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# Evaluation of the impact of national EPBD implementation in MS

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## 1 > Introduction

The Energy Performance of Buildings Directive (EPBD) only imposes Member States to set energy performance requirements, without any specification about their severity. As such, MS can fulfil the provisions of articles 4 to 6 of the EPBD without increasing the pre-existing levels of the energy performance requirements. This of course would mean failure to achieve the main objective of the Directive, which is to ensure, through its implementation, an important additional reduction of the energy use of buildings.

This paper aims to obtain a good overview how the EPBD implementation has changed (or is changing) the national requirements in terms of energy efficiency and indoor climate and to describe what has been the impact (if any) of the EPBD implementation on the severity of those requirements. It aims to summarise and compare if there has been a widening of the existing types of requirements in the different MS (e.g. more severe requirements, widening of the range of buildings covered by the regulations, more requirements, requirements for renovations…) and tries to conclude whether the implementation of the EPBD already has succeeded to reduce the energy use of the building stock in Europe.

The paper is part of a study carried out among 12 countries (Belgium, Czech Republic, Denmark, Finland, France, Germany, Italy, The Netherlands, Norway, Poland, Spain and Greece) in the framework of the project ASIEPI, funded by the Community's Intelligent Energy Europe programme.

## 2 > Impact of the EPBD implementation on the national requirements

### Energy performance requirements and energy certification in the MS before the EPBD

The majority of the questioned MS had some type of energy specifications incorporated into their national building or other regulations before the introduction of the EPBD.

Almost all of the investigated countries had indirect specifications or regulations referring only to the restriction of heat losses (U-values, minimum levels of insulation) and minimum ventilation rates. For these countries the implementation of the EPBD meant a complete revision of their national legislation and the imposition of new relative regulations, which set for the first time minimum energy performance requirements and adopt energy assessment and certification of buildings.

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A number of countries however already had both EP requirements, as well as a well-structured certification scheme in place (mandatory or voluntary), long before the introduction of the new Directive. Those were Denmark, France, Germany, The Netherlands and the Czech Republic. For those countries, the implementation of the EPBD provided an opportunity to reconsider their national regulations, expand their coverage and application and tighten the requirements. As an example, in The Netherlands, there was already a mandatory certification system in place for new buildings since 1995, but only a voluntary system for existing buildings. With the implementation of the EPBD, certification became obligatory for existing buildings as well.

**Impact of the implementation of the EPBD on the national methodology, the national requirements and schemes**

In general, the implementation of the EPBD forced MS to update their national regulations in order to apply a methodology for the calculation of the energy performance of buildings, to meet (more strict) energy performance requirements and to introduce energy certification. Even countries which already had EP requirements and a clear and strict certification scheme in place, they were forced to update their method to be in line with the EPBD and the CEN standards.

The new Czech calculation procedure is based on published CEN standards. Norway improved the national EP calculation standard (NS 3031) to be in line with ISO 13790 and Germany developed a new national calculation method for non-residential buildings that is fully CEN compatible.

In most cases the existing EP requirements became stricter (e.g. lower limits for energy consumption) than before the EPBD. Denmark and France now further tightened the existing energy performance requirements in their building regulations. However, there are a few exceptions to this rule, countries, whose requirements were not affected by the implementation of the EPBD (e.g. Germany, at least for residential buildings and the Czech Republic), while in one case (Poland), specific requirements for heating paradoxically became looser after implementation of the EPBD. All in all, the average tightening of requirements through the EPBD over Europe varies from 15% in the less positive scenarios, up to 30% in the most positive ones (e.g. Finland).

In many cases, the pre-existing, direct or indirect, requirements were extended to include additional parameters; e.g. in Denmark, the new calculation method now includes thermal bridges, solar gains, natural ventilation, heat recovery, air conditioning, lighting (for large buildings), boiler and heat pump efficiency; in Belgium, requirements were complemented to include space heating and DHW consumptions, auxiliary energy consumption, cooling consumption, but also energy production through PV cells or a cogeneration installation; and in Norway, the new EP calculation standard now includes cooling, DHW, lighting, fans & pumps, but uses some fixed input parameters including internal heat gains (equipment, people), DHW, operating hours, set-point temperatures for heating & cooling and default lighting energy.

An important addition to the existing requirements Europe-wide is shown to be the introduction of summer requirements, often for the first time, even in Northern climates such as Finland and Norway.

Quite a number of countries (like Greece, Italy, Poland, Belgium, Finland, Norway and Spain) first introduced energy certification, as a result of the EPBD. So was as well the Renewable Energy Sources feasibility study, applicable mostly for buildings >1,000 $m^2$, in the Czech Republic, Greece but also in France.

In many cases the existing methodology found a broader application. The pre-existing method has been extended, or is currently being extended, for example to include additional building types. The German certification methodology set in 2002 changed to apply as well in case of sale or renting of existing buildings. In other examples this extention of application goes beyond the strict scope of the current EPBD. This is the case for example in France, where the existing method already became applicable for existing buildings as well. In The Netherlands, two different existing methodologies are now being combined into a single new one that will cover both existing, as well as new buildings.

**Specifications stricter than imposed by the EPBD?**

Most MS just meet the specifications set in the EPBD. However, some interesting approaches go beyond the necessary EPBD specifications and set additional rules to ensure high energy performance.

In Denmark for example, all cost-effective energy saving measures are obligatory in the case of major renovation. Furthermore it is required that some individual, profitable measures (like insulation of external walls when changing the weather shield, insulation of attic and roof when changing the roof, a replacement of the boiler or heat supply) have to fulfil the requirements, regardless of the size of the renovation. Public authorities are obliged to implement energy-saving measures with a pay-back time of less than five years as described in the energy certificate of the buildings; this is a stricter rule than the one implied by the EPBD. And finally for Denmark, the lifetime of the certificate is 5 instead of 10 years.

In France, compliance with the requirements and certification is also valid for renovation of small buildings (< 1000 $m^2$), which is not required by the EPBD. Additionally, feasibility studies on RES are required as well for buildings over 1.000 $m^2$ in case of important energy renovation, when EPDB only requires these studies for new buildings.

Germany also has no 1,000 $m^2$ threshold for buildings that undergo a major renovation. Furthermore, Germany has stipulated a minimum use of renewable energy for all new buildings, while in some federal states the use of renewable energy is also required for major renovations of existing buildings.

The threshold of 1,000 $m^2$ is also overcome in Poland, at least in theory. However, since execution of the certificate is required only if, after construction, the building needs to get a permit for operation, this does not include renovation, not even major. Additionally, Polish requirements are less strict than the EPBD as they only apply to new buildings (no rent or sale).

A totally different approach is the one used in Finland and Norway, where the legislation allows the local building supervision authorities to decide whether the building regulations will be applied to the renovation or not. The problem with this approach is that local authorities tend to be lenient, giving dispensation too often.

**Certification scheme**

Many of the questioned countries, among which are Belgium, Finland, Poland, Spain, Italy and Greece, first introduced a certification scheme in their national regulation frame, as a result of the EPBD implementation. Denmark, the Czech Republic, France, Germany and The Netherlands already had a certification scheme in place before the EPBD. With its implementation, changes may have occurred to the existing certification schemes. In Denmark, the certification was originally based on the measured consumption (operational rating) for buildings > 1,5000 $m^2$, but after the implementation of the new Directive, all certificates have to be

calculated (asset rating). In the Netherlands the certification scheme became mandatory, the calculation method slightly changed and an A to F rating was introduced. Germany introduced certification of existing buildings for the first time and in France, the existing method became applicable for existing buildings as well.

In the Czech Republic, and possibly also in other countries where certification is applied only to new and renovated buildings and the average age of the building stock is relatively high, all issued certificates are category C and above, so the classes "D" to "G" remain entirely unused for buildings that are assessed in terms of energy performance as poor and therefore requiring the implementation of saving measures. In the case of Poland, possible errors and misleading methods in practice downgrade the energy certificate to just a piece of paper required by law that does not provide much useful information to the building owner.

**Indoor climate**

Prior to implementation of the EPBD, all Member States (except for Italy) already had incorporated some requirements concerning indoor climate to their national legislation. Those mainly focused on ventilation levels and heating. The implementation of the EPBD, did not totally alter those.

However, with its implementation, many MS first formally introduced in their national regulation aspects related to summer comfort (avoiding the risk of overheating and reducing the cooling loads). This was specifically the case for Belgium, Finland, The Netherlands, Norway and Greece. A few other countries, among which is France, used the EPBD as an opportunity in order to further specify existing requirements related to summer comfort (defining indoor temperatures for unconditioned buildings, changing the ventilation rate and the air tightness level). Germany had a requirement for the prevention of overheating already in place, which is based on a limitation of the solar gain factor.

**The use of Renewable Energy Sources (RES)**

In all Member States, the use of RES has been incorporated into the energy efficiency of buildings and the overall calculation procedure.

A RES feasibility study has been first introduced and is obligatory for new buildings over 1,000m$^2$ in almost all the investigated countries, including the Czech Republic, France and Greece.

Although most countries' policies are to introduce more RES, many Member States have no specific regulation that makes the use of RES obligatory for buildings. Exceptions are Germany, Italy, Spain, Norway, The Walloon region of Belgium and Finland. In Germany, the law imposes a minimum use of renewable energy for all new buildings. The ratio is dependent from the type of renewable energy (e.g. 15% solar thermal, 30% biogas, 50% heat recovery, biomass and biofuel, geothermal and waste heat). One federal state requires as well as that renewable energies are used for existing buildings for which the heating system is exchanged. In Italy, it is required that 50% of domestic hot water (DHW) comes from solar thermal systems. The percentage decreases to 20% in the historical city centres. This rule can be avoided if the impossibility of such an installation is accurately described in a technical report. This latter aspect is crucial as it avoids the installation of solar systems in many cases. Also, the installation of photovoltaic (PV) systems for at least 1 kWp minimum per dwelling is mandatory. In Spain solar DHW is obligatory, as is the use of PV's for non-residential buildings. Norway imposes a requirement that ≥40% of a building's net energy demand shall be supplied by RES (not electricity or fossil fuels). In the Walloon region of Belgium, the installation of solar

thermal systems for domestic hot water or any system that saves an equivalent amount of energy will be mandatory for existing buildings in the case of large renovation and for new buildings. Finally, the current status in the Finnish building stock is that renewable energy sources (in specific wood) are mainly used in the single family houses.

In some countries (France, Poland, Germany and Greece among others) there are individual incentives to promote the use of RES in the building sector. These incentives mainly involve tax incentives or increased tariffs for the energy fed to the grid. In Germany, for example, the PV-production was accelerated by the law, because it was ensured that renewable energy can be fed into the grid at rather high tariffs. The same principle is valid also for Greece where additionally, the installation of photovoltaics in buildings is reinforced by a simplification of the administrative burden.

### Energy auditors

Countries that already had a certification scheme in place prior to EPBD implementation, had as well a group of experts responsible for carrying out the energy audits. The implementation of the EPBD meant in most cases changes to the national requirements, but not to the qualifications of the energy experts. The selection criteria remained mostly the same, including engineers, architects and experts from other relevant fields. A training session has been implemented in some countries for keeping experts up-to-date.

In many cases energy assessors and system inspectors are brought under the same structure and have to fulfil the same requirements and qualifications. However, some countries, including for example France, still do not have a regulation concerning inspectors in place. At the other hand, many already established voluntary regimes now become mandatory, as is for example the case in Norway. It is interesting that in Germany, the existing group of experts for the assessment of new buildings remained unaltered, while the criteria have been enlarged for the new group of experts assigned with the assessment of existing, or non-residential buildings.

On the other hand, countries that did not have a certification scheme before, are now defining their experts groups and qualification criteria, in order to comply with the recommendations of the EPBD.

## 3 > Impact of the EPBD implementation on the energy performance of buildings and the building market

When looking at the building market in the EU, there seems to be a clear shift towards more energy efficient constructions and introduction of better performing products. However, such changes can not be attributed solely to the implementation of the EPBD, as they are much more affected by the regional, seasonal, social and general economic situation. Therefore, the impact of the EPBD on the energy performance of buildings, or the building prices is not yet really quantifiable.

### Energy performance of buildings

Setting aside whether the result is directly, or not, related to the implementation of the EPBD, the general trend shows a clear improvement in the energy efficiency of buildings in the EU.

Specifically, the Danish energy consumption of households is proven to have stayed rather constant over the years, despite their continuously growing floor area. The energy consumption per $m^2$ is considered to be decreasing due to better insulation and boiler efficiencies.

Also Italy shows a positive trend in the energy consumption reduction, even if the intensity is modest. This reduction is owed not so much to the new energy policy, than to the reduction in the heating energy consumption in the past years.

In Norway, the energy consumption per $m^2$ has decreased, as has consumption per dwelling and per capita. This improvement in energy-efficiency is considered to be the result of a combination of factors, including higher energy costs, better focus on energy conservation, better insulation and more efficient equipment. It is too early to say what impact the EPBD has had on the energy consumption of the building stock as a whole. However, the few new buildings that are being constructed under the new EPBD regulations in Norway are more energy-efficient (estimated approx. 25%) than older buildings, built under the previous building regulations.

The German building stock has not clearly become more energy efficient yet, however, energy efficiency has reached a higher level of visibility with certificates also for existing buildings and especially for public buildings. The EPBD implementation did not have an influence on the energy performance of the German building stock if we regard strictly the energy performance requirements.

Polish energy requirements, on the other hand, are less strict than before the implementation of the EPBD, and as a result the performance of the Polish buildings stock it not expected to be positively influenced.

**Market overview**

So far, there is no clear evidence available whether, and in what way, building prices are affected by the implementation of the new Directive. As mentioned earlier, also the changes in the building prices, can not be directly appointed to the implementation of the EPBD, as these may as well be primarily affected by other parameters like season, social and general economic situation.

A recent study of rising construction costs in Finland, did not prove a clear correlation with energy efficiency, but rather with overall social improvements of buildings. Also, in Germany there is no measurable influence of the EPBD implementation on the building market and prices. However, in cases where an increase in building prices due to improved energy efficiency is expected (e.g. France) the average expected price increase (here 2%) has to be compared against the energy savings (that are estimated to reach 15%). In Denmark the price for a new building compared to a building built according to the previous building regulation is calculated to be approx 15-30 euros higher per $m^2$. In the Netherlands, it seems that having a "green" label has a small positive effect on the transaction price and on the period of time that a house remains unsold, compared to having a "red" label.

In general it could be anticipated that the owners of better energy performing buildings will be able to demand higher prices for them, as their performance means lower running costs and conversely, owners of poorly performing buildings will have to lower prices, or invest in improving their performance, in order to make them attractive.

In Poland, as new requirements are less demanding than the old ones and due to overall economy crisis, even the opposite could be expected: that new constructed buildings should be cheaper than before.

The effect of the EPBD on the building market therefore mainly focuses on the development of new building products and innovative techniques. Thus,

the higher prices concern mainly the new-technology products and not the prices of buildings themselves. Products and techniques that already gained market ground through the EPBD implementation are condensing boilers, improved insulation and glazing, heat pumps, mechanical ventilation and heat recovery systems, DC fans, improved lighting systems and renewables (like solar thermal collectors, photovoltaic cells and others). Also, new techniques have been introduced, e.g. heat recovery systems of shower water and demand driven ventilation systems, cool paints, etc.

It is interesting to mention that in a couple of countries like the Netherlands and Germany, with every step of reducing the energy performance requirement level, the procedure is to perform a study on cost-effectiveness. By announcing the reduction of the EP level far in advance, the industry has time to adapt and develop improved and innovative systems. The industry uses the EP regulations as a PR instrument for their improved products.

## 4 > Conclusions

Despite the significant variation in EPBD implementation and experiences, the current analysis shows some clear tendencies related to impact.

There are different fields that have been influenced through EPBD implementation and so the tendencies are analysed in terms of changes in:

- legislation
- requirements
- energy consumption of the building stock
- building market and prices
- public awareness

All countries used the opportunity to change their legislation: either to impose EP requirements and/or certification for the first time, or to re-evaluate their existing ones. It is interesting to note that countries that already had requirements in the past, tend to make them even stricter. A pre-existing methodology often is extended to apply to additional building types, inserting obligations for the use of renewables and going beyond the exact obligations imposed by the EPBD. Conversely, countries that are imposing energy requirements and certification for the first time, tend to be more conventional and uninventive for the time being.

Changes in the building energy consumption can not be easily attributed to the EPBD alone. The actual impact on the energy performance of the building stock is not yet clearly estimated, although there are some countries with success stories showing a positive change in the energy performance of the new building stock due to the EPBD related regulations.

At the same time, the building market is clearly affected by the implementation of the EPBD, especially by means of visibility and introduction of new and improved building products and technologies. There are success stories regarding the market uptake of innovative systems, wherein the EPBD regulations have had a catalysing effect. However, the specific effect of the EPBD on the building prices is again difficult to isolate.

Clearly affected is the public awareness, which shows an increasing tendency towards more efficient constructions and systems but also towards sensible use of energy.

All in all it is expected that the recast of the Directive will further build on the tendencies already set by the EPBD, therefore making it possible to meet the specific objectives.

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Also measures not included in the original EPBD will be seriously considered, such as stricter control of refurbishment, forewarning of staged tightening of energy regulations up to at least 2020, white certificates, etc. Such measures have already been implemented in select countries.

## 5 > References

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