

REHVA SUBMISSION TO THE CONSULTATION ON THE ENERGY PERFORMANCE OF BUILDINGS DIRECTIVE

11. *What has worked well in the EPBD? What needs to be improved?*

As reported in the [HealthVent](#)¹ project and in a [BPIE study](#)², the EPBD was implemented in most Member States without paying attention to indoor environment quality, although the Directive mentions that indoor climate can't be compromised. Energy efficiency measures (tighter buildings, increased envelope performance) may deteriorate indoor environment quality and lead to significant health problems. Known problems include:

- Building envelope is made tight while ventilation is not taken care simultaneously. As consequence ventilation is too low and pollutant concentrations become too high. (For instance according to the statistics in Czech Republic the number of deaths caused by CO inhalation - due to improper ventilation while using open combustion heating and/or DHW appliances - increased 10-times in the last years, and trends are probably similar in other central and eastern European countries.)
- Stopped ventilation and overheating of buildings after thermal retrofit of the envelope and replacement of windows can be a problem in energy refurbished buildings, as well in some high-performance buildings (e.g. cases of overheating in passive buildings in Sweden).
- Development of mould and increased humidity leading to asthma and other respiratory diseases.

The EPBD shall follow the “Health in all policies” approach and strengthen the importance of indoor environment quality linked to energy efficiency in buildings. This is also in line with the Energy Union approach putting the consumer in the heart of the energy system. Consumers shall be aware also of the health and comfort related aspects of the buildings their use or live in. especially when investing in energy refurbishment.

To achieve this, the EPBD shall handle ventilation as a separate area besides heating and cooling, streamlined through the whole directive as described below:

1. The revised EPBD shall set a clear mandate for Member States to define minimum ventilation and Indoor Environmental Quality (IEQ) requirements that are monitored and reported in a harmonised way in building regulations across Europe. Minimum IEQ related requirements shall:

- Define minimum user independent ventilation airflow rates.
- Take into account the intended use of the building.
- Take into account the pollutant generation in rooms
- Ensure the quality of the installed ventilation system and its regular maintenance

2. REHVA together with EVIA recommends developing a common methodology for an indoor environmental quality indicator to be used together with primary energy indicator. This IEQ indicator shall be reported in a transparent way in the energy performance certificates: it shall provide information about indoor air quality (ventilation rate) and about the indoor thermal environment (summer and winter). This shall be implemented based on the EN 15251 (new number prEN 16798-1) standard defining I-IV indoor climate categories. The indoor climate category shall be added to energy performance certificates. In a more detailed description the indoor climate category could be provided separately for air quality (ventilation rate), temperature in summer and temperature in winter.

¹ Health-based ventilation guidelines for Europe, HealthVent project, www.healthvent.eu.

² [Indoor air quality, thermal comfort and daylight](#). An analysis of residential building regulations in 8 Member States. BPIE, 2015.

3. Inspection: the EPBD shall require regular inspection of ventilation systems and not only of air conditioning. The inspection shall include:

- Assessment of the system efficiency
- Assessment of the sizing in relation to the indoor air quality requirements of the building. The assessment of the sizing shall be repeated when the ventilation system or the defined IEQ requirements or the use of the building and its rooms have been changed.
- In building with continuous monitoring and control systems in place, Member States may reduce the frequency of such inspections as appropriate.

4. General framework for the calculation of energy performance of buildings: the calculation methodology shall consider ventilation and IEQ appropriately by taking into account at least the following aspects:

- (c) air-conditioning installations;
- **(c1) ventilation systems**
- (d) natural and/or mechanical ventilation which may include air-tightness;
- (h) indoor environmental conditions and indoor environmental quality

5. Accelerating deep energy refurbishment: when building or renovating buildings, adequate air quality conditions (e.g. air flow rates and ventilation efficiency) must be safeguarded, and controlled ventilation systems built in if necessary. Priority shall be given to energy- and cost-efficient technological providing application-specific and demand-driven levels of indoor air quality. The minimum acceptable levels of IAQ shall be clearly defined for different categories of buildings. This – together with efficiency - shall be a requirement in every grant and financial support schemes for energy refurbishment. There are already some existing good practices: e.g. in Estonia the grant scheme for buildings energy renovation contains the mandatory installation of mechanical ventilation systems also in residential buildings.

I. Minimum energy performance & nZEB requirements, cost-optimality

5. Overall, do you think that the EPBD is contributing to cost-effective improvements in energy performance? Why/Why not?

Yes, EPBD has obliged the MS to set up minimum energy and maintenance requirements, and increased consumers' consciousness of building energy performance through the energy certification. This made it possible to apply and further develop economical energy saving measures.

Because of the **cost optimality principle, which is technology neutral and performance based**, energy efficiency of new buildings has been improved cost effectively. All MS have conducted cost optimal calculations with the same (regulated) methodology and comparable results and many MS have set more stringent requirements – this can be seen as a success story in EP improvement in new buildings.

The cost optimal principle and the Commission Delegated Regulation (EU) No 244/2012 on the global cost calculation in terms of 20-30-year net present value is one of the biggest successes of EPBD. The move towards the cost optimal energy performance level has happened in most of the MS. As the cost optimal calculation is required in every 5 years, this mechanism as such is a major driver for development and energy performance improvements.

However one need to consider that nZEB of the existing building stock is beyond cost optimality and using the current EU cost optimality principle the LCC for nZEB will be much higher than the cost optimality level. Therefore the next step is to include also other benefits in the cost optimal principle, e.g.

positive asset value development, as well as increased work productivity, less employees on sick leave, lower healthcare costs, healthier indoor environment due to the higher IEQ resulted by the undertaken energy efficiency measures.

6. Do you think that the aim of ensuring the same level of ambition across the EU in setting minimum energy performance requirements within the EPBD has been met? Why/Why not?

No, because MS have just moved to cost optimal energy performance, which in some countries did not caused remarkable changes and effort, while in others it resulted in much more stringent requirements. From the point of view of harmonisation the ambition has been very diverse and sometimes completely missing as MS have interpreted and applied the EPBD in different ways: different definitions, different metrics, and different calculation procedure despite the CEN-EPBD standards package.

Justification:

REHVA, BPIE among others have analysed available nZEB and minimum energy performance requirements with conclusive results for few countries. There is evidence that in Nordic countries EP minimum requirements are developed to very similar level (applies for current cost optimal minimum requirements in Denmark, Sweden, Finland, Estonia and Norway (Kurnitski et al. 2013, CLIMA 2013 conference paper). It is clear however that national methodologies are different and the output (EP requirements) depends on input data and calculation rules. Available nZEB requirements in 16 MS do not allow to evaluate precisely whether the ambition has been the same or not, because of huge differences and diverse methodologies. nZEB EP values vary mainly between 20-200, and existing studies (D. D'Agostino / Journal of Building Engineering 1 (2015) 20–32), Kurnitski et al. REHVA Journal 2/2014) conclude that the ambition is not the same.

18. Is the definition of NZEBs in the EPBD sufficiently clear?

No it is not. Especially the use of the renewable energy sources is unclear. It could be stated more clearly that all renewable energy generation should be accounted on equal basis: on-site, nearby and distant (centralized energy systems) generation. Currently Article 2 nZEB definition “including energy from renewable sources produced on-site or nearby” has been understood in different ways in MS. In addition, it could be clarified that nZEB should be measured with non-renewable primary energy indicator (now this could be find only from Cost optimal regulation, as EPBD just operates with unspecific primary energy).

19. Is the NZEB target in the EPBD sufficiently clear to be met?

No. The range of nZEB requirement values varying remarkably from positive energy buildings to 270 kWh/m²/y primary energy (reported by D. D'Agostino and REHVA) shows that it is difficult to speak about THE nZEB target, as there is no common understanding, neither same ambition of the nZEB performance level. This indicates clearly that the revised EPBD should provide more clear guidance and definition about nZEB. Before the target is not defined (in a sufficiently explicit manner) it can't be measured.

REHVA has concluded that the remarkable differences of nZEB values are caused mostly by the different energy uses included, however the calculation methodologies (input data) have also a large effect on the outcomes. . In order to end up with measurable and transparent targets, REHVA suggest that the EPBD or

its Annexes define common grounds making sure that all MS require and measure similar thus comparable values.

The energy performance definition of the EPBD (article 2) *“Energy performance of a building’ means the calculated or measured amount of energy needed to meet the energy demand associated with a typical use of the building, which includes, inter alia, energy used for heating, cooling, ventilation, hot water and lighting.”* allows to account different energy uses because of “inter alia” wording. For example non-EPB-use appliances and lighting correspond to 50-60 kWh/m²y primary energy in residential buildings. D’Agostino reports that 7 countries out of 13 account appliances (AT, BG, EE, FI, LV, LT,NL, however the data of NL seems not to be correct), the rest do not. Thus harmonising the accounting of energy uses will result in more homogenous and comparable nZEB requirements, as this would remove 50-60 kWh/m²y from current differences.

REHVA recommends accounting all major energy uses including appliances and lighting (but no processes) (REHVA Report No 4, 2013). This is a key issue, because the exclusion of the energy uses may lead to a situation where the calculated energy use represents only a fraction of measured energy use in real buildings, so EPC-s won’t represent at all the actual energy use of buildings.

Also the recent US DOE common definition for zero energy buildings has made a similar proposal <http://energy.gov/eere/buildings/articles/doe-releases-common-definition-zero-energy-buildings-campuses-and> showing similar understanding by European and US energy experts.

NON-EPB-Appliance plug loads that are typical for certain building functions (for example dwellings, hotels, schools, offices etc.) shall be an input to the EP-assessment procedure. EN 15251 (new number prEN 16798-1) standard has developed standard occupancy, lighting and appliances profiles that makes it possible to include plug loads on standard building use bases into EPB assessment procedure and primary energy indicator. Standardisation work in the area of extended user profiles is in progress also in ISO level by the Joint Working Group of ISOTC163 & 205, Task-group 6.

The definition of energy performance is not sufficiently clear from the aspect of primary energy indicator. For instance Italy has chosen total primary energy indicator instead of non-renewable one. Total EP has no sense, because the energy needs of comfort and functional requirements can never be zero, the only possibility is to reduce the needs as much as possible and to cover them as much as possible with renewable energy, then non-renewable energy can be zero.

A further definition problem is the use of **on site and nearby renewable energy sources**. While on site is clear, **nearby has been interpreted in very different ways** among MS, however this definition is now well established in the EPB overarching standard. However it is a problem that the upcoming CEN EPBD standard package allows high flexibility and introduces too many options, which can hinder the uniformed definition and calculation of building energy performance. This is an indication that European standardisation is not yet able to find consensus in this context and EPBD should specify more detailed definitions. EU-Member States shall be encouraged to influence this process towards EU-harmonisation in a pro-active way.

Linked to nZEB requirements, there is small but highly significant **problem with building categories**. EPBD Annex 1 provides a relevant list of major building categories but there are two problems:

- Instead (or beside) of hospitals we recommend using clinics, because clinics are highly energy intensive process driven buildings with 24/7 operation time. This is well illustrated by Estonian

nZEB requirement for hospitals (270 kWh/m²y) compared to nZEB requirement for most other building categories are close to 100 kWh/m²y. Clinics would solve this process problem, as they would correspond to operation of office buildings.

- A building category not covered by EPBD are industrial buildings without significant process, i.e. assembly halls representing typical modern production facilities which have significant share in building stock and make a solid contribution to lighting, ventilation, cooling and heating energy. We agree with the principle of EPBD not to regulate process driven industrial buildings, but as most of modern production facilities have comfort driven energy use, this would justify the extension of building categories with this building type. Such buildings have caused confusion in some countries, because not covered by EP minimum requirements and causing a problem for owners and designers how to design them.

Many MS have set nZEB requirements for residential and non-residential building categories only. From engineering point of view, **these countries can't tackle the eight building categories specified in EPBD Annex I**. Building category specific nZEB requirements are important, because usages, intensities and operation times vary a lot between different building types and optimal EE and RES measures differ accordingly. Therefore, in order to achieve that EP requirements steer cost optimal design solutions, appropriate nZEB requirements and standard use input data has to be defined for each building category.

There are some specific technical nZEB related questions, such as **monthly or hourly time step in energy calculation**, or period and type of balance when accounting RES export. The overarching EPB standard has made good progress in these questions by enabling natural evolution from monthly to hourly calculation methods and providing options how to account exported energy. In order to boost harmonisation REHVA recommends including an EC mandate in the EPBD to issue a delegated regulation on energy accounting similarly as was done to prepare the regulation on the cost optimal calculation. It is strongly advised to include the hourly approach as a necessary requirement for nZEB assessment procedures, not using this approach will underestimate the dynamic aspects of building, system and user behaviour.

For existing buildings undergoing renovation the Directive allows MS to define different minimum energy performance requirements than for new buildings. Most MS have implemented specific requirements when retrofitting only partially the building. However there isn't any specific consideration in the EPBD for existing building subjected to partial protection. While full protected listed buildings are excluded from any compliance with EPBD measures, partially protected historic buildings – which in some MS like Italy mean the majority of the existing building stock - must comply with the new building requirements. This is impossible, thus there's a risk that they won't undergo any energy retrofit.

II. EPCs

10. How successful has the inclusion of Energy Performance Certificates in the EPBD been? Have the certificates contributed to improvements in energy performance of buildings?

EPCs have made good progress and are evidently successful. As an example, the Italian law required EPCs since 1991, but it was only when the first EPBD required the same. EPCs are consumer friendly as they enable building users to understand the energy quality of a building through the simple labelling. Statistics are proving that the Italian building market has reacted positively to the requirement of energy quality.

However there's a need for measures certifying the quality (=correct data) of EPCs, such as:

- Certification or qualification schemes for persons and/or companies issuing EPC
- Regular surveillance schemes

The level of surveillance and the actions following infringement procedures are often insufficient. Incorrect data in the EPCs hinder the general acceptance of the certificates as a serious tool promoting improvements in energy performance. The lack of surveillance and the low quality of EPCs is well addressed in the ongoing QualiCheck project, providing evidence that in some MS almost anybody can issue EPCs and EPCs don't reflect the actual energy performance of buildings.

27. Have EPCs played a role in increasing the rate of renovation, the extent of renovation, or both? For instance, are EPC recommendations being defined as the most effective packages of measures to move the performance of buildings and/or their envelopes to higher energy classes?

In general EPCs have played an indirect positive role in pushing both for higher renovation rate and major renovation. Usually EPC recommendations are effective packages to improve the energy performance of buildings. However their application and success strongly depend on MS level policies and financial support schemes for building energy retrofit.

In Finland it was reported that building owners in the residential sector consider EPCs too complex, therefore the certificates are often ignored by non-professionals. This resulted in changing the EPC templates in Finland. To convince consumers about the necessity and benefits of EPCs tailored communication and promotion is needed targeting non-professional building owners and decision makers.

33. Should EPCs have been made mandatory for all buildings (a roofed construction having walls, for which energy is used to condition the indoor climate), independent of whether they are rented out or sold or not?

Yes. EPCs have to be seen as a mandatory requirement just like the certificate of conformity of electric and gas systems in buildings.

III. Compliance issues

*20. What, in your view, are the **missing factors that would ensure compliance** with:*

- a. Minimum energy performance requirements in new buildings?*
- b. Minimum energy performance in major renovations of existing buildings?*
- c. Minimum energy performance for the replacing/retrofitting parts of the building envelope (roof, wall, window, etc.) and replacing/upgrading/installing technical building systems (heating, hot water, cooling, etc.)?*
- d. Minimum renewable energy requirements to meet the NZEB target by 2020?*
- e. Certification of the energy performance of buildings, including tailor-made recommendations for the improvement of the energy performance of buildings?*
- f. Regular inspections of heating and air conditioning systems?*



a-f. Compliance requires not just a product based approach. Minimum standards can be set for individual elements of the building, such as roofs, walls, windows, floors, or for installed systems such as boilers, pumps, heat emitters and controls. But unless the whole system functions effectively then it does not matter how good the individual components are. There is insufficient focus on installation and commissioning of the systems, the overall performance of the building envelope and the effectiveness of the building as a whole as a low energy system. At present the focus is on low energy inputs, but what is really needed is low energy outcomes.

The EPBD revision shall require that the energy performance is verified by a **recalculation for final design and also for as built building**. The QualiCheck project has reported that 2 out of 9 countries have comprehensive compliance frameworks covering the final design, the construction and the commissioning phases. This shall be mainstreamed as good policy examples across the EU. Beside the “as built” certificates, also follow-up inspections shall be required at regular basis (e.g. minimum 5-years and maximum 10-years).

c. The standards for the individual parts and systems are well addressed already. It is the overall energy performance of the resulting building that matters, and there is not enough focus on this outcome. In particular, for technical building systems, it is essential that they are correctly designed, that efficient components are used in the system, that the components are correctly installed, and that they are then commissioned, set to work and tested as a fully functioning system. It is also essential that effective controls are installed. Again, just adding in some controls alone will not deliver low energy buildings – the controls must be properly installed as part of the technical building system, and commissioned correctly.

d. Setting renewables targets without first setting targets for reduced energy demand in buildings may not be effective. The EPBD does not address adequately the issue of exergy efficiency or exergy quality. Integrating renewable energy solutions into the European energy mix in an ambitious way is highly desirable, but this doesn't automatically guarantee that energy solutions/services are exergy efficient; neither that energy with an appropriate quality level is used for specific applications.

e. The EPBD has to take a step further in **requiring control mechanisms and compliance frameworks** beside the building permit. In many MS EPCs are prepared to apply the building permit, but there are no control or inspection mechanisms established to verify that constructed buildings comply with requirements and with the data reported in EPC. De jure building owners are liable for the compliance with minimum requirements, but de facto nobody is checking this (reported by QualiCheck project). There's a need for clear control procedures by independent bodies at MS level. MS must control the compliance of the real buildings performance with the declarations of respecting the minimum energy performance requirement and of energy certificates with real buildings conventional performance. Verification of building energy performance shall be carried out by unbiased (independent), qualified (according to well-defined qualification standards) and authorized professionals/organizations, based on measured (not calculated) data of building energy performance and indoor air quality. The methodologies for measuring building energy performance should be clearly defined and standardized.

One good solution to improving the compliance of buildings with the EPBD requirements for certification should be to require Member States to hold an open database of the EPC rating of every property sold or rented out.

f. The inspection of air conditioning (A/C) systems doesn't work properly in most of the MS. In Finland for example A/C inspection is regarded as an isolated measure limited to the cooling

generation equipment, but not the entire system. Very low compliance level with air conditioning inspections is reported from the UK.

Inspection shall include the whole A/C and also the ventilation system for proper indoor environment and efficiency. (See also Q11) Alternative approaches like self-inspection, continuous monitoring and inspection of proper operation & maintenance (+inspection of maintenance records) shall be included and more encouraged in the EPBD.

21. Do you think *the cost-optimum methodology gives sufficient evidence regarding the actual cost of renovating buildings on top of the additional cost for Near Zero-Energy Buildings?*

No. In practice the cost-optimum methodology doesn't give sufficient evidence. Most MS have focused their attention so far setting up minimum energy performance and NZEB requirements for new buildings. There's not enough attention paid to existing buildings that can't reach economically the performances of new buildings. This issue is dominated by local constraints and only specific cost-optimum analysis (at MS and regional level) can clearly indicate if a certain type of existing building can or cannot reach the NZEB performance with an acceptable additional cost. Until now there is a lack of such analysis.

22. Are there *any cost-effective measures for ensuring compliance at local and regional level that could be replicated and used to improve compliance on a larger scale?*

The QualiCheck project has reported that 2 out of 9 countries have comprehensive compliance frameworks covering the final design, the construction and the commissioning phases. These schemes can be replicated as good example across the EU.

23. What do you think of the various ways of calculating building energy performance at national/regional level? Please include examples.

The EPBD recast underlines a common way of calculating building energy performance, and there's a clear CEN mandate to establish a common procedure. However the EC has not obliged MS to adopt CEN standard as they are. Thus today there is a large variety of calculating building energy performance among the MS. As an example the infringement of the stand still CEN procedure by DIN, NEN and UNI, with DIN V 18599 series, the Dutch EN 7120 and the UNI-TS 11300 series, which are national deviations from the CEN-EPBD standards package. They have justified such infringement with the fact that such standards are directly recalled by their EPBD national transposition laws. But while different target values for different countries have a reasonable meaning, there is no technical or economic justification for different calculation procedures. The current developed CEN-EPB standards offer the maximal possible flexibility in boundary conditions and default choices (Annex A/B approach) so there is no justification for MS's in not using these EPB standards as they are. A requirement to use the EPB standards will support the harmonisation of the assessment procedures and support more cost-effective technologies to be developed for the EU-market and as consequence lead to more energy savings and CO2 reductions throughout the EU.

IV. EPBD and district level

58. Has the promotion of smart cities, smart buildings, sustainable transport solutions, smart mobility, and similar initiatives been linked with the EPBD and its aims? If so, how?

No. There isn't any real link between the two areas. The current EPBD focuses on the performance of individual buildings. The resulting efforts to pursue nZE performance at the level of individual buildings is not in harmony with the overarching goals to achieve better energy performance and resource utilization at societal level. To better harmonise the goals of the EPBD with the policies on smart cities, smart buildings, sustainable transport solutions, smart mobility, and similar initiatives, a better understanding of the interactions between the energy use in the built environment and in other sectors needs to be developed.

Inter-sectoral energy synergies and opportunities for a more efficient energy use at societal level should be considered in the EPBD. Inter-sectoral energy/power sharing (including shared generation, distribution and storage) could lead to significant opportunities for peak-shaving, integration of low-exergy resources and solutions, as well as a faster and more cost-efficient integration of renewable resources (economies and systems of scale) at societal level.

This is due to the different nature of EPBD compared to the listed initiatives. While they are voluntary initiatives, the EPBD is a regulatory framework. To create a link the listed activities shall be included in the regulatory framework. However the CEN-EPB standards give the possibility to include this in the assessment procedures.

60. What incentives are missing, that would help promote efficient district heating and cooling or meeting the goals of the EPBD?

Optimizing energy systems for nZE-performance at the level of individual buildings (as currently promoted by the EPBD) may result in sub-optimal energy-performance at urban/national level. There is a substantial body of historical evidence showing that district energy services (heating/cooling/hot water generation) can be significantly more cost- and resource efficient, as well as environmentally compatible than services optimized for individual buildings. Still it is observed in some countries (e.g Eastern and Central Europe) that buildings are sub optimized and were decoupled from the public DH system. As DH system become more sustainable by integrating RES this should be avoided by incentives.

In pursuing nZE-performance in new construction and retrofitting, a thorough analysis should be made of the implications of different energy system solutions, including the overall benefits/impacts of shared versus individual energy systems and services.

Depending on user density, user profiles and other parameters, larger-scale district energy systems, or smaller, local energy-loops between compatible buildings and building clusters may facilitate a more cost-efficient use of residual heat-flows (e.g. residual heat from waste-water, local cooling plants and industrial processes), as well the integration of other types of low-exergy resources/systems (e.g. energy storage). The EPBD shall provide solution-neutral, performance-based guidelines/requirements regarding the appropriate choice of building and energy system boundaries

likely to meet desired levels of energy performance and resource efficiency in new construction and retrofitting.

More favourable (economic) support packages could, for example, be provided to stakeholders (involved in new construction or retrofitting) who manage to identify and exploit energy synergies to develop and use of more resource-efficient energy systems and services. This could lead to new business models, as well as innovative energy services and system solutions.

Efficiency of district heating or cooling depends on the size and typology of the served area and buildings. To be cost efficient it higher energy density and low supply water temperature for heating is preferable. Local level incentives shall be given to the urban planning sector involving also the energy service companies to finance new district heated/cooled urban areas. This action can be linked to the smart city and similar concepts. Regarding available technologies the efficiency of district heating and cooling can significantly improve with large scale heat pumps and integrating renewable sources into the district heating network. The models applied already in Scandinavian cities like Helsinki could be applied in many other EU cities.

62. Does the EPBD and its definition of NZEB reflect the requirements that could derive from the energy systems of nearly zero-emissions districts and cities?

No, the current EPBD focuses on the performance of individual buildings. There is need to develop dynamic EP indicators and calculation methodology to take into account two-way energy flows, dynamic tariffs etc. The EPBD should be fitted for the upcoming deployment of smart buildings, which is actually pushed by its own nZEB requirements. The EPBD is not prepared to consider the disruptive nature of smart buildings, because it uses a static system based performance calculation methodology. To support smart buildings, the issues discussed under Q18-Q19 are important: accounting all major energy uses, hourly time step etc. The current EPB (CEN) standard assessment procedures offer openings towards smart building-system and energy infrastructure applications, however further development is needed to really implement these technologies

V. Building system requirements

74. Based on existing experience, do you think in the EPBD requirements are missing for regular inspections of the technical building systems to ensure:

a. that systems' performance is maintained during their lifetime?

There's a need for a harmonised approach of building performance assessment. Where appropriate building energy and indoor environment performance shall be measured and monitored continuously.

b. that owners/occupiers are properly informed about the potential improvements to the efficiency of their systems?

c. that replacement/upgrading of the technical building systems is triggered?

Yes, these are most appropriate requirements; if this is not done it is very likely that the level of energy performance and the connected IEQ will not be maintained. The fact that an energy certificate has a limited lifetime of 10 years is not sufficient. If there is no change in rental or ownership requirements, continuous monitoring and commissioning is the only guaranty that the EP level can be maintained or even improved.

75. Have inspections required by the EPBD, been incorporated into or more tightly linked to other inspection/certification/energy auditing activities and schemes under other EU or national directives?

No, we are aware of the strong resistance in many MS's to require more inspections, apart from those directly related to safety and health. It is underestimated that poor ventilation due to EP-measures is a serious health risk for the population.

The inspection of air conditioning (A/C) systems doesn't work properly in most of the MS. In Finland for example A/C inspection is regarded as an isolated measure limited to the cooling generation equipment, but not the entire system. Very low compliance level with air conditioning inspections is reported from the UK.

Inspection shall include the whole A/C and also the ventilation system for proper indoor environment and efficiency. Alternative approaches like self-inspection, continuous monitoring and

inspection of proper operation & maintenance (+inspection of maintenance records) shall be included and more encouraged in the EPBD.

76. Are the requirements for building elements set by Member States optimised to avoid market barriers limiting the installation of building products complying with EU requirements/standards e.g., under eco-design requirements?

No, as eco-design requirements are product related and minimum building element requirements should be building-system related there is not a one to one relation, sub-optimal choices could result of misleading Eco-design declarations. For the EP of buildings the EPB (CEN) standard assessment procedures should be leading.

The EPBD has influenced on development of Finnish requirements to the right direction – i.e so that main attention is now paid on the overall energy use instead of individual building components and systems.

72. Based on existing experience, do you think the setting of minimum requirements in the EPBD for technical building systems is missing? Would have technical building systems minimum requirements contributed to the improvement of buildings' energy performances?

The minimum overall performance requirement in terms of non-renewable primary energy is sufficient. Additional requirements are not necessary. Too many constraints reduce the designers' freedom in choosing the best solution for the given case. For the EP of buildings the EPB (CEN) standard assessment procedures should be leading.

73. Based on existing experience, do you think in the EPBD minimum requirements for technical buildings systems focussing on other factors than heating, air condition, large ventilation systems and domestic hot water e.g. certain building categories, building size, etc., is missing?

Missing services, such as internal transportation systems (elevators, escalators, etc.), telecommunication and security systems should be included in the total energy balance of the building. The EPBD requirements have to be applied to all building categories and sizes, with special attention to clinics/hospitals (see also answer to Q19-20). REHVA recommends performing a complete energy audit every 10 years in these building categories in addition to the EPCs to verify minimum performance requirements.

VI. Accelerating energy renovation

3. Has the EPBD helped to increase renovation (more than 25% of the surface of the building envelope) rates?

The EPBD has **accelerated renovation in countries which use renovation grant or other incentives with energy performance requirements** (deep integrated renovation) as a precondition to get the financial support. Major renovations cannot be boosted by setting strict requirements only. On the contrary this can slow down the renovation rate. There is evidence from countries using incentives (renovation grants and other supports such as in Estonia, Austria, Germany etc.) that renovation grants together with strict technical requirements have boosted renovation rates. The Estonian KredEx renovation grant scheme for apartment buildings is a concrete example with measurable results that can be shared with other MS.

Incentives principle is well addressed in EPBD. However there' a need for better coordination with the available ESIF funds and MS level support schemes. DG REGIO provides guidance and technical assistance to MS in developing revolving funds and sustainable financial schemes for energy refurbishment (off-shelf instruments, JESSICA, etc.). However these schemes focus on the financial feasibility and the bankability of projects, technical requirements or direct link to EPBD requirements promoting deep renovation are missing in many recent schemes. Energy performance and monitoring requirements to measure the achieved performance improvements shall be mainstreamed in financial support schemes co-financed by ESIF.

4. In your view, has the EPBD sufficiently contributed to accelerating investment in improving the energy performance of the EU's building stock? Why/Why not?

Yes, it contributed mainly through the energy certificate. Customers became more sensitive to energy efficiency than before and building energy quality is today a new selling point. Building owners and contractors invest more in energy savings, because it is recognised as an additional quality by the market. However it is observed that the lack of strict and regular surveillance schemes reduces the effect. The general public (including surveyors in the real estate sector) will in those cases be demotivated by the regulator not taking seriously the quality or/and availability of the energy certificate.

7. Has the EPBD effectively addressed the challenges of existing buildings' energy performance?

No. The EPBD didn't address sufficiently the challenge of reaching nZEB performance of the existing building stock. Most of the effort is spent on new nZEBs and not on the refurbishment of the existing building stock to nZEB level. Also there's a significant delay in the planning and implementation of national refurbishment strategies and the refurbishment related EED requirements. There's a need for more enforcement and for non-regulatory support for MS to set-up and successfully implement refurbishment strategies.

28. Is setting a minimum renovation target for Member States to undertake (e.g. each year; percentage of building stock) important and requires further attention in the context of meeting the goals of the EPBD?

Yes, setting binding renovation target is important but has to be done with care in order to define affordable, country specific targets taking the national and regional conditions into consideration. It is evident that real energy saving can be only achieved through the renovation of the actual building stock. However it is not enough to set up obligations and targets. The existing building stock does not have the same characteristics across Europe and the intervention policy is different in the MS (protected buildings, partially protected buildings, landscape protection constraints, etc.).

*29. Are obligations or **binding targets** for renovation or **any other mandatory measure** (e.g. mandatory minimum thermal efficiency standards for rental properties) **missing from the EPBD** to ensure that the directive meets its goals? If, yes, what kind of obligations and targets?*

No. There are more obligations and binding targets than what MS can comply with for the time being; therefore more attention shall be paid to compliance check, and the proper implementation of existing regulations.

Major renovations cannot be boosted by strict requirements only, but rather through renovation grants and other financial incentives. EPCs, if visible and providing correct data Quality Assurance are another mechanism boosting renovation.

VII. Operational management and maintenance

*77. Based on existing experience, does the EPBD promote the key ways to ensure that **buildings meet stringent efficiency targets in their operation**?*

No, the EPBD doesn't promote sufficiently energy efficiency improvements achieved through building operation and use. The introduction of intelligent metering and control systems when doing energy renovation shall be mandatory for every MS.

Energy (and cost) savings that can be achieved through efficient system control, maintenance and operation are among the most cost-efficient measures in the energy-efficiency arsenal. A kilowatt not needed is cheaper than any kilowatt produced, however efficiently. The HARMONAC and iSERVcmb projects proved that significant energy savings can be achieved by monitoring and benchmarking the operation of HVAC systems (33% saving of the total power demand). The EPBD shall better exploit the huge potential of energy savings that lies in optimised operation, as this is the most cost-effective way of improving energy performance and has also a positive effect on the energy consciousness of consumers and building users.

*78. Based on existing experience, does the EPBD promote the best way to **close the gap between designed and actual energy performance of buildings**?*

No. The EPBD does not promote the closing of the gap between designed and actual energy performance of buildings. To close the gap there is a need for mandatory building commissioning followed by the monitoring of actual operational performance to be required in MS level regulations. The EPBD shall promote this.

Actual differences between the designed and the real performance is weakly addressed by the EPBD, because it only mentions metering systems to monitor the real operation and does not oblige MS to have any verification policy (i.e. to check the compliances between declarations and realizations). The monitoring of real operation with intelligent metering systems shall be made mandatory in deep renovated or new buildings. Successfully monitoring can only be achieved when the non-EPB-use plug loads of the building are included. This can be handled by the current set of EPB standards however it was always excluded because of the limiting reference in the EPBD.

The impact of user behaviour is not addressed by the EPBD, which is a significant problem. Monitoring and user friendly control systems have to be better promoted by the regulation.

79. Based on existing experience, are the provisions provided by the EPBD to stimulate a proactive, innovative maintenance market effective?

NO. In the EPBD there is no clear distinction between inspection and maintenance, which are two separate measures. The EPBD actually targets only inspection. Inspectors and maintainers are different professionals. Thus there is no direct “stimulation” to develop an effective innovative maintenance market. There is a need to strengthen the role of proper maintenance, not only as an alternative to inspections but also as the best and most economical way towards good energy performance and indoor environment at the same time.

VIII. Financing energy efficiency investments

35. What non-financing barriers are there that hinder investments, and how can they be overcome?

The lack of knowledge and independent technical assistance and guidance to non-professional building owners both in public and private sector hinders investment. Building owners are often overwhelmed by manufacturers or consultants selling specific technologies as the best energy efficiency solution. They need reliable technical assistance not to be misled. For example the neZEH project showed the need for credible and independent technical assistance together with financial incentives. One of the recommendations of neZEH is setting-up of comprehensive consultancy services or energy help desks to guide hotel owners through the whole renovation process. They should provide independent, credible and evidence-based information on the available technical solutions; have knowledge about the available public and private financial support schemes as well as expertise in the design and implementation of refurbishment projects. This statement is likely to be true for other public and private sector building owners without technical capacity.

36. What are the best financing tools the EU could offer to help citizens and Member States facilitate deep renovations?

Incentive based logic is good and shall be mainstreamed. However renovation grants and other financial support schemes have to be linked to real and certified energy performance improvements (e.g. higher energy certificate classes). Existing good practices, like the German KfW renovation loan, or the Estonian KredEx scheme providing higher support for higher EP improvement, can be replicated in other MS to maximize energy performance improvements. It is of key importance to avoid incentives boosting renovation rates but not addressing energy performance (in principle, renovation may increase energy use, if EP is not addressed).

There's a need for better coordination between EPBD requirements on deep refurbishment and the available ESIF funds and MS level support schemes. DG REGIO provides guidance and technical assistance to MS in developing revolving funds for energy refurbishment (off-shelf instruments, JESSICA, etc.). However these schemes focus on the financial feasibility and the bankability of projects, performance requirements or a direct link to EPBD requirements promoting deep renovation are missing in many recent schemes (see e.g. the presentations on good practices at the Open Days workshop “Financing Energy Efficiency in Buildings, Heating and Cooling”, 14/10/2015 Brussels). Energy performance and monitoring requirements measuring the achieved performance improvements shall be mainstreamed in the financial support schemes co-financed by ESIF.

IX. Sustainability, competitiveness and skills in the construction sector

69. How does the construction sector cost-effectively demonstrate and check compliance with the EPBD while also upgrading the skill and knowledge of tradespeople and professionals?

Beside the Build Up Skills initiative for construction workers there is huge need for harmonised guidance, as well as training and qualification/certification schemes to continuously upgrade the skills and knowledge of white-collar professionals and also for schemes to guide and check the

quality of the work in the construction sector. There is a need to educate all parties involved in the life cycle of buildings, including conception, briefing, design, procurement, construction, operation, maintenance and ultimate disposal. Multiplier organisations and federations like REHVA can facilitate this process in a cost-effective way by transferring and sharing knowledge through its MS level members reaching more than 100.000 professionals across Europe. The ongoing PROF-TRAC project will show the benefits of such a European scheme. The development of similar initiatives shall be supported by the EC for promoting the adaptation and compliant use of CEN EPB standards a harmonised way.