Public Consultation on the Evaluation of Directive 2010/31/EU

Final synthesis report

ECOFYS
sustainable energy for everyone

Authors: Thomas Boermans, Katja Dinges, Jan Grözinger, Moritz Schäfer Sonja Förster, Andreas Hermelink, Ira Dorband, Bernhard von Manteuffel
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Unit C.3 — Energy Efficiency

E-mail: ENER-C3@ec.europa.eu

European Commission
B-1049 Brussels

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1. Introduction and Approach

In December 2002, the Energy Performance of Buildings Directive (EPBD) was adopted by the European Parliament and the European Council with the aim to lay down more concrete actions and with a view to achieving the great unrealised potential for energy savings while reducing the large differences between Member States in this sector. The EPBD acts as the main legislative instrument to promote the improvement of the overall energy performance of buildings in the EU. It lays down provisions to set and ensure minimum energy performance requirements, provide targeted information to consumers and to give financial incentives while removing barriers to improve energy performance of buildings.

The EBPD was the first directive on buildings to introduce binding requirements and can be considered as the "starting point" for an intervention of the EU in the building sector. Following the EC Action Plan for Energy Efficiency and the energy and climate framework for 2020 in 2006 and 2007, respectively, a recast of the EPBD was carried out and published in May 2010 in order to further reap the existing energy efficiency potentials in the building sector while retaining the same objective of the EPBD 2002. The recast of the EPBD widened the scope of the directive (by removal of the 1,000 m² threshold on renovation), introduced levels of ambition to be met in new buildings and in renovation (cost-optimal performance requirements and ensure that, by end of 2020, all new buildings are 'nearly zero energy buildings'), required the MS to address financing related to renovation and high performance buildings, and strengthened the provisions around energy performance certification and inspection of heating and air-conditioning systems.

The purpose of this analysis is to gain an in-depth view of the public opinion on the EPBD review. It is citizens, public authorities, organisations, companies, etc. who are responsible for or directly or indirectly affected by the implementation of the EPBD and other EU buildings regulations and it is them who should know best where those policies are most effective and work well and where the bottlenecks lie. It should reflect on the experience gained and progress made since the implementation of the directive and, furthermore, indicate future developments of the directive. Thus, the examination of the consultation is an important contribution to the evaluation and support the identification recommendations and conclusions on policy options that feed into the review process.

The public consultation ran from 30th of June to 31st of October 2015 and aimed at evaluating the current EPBD. The public consultation covered twelve sections including 79 questions. Ecofys was assigned to evaluate the responses in a quantitative and qualitative manner. All responses were entered into an evaluation matrix which was developed for the assessment of the public consultation. The evaluation matrix enabled us to quantitatively and qualitatively assess all answers while the evaluation method used was based on a qualitative content approach.

2. Responses to the Public Consultation

Between 30th of June to 31st of October 2015 308 stakeholders replied to the questions of the public consultation. As can be seen in Figure 1 more than half (58%) of the respondents were organisations followed by companies (20%) operating in the Member States of the European Union. Individuals, Public Authorities and others represent 7-8% of the respondents.

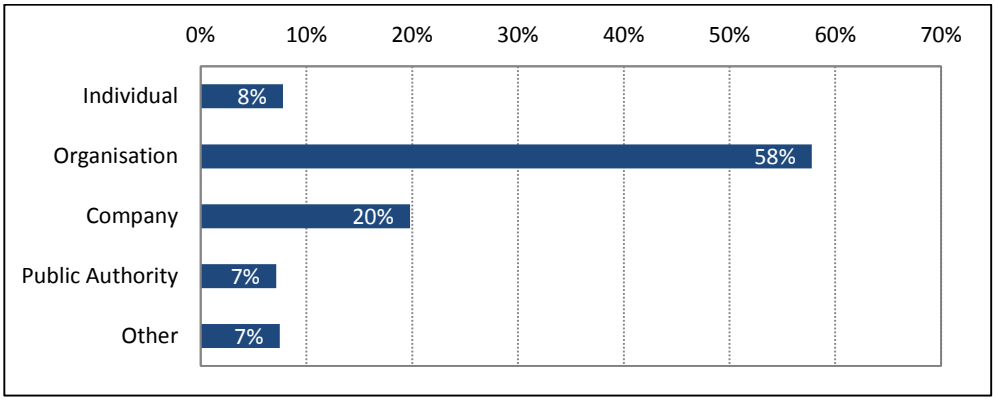

Figure 1: Type of respondents

The respondents of the public consultation cover all Member States of the European Union (Figure 2). Additionally, also responses from outside the EU have been submitted.

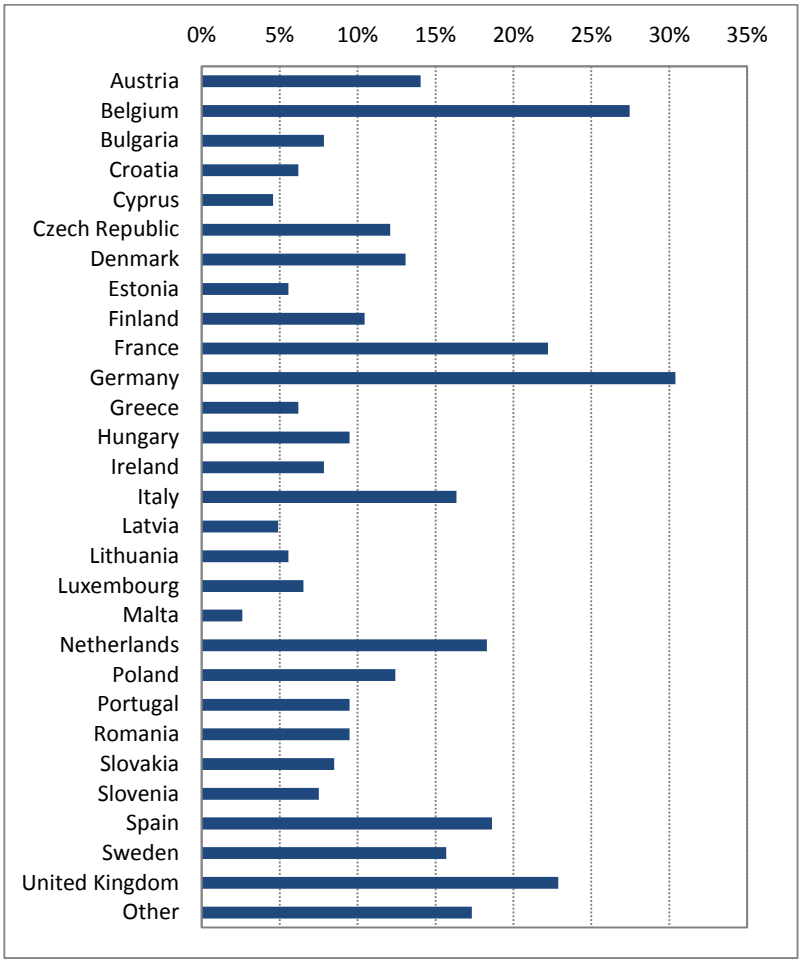

Figure 2: Percentage of contributions where respondents are active in a given Member State

3. Overall Summary of Responses

Many of the respondents state that the EPBD has set a good framework for improving energy performance in buildings and that it has raised awareness on energy consumption in buildings giving it a more prominent role in energy policy and its necessary contribution to 2030 and 2050 energy and climate targets. Almost half of the respondents think the EPBD has been successful while a third believes it has not. Several respondents said that it is too early to say how successful the EPBD has been or it is difficult to isolate its effect while others say that it is not effective as it could be, considering the huge potential in the building sector. The mentioned reasons for this are the delayed implementation in Member States, the slow uptake of measures and the low renovation rate. Several respondents also highlight the poor compliance and enforcement of measures while others recognise that the economic crisis in the construction sector has slowed improvements. It is stated by several respondents that the EPBD has been successful in improving energy performance for new buildings while it does not incentivise energy efficiency renovations.

Most respondents state that compliance with the provisions of the EPBD is not adequate and could be significantly improved. This also includes procedures and sanctions for non-compliance. The respondents stress that the impact of the EPCs on the rate and depth of renovation is very limited and cannot be used as a benchmark for asset value or a driver for renovation. It is also stated that EPCs could be designed as individual renovation roadmaps, covering the entire life cycle of a building, and should be linked to improved access to finance.

Related to the question for the main reasons for the insufficient take-up of the financing available for energy efficiency in buildings, barriers mentioned are the complexity of the renovation decision-making process as such, which requires insight and decisions not only of financial nature but also of technical, organisational and legal nature. Further reasons mentioned are also insufficient awareness of the benefits of efficient buildings, caused by a lack of information and advertising, split incentives (landlord/tenant issue) that is not properly addressed and the complexity of financing tools, which lacks adequate promotion and information and therefore is difficult to understand for non-professionals.

Stakeholders also see a lack of consumer demand, which is also linked to the absence of long term goals, e.g. building owners are not yet convinced that all existing buildings will have to be renovated, at a certain moment, to a certain level, but also lack of trust towards the achieved financial benefits.

Generally, the importance of energy efficiency and renovation measures for tackling energy poverty is increasingly acknowledged. It is also stated that the integration of long-term health, energy poverty and building renovation strategies is desirable.

Related to the question what the best policies at district and city level for increasing energy efficiency and use of renewable energy in buildings would be, basically three types of recommendations can be distinguished. Various recommendations stress the need to follow the Energy Efficiency First principle and trias energetica, in a way that once heating and cooling energy needs are minimized through demand reduction from the building envelope, the opportunities offered by the surrounding environment should be considered.

Further respondents state that within an integrated approach, thermal grids can increase the efficiency of the system as a whole and of buildings as such and that at the same time, district heating and cooling can improve the utilisation of available resources such as residual heat, renewable heat and surplus electricity.

Finally, other respondents take position that in order to realize energy efficiency improvements in the building sector and increase the amount of renewable energy an approach needs to be taken that focuses on the reduction of primary energy at system level.

In organisational terms, respondents state that first local authorities have to gain an overview of the local building stock and its energy performance and that a thorough monitoring of progress, coupled with a long-term vision, are key elements to ensure an improvement at the district and city level.

4. Summary of Responses per Section

4.1 Overall Assessment (question 1-16)

1. How successful has the EPBD been in achieving on its goals?

Many of the respondents state that the EPBD has set a good framework for improving energy performance in buildings and that it has raised awareness on energy consumption in buildings giving it a more prominent role in energy policy and its necessary contribution to 2030 and 2050 energy and climate targets. Almost half of the respondents think the EPBD has been successful while about a third believes it has not. Several respondents said that it is too early to say how successful the EPBD has been or it is difficult to isolate its effect while others say that it is not effective as it could be, considering the huge potential in the building sector. The mentioned reasons for this are the delayed implementation in Member States, the slow uptake of measures and the low renovation rate. Several respondents also highlight the poor compliance and enforcement of measures while others recognise that the economic crisis in the construction sector has slowed improvements. It is stated by several respondents that the EPBD has been successful in improving energy performance for new buildings while it does not incentivise energy efficiency renovations. Some say that the NZEBs are not understood very well and that there remains a performance gap between the theoretical (legislation on paper) and the real potential in many MS.

2. Has it helped improve energy efficiency in buildings?

Most of the respondents clearly say that the EPBD has helped to improve energy efficiency in buildings. It is often stated that the EPBD has created an important vision and legal framework and has been a driver for the demand of energy efficiency in buildings. It is also mentioned that the EPBD has driven innovation in the construction sector. Similar to the above question, several respondents are missing evidence for energy efficiency improvements in terms of statistics or evaluations. The EPBD has defined minimum energy performance requirements that have imposed new design criteria for buildings but several respondents say that the EPBD only improved energy efficiency in new not in existing buildings. But several say that there is a great potential not yet exploited and more efforts have to be made, e.g. in the existing buildings or building automation[1]. Several respondents also would like the scope of the EPBD to be widened to district and city level. NZEB are perceived as an important tool to improve energy efficiency but many mention that the definition of "nearly zero" is not clearly defined.

[1] Waide Strategic Efficiency et al., 2014

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

Most respondents state that the EPBD has not sufficiently incentivised an increase in renovation rate. Several refer to the BPIE study[2] showing that with the current renovation rate only 40% of the building stock would be renovated and would not meet EU's ambition to renovate the whole building stock until 2050. One respondent states in the consultation that there is insufficient evidence to state what the actual renovation rate is and whether it has increased or not as a result of the EPBD. Some of the reasons for the low renovation rate which are mentioned by respondents are the economic situation in MS, split incentives, no linking of financial incentives with the recommendations of the EPCs and that the EPBD does not include any mandatory requirements to carry out refurbishments. Several respondents indicate that not only the renovation rate but also the depth of renovation that should be focussed on. One respondent recommends that MS should report on renovation market activity in their NEEAPs while at the same time developing harmonised and strict definitions on renovations.

One respondent says that this has not been the intention of the EPBD and that this will "require additional financial, fiscal and other incentives, and strengthening of the rather weak Art. 4 in the EED, which concerns renovation roadmaps and long-term strategies."

[2] BPIE, 2011

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?

Several respondents say that the EPBD has not sufficiently contributed to accelerating investment in improving the energy performance of the EU's building stock. However, some say that it has partly contributed, e.g. to the design of new investment facilities or through the introduction of EPCs and NZEBs. But for some of these tools a performance gap remains which does not fully exploit the potential of these tools. Again for this question the economic crisis is mentioned by some stakeholders as one of the reasons for it. The findings of the EEFIG report that €60-100 billion is needed to be invested annually in EU buildings to achieve Europe's energy efficiency targets are widely acknowledged[3].

Respondents that consider that the EPBD did not sufficiently contribute to accelerate investments mention several reasons such as high upfront investments for (deep) renovation, too unspecific requirements for renovation, the fact that the control of compliance with the requirements is left to the MS. Other reasons that are mentioned are lack of awareness by the building owner of efficiency as a clear, immediate advantage.

[3] EEFIG, 2015

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

Most respondents think that the EPBD is at least partly contributing to cost-effective improvements of energy performance (sometimes the reason is seen in its cost-effectiveness principle (Article 5). Some respondents find it essential that no particular technologies are prescribed by the Directive.

Several respondents say that this is especially the case for new buildings whereas it is not contributing to improvements for existing building stock. It is also mentioned that the improvements mainly take place in MS where there have not been ambitious energy performance requirements in place. Some stakeholders say that it is difficult to assess as a clear definition of cost-effectiveness is missing. Others say that a "it would be advisable to develop more harmonized guidance on cost-optimal calculation to ensure greater convergence in parameters used, more transparency on input data (e.g. costs), the accounting of societal benefits of increased energy performance, the need to input energy consumption generated by lighting for calculations on residential buildings, […]).

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?

Respondents clearly disagree that the aim of ensuring the same level of ambition across the EU in setting minimum energy performance requirements has been met. As an example NZEB levels are mentioned which range between 20–200 kWh/m2/yr[4] in primary energy use and cannot be explained by the differences in climatic conditions alone. Some mention that MS have just moved to cost-optimal energy performance requirements and MS have interpreted the requirements of the EPBD in different ways.

Other respondents agree on the argument that due to "different climatic conditions, buildings styles and traditions different levels of energy efficiency" and thus different optimization goals (heat protection in the North and preventing overheating in the South) it does not make sense to implement the same energy performance requirement across all the Member States.

[4] ECOFYS, 2014b

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

Most of the respondents do not think the EPBD has effectively addressed the challenges of existing buildings' energy performance. It is said that while the EPBD gives a clear path for new buildings towards NZEB there is no such goal for existing buildings. Recommendations that given are: "adopting a legally binding definition of "deep renovation", rather than solely using the definition of "major renovation" for applying MEPR" or "more enforcement and non-regulatory support for MS to set-up and successfully implement refurbishment strategies"

8. Has the EPBD set effective energy performance standards for new buildings?

As mentioned above a clear majority of the respondents sees effective energy performance standards for new buildings, especially through cost-optimality approach for minimum requirements and NZEB. But as mentioned before more guidance and clarity on NZEB definition is asked for by several participants.

Other respondents mention that the gap between predictions and real performance (high energy performance buildings that do not deliver on their design expectations) is not tackled in the current legislation.

9. Will the 'nearly zero energy buildings' targets be met? Why/Why not?

There is no clear picture from the consultation whether the NZEB targets will be met. Several respondents say that targets might be reached but it highly depends on the definition of NZEB. Others say that especially the slow implementation in several MS is a risk to achieve the targets.

Several respondents state that most MS delayed the introduction of intermediary levels for NZEB. Some respondents consider it important to develop a roadmap and thus giving investors and market players the regulatory predictability and stability needed to drive improvements.

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?

Most respondents to the question think that EPCs have been successful in their prime purpose: to inform and empower building users and owners to make informed choices on the way they consume energy. While some say there is not sufficient evidence on how much renovation EPCs have triggered others say that this "renovation accelerator" role has not been fulfilled due to the lack of quality and recommendations which are neither tailor-made nor part of a holistic plan for the building. However, several mention a growing impact of EPCs on the value of properties.[5]

Some respondents say that still work is required for improving the quality and for including all energy uses (not only building envelope, but all technical systems that have an impact on the energy use of the building) ion the EPCs. Some respondents indicate the theoretical nature of the EPC. It is recommended to improve the link between EPCs and access to financing (e.g. linking the EPC to an interest rate, or providing an EPC for free to owners who decide to renovate their buildings into NZEB). Another respondent recommends to improve the competences of the energy auditors and certifiers.

[5] Bio Intelligence Service, 2013

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

There have been several issues raised to the question what has worked well in the EPBD and what not. The most prominent replies for what has worked well are increasing awareness for energy efficiency in the building sector, the setting of minimum energy performance requirements at cost-optimal level and the introduction of NZEB for new buildings. There have also been several replies to what has not worked well which include an inconsistent implementation of the EPBD across EU MS, the poor quality of EPCs, the missing increase in renovation rate, national compliance and enforcement, the missing definition of NZEB and an improved use of financing instruments.

12. Is the EPBD helping to contribute to the goals of EU climate and energy policy (Reduce greenhouse gas emissions by at least 40%; increasing the share of renewable energy to at least 27%; increasing energy efficiency by at least 27%; reform of the EU emission trading system)?

A majority of the respondents thinks that the EPBD is contributing to EU climate and energy goals but that the EPBD could and should do more to tap the large energy savings potential in the building sector. Especially the need to better address the existing building stock and to strengthen the current EPBD through more ambition, better implementation and enforcement are key arguments.

13. Is it in line with subsidiarity? What should continue to be tackled at EU level and what could be achieved better at national level?

A majority of respondents states that the EPBD is in line with subsidiarity as it sets a vision and leaves the details at MS level. Energy efficiency and the moderation of energy demand is seen as a clear EU competence by many. Many respondents believe that the current flexibility should be kept especially for implementation, setting energy performance requirements including national conditions and enforcement. But it is also mentioned, that while flexibility is needed, implementation must be in close cooperation with EC. There are also stakeholders who state that the large flexibility also leads to inefficiencies. Several respondents say that NZEB should be defined at EU level.

14. Are the objectives of the EPBD delivered efficiently?

Several respondents think that the objectives of the EPBD – the improvement of energy performance in buildings - are partly delivered efficiently. The main reasons for this are the economic crisis, the delay of MS in transposing the directive and that NZEB have not been fully clear. The EPBD recast is recognised by some to have had a strengthening approach of achieving the objectives. Some stakeholders think that more guidance by EC is needed to achieve the objectives more efficiently.

15. Has the EPBD created any unnecessary administrative burdens? If so, please provide examples

While the majority of respondents agrees that the EPBD has created administrative burdens not all of them think they are unnecessary or only unnecessary at current status. The example most often provided for this are EPCs. Some stakeholders think that EPCs are unnecessary administrative burdens and it should be reviewed if EPCs should still be mandatory for new buildings after 2020 when NZEB standard is in place. Others argue that EPCs can be perceived as unnecessary administrative burden at the moment but could be transposed into an effective tool. Good examples mentioned are the Display Campaign and the Portuguese EPC database run by ADEME.

16. Has the EPBD created any unnecessary regulatory burdens? If so, please provide examples

Several respondents say that any adaptation of building requirements require some regulatory effort. Others even state that if it had created regulatory burdens, they cannot be considered unnecessary in the light of the energy saving potential of the building sector. One respondent states the regulations that the EPBD results in, such as building codes, their review, and their revision are among the most cost-effective tools for realising the savings potential that are available to MS. On the other hand, there are examples provided such as the need for external experts for EPCs while the EED allows for in-house experts on energy audits[6] or the carrying out of feasibility studies of high-efficiency alternative system regardless of the surface of the building.

[6] The European Parliament and the Council of the European Union 2012, EED recital 25

4.2 Facilitating enforcement and compliance (question 17-24)

17. Is compliance with the provisions of the EPBD adequate?

Most respondents state that compliance with the provisions of the EPBD is not adequate and could be significantly improved. Compliance issues are especially noted for the definition of NZEBs, the lodging of EPC and the quality of work. Several refer to a poll by DENEFF[7] which states that 70% of German companies find the implementation of EU legislation an important driver in the energy efficiency field. Respondents note that compliance is not a matter of quantity, but quality. Therefore, quality requirements and monitoring of compliance both in national legislation and on EU level should be promoted. This also includes procedures and sanctions for non-compliance. Currently, only 50% of the MS monitor compliance of new buildings with energy performance requirements[8].

[7] Branchenmonitor Energieeffizienz 2014, May 2014
[8] BPIE, 2014b

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

The majority of respondents finds the definition of NZEBs in the EPBD not sufficiently clear. Several respondents highlight that the NZEB requirement values vary to a great extent between different Member States. Reasons for this are different parameters used for the definition of an NZEB, as well as for the input data used to calculate the NZEB requirements. Even though conditions and the building stock in Member States vary, many terms in the definition (e.g. "significant share") are too vague and therefore subject to interpretation. To overcome this issue, some respondents suggest to put energy efficiency as foremost criterion for NZEBs and renewable energy as secondary criterion.

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

Most respondents state that the NZEB target in the EPBD is not sufficiently clear to be met as the definition of NZEBs is not clear. Respondents think that the NZEB target for new buildings is however clearer than for the transformation of the existing building stock. One respondent states that the target is clear, but not specific enough. The target can be met, however, the resulting building solution may not be the best practice possible. Requirements concerning the contribution from energy efficient fabric, building design and from the services and renewable sources of energy could be more specific. Some stakeholders suggest that intermediate milestones for Member States are needed as deadlines included in Article 9(1) of the EPBD are not sufficiently clear. Furthermore, one stakeholder emphasizes that MS might need more guidance on how to transpose the NZEB targets into national legislation.

20. If not, 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?

Missing factors according to respondents are:

    a. Energy performance targets for different building types taking into account the climatic context, improved and harmonised requirements for qualification of certifiers including training, testing of issued EPCs.
    b. Inclusion of further benefits into the definition, harmonisation of EPC calculations, development of national databases with building data, long term and intermediate targets, on-site compliance and quality checks.
    c. Use of the energy balance approach (specifically for windows), introduction of minimum energy performance requirement at point of sale/lease, fines for non-compliance, installation of effective controls, long term renovation strategies.
    d. Integrated systems approach, technology neutrality, guidelines for understanding the contribution of renewable energy sources in NZEBs.
    e. Development of "building passports", attention to performance gap, high quality of certifier, clear control procedures to verify that buildings comply with EPC.
    f. Mandatory inspections of heating systems including control functions (automation, monitoring and follow-up), quality insurance combined with financial incentives.

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?

Respondents have a divided opinion on whether 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. While some argue that cost optimality has especially helped Member States with lower requirements in effectively enhancing building codes, others argue that the cost-optimum methodology does not correspond to economic efficiency calculations, especially given the low energy prices.

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?

Respondents often refer to an analysis by BPIE[9] with regard to cost-effective measures for ensuring compliance at local and regional level that could be replicated on a larger scale. Among others, these are: checking EPCs at completion, preliminary certification for new and renovated buildings (which will be replaced at a later stage), standard formats for data input and calculations, automatic checks in calculation software, product databases and catalogues of construction methods, airtightness tests and a penalty system for non-compliance. Some respondents state that some short contributions can also come with evidence10. Generally respondents consider means for measurement and verification as well as data collection and use of databases a prerequisite for cost-effective compliance.

[9] BPIE, 2014b
[10] Energicentrum, 2012

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

Respondents agree that the various calculation methodologies have led to large differences between energy certificates and energy performance classification of similar buildings in different EU countries, and even to differences within one country. For example, DIN, NEN and UNI with the DIN V 18599 series, the Dutch EN 7120 and the UNI-TS 11300 series are national deviations from the CEN-EPBD standards package. There is no technical or economic justification for different calculation procedures. A requirement to use the EPBD standards will support the harmonisation of the assessment procedures and support more cost-effective technologies to be developed for a harmonized EU-market.

24. What measures are missing that could simplify the implementation of building regulations to make sure that buildings meet the required high energy performance levels?

Respondents list the following measures: innovation including research and development, quality schemes including training, communication and dissemination activities including sharing of lessons among countries, best practice examples, a stronger focus on quarters and not individual buildings and financial incentives. One respondent suggests that detailed compliance checks by qualified professionals might avoid expensive mistakes and improve the quality of constructions and renovations.

4.3 Energy Performance Certificates and stimulating energy efficient renovation of the building stock (question 25-33)

25. Are the available data on the national/regional building stock sufficient to give a clear picture of the energy performance of the EU's building stock, as well as the market uptake of energy efficiency technologies and the improvement of the energy performance of buildings in the EU?

Respondents agree that the availability and reliability of building data vary across MS. Data mostly are not collected in a systematic way and comparison between MS are difficult. It is stated that data collection and reporting standards across EU must be aligned across EU. Standardised methodologies and formats for data gathering and assessment as well as reporting of high level data are thereby essential. In addition, a centrally managed register for energy performance of buildings would help to monitor the improvements of energy performance of buildings over time and to design appropriate policies. Some respondents recommend that EC provide guidance for MS with regards to develop EPC databases on national level and support the assessment of those.

26. Are the long-term national renovation strategies adopted sufficient to stimulate the renovation of national building stock? What examples of best practice could be promoted across the EU and how?

The respondents estimate that the renovation strategies lack a clear long-term strategy that lead to a significant upturn in renovation activities. It is not transparent how these strategies are put into practice including financing options. They mostly include a catalogue of current measures. Moreover, some respondents criticise a lack of concertation and political engagement around these strategies. Most respondents recommend what the long-term national renovation strategies should include, above all, a long-term objective, road map to at least 2030 indicating key data, a number of policy and financing instruments to implement the strategy and a stakeholder process. Individual statements emphasize that co-benefits need to be better quantified and a more coherent approach is needed aligning Art. 4 and 5 EED with Art. 9(3) EBPD.

As best practice examples are mentioned e.g. Denmark (good concertation process), France (requirement to do EE work at the same time as maintenance work is carried out (from 2017), Germany: KfW building renovation programme; UK: subsidies paid directly to installers (ECO - Energy Company Obligation).

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?

The respondents stress that the impact of the EPCs on the rate and depth of renovation is very limited. They cannot be used as a benchmark for asset value or a driver for renovation. Even if few respondents underline a certain positive impact on the value of the buildings in some MS. Some respondents state that EPCs are a powerful enabling mechanism but in practice, their potential is very far from being realised.

The quality of asset rating and performance rating in EPCs is estimated differently among the respondents. Only half of the MS have included performance rating in their EPC calculation methodology. The convergence of national calculation methodologies and input data must be improved. Using a combination of asset rating and performance rating is often recommended. It is also stated that EPCs could be turned into "dynamic building passports" (like individual renovation roadmaps), covering the entire life cycle of a building, and should be linked to improved access to finance.

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?

A clear majority of respondents advocates a minimum renovation target in order to achieve the goals of the EPBD considering both the rate and the depth of renovation. Some respondents propose as a first step that the minimum renovation rate included in Art. 5 EED is extended to all public buildings. Part of the respondents refer to the necessity that applying to all buildings a target setting must be accompanied by appropriate financial mechanisms and by regulatory requirements like the removal of possibility to rent out the most inefficient buildings (in UK from 2018).

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?

Respondents have a divided opinion on obligations and binding targets for renovation. Some favour mandatory requirements. Hereby, "trigger points" should be used to undertake energy savings work, e.g. integrating energy renovation into other types of work (equipment, aesthetic, technical etc.) recently adopted in France or phasing-out the worst performing buildings. Once well-designed renovation strategies are adopted and implemented, with a long-term perspective and in coordination with the national building renovation strategies (Art. 4 EED), renovation targets (on rate and depth) should be put in practice. But in all, a right balance between incentives and regulatory milestones has to be chosen. Occasionally, it has been proposed that annual reporting obligations for Member States are introduced in order to enforce the market surveillance. Other respondents point out that voluntary elements seem to be more effective like sectoral and regional agreements.

30. Are EPCs designed in a way that makes it easy to compare and harmonise them across EU Member States?

There is a high agreement among respondents that the current EPCs are designed at national level and do not allow for comparison or harmonisation. This is especially as calculation methods and qualification of experts is different among Member States or even regions. While several would favour such a harmonisation taking into account climatic differences others do not see the necessity of an EU wide harmonisation. One respondent recommends that benchmarking based on harmonised standards should be mandated to be effective but binding targets on achieved performance should be agreed at national level. But it is stressed that an ´open data´ policy must be mandated for such a framework.

Some mentioned that the quality of the EPCs should be focussed on first.

Some participants also mention the need for the voluntary European certification scheme for commercial buildings which still has to be developed. They do recognise that work on this has started.

31. Do you think that the 'staged deep renovation' concept is clear enough in the EPBD?

Many respondents indicate that there is no definition of ‘staged deep renovation’ in EPBD but only mentioned in EED Art. 4c and rec 16. There are different definitions on MS level and a more clear definition would be desirable. A staged deep renovation concept has to be understood in relation to a targeted level of performance after renovation. A holistic renovation plan remain the prerequisite for a successful implementation of a staged deep renovation. One respondent specifies that the plan is based on Life Cycle Costs Analysis (or simple payback periods) and determines short, medium and long-term actions which have to be applied successively.

32. Have EPCs raised awareness among building owners and tenants of cost-efficient ways of improving the energy performance of the buildings and, as a consequence, help to increase renovation rates across the EU?

The awareness level of the value of an EPC across tenants is still low. Real estate agents are often not showing an EPC to the new owner or tenants. Furthermore, tailor-made recommendations incl. multiple benefits are missing from the EPC. Many respondents therefore suggest tools like individual renovation roadmaps or renovation passports which provide a clear understanding of possibly expected costs and benefits (like energy savings but also indoor air quality, health, comfort) and would raise a better awareness among owners and tenants how to improve the energy performance of the buildings. Some respondents mention as a possibility to address this market failure to include the assessment of heating systems as mandatory requirement and/or to link EPCs to the access to finance in a greater extent.

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?

The opinions of the respondents are divided. Some respondents also support making EPCs mandatory for all buildings but highlight that improved quality and full implementation of EPC should be ensured at first. In addition, it could also have positive effects on mapping the building stock and monitor the impact. Other respondents stress that the original intent for EPCs was to impact purchase and rental decisions. Building renovation is still most likely to occur at the phase of rent out or sold. And owners cannot see an immediate benefit for them.

4.4 Smart Finance for Smart Buildings: Financing energy efficiency and renewable energy in buildings and creation of markets (question 34-41)

34. What are the main reasons for the insufficient take-up of the financing available for energy efficiency in buildings?

Barriers mentioned are the complexity of the renovation decision-making process as such, which requires insight and decisions not only of financial nature but also of technical, organisational and legal nature.

Further reasons mentioned are also insufficient awareness of the benefits of efficient buildings, caused by a lack of information and advertising, split incentives (landlord/tenant issue) that is not properly addressed and the complexity of financing tools, which lacks adequate promotion and information and therefore is difficult to understand for non-professionals.

Stakeholders also see a lack of consumer demand, which is also linked to the absence of long term goals, e.g. building owners are not yet convinced that all existing buildings will have to be renovated, at a certain moment, to a certain level, but also lack of trust towards the achieved financial benefits. Also the age structure of building owners is mentioned that are hesitant to enter into long term financing agreements.

Other respondents state that a barrier is that "energy efficiency is not yet been mainstreamed in mortgage affordability calculations and that the profile of energy efficiency investments has not been raised among sectors of the economy with capacity to invest and drive the market, such as large companies". Some respondents mention the low oil prices as a barrier (external factor).

Several stakeholders refer to and/or support the recommendations of the EEFIC report[11]: long term and stable regulatory framework, a 'one stop shop' access with expert advice for renovation, and financing options for building segments (sources, see here: [12] [13]).

[11] EEFIG, 2015
[12] UKGBC, 2014
[13] EIU, 2013

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

The respondents see barriers in insufficient price signals (energy prices rather decreased and higher value of high performing building is not recognized), insufficient regulatory signals, and the complexity, and quality of the offers by building professionals. As important aspect also the lack of long term political objectives are mentioned several times that hampers individual long term planning and investment decisions and can lead to realisation of small scale measures only. Barriers are also seen in a lack of a continuous support of building owners from selection of renovation options and economic calculations to recommendations for communication with tenants and support in the implementation. A barrier is also seen in the lack of track record of building renovation, where a role is seen for the European Commission to initiate the development of such evidence, rather than light house projects. More evidence of successful projects is mentioned to reduce the risk assessment and transaction costs and improve standardization of procedures such as energy performance contracting. Further aspects mentioned are that the EUROSTAT reporting rules hamper public authorities with high debt ratios to launch wide-scale investment programs in energy efficiency.

Some respondents refer to the *Breaking Barriers*[14] and also to the *Performance Energétique du Bâtiment - Programme de rénovation thermique du parc existant 2015-2050* report[15]. Other respondents cite two BPIE studies: *State of Play of Financial Instruments*[16] and the *Europe's Buildings under the Microscope*[17].

[14] NEF, 2014
[15] The Shift Project, 2013
[16] BPIE, 2012
[17] BPIE, 2011

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

As important tools, national finance mechanisms providing long-term access to soft loans and default guarantees are mentioned to have to be established that make maximum use of EU funds and national revenues, inter alia from auctioning of ETS allowances, including the principle of revolving funds.

As further mechanisms to be considered, tax exemptions (also from regional and local taxes), VAT reduction for renovation works (including private, non-social housing), Property tax reductions linked to EPCs, lower or graduated interest rates linked with deeper renovation projects and/or NZEBs, A salary sacrifice scheme (as developed in Ireland by the Sustainable Energy Authority), risk-sharing facilities, First-loss guarantee funds and On-bill financing (such as PACE in the US), green bonds (possibly based on an EU Carbon Counting methodology, like ASE in the US), mandatory earmarking of more EU ETS auctioning revenues or building renovations, linking EPBD financing requirements to building renovation in Articles 4 and 7 of the EED, emissions reductions obligations for MSs in buildings as set out in the ESD and ensuring subsidy schemes that focus on those works realised by qualified professionals (e.g. RGE/eco-conditionality scheme in France) are mentioned.

The EFSI fund and the continued support for aggregate project as is the case of Energie Positif (FR) and the EEEF are mentioned as important funds that have proven to work. The EEFIG Report[18] (Energy Efficiency – the first fuel for the EU Economy - How to drive new finance for energy efficiency investments, February 2015) is mentioned several times to hold valuable information about financial instruments.

[18] EEFIG, 2015

37. What role do current national subsidies for fossil fuels have in supporting energy efficient buildings?

Respondents widely agree that current national subsidies for fossil fuels, along with regulated prices, are a serious barrier to energy efficiency and fuel switch to renewable heating technologies, distort market price setting and should be phased out. As an alternative some respondents stress the need to shift public funds away from supporting income and heating subsidies towards supporting effective renovation measures are recommended.

As sources of information/evidence the studies "Alleviating Fuel Poverty in the EU"[19] and the European Commission (EC) study "Subsidies and costs of EU energy"[20] and a recent report from the International Monetary Fund[21] report on the need to remove fossil fuel subsidies are mentioned.

[19] ONPE, 2014
[20] ECOFYS, 2014a
[21] IMF, 2015

38. Have energy efficiency and renewable energy projects been combined to maximise their financing? How can the EU help?

The majority of respondents states that renewable energy and energy efficiency measures face similar barriers and can generate synergies in financing and implementation, but that these synergies have not been fully exploited yet.

At the same time, respondents stress that for the combination of energy efficiency and renewable energy measures, there is no one-size fits all solution and that circumstances have to be taken into account case-by-case to develop cost-optimal solutions.

Various respondents also stress the opportunities of high efficient buildings with low energy demands as integral parts of the future renewable energy system and e.g. support the concept of smart buildings as defined by EuroACE[22] which sees buildings as part of the wider energy system and recognises the local environment and energy mix. In this context a smart building is described as one that is well designed, has low intrinsic energy demand, is comfortable (and has a healthy indoor environment), has the right materials and equipment, connected to the grid and has a cost-effective use of renewable energy sources and can ultimately empower the consumer to take the best decision for them and their situation.

Several respondents encourage the EU to continue its efforts on heating and cooling and adopt EU binding measures to exploit the synergies between RES and energy efficiency.

A respondent points out that ”support for combined projects linking the utilisation of available resources such as renewable and residual heat and energy saving measures onsite has been limited, thereby failing to seize the apparent energies of joint actions. Most funds aim either at individual buildings or infrastructure only. EU funds for district-level development must be increased in order to support municipalities and other regional actors in their efforts to realize integrated development plans.”

[22] EuroACE, 2015

39. How is investment in high-performing buildings stimulated and what is being undertaken to gradually phase out the worst performing buildings? Is it sufficient?

Respondents in majority share the view that investments in high-performing buildings and especially gradually phasing out of worst performing buildings is not sufficient.

Most of the respondents agree that the most effective ways of phasing out worst performing buildings is to develop a long term ambition for the EU building stock, leading to national long term national strategies (as required under the EED) in which a progressive regulatory framework to meet the long term goals, incentives, financing, and targeted information are combined.

As example of schemes to support investment in high performing buildings and to gradually phase out worst performing buildings, schemes such as zero energy retrofits of social housing at zero cost for tenants (e.g. "Stroomversnelling" programme in Netherlands), revolving loan funds (e.g. KredEx in Estonia), large scale national programmes incentivising deeper renovation (e.g. KfW in Germany), renovation programmes addressing specifically fuel poverty (e.g. Habiteur Mieux in France) and energy performance contracting for the public sector (e.g. the Carbon and Energy Fund in United Kingdom) are mentioned by respondents.

Some respondents say that most of the different national or regional subsidy schemes that exist do not have as a target high-performing buildings and "often their funding is not sufficient, very complicated to apply for, or has a very limited life time."

40. What is being undertaken to solve the problem of 'split incentives' (between the owner and the tenant) that hampers deep renovations? Is it sufficient?

Most respondents express that the issue of 'split incentives' is not sufficiently taken into account yet, referring e.g. to information from JRC that 65% of European buildings face split incentives or to findings of the Coalition for Energy Savings recently published an analysis of the National Energy Efficiency Action Plans[23] in the context of Article 19 of EU Energy Efficiency Directive (EED) reporting that the barriers mostly reported by MSs are those related to split incentives. Solutions to split incentives frequently mentioned by respondents are (partly based on Joint Research Centre, Overcoming the split incentive barrier in the building sector, 2014 and the analysis of the National Energy Efficiency Action Plans published by the Coalition for Energy Savings in September 2015) to introduce a minimum standard for rental properties tied e.g. with specific financing support schemes for owners (e.g. UK, Flanders in Belgium), revise rent acts to introduce flexibility which would allow voluntary agreements between landlords and tenants or in multi-owner buildings, and would make it easier to redistribute benefits, introduce green Leases (e.g. France Energy Transition Law Article 14, Emilia Romagna in Italy, Netherlands), introduce mandatory EPCs for all buildings in order to increase awareness and provide more information to a wider public, to improve skills of professionals (certifiers and auditors) to increase trust in their advice among consumers, to develop specific financing schemes for multi-owner buildings (e.g. Netherlands, Bulgaria, Latvia) and on-bill financing.

[23] The Coalition for Energy Savings, 2015

41. Was

a. the scaling-up of existing funds sufficient to meet the goals of the EPBD?
b. the creation of aggregated facilities (through standardisation of Energy Performance Contracts and clarification of regulatory, fiscal and accounting issues) sufficient to meet the goals of the EPBD?

On question a, most respondents stated that the scaling-up of existing funds was not sufficient to meet EPBD goals and mentioned e.g. the need for better coordination between EPBD requirements on deep refurbishment and the available ESIF funds and MS level support schemes. Respondents also stated that DG REGIO provides guidance and technical assistance to MS in developing revolving funds for energy refurbishment (off-shelf instruments, JESSICA, etc.), but that 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. On the question whether the creation of aggregated facilities (through standardisation of Energy Performance Contracts and clarification of regulatory, fiscal and accounting issues) was sufficient to meet the goals of the EPBD some respondents agree and some disagree. Respondents that do not agree indicate that lack of awareness and knowledge in combination with regulatory and accounting barriers make it difficult for the Energy Performance Contracting market to evolve.

4.5 Energy poverty and affordability of housing (question 42-45)

42. What measures have been taken in the housing sector to address energy poverty?

The opportunity to reduce energy poverty through energy efficiency measures in buildings has been recognized in several Member States. Among others, the UK, France, Ireland and Romania have implemented programs to support measures to improve the energy performance of low-income and, thereby, fuel poor homes. However, according to BPIE, such energy poverty schemes mostly remain stand-alone instruments and are not integrated in a broader strategy on national or even on EU level[24]. The majority of national schemes to reduce energy poverty in Member States still focuses on fuel, heating and electricity subsidies and other income support schemes. Moreover, some Member States, like Spain have not yet taken any concrete measures to combat energy poverty. Other countries, like Germany, have talked energy poverty successfully through general social welfare laws (e.g. Hartz IV in Germany). Generally, in order to avoid energy poverty, requirements should resemble the cost-optimal level from the building users' perspective. Requirements which are more ambitious than the return on investment will lead to increased poverty[25].

[24] BPIE, 2014a

[25] Fraunhofer IBP, 2014

43. Should have further measures tackling energy poverty been included in the EPBD?

Respondents are rather divided on this issue. A slight majority acknowledges the opportunities for the EPBD to also tackle energy poverty while others share that fuel poverty may fit better into the EED rather than the EPBD. Opportunities in the EPBD are, for example, that databases established through national EPC registries enable the mapping and identification of energy poverty risk areas. Furthermore, the further inclusion and definition of energy poverty in the EPBD could raise awareness to the issue as, one respondent finds that less than a third of the Member States officially recognizes the concept[26]. There is also some agreement among respondents that the EPBD could encourage MS to better integrate national long-term health, energy poverty and building renovation strategies and respective funding schemes. One respondent recommends the development of new business models (e.g. leasing of heating devices like micro-CHP) to reduce energy poverty.

[26] Insight_E, 2015

44. Has tackling energy poverty been a requirements when constructing new buildings and renovating existing buildings in Member States?

Respondents mostly agree that currently, throughout EU Member States, requirements for new construction and renovations are primarily referring to energy and environment related aspects and do not take into consideration social aspects, such as energy poverty. Mentioned exceptions are, for example, the French Energy Transition Law which states that half of future building retrofits should focus on low-income housing and the UK Fuel Poverty Strategy as many fuel poor homes as practicable should meet the minimum of EPC band C by 2030.

45. Are energy costs for heating and air conditioning being made available to interested buyers/tenants?

Many respondents criticize that, in general, property owners are not obliged to provide the future buyers or tenants with information on energy costs. In some countries, like Denmark and Sweden, however, this information is passed on. It is widely stated that often heating and air conditioning cost information is shared between owners and tenants in the form of receipts from the previous billing period. In other cases, all energy costs are included in the rent and, therefore, not visible to the tenants. Individual metering is widely discussed as a cost-effective solution to this problem. Numerous studies find that, if the building stock is broken down into different building types, individual metering of heating, cooling and DHW can be cost-effective. One respondent also shares that the implementation of heat cost allocators as required under Article 9.3 of the EED will have a positive impact. Further respondents voice that actual energy costs should be made an obligatory part of the EPCs which should be required to be attached to the rental or purchase agreement in order to assure more transparent and easily understandable cost information.

4.6 Ensuring new highly efficient buildings using a higher share of renewable energy (question 46-53)

46. What are the best policies at district and city level to increase energy efficiency in buildings? Have specific targets on renewable energies in buildings been included?

The respondents agree that policies at district and city level for increasing energy efficiency need to take into account the local conditions also by ensuring that local authorities have an overview of the local building stock and its energy performance. Some respondents agree that policies shall follow the primary energy approach to ensure that the improvement of the energy performance of buildings goes hand-in-hand with the improvement of the overall performance of the system. The energy efficiency of the building itself needs to be improved which secures low energy needs to make a building future proof no matter how the supply side develops. It is stated that this needs to be done in a comprehensive way linking EED, EPBD and RES-D. A thorough monitoring of progress of reduction of energy demand in buildings, coupled with a long-term vision, are key elements to ensure an improvement at the district and city level in terms of energy efficiency of buildings.

Also examples for best practices are identified by the respondents:

- The Celsius project collected examples on district and city level concerning local planning, system integration and technical solutions[27].
- Several studies have been performed by leading cities (e.g. Gothenburg, London, Rotterdam) to determine the best possible solutions on the city or district level[28] (cf. Stratego project).
- Comparisons between different supply and utilisation options have been performed in the framework of the EU-funded Rescue project[29].

No clear picture exists if specific targets on renewable energies in buildings have been included. Some respondents state that demand-side energy management, i.e. when and how energy is used, will become more important with the rise of renewables and the related fluctuation of electricity supply.

[27] Celsius, 2015
[28] Stratego, 2015b
[29] rescue, 2015

47. On the basis of existing experience, are provisions on targets or specific requirements for new buildings, beyond the current NZEB targets, missing in the EPBD which could help achieve the energy efficiency 2030 target? If so, in what types of targets or requirements?

Most respondents agree that new building requirements beyond the NZEB targets could help achieve the energy efficiency 2030 target. It is stated that additional focus of the EPBD should be put on renovation of existing buildings in order to reach a NZEB level building stock by 2050 whilst retaining current NZEB requirements for new buildings. Additionally, respondents criticise the lack of requirements for maximum energy demands (kWh/(m²y)) which would ensure necessary renovation steps in existing buildings. Furthermore, requirements for automated monitoring and performance control as well as for interactions with the energy market through demand responsiveness and energy storage should be more specific. The ACE and BPIE agree that full implementation of LCA and LCC methodologies in public and private procurement and respective impacts on the price structure, e.g. through carbon pricing, would be beneficial.

As best practice example Denmark is stated where two voluntary building classes (2015 and 2020) exist. Almost half of the new Danish buildings were constructed in accordance with the voluntary future building classes. The provision on targets should take into account requirements at different stages of energy efficiency: the building envelope, technical building systems, renewable energies, the interaction between the building and the grid (building as energy producer).

48. Which building sectors have been addressed as a priority (public/private, residential/non-residential, industry, heating & cooling)?

The respondents show high consensus in priorities that have been addressed so far in the residential and public sector concerning the heating demand.

Furthermore specific information per country are provided:

- Greece: Greek Energy Policy put priorities on the private sector, mainly residential buildings for heating purposes.
- Ireland: In Ireland the only current support schemes are for residential housing.
- Sweden: Heating and cooling to public and private residential/non-residential buildings. National policies regarding buildings seem to give more attention to residential buildings.

Some respondents call for a prioritization of the worst performing existing buildings, some for a focus on the 'low hanging fruits', while others state that all sectors and building types should be considered equally.

49. Has having no EU set targets (indicative or binding) for the sustainable public procurement of NZEB buildings by public authorities affected the development of NZEBs?

No clear picture exists among the respondents whether the missing EU targets for the sustainable public procurement of NZEB buildings by public authorities affected the development of NZEBs. It is stated that the existing NZEB targets for new building generally stimulated the market towards better energy performance. At the same time it is also stated that the market pull would have been increased if targets would have been set.

Furthermore the respondents indicate that public authorities have an important role to play as early adopter of NZEB buildings to support the market development (e.g.: Brussels region, city of Hannover, etc. as analysed by the EU funded PassReg project[30]).

[30] PassREg, 2015

50. Has the EPBD framework improved the self-consumption of electricity in buildings?

Most respondents agree that the EPBD framework has not improved the self-consumption of electricity in buildings. Respondents state that the EPBD only encourages the installation of renewable technologies, but does not include specific targets. Furthermore, some respondents ask for a clarification of "nearby" renewable production to prevent that behavioural measures, e.g. the subscription of a contract with a green energy supplier or the financing of a local renewable energy project, are perceived on the same level as structural measures31. Also respondents indicate a need to coordinate subsidies to first reduce energy demand in order to optimise the use of renewables. Furthermore, it is highlighted that the EPBD had an impact on self-production and self-consumption, but only on building level and not e.g. on community level (cf. EUSEW-workshop on nearly zero energy districts). Also unused potentials are stated like the on-site combination of PV with a heat pump which increases self-consumption.

[31] BPIE, 2014c

51. Does the EPBD address the issue of embedded energy? If so, in what way?

About half of the respondents state that the EPBD does not and should not address the issue of embedded energy as this is already addressed by other European initiatives (CEN/TC350's EN15804 and EN15978 standards mandated by the Commission, GPP, Ecodesign, PEF, new building assessment tool of DG ENV etc.). Some respondents say that the EPBD should keep its clear focus on energy efficiency and avoid duplication. Some respondents criticize that the EPBD does not take into account the whole life cycle of a building, focusing solely on energy performance while in use, disregarding the energy embedded in the construction or dismantling of a building.

52. Is demand response being stimulated at the individual building level and if so, how?

Several respondents disagree that demand response is stimulated at the individual building level. If it is stimulated then by national supporting programs (financial incentives) for thermal renovation of buildings or in case of the UK it is stimulated by the fear that insufficient spare capacity exist and without demand response power outages would occur.

Recommendations of the respondents to ensure stimulation include:

- Using more intelligent controls and automation (activating all devices according to each building's and consumer's needs).
- Redraft the NZEB definition by putting into practice the "Energy Efficiency First" Principle.
- Buildings should be made 'demand-response ready' in order to offer demand-side flexibility. This is a prerequisite to the successful integration of buildings in energy systems and to the emergence of Smart Buildings[32].
- The benefits of an efficient building stock to deliver reduced peak demand and enhanced flexibility in the grid should be taken into account when considering the role of buildings in the energy system[33].

[32] EuroACE, 2015
[33] ECOFYS, 2015a

53. What obligations are missing at EU level and national level, and at regional and local level to meet the goals of the EPBD?

The respondents see the need at EU and national level to have a long term vision until 2050 setting clear milestones and objectives to reach a NZEB building stock by 2050. Respondents also mention that EPBD measures are not properly translated into clear objectives in most Member States and that stricter national measures (i.e. quantified targets) on building level to improve their energy performance through energy efficiency and cover specific percentage of their energy consumption with RES is needed.

In order to achieve the goals of the EPBD the respondents mention amongst others the following obligations:

- A maximum heating and cooling energy demand for NZEB and existing buildings.
- Better provisions on energetic renovations of buildings.
- An integrated approach including the optimisation of building envelope, building systems, maintenance and controls.
- Member States should be incentivized to have clearer definitions and objectives/targets in their national building obligations (by a better implementation of article 7 of the EPBD but most importantly through the revision of the EED and RES-D).
- Further and strengthened measures to address the existing stock of buildings should take place under the EED and RES-D, while the scope of the EPBD remains focused and addresses well new buildings and buildings going under major renovation.
- Energy performance of buildings: no offset between buildings' energy consumption and on-site energy production.
- RES: in national building regulations, codes, and incentives, suppress any discrimination between energy produced from renewable sources on-site and energy produced from renewable sources nearby and supplied to the building by an efficient district heating or cooling.
- Public buildings: enlarge the scope of the Articles 5 and 6 of the EED to all the buildings occupied by public authorities and agencies, and promote the Energy Performance Contracting as the only way to ensure real energy savings.
- Energy performance certificates: complete the existing legislative framework with a chapter on day-to-day functioning, taking into consideration the real occupation and use of the building.
- Emission Trading Scheme (ETS): stop discrimination against district heating and cooling resulting from the current EU ETS.
- Strong monitoring of the application of the article 14 of the EED (planning heat needs), linked with the promotion the development of diagnosis and mapping tools at national level.
- Strong monitoring of the application of the article 19 of the EED, with the inventory of obstacles in Member States such as: split tenders in public procurements, investments in energy efficiency considered as public debt if less than 50% of the value of the building, reduced VAT rates against energy efficiency services/ Energy Performance Contracts, etc.

4.7 Links between the EPBD and district and city levels, smart cities, and heating and cooling networks (question 54-62)

54. What are the best policies at district and city level for increasing energy efficiency and use of renewable energy in buildings?

Basically three types of recommendations can be distinguished. Various recommendations stress the need to follow the Energy Efficiency First principle and trias energetica, in a way that once heating and cooling energy needs are minimized through demand reduction from the building envelope, the opportunities offered by the surrounding environment should be considered.

Further respondents state that within an integrated approach, thermal grids can increase the efficiency of the system as a whole and of buildings as such. At the same time, DHC can improve the utilisation of available resources such as residual heat, RES heat and surplus electricity, thereby decreasing the share of fossil fuels in the system and replacing them with low-carbon ones.

Finally other respondents take position that in order to realize energy efficiency improvements in the building sector and increase the amount of renewable energy an approach needs to be taken that focuses on the reduction of primary energy at system level.

In organisational terms, respondents state that first local authorities have to gain an overview of the local building stock and its energy performance and that a thorough monitoring of progress, coupled with a long-term vision, are key elements to ensure an improvement at the district and city level in terms of energy efficiency of buildings. The engagement of neighbourhoods, districts and cities in larger scale energy efficiency improvements should be incentivized through legislation, financial and subsidy schemes and awareness raising campaigns[34].

[34] Euroheat & Power, 2013

55. Are there any separate (new) obligations set at city and district level missing from the EPBD which would help increase energy efficiency and use of renewable energy in buildings?

The majority of respondents states that there are no missing obligations and that the current system boundaries of the EPBD should not be expanded as the external environment and evolving energy system is already fully accounted for in the current scope. A smaller share of stakeholders expresses that e.g. obligatory assessments of energy efficiency and use of renewable energy of the building stock) and improvement plans (energy and climate plans at local territory level) would help increase energy efficiency and use of renewable energy in buildings. Furthermore, some respondents emphasize adding an obligation to collect and provide data at local level. Others state that the risk of overheating and respective health impacts should be addressed. One respondent calls for a separate obligation regarding targets for district heating and cooling in the most populated cities in Europe.

56. How has the information exchange on smart technologies which contribute to compliance of the EPBD, been promoted in cities?

Respondents mainly state that they do not experience an information exchange regarding smart technologies promoted by cities. Some state that further promotional activities should take place at regional and local levels, promoting good and best practice examples. As examples of information exchange, e.g the Energy Agency of Plovdiv in Bulgaria is mentioned that organises every year national conferences for promoting best practices and realised smart projects, inviting all of 208 municipalities or the city of Malmö that established an information exchange platform under its smart city development cooperation. Furthermore, voluntary initiatives like Smart Cities and Smart Communities are mentioned.

57. Are smart meters and their functionalities contributing to meeting energy efficiency targets and the proper implementation of the EPBD? Are other targeted meters for heat, gas and water have specific provisions such as those for electric meters needed?

The opinion of respondents in this question is split. While part of the respondents are in doubt of the (long lasting) effect of metering and sub-metering, other parts state that the accurate implementation of the EED in the reference to smart metering is key to meet energy efficiency targets. They consider building automation and continuous monitoring a centre piece of the EPBD. A third group supports the use of smart meters as they contribute to energy savings, but that they cannot be regarded as the unique solution, as their impact also depends on what is done to address other barriers to energy efficiency[35] [36] [37]. Some stakeholders emphasize that smart meters contribute to energy efficiency mainly through information provision on energy consumption and generation.

One respondent mentions the synergies between the smart metering elements of the Energy Efficiency Directive and the EPBD that could facilitate - with appropriate metering strategies and contextual data - the automatization of 'live' ratings for buildings which would permit the actual expression of energy performance.

[35] EC, 2014
[36] RVO, 2014
[37] BEUC, 2011

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?

The majority of respondents states that this is not the case with the current EPBD focussing on the performance of individual buildings. However, it is also mentioned that the CEN-EPB standards give the possibility to include aspects beyond the scope of individual buildings in the assessment procedures (e.g. connection to district heat). Several respondents mention that the promotion of smart cities would be better placed in the EED as the EED is seen as more suitable for strategic and "macro"-level measures, while the EPBD is aimed for addressing building-level measures. A source frequently mentioned in connection to smart buildings is the EuroACE position paper on smart buildings[38]. The EPBD could promote inter-sectoral energy synergies and opportunities for a more efficient energy use at societal level through an incentive to gather relevant information on these synergies.

[38] EuroACE, 2015

59. Have obligations been set at a national/regional level in relation to buildings and district heating and cooling, or in relation to buildings and storage? Why/Why not?

The answerers of the respondents in this question mainly dealt with the connection of buildings and district heat (and less with buildings and storage) and reflect the differences in Member States related to obligations on buildings and district heating and cooling but the majority states that this is not the case. As an example of such obligation, Hungary with its law on thermal energy market (OG 80/13, 14/14, 102/14, 95/15) is mentioned. One respondent opposes obligations at national or regional level, but promotes the inclusion of district heating in long-term strategic plans.

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

Respondents mention various options such as the recommendation that there should be a system level cost benefit analysis required to be carried out by the developer, e.g. at city quarter level, which requires a comparison between technological approaches. Further incentives mentioned are incentives of utilization of waste/industry surplus heat with strong implementation mechanism at national level and incentives connected to flexibility requirement to increase uptake of thermal storage and integration of small-scale combined heat and power (CHP) to match peak demand. In addition heat pumps are mentioned to be suitable to be connected to thermal grids. It is also recommended that the EPBD should reinforce other government actions that aim to assist energy utilities with the delivery of their obligations set forth in the Energy Efficiency Directive.

There are split view on the required scope of the EPBD in relation to district heating and cooling with respondents stating that the focus of the Directive should be expanded to a system level to harvest benefits of a total system optimisation while others stress that the focus of the EPBD should remain at building level as the external environment and evolving energy system is already fully accounted for in the current scope and therefore the EPBD focus should remain on reducing the energy consumption of the building.

61. Have cost-optimal policies been devised that improve the performance of buildings so that they use less heating and cooling, while ensuring a decarbonised energy supply?

Several respondents state scepticism related to the transparency, reliability and usefulness of the results, while others see encouraging results in Member States. Several respondents are interested in seeing the results of MSs assessments, e.g. via publication of the study on the assessment of national cost optimality calculations[39].

[39] ECOFYS, 2015b

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?

The majority of respondents state that that this is not the case as the current EPBD focuses on individual buildings. There are split views on the required scope of NZEBs in relation to districts and cities with respondents stating that the NZEB definition should be expanded to a system level to harvest benefits of a total system optimisation while others state that the current focus of the EPBD on building level and the definition of NZEB already form a good basis for nearly zero emissions districts and cities. Recommendations on definition of NZEBs include the proposal to include the setting of a maximum H&C energy demand (defined nationally and/or an EU benchmark).

4.8 Awareness, information and building data (question 63-68)

63. What do you think of the quantity and quality of information on the importance of energy efficiency provided to consumers by:

    a. The European Commission?
    b. National authorities?
    c. Regional authorities?
    d. Local authorities?
    e. Local companies?

    a. Most of the respondents agreed that the European Commission provides sufficient information regarding energy efficiency in general. However, information on building performance, on the multiple soft and economic benefits of energy renovation as well as easily understandable guidance on the correct implementation and implementation options of the EPBD could be improved. Furthermore, the EC should give guidance on information campaigns and promote concerted action initiatives on regional and national level and, thereby, leave the dissemination on detailed information on building stock and performance up to the MS.

    b. Most respondents state that the Member States are not sufficiently fulfilling their responsibility of informing owners and tenants of the methods and benefits of improving building energy performance, in line with Art. 20 of the EPBD. The MS should work to improve harmonization and quality of collected data on the building stock and disseminate them in concise free of charge databases. Several respondents also called for information provision on best-practice examples, technical manuals, e.g. NZEB, as well as on qualified professionals and companies in the high energy performance building sector.

    c. Respondents did not have a clear preference concerning information provision by regional authorities. They assigned them a similar role as the MS of providing clear neutral contact points for administrative, technical and financial advice which is not exercised sufficiently at this point.

    d. The majority of respondents emphasise that local authorities are the most effective avenue for energy advice due to their involvement on the ground through planning and building permits as well as training of experts, designers and builders. However, many respondents emphasize that communities depend on funding and know-how provided by higher authority levels in order to fulfil this function which is, therefore, carried out insufficiently at the moment.

    e. Several respondents state that the provision of databases of companies in the high energy performance building sector would promote implementation of the EPBD[40] [41] [42]. Some respondents say that construction companies, installers and especially renovators are often the first and direct link to consumers. However, some respondents, e.g. the

[40] BPIE and ECOFYS, 2012c
[41] BPIE and ECOFYS, 2012a
[42] BPIE and ECOFYS, 2012b

European Federation of Agencies and Regions for Energy and the Environment (FEDARENE), voice scepticism concerning the companies' role as their advice might be conflicting with their corporate interests or as it might be biased toward their own products.

64. Has the directive promoted information on opportunities for consumer-friendly smart meters and interoperable energy efficient appliances?

The great majority of respondents does not believe that the Directive promotes information on opportunities for smart meters and interoperable energy efficient appliances. Several stakeholders recommend that more specific information requirements should be laid out in Article 20 for each building automation technology, as mentioned in Article 8. Furthermore one respondent emphasizes that information on actual consumer experience and benefits from the use of energy efficiency appliances should be collected because such cross-national information would be useful to promote the respective appliances. It is repeatedly stated that efficiency and interoperability of technologies are best dealt with in the Eco-Design Directive.

65. What relevant building data has been collected at EU and Member State level, and city and district level? Who has access to this data?

Generally, the collection of data both on building stock energy performance as well as on compliance and quality of renovations is stated to be insufficient. Most respondents criticize the EPBD for the absence of measurement, verification and reporting requirements as well as for the lack of transparent harmonized benchmarking schemes and building level performance indicators, e.g. concerning actual operational energy use. The national databases of Energy Performance Certificates (EPCs) are widely recognized to be potentially very useful means to collect statistical insights in the energy performance of the existing building stock. However, the BPIE study[43] on Energy Performance Certificates found out that of the 24 centralized EPC registers established by the MS, only twelve are publically accessible. A further challenge is to provide these data in a user-friendly manner. Apart from EPCs, respondents recommend to utilize housing surveys and energy audits to collect further data.

[43] BPIE, 2014b

66. How can data on the energy performance of a building and its related renovation work, across its life cycle, best be managed and made available?

Several respondents recommend extending the current EPC and staged renovation roadmap to a 'building passport' to manage life-cycle performance data of properties. Such passports could include the planning, design and construction phase, used materials, technologies and building structure, as well as the use and operational phase, real energy performance data, thermal comfort and indoor air quality aspects, as well as further interventions and involved professionals. In order to facilitate the further development of (open source) centralised databases, respondent recommend to digitalize such building passports. Furthermore, some respondents mention Building Information Modelling (BIM) which uses data from energy sensors, building structure and systems in order to inform the operation and refurbishment of buildings. Another option are data exchange protocols based on relevant ISO and CEN standards. Again, respondents call for harmonized European reporting metrics and indicators as a prerequisite.

67. Has building data harmonisation been achieved?

More than half of the stakeholders deny that any data harmonization has been achieved, neither between nor within MS. Examples for inconsistent measurement are the NZEB calculation of floor area and of the density of occupancy. Also, there are often several ways to consider the input data for a specific system or product, for example, heat recovery efficiency of a balanced ventilation fan box, corresponding to different operating conditions described by the testing method. Some respondents suspect that some EPC input data, e.g. on systems and technologies, are found to depend too much on the application type and sector, e.g. new versus existing and residential versus non- residential buildings, as well as on the specific geographic context.

68. Is there a need for a central EU database of EPCs and qualified experts?

There is general agreement among respondents that a publically available aggregate EPCs and qualified experts database would be highly useful to monitor policy progress and compliance, to inform renovation strategies and to enable stakeholders in the supply chain to better understand the market for their products. However, responses widely acknowledge that further EU-level harmonisation and guidance concerning methods for data collection, data analysis and protocols for data sharing are an indispensable prerequisite for the aggregation of data because otherwise no comparison is possible[44] [45]. Some best-practice examples of MS prove the added value of such publically accessible databases. Respondents, therefore, acknowledge the EC's responsibility to encourage MS to open their EPC databases to the public and then to aggregate a selection of these data in a user-friendly manner on EU-level.

[44] BPIE, 2014b
[45] Climate-KIC, 2013

4.9 Sustainability, competitiveness and skills in the construction sector (question 69-71)

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?

The respondents make several propositions how the construction sectors cost-effectively demonstrate compliance with the EPBD where these quality aspects and upgrading skills are not explicitly mentioned. It is stated that integrated planning and the involvement of the full construction team are essential in order to achieve the standards. Mitigating the communication gap between the different building professionals (design, installation and operation phase) involved is a prerequisite for the market.

Professional standards for retrofit should be implemented which are assessed by a respected qualification body. Trainings for all professionals covering the life cycle of buildings are useful but only half of the MS have mandatory training requirements[46]. Further development of construction workers through nationally accredited mandatory training programmes such as BUILD UP Skills, Qualibuild in Ireland or the training programme FEEBAT in France are here mentioned.

Periodic inspection of building sites by the authority to validate performance would strengthen the compliance with the EPBD.

[46] Egmont, 2015

70. Would it have been useful to extend Eurocodes to include energy performance in buildings and other relevant aspects? If so, why?

Most respondents do not support integrating energy performance in buildings into Eurocodes. Nevertheless, few respondents state that a scheme whereby aspects such as energy performance and other sustainability aspects as well as structural design are taken into consideration in an integrated way at the design stage does make sense[47]. One respondent declares that fire safety is probably more closely related to energy performance and should be linked with the EPBD in some way.

[47] JRC, 2014

71. Are energy, materials, waste and water use addressed in the EPBD?

The majority of respondents point out that the current EPBD addresses energy use and efficient energy performance as its primary concern. Materials, waste and water are not covered in EPBD but in other EU initiatives (e.g. CEN/TC 350, EN15804 and EN15978 standards mandated by the Commission, Eco-design, Waste Directive, Green Public Procurement, new building assessment tools). These should continue to be kept outside the EPBD. Nevertheless, these processes should be monitored closely in order to avoid overlap and to ensure coordination and compliance with the EPBD and its objectives.

4.10 Building systems requirements (question 72-76)

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?

There is no clear picture among the respondents whether the setting of minimum requirements in the EPBD for technical building systems is missing. Several respondents mention that the requirements under article 8 are unclear in the way the energy performance of such systems would be measures and which products should be considered part of that system. Respondents also mention that systems not covered by the Ecodesign directive may be difficult to set requirements for and also to test as their testing conditions are difficult to control. It is also stated that in addition, systems are often composed of products under the Ecodesign directive and as such a good efficiency foundation is given while the benefit of assessing the performance of connected products and the way they are run and maintained is acknowledged. Several respondents also stress that controls and building automation should be included in Annex I paragraph 3. A recommendation is also to change the text in Article 8 of the EPBD from system requirements "to be applied so far as they are technically, economically and functionally feasible" to "should be applied taking into account their technical, economical and functional feasibility". Some respondents indicate that there may be a lot of emphasis on heat generation such as boilers but not enough on heat distribution and control.

Evidence for improvement is indicated by some stakeholders[48].

[48] Research by Salford University (UK) comes to the conclusion that *a heating system with a room thermostat and thermostatic room valves uses up to 40% less energy than the same system without these basic controls*. See: [Beama, 2013]. Another source mentioned is a review carried out on behalf of eu.bac in 2014 that looked at the current installed base of heating controls in EU homes. The study concluded that in average only half the houses have a minimum level of heating controls (time control, boiler control and room temperature control) and that this number varies largely in the EU (from 95% to just 20%). According to this study there are 52 million EU homes that could benefit from an improved level of heating controls (or 60 million if the potential to upgrade old TRVs is included). Enhanced adoption of existing heating control technologies in EU homes could lead to peak annual energy savings of over 50TWh per year by 2030, with nominal fuel bill savings of around €4.3 billion. See [Eu.bac, 2014]

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?

Many respondents stress the need to fully include building automation and controls into the provisions for technical building systems. It is mentioned that article 8 is not supporting BAT/BACS, nor the electrical installation due to its focus on HVAC.

Several respondents mention that lifts, escalators and moving walks should join the already included technical buildings systems. One respondent states that lifts are involved in the energy consumption of the buildings in two ways: Lifts represent 4 to 10% of the total energy consumption of a building, depending of the use and the type of the building. This consumption may reach 50% during peak operational times.

An additional area that is stated to have to be better addressed under requirements for technical building systems is lighting.

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

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

About a quarter of the respondents share the opinion that the EPBD requirements for regular inspections of the technical building systems to ensure maintenance of systems' performance during lifetime are not missing. Less respondents have the opposite opinion (requirements are missing). It is common agreement among respondents that say that requirements (to ensure maintenance of systems' performance during lifetime) are missing that HVAC inspections do not guarantee that the benefits achieved will last in post-inspection operation. They consider maintenance crucial for long time period energy saving projects. Several respondents mention a study from the French trade association (a study performed for FEDENE). The outcome was

"three multi-family residential buildings with collective heating systems, showed that lack of appropriate maintenance of the heating system in operation can lead to an increase in energy consumption of 20% on average over ten years (the increase is exponential with 10% additional annual energy consumption after five years, 18% after seven years and 35% after ten years). The cumulated increased energy bill over ten years amounted to €18 000 for buildings with a new boiler, and €20 000 for those buildings with an old less efficient boiler[49]".

The HARMONAC project, mentioned by several respondents showed by studying the HVAC systems in 400 buildings around Europe that only 37% of the energy savings potential (identified by analysis of the sub-hourly data with monitoring systems), have been spotted by inspection. In conclusion inspections due to their focus on operational and maintenance issues alone will only achieve 3.8% of savings potential rather than 10.4%, "therefore neglecting 62% of the potential savings to be had"[50].

Some respondents have the opinion that the EPBD could bridge the gap between Ecodesign directive (regulation on equipment level) and the sizing, design and installation by setting a maintenance requirements for HVAC equipment above a certain size.

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

No common picture exists regarding this question. The number of respondents that share the opinion on whether the EPBD requirements for regular inspections of the technical building systems to ensure that owners/occupiers are properly informed about the potential improvements to the efficiency of their systems are missing equals out the number of the respondents that disagree (not missing).

Several respondents think current EPBD requirements on inspections and performance requirements for technical building systems are vague. The opinion from one respondent illustrates is exemplary for several other respondents: "Informing owners, occupiers and managers of buildings about the best ways to improve energy efficiency, together with regular servicing,

[49] FEDENE, 2014
[50] HARMONIAC, 2010

maintenance and inspections of buildings' energy systems would ensure that equipment is optimized to its efficiency potential and that configurations are done correctly. For example, if actual energy consumption is measured and differs from the expected consumption (based on design), there should be an explanation given on the reasons and if necessary, advice". Apart, some respondents consider it important to raise awareness of owners/occupiers through enforced inspections and its results presented in a compelling way (inspection reports with clear recommendations for cost-effective energy efficiency improvements concerning sizing, running, maintenance etc. for technical systems). Some respondents suggest sub-annual billing information in order to provide a cost-effective data basis for a targeted and qualitative energy consulting service, empowering the consumer to take control over his energy consumption.

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

No common picture exists amongst the respondents. About one quarter of the respondents have the opinion that the EPBD requirements for regular inspections of the technical building systems to ensure that replacement/upgrading of the technical building systems is triggered are missing and about the same share of respondents think that requirements are not missing. Respondents say that especially when it comes to small- and medium-sized renovation projects replacement or upgrading of technical building systems is not sufficiently triggered by the implementation of the current EPBD. A respondent suggests to include such measures in the recommendations attached to the EPCs / Building Passports, or to tie them with audits. Several respondents say that due to the absence of measurements (due to absence of a control systems) the trigger for replacement/upgrading of the technical building systems is missing. They indicate that currently, 50% of the commercial building have no digital controls (thermostats) and for the rest of the buildings, 50% of the applications are not controlled. They see the reason mainly due to lack of regulation and awareness. Some respondents suggest minimum requirements for control functions, building automation and continuous monitoring in order ensure an evidence base for energy conservation measures.

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?

More than one quarter of the respondents think that inspections required under the EPBD, have not been incorporated into or more tightly linked to other inspection/certification/energy auditing activities and schemes under other EU or national directives. Less than half agree with the statement (EPBD inspections have been incorporated/more tightly linked to other inspections).

Other respondents say that they feel a strong resistance in many MS to require more inspections, apart from those directly related to safety and health and they point out that poor ventilation due to EP-measures is a serious health risk for the population is underestimated. Some respondents think that the inspection of air conditioning (A/C) systems doesn't work properly in many MS (isolated measure, low compliance level). Some suggest to include/encourage alternative approaches like self-inspection, continuous monitoring and inspection of proper operation & maintenance inspection of maintenance records) in the EPBD. Other respondents suggest to link inspections with the energy audits requirement laid down in Article 8 of the EED, and possibly with leakage inspections requirement laid down in the f-gas Regulation. The inspection of HVAC required by EPBD Article 14 and 5 are supposed to evaluate the efficiency of the equipment and its installation, but according to companies' experience, it does not lead to sufficient efficiency improvements, as many Member States chose the alternative proposed by the EPBD (paragraph 4). A first improvement shall therefore lie on fully implementing EPBD Article 14 and 15, ensuring that regular inspections of HVAC systems effectively lead to energy performance improvements.

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?

More than one quarter of the respondents think that requirements for building elements set by Member States have not been optimised to avoid market barriers limiting the installation of building products complying with EU requirements/standards e.g., under eco-design requirements. Only few respondents agree with this statement (requirements have been optimised). A respondent states that 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 and sub-optimal choices could result e.g. from misguiding Eco-design declarations. A respondent also stresses that current EPBD does not ensure that buildings meet stringent efficiency targets at the operational stage, since in most MS, the minimum energy performance requirements are based on designed energy values, and not on actual energy performance.

A respondent states that the Ecodesign requirements for heat pumps represent an important barrier to introduction of low-energy, climate friendly heat pumps using CO2 as a refrigerant. Starting in 2017, the Ecodesign Regulation introduces stricter energy efficiency requirements, requiring that minimum efficiency should be higher than 125% for low temperature space heating and 110% for high temperature space heating. With tests based on EN 14511 & EN 14825, CO2 heat pumps cannot meet the minimum requirements for space heating (10% lower than the minimum requirement), even though they perform much better for water heating and as combined space and water heaters, especially in low energy and passive house

4.11 Operational management and maintenance (question 77-79)

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

Most respondents share the opinion that the current EPBD does not ensure that buildings meet stringent efficiency targets at operation stage. There are several reason and suggestions mentioned: Minimum energy performance requirements are based on "as-designed" energy values, and not on "as-built" energy values. It is suggested to also consider as-built performance, in order to ensure consistency between as-designed and operational efficiency. Another option would be to introduce control and maintenance requirements on technical building systems and to adopt a holistic approach for (deep) renovation, addressing all elements contributing to the energy performance of the building.

Several respondents stress that there is a need for greater insight as to how buildings perform in operation in order to close the performance gap, both to inform the decisions of managers and occupiers but also to channel those insights back into design decisions and anticipations of performance that are more grounded in reality.

One respondent recommends to better address the potential of energy savings that lies in optimised operation, arguing that it is the most cost-effective way of improving energy performance and that it also has a positive effect on the awareness of 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?

Almost no respondent thinks that the EPBD promotes the best way to close the gap between designed and actual energy performance of buildings. More than one third of the respondents explicitly disagree with this statement.

The position of a respondent reflects a general opinion that the EPBD is not targeting reductions in measured energy use but requires to develop calculation metrics that assess a building's energy consumption. As compliance calculations are the only mandatory calculations required to assess energy performance, factors relating to construction quality, occupancy and management are routinely omitted.

Some respondents stress the point of the theoretical nature of the EPCs and thus the disadvantages for the users (in his experience: EPC's do not account "for controls that do not work properly, or any lack of understanding of building services by occupiers and building managers". The asset ratings "are expensive to deliver, are of limited accuracy, offer limited insight and report only predicted improvements." In summary the EPC provides only theoretical information based solely on the design of a building but no "real" information based on real data.

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

The majority of respondents states that the provision of the EPBD does not sufficiently stimulate a proactive, innovative maintenance market. Opinions more frequently stated are similar to the following ones:

EPBD Articles 14 15, 16, 17 and 18 on inspection of heating and air-conditioning systems, inspectors and control schemes to check the inspectors, based on anecdotal evidence, seem to be too fragmented and heterogeneous to stimulate the maintenance market effectively. These need to be strengthened and complemented with improved articles in the EED, including Articles 16 and 18 on energy service providers. Improving the quality of the inspectors in many MS is very important, as has been pointed out elsewhere in this consultation.

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ANNEX I: RESPONDENTS THAT SUBMITTED CONTRIBUTIONS

In the following the list of respondents that agreed to have their name published:

1st For Energy limited
3M
A2Conseils
Active House Alliance
ADviesbureau Energiebesparing Particulieren
AEGPL - European LPG Association
AFM+E Aussenhandelsverband fuer Mineraloel und Energie e.V.
Agder Energi
AGFW, The Energy Efficiency Association for Heating, Cooling and combined heat and power (CHP)
Agoria
AIE - Europen Association of European Electrical Contractors
AIMCC Association française des industries des produits de construction
ali malaki
American Chamber of Commerce to the European Union (AmCham EU)
ANEC, the European consumer voice in standardisation
ANESE (Spanish National ESCO Association)
Anglesey against wind turbines
ANIE Federation
ANIE Federation
Architects' Council of Europe (ACE)
ASOCIACION DE EMPRESAS DE MANTENIMIENTO Y SERVICIOS ENERGETICOS (AMI)
ASSEMBLEA LEGISLATIVA DELLA REGIONE EMILIA - ROMAGNA
Association for District Heating of the Czech Republic
Association for the Conservation of Energy
Association for the Conservation of Energy
Austrian Energy Agency
Autodesk, Inc.
AVEPA, Associatie van EPA Adviseurs
BASF SE
BEAMA Limited
BEIBCI Expertises sprl
BFW Bundesverband Freier Immobilien- und Wohnungsunternehmen e.V.
BFW Bundesverband Freier Immobilien- und Wohnungsunternehmen e.V.
Biddle BV
BMP-PMC (Belgian association of Construction Materials Producers)
Bouygues Europe
British Standards Institution
Brussels Environment
Building Alliance CIC
Buildings Performance Institute Europe (BPIE)
Bundesarchitektenkammer e.V.
Bundesverband der Energie- und Wasserwirtschaft e.V. (BDEW)
Bundesvereinigung Bauwirtschaft
CAPIEL - European Coordinating Committee of Manufacturers of Electrical Switchgear and Controlgear
Carbon2018 Limited
CEDOM (Asociación Española de Domótica e Inmótica)
CEMBUREAU - The European Cement Association
CEN/TC 169 "Light and Lighting"

Changeworks (Scotland), Centre for Sustainable Energy (England), ALE Lyon (France), FLAME (France), e7 (Austria), Energiaklub (Hungary), Fraunhofer Institute for Building Physics (Germany), Uppsala University (Sweden)
Chartered Institution of Building Services Engineers
Chiara Briatore, Policy Director, LightingEurope
CIR vzw/asbl - Conseil d'Isolation - Isolatie Raad
Citizens Advice
CLER, réseau pour la transition énergétique
Climate Action Network Europe
Climate Alliance
Coalition France pour l'efficacité énergétique
COGEN Europe
Collectif Effinergie
Collectif Isolons la terre contre le CO2
CONFEDERACIÓN ESPAÑOLA DE ORGANIZACIONES EMPRESARIALES
Confédération Construction
Confédération Nationale du Logement
Confederation of Norwegian Enterprise
Construction Confederation
Convention of Scottish Local Authorities (COSLA)
Council of European Municipalities and Regions (CEMR)
CV2 advies- en ontwerpbureau
Danfoss
Danfoss B.V.
Danish Energy Association
Deutsche Bausparkassen
Deutscher Industrie- und Handelskammertag
DGEG - The Portuguese Directorate General of Energy and Geology
E.ON SE
EDF
EDORA
Electric Underfloor Heating Alliance
Electricity Supply Board
Enagas, S.A.
Energetisch
Energie-Nederland
Energy Cities
Energy Efficient Buildings Platform (EEBCZ)
Energy Norway
Energy Saving Trust
ENGIE, Transparency
Enjoy Energy
Environmental Citizens' Organisation for Standardisation (ECOS)
EPA Zeeland
ESMIG
ES-SO, European Solar-Shading Organization
Etienne Maricq
EURELECTRIC
Eurima - European Insulation Manufacturers Association
EuroACE (European Alliance of Companies for Energy Efficiency in Buildings)
Eurofuel (European Heating Oil Association)
Eurogas
Euroheat & Power
Europabüro der baden-württembergischen Kommunen
European Aluminium (European Aluminium Association AISBL)
European Autoclaved Aerated Concrete Association (EAACA)

European Biomass Association (AEBIOM)
European Builders Confederation - EBC
European Building Automation and Controls Association (eu.bac)
European Chemical Industry Council (Cefic)
European Concrete Platform (ECP)
European Confederation of Fuel Distributors (ECFD)
European Copper Institute
European Council for an Energy Efficient Economy (eceee)
European Environmental Bureau - EEB
European Federation of Intelligent Energy Efficiency Services
European Geothermal Energy Council
European Heating Industry Association - EHI
European Historic Houses Association
European Landowners' Organization
European Lift Association (ELA)
European Partnership for Energy and the Environment (EPEE)
European Photovoltaic Technology Platform
European Property Federation
European Solar Thermal Industry Federation
European Ventilation Industry Association (EVIA)
European Window Film Association (EWFA)
Eurovent
EuroWindoor AISBL
Febetec
FEDARENE
Fédération des Ascenseurs
Federation of European HVAC Associations - REHVA
FIEEC
Finnish Energy
Fire Safe Europe
Fortum Oyj
France Nature Environnement
Francesco Scuderi - Eurovent Association Technical and Regulatory Affairs Manager, Secretary of the Product Group 'European Air Curtains'
FUNDACION LABORAL DE LA CONSTRUCCION
GdW Bundesverband deutscher Wohnungs- und Immobilienunternehmen e.V.
Glass for Europe
GRDF
Green Building Council España (GBCe)
Gütegemeinschaft PCM e.V. (Quality Association PCM)
Handelsverband Deutschland (HDE)
Handwerkskammer Frankfurt-Rhein-Main
Hauptverband der Deutschen Bauindustrie e.V.
Haus & Grund Deutschland
Hilson Moran Partnership Limited
Historic Houses Association
HOUSING EUROPE
IBERDROLA
International Council of Shopping Centers (ICSC)
International Union of Property Owners (UIPI)
International Union of Tenants
ISSO
IWO
IWO-Österreich
Jan Pejter, ENVIROS, s.r.o.

Kingspan Insulation Ltd
Landeshauptstadt München
L'Union sociale pour l'habitat
Ministry of Economic Affairs and Communications
Ministry of Local Government and Modernisation
NHS Scotland - National Energy Forum
Norsk Teknologi - Norwegian Technology
Norwegian District Heating Association
Norwegian Ministry of Petroleum and Energy
OFTEC (Oil Firing Technical Association)
ORGALIME - The European Engineering Industries Association
Österreichischer Verband gemeinnütziger Bauvereinigungen - Revisionsverband
Pearle* - Live Performance Europe
PlasticsEurope
PU Europe
QUALICHeCK
Quercus - Associação Nacional de Conservação da Natureza
RehabiMed
RICS
ROCKWOOL International A/S
Rockwool Peninsula S.A.U.
SABO – the Swedish Association of Public Housing Companies
SAINT-GOBAIN ISOVER
Schneider Electric
Schöck Bauteile
SCHÖCK FRANCE
SE
SERCE
SHV Energy
Skupina ČEZ
SolarPower Europe
Spanish Association of Electrical Equipment Manufactures (AFME)
Stadtwerke München GmbH
Stockholm Region Association for European Affairs (SEF)
Suomen Kuntaliitto
Suomen Omakotiliitto ry
Sustech Ltd
Swedish District Heating Association
Swisscom Energy Solutions
tegut... gute Lebensmittel GmbH & Co. KG
The Bellona Foundation
The CELSIUS project
The Danish Ecological Ciuncil
The European Group of Valuers' Associations (TEGoVA)
TightVent Europe
UEPC
UK Green Building Council
United Technologies Corporation, and its business units Otis and UTC Climate, Controls & Security.
Vattenfall
VELUX A/S (VELUX Group)
venticool platform
Veolia
Vienna, Administrative Group Housing, Housing Construction and Urban Renewal, Andrea Wagner
VIK - German Federation of Industrial Energy Consumers

VIPA International - Vacuum Insulation Panel Association - TR 150461018461-67
W H Malcolm Limited
WHO Regional Office for Europe
Wirtschaftskammer Österreich (WKÖ)
WWF European Policy Office
Zentralverband des Deutschen Baugewerbes
ZERO, Zero Emission Resource Organisation
ZIA Zentraler Immobilien Ausschuss e.V.

ANNEX II: STATISTICAL OVERVIEW OF RESPONDENTS

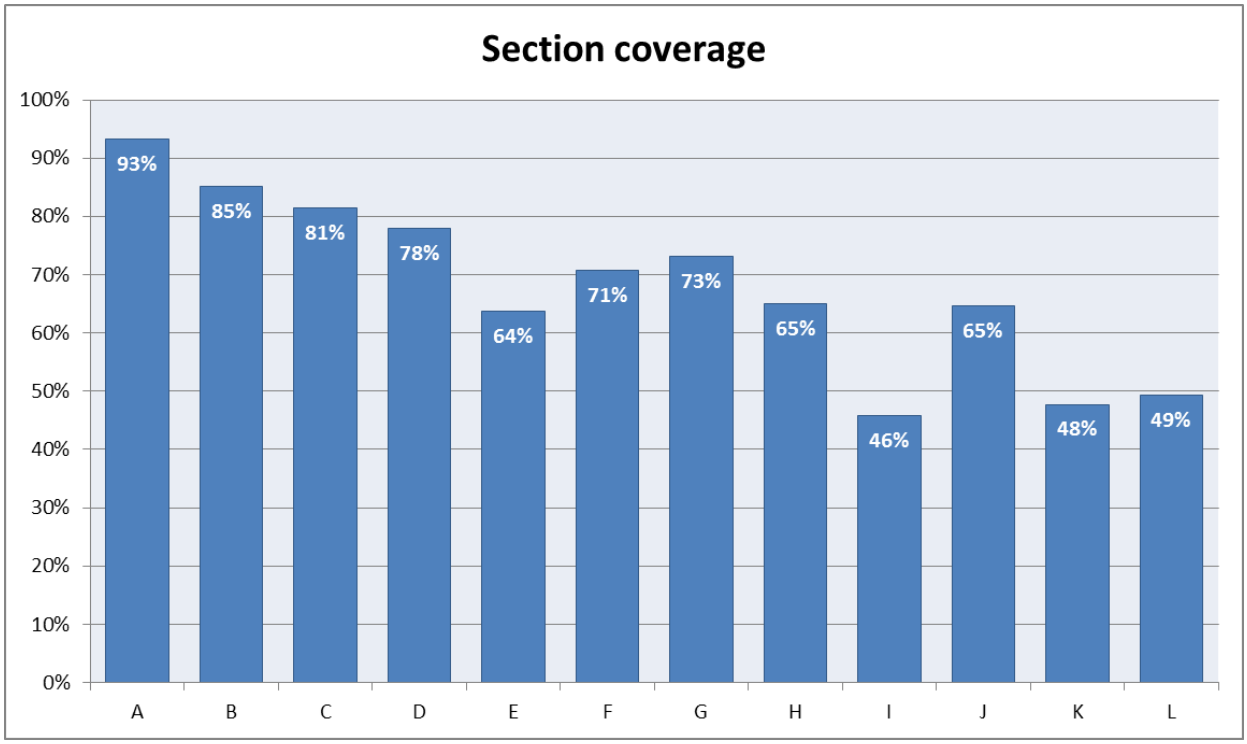

Figure 3: Section coverage

ANNEX III: QUESTIONS OF THE PUBLIC CONSULTATION

1. How successful has the EPBD been in achieving on its goals?
2. Has it helped improve energy efficiency in buildings?
3. Has it helped to increase renovation (more than 25% of the surface of the building envelope) rates?
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?
5. Overall, do you think that the EPBD is contributing to cost-effective improvements of energy performance? Why/Why not?
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?
7. Has the EPBD effectively addressed the challenges of existing buildings' energy performance?
8. Has the EPBD set effective energy performance standards for new buildings?
9. Will the 'nearly zero energy buildings' targets be met? Why/Why not?
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?
11. What has worked well in the EPBD? What needs to be improved?
12. Is the EPBD helping to contribute to the goals of EU climate and energy policy (Reduce greenhouse gas emissions by at least 40%; increasing the share of renewable energy to at least 27%; increasing energy efficiency by at least 27%; reform of the EU emission trading system)?
13. Is it in line with subsidiarity? What should continue to be tackled at EU level and what could be achieved better at national level?
14. Are the objectives of the EPBD delivered efficiently?
15. Has the EPBD created any unnecessary administrative burdens? If so, please provide examples
16. Has the EPBD created any unnecessary regulatory burdens? If so, please provide examples
17. Is compliance with the provisions of the EPBD adequate?
18. Is the definition of NZEBs in the EPBD sufficiently clear?
19. Is the NZEB target in the EPBD sufficiently clear to be met?
20. If not, 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?
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?
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?
23. What do you think of the various ways of calculating building energy performance at national/regional level? Please include examples.

24. What measures are missing that could simplify the implementation of building regulations to make sure that buildings meet the required high energy performance levels?
25. Are the available data on the national/regional building stock sufficient to give a clear picture of the energy performance of the EU's building stock, as well as the market uptake of energy efficiency technologies and the improvement of the energy performance of buildings in the EU?
26. Are the long-term national renovation strategies adopted sufficient to stimulate the renovation of national building stock? What examples of best practice could be promoted across the EU and how?
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?
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?
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
30. Are EPCs designed in a way that makes it easy to compare and harmonise them across EU Member States?
31. Do you think that the 'staged deep renovation' concept is clear enough in the EPBD?
32. Have EPCs raised awareness among building owners and tenants of cost-efficient ways of improving the energy performance of the buildings and, as a consequence, help to increase renovation rates across the EU?
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?
34. What are the main reasons for the insufficient take-up of the financing available for energy efficiency in buildings?
35. What non-financing barriers are there that hinder investments, and how can they be overcome?
36. What are the best financing tools the EU could offer to help citizens and Member States facilitate deep renovations?
37. What role do current national subsidies for fossil fuels have in supporting energy efficient buildings?
38. Have energy efficiency and renewable energy projects been combined to maximise their financing? How can the EU help?
39. How is investment in high-performing buildings stimulated and what is being undertaken to gradually phase out the worst performing buildings? Is it sufficient?
40. What is being undertaken to solve the problem of 'split incentives' (between the owner and the tenant) that hampers deep renovations? Is it sufficient?
41. Was
    a. the scaling-up of existing funds sufficient to meet the goals of the EPBD?
    b. the creation of aggregated facilities (through standardisation of Energy Performance Contracts and clarification of regulatory, fiscal and accounting issues) sufficient to meet the goals of the EPBD?
42. What measures have been taken in the housing sector to address energy poverty?
43. Should have further measures tackling energy poverty been included in the EPBD?

44. Has tackling energy poverty been a requirements when constructing new buildings and renovating existing buildings in Member States?
45. Are energy costs for heating and air conditioning being made available to interested buyers/tenants?
46. What are the best policies at district and city level to increase energy efficiency in buildings? Have specific targets on renewable energies in buildings been included?
47. On the basis of existing experience, are provisions on targets or specific requirements for new buildings, beyond the current NZEB targets, missing in the EPBD which could help achieve the energy efficiency 2030 target? If so, in what types of targets or requirements?
48. Which building sectors have been addressed as a priority (public/private, residential/non-residential, industry, heating & cooling)?
49. Has having no EU set targets (indicative or binding) for the sustainable public procurement of NZEB buildings by public authorities affected the development of NZEBs?
50. Has the EPBD framework improved the self-consumption of electricity in buildings?
51. Does the EPBD address the issue of embedded energy? If so, in what way?
52. Is demand response being stimulated at the individual building level and if so, how?
53. What obligations are missing at EU level and national level, and at regional and local level to meet the goals of the EPBD?
54. What are the best policies at district and city level for increasing energy efficiency and use of renewable energy in buildings?
55. Are there any separate (new) obligations set at city and district level missing from the EPBD which would help increase energy efficiency and use of renewable energy in buildings?
56. How has the information exchange on smart technologies which contribute to compliance of the EPBD, been promoted in cities?
57. Are smart meters and their functionalities contributing to meeting energy efficiency targets and the proper implementation of the EPBD? Are other targeted meters for heat, gas and water have specific provisions such as those for electric meters needed?
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?
59. Have obligations been set at a national/regional level in relation to buildings and district heating and cooling, or in relation to buildings and storage? Why/Why not?
60. What incentives are missing, that would
61. Have cost-optimal policies been devised that improve the performance of buildings so that they use less heating and cooling, while ensuring a decarbonised energy supply?
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?
63. What do you think of the quantity and quality of information on the importance of energy efficiency provided to consumers by:
    f. the European Commission?
    g. national authorities?
    h. regional authorities?
    i. local authorities?
    j. local companies?
64. Has the directive promoted information on opportunities for consumer-friendly smart meters and interoperable energy efficient appliances?
65. What relevant building data has been collected at EU and Member State level, and city and district level? Who has access to this data?

66. How can data on the energy performance of a building and its related renovation work, across its life cycle, best be managed and made available?
67. Has building data harmonisation been achieved?
68. Is there a need for a central EU database of EPCs and qualified experts?
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?
70. Would it have been useful to extend Eurocodes to include energy performance in buildings and other relevant aspects? If so, why?
71. Are energy, materials, waste and water use addressed in the EPBD?
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?
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?
74. Based on existing experience, do you think in the EPBD requirements is missing for regular inspections of the technical building systems to ensure:
    a. that systems' performance is maintained during their lifetime?
    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?
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?
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?
77. Based on existing experience, does the EPBD promote the key ways to ensure that buildings meet stringent efficiency targets in their operation?
78. Based on existing experience, does the EPBD promote the best way to close the gap between designed and actual energy performance of buildings?
79. Based on existing experience, are the provisions provided by the EPBD to stimulate a proactive, innovative maintenance market effective?

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