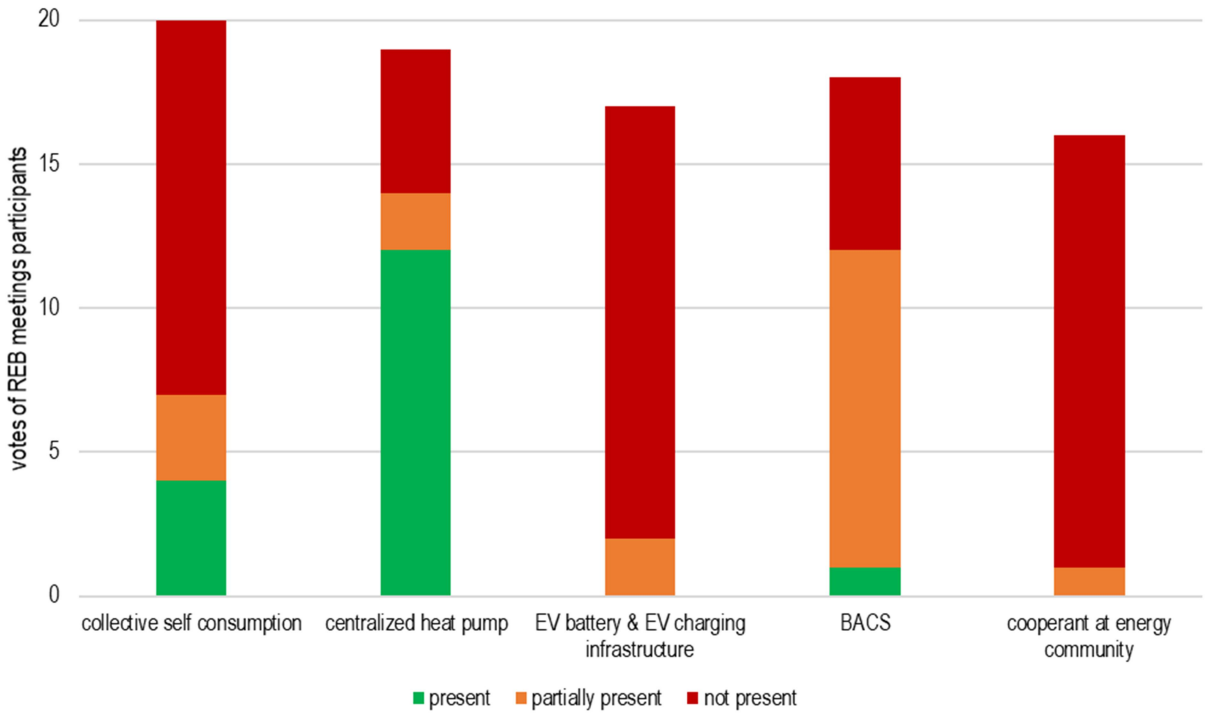

Figure 8: overview on presence in the current EPC schemes of the REB members' countries

Collective self-consumption was mentioned relevant from participants of 8 countries, because of a fast-developing PV market and for participation of citizens in the energy transition. Some countries still don't have the legal framework and therefore it is not that relevant yet, but it will gain importance once the national legal framework is designed. Only representatives from United Kingdom and Ireland stated that they have a low number of multi-family building stock in their countries and therefore this feature isn't relevant. As shown in Figure 8 this feature is still not present in current EPC schemes of most of the countries, but highly relevant.

Centralized heat pumps are currently relevant in 7 countries, whereas some meeting participants mentioned that it's not common now but will gain importance in the future. It was also stated that this feature should be very relevant in all countries since electrification is key step to the future. However, most of the meeting participants stated that centralized heat pumps are already present or partially present in their current EPC schemes. This leads to the assumption that this technology is of subordinate relevance within the ePANACEA project, because there is no urgent need to develop a new calculation methodology.

EV battery & infrastructure become more popular in nearly every REB country and therefore is highly relevant. In addition, the EV infrastructure is part of SRI concept. Only representatives from Finland stated that battery and energy storages in general are more important. Nevertheless, these two features are still not present in the majority of current national EPC schemes and a methodology is highly needed.

BACS were perceived very relevant for every meeting participant because of the fast-developing market, importance for peak reduction and contribution to increase energy efficiency and energy savings in buildings. Some meeting participants mentioned that BACS is especially important for medium and larger buildings and that the importance of this feature is already given in the EPBD requirement. However, this feature is partially or not present in most of the national EPC schemes. Representatives from Poland and Czech Republic mentioned that they have a methodology for their national EPC schemes, but it is not well defined. Based on this feedback, BACS is considered to be highly relevant for the ePANACEA project.

Cooperant at an energy community is perceived as good approach to empower consumers and to participate in the energy transition. However, the opinions among the REB members are not uniform: some stated that it has the same relevance as collective self-consumption, but on the other hand this feature is mainly linked to the building user and not the building itself, which makes it not necessary to be included in national EPC schemes. This feature is still not present in most of the European national EPC schemes and some countries still don't have a legal framework for it. However, it must be decided upon the concerns of some REB members, if the ePANACEA consortium wants to provide a methodology for this feature.

Based on these outcomes and further consultations within the consortium, a minimum of three technologies will be selected. For these technologies, a methodology will be developed to assess the impact on the building energy performance (or the wider energy system) which can be incorporated in simplified energy balance calculations of existing energy performance certification schemes.

	WHY RELEVANT for national policies?	WHY NOT RELEVANT?	General comments
Collective self-consumption	FI, NOR, EST: PV becomes cheaper and more popular in all building types AT, ES, IT: especially relevant in residential buildings to participate in the energy transition, big residential building stock BE: relevant but existing barriers in regulation PL: allows to combine energy demand profile with energy production	RO, BG, HU, CY: Not yet relevant because missing legal framework CZ: still not many applications UK, IE: low number of multi-family buildings	Big potential to increase renewable integration in buildings Will be relevant for most countries if national legal framework is defined Closely linked with energy communities
Centralized heat pump	AT: very relevant, especially for excess heat, gets more common FI, NOR, EST: becomes more popular RO: relevant but expensive GR: very important if HP is highly efficient but difficult in Greece (end users prefer decentralized energy systems) IT: very relevant	CZ, ES: not an issue, not relevant at the moment HU: not common but starts to be popular PL: such solution is similar to WLHP and there is no need for special calculation method LVA: currently not popular SK: impossible to disconnect from DH	Needs market development, more expensive than gas Interesting when it can be combined with BACS Should be relevant in all countries because electrification is key step for the future Centralized heat pump is innovative
EV battery & EV charging infrastructure	ES, IT, AT, NOR, FI, UK, IE: EVs already are or become more popular AT, SK: electric batteries have importance for the concept of SRI CZ: highly relevant for new buildings HU, RO: would be important, much needed BE: Mandatory in Flanders for new housing units (above 20) and new schools to include provision for smart charging KNX representative: it is a must	FI: battery and energy storages in general are more important	Must be linked with smart technologies Should be considered as renewable energy source Alternative to energy storage in buildings Important technology to link buildings with electricity market
BACS	FI, NOR: important for peak reduction ESP, BE, UK, IE, AT: very relevant because energy savings and energy efficiency improvements are highly linked with this technology PL, CZ: becomes more relevant and is important, but methodology not well defined in EPC scheme HU: interesting for public buildings and offices, slowly starts in residential buildings as well RO: relevant because of fast developing market CY, GR: especially relevant for medium/large buildings (e.g. office buildings or buildings with a large number of visitors)		Importance already given in the EPBD requirement Many open questions for end users especially about data security, data storage and legal data security Control system should not replace end users' autonomy End users must be educated on how to use these systems
Cooperant at energy community	CY: will be important to know how much energy is provided to the community HU: important for grid flexibility PL: allows to combine energy demand profile with energy production EST: same relevance as collective self-consumption IT: national policies start these months GR: relevant, but doesn't work very well at individual level	CZ: not necessary to be included IE: mainly linked to the building user and not the building per se UK: no large impact on energy transition RO: not relevant yet AT: relevant in general, but not in context of EPC ESP: not relevant but interesting	Good approach to empower consumers Not part of EPC as it is out of system border of the building Increases on site RES production Could be interesting due to high population density mainly in cities, but difficult to implement due to property structure Very interesting in combination with energy management

Table 3: Overview on results of discussion of smart and novel technologies, abbreviations used for country names

3.3. Discussion 3 – user need analysis and increase user friendliness of EPC

Another important topic for the first meetings of the five REBs was the discussion on increasing user friendliness of EPC. For this purpose, the conclusions of more than 60 interviews with end users and stakeholders, which have been carried out in October and November 2020 in 6 pilot countries (Spain, Belgium, Finland, Austria, Greece and Germany), were discussed with the REB meeting participants.

Based on this user need analysis, a stakeholder map (Figure 9) was created and discussed among the REB meetings and additional important stakeholders were added during the meetings (in red).

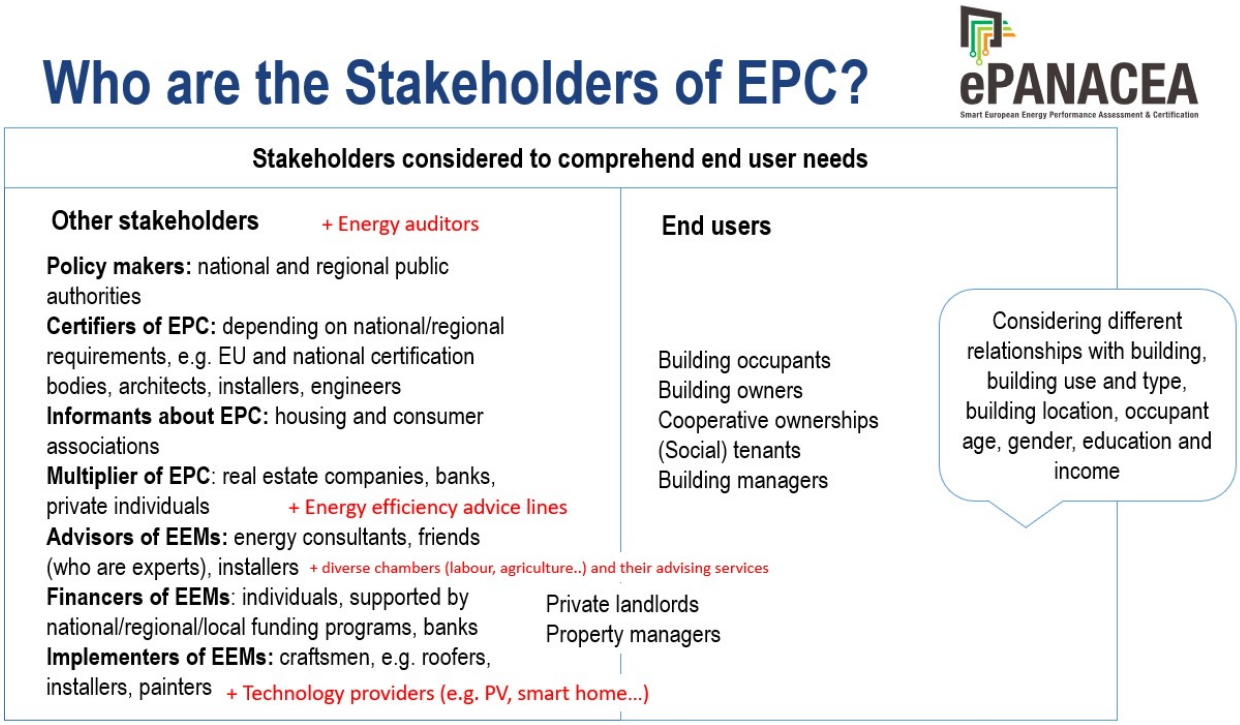

Figure 9: ePANACEA stakeholder map (October 2020) and feedback in red from REB meetings

In addition, meeting participants also mentioned that the energy behaviour of end-users could be **influenced by installing a simple building management system,** which shows the energy consumption and therefore raises awareness. Supplementary, the role of **energy auditors and energy consultants** should be more important in the public perception and to achieve the energy transition.

Based on the feedback from the interviews, a common template for the summary pages of the EPC report within ePANACEA was proposed. The proposal implies two different formats with very different information according to the target audience**: (1) for the Administration/Regulation/Policy** makers based on standard conditions and **(2) for end-users** based on actual operational conditions.

The following Figure 10 and Figure 11 show the two summary pages as well as the main conclusions from the REB meetings from each section. The layout of the two **summary pages was perceived as well structured and very clear**.

In general, the idea of introducing target-group oriented summary pages was perceived as possibly helpful to increase user friendliness, whereas only meeting participants from the Southeastern REB stated that there is no need to have different EPCs for these two target groups. The first page of an EPC should be usable for end users and administration, including selected, high qualitative data.

Several meeting participants mentioned that real consumption data are not relevant for their national EPC scheme and therefore they are sceptic if this is introduced for the end users. It may cause even more confusion because real consumption data could be even more difficult to be interpreted in the right manner. If the "In use" part of EPC is present, the information on occupancy, climate condition, internal parameters must be given as well.

In addition, inclusion of energy costs, economic analysis, measurement data or data from energy bills is seen as valuable for end users, but it goes beyond EPC activity and increases EPC costs. Alternatively, different energy cost labels could be developed and therefore the building could be assigned to **a certain cost label.**

In conclusion, the following recommendations are retrieved from the REB discussions:

- At a first sight, design and layout were perceived as very good
- Provided information should be reduced as much as possible, some REB members even recommend to just show 3-4 indicators (e.g. only relevant legal parameters)
- Indoor environmental quality parameters and indicators related to overheating of a building could be included
- QR code could be included with follow-up information, what the key figures mean
- Further methodology for the shown indicators must be provided
- **Administration-oriented summary page:**
    - Legal necessary indicators and thresholds should be shown
- **End users' summary page:**
    - Energy class instead of pie chart
    - Focus on qualitative recommendations and provide more information for the nZEB roadmap
    - Energy costs better understandable than energy consumption, but issue of obtaining data
    - Specific values with m² could be erased
    - If real consumption data are used, the information on occupancy, climate condition, internal parameters, etc., must be given.
    - The benchmarking should be made in a different way, e.g. with the scale as on the administrative page. It is not relevant for end users if they are above or below the median of something
    - Reduce information as much as possible

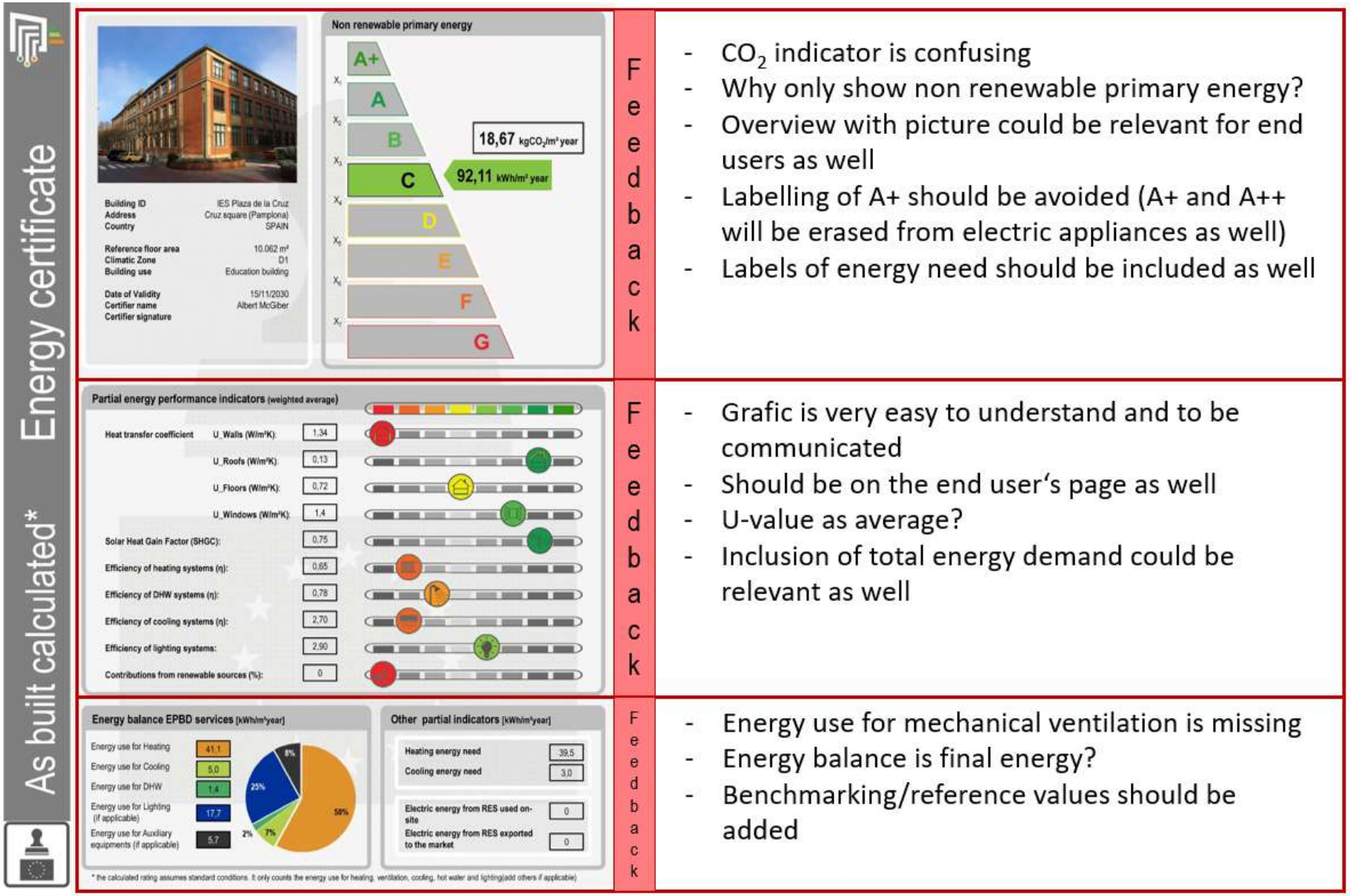

Figure 10: summary of obtained feedback from REB meetings of the administration-oriented proposal

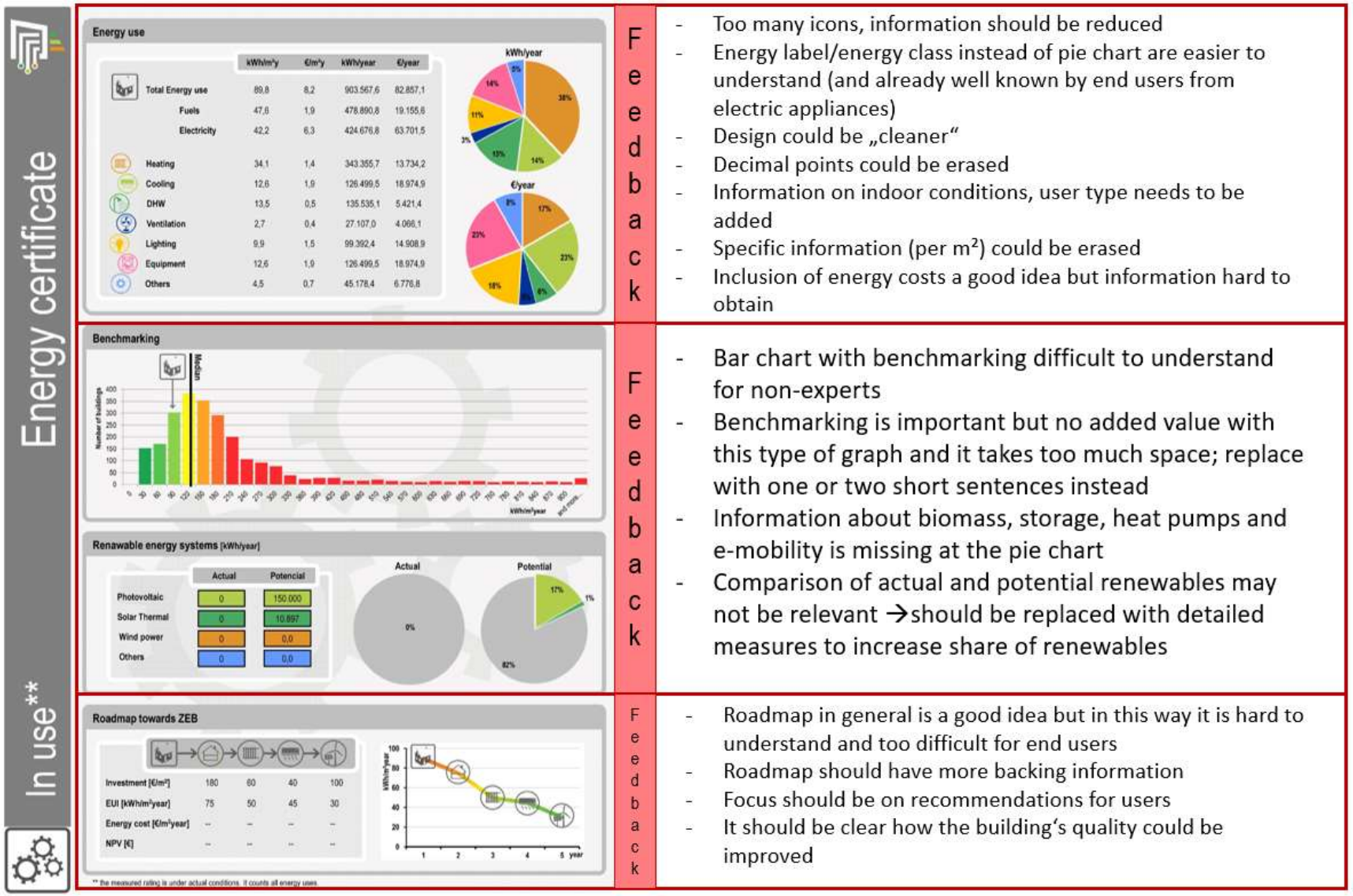

Figure 11: summary of obtained feedback from REB meeting of the end-user-oriented proposal

4. SUMMARY AND NEXT STEPS

New innovative features

New and innovative features have been discussed based on a catalogue of 41 features, elaborated with the purpose to include most important ones in the next generation of energy performance assessment under the ePANACEA approach. All findings are summarized in a public report "Implementation of innovative Certification Schemes", which is available at the ePANACEA webpage.

The highest potential for trust improvement and already mandatory in some EPC schemes is assigned to resilient tailored recommendations. Well prepared recommendations have a high added value for end-users, but it may be difficult for them to identify the quality of the recommendations. Mandatory on-site visits as well as use of actual consumption data could also increase trust, but the framework conditions of consumption data (measurement period, operational conditions, users…) need to be given as well, however it makes comparability for non-experts more complicated.

The highest contribution to increase accuracy of national EPCs is seen for the feature of dynamic building simulation. It is already mandatory in Estonia (except SFH) and it works out well.

To completely base national EPC schemes on measurement data and actual operational conditions is widely perceived as not applicable and with low implementation feasibility because the introduction of the user behaviour complicates the comparability of different buildings. However, a way to integrate the "end-user dimension" (consumption data, actual operational conditions) and already included in the ePANACEA approach is to provide it as supplementary information to the end-users, e.g. on a separate summary sheet. This may increase trust of EPC end users in the calculation results and contribute to more robust economic estimation of energy efficiency measures and more realistic tailored recommendations.

Within the upcoming months, the approach of using actual measurement data in buildings' energy performance assessment will be evaluated. In addition, methods and policy guidance on complementing traditional EPCs with metered performance data will be developed ("end-user dimension"). And it will be explored the viability of a complementary approach, in which building performance characteristics serve as input for EPC calculations or certifications, directly derived from processing on-board monitoring data through the use of inverse modelling techniques. These activities will serve as base for further discussions with the REB members, in order to evaluate the ePANACEA approach in detail. In addition, the use of on-board-monitoring data as input for EPC calculations will also be tested in Austria, Belgium, Finland, Greece and Spain through 15 case studies. The findings will show, if the approach is feasible for the relevant stakeholders or not.

Inclusion of smart and novel technologies

Within the past weeks, an inventory of smart and novel technologies has been developed and summarized in the public report "Inventory of smart and novel technologies". The complete initial inventory includes 45 technologies which are grouped in 10 categories such as construction, building installations, renewable energy supply, etc.). Based on an internal assessment, five technologies were selected and discussed during the five REB meetings. The meeting participants were asked how relevant the technologies are in the current energy policies of their countries and how the presence of these technologies is in their current EPC schemes. This led to the following priorisation:

1. BACS
2. EV battery & EV charging infrastructure
3. Collective self-consumption
4. Centralized heat pump
5. Cooperant at an energy community

It is advised to follow this priorization, if less than five technologies will be elaborated by the ePANACEA consortium in the upcoming months. The next steps related to this activity are to develop a methodology to assess the impact of these

technologies on the building energy performance (or the wider energy system) to be incorporated in simplified energy balance calculations of existing energy performance certification schemes.

User-need analysis and new EPC

During this session, the new EPC layout and stakeholders of EPC have been discussed with the REB meeting participants. The proposed ePANACEA EPC layout was perceived as well structured and very clear and the majority of the REB members think that target group-oriented summary pages increase usability and user-friendliness of EPC.

The next steps related to this activity include the improvement of the proposed layout based on the REB feedback. In addition, five user-need workshops in Austria, Belgium, Finland, Greece and Spain will be conducted in December 2020 and January 2021. The objective of the user-needs workshop is to figure out participants' needs and interests regarding the EPC (including content, visualization and structure/didactic elements. Thereunder is the objective to find out how the perceptions and needs can be differentiated among stakeholders and how they are related to the specific type of end user. The proposed ePANACEA EPC layout will be discussed as well and the feedback incorporated.

Upcoming REB activities

In the next week and months, the REB members will be continuously informed about the project's process and how their feedback is used during the ePANACEA methodology development. In addition, the REB exclusive area at the ePANACEA will be accessible for the REB members with additional information.

The next REB meeting is supposed to take place (physically) by the end of 2021. Additionally, survey campaigns will be launched with the REB members in order to assess the status of the national renovation strategies and other relevant aspects (such as data availability, stakeholders' engagement, market readiness). This feedback will be used to develop an approach, how current EPC schemes can be linked with building renovation passports and digital logbooks.

5. ANNEX – LIST OF PARTICIPATING INSTITUTIONS

Institution	Country
Technical University of Vienna	Austria
SEVEn	Czech Republic
National Energy Conservation Agency	Poland
EMI Company for Control and Innovation in Building	Hungary
Building Testing and Research Institute	Slovak Republic
Building and Civil Engineering institute ZRMK	Slovenia
Federal Office for Building and Regional Planning	Germany
Federal Ministry Climate Action, Environment, Energy, Mobility, Innovation and Technology	Austria
Austrian Institute of Construction Engineering	Austria
Federal real estate company	Austria
Styrian Chamber of Labour	Austria
VITO	Belgium
Zonnige Kempen	Belgium
Flemish Energy Agency	Belgium
Sustainable Energy Authority of Ireland	Ireland
Energy Saving Trust	UK
Centre for Renewable Energy Sources and Saving (CRES)	Greece
Sustainable Energy Development Agency (SEEA)	Bulgaria
Cyprus Energy Agency (CEA)	Cyprus
Association Cluster for Promoting NZEB Buildings (Pro-nZEB)	Romania
Romanian Association of Energy Auditors for Buildings (AAECR)	Romania
Pan-Hellenic Federation of Dealers and Craft Glass (POEVY)	Greece

Ministry of Environment & Energy	Greece
Pan-Hellenic Federation of Aluminum and Craft Manufacturers (POVAS)	Greece
Financial Institution	Greece
Thelcon	Greece
Pan-Hellenic Association of Certified Energy Auditors (PACEI)	Greece
VTT	Finland
Tartu Regional Energy Agency	Estonia
MOTIVA - a Sustainable Development Company	Finland
RIL ry Finnish Association of Civil Engineers	Finland
Ministry of Economics Department of Housing Policy	Latvia
The Norwegian Water Resources and Energy Directorate (NVE)	Norway
National Renewable Energy Center (CENER)	Spain
Spanish Government's Institute for the Diversification and Saving of Energy (IDAE)	Spain
Efinovatic- Certificación energética SL, Software developpers of CE3X Spanish EPC method	Spain
Directorate-General for Urban Agenda and Architecture. Ministry of Transport, Mobility and Urban Agenda of Spain (MITMA)	Spain
Eduardo Torroja Institute for Construction Sciences (IETcc-CSIC)	Spain
Higher Council of Associations of Architects (CSAE)	Spain
General Council of Associations of Industrial Engineers (CGCOII)	Spain
Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA)	Italy
R2M solutions company	Italy
Policy Development and Programme Implementation Directorate. Ministry for Transport, Infrastructure and capital projects (MTIP-PDPID)	Malta
Energy Agency of Styria	Austria
KNX Association Control and automatization protocol manufacture products Association	Europe

6. REFERENCES

6.1. Table of figures

6.2. Table of figures