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PROPOSAL FOR A RECAST OF THE ENERGY PERFORMANCE OF BUILDINGS DIRECTIVE (2002/91/EC)

IMPACT ASSESSMENT

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COMMUNICATION FROM THE COMMISSION

IMPACT ASSESSMENT SUMMARY

EU buildings sector and EU policy objectives

Energy use in residential and commercial buildings represents the lion's share, about 40%, of the EU's total final energy consumption and CO_2 emissions. Activities related to buildings represent a large part of the EU economy, about 9% of EU GDP and 7-8% of EU employment, and the importance of the sector in terms of social, cultural and historic value is enormous. Therefore, the EU buildings sector can play a key role in achieving EU growth, energy and climate policy objectives, while contributing to an improved level of comfort and lower energy bills for citizens.

Energy efficiency of buildings is an important part of broader initiatives on achieving EU energy and climate change objectives, as outlined in the Commission Communication *Energy policy for Europe*[1], and plays a role in limiting the negative impact of high energy prices[2]. The European Council in its Presidency conclusions[3], and the European Parliament in two of its resolutions[4], have urged the Member States and the Commission to follow a proactive approach towards realizing the energy savings potential. In response, the Commission has continued its work on strategic initiatives, also on energy efficiency, with buildings being a basic element.

The potential for cost-effective energy savings is about 30% of the whole sector's expected energy consumption by 2020, which would lead to significant economic, social and environmental benefits. The savings stimulated by the main current EU measures are estimated to result in about 15% total energy savings. Thus, an additional potential of a further 15% energy savings has been identified. This potential can be realized at very low or even negative CO_2 abatement costs, because of the relatively low cost of energy relevant investments (when combined with other construction and renovation works in a building) and the very high value of energy savings compared to the other sectors, making energy saving a very attractive approach for tackling the climate change challenge.

Buildings are often regarded as a "local" issue. Nevertheless, the buildings sector is crucial for meeting the EU policy objectives and the EU added value of energy savings is significant. Buildings concern every EU citizen and with the high energy prices and their volatility energy efficiency is now becoming an important issue. EU action on building could provide for more and better information on the energy savings possibilities. The 'holistic approach' in this direction could also provide for improvements for the lowest quality houses in a proactive manner, as support from the national budgets for subsidising energy bills could now be targeted to long-term solutions for quality improvements in buildings.

EU legislative action

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1 COM(2007) 1
2 COM(2008) 384
3 11018/1/08, REV 1 and 7224/1/07, REV 1
4 2006/2113(INI) and (2007/2106(INI))

The existing EU core instruments in this context, e.g. Energy Performance of Buildings Directive (EPBD), Eco-design of Energy-using Products Directive, and Energy End-use Efficiency and Energy Services Directive, have proved to be a solid basis for achieving and supporting energy savings in the buildings sector. Amongst them, the EPBD is the main tool that provides for a holistic approach towards efficient energy use in the buildings sector.

The main objective of the EPBD is to promote cost-effective improvement of the overall energy performance of buildings, whilst taking into account local conditions and requirements. The Directive covers the energy needs for space and water heating, cooling, ventilation and lighting. It provides for a holistic view on the energy use of buildings and combines in a legal text different regulatory (i.e. minimum energy performance requirements) and information based instruments (i.e. certificates and inspection requirements):

- Member States have to set up minimum energy performance requirements for new buildings and for large existing ones that undergo major renovation. This means that these buildings shall meet certain national and regionally determined minimum energy performance levels, with the aim of achieving improved energy performance, thermal comfort and lower energy bills.
- Member States have to introduce an energy performance certification scheme that provides information on the energy needs of a building and on what can be improved. It should be presented to potential buyers/tenants so that they have an independent assessment of the energy-use aspects of the buildings, enabling informed decisions to be taken.
- Member States shall establish a system for inspection of medium- and large-size heating and air-conditioning systems at regular intervals so that their energy performance can be monitored and optimized. These systems are specially targeted as they dispose of very high energy savings potential. Promotion campaigns can be undertaken by Member States as an alternative to inspections, provided it can be demonstrated that this approach would be of equal impact.

These three main instruments take effect at different times of a building's lifetime. Minimum energy performance requirements are to be met at the time of construction or major renovation (i.e. every 25-40 years approx.). An energy performance certificate is required only when buildings are newly constructed, sold or rented out and is valid for a maximum of 10 years. The inspections of heating and air-conditioning systems are carried out more frequently, this being a function of the system size and fuel source. For instance, in the case of medium-sized boilers and air conditioning systems Member States are entitled to decide on the frequency of inspections regardless of whether or not the building is for sale or rent (as is the case for the energy performance certificate), whereas for large boilers it should be every two years, etc..

Member States also have to develop their own methodology, or use European standards[5], for calculating the energy characteristics and performance of buildings, whilst also ensuring that there are enough qualified experts to carry out the certifications and inspections.

The EPBD does not fix concrete EU-wide energy performance requirements, but obliges Member States to lay down holistic methodologies, requirements, and inspection and

[5] European standards are adopted by a European standardisation body (CEN) and made available to the public. A package of 31 EPBD has been prepared by CEN acting on a mandate by the European Commission to support Member States for the national implementation of the EPBD.

certification regimes to rate the energy performance of buildings at a national/regional level. Thus, its approach takes national/regional boundary conditions, like outdoor climate and individual building traditions, fully into consideration and respects the subsidiarity and proportionality principles. Member States can go beyond the minimum prescriptions laid down in the Directive and be more ambitious.

Before the adoption of the EPBD in 2002, many Member States did not have energy efficiency requirements or promotional instruments in their regulations and building codes. Therefore, in a number of countries the EPBD implementation has been a significant challenge but also, in parallel, an opportunity to improve the quality of their building stock. These challenges led to delay in transposition and a number of infringement cases (21 cases at their maximum) and support actions were initiated by the Commission. There has been positive reaction by the Member States and now 22 of them declare full transposition (which is still under evaluation by the Commission). Nevertheless, the implementation is a continuous process and there are still a number of challenges to be resolved, such as low level of ambition, ambiguous interpretations, and poor enforcement by some Member States.

The main contribution of the EPBD, so far, has been in bringing the subject of the energy efficiency of buildings onto political agendas, into building codes and to the attention of citizens. In terms of implementation costs, several Member States reported moderate costs, but with significant improvements in terms of energy savings in the buildings sector stimulated by the Directive.

Need for further activities?

Despite the actions already undertaken within the buildings sector, the main problem is that there is still a large cost-efficient energy saving potential that remains unutilized. Whilst the available data does not allow for a full assessment of the impacts of the current directive, rough calculations show that, if fully and properly implemented, the energy savings from the EPBD can be as much as 96 Mtoe final energy in 2020, this being 6.5% of EU final energy demand. However, its wording and the 'openness' of its provisions allow for various interpretations in its implementation. This would probably mean that its full impact may not be realized.

Many of the potential social, economic and environmental benefits at national and EU level are being neither fully explored nor fully exploited. This is due not only to the complexity of the sector and the existence of market failures, but also to limitations of the current EPBD. The possible alternative ways of tackling the challenges are: (i) repealing the EPBD and replacing it by ‘soft’ instruments, (ii) business as usual through use of the existing instruments without adaptation, and (iii) EU action by complemented and improved instruments of the current EPBD.

The first alternative, which is to repeal the EPBD and rely on 'soft law' instruments, such as information, voluntary activities, financing measures, etc., would entail pro-active and ambitious actions from Member States wherein the Commission would monitor and support the progress. However, the specifics of the sector, insufficient measures in many Member States, the high cost of “soft” instruments, and the fact that there is already a functioning Directive at EU level, all lead to the conclusion that this alternative would not solve the problems at acceptable cost. In addition, repealing the EPBD would send a very negative signal regarding the EU ambitions to pursue its policy objectives on energy efficiency.

The second alternative is to continue with the 'business as usual' or ‘do nothing more’ than the existing measures, besides continued and improved implementation. If such an approach were adopted a large potential, currently outside of the EPBD, would remain untapped. Also, due to the limitations in the wording of the current EPBD, the full expected potential would not be realized. On the contrary, because of the vagueness of some provisions there may even be a negative connotation. For instance, because of the lack of provisions on monitoring and compliance, the certificates might be of very poor quality in some countries and considered as a useless bureaucratic burden imposed from Brussels.

The third alternative is to revise the EPBD. The main provisions of the current Directive would be kept, as they are already delivering, but their efficiency would be significantly improved and their scope extended. By building on its current structure and provisions, as well as the implementing measures already undertaken in Member States, the transposition - and indeed the comprehension of these measures by all stakeholders- would be eased, whilst at the same time provision could be made for tapping a larger share of the energy saving potential and other related benefits. The setting up of the concrete levels, requirements and mechanisms would, as under the current EPBD, be left to the national/regional authorities in respect of the principles of subsidiarity and proportionality.

The conclusion drawn from the three policy alternatives was that the largest contribution towards meeting the EU policy goals can be achieved through revision of the EPBD. This can be done with modifications of the current provisions that would keep the principles and their essence, but would significantly improve their efficiency. In this case, the current Directive will be the starting point for the revised instrument and will constitute its 'backbone'. Therefore, the continued implementation of the EPBD is of crucial importance.

However, it should be emphasized that the solution is an integrated mix of policy instruments and thus other non-regulatory measures, although not sufficient on their own, are necessary to complement the implementation of the Directive. Therefore, the efforts in providing more financial and fiscal incentives, information, training of experts, and agreeing on voluntary actions should be strengthened. The 'soft law' instruments already contained in the current EPBD should be further developed.

EU's right for undertaking these activities

Climate change, security of energy supply and environmental protection are challenges that cannot be sufficiently addressed at national level only. Energy efficiency provides part of the solution of these problems and the instruments on energy efficiency that have already been adopted at EU level, based on Art. 6 of the Treaty (environmental protection), reflect this need for Community action.

The buildings sector is responsible for about 36 % of the EU's total CO_2 emissions and for about half of the CO_2 emissions which are not covered by the Emission Trading System. It disposes of a considerable cost-effective energy savings potential which can hardly be found in any other area and which is attainable at comparatively low costs. Therefore, it becomes evident that every country needs to urgently save energy in buildings but not all dispose of the knowledge needed.

The buildings sector is also highly disaggregated and is experiencing a number of market failures (e.g.: partial internalization of externalities in energy prices; principal-agent problems; split incentives; lack of appropriate information, education and training; low uptake

of new and innovative technologies; etc.) which have limited the rate of energy efficiency gains in the sector. Indicators show that while for example the energy consumption of industry is decreasing, that of households is constantly on the rise. Construction products, appliances and services related to buildings are an important part of the EU internal market. In addition, with the increasing mobility of people and number of businesses with operations across the EU, a similar way to measure, for example, the energy performance of buildings would decrease the administrative burden for them.

As energy efficiency objectives could not thus far be achieved by Member States to a sufficient extent, then action at Community level is appropriate to facilitate and support the uptake of activities at national level.

The main elements of the current EPBD have already been discussed from the point of view of the principles of subsidiarity and proportionality when the Directive was tabled in 2001 and adopted in 2002. Furthermore, they have also been tested in practice, demonstrating the appropriateness of the approach. Since then the need for common action to tackle the challenges of climate change and energy dependency have become even more apparent. In this Impact Assessment, subsidiarity and proportionality were guiding principles when developing the initial screening of options. Nevertheless, some options, which could possibly not be in line with these two principles, were discussed in the text as they have high potential for energy and CO_2 reductions. In this case appropriate indication has been given in the text.

What options for a better EPBD?

The Impact Assessment concluded that several aspects of the current EPBD could be improved. These in general refer, firstly, to the improvement of some ambiguous wording (in particular of definitions) and, secondly, to each of the main pillars of the current Directive. Within each pillar several options were chosen, based on a broad discussion with stakeholders and observations from the implementation of the current EPBD.

The options were analysed in view of their economic, social and environmental impacts. For the analysis, the BEAM model (see Annex IV) and data/assumptions available in a large number of studies were used, as well as the knowledge and observations accumulated by following the implementation of the EPBD and discussion/inputs from Member States and stakeholders. The calculation of the impacts is bottom-up (i.e. based on following the construction, demolition and renovation rates, and energy-efficiency measures in building retrofits). The baseline is the latest update (September 2007) of the PRIMES model of DG TREN which includes policies and measures implemented in the Member-States until the end of 2006. The latest policy developments for the ETS and non-ETS sectors are not included in the baseline. For some options, only qualification of the impacts was possible, due to limitations in the available quantitative data.

The options discussed include a mix of policy instruments, including regulatory and also non-regulatory alternatives, like information and other soft measures.

The main areas where action is required and within which various options needed to be discussed were:

General: Clarification and simplification

This is essential for proper implementation of the EPBD. The need for action in this direction surfaced during discussions with representatives from Member States and via inputs from stakeholders. Two actions are key in this direction: (i) to clarify and simplify the text itself (i.e. certain definitions and provisions), and (ii) to choose the proper legal format of the proposed revised text (recast vs. amendment).

A: 1000 m^2 threshold for existing buildings when they undergo major renovation

The current EPBD provision that only existing buildings above 1000m^2 should meet certain energy performance requirements when undergoing major renovation (for which either the investment is above 25% of the whole building value, excluding the land, or the renovation concerns more than 25% of the building shell), means that only about 29% of the EU buildings sector falls within the scope of this provision. The best moment for the introduction of energy efficiency measures is when a building anyhow undergoes major renovation, which is approximately every 25 years. At that stage, the additional investment needed is not high and -as the investment also leads to energy savings- it is usually repaid during its lifetime.

This provision therefore limits the impact of the Directive.

Three possible options on the extension of the EPBD were analysed:

Option A1: Lowering the threshold to 500 m², (all medium sized buildings).

Option A2: Lowering the threshold to 200 m², (all buildings apart from small ones (mainly single family houses)).

Option A3: Abolishing the 1000 m² threshold (all buildings).

For all options the current exceptions listed in Art.4 (3) for certain buildings (for example, buildings officially protected because of their architectural or historical merit, the stand-alone buildings smaller than 50 m², etc), are considered to remain. Also, the possibility for Member States to go beyond the requirements, i.e. below 500 or 200 m² would remain.

It should be highlighted that within the discussed options, Member States would still be responsible to set up the individual requirements of energy performance and thus the subsidiarity principle will be respected. Also, the definition of major renovation would be retained as in the current EPBD, which means that, for example, renovation of an apartment in a large multifamily building would, in most cases, not be covered by the requirements. The effect on individual households would be limited further by the fact that renovations are usually made 'step by step'. The current EPBD also entails that for existing buildings, when they undergo major renovation of a certain part, the energy performance requirements are to be met only for this part and not for the whole building. For example, if the building shell is renovated this would not mean that the heating system should mandatorily be changed.

A summary of the calculated impacts of the three options is provided in the table below.

	Option A1	Option A2	**Option A3**
Final energy savings in 2020 (Mtoe/a)	3	5	**20**

	Option A1	Option A2	**Option A3**
CO_2 emission reductions in 2020 (Mt/a)	8	14	**51**
Capital costs in 2020 (billion €/a)	1 (but 3 saved energy costs)	2 (but 7 saved energy costs)	**8 (but 25 saved energy costs)**
Job creation in 2020	10,000	21,000	**75,000**
Administrative costs	Low	Low	**Medium**

The analysis indicates that option A3 could most significantly contribute to the realization of the EU policy objectives in question.

B: Energy performance certificates

The certificates, which are already mandatory under the current EPBD when buildings are constructed, sold or rented out, can be a powerful tool to create a demand-driven market for energy efficient buildings, as they allow economic agents to estimate costs in relation to energy consumption and efficiency. However, observations show that some certificates issued in some Member States are not of satisfactory quality, or they are not systematically made available during property transactions, thus significantly restricting their real impact at the present time. Higher uptake of the recommendations, as shown on the certificates, for energy improvements of the buildings can stimulate further energy savings. Therefore, several options have been analysed:

Option B1: Quality and compliance requirements for certificates. It is proposed that a requirement for random sampling checks of the quality of energy performance certificates and compliance with the building energy codes is carried out by public authorities or accredited institutions. This regulatory instrument would ensure that the information on the certificates is of good quality and reliable. It is also expected that it would trigger an increase in the rate of renovations, and thus high energy savings as, due to the improved quality, people would be more aware of the possibilities for improvements and of their cost-effectiveness. Proposing such requirements can be justified from a proportionality point of view as, from the current practice, it has been evident that the low quality of certificates is one of the key factors for the credibility and market uptake of the certificates in a number of Member States.

Option B2: Requiring that the recommended cost-effective measures of the certificate are realized within a certain time period. The proposal is to require that the cost-effective recommendations on the certificate are implemented within a certain period of time. The setting up of a definition for 'cost-effective' and the period of time are to be decided at national or regional level. This regulatory instrument can be introduced either for all buildings or only for those of the public administration. Due to data availability limitations, the introduction of such a requirement was only analyzed for tertiary sector buildings. This would be a significant financial burden for EU citizens and businesses, and therefore such action would not be justified at EU level if no sufficient financial mechanisms are ensured.

Option B3: Making certificates a mandatory part of property advertisement and/or property transaction documents. This would entail that information on the energy performance of a building is included in advertisements and publicity for property transactions and that with each transaction the certificate has to be presented. The former is an information tool that would increase the awareness about the certificates and energy efficiency. Such a requirement

at EU level has already been made for the display of CO_2 emissions of cars and, taking into account the important contribution such action may have, its introduction would be in line with both the subsidiarity and proportionality principles. The latter is a regulatory measure that would limit the interpretations of the current text of the EPBD which already states that a certificate should be 'made available', but for which, nevertheless, there are some interpretations which mean that the certificates are not *de facto* presented.

Option B4: Requiring the linking of the certificates with other support or discouragement mechanisms. It is suggested that the energy efficiency improvements of a building, which are achieved as a result of a financial incentive, are demonstrated or justified using the certificate. For example, if a certificate is made before and after the investment, the financial support may be given only if there are improvements to the ranking of the building. This will help property owners/tenants to make informed decisions about the cost-effectiveness of their investments and there will be a proof that the funding provided would really lead to energy savings. However, such a requirement would not be in line with the subsidiarity principle, as it would touch upon issues of national budget spending. Furthermore, introducing such a text into a Directive based on Art. 175 (environmental protection) of the Treaty may not be possible from a legal point of view.

A summary of the calculated impacts of the three options is provided in the following table.

	Option B1	Option B2*	**Option B3**	Option B4
Final energy savings in 2020 (Mtoe/a)	**21**	12	**++ (lower than B2)**	++ (lower than B2)
CO_2 emission reductions in 2020 (Mt/a)	**57**	33	**++ (lower than B2)**	++ (lower than B2)
Capital costs in 2020 (billion €/a)	**8 (but 26 saved energy costs)**	5 (but 9 saved energy costs)	**Very low**	Strongly depends on type of measures
Job creation in 2020	**60,000**	100,000	**++**	++
Administrative costs	**Low - medium**	High	**Very low**	Medium
Comments	**CO_2 abatement costs of about -315 €/ton.**	High one-off investments; legal constraints		Measures outside EPBD, legal constraints

* Impact quantified for the tertiary buildings sector only, so figures do not contain the potential of the residential sector.

The analysis indicates that options B1 and B3 could significantly contribute to the realization of the EU policy objectives in question. Option B4 could also be further developed outside the scope of the EPBD.

C: Inspection of heating and air-conditioning systems

These systems have a very high energy saving potential, up to 40-60% of their total energy use. At present, the current EPBD requires that a regular inspection be performed on systems above certain thresholds, although it is very unclear what the outcomes of these inspections are and furthermore their quality is not always satisfactory. As a result, it is estimated that the EPBD as it is today can bring only 10% energy savings in this field by 2020. There is significant room for further savings, for which two options have been discussed:

Option C1: Requiring an 'inspection report' for heating and air-conditioning systems. It is proposed that an 'inspection report', to be drawn up by an independent expert, is given to the building owner. It would include an energy efficiency rating of the heating/cooling system and recommendations for cost-effective measures. This information tool aims at providing practical and useful results to building owners when deciding on retrofitting and would therefore increase the impact of the current EPBD provisions. In this context, existing CEN standards for inspections could be further developed to allow for an efficiency rating of the installation systems. The recast EPBD could therefore refer to European standards and make the efficiency rating part of the inspection report. Minimum energy efficiency installation requirements could then be set by Member States. This would link the EPBD with the Eco-design Directive. The inspection report would be an important upgrading to the existing requirements for inspection and would help consumers in identifying important possibilities for cost-effective energy savings and, hence, is justified from the point of view of proportionality.

Option C2: Introducing compliance requirements. It is proposed that random sampling checks of inspection reports (presented in option C1) of different levels of detail and frequency could be introduced. This regulatory tool could ensure that the inspections are carried out regularly and are of satisfactory quality (which is not always the case at present). Similarly to option B1, proposing such requirements can be justified from a proportionality point of view as, given the evidence from the current practice, it has been witnessed that without compliance checks the usefulness and credibility of inspections is drawn into question.

A summary of the calculated impacts of the two options is provided in the table below.

	Option C1	**Option C2**
Final energy savings in 2020 (Mtoe/a)	**5**	++ - +++ **(higher than C1)**
CO_2 emission reductions in 2020 (Mt/a)	**15 – 20**	++ - +++ **(higher than C1)**
Capital costs in 2020 (billion €/a)	**Net benefits (investments minus energy savings) estimated to €2 billion per year.**	**In the same magnitude as C1**
Job creation in 2020	**46,000**	**23,000**
Administrative costs	**Low**	**Medium**
Comment	**CO_2 abatement costs estimated to be around -133€/ton.**	**CO_2 abatement costs estimated to be in the same magnitude as option C1.**

The analysis indicates that taken together both options C1 and C2 could significantly contribute to the realization of the EU policy objectives in question, without leading to negative social or administrative implications.

D: Energy performance requirements

At present, Member States determine individual energy performance requirements and their levels of ambition. These vary widely across the EU, even within similar climatic zones. In many Member States cost-optimal levels are not yet achieved, which means that the cost-efficient energy savings and CO_2 emission reduction possibilities are not fully utilized. Furthermore, cross-border comparisons of how Member States have advanced in this respect are difficult due to diverse national/regional approaches of calculation and setting up of the

underlying parameters. Therefore, further stimulation at Community level, while respecting the subsidiarity and proportionality principles, could realize additional energy savings.

Four options have been identified:

Option D1: Specifying EU–wide energy performance requirements. The proposal would entail that specific energy performance requirement levels are proposed as an Annex to the revised EPBD, based on robust calculations that have to take into consideration various factors, for example, different climate zones and building types for residential and non-residential buildings. This regulatory instrument would allow for a large part of the energy savings potential to be reaped, as in some countries the requirements are below cost-optimal level, but would require a high level of regulation at EU-level. It would ease cross-border operating businesses and support the internal market of energy efficiency related construction materials and appliances. However, determining these levels would be a very demanding and highly disputed task. Such concrete regulation at EU level would not be in line with the principles of subsidiarity and proportionality.

Option D2: Introducing a benchmarking mechanism. The proposal is to include in the EPBD (i.e. as an Annex) principal parameters to calculate the cost-optimal level of energy performance requirements for buildings which can be used to compare the Member States' level of ambition in the implementation. The current provisions of the EPBD would not be changed regarding the minimum energy performance requirements, i.e. Member States would still have to set up the individual levels based on their national circumstances. In addition there would be a calculation methodology proposed, for example, by the Commission, which would allow for a cross-check of how close national/local requirements are to the optimal levels. In order for this comparison to be carried out, Member States would have to provide input data or to calculate the levels for themselves but report the results. This would clearly indicate whether Member States are below the optimal levels, which would mean that money from energy savings is lost every time national or local regulations are applied, or whether Member States are too ambitious in their requirements and place an unjustified burden on their citizens.

This is a "soft law" instrument and would not impose any requirement for the Member States to correct their levels and thus would be in line with the proportionality and subsidiarity principles. However, it is believed that it would create significant peer-pressure from the front runner countries, as well as from the construction industry and other stakeholders, and would ultimately move all Member States towards optimal energy efficiency requirements. The impact that is measured is the maximum possible, i.e. meaning that Member States would gradually correct their national levels, with half of them would adjusting their national levels to cost-optimal ones by 2020 and the remainder, possibly, by 2030.

Option D3: Requiring an evolving improvement scheme for the buildings stock focussing on the worst performing buildings (a kind of top-runner approach). It is proposed that Member States monitor their building stock and lay down Action Plans on how to increase the refurbishment rate and the energy performance of the worst performing buildings. This mix of instruments could tackle the most cost-effective potential. However, it would require that a significant quantity of presently unavailable good quality statistical information on the building stock is collected, thus implying high administrative costs. Such an approach would also be a considerable burden for the owners (some of them with low incomes) of the poorly performing buildings and this would also entail that Member States would have to provide

financial support mechanisms. This approach would not be in line with the subsidiarity principle as it would touch upon issues of national budget spending.

Option D4: Setting up EU–wide low or zero energy/carbon buildings/passive house requirements. It is proposed that a requirement is introduced that all newly constructed buildings must meet the low energy building requirements from a certain date onwards. Alternatively, Member States can be encouraged to set a definition and strategy for achieving the low energy building standard where the final and intermediary target years are clearly mentioned. These actions would lead to very well performing new buildings and foster innovation.

However, such a requirement would pose a significant challenge to the construction industry to build such houses and would increase houses prices by 7% to 15%. It would also not respect the subsidiarity and proportionality principle, as it would require investments that are not in all cases cost-efficient and would create burden for the national budgets as they would have to support households that could not afford to build such low energy homes. Therefore, a softer approach can be taken which is to include an obligation for the development of 'roadmaps', wherein Member States would show their commitment toward achieving low energy/emission houses in the future and the concrete measures they plan to undertake.

A summary of the calculated impacts of the four options is provided in the table below.

	Option D1	**Option D2**	Option D3	**Option D4**
Final energy savings in 2020 (Mtoe/a)	10	**5 (up to 10 in 2030)**	+	15 (if required for all new-build) **+ (if gradually with roadmaps)**
CO_2 emission reductions in 2020 (Mt/a)	24	**13 (up to 24 in 2030)**	+	41 (if required for all new-build) **+ (if gradually with roadmaps)**
Capital costs in 2020 (billion €/a)	6 (but 12 saved energy costs)	**3 (but 6 saved energy costs)**	++	50 – 120 (if required for all new-build)
Job creation in 2020	82,000	**up to 82,000**	+	**+++**
Administrative costs	Very high	**Very low**	High	**Low**
Comment	CO_2 abatement costs of about -250 €/ton. subsidiarity concerns	**CO_2 abatement costs of about -250 €/ton.**		Very high one- off investments if required for all new-build

The analysis indicates that option D2 could significantly and quickly contribute to the realization of the EU policy objectives in question. Option D3 could be taken on board by Member States when starting national activities, in particular related to the National Energy Efficiency Action Plans. Option D4 could, due to economic and legal constraints be considered in a less prescribed form, i.e. by national visions/roadmaps.

Furthermore, the role of the public sector to act as a leading example in energy efficiency is dealt with in the Impact Assessment by proposing stricter deadlines for the public sector than for other sectors to comply with EPBD obligations and by proposing an obligatory realization of energy efficiency measures which are recommended in the energy performance certificate of a building.

Conclusions

The results for the most cost-effective and beneficial options (indicated in bold in the tables above), with all available quantifications, **show significant positive impacts which are possible if the Directive is revised, that would make use of a large part of the remaining potential in the buildings sector and would also contribute to the realization of the full potential of the current EPBD.** Furthermore, such a revision would create a simplified and improved framework for energy savings. The minimum total impact of the options identified as being most beneficial and for which quantification was possible, is:

– 60 – 80 Mtoe/year energy savings in 2020, i.e. reduction of 5-6% of the EU final energy consumption in 2020;

– 160 to 210 Mt/year CO_2 savings in 2020, i.e. 4-5% from EU total CO_2 emissions in 2020;

The impact on the labour market would also be important. It is expected that 280,000 (to 450,000) potential new jobs will be created by 2020 by the revised EPBD. This would mainly be in the construction sector itself as well as for the services of energy certifiers, auditors and inspectors of heating and air-conditioning systems.

The investment requirements and the administrative costs of the measures were analysed and are relatively low compared to the benefits and the returns. For example, abolishing the 1000 m^2 threshold on an EU scale would lead to €8 billion/year additional capital investments but would trigger €25 billion/year energy cost savings in 2020, which also means considerably negative CO_2 abatement costs These calculations have been made on the basis of conservative estimations about oil prices (e.g. 55$ per barrel oil in 2005, 100$ in 2020 and 119 $ in 2030 in year 2005 prices). With higher oil prices it can be expected that returns on investment would be in even shorter periods and the potential would be even higher.

The investment needs differ substantially across Europe depending on the social and economic conditions, on the initial state of property and on the type of renovations people undertake. They are not equally distributed amongst EU citizens, i.e. there will be additional costs for those who make major renovations of their buildings or are engaged in property transactions. However, with the high oil prices these initial investments will have attractive returns. The overall benefits for society in terms of reduction of energy consumption and thus reduced CO_2 emissions and energy import dependency, job creation, especially at local and regional level, positive health and labour productivity far exceed the costs of the measures analysed.

ANNEXES

III Summary report of the consultation meeting

IV Main methods and assumptions

V EU buildings sector

1. PROCEDURAL ISSUES AND CONSULTATION

1.1. Organisation and timing

The Energy Efficiency Action Plan of 2006[6], endorsed at the Spring 2007 European Council[7] and further supported by the June 2008 European Council, details a plan for achieving 20% energy saving by 2020 and highlights the importance of the buildings sector to this end. One possible measure with significant potential that is discussed and evaluated in the Action Plan and its Impact Assessment[8] is the strengthening of existing policies, and in particular, of the Energy Performance of Buildings Directive (hereinafter EPBD) 2002/91/EC. Possible action in this direction features on the Commission Legislative Work Programme of 2008 as one of the four strategic priorities on energy[9] and on the Commission Simplification Rolling Programme for 2008-2009[10] aimed at better regulation and lawmaking.

Energy efficiency of buildings is an important part of broader initiatives on achieving EU energy and climate change objectives as outlined in the Commission Communication *Energy policy for Europe*[11] and on limiting the negative impact of high energy prices[12]. The European Council in its Presidency conclusions[13], and the European Parliament in two of its resolutions[14], has urged the Member States and the Commission for a proactive approach towards realizing the energy savings potential. In response the Commission is preparing an encompassing Strategic energy review 2 package to be adopted by the Commission in November 2008. Action on buildings, as discussed in this Impact Assessment, would be part of this package.

The Impact Assessment has been prepared in the first half of 2008 to evaluate options that could be explored in this area. It does not prejudge the final form of any decision to be taken by the Commission.

1.2. Consultation and expertise

The impact assessment is based on a wide range of information sources such as material from the Member States, experts, stakeholders, as well as from conferences, public consultations and studies. The process was supported inside the Commission by an Inter Service Steering Group, lead by DG Energy and Transport (DG TREN).

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6 COM(2006)545

7 7224/1/07, REV 1

8 SEC(2006)1174

9 COM(2007) 640 final

10 COM(2008) 33 final

11 COM(2007) 1

12 COM(2008) 384

13 11018/1/08, REV 1 and 7224/1/07, REV 1

14 2006/2113(INI) and (2007/2106(INI))

1.2.1. Member States and Stakeholder consultations

DG TREN has a very good understanding of the challenges encountered by the Member States with the implementation of the EPBD at national/regional level, as there has been a continuous exchange of information based on regular contacts since the existing Directive was adopted in 2002. While DG TREN closely follows the transposition of the EPBD into national legislation, it also extensively discusses the implementation with national representatives in regular meetings. The Energy Demand Management Committee is one such discussion platform to follow the status of implementation and challenges of the Directive between Member States and the Commission which usually meets twice a year (a summary of Member States' input on the impacts of the EPBD and need/possibilities for its modification is included in Annex II).

Further intensive discussions were held in the context of two dedicated initiatives, so-called Concerted Actions (01/2005-06/2007 and 12/2007-11/2010), which were initiated under the Intelligent Energy Europe Programme of the EU (implemented by the Executive Agency for Competitiveness and Innovation (EACI)) to provide support to the Member States for transposing and implementing the EPBD. The Concerted Actions consist of regular 2 - 3 day meetings (about twice a year) of all Member States' representatives - involving around 100 participants of national authorities and institutions directly in charge of implementation of the Directive in each Member State. Best practices and detailed questions on transposition are discussed in the plenary sessions and parallel workshops held therein. The exchange of information continues in between the meetings via working groups, internet meetings, newsletters and a supporting web based service platform.

DG TREN has many bilateral contacts with stakeholders, such as property and industry associations, banks and energy services companies to assess how the EPBD impacted their businesses. Some major stakeholders contributed with position papers presenting their ideas on how to increase energy efficiency of buildings in the framework of the EPBD.

At the beginning of 2008, DG TREN organized, with the support of the EPBD Buildings Platform, the "Energy Performance of Buildings Directive: Next steps" Conference as part of the EU Sustainable Energy Week. The objectives were to present DG TREN's preliminary ideas for gaining more energy saving from buildings and to initiate a consultation on the elements of the Directive which could be revised (see Annex III for its summary). The conference was attended by more than 150 participants and the ideas for the challenges and possibilities for further steps were discussed and in general very well accepted.

To further widen the scope of ideas on how to upgrade the energy performance of buildings, DG TREN also launched an online consultation for a period of eight weeks, starting from April 25[15]. There were in total 246 responses, of which 82% organizations and 18% citizens, originating from 22 Member States and several countries outside the EU (for summary see Annex I). There has been a strong support of the revision of the EPBD (more than 75%). The answers indicate a clear wish for clarification or simplification to extend the scope of the existing Directive concerning e.g. specific definitions or lowering/abolishing of existing thresholds, and strengthening the role of its instruments, e.g. the Energy Performance Certificate. Furthermore, suggestions were made for a better European harmonization that

[15] It was in the form of questionnaire and was published on the Commission's webpage 'Your voice in Europe' and on the webpage of DG TREN

would ease cross-country comparisons and improve business environment. Also a stronger role of the public sector to act as a leading example was clearly proposed.

1.2.2. Studies

Broad knowledge exists on the different economic, social and environmental dimensions associated with the energy performance of buildings, and is well documented in various studies, including those supported by the EU within its Intelligent Energy Europe Programme and the Framework Programmes for Research and Development. However, these studies, many of which arise from grass-roots initiatives supported at European or national level, are fragmented with regards to the issues discussed and countries covered. Hence, this impact assessment considers the results of a large number of studies having very different scopes.

The National Energy Efficiency Action Plans of the Member States, submitted within the reporting obligations of the Energy end-use efficiency and energy services Directive (2006/32/EC), were also consulted for information on the energy efficiency measures taken in the buildings sector of Member States.

In addition to the literature already available, the assessments made in this document are also based on the analyses and data provided by an external consultant, who was contracted by DG TREN to provide support with the quantification of the various impacts resulting from the options discussed in this impact assessment. The task of the consultant was to screen available studies for best practice examples and foremost to provide estimates for costs and benefits based on official statistical data and modelling tools.

1.2.3. Opinion of the Impact Assessment Board

This Impact Assessment has been on the agenda of the Impact Assessment Board hearing on 16 July 2008 and a written procedure in September 2008.

All items of the Impact Assessment Board opinion of 22 July 2008 were comprehensively addressed in a revised version of the Impact Assessment resubmitted on 4 September 2008. In its second opinion the Impact Assessment Board asked for new modifications of the document mainly on: (i) further in-depth analysis of subsidiarity aspects; (ii) another clarification on the analysis of costs and benefits of the options analysed; (iii) assessing administrative costs of the options analysed using the EU Standard Cost Model; (iv) further clarification of the problem definition; and (v) possibility for a discussion of the other foreseen EU measures which possibly target on energy efficiency of buildings.

Points (i), (ii) and (iv) have been addressed in this Impact Assessment by adding and further explaining the text. The administrative costs have been analysed based on available studies, referred in the text. As the request in point (iii) to use the EU Standard Cost Model came at a very late stage it was not met. The same applies for point (v).

2. PROBLEM DEFINITION

2.1. Overarching problem definition

The EU buildings sector can play a key role in achieving EU growth, energy and climate policy objectives, while contributing to an improved level of comfort and lower energy bills for citizens. To meet the common policy targets on energy and climate change Member States

need to act in all fields, ETS and non-ETS. The policy frame for non-ETS is also given in the EEAP of which buildings constitute an important element.

However, **the problem is that a large part of the cost-effective[27] energy efficiency potential is not realised in practice**. The potential of the buildings sector is estimated at the possibility for 28% cost-efficient energy savings by 2020 for the sector (or 143Mtoe final energy) which could be translated in 11% reduction of the total EU final energy consumption and 11% reduction of EU total CO_2 emissions. This potential is for both existing and newly constructed buildings. This will result in a number of other benefits (see Annex V).

Narrowing of the gap between the realisable potential and its real uptake is the Commission's main motivation for initiating a discussion and analyzing the possible options.

Before proceeding to identifying the concrete problems and suggestions for actions it is important that a good understanding of the buildings sector is developed and of the existing policy that was developed to partially tackle the problem. This presentation is provided in Annex V and the following Section 2.2. Taking these actions into account a discussion of the remaining problems is included in Section 0.

2.2. Actions in the EU

After the oil crises of the 1970s, many governments around the world realized the impacts energy supply disturbances can have on their economies and the benefits of decreasing their energy needs. As a consequence, significant energy efficiency gains were realized which, for example, resulted in about 30% reduction of the energy intensity of households and service sector by 1990 compared to 1973 in the biggest eleven OECD countries[16].

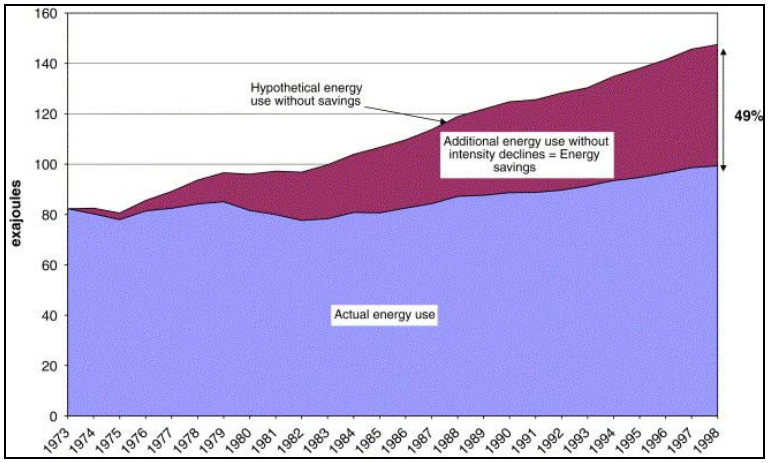


Figure 1. The impact of energy efficiency improvements on energy use in several OECD countries. Source: Geller *et. al* 2006

The instruments varied from country to country but included building codes, financial and fiscal initiatives, research and development programmes, and information and education campaigns. From the frontrunners, Sweden and Denmark were the first to introduce energy

16 Geller *et. al*. Polices for increasing energy efficiency: Thirty years of experience in OECD countries. *Energy Policy 34*, 556–573. Data refer to 11 OECD countries OECD countries Australia, Denmark, Finland, France, Germany, Italy, Japan, Norway, Sweden, United Kingdom, and the United States, 2006.

efficiency requirements in their buildings codes in 1947 and 1961, respectively, and requirement for provision of information on the energy consumption of buildings as a certificate in 1997[17]. The introduction of thermal insulation requirements reduced the heating energy consumption per unit of floor area in Germany by 30% over 1978-1993 period. However, at that time, fewer activities were carried out in other Central and in Eastern European countries, which is also true for many EU-15 countries. In the 1990s, energy efficiency gains slowed worldwide and only recently there was a new upsurge of attention and dedicated policy.

At EU level, several energy policy measures have been introduced since 1970's, but the major policy initiative was the adoption of the Energy Performance of Buildings Directive 2002/91/EC (EPBD) in 2002.

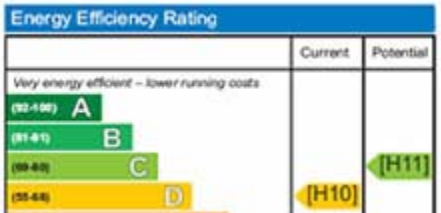
2.2.1. Energy Performance of Buildings Directive (EPBD) (2002/91/EC)

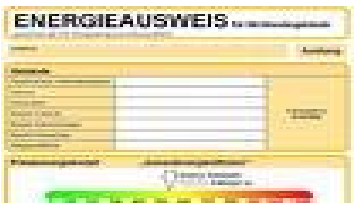
The main objective of the EPBD is to promote cost-effective improvement of the overall energy performance of buildings, while taking into account local conditions and requirements. The Directive covers the energy needs for space and hot water heating, cooling and lighting and has three main pillars: energy performance requirements for new buildings and for existing that undergo major renovation, energy performance certificates, and the inspection of boilers and air-conditioning systems. The Directive sets the basic principles and recruitments and **leaves significant room for Member States** to establish the concrete mechanisms and numeric requirements and ways to implement them. To this end **Member States shall**:

- Set up **minimum energy performance requirements** following their national/local situation. This means that whenever a new building is constructed or a **large existing one (above 1000m^2) undergoes major renovation**[18] certain nationally or regionally determined minimum levels of energy efficiency should be met. This level for new build may be, for example, one value that represents the maximum permissible energy consumption or CO_2 emissions of a building. For existing buildings it may refer to a value for certain components. For instance, if the windows are replaced then only the efficiency of this component should meet the national or regional minimum requirements and not the other components (such as roof, façade, floor, heating/cooling system) or the whole building. The holistic approach for new-build gives maximum flexibility for the choice of system or design to reach the value and thus stimulates innovation. In parallel, the component approach for existing buildings provides that owners/tenants are not burdened with huge expenses when they want to carry out partial renovation. To promote further innovation for **all new buildings above 1000 m^2 the feasibility of alternative systems** (i.e. renewables, co-generation, district heating and cooling, and heat pumps, under certain conditions) is to be considered and taken into account.
- Establish a national scheme for energy labelling of the buildings (see examples from Germany and England & Wales below; similar for example to the energy efficiency labelling of household appliances). This **Energy Performance Certificate** shall include

[17] Laustsen. Energy efficiency requirements in building codes, energy efficiency policies for new buildings. IEA Energy Efficiency Working Party note by the Secretariat, 2007

[18] Major renovations are cases such as those where the total cost of the renovation related to the building shell and/or energy installations such as heating, hot water supply, air-conditioning, ventilation and lighting is higher than 25 % of the value of the building, excluding the value of the land upon which the building is situated, or those where more than 25 % of the building shell undergoes renovation.





information on the energy consumption needs of a building, its rating compared to other buildings, and recommendations for cost-effective improvements. The Certificate shall be provided to the (potential) buyer/tenant when buildings are constructed, sold or rented out by their owner. The aim is to provide information so that informed choices can be made and also to provide with guidance on the cost-efficiency and savings possibilities for possible improvements of the property. All **public buildings** or buildings frequently visited by the public above 1000 m^2 should have certificates that are to be displayed in a place that is visible to the general public.

Figure 2. Examples of Member States Energy Performance Certificates

- Introduce **inspection requirements so that heating and air-conditioning systems** above certain thresholds should be regularly checked for their efficiency[19]. Boilers and air-conditioning systems are addressed because they play a significant role for the building's energy consumption and their efficiency can be improved considerably. Instead of inspection requirements, boilers may have a promotion scheme that should have the same savings effect as the inspection schemes.

These three main instruments take effect at different times of a building's lifetime. Minimum energy performance requirements are to be met when buildings are built or they undergo major renovation (i.e. every 25-40 years). The energy performance certificate is required only when building are newly constructed, sold or rented out and is valid for a maximum of 10 years. The inspections of heating and air-conditioning systems are more often. The regularity is a function of the size and fuel source (e.g. for medium sized boilers and air conditioning systems Member States should decide on the regularity, for large boilers it should be every two years, etc.) and the inspections are independent of the sale or rent of a building.

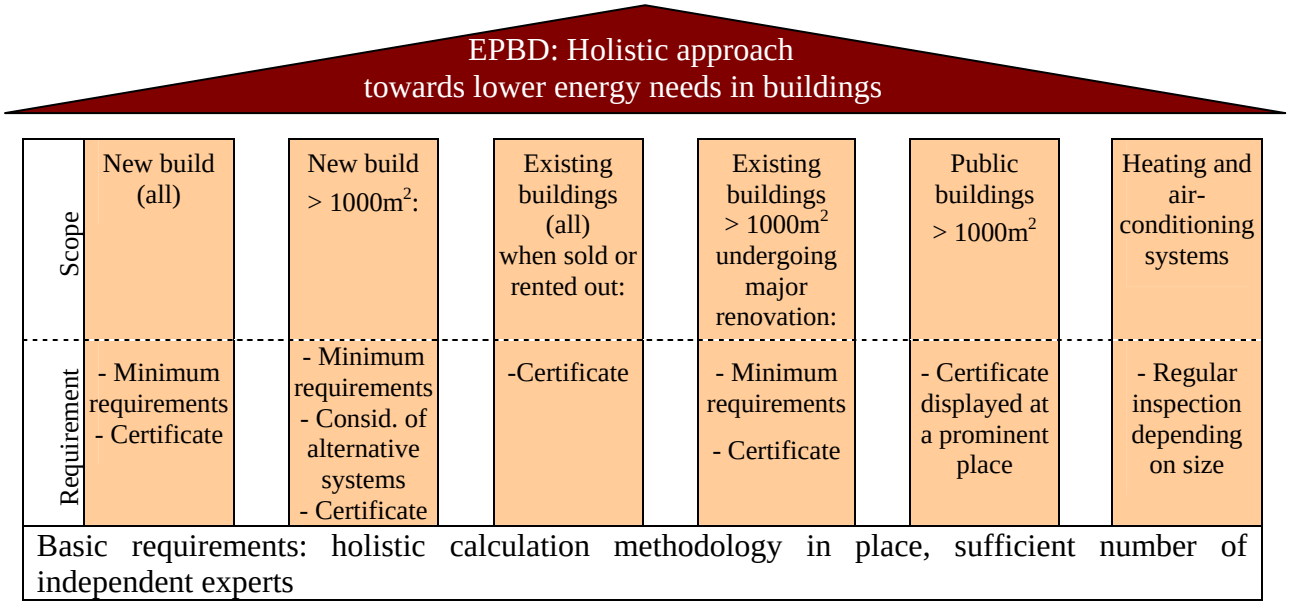
In this way the Directive calls for setting up a regulatory policy instruments measures (i.e. minimum requirements) along with informative ones (i.e. the certificates and inspections). The use of mix of policy instruments provides for means of addressing various challenges of the sector and developing a coherent approach towards problem solution.

[19] For boilers fired by non-renewable liquid or solid fuel with rated output of 20 kW to 100 kW – regular inspection, for boilers above 100 kW – inspection every two years (with possibility for expansion to four years for gas boilers). For all heating installation with boilers of effective rated output of more than 20 kW older than 15 years – a one-off inspection is required. For air-conditioning systems with effective rated output of more than 12 kW – regular inspection required.

To achieve the above-mentioned requirements the Member States should:

- Establish (or use the relevant CEN standards) **a methodology for calculation of energy performance of buildings**. Such is needed for the calculation of energy performance requirements and carrying out of the certifications. This includes calculations on the quality of insulation of the building, the efficiency of heating, cooling and lighting installations, ventilation needs, position and orientation of the building, heat recovery, active and passive solar gains and other renewable energy sources, and also takes into account local conditions, such as climate and economic aspects (e.g. labour costs).
- Ensure that **certification and inspections requirements** implemented in practice are carried out in an independent manner by qualified and accredited experts.

Summary of the main provisions of the EPBD are included in the following figure.



The deadline for the **implementation** of the provisions on energy performance requirements was January 4, 2006, whilst for certification and inspection - due to the challenges that MS have with training and accrediting experts to carry out the certifications and inspections - a justified derogation of up to three years (until January 4, 2009) was allowed of which most of the Member States took advantage of[20].

Before the adoption of the EPBD the majority of Member States did not have energy efficiency requirements in their regulations and building codes, nor did they have long running, sustained instruments for their promotion. Therefore, the implementation in a number of Member States has been a huge challenge, but also in parallel an opportunity for improving the quality of their buildings stock. The complex nature of the Directive requires framework legislations as well as in many cases individual pieces of legislation for each of its main provisions. Also, the development of standards and software has been required for the proper implementation of several provisions. Furthermore, in some countries the EPBD is to be implemented at regional level. For example, this means that in Austria there should be transposition of all Articles in all nine Länder, in Italy in all twenty regions, whilst in the UK

[20] In total, 23 Member States have opted for the additional three-year extension to apply Art. 7, 8 and 9 of the EPBD, as provided for by Art. 15 ibid.

apart from in England and Wales, Scotland, and Northern Ireland, enforcing legislation is also needed for Gibraltar.

These challenges led to delay in transposition and a number of infringement cases (at their maximum 21) and support actions were initiated by the Commission to speed up the process. Since 2006, the transposition has improved tremendously and now all Member States have at least framework legislation on the issue. By August 2008 twenty two Member States have reported that their EPBD transposition is complete. The Commission is now in the process of review of the notified legislation and considering closing some of the seventeen ongoing infringements. Nevertheless, if it identifies that there is no full conformity on all Articles or lack of full implementation in all regions, the cases will be kept open and will advance in their stages. Apart from legal conformity, the real and ambitious implementation of certain articles is questionable in some Member States which is due to, as described in Section 2.3.2, the ambiguous EPBD wording and large room for various interpretations, poor enforcement, and the lack of possibility for comparisons between the national/regional implementing measures (i.e. setting up of requirements that are far from the optimal levels).

Building on the EPBD, some countries have even gone beyond its requirements. For example, about one third of the EU Member States have extended the requirements to all existing buildings that undergo major renovations, whilst several Member States have set targets to reach low energy/passive house standards for new build. In some countries or regions, the installation of renewable systems, or the implementation of the cost-effective recommendations on the certificates with specified pay-back time, are made mandatory for all or certain types of buildings. More good practices are included as examples in the discussions of Section 5.

The main contribution, so far, of the EPBD is in bringing the subject of the energy efficiency of building onto political agendas, into buildings codes and to the attention of citizens. Nevertheless, it is early and very difficult to quantify the real impact of the Directive for the whole Community because of highly disaggregated nature of the sector, the complementarity of energy improvements to other policy objectives, slow transposition, and lack of proper monitoring. Still, calculations[21] of EPBD expected impact show that, if fully and properly implemented, the energy savings from the EPBD can be as much as 130 Mtoe[22] or 7% reduction of the total EU primary energy supply in 2020 (or 96 Mtoe final energy), evidently a very high figure. Therefore the current EPBD is already contributing considerably to the EU energy policy objectives. However, there are a number of limitations arising from the low level of ambition to its implementation and also from its wording. These remaining challenges are discussed in Section 0.

2.2.2. Other regulatory instruments

In addition to the Energy Performance of Buildings Directive, there is a comprehensive set of legislation in place on both the European and the national level, the requirements of which impact on the energy performance of buildings. The following table presents the main pieces of legislation interacting with the EPBD and offering complementary requirements to enhance energy efficiency in buildings. These activities in an energy consuming and GHG emitting

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21 SEC(2006)1174

22 In the EEAP IA the figure: 125 Mtoe for EU-25 is provided. 130 Mtoe is an extrapolation to EU-27. The conversion factor used is 1.35 as included in Annex IV.

sector (buildings), which is not covered by the EU Emission Trading System (ETS), are also an important part of the response to the climate change challenge: due to the enormous cost-effective energy and CO_2 emission savings potential of the buildings sector, it is evident to take action in this field in order to achieve the EU's overall CO_2 abatement targets in the macro economically optimum and therefore cheapest way, which would not occur if CO_2 abatement measures were limited to the ETS sectors.

Table 1: Main legislation influencing the energy performance of buildings

Directive	Purpose	Requirements influencing the energy performance of buildings
Energy end-use efficiency and energy services Directive (ESD) (2006/32/EC)	Enhance cost-effective improvement of energy end-use efficiency in the Member States (in non ETS-sector)	To achieve the indicative fixed energy savings target in 2016, the Member States can opt for energy efficiency measures in the residential and tertiary sector such as improving heating and cooling systems, insulation and ventilation, hot water installations and lighting. The use of standards and norms improving the energy efficiency of buildings are also eligible measures (Article 4 and Annex 3). The funds foreseen by the ESD can be used to finance energy audits and to provide financing (loans, grants, etc.) for energy efficiency improvement measures. The funds are open to all providers of energy efficiency improvements measures (Article 11). ESD requires the MS to ensure the availability of high-quality energy audits (Article 12).
Directive on the promotion of cogeneration (2004/8/EC)	Creates a framework for promotion and development of high efficiency cogeneration of heat and power.	According to Article 5 of the EPBD, the feasibility for the use of cogeneration of heat and power in new buildings (>1000 m²) has to be considered and taken into account before construction starts.
Eco-design of energy-using products Directive (2005/32/EC)	Establishes a framework for setting Eco-design requirements for all energy using products in the residential, tertiary and industrial sectors.	A set of implementing measures establishing eco-design requirements are in preparation for a range of energy using products, which have a decisive impact on the energy performance of buildings, such as boilers, water heaters, office lighting, residential room conditioning appliances, electric motors in commercial buildings and domestic lighting.
Construction products Directive (89/106/EEC)	Ensure that declaration of performance accompanying the product is accurate and reliable.	Developing specific standards for buildings products and components such as insulation and windows concerning the declaration of conformity.
Promotion of the use of energy from renewable sources (Proposal COM(2008) 30 final)	Establishes a common framework for the promotion of energy from renewable sources.	With respect to their building regulations and codes, Member States shall promote the use of renewable energy in heating and cooling systems and equipment that achieve a significant reduction of fossil energy consumption and they shall use energy or eco-labels or other appropriate certificates or standards developed at national or European level, where these exist, as the basis for encouraging such systems and equipment.
Sustainable Production and Consumption and Sustainable Industrial Policy Action Plan (Proposal)	New dynamic framework to improve the energy and environmental performances of products.	The proposals to extend the Eco-Design Directive as well as the Energy Efficiency Labelling Directive to cover more products and to promote Green Public Procurement will impact on buildings products.
Community guidelines on state aid for environment. protection (2008/C 82/01)	Apply to State aid for environmental protection.	Investment and/or operating aid enabling undertakings to achieve energy savings will be considered compatible with the common market within the meaning of Article 87(3)(c) of the EC Treaty, if certain conditions are fulfilled.

2.2.3. Provision of information and expertise

The European Commission has started many activities to promote and support energy saving in buildings. These also give a good understanding of the challenges and opportunities that Member States, industries, and citizens are faced with.

Activities on **exchange of information and experience** include the Concerted Action I and II that provide fora for discussion of specific challenges and exchange of best practices among representatives of Member States. Furthermore the EPBD Buildings Platform is established - a dynamic web portal that aims at disseminating information on the energy efficiency of buildings and related activities and at providing support on the EPBD implementation via a helpdesk and more detailed and targeted information to all interested stakeholders and citizens. Many **events** have also been organized to discuss the opportunities and challenges with a large number of experts and stakeholders.

Research on the possibility for improved energy efficiency of buildings and the development of sustainable communities has been carried out within the EU Research and Development Framework Programmes and the barriers and possibilities for energy saving policy and solutions have been revealed within the **Intelligent Energy Europe Programme** which in the recent years has supported about 70 projects related to energy aspects of buildings. In addition, the Commission mandated the European standardization body – CEN to develop a set of 31 EPBD **CEN standards** which cover different elements of the calculation procedures for evaluating energy performance of a building and of its various systems and components, heating and air-conditioning systems inspection procedures and other relevant procedures. The work on all standards is completed now and only few are not officially published yet.

Furthermore, the EU's dissemination activities like ManagEnergy and Sustainable Energy Europe initiate many actions to promote energy efficiency in buildings.

2.2.4. Financial and fiscal instruments

The largest energy saving potential in the buildings sector lies with the existing buildings when they undergo major renovations. The lack of information and lack of financing appears to be one major limitation for reaping this energy savings potential but also for carrying out renovations. Due to the importance of energy consumption in buildings, but also because of the sector's social and employment impacts, many countries have established financial and fiscal schemes to stimulate energy saving investments.

At the European level, the financial schemes include such as the **Cohesion Fund**. For the 2007-2013 period, EUR 4.2 billion of the Cohesion policy funding have been allocated to energy efficiency for the housing sector projects in Bulgaria, Cyprus, the Czech Republic, Estonia, Greece, Hungary, Latvia, Lithuania, Malta, Poland, Portugal, Romania, Slovakia and Slovenia. A change in the minimum energy performance requirements for existing and new buildings will increase the investment needs for the buildings' owners but reduce energy costs.

Member States are also allowed to apply a reduced VAT rate until 31/12/2010 (VAT Directive 2006/112//CE) to a specific list of labour intensive services, including the renovation and repairing of private dwellings. On 7 July 2008 the Commission adopted a proposal on reduced VAT rates. This Proposal provides for the option for Member States to apply reduced VAT rates to the whole housing sector and certain services relating to some non commercial buildings (including the supply and construction of housing, the renovation, repair, alteration, maintenance and cleaning of housing and of places of worship and of

cultural heritage and historical monuments recognised by the Member States concerned). This Proposal is currently under discussion in the Council.

Consequently, the supply of services including the combined supply and installation of equipment which aims at increasing energy efficiency and saving or using sustainably generated energy relating to the buildings mentioned, would be eligible for reduced rates, if the Proposal is adopted by the Council.

Additionally, the Commission is currently analysing the possibility of applying reduced VAT rates to environmentally friendly goods and services not mentioned above, as well as the abolition of the possibility to apply reduced rates to environmentally harmful products. In the near future the results of the Commission's analyses will be presented, as a part of a more global communication on the role of taxation in energy and environmental policy, accompanied by relevant proposals and recommendations.

Under the revised Community Guidelines on State Aid for Environmental Protection which were announced as part of the Climate Action package of January 23, 2008, energy savings are eligible for state aid. It is up to the Member States to develop schemes for the support of energy savings activities.

2.3. Remaining problems

Major energy savings potential in the buildings sector is still available. Various factors limit the utilisation of the potential. Some come from the complexity of the sector and the existence of market failures, while others stem from limitations of the regulatory framework.

2.3.1. General challenges of the sector and market failures

The EU's buildings sector is a true example of the EU's diverse nature. Different climates, building traditions and cultural, historic and economic factors have resulted in significant variations between the EU Member States and even between their regions. Therefore, detailed regulation and complete harmonization at EU level is not possible and is not sought. However, a certain level of harmonization of the approaches and certain instruments are needed in order to ensure that energy aspects are considered seriously, that there can be a possibility for comparison of the achievements and transfer of experience, but also to facilitate the companies that operate at EU level. This **diversity and disaggregation of the buildings sector** also poses significant difficulties in obtaining quantitative data about the sector.

The other significant barrier is the existence of imperfect market conditions or **market failures**. A typical example for such failure is the lack of complete internalization of all **externalities in energy prices**. In many countries, this has led to a low priority for energy efficiency in buildings as energy demand is distorted. Although most of the investments in energy efficiency improvements have low pay-back times, especially if done within the renovation cycle, they still require substantial upfront costs for many European citizens and companies. Therefore both the lack of sufficient initial investments and the low priority of energy considerations are some of the main challenges. The EU and a number of individual Member States have realised, or are starting to comprehend, that there are societal benefits that may have a high private cost. To partially compensate for these market failures, some

financial and fiscal support mechanisms are already established (as described in Section 2.2.4), but **new and additional financing tools are needed**.

Another market failure that is very relevant for the sector is **imperfect information**, i.e. the general lack of good quality and understandable information on energy performance of buildings and on potential energy savings. The problem is further exacerbated by the 'principal-agent problem' or the fact that it is of seller's or leaser's advantage not to provide information on energy consumption if the property they offer is of poor energy performance quality.

Furthermore, as the tenant normally pays the energy bill, then the incentive for the owner to invest in energy efficiency is weak. This also relates to another market failure, the so-called **split incentives**. For instance, in the Netherlands, this problem is relevant to 40% of the total energy use in the commercial sectors and 41% of energy use for heating in the residential sector[23]. There only about 40% of private and 59% of social rental residential buildings have proper roof insulation, while for the privately owned sector, this figure is up to 70%.

Therefore, provision of clear and reliable information at affordable cost, at the correct time and at low transaction costs to prospective tenants and buyers is crucial for making energy efficiency investments more attractive. Some requirements for information provision are already included in the EPBD (i.e. Energy Performance Certificates). However, there are certain problems in interpretation and ambition that limit their full impact.

The **low uptake of new and innovative technologies** is one of the main consequences of the two problems mentioned above. The lack of sufficient information limits the uptake of these technologies and the cost of some is prohibitive for their higher market uptake.

Other commonly recognized problems are related to the **low number of trained professionals** (such as architects, energy auditors, builders, installers) that can successfully integrate, evaluate, construct and maintain a low energy consuming building. Also, the **behavior of the inhabitants** is of significant importance as even a zero energy house can turn into an energy waster. The rebound effect of having bigger houses occupied by less people but also subject to excessive heating or cooling are other general problems that, although very important, are also very difficult to tackle.

2.3.2. Regulatory limitations

Limitations of the existing regulatory framework, in particular EPBD and the national/regional measures that implement it, are also preventing the higher reductions of energy consumption. These originate, firstly, from lack of clarity and the complexity of certain provisions of the EPBD and, secondly, from the low level of ambition in its implantation.

Representatives of Member States and stakeholders claim that there are some **definitions and wording** of the Directive that are not clear enough, and create confusion and difficulties in implementation, resulting in differences between Member States and even between their regions. For example, the term 'public building' is explained in the preamble and Article 7 of the Directive in two different ways. Also, the requirements for provision of the

[23] IEA. Mind the gap: Quantifying Principal-Agent Problems in Energy Efficiency. IEA: Paris, 2007

recommendations from the Energy Performance Certification are not very clear to stakeholders and national or local policy-makers. This leads to a situation that the recommendations on how energy efficiency can be improved, are not shown to the tenants/buyers.

Another limitation comes from the **thresholds** that are set in the Directive. As mentioned in Section 2.2.1, EPBD provisions call on Member States to require that certain minimum energy performance levels are met when existing buildings above 1000 m^2 undergo a major renovation. Because of this 1000 m^2 threshold for existing buildings, the EPBD covers only about 28% of the EU-15 buildings stock[24]. In introducing energy efficiency measures when retrofitting, the costs are on average between two and three times less than when done separately. This in general means that, with renovations below 1000 m^2, an opportunity for cost-effective energy savings for the owner might be lost. However, in a number of Member States, this 1000 m^2 threshold has been lowered or abolished so that all buildings that undergo major renovation have to fulfil certain energy performance requirements.

There are a number of limitations that stem from the **low ambition in the implementation**. For instance, the experience with the **Certificate** shows that in some cases they are **of very poor quality** and do not provide sufficient and correct information. This raises questions regarding the usefulness of the certificates. Furthermore, the currently required **inspections of boilers and air-conditioning systems have limited impact** on their energy performance improvement, as their objective is not included in the Directive and due to missing specifications and requirements. This is the experience of Member States that have already implemented an inspection scheme. The **energy performance requirements set by Member States do neither fully meet expectation with regard to their level of ambition**. If they were set in a cost-optimal way (i.e. taking into account a number of parameters, such as climate, oil prices, labour and products costs) this would mean that once a building is constructed, or an existing large one is undergoing major renovation, the result is the optimal of what is available at market and a reasonable pay-back times. At present there are many Member States that do not have cost-optimal requirements. This means that the occupier of the building pays more for their energy bill than is economically reasonable.

More detailed explanations of these shortcomings and limitations are provided as background information when the policy options are discussed.

3. OBJECTIVES

3.1. EU policy objectives

The EU has set ambitious targets in *Energy Policy for Europe*[25] of 20/20/20% for reduction of energy consumption and greenhouse gas emissions, and increased share of renewables by 2020. Urgent actions are needed in the light of the mounting scientific evidence of climate change[26] and high oil prices and the ever growing energy dependency. The buildings sector

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[24] Ecofys for Eurima. Mitigation of CO2 Emissions from the Building Stock - Beyond the EU Directive on the Energy Performance of Buildings, 2004

[25] as outlined in the Commission Communication An Energy Policy for Europe COM (2007) 1

[26] as outlined in the latest report of the Intergovernmental Panel on Climate Change of 2007 the preceding report of Sir Nicholas Stern on the economic costs for non-action (reference)

has significant untapped potential for cost-effective[27] energy savings. Thus it can contribute to all the energy policy targets.

The objective here is to harness the unrealized, cost-effective energy saving potential. The important role of the buildings sector was recognized with the adoption of the *SAVE Directive*[28] in 1993 and later through a holistic approach as laid down in the *Energy Performance of Buildings Directive of 2002*. Consultation on possible further actions for its realization was initiated in the Commission's *Green Paper on Energy Efficiency: Doing More with Less*[29] of 2005. The outcomes resulted in the adoption by the Commission of the *Energy Efficiency Action Plan*[30] in November 2006. In the action plan, making buildings more energy efficient was identified as one of the five priority actions, with the strengthening of the EPBD identified as playing a key role with highest positive impact. The Action Plan was endorsed at the spring 2007 European Council.

From the *Renewed EU Sustainable Development Strategy*[31], the buildings sector can support the fulfilment of its objectives on climate change and clean energy, sustainable consumption and production, but also on social inclusion, demography and migration. A possible revision of the EPBD will be complementary to the actions included in the recently adopted Sustainable Consumption and Production package.

In the light of the growing energy prices and related social consequences, the energy use reduction of the buildings sector is key area to be tackled as it would ease the difficulties for many EU citizens to pay their bills by providing a long-term solution and not only short-term fixes through, for example, energy subsidies. Therefore, actions in this area, esp. the revision of the EPBD to further help Member States in developing policies on the issue, are included in the Commission's Communication *Facing the challenge of higher oil prices* of April 2008[32].

3.2. Specific policy objectives

The following specific objectives can be identified based on the problems of energy efficiency in the buildings sector and while taking into account existing measures:

- Provide a simple and unambiguous legal framework that will provide clear guidance and ease the transposition and implementation
- Ensure that the policy instruments used stimulate further energy savings

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27 Cost-effective can be interpreted in different ways. In a study (Boonekamp 2006) for the Energy Efficiency Action Plan it is mentioned that the World Energy Assessment 2000 (Jochem, 2000) has been used and it refers to the term 'life cycle costs'. This suggests that the pay-back time of the investment can be equal to the technical lifetime of the saving measure. However, this is an extended definition of cost effectiveness compared to other sources, e.g. the 3, 5 or 8 year pay-back time that is currently used in the Netherlands (Menkveld et al, 2005).

28 Council Directive 93/76/EEC of 13 September 1993 to limit carbon dioxide emissions by improving energy efficiency (SAVE). Repealed by Directive 2006/32/EC.

29 COM(2005) 265

30 COM(2006)545

31 10917/06,

32 COM(2008) 384

- Ensure that the measures have a wider coverage of the EU buildings stock and relevant energy consumption but are at low additional cost

- Ensure that buyers/tenants/owners receive good quality information at a reasonable cost on the energy performance of buildings and about the performance of their heating and air-conditioning systems

- Establish a base for cost-effective energy performance requirements for buildings or for their comparison

- Stimulate the public sector to show good example in buildings' energy efficiency.

3.3. EU's right to act

The EU's actions regarding energy performance of buildings are primarily based on article 6 of the Treaty,[33] which states that environmental protection requirements must be integrated into the definition and implementation of the Community policies and activities, in particular with a view to promoting sustainable development. This requirement has to be seen in the light of article 174(1) of the Treaty, which specifies that the Community policy on the environment shall contribute to preserving, protecting and improving the quality of the environment and the prudent and rational utilisation of natural resources.

The importance of coordinated action in energy efficiency has been stressed in previous legislative documents, such as the Council Decision of 29 October 1991 concerning the promotion of energy efficiency in the Community (SAVE programme)[34] and Council Directive 93/76/EEC of 13 September 1993 to limit carbon dioxide emissions by improving energy efficiency (SAVE).[35] These considerations led to the EPBD Directive which was adopted on the legal basis of article 175(1) of the Treaty. In the framework of a possible revision of the current EPBD Directive, **these legal bases for EU action remain unchanged.**

3.4. EU value added

Climate change, security of energy supply and environmental protection are challenges that cannot be sufficiently addressed at national level only. Energy efficiency provides part of the solution of these problems and the instruments on energy efficiency that have already been adopted at EU level reflect this need for Community action.

The buildings sector is responsible for about 36 % of the EU's total CO_2 emissions and for about half of the CO_2 emissions which are not covered by the Emission Trading Scheme. It disposes of a considerable cost-effective energy savings potential which can hardly be found in any other area and which is attainable at comparatively low costs. Therefore, it becomes evident that every country needs to urgently save energy in buildings but not all dispose of the knowledge needed.

The buildings sector is also highly disaggregated and is experiencing a number of market failures (e.g.: partial internalization of externalities in energy prices; principal-agent problems; split incentives; lack of appropriate information, education and training; low uptake

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33 Recital 1 of the EPBD.

34 Decision 91/565/EEC.

35 Repealed by Directive 2006/32/EC.

of new and innovative technologies; etc.) which have limited the rate of energy efficiency gains in the sector. Indicators show that while for example the energy consumption of industry is decreasing, that of households is constantly on the rise. Construction products, appliances and services related to buildings are an important part of the EU internal market. In addition, with the increasing mobility of people and number of businesses with operations across the EU, a similar way to measure, for example, the energy performance of buildings would decrease the administrative burden for them. Member States also stimulated the Commission to take action in order to ease tackling the potential at national level in this complex and highly fragmented area by common EU efforts (see Annex III).

Due to the identified market failures the proposed revised directive justifies the action on energy performance of buildings also in the framework of the Climate and Energy package proposals (not approved yet). Moreover, the revision of the EPBD will lead also to clarification and simplification of an existing directive. In tackling a sector with high reduction potential at relatively low cost, the revised EPBD will reinforce the effects of the Climate and Energy package.

Buildings are often regarded as a "local" matter. Local people/legal entities own buildings and these are controlled by national/regional legislation. The buildings sector is nevertheless crucial for meeting the EU policy objectives stated above and the EU added value of energy savings is significant which justifies action at EU level, since:

- Although buildings are stationary, the construction products and services and the heating, air-conditioning and lighting devices and systems sectors are important part of the EU internal market. Furthermore, nowadays the everyday activities of many people and businesses are not limited to a single country. Increasing the rate of renovation rates and the quality of building (resulting thus in increased sales of insulation materials, windows, heating and air-conditioning systems, etc.), would have a positive effect across the related business sector. In addition, with the increasing number of Europeans that live in a country other than their native one and companies that have their businesses activities across the EU, similar ways to measure, for example the energy performance of the buildings they rent or buy, would mean significant decrease of administrative burden. Not surprisingly requests for EU unification of methods and even complete harmonization of individual requirements come from owners of service-providing chains (such as supermarkets, hotels, etc.) and from construction materials and products manufacturing industries.

- It would contribute to national and EU security of supply policy objectives. Energy savings lead to decreased energy demand and reduced need for generation capacity, or the so called Nega Watts (or negative Watts, coming from the analogy with Mega Watts (MW), of installed capacity and meaning that with the decrease of energy demand less power plants will be needed). These Nega Watts would lead to the decreased energy dependency of the Union. Furthermore, it is rational to have an EU-wide approach on efficiency given the EU energy policy priorities for creating an internal energy market and the common approach on energy security.

- It might direct Member States to a sector that has significant potential for cheap CO_2 and thus will contribute significantly towards climate change mitigation and adaptation. Traditionally there is a focus on CO_2 reductions on the supply side and from large consuming units. The buildings sector with its disaggregated nature and underestimated positive impacts is often overlooked. However, if the greenhouse gas reduction and renewables increase objectives are to be met, action in the sector is a must.

- It could stimulate sustained activities on national energy efficiency improvements in the buildings sector that need to be taken in all EU Member States. This has been proven by the impact of the current EPBD. As mentioned, before 2002 only a limited number of Member States had embarked on adopting policy measures to improve the efficiency of their building stock (see Section 2.2.1).

- EU experience could serve as a leading international example and establish the Union as a forerunner in the area, this also being beneficial for EU businesses. In a time of emerging pressure for action on reduced energy consumption the activities at EU level are closely followed worldwide. Developed and developing countries are starting to adopt similar approaches to the EPBD, which will contribute to lower global CO_2 emissions. Therefore, the EU can show leadership on sustainable building policy and be a recognized player on the international scene (as shown by the findings of the 2008 Impact Assessment on the recast of Directive 92/75/EEC on the indication by labelling and standard product information of the consumption of energy and other resources by household appliances, Annex 7).

- It might create peer-pressure for improvements of the building stock within all Member States and also internationally which could possibly lead to faster adoption of policies, but also stimulate innovation and cost-reductions. This would be facilitated by an EU-wide system for the comparison of the different national requirements.

3.5. Subsidiarity and proportionality

Given the national importance of this sector, **EU policies have added value beyond the confines of subsidiarity and proportionality**.

The main elements of the current EPBD have already been discussed from the point of view of the principles of subsidiarity and proportionality when the Directive was tabled in 2001 and adopted in 2002. Furthermore, they have also been tested in practice, demonstrating the appropriateness of the approach. Since then the need for common action to tackle the challenges of climate change and energy dependency have become even more apparent.

National differences cannot be ignored. EU action has to take into account the specificity of each Member State and the diverse nature of its building stock, climatic and economic circumstances and, thus, the fact that it is not possible nor necessary to set up the exact requirements at a EU-level. Emphasis should therefore **focus on the establishment of a harmonized approach which creates the basis for coherent and mutually reinforcing mechanisms** for energy efficiency improvements in the sector, while at the same time **Member States retain control over setting, in a transparent and comparable way, the individual levels**.

These have already been the main guiding principles of the current EPBD and should be kept in any action that is to be undertaken. Its preamble refers to the subsidiarity principle and clearly delineates the borderline between national/regional action and Community one:

"In accordance with the principles of subsidiarity and proportionality as set out in Article 5 of the Treaty, general principles providing for a system of energy performance requirements and its objectives should be established at Community level, but the detailed implementation should be left to Member States, thus allowing each Member State to choose the regime which corresponds best to its particular situation. This Directive confines itself to the minimum

required in order to achieve those objectives and does not go beyond what is necessary for that purpose."

4. POLICY OPTIONS

A number of activities have been initiated to reap the potential benefits of the buildings sector. Legislation promoting energy efficiency of buildings exists at EU level. However, there is still large room for improvements (as discussed in Section 0). The fundamental question concerns the best approach to address the remaining challenges and barriers and to achieve the relevant EU objectives. In this respect three alternative approaches can be considered: (i) repealing the EPBD and replacing it with 'soft' instruments, (ii) business as usual through use of the existing instruments without adaptation, and (iii) EU action by complemented and improved instruments.

4.1. Repealing the EPBD and replacing it by 'soft' instruments

Soft instruments, such as the open method of coordination, voluntary agreements, provision of information, financial incentives, etc. are an alternative approach to the use of legal requirements. This would entail proactive and ambitious actions from Member States while the Commission would monitor and support the progress. If the actions undertaken are sufficient to achieve the EU policy objectives at low social and economic cost and to provide EU citizens and businesses with lower energy bills at the same or better levels of comfort, then the existing legislation, especially the EPBD, can be repealed.

The method of open coordination refers to the use of "soft law mechanisms", such as guidelines and indicators, benchmarking and sharing of best practice. Its success is very much dependant on the willingness of each individual Member State to adopt appropriate measures as there are no sanctions, but only possible peer pressure and naming and shaming. As mentioned in Section 3.3 activities on energy performance improvements of the buildings sector are justified on environmental, but also on internal market grounds. The energy savings, environmental and security of supply benefits were often overlooked in many EU Member States, one of the reasons being that actions dealing with 'my home – my castle' may not be appealing to the voters even if they are beneficial and cost-effective but, nevertheless, require some additional up-front investments and time. Also the energy prices have not been a major challenge to the citizens for many years, although fuel poverty exists in all Member States. Now with the high oil prices and climate change manifestation, the governments are starting to realize the importance of the sector.

Voluntary agreements can be another efficient tool for achieving policy objectives without the need for governmental intervention but on the grounds of good dialogue and understanding from all parties. For example, these could be agreements between governments and buildings industry or property owners so that all new buildings or all major renovations of the existing building stock meet certain energy performance requirements, or that good quality information on energy performance of buildings is always provided when transactions occur. Today, such agreements are used in some limited cases when authorities want to go beyond the existing, already ambitious, legally binding minimum requirements set within the EPBD and in countries where there is a tradition of such type of instrument, e.g. in the Netherlands where they are used to reach the standards of energy 'neutral buildings' by 2020.

The observed very limited use of voluntary agreements on improving energy performance of buildings is due to the specificities of the sector (such as the high share of individual

ownership and the large number of SMEs in the construction sector) that would entail significant transaction costs for a negotiation of and compliance checks. Also it is not in the interest of the building owner to provide adequate information on the energy efficiency of their property that is to be rented out or sold, especially, if it is not satisfactory.

Providing good quality and understandable information that reach citizens and stakeholders **at the right moment** is an important factor behind the success of energy savings policy objectives and a number of initiatives in this direction have been initiated (some of those at Community level were described in Section 2.3.3). However, for such measures to have a high impact, several conditions should be met, i.e.: (i) the information should reach a very large number of people around the EU; (ii) as property transactions are happening all the time, any campaign should be maintained over long periods of time; (iii) information provided should be regularly updated as the cost-effectiveness of measures can change within short periods of time. Meeting these three conditions will mean very high costs and an additional burden to the national budgets.

Increased provision of financial support could be another 'soft law' approach. In this case, Member States should provide financial means to property owners or tenants to increase the energy efficiency of their buildings or fiscal incentives, such as for instance, the German KfW programmes. This would trigger energy savings, but to achieve significant impact it would require substantial financial resources to be provided that may be a serious burden to the national/regional budgets. At present, there are some subsidy programmes that provide financial assistance to fuel poor households to pay their energy bills. However, this approach is not sustainable in long-term as it does not reduce energy bills and can have only limited impact.

Some countries, such as the UK and its Energy Efficiency Commitment, have introduced an obligation on the suppliers (but can also be on producers or distributors) to achieve certain savings at their consumers (usually including a proportion of fuel poor households). This is done through investing, in most of the cases, in the lowest cost measures. The costs are born by all consumers and if they are not high this instrument (also called white certificates) can be very efficient. However, it cannot be used to achieve the significant potential as it would dramatically increase the energy prices.

The specifics of the sector, slow uptake of national measures, if not supported at EU level, and the high cost of “soft” instruments, together with the fact that there is already a functioning Directive at EU level leads to the conclusion that it is not appropriate to repeal the EPBD and depend only on “soft law” to solve the problems and objectives as outlined in Sections 2 and 3. In addition, repealing the EPBD would send a very negative signal regarding the EU's ambitions to pursue its policy objectives, both within its Member States and also internationally. The EPBD has certain limitations but it has already laid the basis for action and this has been recognized as an EU achievement. Its transposition has been a challenge but is progressing well and Member States are starting to see its importance. In the times when energy efficiency action is requested by all, repealing of a well-established legal document cannot be justified.

4.2. Business as usual

The 'business as usual' or ‘do nothing more’ alternative implies that there is no need for additional measures beyond the existing ones, including continued implementation of the current EPBD and all related regulatory and non-regulatory instruments (described in Section

2.2), which, combined with the normal market operation, are to deliver the cost-effective level of energy performance. This approach can be supported with measures that can maximize the impact of the EBPD by encouraging its full transposition. The Commission has already relied heavily on infringements to strongly move forward EPBD implementation, has already won one case against a Member State and has several others brought before the Court or at the final stage of the infringement process. As mentioned in Section 2.2.1 this had a very positive impact on accelerating the adoption of needed legislation and now most of the Member States declare complete transposition. The Commission has also already undertaken a number of additional activities, i.e. by funding projects on information exchange and research of the best practices, and the development of standards, to support the implementation.

The full impact of the existing EPBD in 2020 is estimated to be a reduction of about 96 Mtoe of final energy consumption[36], while the remaining cost-effective potential in the buildings sector, not covered by the existing Directive, is an additional saving amount of 143 Mtoe (final energy) as mentioned (see Section 2.1).

This would mean that even if the EPBD is fully implemented **a large potential would still remain unutilized** (which equals about 11% of EU total final energy consumption and CO_2 emissions, see Annex V).

In addition, if this approach is adopted, the **limitations of the current legislation will remain** and may even have a negative influence on the possibilities for achieving EU energy and climate change policy objectives. For example, if no measures are adopted to tackle the problem with the very poor quality energy performance certificates that are issued in some Member States only to fulfill the legal requirements, they may become a "useless administrative burden" set by Brussels and have even a negative impact on the perception for energy savings and for any future measures.

4.3. EU action by complemented and improved instruments

A third alternative is to improve the existing regulatory instruments. An encompassing regulatory framework has already been developed at EU level, and although it has some limitations, it can serve a good base upon which one can built and thus the efforts should be focused on its improvement. From the number of adopted legal documents (some listed in Section 2.2), the EPBD is the one that deals in a holistic way with energy use of buildings[37]. They have emphasized the need and benefits of strengthening the EPBD. This option scored first amongst all options discussed in terms of potential energy savings and high in terms of cumulative effect.

While building on the current EPBD, the measures already undertaken by national and regional authorities for its implementation would be the base which will be upgraded. This would ease the transposition and understanding of the measures by all stakeholders while at the same time tapping a larger share of potential and related benefits. For this reasons the original EPBD requirements and basic structure should be kept and improved or extended for

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[36] SEC(2006)1174 the data there provided for primary energy or 125 Mtoe for EU-25 is extrapolated to EU-27 and converted into final energy. Due to lack of ambition of implementation of the EPBD or lack of clarity of some provisions this potential may not be fully realized. However, it is not possible at present to calculate what would be the impact of this.

[37] i.e. RES directive, EuP implementing measures, Construction Products Directive that are under discussion now.

the cases when this is proven necessary and beneficial. This is the underlying principle for each of the options that are analyzed in the text to follow.

This approach allows for the use of a combination of policy instruments, such as regulatory, provision of information, comparisons between Member Sates instruments. Still, the concrete levels, requirements and mechanisms are determined at national/local level so that the subsidiary and proportionality are respected.

Based on the knowledge gathered, analysis and broad consultation, a conclusion was reached that several aspects of the EPBD need to be tackled in order to reach the specific policy objectives. These in general refer, firstly, to the issues of improvement of the wording and, secondly, to each of the four main pillars of the current Directive, namely: (i) 1000 m^2 threshold for existing buildings when they undergo major renovation; (ii) energy performance certificates; (iii) inspection of boilers and air-conditioning systems; and (iv) energy performance requirements. Within each pillar several options are discussed. The selection of the options is a result of pre-screening of a larger number of options that were raised in the last several years by Member States' representatives and stakeholders based on observations of EPBD implementation and various analyses of possible actions (see Section 1.2).

Under all main pillars of EPBD the improvement options comprise all type of measures (in line, like combining approaches in 4.1, 4.2 and 4.3). The options are:

- General: Clarification and simplification
- 1000 m^2 threshold for existing buildings when they undergo major renovation
  - Option A1: Lowering the threshold to 500 m², to include all medium sized buildings.
  - Option A2: Lowering the threshold to 200 m², to include all buildings apart from small ones (mainly single family houses).
  - Option A3: Abolishing the 1000 m² threshold to include all buildings.
- Energy performance certificates
  - Option B1: Quality and compliance requirements.
  - Option B2: Requiring the recommended cost-effective measures of the certificate are realized within a certain time period.
  - Option B3: Making certificates a mandatory part of property advertisement and/or property transaction documents.
  - Option B4: Requiring the linking of the certificates with other support or discouragement mechanisms.
- Inspection of boilers and air-conditioning systems
  - Option C1: Requiring an 'inspection report' for heating and air-conditioning systems.

– Option C1: Introducing compliance requirements.

- Energy performance requirements

  – Option D1: Specifying EU – wide energy performance requirements.

  – Option D2: Introducing a benchmarking mechanism.

  – Option D3: Requiring an evolving improvement scheme for the buildings stock focussing on the worst performing buildings (a kind of top-runner approach).

  – Option D4: Setting up EU–wide low or zero energy/carbon buildings/passive house requirements.

As a conclusion from the three discussed policy alternatives the revision of the EPBD is the appropriate action to meet the EU policy objectives given the problems and the ways they are tackled at present. In this case the current Directive will be the starting point and the 'backbone' of the revision. Therefore, the **continued implementation of the EPBD is of crucial importance**.

However, it should be emphasized that **the solution is in an integrated mix of policy instruments** and thus other non-regulatory measures, which otherwise would not be sufficient on their own, are necessary to complement the implementation of the Directive. Therefore the efforts in providing more financial and fiscal incentives, and information, training of experts, and agreeing on voluntary actions should be continued and further developed.

5. ANALYSIS OF IMPACTS

For each of the options presented in the previous section, a general description is provided followed by explanation of what is proposed, and evaluation of the benefits and limitations in terms of their economic, social and environmental impacts.

5.1. Main analytical approach

For the baseline the latest available update (September 2007) of the PRIMES model of DG TREN was used. It includes policies and measures implemented in the Member States up to the end of 2006 and was used in order to ensure consistency with other impact assessments and publications of the European Commission on energy. The Ecofys BEAM model was used by the consultant to this Impact Assessment for the calculations of the economic, social and environmental impacts. Building up on PRIMES, the EU building stock was replicated by the model to calculate the impact of the individual options. The calculation of the impacts is bottom-up (i.e. based on following the construction, demolition and renovation rates, and energy-efficiency measures in retrofits). BEAM is a holistic model that reproduces the building stock by using reference buildings. With regard to all factors quantified, the calculations of the BEAM model take the interactions between the individual measures/options analysed into consideration and eliminates overlaps in the results. The individual options analysed were not calculated independently by the model but within connected loop model runs. Additionally, where modelling of the impacts was not possible by the BEAM model, the results of the studies available were used and extrapolated to EU-27.

Out of the BEAM model and study results, the CO_2 abatement costs are calculated (annual capital costs of a measure in 2020 minus annual energy cost savings of a measure in 2020 divided by annual CO_2 emission savings of a measure in 2020) and are consistent through the whole text. The year 2009 was assumed to be the starting year of measures analysed. This e.g. means, assuming the annual renovation rate of 2.5% in the buildings sector, by 2020 27.5% of all existing buildings would be renovated (11 * 2.5%), therefore be subject to annual capital costs for the renovation presented under this option and achieve the energy cost and CO_2 emission savings presented.

For some of the options only qualification of the impacts was possible due to limitation of the available quantitative data and the complexity of the issues. If data are not reliable or missing, but there is enough evidence from experience and practice, only qualitative conclusions are made. In addition, as there are few studies that include the whole EU, extrapolation is often needed.

The calculations were made for year 2020 as the 20% target for energy consumption reduction is for the year 2020. However, the benefits would continue to increase in the future. To demonstrate this, projections for the year 2030 were also occasionally presented.

For further details and assumptions see Annex IV and footnotes in the text.

5.2. General: Clarification and simplification

The simplification and clarification is essential for proper implementation of the EPBD. The need for action in this direction surfaced in discussions with the Member States at the Energy Demand Management Committee (see also the summary of a questionnaire in Annex II) and Concerted Action meetings, and inputs from stakeholders. Such actions have also been requested by a majority of the respondents to the public consultation.

Two actions are essential in this direction. The first action is the choice of proper legal format of the proposed revised text. The second is to clarify and simplify the text itself i.e. certain definitions and provisions. These shall be an inseparable part of the EPBD revision and be carried out to support its smooth and complete transposition and implementation.

5.2.1. Simplification through the use of appropriate legal form (recasting vs amendment)

Energy efficiency in buildings is part of the Commission's Better Regulation Strategy, in particular of the Action plan "Simplifying and improving the regulatory environment"[38]. Although the policy options will remain the same, the measures would be strengthened and clarified.

The choice of a legal form for the final text of the Directive to be proposed is important from the point of view of simplification, as it can provide for improved understanding and simplified implementation. In this respect the two possible instruments of revision at disposal are: amendment or recasting. The main difference between them is that in the recasting, the new text of the Directive will be a consolidation, in other words it will be a single new legal document, and not a second one that includes only the revised parts, as in the case of

[38] COM/2002/0278 final

amendment. This will improve readability and will facilitate comprehension for both implementing authorities and affected stakeholders alike.

As the principles of the existing EPBD should be kept, the recasting is an opportunity to develop further EU and national policies and measures related to energy efficiency in the buildings sector, based on what has been learnt from the implementation of the current EPBD, and on the ambitions implied by the EU and national targets. It is crucial that the current EPBD be properly implemented and on time. The forthcoming recasting should not be an excuse for delay in implementation of the current Directive.

5.2.2. Clarifying and simplifying certain provisions

One of the factors that limit the full realisation of the energy saving potential intended by the EPBD is the wording of some of its provisions and definitions. The Directive could achieve a higher degree of consolidation, legal certainty and simplification of legislation by being more unambiguously worded on certain aspects. This has been detected by responsible national authorities in the EPBD Concerted Action, based on their experience with implementing the existing Directive. National implementing bodies should therefore be provided with a clear legal framework which ensures better overall coherence of their legislations and thereby simplifies its implementation and application for involved parties, such as the construction sector, designers, energy services companies, installers and building owners.

There is room for improvement of several EPBD definitions, such as 'public buildings', for which special EPBD provisions apply, inter alia the display of the energy performance certificate at a prominent place: The definition of public buildings in EPBD recital 16 shall also be used in Article 7(3), instead of having two different wordings. 'Major renovation', 'alternative systems' and 'air-conditioning systems' are further terms, whereof the existing Directive contains vague or ambiguous descriptions. "Passive heating" and "passive cooling" are elements which, although implicitly brought up in the existing Directive (recitals 8, 10, and 18, article 3 and its reference to Annex part 1), could be highlighted and stressed more in the text of the Directive. This would also reflect the relevant proposal for stimulating "passive heating and cooling" of the Commission's Energy Efficiency Action Plan (Annex, part 1)[6]. Furthermore, clarification of certain provisions could be made, where it has not been made clear in the existing EPBD what exactly is required to be done, at what time, and by whom: i.e. with regard to the required recommendations within the energy performance certificate of a building and how/when exactly it is to be made available to an interested buyer or tenant of a building or building unit (Article 7 of the existing EPBD). Wherever available (e.g. as for air-conditioning systems), these definitions in the EPBD should now be taken from the relevant, recently developed 31 CEN standards, in order to further simplify the implementation of the EPBD provisions.

In order to address the **public sector** as a leading example more strongly than in the existing EPBD, this sector could be required to comply with obligations of the revised EPBD earlier and in a stricter way than the private sector has to. This would be in line with the relevant activity announced in the Commission's Energy Efficiency Action Plan 2006 and with the Commission's Green Public Procurement initiative of 2008. Furthermore, the public sector could be required to realize cost-effective measures which are recommended in the energy performance certificate of a building (see option B2 in chapter 5.4) within a certain period.

5.3. 1000 m² threshold for existing buildings when they undergo major renovation

Current situation: The EPBD requires that owners of buildings larger than 1000 m² upgrade the energy performance of their buildings to meet the nationally set requirements, when these undergo major renovations[39]. In relation to the total EU-27 building stock, this means that only 29% of the total conditioned floor area and 27% of CO_2 emissions caused from total space heating are covered by the above mentioned legal provision. If the figures for the residential and commercial buildings are considered separately, it shows that mostly residential house owners do not have to meet any minimum energy requirements when renovating, as 86% of the residential floor area is left out of the scope of the Directive (see Figure 2). On the other hand, since commercial buildings are usually larger than residential ones, almost two third of the commercial floor area is already covered by the legal provision for major renovations. This means that large part of the existing buildings do not fall within the scope of the EPBD and therefore the possibilities for the realization of energy savings and CO_2 emission reductions potentials that lie with them are not exploited.

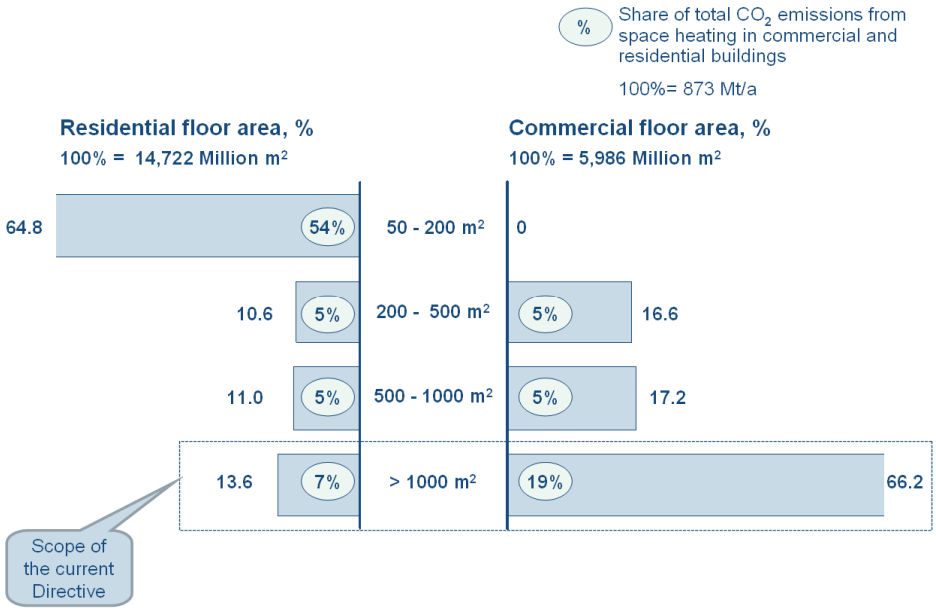

Figure 2. Floor area distribution and CO_2 emissions by threshold categories in 2005 (Source: BEAM)

However, at least 9 Member States[40] transposed the EPBD without a 1000 m² threshold, hence requiring energy performance upgrades for all existing buildings[41] undergoing (major) renovations. The national reasons for not introducing a 1000 m² limit were diverse. For instance, Denmark and Germany had already in place strong regulation and introducing a threshold would have weakened existing building legislation. Finland e.g., stated that 40% of the heating energy consumption of the building stock would have been excluded with such a

39 See endnote 18

40 K. Engelund Thomson et al and Member States answers to the questionnaire circulated at the Committee meeting in March 2008 (see Annex X): Thresholds related to renovation of buildings (not published yet): The following countries do not have a minimum 1000 m² threshold: Flemish Region of Belgium, Czech Republic, Denmark, Finland, Germany, Latvia, Portugal, Slovak Republic and Sweden.

41 Most countries do have a minimum m² threshold, usually equivalent to the smallest type of building, such as 10, 40 or 50 m².

threshold. Portugal on the other hand argued that energy savings measures are cost-effective for every building and therefore no exception should be made for smaller ones. On the other hand, Cyprus opted for a 1000 m² threshold, because it had no experience with similar buildings regulations in the past and therefore wanted to set a threshold in accordance to common practice in the construction industry. However, even the less experienced Member States now dispose of a couple of years of experience on this topic since the EPBD has been adopted in 2002.

Proposal: Keeping in mind that buildings with less than 1000 m² are responsible for 73% of total CO_2 emissions caused by the building stock, it seems appropriate to discuss whether abolishing this threshold, or at least lowering it to cover more buildings, are feasible options to increase the amount of energy saved in the buildings sector in a cost-effective way.

The following three options are looked into for more details:

- Option A1: Lowering the threshold to 500 m² to include all medium sized buildings.

A 500 m² threshold would cover 81% more residential (i.e. 25% of total) and 26% more commercial (i.e. 83% of total) floor area as with the current threshold in the Directive. Buildings between 500 m² and up to 1000 m² are medium sized multifamily houses and medium sized office buildings.

- Option A2: Lowering the threshold to 200 m² to include all buildings apart from small ones.

With this option, mainly just the owners of single family houses will not have to consider minimum energy performance requirements while refurbishing their homes. This threshold would then cover almost 100% of the commercial and 35% of the residential floor area.

- Option A3: Abolishing the 1000 m² threshold to include all buildings.

The minimum conditioned area of a stand-alone building is usually about 50 m². Abolishing the 1000 m² would mean that all buildings with an area of more than 50 m² are subject to legal requirements when undergoing major renovations.

It should be highlighted that within the discussed options, Member States would still be responsible to set up the individual requirements of energy performance and thus the subsidiarity principle will be respected. Also, the definition of major renovation would be retained as in the current EPBD, which means that, for example, renovation of an apartment in a large multifamily building would, in most cases, not be covered by the requirements. The effect on individual households would be limited further by the fact that renovations are usually made 'step by step'. The current EPBD also entails that for existing buildings, when they undergo major renovation of a certain part, the energy performance requirements are to be met only for this part and not for the whole building. For example, if the building shell is renovated this would not mean that the heating system should mandatorily be changed.

Eliminating or lowering the 1000 m² threshold for buildings undergoing major renovation will not change the overall framework of the EPBD, nor the possible exceptions foreseen for certain categories of buildings, such as stand-alone buildings smaller than 50 m². In order to assess the three options presented above, it is necessary to weight the gains made in terms of energy savings, reduction of CO_2 emissions and job creation against the energy related investment costs for the owners of the smaller buildings and for the administration to implement and control this new legal requirement.

Impact: The most meaningful indicator is the total costs savings, as it shows the difference between the energy costs saved in a specific year and the costs of capital raised (interest rate and amortization) for carrying out an energy performance upgrade in the context of a major renovation. In the very short term, i.e. in 2010, introducing lower or no thresholds will not have any decisive additional impact on the total costs savings, since only a small proportion of the buildings stock will by then have undergone major renovation. However, the accumulation of energy savings from energy related renovations of an increasing number of buildings will by 2020 have a decisive impact: 19.8 Mtoe or 4 % of the final energy consumed by the residential and service sectors (510 Mtoe in 2020 according to PRIMES) in the EU-27 can be saved additionally if the threshold is abolished (option A3). Furthermore, the total costs savings from this option will amount to an additional €17 billion per year compared to those reached through the current EPBD.

The economic benefits for the buildings industry can be derived from a higher demand for energy saving appliances such as insulation material, multi-glazed windows or more energy efficient boilers, heating and cooling systems. The impact on the labour market in terms of additional employments created was assessed based on turnover values in the buildings industry.[42] According to these calculations, approximately 75.000 additional jobs in EU-27 could be created and maintained in 2020 when eliminating the 1000 m² threshold (see Table 1). See Annex IV for the assumptions.

Table 1. Impact on job creation in terms of additional jobs created in 2020, by threshold option, compared to the 'business as usual' scenario (BAU), Source: Ecofys

Scenario	Jobs in 2020	Change compared to BAU
BAU (existing EPBD (> 1000 m²))	149 000	--
Option A1 (EPBD > 500 m²)	159 000	+ 10 000
Option A2 (EPBD > 200 m²)	170 000	+ 21 000
Option A3 (EPBD > 50 m²)	224 000	+ 75 000

The economic and environmental impacts have been quantified based on the Ecofys Building Area Model (BEAM), which provides estimates for final energy savings, energy related investment costs, annual capital costs, saved annual energy costs and total costs savings for the three threshold options and for the years 2010, 2020 and 2030[43]. The results are presented in terms of additional costs and benefits compared to the business as usual scenario (BAU), which is the current Directive.

Table 2. Estimated impacts of different thresholds for minimum energy performance requirements for major renovations, Source: BEAM model (see Annex IV)

Impacts for EU-27	2010	2020	2030
Final energy savings, Mtoe/a			
BAU (EPBD > 1000 m²) compared to 2009	4.4	47.1	75.8

[42] The estimates area based on a simplified method neglecting smaller effects but offering a good indication of possible employment related impacts of energy efficiency measures. For this purpose, the assumed additional turnover from energy efficiency projects is divided by the average turnover per employee in the construction sector and multiplied by a specific factor 1. This factor depends on the labour intensity of the measures carried out. For this impact assessment, it was assumed that the additional turnover is caused by the usual mix of material and labour costs as presently observed in the building industry of the EU-27.

[43] See Annex IV for more information on the BEAM and the assumptions made for compiling the estimates.

Additional impact compared to BAU:			
Option A1 (EPBD >500 m^2)	0.3	2.8	3.2
Option A2 (EPBD >200 m^2)	0.5	5.4	5.7
Option A3 (EPBD >50 m^2)	2.0	19.8	21.2
CO_2 emissions, Mt/a			
BAU (EPBD > 1000 m²) compared to 2009	12	129	204
Additional impact compared to BAU:			
Option A1 (EPBD >500 m^2)	1	8	9
Option A2 (EPBD >200 m^2)	1	14	15
Option A3 (EPBD >50 m^2)	5	51	55
Energy related investment costs, billion €/a			
Additional impact compared to BAU:			
Option A1 (EPBD >500 m^2)	2	1	1
Option A2 (EPBD >200 m^2)	4	3	2
Option A3 (EPBD >50 m^2)	12	11	7
Annual capital costs for energy related investments, billion €/a			
Additional impact compared to BAU:			
Option A1 (EPBD >500 m^2)	0	1	2
Option A2 (EPBD >200 m^2)	0	2	4
Option A3 (EPBD >50 m^2)	1	8	13
Saved energy costs, billion €/a			
Additional impact compared to BAU:			
Option A1 (EPBD >500 m^2)	0	3	4
Option A2 (EPBD >200 m^2)	0	7	8
Option A3 (EPBD >50 m^2)	2	25	31
Total cost-savings, billion €/a (Saved energy costs - capital costs)			
Additional impact compared to BAU:			
Option A1 (EPBD >500 m^2)	0	2	2
Option A2 (EPBD >200 m^2)	0	5	4
Option A3 (EPBD >50 m^2)	1	17	18

The CO_2 abatement costs (total cost savings per year divided by annual CO_2 savings of an option) and annual capital costs per saved ton CO_2 can be calculated out of the table above, which results e.g. for option A3 ("EPBD >50") in the following values:

Option A3 (EPBD >50)	**2010**	**2020**	**2030**
Abatement costs in € per saved ton CO_2	-200	-333	-327
Annual capital costs in € per saved ton CO_2	200	157	236

It should be noted that the annual capital costs per saved ton CO_2 presented in the table above cannot simply be compared to e.g. those of investments in renewable energy techniques, as this would neglect the benefits (energy cost savings) which are linked to energy efficiency measures. So the presented CO_2 abatement costs are the appropriate indicator for cross-comparisons of the economy of measures, although negative abatement costs have to be interpreted with care in general.

Regarding the additional administrative burden which a change in the threshold would cause, a survey undertaken[44] in the framework of the Buildings Platform has revealed that most Member States assessed the current administrative burden as moderate or small. Extending the legal requirements for major renovations to the entire building stock should not considerably impact on the administrative burden.

At the level of citizens, the impacts materialize at the moment of a major renovation as they need to meet the national building code requirements. This could mean for instance the moment when a building/refurbishment permit is needed. Realizing energy efficiency measures when retrofitting costs, on average, between two and three times less than when done separately. This in general means that by every renovation below 1000m^2 which is not combined with efficiency measures, a unique opportunity for cost-efficient energy savings is lost for the owner. The level of requirements and the related additional costs vary from one country to another but normally remain moderate when planned properly.

The investment needs differ substantially across Europe depending on the social and economic conditions, on the initial state of the property and on the type of renovations people undertake. For example purchasing a high efficient boiler would require about €800 additional to the price of an average boiler sold today on the market. However, in 4-5 years these would be reaped from the savings on the energy bill and afterwards the household would save €250-300 annually until the end of the lifetime of the boiler (15 years). An example from the UK shows that if there is no loft insulation in a building and in a renovation the recommended 270mm are installed, then the investment costs for the household would be about €600. Annually €150 would be saved on the energy bill so the payback time will be only about 4 years. If there is already 50 mm insulation, the investments would be the same but energy savings only €40 and thus the payback time about 16 years.

Well insulated and acclimatized buildings have a probable positive effect on the persons working, learning or living in them. Increasing the amount of buildings subject to minimum energy performance requirements when undergoing major renovations, will reinforce this effect. Although this impact cannot easily be quantified as it is often perceived as very subjective, some studies have shown e.g. that a better insulated building can have a positive impact on the learning environment of students in terms of better results.

Based on the available estimates and the positive experiences made in countries without a 1000 m² threshold for existing building undergoing a major renovation, the removal of minimum area thresholds to cover all buildings is the most appropriate option in terms of cost-effectiveness and impact on final energy demand.

5.4. Energy performance certificates

The certificates, which are already mandatory under the current EPBD when buildings are constructed, sold or rented out, can be a powerful tool to create a demand-driven market for energy efficient buildings, as they allow economic agents to estimate costs in relation to energy consumption and efficiency. The aim of the Certificate is to make the complex issue of the energy performance of a building transparent to non-energy experts (such as average building owners and tenants) and therefore tackles the lack of information market failure. The possible impact of the certificates in some countries is estimated at annual 2 % energy savings

[44] Thomson *et al.:* Thresholds related to renovation of buildings (not published yet)

in the buildings sector when a proper certification scheme is implemented[45]. Although the first Member State introduced energy performance certificates as early as of 1997 and made positive experience, only few other Member States started similar requirements, that is why the Commission initiated action at Community level and made certificates part of the existing EPBD requirements.

At present, Member States have already implemented, or transposed, or are currently setting up regimes and administrative preconditions for the energy performance certificate for buildings, when a building is constructed, newly rented out or sold, at national level as requested by the EPBD. The certificates shall be issued by accredited experts. The qualification needs of these experts are fixed at national level, not in the EPBD. The majority of Member States start in practice not before summer 2008.

The observations from some of the Member States which have already introduced the certificate show that some are not of satisfactory quality, or that there is insufficient bottom-up uptake to ensure that they are systematically made available during property transactions. In addition, higher realization of recommendations for energy improvements of the buildings can stimulate further energy savings. These prompted the need for improvements of the provision on the Certificates in the EPBD so that the market failures of lack, or low quality, of information and to tackle the remaining energy savings potential.

In order to respect the principle of subsidiarity, the objective of the energy performance certificates will still remain limited to the provision of information and any effects of these certificates in terms of legal proceedings or otherwise shall be decided in accordance with national rules, as is stated in the EPBD, for all the following options B1 to B4.

5.4.1. Option B1: Quality and compliance requirements for certificates

Current situation: There are no provisions in the EPBD requiring that Member States set up a quality check of the certificate. The lack of such a system in some countries has resulted in bad quality certificates being issued. Also, compliance with the requirements for issuing of the certificates and for meeting of the minimum energy performance requirements is not satisfactory. Although the implementation is still in its early stage numerous complaints were already sent to the Commission in 2007 and 2008 about unsatisfactory quality of energy performance certificates.

The procedure of issuing of certificates, as developed in some Member States, often starts with an on site check of the building by an expert to gather information on its technical properties, based on which a calculation of the energy rating of the building is performed. This proceeding usually leads to high quality certificates, assuming that the training of the experts is sufficient. Alternatively, in some Member States the building owner is providing technical information on the building's properties to an expert, who prepares a certificate only based on this information and using many simplified and standardised assumptions depending on the building type without visiting the site. This does not always reflect the actual situation and therefore can lead to incorrect rating results and inappropriate recommendations in the certificate, but leads to low costs for certification. Furthermore, it allows for incorrect and false input to 'sugar-coat' the rating result, which is not always easy to detect afterwards by

[45] Minna Sunikka, Discussion on the potential impact of the energy certificate on existing housing: the UK as a case study, 2005

e.g. a future prospective buyer or tenant of a building. Moreover, the independence, required by the existing EPBD, and quality of these experts varies widely within the EU. Consequently, the quality of currently issued certificates varies widely as well.

The certification of a building could also be linked to compliance criteria on building regulations to improve the compliance rate and realize higher energy savings. Several stakeholders[46], experts and energy agencies[47] have asked for effective control regimes to be put in place in order to increase compliance with building regulations. Ideally, sufficient quality of energy performance certificates could also contribute to better compliance on buildings regulations. The check of EPBD building certificates by a compliance control scheme could be such an efficient instrument. A similar control regime is i.e. currently developed in the Flemish Region of Belgium. Denmark already introduced a regime for systematic quality control of certificates in 2006. Such a control scheme should be as effective and as less administrative as possible.

Proposal: Introduction of a requirement that random sampling checks of the quality of energy performance certificates and the compliance with the building energy codes is carried out by public authorities or accredited institutions.

A random control of the real outcomes, validity and quality of certificates, could be required for certificates in the EPBD recasting[48]. Checks at different levels of detail and frequency could therefore be introduced as a new requirement by the EPBD recasting**.** These levels of random sampling regime could range from validity checks of input and/or result data for certificates to on-site checks of buildings certified.

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46 In position papers and studies, such as European Construction Industry Federation FIEC: FIEC Memorandum - The impact of buildings on climate change, 2007 (amended version 2008); European Energy Network EnR: Implementation of the EU Energy Performance of Buildings Directive - a snapshot report, 2008

47 As e.g. presented at the 2nd Sustainable Energy Week event 'Energy Performance of Buildings Directive - Next Steps' in January 2008.

48 For similar objectives, Denmark already revised its certification procedure in 2006, firstly introduced in 1997, to 'quality level' 5 and 6 respectively in its 2nd generation certification scheme:
In a range from 1 to 6, 1 being lowest quality which only consists of "Meter reading reported by the building owner and the utility companies", whilst 5 and 6 mean "Computation by energy consultants based on building envelope inspection" and " Computation by energy consultants combined with meter reading".

The revision of the Danish provisions was based on several years of experience since 1997, which also underlined the importance of quality control within the certification scheme (subsequently also named as 'label'/'labelling scheme'). The analysis of Jensen et al conclude that "Confidence in the energy label is the most important factor in achieving the main aim of the labelling scheme - energy savings. The user must at all times have confidence in the registrations made, the calculations, the label itself, and especially that the suggested energy saving measures are viable and will result in improved economy. Thus, it is essential to maintain a high level of quality in the energy labelling scheme. If quality is poor, the users will lose confidence in the labels. […] Credibility may be lost very fast as a few poor labels can do a lot of damage. The quality control of the Danish energy labelling scheme takes place at all levels of the scheme.", taken out of: Ole Michael Jensen, Morten Tony Hansen, Kirsten Engelund Thomsen, Kim Wittchen: Development of a 2nd generation energy certificate scheme – Danish experience, 2007

Random sampling checks could take place for e.g. 0.5% of certificates annually issued[49] with 3 levels of detail: A certain share of these checks could be requested to be done by a validity check of input data and rating outcome of energy performance certificates only. Another (lower) share could requested be checked (stricter) for input data and be recalculated by a controller. And another (very low) share of random sampling checks could consist of the aforementioned proposal plus control of the building on site for compliance with building regulations and correspondence with the certificate.

Impact: Detailed analyses of the various impacts of the certificates (stimulation of more renovations and improvement of compliance with building codes) were made with the BEAM model calculations (for details on the model: see Annex IV). According to that it results in 21 Mtoe/year energy savings and 57 Mt CO_2 emission savings in 2020 for EU-27. This is linked to annual capital costs of €8 billion, but causes annual energy cost savings of €26 billion. Consequently, properly carried out energy performance certificates may bring along up to 20,000 new jobs[50] for certifiers and up to 40,000 new jobs in the construction and refurbishment sector by 2020 (see Annex IV for the assumptions). This is confirmed by data known for the UK[51] (and some limited data for Germany which is in the range of that for the UK[52]). For the UK it is estimated that 8 to 12% of cost effective energy efficiency measures are realized[53]. The UK figures simply extrapolated to EU-27 level would mean an increase of 10 to 29 Mtoe/year realized energy savings and of 24 to 84 Mt/year CO_2 emission savings in 2020[54].

The costs for a thorough quality control system appear manageable. For example, the total yearly costs of the Danish administration of the scheme paid by the consumers amount to about €0.8 million for the development of the system[55] and about €0.3 million annual

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49 Underlying that an accredited expert, specialised on issuing energy performance certificates for buildings, compiles one certificate per working day, so about 200 certificates a year. A random sampling check of 0.5 % of certificates would therefore mean that accredited experts face with one control per year on average.

50 In full time equivalents. Actual jobs may fluctuate because of anticipated certification in rental sector and EPC saturation. Based on 4.8 to 9.3 hours per EPC, calculated from several country reports of the IMPACT project.

51 Calculated from data originating from Department for Communities and Local Government, 2007. "Regulatory Impact Assessment Energy Performance of Buildings Directive Articles 7-10". Carbon saved claimed for EPCs in first year of implementation, electricity use excluded in PRIMES reference emissions.

52 For example, for the UK the savings equal 0.9% of the existing residential building stock's emissions. For comparison: in Germany, the certificates are projected to help avoid 0.35% of the existing residential building stock's emission (calculated from: Forschungszentrum Jülich, 2005. "Evaluierung der CO_2-Minderungsmaßnahmen im Gebäudebereich", p. 20. Carbon saved claimed for EPCs after three years of implementation, electricity use excluded in PRIMES reference emissions).

53 Calculated from data originating from Department for Communities and Local Government, 2007. "Regulatory Impact Assessment Energy Performance of Buildings Directive Articles 7-10". Savings claimed exclusively for EPCs, i.e. additional to EEC savings. Applies for first year of full implementation (2009) to 2020, only when EPC is available. This range may differ from figures mentioned below because of non-additionality and different time frames. No information is available on the effect of certification on the renovation rate of buildings

54 Of course, conditions in other Member States differ from the UK in terms of savings potential (size, profitability) and complementary policies.

55 Jens Laustsen (Danish Energy Authority) & Kirstine Lorenzen (COWI), 2003. "Danish Experience in Energy Labelling in Buildings", p. 20. For comparison, for the UK one-off administration costs are

maintenance cost. These amounts include the quality assessment control, the registration of data and the development of facilities to help improve and minimise the work for the consultants as well as some training activities for the consultants. Based on extrapolations of the Danish approach the overall administrative cost of random sample checks in the EU-27 are of the magnitude of 5 to 16 M€ per year[56]. In general, costs of a more elaborate quality control scheme could add up to 10 to 32 M€ administrative costs per year[57].

Moreover, this control regime could also guarantee a sufficient quality of experts issuing the certificates as an indirect consequence.

Proposing such requirements can be justified from a proportionality point of view as, from the current practice, it has been evident that the low quality of certificates is one of the key factors for the questionable credibility and market uptake of the certificates in a number of Member States.

5.4.2. Option B2: Requiring the recommended cost-effective measures of the certificate are realized within a certain time period

Current situation: According to the EPBD the energy performance certificate shall be accompanied by a list of recommendations for cost-effective improvement of the energy performance. There are no requirements in the EPBD that some of these recommendations, such as those with short pay-back time, are to be realized. However, if there is no uptake of these recommendations a significant possibility for energy reductions is not achieved. This possibility prompted criticism by some stakeholders who argue that in this way the potential may not be tackled and asking that the cost- effective recommendations are implemented. For example, the European Energy Network in its report[58] suggests that recommendations with 7 years pay-back time are to be mandatorily implemented.

It is difficult to evaluate from practice what is the rate of uptake of these recommendations in the certificates as there is no sufficient experience in most of the Member States. The lack of such information has been highlighted in a study carried out within the Buildings Platform for which only one respondent to a questionnaire sent to experts from all EU Member States provided estimation that an uptake of up to 20% of low and non-cost measures for the service sector[59].

Some Member States have also already included such provisions in their legislation. For example, in Portugal for the non-residential buildings the cost- effective opportunities with a payback smaller than 8 years must be implemented within 3 years. There are severe financial penalties if these are not realized. In Denmark all buildings owned by public administration

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estimated at app. 2 M€, and yearly enforcement costs at 14 M€ (all sectors, excluding communication). Calculated from data originating from Department for Communities and Local Government, 2007.

56 Extrapolation of the Danish approach: one out of 500 EPCs is fully re-issued. In addition, one out of 100 data forms is reviewed. Costs of random checks are thus approximately 0.25% (1/400) of the total costs of issuing the EPCs.

57 Quality checks costs equal to 0.5% of EPC issuing costs (information given orally by the IA consultant on, 23 June 2008).

58 EnR. Implementation of the EU Energy Performance of Buildings Directive - a snapshot report, 2008

59 BRE. Impact of the Energy Certificates on the energy savings in the existing buildings in the MS (EPBD article 7). Draft June 2008

(government, regions, municipalities) shall be certified and the cost- effective recommendations with a pay-back time of 5 years or less shall be implemented.

Proposal: A requirement can be introduced that the cost-effective recommendations of the certificate are to be implemented within a certain period of time. Such requirement can be for the owners of all buildings or for some parts of them based on the division: residential, commercial and public buildings. In case of purchase the investment requirement may be on the new owner. The setting up of a definition for 'cost-effective' and the period of time are to be decided at national or regional level.

Impact: Unfortunately, the evaluation of the impact of requiring that the cost-efficient recommendations of the Certificate are realized within a certain time cannot be based on the countries that have adopted certain requirements in this aspect, i.e. Denmark and Portugal, as there are no impact assessments available. Still, it has been evaluated that if requirements are included solely for the buildings of the **tertiary sector**, this may already lead to final energy demand saving of approximately 12 Mtoe, i.e. 3% reduction in 2020 in the EU-27 buildings sector; to a CO_2 emission reduction of about 33 Mt, i.e. 1% reduction in 2020 in overall EU-27 CO_2 emissions.

However, although from the data available it is not possible to make estimations on the investment requirements for the whole buildings sector (tertiary only), it can be expected that meeting the costs can be a significant challenge for some property-owners, especially those with restricted budgets, or housing associations that own a large number of properties. To ease the burden on this segment, targeted financial support mechanisms could be established by Member States (see option B4).

For the purpose of requesting the realization of the recommendations of the certificates, their quality would have to be sufficiently good such that no economically wrong investments are required. Currently, the experience of some countries shows that as there is a drive towards very low cost of certificates, they do not provide reliable and sufficient information for these principle investment decisions.

In addition, the results of the STABLE[60] project do not show a clear need for adopting a mandatory approach. In its activities the perceptions of professional parties[61] of whether they will act upon the recommendations if they are mandatory or voluntary was evaluated. The results show that 58% of respondents said they would increase their investment in energy efficiency measures if the recommendations on the certificate were voluntary, whilst 64% believe they would do so if the recommendations were made mandatory.

From a subsidiarity point of view, introducing such a requirement would be a significant financial burden for EU citizens and businesses and therefore such action would not be justified at EU level. To varying degrees Member States also use market-based instruments such as taxes on energy products used for heating to incentivize efficiency measures in the housing sector. For subsidiarity reasons Member States should continue to be able to choose a

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60 Motiva Oy *et al*. 2007, *Securing The Take-off of Building Energy Certification: Improving Market Attractiveness through Building Owner Involvement*, STABLE final report, cited at http://stable.motiva.fi/about/ STABLE, stands for Securing the take-off of Building Energy Certification. The project has been co-funded under the Intelligent Energy Europe Programme

61 Professional parties include large owners, suppliers to owners, associations of users, the sample includes 466 respondents from Austria, Belgium, Bulgaria, Finland, Greece, Sweden, and Netherlands

combination of market-based and command and control measures, which would no longer be the case if every price increase would automatically trigger higher minimum standards.

Nevertheless, the public authorities should lead the way in demonstrating best practices in energy efficiency improvements. Therefore, setting up of a requirement that for the buildings occupied by the **public sector** the cost-efficient recommendations should be implemented can be a good step for showing such an exemplary role. This has also been proposed by several organizations that have responded to the public consultation.

5.4.3. Option B3: Making certificates a mandatory part of property advertisement and/or property transaction documents

Current situation: The EPBD only specifies that the certificate "has to be made available" to the potential owner (for newly built constructions), the prospective buyer or tenant. When and how this information has to be communicated, is not specified. In certain situations this information is only disclosed as one of the many annexes to a contract ready to be signed. At such a moment the information on energy performance can no longer influence the decision of the prospective buyer or tenant and it consequently loses its added value.

In order to use the full potential of the energy performance certificate, the information related to the energy performance of a building has to be disclosed as early as possible. In this way information on the energy performance can determine the choice for a particular building. Such information is already provided by some real estate agencies, for example in the UK, which include the 'rainbow' rating from the Certificate in the ads that are at displayed in their offices and in the websites.

Proposal: To require that the energy performance certificate is displayed in the publicity for property transactions when a property is on sale or for rent and to require that it is included as part of the property transaction documentation.

The information on energy performance of a building should be integrated in all publicity for property transactions. A similar requirement at EU level has already been made for the disclosure of fuel economy and CO_2 emissions for the marketing of new passenger cars. In order to have an effect, this information should be explicitly mentioned on any contract for a property transaction. In this it can be considered as any objective information regarding a building such as the surface or the material description.

Impact: Making energy performance part of the marketing process can, over time, add market value to good performing buildings, which will have a competitive advantage over similar buildings with the same price but performing less efficiently. Integrating energy performance information in publicity and marketing tools could also raise the awareness of the general public. Not only will potential buyers or tenants be able to compare the efficiency of their possible choices, the general public will familiarise itself with the concept of energy efficiency of buildings. Home owners could perceive this as an incentive to establish the energy performance of their own property and act accordingly.

As the preparation and presentation of the certificates are already required in the current EPBD the costs for the consumers will be mainly for displaying the information (printing and including it in websites) while the costs for Member States will be for monitoring the compliance. However, the added value of the information for the real estate market could compensate possible additional cost. No quantification on the impacts on energy savings and

CO_2 emission reductions are available but they can be considered relatively high and increasing in time as the role of the certificate will be considerably strengthened.

Taking into account the important contribution of a requirement that would make certificates a mandatory part of property advertisement and the fact that similar approach at EU level has already been adopted in other sectors (i.e. CO_2 emissions for the marketing of new passenger cars), the proposal would be inline with both the subsidiarity and proportionality principles. Making the certificate a mandatory part of property advertisement and/or property transaction documents would limit the interpretations of the current text of the EPBD which already states that a certificate should be 'made available' but nevertheless there are some interpretations that it does not mean that the certificates are *de facto* presented or handed over.

5.4.4. Option B4. Requiring the linking of the certificates with other support or discouragement mechanisms

Current situation: There are no requirements in the EPBD that stipulates that support mechanism should be linked with the certificate. Some of the possibilities that are available at EU level for general support schemes which could be linked to the certificate were listed in Section 2.2.4 and there are a number of examples from around the Europe of well functioning support schemes, although at present these do not necessarily include all of those which are needed.

In the residential and commercial buildings chapter of the fourth Assessment Report of the Intergovernmental Panel on Climate Change[62], it is stated that there is no single policy instrument that can capture the entire potential for GHG mitigation. Due to the especially strong and diverse barriers in the residential and commercial sectors, overcoming these is only possible through a diverse portfolio of policy instruments for effective and far-reaching GHG abatement and for taking advantage of synergistic effects. Since climate change literacy, awareness of technological, cultural and behavioural choices and their impacts on emissions are important preconditions to fully operating policies, these policy approaches need to go hand in hand with programmes that increase consumer access to information, awareness and knowledge (*high agreement, medium evidence*). This is confirmed by the summary report of the "Active Implementation of the European Directive on Energy Efficiency" (AID-EE).

Nevertheless, such approach has already been adopted in several EU Member States. For example, in the Netherlands there is a green mortgage which house owners can use to implement energy saving measures during renovation. The size of the loan is coupled to the improvement of the energy performance label. This means that in cases where more energy saving measures are implemented the energy performance of the house is further approved and more money can be borrowed against favourable conditions (see Table 3). In general the interest is 1% lower than the market interest. The scheme is in force since May 2008, so there is no assessment available yet of its possible impacts[63].

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62 IPCC, Levine, M., D. Ürge-Vorsatz, K. Blok, L. Geng, D. Harvey, S. Lang, G. Levermore, A. Mongameli Mehlwana, S. Mirasgedis, A. Novikova, J. Rilling, H. Yoshino, 2007: *Residential and commercial buildings. In Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (eds)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

63 VROM. Adjustment regulation Green investments, Ministry of Finance and Ministry of Housing, Spatial Planning and Environment, 22 April 2008

Table 3. Improvements to the energy performance (in terms of energy rating) and amount provided for green mortgage in the Netherlands

From label	To label	Number of steps	Maximal green mortgage (EUR)
F	D	2	25 000
F	B	4	50 000
F	A	5	100 000

In Portugal energy conservation measures will be financially supported by tax benefits, this scheme will in the near future be coupled to energy performance certificates[64].

Interesting examples of linking energy certificates to complementary financial or fiscal mechanisms are to be found outside the built environment. For example, in 2006, a bonus-malus (or 'feebate') mechanism was introduced for new automobiles in the Netherlands. The objective of the scheme is to shift market shares from inefficient vehicles towards more efficient ones. The scheme entails a fiscal bonus (re-ward) or malus (penalty) for buyers of vehicles. The size of the bonuses or penalties is proportionate to the energy label of the car, which is considered an indicator of its CO_2-emissions.

An evaluation of the scheme showed that a considerable shift in market shares had in fact taken place. Meanwhile, the costs of execution of the scheme are characterized as 'relatively modest'. After all, an existing tax scheme for motorized vehicles was used as a platform for additional incentives for efficiency. Early 2008, the bonuses and maluses were increased to higher amounts, in order to shift market shares further against virtually no additional cost[65].

The case of energy labelling of appliances in the Netherlands constitutes another interesting example. It can be questioned whether labelling as a single instrument would have had a substantial impact in the Netherlands. High efficient appliances are more expensive and are probably not attractive for consumers without additional policies (subsidies and/or eco-tax). What happened after the introduction of the energy label -and a subsidy scheme linked to it- was that the market share of energy efficient appliances increased rapidly and inefficient appliances were removed from the market. This happened at higher pace in the Netherlands than elsewhere in Europe. In this case the policy package counts up to success. In Sweden no subsidy scheme was linked to the labelling. Current penetration of high efficient appliances is comparable with penetration in the Netherlands. Market transformation, however, came at a later stage and might have benefited from policies introduced in other countries[66].

Proposal: It can be required (or recommended) that a link with the energy performance improvements is made when financial or fiscal support by Member States is provided to property owners (or tenants).

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64 Information provided by Eduardo Maldonado, Universtiy of Porto, Portugal, email and telephone call 13 and 17 June 2008

65 VROM. Cijfers over wonen 2006 (Statistics on housing 2006), a report issued by the Dutch Ministry of Housing, Spatial Planning and Environment. The Hague, April 2007

66 Kahn *et al.* From Theory Based Policy Evaluation to SMART Policy Design. Summary report of the Active Implementation of the European Directive on Energy Efficiency"(AID-EE) project, within the framework of the EU Intelligent Energy by Jamil Khan (Lund University), Mirjam Harmelink, Robert Harmsen (both Ecofys Netherlands), Wolfgang Irrek (Wuppertal Institute) and Nicola Labanca (Politecnico), April 2007

There are various tools Member States can use to provide economic incentives for promoting energy efficiency measures in buildings and to respect subsidiarity the exact support should be decided on national or regional level. One option could be to link financial instruments such as subsidies, preferential loans or fiscal deductions with the use of energy performance certificates. For this option, energy auditors would determine the energy performance of a building and identify cost-effective energy savings measures accordingly. If the owner decides to carry out the suggested energy efficiency measures, he/she could get financial support when decisively upgrading the energy performance of his building from e.g. a D to a B grade. A new certificate would then be issued to document the savings reached after the implementation of the savings measures.

Impact: The impacts of linking of the certificates with other support or discouragement mechanisms are difficult to quantify as they are very dependant on the specifics of the support system that is to be devised by individual Member States. However, it would require significant state funds (some also coming from the Structural and Cohesion funds).

Provision of financial stimuli will inevitably lead to energy efficiency improvements. For example, the above-mentioned STABLE project concluded, among others, that the most important factor which would influence the uptake of energy saving measures was the availability of investment grants and subsidies. Nearly all respondents (93%) consider that if implementation were to be supported by financial mechanisms, this would stimulate them to realize the cost-effective recommendations of the energy performance certificate.

However, such a requirement would not be in line with the subsidiarity principle as it would touch issues of national budget spending. Furthermore, the introduction of such a text into a Directive based on Art. 6 (environmental protection) of the Treaty may not be possible from a legal point of view.

5.5. Inspection of heating and air-conditioning systems

The EPBD requires organising regular inspections of heating and air-conditioning systems. These systems have a very high energy saving potential, up to 40-60% of their total energy use. In this context, the current EPBD's inspection requirement is estimated to result in just 10% energy savings[67]. So there is significant room for further savings. The need for further action is even more important because of the significant increase of air-conditioning systems throughout Europe. As the components of heating and air-conditioning systems are tradable goods, an initiative which is as much harmonized as possible within the EU is desirable (i.a. to ease internal market activity), that is why action at Community level is deemed to be appropriate.

5.5.1. Option C1: Requiring an 'inspection report' for heating and air-conditioning systems

Current situation: The existing EPBD inspection requirements generally aim at energy and CO_2 savings, but they do not specify the inspections' content and deliverables. Therefore, some of the Member States' inspection schemes are imprecise and give limited energy

[67] Estimations made corresponding to current Danish action plans, for new buildings. According to Scholten et al. about 10% of energy savings are expected as result of an average increase of heating system efficiency from 76% to 86%. Source: *Toothless tiger? Is the EU action plan on energy efficiency sufficient to reach its target?*, A. Scholten, S. Lechtenböhmer, D. Mitze and S. Thomas, 2007

savings. In many Member States inspections are not sufficiently prescribed or are only based on safety checks (i.e. in France, The Netherlands), so they do not directly lead to energy savings. Besides, few Member States have organised systematic information, promotion, and advice campaigns to date, as requested by article 8(b) of the EPBD.

Consumers and building owners need more information. Better operation and control of systems and retrofit of old systems and components by more efficient ones, brings big savings. Proper and regular inspection and maintenance of the heating and air-conditioning systems accompanied by adequate information/advice to building owners for retrofitting can significantly stimulate and accelerate these savings[68].

Proposal: An inspection report should be given to building owner after the inspection. This should include an energy efficiency rating of the heating/cooling systems, e.g. compared to up-to-date and/or best technology available, and recommendations for cost-effective improvement measures.

Furthermore, it could be requested that these recommendations contain an estimate of the costs for replacing the existing boiler, water heater, or cooling system with a new one that complies with the Eco-design[69] minimum requirements, or 'A' class under Energy Labelling[70].

An inspection report including recommendations for system improvement would not need to be made with the same frequency as the inspection of the systems themselves, as its rating and recommendation results remain valid for a longer period of time.

The relevant CEN standards for inspections could be further developed. These would allow an efficiency rating of the installations. They could represent an overarching guideline which supports Member States' implementation of an inspection report[71]. The EPBD recasting could therefore directly refer to these CEN standards and minimum energy efficiency installation requirements could be set by Member States based on these standards.

As a further step, the recommended saving measures in the inspection report could be requested to be realized. Measures with short payback periods could be required to be implemented faster than the ones with a longer payback period. Therefore, the inspection report should have clear information on economic information to building owners.

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68 Due to boiler replacement combustion efficiency increased on average by 7 % in Italy (mainly gas boilers) and 5 % in Finland (mainly oil boilers); Fuel saving due to a more frequent regular maintenance (yearly instead of customary average) was calculated between 1.3 % and 2.5 % (Ireland); Statements by Marcello Antonucci, Krzysztof Klobut in presentation 'How to evaluate the impact of inspections and advice programmes for boilers' at 9th World Congress Clima2007, Helsinki, June 2007 (http://www.rehva.com/projects/clima2007/WSs/WS7/WS7_pSUMMARY.pdf)

69 Directive 2006/32/EC of the European Parliament and of the Council of 6 July 2005 establishing a framework for the setting of ecodesign requirements for energy-using products and amending Council Directive 92/42/EEC and Directives 96/57/EC and 2000/55/EC of the European Parliament and of the Council, *OJ L 191, 22/07/2005 p. 29 -58*

70 Council Directive 92/75/EEC of 22 September 1992 on the indication by labelling and standard product information of the consumption of energy and other resources by household appliances, *OJ L 297, 13/10/1992, p. 16–19*

71 The outcomes of relevant projects under the EU IEE programme, such as AUDITAC and HARMONAC, can be of further support.

Impact: In average, the inspection report could bring about 30% of building owners inspected to follow the advice, e.g. in France, the impact of individual energy advice has been estimated at 30%, and in Sweden incentives on individual oil boilers substitution resulted in 30% renovation[72]. Assuming an average inspection frequency of 3.3 years, the requirement for an inspection report would therefore lead to an annual renovation rate of 9.1% per year (30% / 3.3). The current renovation rate is about 6.7% per year (assuming an average boiler lifetime of about 15 years). Thus the inspection report could lead to about 2.4 % additional replacements/retrofits of the stock of boilers and combi-water heaters per year. As a consequence, not only 80% of the stock of boilers and combi-water heaters would be replaced by 2020 (as is the case with current replacement rate), but 100 % of the stock would be replaced by more efficient products. Realistically, this figure might be lower at 95 % due to market imperfections, to calculate conservatively. The additional annual savings in 2020 caused by the inspection report requirement would therefore be around 5 Mtoe final energy, 15 to 20 Mt CO_2, or €2 billion (net of extra cost of replacement)[73].

Inspections of heating and cooling systems can furthermore - apart from energy savings - achieve co-benefits, such as decrease of discomfort hours caused by non-properly operating heating/cooling systems, as examined by Bory *et al*[74].

In addition, the new system could help manufacturers to produce heating and air-conditioning systems for the entire EU market which are easier to inspect, which could therefore improve the companies' competitiveness. Furthermore, inspection of heating systems is linked to creation of jobs, which can be estimated at 195,000 jobs (inspectors and energy consultants) in EU-27[75] in 2020 if made properly and if including the inspection report requirement. This means about 25% or 40,000 more inspectors than currently needed for the existing EPBD heating system inspection requirement. For air-conditioning systems, it can be estimated at around 30,000 (inspectors and energy consultants) in EU-27[76] in 2020, which means about 6,000 more inspectors than currently needed for the existing EPBD air-conditioning system inspection requirements (see Annex IV for the assumptions).

Additional cost to the Member States and their consumers of the inspection report should be low, as the information on the existing boiler, and system etc. should already be available from the building certificate and boiler/cooling inspection. The extra cost will be selecting the right size and technical specification of a replacement and cost of installation system. Given a well designed system, the add-on cost to the inspector should be low (less than 10% of inspection cost e.g. every 4 to 6 years).

Finally, as is the case for recommendations from the buildings certificate, national subsidy schemes could and should support the investments that originate from the inspection report.

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72 'Summary of WS : How to evaluate the impact of inspections and advice programmes for boilers' at 9th World Congress Clima07, Helsinki, 2007, www.rehva.com/projects/clima2007/WSs/WS7/WS7_pSUMMARY.pdf

73 VHK EcoDesign of boilers and combi-boilers study, 2007 and DG TREN model based calculations built on the VHK study.

74 Daniela Bory, Jerome Adnot, Carmelo Greco, Dominique Marchio: Auditing the European room air-conditioning systems and potential energy savings, 2007

75 VHK EcoDesign of boilers and combi-boilers study, 2007, task 2 and extrapolated from EU-25 to EU-27 by BIO Intelligence Service S.A.S. (using calculation methodology according to Jerome Adnot)

76 In 2017, based on extrapolation out of Roger Hitchin, Jerome Adnot, Maxime Dupont: 'Issues of the implementation of the EPBD article 9', 2005

The inspection report would be an important upgrading to the existing requirements for inspection and would help consumers in identifying important possibilities for cost-effective energy savings and therefore it is justified from proportionality point of view.

5.5.2. Option C2: Introducing quality check and compliance requirements for inspections

Current situation: Member States have introduced very different requirements with regard to educational preconditions and training of the independent experts which are allowed to execute inspections. The actual independence, required by the existing EPBD, and quality of inspectors therefore varies widely within the EU.

Where there is currently little or no compliance control of inspections and inspection outcomes of heating and air-conditioning systems, the implemented national inspection schemes are unlikely to contribute a lot to the realization of the energy saving potential of installations: The technical saving potential for heating systems is estimated to be very high, at 30%[77], which correspond to around 66 Mtoe final energy savings, reduction of €55 billion of costs and 252 Mt CO_2 emission savings per year in 2020. Similarly regarding the air-conditioning systems, technical energy savings potential can reach a maximum of 50% of their final energy use[74].

Without control of the inspection outcomes of heating and air-conditioning systems, the national inspection schemes are unlikely to achieve sufficient energy efficiency improvements. Analysis of stakeholders and experienced Member States[78] (e.g. Sweden, Germany, France, Italy) recommend ensuring that effective enforcement systems are in place for compliance and to regularly and independently assess whether the control regimes are effective. The importance of compliance controls is also underlined by numerous contributions to the public consultation on the EPBD recasting: About one third of all contributors asked explicitly for compliance control requirements for inspection in an EPBD revision, whereof about 90 % of them are representing big European associations.

For example, for air-conditioning systems the energy savings of the compliance requirements can be estimated at up to 20% of their total energy saving potential, which correspond to around 0.5 Mtoe final (electricity) energy savings[79], reduction of €1.1 billion of costs and 5.7 Mt CO_2e emissions savings per year in 2020.

Member States have introduced very different requirements with regard to educational preconditions and training of the independent experts who are allowed to execute inspections. Their actual independence, required by the existing EPBD, and quality therefore varies widely within the EU.

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77 VHK EcoDesign of boilers and combi-boilers study, 2007, task 6, p. 36 (data correspond to scenario for design option 3 for XL boilers).

78 As e.g. presented at the 2nd Sustainable Energy Week event 'Energy Performance of Buildings Directive - Next Steps' in January 2008 and as demonstrated in a Swedish case study of 2007 (see European Energy Network EnR: Implementation of the Energy Performance of Buildings Directive - a snapshot report, 2008), In Sweden, energy monitoring must be undertaken for a period of two years after the building has been completed, to demonstrate compliance on the ground. The policy was introduced in mid-2006 and results will begin to emerge soon. Large property developers have expressed their support for the initiative

79 Based on extrapolation out of data originating from 'Energy Efficiency and Certification of Central Air Conditioners' (EECCAC), 2003.

The importance of compliance controls is also underlined by numerous contributions to the public consultation on the EPBD recasting: About one third of all contributors asked explicitly for compliance control requirements for inspection in an EPBD revision, whereof about 90 % of them are representing big European associations.

Any compliance control scheme for inspections should be well balanced with regard to control costs and achievable benefits in terms of energy and emission savings and their gross economic costs. Such a control scheme has to be as effective as possible at low administrative efforts. In doing so, a positive balance between benefits and control costs (in terms of improved quality and saved energy and emissions) can be achieved

Proposal: Similar to what has been presented under option B1 on energy performance certificates for buildings, random sampling checks of inspection reports (presented in option C1) of different levels of detail and frequency could therefore be introduced as a new requirement. The levels of the random sampling regime could range from validity checks of input and/or result data for inspection reports to on-site checks of heating and air-conditioning systems inspected.

The compliance control regime could also guarantee a sufficient quality of experts carrying out the inspections[80], leaving it to the Member States to lay down training requirements and educational preconditions for inspectors. However, as an indirect consequence, by a control of the inspection report a sufficient quality of inspectors would be checked automatically at the same time.

Member States could be requested to establish random sampling checks, for e.g. 0.1 % of annually carried out inspections[81], at 3 levels of detail: A certain share of these checks could requested to be done by a validity check of input data and given recommendations of inspection reports only. Another (lower) share could be requested to be checked (stricter) for input data and the recommendations could be recalculated by a controller. And another (very low) share of random sampling checks could consist of the aforementioned proposal plus control of the heating/air-conditioning system on site for correspondence with the certificate.

Impact: Similar to what has been described under option B1 on certificates, a random sampling control of inspection results/reports is an option to improve the quality of inspections; guarantee a sufficient quality of information on energy efficiency improvement measures provided to the owner of a building by the inspection report and therefore increase the retrofitting rate of heating and air-conditioning systems; and ensure a sufficient quality of inspectors at the same time for reasonably low administrative efforts and costs.

A random sampling check of the inspection outcomes for heating and air-conditioning systems does have positive effect on creation of jobs: i.e. in Portugal, the quality of the certificates is checked every five years on 10% of the total. For inspections, random sampling

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80 i*bid* 48

81 Underlying that an accredited expert, specialised on issuing energy performance certificates for buildings, compiles one certificate per working day, so about 200 certificates a year. A random sampling check of 0.5 % of certificates would therefore mean that accredited experts face with one control per year on average.

rate can be assumed as similar, which could result in 23,000 jobs[82] (inspectors and energy consultants) for EU-27 by the year 2020.

Similar to option B1 proposing such requirements can be justified from a proportionality point of view as, from the current practice, it has been evident that without compliance checks the usefulness and credibility of inspections is in question.

5.6. Minimum energy performance requirements

The present energy performance requirements[83] and their levels of ambition vary widely across the Member States, even within similar climatic zones. Cross-border comparisons of fixed requirements are difficult due to very different basic approaches regarding how energy performance requirements are calculated and expressed. In addition, a multitude of different parameters are used for calculation purposes. Furthermore, with regard these parameters, very different definitions exist in Member States[84]. Moreover, some Member States focus on fixing the transmission losses of a building by setting minimum requirements for individual components, such as windows, others have established holistic energy performance rating methodologies, fixing e.g. the maximum allowed primary energy demand and/or CO_2 emission for a building, fully or partly based on relevant CEN standards. These incorporate, inter alia, energy consumption for lighting, ventilation and domestic hot water.

This fragmented situation is the result of many years of development of building regulations in the Member States, each having different starting points, dates (some started decades ago, some recently) and executive bodies. The existing performance requirements and methodologies also regularly undergo revision. Furthermore, the performance requirements have to be in line with other, non-energy national building regulations, which are outside the scope of the EPBD. An all-embracing project[85] was launched in autumn 2007 in order to assess these differences and to analyse how cross-border comparisons can be made in principle. The project consists of 16 international partners from across the EU and is scheduled to run for 2.5 years.

The overarching aim of an EU legal activity on energy performance requirements in the buildings sector is to achieve optimum performance requirements, which are feasible, cost-effective and in balance with provoked energy savings, technical and environmental feasibility and subsidiarity[86]. Cost-optimal levels are not yet achieved European-wide by

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82 Based on Roger Hitchin, Jerome Adnot, Maxime Dupont: 'Issues of the implementation of the EPBD article 9', 2005; see Annex IV for further information.

83 Energy performance requirements: meaning regulations which limit the energy use of buildings under standardised conditions, expressed as a fixed limit of e.g. the annual final or primary energy use in kilowatt hours per square meter useful floor area of a building [$kWh/m^2.a$]

84 Such as e.g. "useful floor area", a common value on which the energy performance of a building is based on: Energy consumption in kWh per m^2 useful floor area, varying up to +/-10 - 15 % across Member States, see e.g. information paper P65 "Comparing Energy Performance Requirements over Europe" at the Commission's Buildings Platform (www.buildingsplatform.eu).

85 ASIEPI project - Assessment and Improvement of the EPBD Impact, project under the Intelligent Energy Europe Programme, 10/2007 to 3/2010

86 Ambitious energy performance requirements for buildings (insulation and reduction of uncontrolled ventilation by improved air-tightness) sometimes have been blamed for a degradation of the indoor environment and increase in problems in connection with moisture and dampness in buildings. Several studies, such as the comprehensive Swedish survey about health, well being and energy efficient buildings (Energy efficient and healthy buildings, M. Gullberg, ÅF Process Sweden, E. Öfverholm,

nationally fixed energy performance requirements, which is why further stimulation at **Community level** could realize additional energy savings. It is also important for regulation to encourage and not hamper innovation in the buildings sector. The existing EPBD respects this by requesting the Member States to set a holistic methodology (instead of fixing very specific details of each component of a building) and any change in legislation must recognise the importance of this approach[87].

The options for energy performance requirements below reflect these fundamentals.

5.6.1. Option D1: Establish EU energy performance requirements

Current situation: Member States individually fix energy performance requirements for buildings at different levels, based on different methodologies and covering different scale of influencing factors[88], as stated above in the introduction to options D. European CEN standards for energy aspects in the buildings sector, initiated by the Commission in 2004 to support Member States implementing the existing EPBD, only reduced this variety to a certain extent. Furthermore, not all Member States make broad use of them. One option to achieve ambitious requirements EU wide and to harmonize them could therefore be to fully lay down binding methodologies and levels of requirements at EU level.

The principle structure of Member States' legislation on buildings differs widely. Energy performance requirements are often embedded in complex national building regulations and rarely laid down separately without interconnections to other legislation. These building regulations often also go beyond energy aspects, such as health requirements on indoor air quality, static requirements, structural fire protection or noise control etc. Member States' notifications on the implementation of the existing EPBD confirm these common legal cross correlations. Furthermore, Member States insist on the subsidiarity principle when it comes to specifying individual building requirements.

To set minimum energy performance requirements for buildings at EU level would therefore require (i) either to unbundle national building regulations in order to separate and fix energy aspects with one harmonized approach (ii) or to develop an approach at EU level which is

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Swedish Energy Agency, M. Bengtsson and N. Tolstoy, National Board of Housing, Building and Planning, 2005) disproved this claim. Health aspects in buildings are rather a question of proper construction work and pattern of use, independent of the level of energy performance requirements on the construction, notably that adding envelope insulation and improving air-tightness need to be made together with correct natural or adjusted mechanical ventilation.

87 In this regard, e.g. an overall limitation of the building's primary energy demand calculated according to the aforementioned holistic methodology by a building regulation leaves full room for best technical solutions how to comply with these requirements, so which combination of e.g. insulation levels, boiler efficiency level and use of renewable energy sources ensures to keep the overall primary energy limit of a building. A counter-example would be to define exactly in the building regulation what type/level of insulation has to be used for the building envelope or which type of boiler is allowed to be installed etc in order to limit the energy consumption of the building.

88 See several comparison studies, such as: Scottish Building Standards Agency, "International comparison of energy standards in building regulations: Denmark, Finland, Norway, Scotland, and Sweden", Scotland, 2007; Belgium Building Research Institute, "Energy performance regulations: small scale comparison between Flanders, the Netherlands, Germany and France", Belgium, announced to be published in summer 2008; Department of the Environment, Heritage and Local Government, 'Consultancy study of energy efficiency regulations for new dwellings and options for improvement', Ireland, 2007; ASIEPI project - Assessment and Improvement of the EPBD Impact, project under the Intelligent Energy Europe Programme, 10/2007 to 3/2010.

able to take implicitly into consideration all existing national interconnections to other building legislations for consistency reasons.

Proposal: Specifying EU-wide energy performance requirements for buildings in the EPBD, taking into consideration various factors, for example, different climate zones and building types (residential and non-residential buildings)

Setting harmonised energy performance requirements at EU level, e.g. expressed as maximum annual primary energy use per useful floor area of a building [kWh/m^2.a] in dependence of the outdoor climate, could ensure more ambitious, cost-optimal energy efficiency levels throughout the EU. As the design and use of buildings is widely varying and does have significant influence on the energy needs, a differentiation of building types would also be necessary when fixing these requirements, as is practice today in almost all Member States.

Impact: The energy savings potential of this option D1 in 2020 can be estimated at 9.5 Mtoe per year for EU-27 (see Annex IV for assumptions made for the potential calculations). This means a potential of 24 Mt CO_2 emission savings per year. It incurs annual capital costs of €6 billion per year for investments and results in annual energy cost savings of €12 billion in 2020. The number of newly created jobs within the buildings sector can be estimated at 82,000. These figures are based on currently laid down levels of energy performance requirements in the Member States compared to newly fixed cost-optimal requirements at EU level, which would be more ambitious on average.

Furthermore, it would ease cross border comparisons and the achievement of equal levels of ambition in all Member States. It could help construction companies, construction products manufacturers and energy services companies to understand and to comply with building regulations all over the EU and therefore stimulate the internal market for this sector.

Setting harmonized minimum energy performance requirements at EU level could be difficult with regard to concerns of Member States, which claimed that it is in Member States competence to specify detailed building regulations. Furthermore, it could hamper Member States from laying down even stricter energy performance requirements which were already announced to come. Moreover, an EU-wide regulation would become very complex in order to reflect all national particularities in a fair way and therefore could become indefinite in practice and take a very long time to be fixed.

5.6.2. Option D2: Introducing methodology for benchmarking

Current situation: As analysed in the previous option, a uniform EU wide energy performance setting is very challenging, that is why other possibilities also need to be verified. Benchmarking is one common instrument whenever complex issues need to be tackled or assessed without specifying all the underlying (technical) details and requirements. It is a results-oriented methodology in order to rate the achieved or aspired level of a matter. Benchmarking of energy performance requirements can e.g. be the comparison of existing national requirements with a set of similar regulations laid down in other countries or with e.g. cost-optimal energy performance requirements. Hence, it can steer Member States towards best practice or cost-optimal solutions and create competition amongst Member States towards the best or most ambitious energy performance requirements. Real estate companies, chain store companies and institutions/authorities often use benchmarking methods when managing a large number of buildings. So an objective benchmarking mechanism could guide and support Member States towards setting cost-optimal holistic

energy performance requirements. Currently, only a few Member States fix their levels of requirements based on national economic impact assessments, as stated in answers to the questionnaire which has been sent to Member States in spring 2008 (see Annex II).

Proposal: Include in the EPBD (i.e. as an annex) a methodology showing how to calculate the cost-optimal level of energy performance requirements for buildings of which Member States shall make use of as a benchmarking instrument and present the calculation and results of the benchmarking to the Commission by reports and/or in the EPBD Comitology Committee.

National energy performance requirements for buildings could be geared to cost-optimal requirements by **providing Member States with a methodology for benchmarking**. The cost-optimal requirements (= best economic balance of investment costs versus energy savings) could therefore be specified by an objective methodology allowing implicit consideration of all boundary conditions by parameters. This methodology should be based on EPBD CEN standards, which already fulfil these requirements. The parameters used inter alia consist of outdoor climate, energy prices, labour costs, material (e.g insulation), product (e.g. windows, heating systems) and service costs, as these vary within the EU and influence the cost-optimal level of energy performance requirements for buildings.

Such a benchmarking mechanism, consisting of a CEN based calculation methodology for cost-optimal energy performance requirements, could be introduced to the EPBD. It would contain all relevant parameters (e.g. underlying construction product costs, energy costs, taxes etc.). The specific parameters would have to be fixed at national level (only for benchmarking purposes), not in the EPBD and therefore with respect to the subsidiarity principle. In practice, Member States could then be requested by the EPBD to recalculate (i) their nationally fixed energy performance requirements and (ii) the cost-optimal level of requirements with the aforementioned new EPBD methodology in order to benchmark. The calculation results and the specific parameters used could then be required by the Commission to be published in reports and/or EPBD Comitology committee meetings.

In doing so, Member States would not be asked to change their (complex and widely varying) **national methodologies** to set their requirements, but would be asked to carry out a **comparison calculation** with the aforementioned new EPBD benchmarking methodology, in order to check whether their level of fixed requirements is at the cost-optimal level or not. Therefore, the ambition of energy performance requirements that Member States actually set would be made transparent, which is very difficult to rate at present. Furthermore, this could also help to make cross-country comparisons for levels of ambition of fixed energy performance requirements, as the calculation methodology and all parameters used would be made public. So the benchmarking instrument is just a "translator" of complex, widely varying energy performance requirements fixed at national levels to an EU-wide identical methodology for comparison purposes, not for regulating the levels of requirements at EU-level. This would clearly indicate whether Member States are below the optimal levels which would mean that money from potential energy savings are lost every time regulations are applied or whether Member States are too ambitious in their requirements and pose an unjustified burden on their citizens.

Impact: Based on current energy performance requirements in the Member States, the long-term impact of the described new benchmarking system in terms of energy savings (current level versus theoretically cost-optimum level) can be identical to option D1, being estimated at 5 Mtoe for EU-27 in 2020 and 9.5 Mtoe in 2030 on a yearly basis in residential and non residential buildings. This also means a potential ranging from 13 Mt CO_2 emission savings

on a yearly basis in 2020 to 24 Mt CO_2 emission savings per year in 2030[89]. The figures represent the maximum possible impact, i.e. meaning that Member States would gradually correct their national levels and half of them would adjust their national levels to cost-optimal ones by 2020 and all Member States would do so by 2030.

Furthermore, the potential number of new jobs (all tackled sectors together, so construction and installation sector, manufacturers and energy services) can be estimated at 82,000[90] in the long run if minimum energy performance requirements for new and refurbishment of existing buildings were individually lifted to cost-optimal levels in all Member States. The administrative costs of this benchmarking mechanism would be very low, as only a recalculation of nationally fixed requirements would be requested (plus publication of fixed parameters used).

Furthermore, administrative costs within the EU could be kept to a minimum by providing Member States with a uniform, objective benchmarking methodology within the EPBD. At present, Member States develop national approaches on how to fix the requirements. Frequently new economic analysis is undertaken for each revision of energy performance requirements.

Introducing a benchmarking methodology for fixing energy performance requirements for buildings in the EPBD could simultaneously:

- support Member States in laying down cost-optimal levels of holistic energy performance requirements in an objective manner,
- lead to more transparency for all parties involved whenever energy performance requirements are fixed by Member States, as a fully transparent and public methodology would be introduced which allows for validating the fixed levels of energy performance requirements,
- provide Member States with a method which does not have to be revised as frequently as the requirements themselves and therefore offers planning certainty to Member States and all parties involved, and
- keep the integral administrative costs for the EU and for Member States to a minimum for this complex issue.

The disadvantage of this option is its soft, rather voluntary nature, as Member States would not be forced to fix their energy performance requirements at the cost-optimal level, but just to benchmark them. So the success of this option cannot be guaranteed. However, it is believed that it would create significant peer-pressure from the front runner countries, as well as from the construction industry and other stakeholders, and would ultimately move all Member States towards cost-optimal energy efficiency requirements.

This is a "soft law" instrument and would not impose any requirement for the Member States to correct their levels and this will be in line with the proportionality and subsidiarity principles.

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89 Provided by consultant, based on PRIMES model calculation.

90 Provided by consultant, based on EURIMA estimates, corrected for current variables.

5.6.3. Option D3: Develop an evolving improvement scheme for the buildings stock focussing on the worst performing buildings (a kind of top-runner approach)

Current situation: Buildings' life cycle ranges from several years to several centuries. The energy performance standard significantly varies by the age of the building. This is caused by the evolution of construction methods and the coming into force of building regulations:

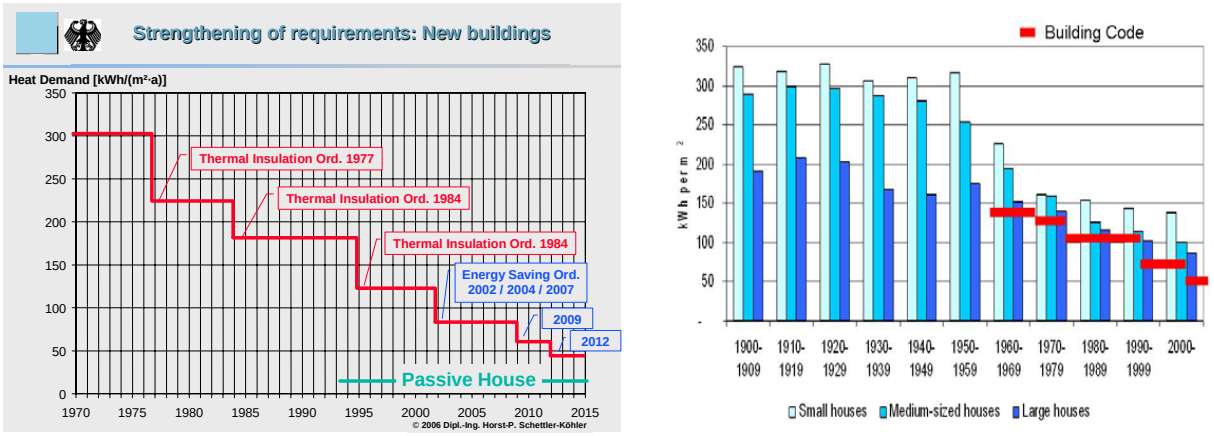

Figure 3. Development of strengthened building codes, German (left) and Danish (right) example

Furthermore, the energy performance differs by building type and the location, due to traditionally different methods of construction in individual Member States.

Proposal: Requirement for Member States to monitor the buildings stock and lay down Action Plans how to increase the refurbishment rate and the energy performance of the worst performing buildings

A countrywise monitoring of the building stock looking at the distribution of energy performance levels is proposed to help identify the worst performing buildings. Initiatives and measures to improve the energy efficiency could then be focussed on specific buildings, i.e. those with a performance below a specified threshold (see Figure 4).

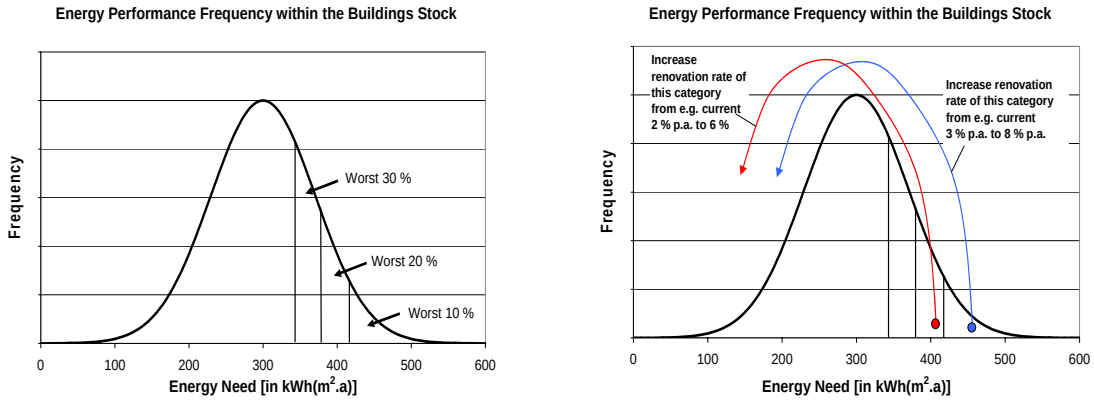

Figure 4. Illustration of the revolving stock concept

Sufficient statistical data on the national building stocks is a precondition for this approach, which aims at shifting poorly performing buildings towards better performance. According to analysis of the European ODYSSEE project[91], the level of available statistics on the building stock today varies widely within the EU. The distribution frequency of energy performance levels for building types is not known in numerous Member States[92]. This situation hampers a systematic regulatory action to focus on worst performing buildings. Member States could be asked to improve the situation by developing detailed statistics on their buildings stock. Based on experience with most advanced countries, this is likely to take several years. On the other hand, Member States are asked to create detailed sectorial energy statistics for other purposes anyway, such as for the National Energy Efficiency Action Plans, which are required by the Energy End Use and Services Directive (2006/32/EC). This could help Member State to focus their financial support initiatives especially on the worst performing buildings where the ratio of saved energy or saved ton CO_2 per € spent is best and therefore could create highest economic, social and environmental benefits.

Impact: This 'evolving buildings stock' approach is a qualitative one which focuses on worst performing buildings. Measures tend to be of high cost-effectiveness in particular for these buildings. Nonetheless, a quantification of such an approach in terms of energy and emission savings, job creation and social and administrative impacts is very difficult as its detailed implementation and scope still need to be further specified and no EU-wide harmonized statistical data is available. Tentative estimations could be given only. Administrative costs can be estimated to be high as the statistical monitoring of the complex and fragmented buildings stock would have to be done in many Member States first.

Such a requirement would have substantial budgetary implication for Member States if they have to provide funding for the poor performing buildings (which would especially be needed if they are occupied by low income people). Therefore, such an intervention would not fully respect the subsidiarity principle.

5.6.4. ***Option D4:*** Setting up EU–wide low or zero energy/carbon buildings/passive house requirements.

Current situation: The buildings that are designed in a way that significantly decreases their energy needs, but providing adequate level of comfort are known under different names; low energy house, zero energy house, high-performance house, passive house[93], etc.

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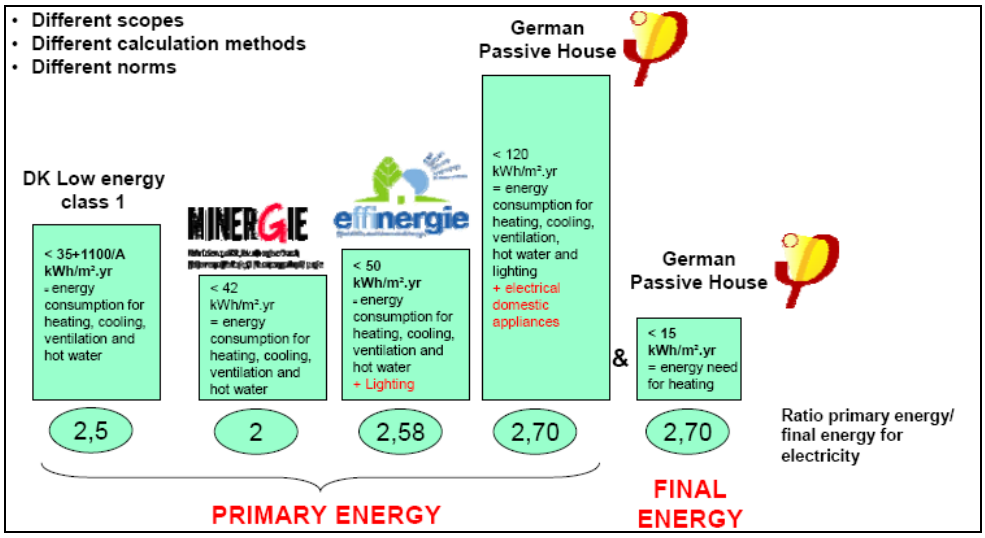
91 ODYSSEE - Energy Efficiency Indicators in Europe: Project under the Intelligent Energy Europe Programme of the Commission, started in 1993, still ongoing (http://www.odyssee-indicators.org/)

92 11 Member States of EU-25 do not dispose of sufficient energy efficiency indicators and data for the household and services sectors according to a presentation of Didier Bosseboeuf, ADEME (ODYSSEE project partner) at workshop 'New energy indicators for buildings and appliances: the way forward' of the International Energy Agency, Paris, 25-26 October 2007.

93 The passive house concept was developed in Germany and refers to buildings that assure a comfortable indoor climate in winter without the need for a conventional heating system (with annual demand for space heating of 15 kWh/(m²a)) which means that they roughly use 85% less energy to heat that a house built to existing German building regulations. The extra costs of construction are repaid over a reasonable time period through the reduced heating bills in a typical Northern European climate. The application of this definition has some limitations for Southern climates where the air-conditioning demand is high and cannot be applied. (http://www.passive-on.org/en/details.php) For convenience in the document hereinafter the term low energy buildings is used.

The definitions and calculations methodologies differ a lot between EU Member States (i.e. seven Member States have official definitions and further seven are currently developing them).

Figure 5. illustrates well the different approaches used in Denmark (DK low energy class 1), Switzerland (Minergie), France (effinergie) and Germany (passive house)[94].



Several Member States[95] have made ambitious policy statements and have set up long-term targets for achieving the low energy standards for new houses. For example, in the Netherlands there is a voluntary agreement with industry to reduce energy consumption compared to the present building codes by 25% in 2011 and 50% in 2015 (which is close to passive house) and to have energy neutral buildings in 2020. In the UK the ambition is to have zero carbon homes by 2016. In France by 2012 all new buildings should comply with "low-consumption" standard, and by 2020 be energy positive, i.e. produce energy. However, the concrete details for the realization of some of these plans are still under development.

The European Parliament[96], stakeholder organizations and some respondents to the public consultation have called for the introduction of very low energy requirements (passive house standard) for new buildings in the revised EPBD.

However, so far the uptake of these houses has been limited, i.e. in the whole EU there are only 12-13,000 passive houses of which approximately 9-10,000 are located in Germany and 2,000 in Austria[97].

Proposal: A requirement can be introduced in the revised EPBD that all newly constructed buildings must meet the low energy building requirements from a certain date.

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94 Effinergie presentation, March 2007. Adapted from EUROACE SBI Survey, March 2008: European national strategies to move towards very low energy buildings

95 Engelund Thomsen, SBi and Wittchen, SBi, for EuroACE European national strategies to move towards very low energy buildings, 2008

96 P6_TA(2008)0033

97 Mission report VB EACI

Alternatively, Member States can be encouraged to set a definition and strategy for achieving the low energy building standard where the final and intermediary target years are clearly mentioned.

Impact: The benefits to the decrease of energy consumption, CO_2 emission reductions can be considerably high, roughly estimated at 15 Mtoe energy savings and 41 Mt CO_2 savings per year by 2020 (if a full uptake is considered to start in 2012 for all new buildings). However, the investment needs for such change are also substantial. In general, studies suggest that the price increase of houses would be in the range of 7 to 15%[98].

In addition, to achieve a full market transformation, so that each year about 210 million m^2 of new residential and commercial buildings in the EU-27 meet this standard would be a huge challenge and would require a substantial change in the construction and buildings market. The full accumulation of necessary knowledge, training of relevant experts, such as architects, constructors, auditors, and availability of construction products and technologies will take about 10 to 15 years.

Investment costs for passive housing are also substantial. To construct all new build up to passive house requirements every year in the EU would cost between €50 billion to €120 billion a year[99] on top of regular construction costs for new buildings. This would lead to very high employment creation with the potential of creating from 240,000 to 580,000 jobs for the passive housing construction sector (i.e. architects, consultants, specialized construction firms and workers). It is important to note that these numbers are purely indicative as the realization of 210 million m^2 of passive housing a year is currently not feasible. Thus job creation must be understood to be proportional to the extent to which passive housing expansion occurs.

Therefore, although the environmental and security of supply benefits of having all new buildings consuming minimal quantities of energy are self evident, it may not be practical to introduce low energy buildings requirements in a short-term in all member States. This is due to the low penetration rates in Europe, higher costs, lack of trained professionals and low readiness of the construction industry to deliver large quantities of low energy buildings in all EU Member States. Furthermore, such requirements would also not respect the subsidiarity and proportionality principle as they would require investments that are not in all cases cost-efficient and would create a burden for the national budgets since they would have to support households that would not be able to afford to build such low energy homes, which are more expensive than cost-optimal ones.

If Member States are encouraged to set a vision for achieving the low energy building standard, this will send a strong signal to the construction industry that a market transformation is sought. In response they shall plan and act accordingly but would also allow for the national differences to be taken into account by each Member State. In addition, the public sector can play exemplary role in promoting low energy buildings concepts. This can possibly be achieved by including more rigorous provisions for the sector in these strategies,

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98 For example, http://www.communities.gov.uk/documents/planningandbuilding/pdf/153125.pdfAudenart (energy policy), http://www.passive-on.org/en/details.php

99 Calculation assumptions: 100 kWh/m² lower total final energy need of these type of buildings than the ones required in a business as usual. Average prices of newly constructed square meter taken are based on ADEME figures (http://www2.ademe.fr/servlet/KBaseShow?sort=-1&cid=96&m=3&catid=15019), and calculated extra costs (7% -15%) associated with passive housing and the benchmarking goals of 210 million m^2 per year.

i.e. by introducing earlier dates at which new public buildings will meet the low energy requirements. This suggestion is in line with the thinking of some of the major stakeholders and responses from the public consultation.

6. COMPARING THE OPTIONS

Energy efficiency in the buildings sector is an effective means to fight climate change and to achieve EU energy policy objectives. Even though many measures have been taken, a very important savings potential still remains to be harnessed. In looking for ways to achieve additional savings, three alternative policy approaches have been studied. The first one was to repeal the existing legal framework, in particular the EPBD, and use only 'soft' instruments. The second approach was to 'do nothing more' than the existing measures, but to strengthen their uptake. Thirdly, the possibility of adding EU action by complemented and improved instruments of the current EPBD was discussed (Section 4).

The impact analyses showed that completion of the regulatory framework including, notably the Energy Performance of Buildings Directive EPBD, the main EU legal tool, is the appropriate action to address the existing problems. In order to improve the effectiveness of the Directive, the first step taken was to obtain certain clarifications and analyse possible simplifications. In addition, a set of possibilities for the improvement of each of the main pillars of the EPBD were discussed in Section 5.

For each option an evaluation of its economic, social and environment implications was made, based on the availability of data and the inputs provided by Member States and a number of stakeholders. As energy efficiency is a key driver, the impacts on energy savings have been quantified for most of the options. However, this has not always been the case of the investment needs or administrative costs and job creation. Wherever possible, quantitative data has been provided. However, due to limitations of data availability in some cases qualitative indications of the impact have been made.

The impacts of each option are presented in the tables in relation to the baseline (i.e. based on following the construction, demolition and renovation rates, and energy-efficiency measures in retrofits). However, if there was no possibility for quantification their relative impact compared to the other options was included. The summing up of the individual impacts has been done on the basis of the BEAM model and studies. The BEAM model is a holistic, closed calculation instrument that reproduces the building stock by reference buildings. In this context and with regard to quantified energy and CO_2 saving impacts, overlapping effects of the individual options analysed were taken into consideration and overlaps in the results were eliminated. The individual options analysed were not calculated independently by the model but within connected loop model runs. Additionally, where modelling of the impacts was not possible by the BEAM model, the results of the studies available were used and extrapolated to EU-27.

For some of the following tables, not all options were fully quantifiable and therefore contain symbols which mean:

+++: very high energy/CO_2 saving potential, very low capital costs or very high job potential, comparable to the highest figures which were quantified for other options.

++: high energy/CO_2 saving potential, low capital costs or high job potential, at about 25 – 50% lower than the highest figures which were quantified for other options.

+: energy/CO_2 saving potential, moderate capital costs or job potential, about 75% lower than the highest figures which were quantified for other options.

A: 1000 m^2 threshold for existing buildings when they undergo major renovation

(regarding minimum energy performance requirements)

Three options were studied under this pillar:

Option A1: Lowering the threshold to 500 m², to include all medium sized buildings.

Option A2: Lowering the threshold to 200 m², to include all buildings apart from small ones (mainly single family houses).

Option A3: Abolishing the 1000 m² threshold to include all buildings.

The table below includes a summary of their EU-27 impacts compared to the business as usual scenario (full implementation of existing EPBD).

	Option A1	Option A2	**Option A3**
Final energy savings in 2020 (Mtoe/a)	3	5	**20**
CO_2 emission reductions in 2020 (Mt/a)	8	14	**51**
Capital costs in 2020 (billion €/a)	1 / 3	2 / 7	**8 / 25**
Job creation in 2020	10,000	21,000	**75,000**
Comment	CO_2 abatement costs of about -250 €/ton. Low administrative costs as the threshold (regardless whether A1, A2 or A3) can easily be embedded in existing national legislation. Executive bodies have to deal with a slightly higher number of cases (e.g. refurbishment permits).	CO_2 abatement costs of about -357 €/ton. See remark on A1. Executive bodies have to deal with a higher number of cases (e.g. refurbishment permits).	**CO_2 abatement costs of about -333 €/ton. See remark on A1. Executive bodies have to deal with a considerably higher number of cases (e.g. refurbishment permits).**

The analysis indicates that option A3 could most significantly contribute to the realization of the EU policy objectives in question, followed by A2.

B: Energy performance certificates

Four options were studied under this pillar:

Option B1: Quality and compliance requirements for certificates

Option B2: Requiring the recommended cost-effective measures of the certificate are realized within a certain time period

Option B3: Making certificates a mandatory part of property advertisement and/or property transaction documents

Option B4: Requiring a linking of certificates with other support/discouragement mechanisms

The table below includes a summary of their EU-27 impacts compared to the business as usual scenario (full implementation of existing EPBD).

	Option B1	Option B2[100]	**Option B3**	Option B4
Final energy savings in 2020 (Mtoe/a)	**21**	12	**+++**[101]	++[102]
CO_2 emission reductions in 2020 (Mt/a)	**57**	33	**+++**[101]	++[102]
Capital costs in 2020 (billion €/a)	**8 (but about 26 saved energy costs)**	About 5.3 (but about 9.3 saved energy costs)[103]	**Very low**[104]	Depends very much on type and scope of measures[105]
Job creation in 2020	**60,000 (by 2020)**	About 100,000 (by 2020; see footnote on capital costs)	**+++**[106]	++[102]
Comment	**CO_2 abatement costs of about -315 €/ton. Highly beneficial proportion of administrative costs (10 – 32M€) and saved energy costs. High and reliable quality is a key element for the functioning of the certification instrument.**	Compliance control could lead to considerable administrative costs. This requirement could lead to challenges for those who cannot afford the one-off investment, although the economic benefits would outbalance in the long run.	**Similar low administrative costs and similar positive effect to end consumers as the broadly known requirement to display the fuel consumption and CO_2 emissions in advertisements and transaction articles for cars.**	Low administrative costs (Member States only need to link the EPBD to support measures). Impact depends on applied support measures, e.g. the scope of financing instruments. Specification of measures is outside the scope of this Directive.

100 Impact quantified for the tertiary buildings sector only, so figures do not contain potential of residential sector.

101 Expected to be very high due to creating more awareness and a demand driven market for energy efficient buildings throughout the society by giving transparent information on the energy performance of a building.

102 Expected to be high, based on experience of Member States which use already similar instruments.

103 Proposed option stimulates refurbishments. Capital costs and job creation (not specified in Section 5) can therefore approximately be quantified by same factor of costs and jobs per energy savings as in option A1 to A3 and are extrapolated in this way.

104 For citizens and administration, as information needed for this action can be taken out of existing certificates.

105 Experienced Member States such as Germany e.g. show that the amount of given subsidies is outbalanced by stimulated investments and additional tax incomes related.

106 Expected to be very high due to indirect stimulation of constructions/refurbishments of higher quality in order to improve the energy rating of a building in the certificate.

The analysis indicates that options B1 and B3 could significantly contribute to the realization of the EU policy objectives in question. Option B4 could also be further developed outside the scope of the EPBD.

C: Inspection of boilers and air-conditioning systems

Two options were studied under this pillar:

Option C1: Requiring an 'inspection report' for heating and air-conditioning systems

Option C2: Quality and compliance requirements for inspections

The table below includes a summary of their EU-27 impacts compared to the business as usual scenario (full implementation of existing EPBD).

	Option C1	**Option C2**
Final energy savings in 2020 (Mtoe/a)	**5**	**++ - +++**[107] **(estimated to be even higher than option C1)**
CO_2 emission reductions in 2020 (Mt/a)	**15 - 20**	**++ - +++**[107] **(estimated to be even higher than option C1)**
Capital costs in 2020 (billion €/a)	**Net benefits (investment minus energy savings) estimated at €2 billion per year. Admin. costs expected to be low, as information needed should mainly be available from existing obligations (certificates and inspections).**	**Expected to be of the same magnitude as the similar option B1 on certificates.**
Job creation in 2020	**46,000**	**23,000**
Comment	**CO_2 abatement costs of about -133 €/ton. Administrative costs can be kept low when Member States embed the inspection report regime into the existing regime for energy performance certificates for buildings.**	**CO_2 abatement costs estimated to be of the same magnitude as option C1. Highly beneficial proportion of administrative costs and savings.** **High and reliable quality is a key element for the functioning of the inspection instrument.**

The analysis indicates that options C1 and C2 together (option C2 requires option C1) could significantly contribute to the realization of the EU policy objectives in question without leading to negative social or administrative implications.

[107] Contributes to realize the high total technical savings potential for heating and air-conditioning systems of about 70 Mtoe energy and more than 250 Mt CO_2 per year.

D: Energy performance requirements

Option D1: Specifying EU – wide energy performance requirements

Option D2: Introducing a benchmarking mechanism

Option D3: Requiring an evolving improvement scheme for the buildings stock focussing on the worst performing buildings (a kind of top-runner approach)

Option D4: Setting up EU–wide low or zero energy/carbon buildings/passive house requirements.

The table below includes a summary of their EU-27 impacts compared to the business as usual scenario (full implementation of existing EPBD).

	Option D1	**Option D2**	Option D3	Option D4
Final energy savings in 2020 (Mtoe/a)	9.5	**5 (up to 9.5 in 2030)**	+[108]	Up to 15 (cutting the energy needs of newly constructed buildings to 0 – 20 % of today's average energy requirements)
CO_2 emission reductions in 2020 (Mt/a)	24	**13 (up to 24 in 2030)**	+[108]	Up to 41 (cutting the CO_2 emissions of newly constructed buildings to 0 – 20 % of today's requirements)
Capital costs in 2020 (billion €/a)	6 / 12	**3 / 6 (up to 6 / 12 in 2030)**	Highly beneficial LLCC capital costs to savings ratio	50 - 120
Job creation in 2020	82,000	**up to 82,000**	+[109]	+++
Comment	CO_2 abatement costs of about -250 €/ton. Very high administrative costs expected due to dramatic changes to complex national building regulations. Complex, long-lasting task; strong concerns of Member States expected with regard to subsidiarity.	**CO_2 abatement costs of about -250 €/ton. Very low administrative costs as the instrument is a guide/ support tool for public authorities. Presupposed that the 'guiding' bench-marking actually leads Member States to strengthen their requirements to cost-optimal (LLCC) levels.**	High administrative costs. Soft instrument, leaving lot of freedom to Member States. Should be embedded in activities on National Energy Efficiency Action Plans, requested by Directive 2006/32/EC.	Low administrative costs expected (can be embedded in existing national building regulations).

The analysis indicates that option D2 could significantly and quickly contribute to the realization of the EU policy objectives in question. Option D3 could be taken on board by Member States when starting national activities, in particular related to the National Energy

[108] Contributes to realize the high cost-effective savings potential of the sector of about 143 Mtoe/a (final) or 382 Mt/a CO_2.

[109] Can contribute to the potential number of 82,000 new jobs presented under D1 and D2.

Efficiency Action Plans. Option D4 could be considered, due to economic and legal constraints, in a less prescribed form, i.e. by national visions/roadmaps.

The Impact Assessment identified the recast of the Energy Performance of Buildings Directive as the most appropriate way to enhance energy efficiency in buildings in a cost-effective way and to achieve the EU energy and climate change policy objectives, as outlined in sections 4.3 and 5. The recast could introduce clarifications and simplifications to facilitate the implementation of the Directive and furthermore (i) abolish the 1000 m^2 threshold for existing buildings when they undergo major renovation (option A3) (ii) require quality and compliance control schemes for energy performance certificates (option B1) and make certificates a mandatory part of property advertisement and/or property transaction documents (option B3); (iii) for the inspections of heating and air-conditioning systems, to require an inspection report being handed over to building owners (option C1) and requiring quality and compliance control schemes (option C2); and (iv) to introduce a benchmarking mechanism for energy performance requirements (option D2). In line with the holistic approach of the Directive, these proposed completions should be accompanied by other policy tools on financing (e.g. as presented under option B4), by public buildings acting as a leading example (see Section 5.2.2) and roadmaps on low/zero energy/carbon buildings (presented under option D4).

The results for the most cost-effective and beneficial options (indicated in bold in the tables above) with quantifications available **show significant positive impacts which are possible if the Directive is revised, that would make use of a large part of the remaining potential in the buildings sector and would also contribute to the realization of the full potential of the current EPBD.** Furthermore, such a revision would create a simplified and improved framework for energy savings. The minimum total impact of the options identified as being most beneficial and for which quantification was possible, is:

– 60 – 80 Mtoe/year energy savings in 2020, i.e. reduction of 5-6% of the EU final energy in 2020;

– 160 to 210 Mt/year CO_2 savings in 2020, i.e. 4-5% from EU total CO_2 emissions in 2020;

The impact on the labour market would also be important. It is expected that 280,000 (to 450,000) potential new jobs will be created by 2020 by the revised EPBD. This would mainly be in the construction sector and for the services of energy certifiers and auditors and inspectors of heating and air-conditioning systems.

The investment requirements and the administrative costs of the measures were analysed and are relatively low compared to the benefits and the returns. For example, abolishing the 1000 m^2 threshold would lead to €8 billion/year additional capital investments but would trigger €25 billion/year energy cost savings by 2020, which in return means considerably negative CO_2 abatement costs. These calculations have been made on the basis of conservative estimates about the oil price (e.g. 55$ per barrel oil in 2005, 100$ in 2020 and 119 $ in 2030 in year 2005 prices).

The investment needs differ substantially across Europe depending on the social and economic conditions, on the initial state of the property and on the type of renovations people undertake. They are not equally distributed to EU citizens, i.e. there will be additional costs for those who make major renovation of their buildings or are engaged in property transaction. However, with increasing oil prices these initial investments will have attractive returns.

The overall benefits for society in terms of reduced energy consumption and hence reduced CO_2 emissions and energy import dependency, job creation, especially at local and regional level, positive health and labour productivity exceed the costs of the measures proposed.

Finally, it needs to be underlined that the implementation of the current legislation remains a priority. Any legal framework also needs the support from other non-regulatory policy measures. Financing, fiscal, information and communication tools are indispensable.

7. MONITORING AND EVALUATION

The Directorate-General for Energy and Transport will continue its assessment on the legal transposition of the EPBD. However, there is a general lack of comprehensive data on the EU buildings and their energy use, which is a serious limitation when it comes to monitoring the implementation of the EPBD and evaluating the progress made in terms of energy savings. Such data should be provided in the framework of the existing Community structures, i.e. Eurostat. These, for example, can include data on energy savings and CO_2 emissions, the number of certificates, energy related renovation, number of trained experts.

A link with the reporting requirements of the Energy Services Directive (ESD) shall be better established. For this purpose, it will be necessary to further explore how and what information on energy efficiency in the buildings sector could be provided in the next National Energy Efficiency Action Plans. Some specific data, for example on uptake of cost-efficient recommendations of certificate and inspection reports and of low energy houses, can be carried out within projects supported within the EU Intelligent Energy Europe programme.