



# MASTERING THE TRANSITION TOWARDS ENERGY EFFICIENCY IN THE BUILDINGS SECTOR: THE EUROPEAN UNION'S ENERGY PERFORMANCE OF BUILDINGS DIRECTIVE

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**ACTION AREA:** Mitigation

**FOCUS AREA:** Delivering

**COUNTRY:** European Union

## SECTORS

**INVOLVED:** Energy, Residential

**TIMEFRAME:** December 2002 - Ongoing

**CASE SUMMARY:** The Energy Performance of Buildings Directive (EPBD) is the European Union's (EU) main legislative instrument promoting the improvement of the energy performance of buildings among the Member States of the EU.

The EPBD sets a framework for energy-efficient building systems, which are adaptable to the national building codes of the Member States. The objective of the Directive is to promote energy savings in buildings by taking into account local climatic conditions in different parts of the EU as well as conditions such as temperature, ventilation, and humidity within buildings. Member States are granted flexibility in the implementation of building standards, taking into account their unique circumstances. In the residential sector, the progressive implementation of the building codes has facilitated an 11% reduction in final energy consumption in buildings between 2005 and 2015.

The EPBD further assists in providing transparent information to building occupants. It has introduced Energy Performance Certificates (EPCs) schemes which inform building tenants and owners about the energy ratings of buildings and cost-effective ways to improve energy performance. The Directive also provides regulatory mechanisms for the energy performance of buildings. Inter alia, all Member States shall ensure that new public buildings are Nearly Zero Energy Buildings (NZEBS) – i.e. highly energy-performant buildings – by the end of 2018, while all new constructions shall be NZEBS by the end of 2020. It has also put in place a comprehensive renovation strategy, requiring Member States to prepare a roadmap to transform their current building stock to a highly efficient stock by 2050. Lastly, the EPBD has included several provisions for the use of smart technology for even more cost-effective energy use in buildings.

The comprehensive stakeholder engagement in the legislative process for the update of the EPBD, which was conducted in an utmost transparent manner, as well as the science-based nature of the process, makes the EU's approach a good practice in how countries may go about in tackling emissions from the building sector.





**BACKGROUND:** Following the energy crisis of the 1970s, European governments were prompted to introduce policies to regulate energy consumption. At the time, operational (indirect) energy use in buildings – i.e. the primary energy demand for heating, cooling, ventilation, hot-water production and lighting (Giordano et al., 2015) – with a focus on indoor environmental quality (the effects that air, lighting, heating, etc. in the building have on the occupants of the building) gathered increasing attention. Subsequently, regulations related to energy efficiency and thermal performance of buildings were adopted in most European countries (Economidou, 2012). One of the specific challenges for the European buildings sector today is that one third of the buildings are over 50 years old and 97% of the EU's building stock is energy inefficient. Therefore there is high potential for energy savings in renovated buildings (Buildings Performance Institute Europe, 2017).

Given the backdrop of international climate talks and the need to reduce carbon emissions, energy efficiency in buildings became subject to EU-wide regulation through the adoption of the Energy Performance of Buildings Directive (EPBD) in 2002. Amongst other things, the Directive introduced Energy Performance Certificates (EPCs) for all newly constructed buildings and frequently visited public buildings (Inforse-Europe, 2014). The EPCs were first introduced in the 2002 version of the EPBD as a mechanism to inform building owners, occupants as well as authorities about the energy ratings of buildings, thereby capacitating them to compare their energy efficiency. The EPCs create transparency in the market and contribute to an incentive creation for enhancing energy performance of buildings.

With advancements in international climate agendas, a more ambitious approach was taken in the recast Directive of 2010. In order to increase energy savings in new and renovated buildings, the Directive strengthened many existing provisions such as the EPCs. Inter alia, it required commercial real estate advertisements to present the energy efficiency of a building based on an existing EPC (European Parliament & European Council, 2010). The recast Directive furthermore introduced new provisions such as the Nearly Zero Energy Buildings scheme (NZEBs), which requires buildings to use very low amounts of energy that should furthermore come from renewable sources (European Parliament & European Council, 2010).

In 2011, the leaders of the EU adopted a roadmap that directs Europe to become a competitive low-carbon economy by 2050 by abating 80-95% carbon emissions from 1990 levels by 2050 (European Commission, 2012). In this regard, residential and office buildings are expected to abate approximately 90% of indirect and direct building emissions by using sustainable design and technology in new buildings, refurbishing old buildings, and substituting fossil fuels with renewables for heating and cooking.

The EPBD was amended in 2018 to reap further energy savings potential in the building sector by accelerating cost-effective renovation of the existing building stock and encouraging the use of smart technologies. A pathway was also defined in a special guide for all Member States to facilitate an increase in the number of Nearly Zero Energy Buildings, such that all new buildings are NZEBs by 2020 (European Commission, 2016 a). Implementation of the latest revision of the EPBD is now underway.

Today, buildings are responsible for approximately 40% of the EU's final energy consumption (European Commission, 2016 a) and 36% of CO<sub>2</sub> emissions (see Figure 1), making this sector fundamental in achieving the EU's emission reduction targets (European Parliament, 2018). Globally, the energy use in buildings rose 20 % between 2000 and 2017, and buildings and appliances were responsible for around 30 % of final energy use in 2017. This global growth in energy use in buildings has been largely driven by structural factors (i.e. increases in floor area, access to services and occupancy) as well as increasing activity (i.e. changes in population, climate and the use of appliances) (International Energy Agency, 2018).

### ENERGY EFFICIENCY – EU BUILDINGS SECTOR

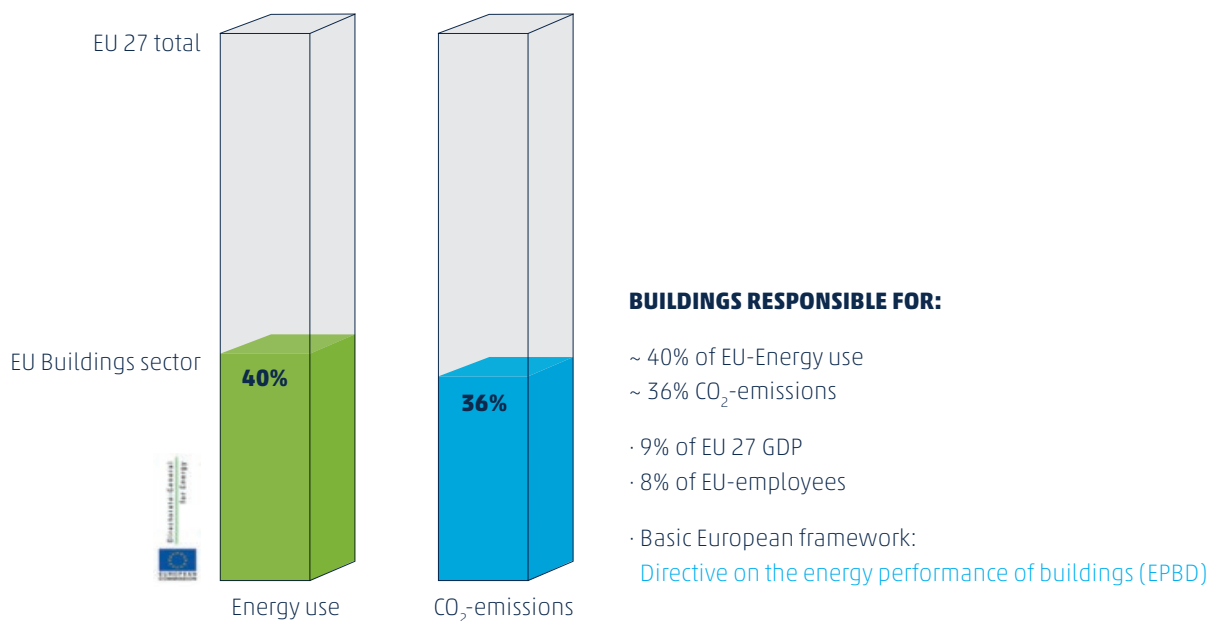


Figure 1: EU - Energy policies for building (Directorate-General for Energy, 2012)

**ACTIVITIES:** ————— The EPBD relies on a set of different mechanisms that have been introduced over time in order to improve the energy efficiency in buildings, entailing a flexible framework for Member States, guidelines for high energy performance buildings, the issuing of Energy Performance Certificates, a renovation strategy as well as smart technology.

• **FIXED FRAMEWORK WITH FLEXIBLE METHODOLOGY FOR STAKEHOLDERS:** The Directive, accounting for the diversity in climate, building tradition, culture, policy and legal frameworks in different nations, does not impose uniform standards for Energy Performance of Buildings (EPB) on Member States. The latest EPBD specifies the unit that must be used to measure energy performance and mandates the Member States to define their national energy performance assessment procedures in accordance with the International Organisation for Standardisation (ISO) procedures. This gives a consistent structure for all stakeholders. At the same time, Member States enjoy a large degree of flexibility in selecting input data and methodology for the calculation of energy cost, primary energy factors and estimated economic lifecycle. This enables the practical application of energy efficiency measures at national and regional levels (Boermans et al., 2011).

• **GUIDELINES FOR NEARLY ZERO ENERGY BUILDINGS (NZEBs):** The EPBD defines a NZEB as a building that has very high energy performance, meaning nearly no or very low amounts of energy should be required to maintain it. This energy should come to a very large extent from renewable sources, including from on-site or nearby production (European Parliament & European Council, 2010). What constitutes for 'high performance' of the building and contribution of renewable sources to a 'large extent' is left up to the Member States (European Commission, 2016 a). 'Nearly' in this context can be understood as cost-effective and therefore depends on the costs of a non-renewable energy unit and the cost of measures to reduce the energy use of buildings (Hogeling & Derjanecz, 2018). Accordingly, Member States can use an appropriate combination of energy efficiency measures such as insulation, smart technology and renewable energy sources to reach the required NZEB level (European Commission, 2016a).



All Member States should ensure that new buildings occupied and owned by public authorities are NZEBs by the end of 2018, while all new constructions should be NZEBs from 2020 onwards (Atanasiu, 2013). The EPBD set indicative national milestones for Member States to incorporate action plans that achieve energy-efficient building stock and deliver the necessary progress towards transformation to Nearly Zero Energy Buildings as defined in the Directive (European Commission, 2016). The Directive takes into account convenience of occupants and building owners alike through provisions such as the 'Building Automation and Control System' that facilitates interaction with smart technology in the building and EPCs that act as source of information on building performance. A structure that caters to the needs of different societal groups affected by the Directive gives way to practical application of the standards by the local governments.

• **ENERGY PERFORMANCE CERTIFICATES (EPCS):** The EPBD gives building owners and tenants the right to information on the purpose and objectives of the Energy Performance Certificates set by the national government. Any new owner must receive an EPC upon construction, sale or rent (European Commission, 2018). This makes EPCs a credible and transparent source of information on cost-effective ways to improve energy performance of the building. By disseminating necessary information on energy efficiency, the EPCs influence the market in incentivising building owners to account for energy performance levels and renovate their buildings in order to have high energy performance buildings in place (CA EPBD, 2016). How the performance rating is presented and what type of recommendation is given to building owners is, once again, for the Member States to decide within their national context (European Commission, 2018 a).

In order to increase awareness on the EPCs, the recast EPBD 2010 mandates the public and private authorities occupying frequently visited buildings to showcase their EPCs, if the building covers a 'total useful area' of more than 250 meter square (EuroACE, 2013).

• **RENOVATION STRATEGY:** The provision on Long Term Renovation Strategies (LTRS) was moved from the Energy Efficiency Directive (which provides binding measures for the European Union to reach its energy efficiency targets by 2020 (European Commission, 2012)) to the EPBD. It requires the Member States to prepare a roadmap to transform their current building stock to a highly efficient stock by 2050, supported by measurable progress indicators at successive stages of implementation. The LTRS must target all public buildings, especially the worst performing buildings of the national building stock (The European Alliance of Companies for Energy Efficiency in Buildings, 2018). The reports must include approaches, policies and actions for cost-effective deep renovations of buildings along with an overview of national strategies to promote smart technologies in buildings (European Parliament & European Council, 2018).

• **SMART TECHNOLOGY:**

One of the key amendments to the recast EPBD 2018 focusses on smart technology for cost-effective efficiency and energy in buildings (Verbeke et al., 2018).

• The provision on 'Technical Building Systems' (TBS) – i.e. the technical equipment used to maintain heating, lighting, cooling, and ventilation of the building – has been strengthened under the new EPBD. On-site electricity generation and on-site electro-mobility now form a part of the TBS, expanding options for energy efficiency (ECEEE, 2017). The building owner ought to be informed about changes to the TBS in their building (The European Alliance of Companies for Energy Efficiency in Buildings, 2018). Such access to knowledge allows them to manage energy efficiency and comfort levels more effectively;

- For example, rating schemes for Smart Readiness Indicators shall be formulated that are used to measure technological readiness of buildings and their capacity to optimise energy consumption;
- A 'Building Automation and Control Systems' (BACS) was introduced that substitutes manual inspection of building systems, facilitating easier inspection of energy performance; Another provision on temperature level control requirements and e-mobility infrastructure further supports building performance standards.
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## INSTITUTIONS

- INVOLVED:** —————
- European Parliament
  - Council of the European Union
  - European Union Member States

- FINANCE:** —————
- The EPBD states that Member States shall take appropriate steps to consider the most relevant funding sources to finance their transition to NZEBs. Structural funds, like the European Fund for Strategic Investments (EFSI), the European Regional Development Fund, and the Cohesion Fund focus on renewable energy sectors and energy efficiency in public and residential buildings and in enterprises, and are available to the Member States. The 'Smart Finance for Smart Buildings' initiative by the European Commission supports effective use of these funds. Additionally, the European Investment Bank (EIB) and other sources of public and private funding ought to be considered by the governments. Coordinated EU and national funding should also be considered to comply with the NZEB standards (Zavrl et al., 2016; European Commission, 2018d).

- IMPACT OF ACTIVITIES:** —
- **INCREASED ENERGY EFFICIENCY:** In the residential sector, the progressive implementation of the building codes has facilitated an 11% reduction in final energy consumption in buildings between 2005 and 2015. However, it is important to note that warmer winters in Europe also play a role in this decrease (European Commission, 2017). The European Commission notes that after the introduction of technological upgrades, new buildings consume 'half as much as typical buildings' from 1980 (European Commission, 2014). The building sector has shown increasing potential to be the driver in achieving Europe's energy efficiency targets and implements its international commitments.
  - **BENEFITS TO OCCUPANTS OF BUILDINGS:** Buildings renovated in accordance with the EPBD guidelines utilise lesser energy to maintain a comfortable indoor temperature which allows occupants to benefit from lower utility bills (The European Alliance of Companies for Energy Efficiency in Buildings, 2018). Additionally, a higher energy performance in buildings provides a good indoor climate free of dampness and leaks, leading to better wellbeing of occupants (European Commission, 2018b). In countries where the population lives in fuel poverty and faces high energy tariffs, energy-efficient buildings are a channel to escape energy poverty or fuel poverty (Ürge-Vorsatz, 2008). Thus, with the introduction of energy efficiency requirements in national building codes, consumers have more tools at their disposal to save energy with financial efficiency and better health, resulting in a positive trend in energy savings in buildings.
  - **ECONOMIC BOOST:** The certification of the energy performance of buildings has encouraged consumers to buy or rent more energy-efficient buildings (CA EPBD, 2016). Such investment has



stimulated the construction industry of Europe which generates about 9% of Europe's GDP and directly accounts for 18 million jobs. The EU has also recognised the potential of job creation in construction and energy-efficient sectors and pushes Member States to establish a link between long-term renovation strategies and relevant skill development (European Commission, 2015). Moreover, a boosted renovation market provides additional benefits to small and medium-sized enterprises (SMEs) that contribute to more than 70% of the value added in the EU building sector (European Commission, 2018b).

#### WHY IS IT GOOD

##### PRACTICE :

- **TRANSPARENCY:** In 2015, the EU Buildings Directive was examined through a public consultation that involved citizens, public authorities, organisations, companies and other stakeholders who were directly or indirectly affected by the policies. The review process comprised a mix of quantitative and qualitative responses that provided insight to stakeholders' experiences. This approach to policy formulation proved advantageous for the review process as it is the beneficiaries who know best which policies are most effective and where bottlenecks lie (Boermans et al., 2015).
- **STAKEHOLDER ENGAGEMENT:** Political willingness to set a framework suited for national stakeholders translated to heavy engagement of the Member States in policy negotiation to achieve an 'energy-efficient and decarbonised building stock by 2050' (Hogeling & Derjanecz, 2018). The EPBD evolved in progressive stages, wherein the process of collaboration was broadened from negotiations among national stakeholders to procedural communication with scientific experts as well as national regulators. The aspects requiring a flexible approach in the Directive such as calculation methodology and assessment of energy performance were set up during consultation with national regulators, which allows smooth implementation of the Directive in the countries within a transparent framework.
- **SCIENCE-BASED:** The process of formulating the recast EPBD 2018 involved consultation with technical and energy experts to set minimum requirements for overall energy consumption of buildings, inspection of heating and air conditioning (AC) systems, definition of Technical Building Systems, and for the template that provides the calculation methodology of the energy performance of buildings to the Member States. Such a systemic approach provides a solid base for national governments to account for scientific measures in policy formulation, leading to a robust pathway towards emission reduction (Hogeling & Derjanecz, 2018).
- **EFFECTIVENESS:** The building codes implemented in the residential sector have proven to be effective over time in terms of reducing final energy consumption in buildings, exemplified by the fact that the latter has decreased by 11% between 2005 and 2015 (European Commission, 2017). Furthermore, the fact that new buildings with technological updates only consume half of the energy than buildings from the 1980s speaks for the effectiveness of the measures taken (European Commission, 2014).

##### SUCCESS FACTORS:

- **MAINTAINING RELEVANCE THROUGH CONTINUOUS IMPACT ASSESSMENT:** In accordance with the provisions of the Directive, the EPBD was reviewed in 2016 in order to identify shortcomings of the Directive and re-align them to the 2030 agenda of energy emissions reduction. The evaluation was undertaken to ensure relevance of the Directive to the EU's international climate commitments while enabling Member States to address the dimensions of the Energy Union that include, inter alia, energy security, internal energy market, energy efficiency, decarbonisation and innovation (ECEEE, 2017). The next assessment report of the Directive is due by January 1, 2026 which is expected to propose further modifications dependent on findings in different countries (European Parliament & European Council, 2018).
- **HARMONISATION OF EUROPEAN REGULATION:** Provisions concerning building efficiency have been moved from the Energy Efficiency Directive to the EPBD. This has harmonised policies within

the building sector and brought consistency to the overarching policy structure of the European Union (The European Alliance of Companies for Energy Efficiency in Buildings, 2018).

- **TANGIBLE IMPACT:** The goal of the Directive in 2010 was to save 60-80 million tonnes of oil equivalent (Mtoe) of energy by 2020, and up to 2014, energy savings had exceeded 40 Mtoe in the residential sector and stood at 7.5 Mtoe in the service sector. The share of renewables in final energy consumption has also been on a constant increase as EPBD work successfully in synergy with other European regulations (European Commission, 2016b).
- **LONG-TERM ORIENTATION:** The building standards have been set to meet long-term goals of energy efficiency in Europe. The 2010 EPBD was set with the aim to achieve emission reduction by 2020, whereas the latest version sets out to meet the 2050 vision. The EPBD standards have been evaluated progressively, giving way to more nuanced standards with every progressive revision.

**OVERCOMING BARRIERS / CHALLENGES:**

**WHAT WERE THE MAIN BARRIERS / CHALLENGES TO DELIVERY?**

**INFORMATIONAL:**

Data on buildings characteristics and their energy efficiency levels is disaggregated. Incomplete information on impacts of investments in renovation on energy efficiency inhibits active engagement of market players. Lack of data also makes processes of tracking, monitoring and evaluation of building performance difficult to implement (European Commission, 2016b).

**FINANCIAL:**

Lack of awareness among Member States about available financial tools to mobilise investments was recognised as one of the main reasons for insufficient efforts to take advantage of net financial gains from energy-efficient buildings (Boermans et al., 2015). Also, a lack of aggregation of finance leads to funds being utilised only for one aspect of the sector (such as changing pipelines) instead of spreading the funds across different energy requirements.

**HOW WERE THESE BARRIERS / CHALLENGES OVERCOME?**

The information gap has been recognised and partly overcome through the Building Stock Observatory launched in 2014. It is a tool for tracking and recording information for individual EU countries on: energy efficiency levels, implementation of EPCs, finance used to renovate buildings and energy poverty. The data-mapper and factsheets made available by the Observatory are a step towards reconciling the information gap across Member States, enabling continuous monitoring of progress for all (Arcipowska A., 2014).

There is guidance available on how Member States can develop schemes to measure energy efficiency, wherein a common format is preferential loans, complemented with a grant, administered by public and private sector partners (CA EPBD, 2016). Non-legislative initiatives like the Smart Finance for Smart Buildings have been put in place to enable efficient usage of public funds and attract private capital towards this area (European Commission, 2016).

Some Member States have already created financial incentives to build more energy-efficiently. Germany, for example, has created energy-efficiency related funding schemes through its State-owned development bank (KfW, in its German acronym), which are combined with adjustable national building codes that are periodically updated. Using different thresholds for energy efficiency like 50% and 70%, compared to the buildings constructed using the minimum legal standards, KfW can give out low-interest loans to higher thresholds.



**POLITICAL:**

Member States already had national policies for energy performance of buildings in place, many of which complied with the EPBD to some extent before the recast was introduced. There was a lack of willingness to change existing national provisions which requires resources and efforts, without much perceived additional return. Thus, many governments shy away from full compliance to the EPBD.

Provisions like the EPC give a push to energy efficiency in the buildings sector from the commercial side by letting the market function in favour of energy savings. This creates competitiveness in the sector which encourages stakeholders to engage more closely in energy performance of buildings and introduce appropriate national policies as the market evolves. Moreover, as energy efficiency standards are set by the industry, there is more room for comparison of technical solutions that encourages innovative and cost-effective methods for energy savings.

**LESSONS LEARNED:**

- **MIND THE IMPORTANCE OF TECHNOLOGY:** With modification and implementation of national buildings codes in accordance with the EPBD, smart technology in buildings has taken centre stage. Aspects such as the inclusion of charging points for electric vehicles and interaction between renewable energy sources and energy efficiency (for example solar chargers for electric vehicles) represent different and innovative ways to achieve energy balance in buildings in Member States.
- **CREATE MARKET INCENTIVES:** By issuing EPCs, the EPBD has created an incentive to buy or rent more energy-efficient buildings. This gives an important economic boost to the renovation market and the industry as a whole to shift to more energy-efficient ways of construction.

**HOW TO REPLICATE  
THIS PRACTICE:**

- **DEFINE A FRAMEWORK FOR DIVERSE STAKEHOLDERS:** Through its indicative national milestones, the EPBD has defined a way forward for the Member States on incorporating actions towards more energy-efficient building stocks and incremental progress towards Nearly Zero Energy Buildings. At the same time, it considers the needs of occupants and building owners by implementing measures such as the EPCs.
- **ALIGN THE STANDARDS OF THE DIRECTIVE TO LOCAL CONDITIONS:** The main objective of the EPBD is increased energy efficiency in buildings through cost-effective policies that are practical for all Member Nations. Policy makers recognised the pertinent factors that would help to achieve this goal for all Member States, such as smart technology and NZEBs. As already established, most buildings in Europe are over 50 years old and in need of renovation. For the European Union, the key was to recognise that the focus needed to be shifted from new buildings to already existing buildings. This increased the applicability of the Directive and the scope for national codes to comply with the European standards. Thus, it is imperative to set targets in line with local conditions (e.g. minimise heating or cooling according to diverse climatic conditions) to make the building codes implementable and achieve defined targets.
- **SET ATTRACTIVE FINANCIAL MEASURES TO GO BEYOND MINIMUM STANDARDS:** The flexibility of the application of the Directive allows Member States to deal with finance in an innovative manner. They can create fiscal incentives for the building sector to spur more energy-efficient construction of buildings. This has been done in Germany through energy-efficiency related funding schemes issued by the State-owned development bank (KfW). The bank can give out low-interest loans to those who construct buildings that exceed the minimum legal standards in terms of energy efficiency.



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## FURTHER KEY

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- WEBSITE:** ————— · European Commission policies, information and services: [https://ec.europa.eu/info/index\\_en](https://ec.europa.eu/info/index_en)

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## CASE STUDY

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## MASTERING THE TRANSITION TOWARDS ENERGY EFFICIENCY

### IN THE BUILDINGS SECTOR: THE EUROPEAN UNION'S ENERGY PERFORMANCE OF BUILDINGS DIRECTIVE

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PERFORMANCE OF BUILDINGS DIRECTIVE**

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