



HI-SMART: HIGHER EDUCATION PACKAGE FOR NEARLY ZERO ENERGY AND SMART  
BUILDING DESIGN

# MODULE #1

## LEGISLATIVE BACKGROUND

Co-funded by the  
Erasmus+ Programme  
of the European Union



## INTRODUCTION

Carbon-free Europe by 2050 is one of the main elements of tackling climate change. Crucial pillar of this target is energy efficiency, completed with the exploitation of renewable sources. In 2019 the EU completed a comprehensive update of its energy policy framework to facilitate the transition away from fossil fuels towards cleaner energy and reducing greenhouse gas emissions.

The agreement - called the Clean energy for all Europeans package - consists of eight legislative acts. Following the political agreement by the Council and the European Parliament (between May 2018 and May 2019) and the entry into force of the different EU rules, EU countries have 1-2 years to transpose the new directives into national law.

As the part of Clean energy for all Europeans package **Energy Performance of Buildings Directive (EPBD)** focuses the buildings sector's modernization, **Renewable Energy Sources Directive (RES/RED)** focuses on renewables with a binding target of 32% for renewable energy sources in the EU's energy mix by 2030 while the **Energy Efficiency Directive (EED)** focuses on energy efficiency to saving money for consumers and for reducing greenhouse gas emissions by decreasing energy consumption by 32.5%.

These so-called directives are legislative acts that set out goals that all EU countries must achieve. However, it is up to the individual countries to devise their own laws on how to reach these goals.

### 1.1 ENERGY PERFORMANCE OF BUILDINGS DIRECTIVE (EPBD)

The Energy Performance of Buildings Directive (EPBD) is one of the most important legislation regarding the CO<sub>2</sub> reduction in the European Union. The first version of the directive was presented in 2002, since then there were several updates of it. The main goal is to realize the saving potential in buildings, as they account for almost 40% of the consumption of energy.

The specific goal of EPBD is to create better and more energy efficient buildings in order to improve the quality of citizens' life while bringing additional benefits to the economy and the society. The specific goals of the EPBD are:

1. achieve a highly energy efficient and decarbonized building stock by 2050
2. create a stable environment for investment decisions
3. enable consumers and businesses to make more informed choices to save energy and money

One of the most visible measure in EPBD, that every new building in the EU should be **nearly zero-energy buildings (NZEB)**.

EPBD set for each member state the obligation to introduce a **system of energy performance certificates**. These documents and analyses must be issued when a building is sold or rented, and inspection schemes for heating and air conditioning systems must be established.

EPBD has introduced the **Smart Readiness Indicator**, which is a voluntary European scheme for rating the "smart readiness" of buildings. The SRI will be able to measure a building's "smartness": it needs to be ready to adapt the needs of the occupant, ready to facilitate maintenance and efficient operation and ready to adapt in response to the situation of the energy grid (energy flexibility). SRI will add new comparable information to building owners and occupants about the buildings' value. Besides the introduction of the new indicator system every smart solution is promoted by the EPBD (i.e.: building automation and control systems and devices that regulate temperature at room level).

## 1.2 RENEWABLE ENERGY SOURCES DIRECTIVE (RED)

One of the political priorities of the European Union is to become the global leader of renewables, so in order to reach this goal the Renewable Energy Sources Directive (RES/RED) was adopted. The directive set a goal for 2030 of at least 32% energy should come from renewables, with a clause for a possible upwards revision by 2023. This goal should also be included in the 10-year National Energy & Climate Plans (NECPs) with the concrete targets and policy measures of upscaling renewable sources for the electricity, heating and cooling, and transport sectors.

RED also set goals for the building industry: each member state must be able to guarantee the origin of electricity, heating and cooling produced from renewable energy sources. The directive also promotes – by easier regulations - local energy consumers to produce their own electricity, individually or as part of renewable energy communities.

## 1.3 ENERGY EFFICIENCY DIRECTIVE (EED)

The original Energy Efficiency Directive (EED) - which was adapted in 2012 - establishes a set of binding measures to help the EU reach its 20% energy efficiency target by 2020. In 2018, the original directive was amended with new goals: to reach **the energy efficiency target for 2030 of at least 32.5%** compared to the base year of 2007.

The EED not only set this target, but defined exact measures, which member states need to be implemented into their national legislative system.

EU countries must achieve new savings each year of 1.5% of final energy consumption from 2024 to 2030, up from the current level of 0.8%<sup>1</sup>. This is an important instrument to drive energy savings in end-use sectors such as buildings, industry and transport. In order to do this reduction, energy efficient renovations of buildings owned and occupied by central governments is mandatory for at least 3% per year of all public buildings. Besides that it promotes the renovation of residential buildings as well.

The EED set new standards for the whole building industry. It declares minimum energy efficiency standards and labelling for a variety of products such as boilers, household appliances, lighting and televisions (energy label and ecodesign), mandatory energy efficiency certificates accompanying the sale and rental of buildings and mandatory energy audits for large companies conducting at least every four years.

## 1.4 NZEB CONCEPTS

Residential and public buildings are the largest energy consumers, so actions are needed to be taken. The universal goal is to create a more sustainable, carbon-free and healthy built environment for the whole European community. The EPBD requires Member States to establish minimum requirements for the energy performance of newly constructed buildings and existing buildings undergoing major renovations.

There are several concepts of energy efficient buildings: nearly zero-energy buildings (nZEB), net zero energy buildings (NZEB), passive houses etc. The nZEB concept is described by the EPBD setting as an obligation to member states. However the definition is rather general as follows:

“Nearly zero energy building means a building that has a **very high energy performance**, and the **nearly zero or very low amount of energy** required should be covered to a very significant extent by **energy from renewable sources**, including energy from renewable sources **produced on-site or nearby**.”

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<sup>1</sup> [https://ec.europa.eu/energy/topics/energy-efficiency/targets-directive-and-rules/energy-efficiency-directive\\_en](https://ec.europa.eu/energy/topics/energy-efficiency/targets-directive-and-rules/energy-efficiency-directive_en)

The end objective of the energy performance calculation is to determine the overall annual energy use in net primary energy, which corresponds to energy use for heating, cooling, ventilation, hot water and lighting. However, the current directive does not provide numerical requirement of the primary energy consumption. Countries where a numerical indicator has been set, the requirements range rather widely from 0 kWh/(m<sup>2</sup>\*y) to 270 kWh/(m<sup>2</sup>\*y). For residential buildings, most Member States aim to have a primary energy use not higher than 50 kWh/m<sup>2</sup>/year.

Member States have to define primary energy factors per energy carrier. These factors should take into account the renewable energy content of the energy supplied to the building, including from nearby sources, in order to place on-site and off-site renewable energy sources on equal footing.

Nearly zero energy demand is not enough to meet nZEB goals, the needed energy 'should be covered to a very significant extent by energy from renewable sources'. Large differences exist across countries regarding those RES solutions which can be included in their energy performance calculations, and those which can be used to fulfil direct nZEB RES requirements. Some technologies (e.g., solar thermal panels for domestic hot water generation and for heating, PV for self-use, as well as biomass boilers and heat pumps coupled to external air/exhaust air/ground or ground water) can in general be taken into account in the energy performance calculation in all countries. Other RES technologies (e.g., PV for feed-in, RES as part of district cooling, micro-wind turbines (self-use or feed-in) and local hydro power for self-use) can be taken into account in the energy performance calculation in about half of the countries.

In addition, the RES and the EPBD required the Member States to update the national building codes in order to promote the renewable energy in the building industry.

The nZEB definition in the EPBD emphasizes that used renewable energy can include energy from renewable sources produced on-site or nearby. The definition is based on the system boundaries which can be:

- 1) at the building envelope (i.e. PVs on the roof included but PVs in the garden are not)
- 2) at the property lines
- 3) even broader, e.g. pipe-systems connected to the building (i.e. district heating) can be 'part' of the nZEB building if it's using renewable sources.

Energy produced on-site (used on-site or exported) reduces the primary energy needs associated with delivered energy. According to the actual EPBD, the positive influence of renewable energy produced on site is taken into account, so that it reduces the amount of delivered energy needed and may be exported if cannot be used in the building.

## 1.5 NATIONAL NZEB PLANS

According to the EPBD all member states should draft national plans for increasing the number of nearly zero-energy buildings with differentiated targets according to the category of building.

The national plans should include the following elements:

- detailed application in practice of the definition of nearly zero-energy buildings, reflecting their national, regional or local conditions, and including a numerical indicator of primary energy use expressed in kWh/m<sup>2</sup> per year. Primary energy factors used for the determination of the primary energy use may be based on national or regional yearly average values and may take into account relevant European standards,
- information on the policies and financial or other measures adopted for the promotion of nearly zero-energy buildings, including details of national requirements and measures concerning the use of energy from renewable sources in new buildings and existing buildings undergoing major renovation.

## 1.6 COST-EFFICIENCY

The European nZEB concept created a cost-optimal building requirement system for the member states which was needed to be implemented into the national regulations. These regulations served as the hall of nZEB regulation and should affect existing and new buildings as well. The national cost-optimal regulations should define an optimal mix of insulation or other energy efficiency measures, inclusion of highly-efficient technical building systems and use of on-site renewable energy sources and need to be monitored every 5 years.

## 1.7 REQUIREMENTS, CERTIFICATES, AUDITS

To monitor the efficiency of a given building and design its development/refurbishment to an even better performing level, a status quo analysis is needed. Energy performance certificates (EPC) and energy audits (EA) are the main tools for this purpose, both of them giving an overview on energy consumption/needs and advice on how to raise energy performance. The differences between them are presented below.

	EPC	Energy audits
Regulated by	EPBD + national regulations	EED, EN 16247 standard
Focus on	all buildings and building units with some exceptions	industrial and large buildings, corporations
Based on	mostly asset method (calculations), in certain countries and cases operational method (historical data)	both asset method (calculations), and operational method (historical data)
Due	<ul style="list-style-type: none"> <li>- when a new building is built</li> <li>- when a building or building unit is sold or rented</li> <li>- public buildings</li> </ul>	in every 4 years
Inform about	energy performance of the building with standardised user profile	energy performance of the building with real user profile, technology and logistics

Table 1: Differences of EPCs and energy audits (own edition)

The Energy Performance Certificate is a legal document certifying the energy performance of houses and building units by evaluating the entire energy supply system (heating, domestic hot water, cooling, ventilation and lighting) system.

The Energy Performance Certificates are regulated by EPBD as well, because the system of certificates is a crucial tool to promote the energy performance of buildings.

According to the EPBD “Energy performance certificate” means a certificate recognized by a Member State or by a legal person designated by it, which indicates the energy performance of a building or building unit, calculated according to a methodology adopted in accordance with Article 3 (calculation the energy performance of buildings). Other relevant articles are:

- Article 11: Energy performance certificates
- Article 12: Issue of energy performance certificates
- Article 13: Display of energy performance certificates

The ultimate goal of EPCs is to create a demand-driven market for energy efficiency in the building sector.

EPCs not only provide new and objective information for the building industry (owners, occupants and real-estate actors) to compare and assess buildings, but also can be a transparent tool to justify and design energy efficiency improvements. EPCs will put energy performance into the decision-making process at real-estate transactions by providing recommendations for the cost-effective or cost-optimal upgrading and can potentially influence builders and real estate owners to invest in greater volume in energy performance.

The framework of EPCs is shaped by each member state in order to show the energy performance of a building or building unit, calculated based on a methodology in accordance with the EPBD.

EPCs are obligatory to be produced for every building (and building unit) that

- is newly constructed,
- is sold or rented to a new tenant
- undergoes major renovation (>1000m<sup>2</sup>) or
- is a public building where the total useful floor area is over 250 m<sup>2</sup> (due to exemplary reasons).

## 1.8 REFERENCES

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The views and opinions expressed in this publication are the sole responsibility of the author(s) and do not necessarily reflect the views of the European Commission.

Co-funded by the  
Erasmus+ Programme  
of the European Union



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