ISSN 1831-9424

European Commission

Assessing the progress of Nearly Zero Energy Buildings (NZEBs) implementation in Europe

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2025

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JRC138771

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PDF ISBN 978-92-68-22049-8 ISSN 1831-9424 doi:10.2760/3333880 KJ-01-24-145-EN-N

Luxembourg: Publications Office of the European Union, 2025

How to cite this report: European Commission: Joint Research Centre, D'Agostino, D., Maduta, C., Tsemekidi Tzeiranak, S., Paci, D. and Castellazzi, L., *Assessing the progress of Nearly Zero Energy Buildings (NZEBs) implementation in Europe,* Publications Office of the European Union, Luxembourg, 2025, https://data.europa.eu/doi/10.2760/3333880, JRC138771.

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Abstract

The building sector holds a relevant position in decreasing greenhouse gas (GHG) emissions within the European Union (EU). The revised Energy Performance of Buildings Directive (EPBD) recently adopted[1], sets forth ambitious goals to make the EU building stock carbon-neutral by 2050. As Nearly Zero-Energy Buildings (NZEBs) remain the mandatory target for new buildings from 2021 to 2030, this report provides a comprehensive assessment of Member States progress towards the implementation of NZEBs.

It depicts the uptake of definitions, providing NZEB primary energy demand (total and non-renewable) across Member States, distinguishing new and existing, residential and non-residential buildings and envelope thermal transmittances thresholds. A focus is given to renewable energy role, including renewable energy share and accounted renewable energy technologies and overview of common building technologies is included. The report compares the national NZEB performance levels with the recommended benchmarks as well as with the latest cost-optimal energy performance levels. Moreover, information regarding the typical measures, number and floor area of NZEBs from the 2020 Long-Term Renovation Strategies (LTRS), 2023 draft National Energy and Climate Plans (NECPs) and 2023 Progress Reports (NECPR) are collected and discussed.

As the revised EPBD further introduces Zero-Emission Buildings (ZEBs) as the objective for all new buildings starting in 2030, this report also explores how ZEB performance levels might evolve based starting with current NZEB definitions.

[1] Directive (EU) 2024/1275 of the European Parliament and of the Council of 24 April 2024 on the energy performance of buildings (recast): Directive - EU - 2024/1275 - EN - EUR-Lex (europa.eu)

Acknowledgements

This report was prepared in the framework of the Administrative Agreement between DG ENER and DG JRC "Technical assistance to the implementation of the EED and EPBD", where JRC provides technical and scientific assistance to support the development, implementation and review of relevant provisions of EU energy efficiency legislative frameworks.

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Executive summary

Policy context

A core point of the European Green Deal is decarbonising the energy demand sector, including buildings to achieve a climate neutral society by 2050. The adoption of highly energy efficient building concept, such as Nearly Zero-Energy Buildings (NZEBs) is a strong pillar to drive decarbonisation of EU buildings. According to the revised Energy Performance of Buildings Directive (EPBD), NZEB has a very high energy performance, as determined in accordance with Annex I, which is no worse than the 2023 cost-optimal level reported by Member States pursuant to Article 6(2) and where the nearly zero or very low amount of energy required is covered to a very significant extent by energy from renewable sources, including energy from renewable sources produced on-site or energy from renewable sources produced nearby. As of 2021, NZEB is the mandatory target for all new buildings, while starting in 2030, the Zero-Emission Building (ZEB) will become the required standard.

Main findings

The JRC carried out an overview of the status of the development of NZEBs definitions in Member States to comply with the EPBD requirements. Apart from performance values (for new, existing, residential and non-residential buildings), the analysis takes into account different aspects related to definitions (such as envelope thermal transmittances (U-values), renewable energy and technologies, end-uses, operational GHG emissions requirements).

The report identifies common features and main differences among NZEBs definitions in place. Based on the national definitions, the NZEB performance level expressed in non-renewable primary energy demand kWh/(m^2y) in Member States and averaged at EU level was estimated. The average non-renewable primary energy demand for new single-family houses varies from 15 to 95 kWh/(m^2y) with an average at EU level of 54 kWh/(m^2y). For new offices, the estimated performance level ranges between 20 and 220 kWh/(m^2y) with an EU average of 73 kWh/(m^2y). For existing buildings under renovation to NZEB level, the average non-renewable primary energy demand varies between 30 kWh/(m^2y) and 135 kWh/(m^2y) with an average at EU level of 70 kWh/(m^2y) for single family houses, while for offices it ranges between 30 and 152 kWh/(m^2y) with a EU average of 90 kWh/(m^2y). In most cases, the NZEB requirements for new buildings are stricter than those for NZEB renovation. On average, the NZEB non-renewable primary energy demand of new buildings is about 30% lower than for renovated buildings. This may also be explained by stricter thresholds and more common and stringent renewable energy requirements in new buildings compared to existing buildings renovated to NZEB level.

Regarding the envelope, thermal transmittance (U-value, expressed in W/m^2K) requirements for both new and existing NZEB buildings are provided in about 80-85% of current NZEB definitions. Values range between 0.09 to 0.49 W/m^2K for roofs and from 0.13 to 1.57 W/m^2K for walls. Most common NZEBs technologies include efficient heating, ventilation and cooling technologies, including heat pumps and mechanical ventilation with heat recovery, efficient lighting and appliances. Regarding renewable energy technologies, photovoltaics (PV) and solar thermal are the most commonly implemented technologies.

Related and future Joint Research Centre work

The JRC has been providing support to the implementation of NZEBs definitions in Member States over last decade. The JRC is following the evolution of NZEBs definitions and energy performance levels, tackling also NZEBs retrofit progress in the light of the need to strengthen measures to successfully stimulate cost-effective NZEBs renovation. As future work, the JRC plans to follow ZEB implementation in Member States.

Quick guide

The structure of the report is as follows. After an introduction of the policy framework related to NZEBs in Section 1, Section 2 assesses the progress of NZEBs definitions in Member States, in terms of primary energy demand, U-values and renewables. It also compares NZEBs performance levels with the benchmark levels of the Commission Recommendation on NZEBs. Section 3 extracts information from Long Term Renovation Strategies (LTRS), draft National Energy and Climate Plans (NECPs) and Progress Reports (NECPR), identifying main NZEBs measures. Section 4 compares NZEB performance with recent cost-optimal levels. An overview of technologies is given in Section 5, while Section 6 depicts the path from NZEB to ZEB, providing potential ZEB levels and discussing the key challenges of this transition. Conclusions are drawn in Section 7. At the end of the report, the Annex reports the country-sheet evaluation template used for this assessment in relation to NZEBs definitions, as collected by the JRC from Member States.

1. Introduction

The building sector plays a significant role in energy consumption and greenhouse gas (GHG) emissions in the European Union (EU), accounting for approximately 40% of energy consumed and 36% of energy-related GHG emissions. Consequently, the sector is a primary focus of EU energy and climate policies. The European Green Deal, launched in 2019, aims to achieve EU-wide climate neutrality by 2050 through a holistic and cross-sectoral approach [EC, 2019a]. It aims to transform the EU in a fair and prosperous society, with a modern, resource efficient, competitive economy having no net greenhouse gas emissions in 2050 [EC, 2019b]. In line with the Paris agreement to keep the global temperature increase to well below 2°C and pursue efforts to keep it to 1.5°C [EC, 2013], the Energy and Climate Union strategy support the EU climate neutral transition setting energy efficiency as one of its strategic dimensions [EC, 2018]. This ambitious target requires to maximise energy efficiency and renewable production within an overall conversion of several sectors.

The 'Fit for 55'[2] package underscores the importance of building renovation and proposes measures to facilitate the transition to environmentally friendly practices, such as supporting building renovation, adopting clean heating and cooling technologies, and integrating renewable energy. The REPowerEU plan further emphasizes the crucial role that EU buildings play in reducing reliance on foreign energy sources [EC, 2022].

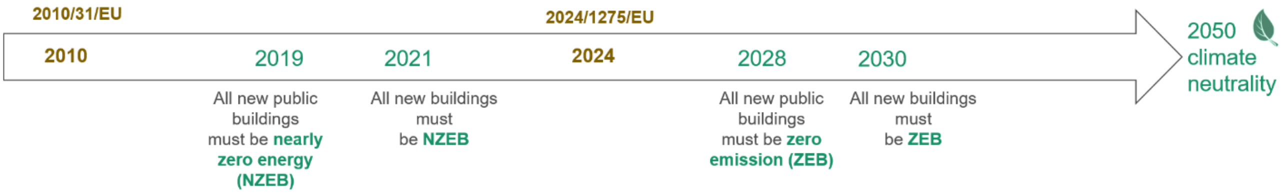
The fist legal pathways for a decarbonized building stock in the EU have been designed under the Energy Performance of Buildings Directive 2010/31/EU [EPBD, 2010]. This Directive provides policies and measures to guide Member States in enacting legislation to improve building energy performance. It establishes requirements for new energy-efficient buildings and outlines the transformation of existing buildings. For new buildings, the EPBD mandates that Member States ensure they meet the Nearly Zero-Energy Building (NZEB) standard from 2021 onward. A NZEB is defined as a highly energy-efficient building where the nearly zero or very low amount of energy required is covered to a very significant extent by energy from renewable sources produced on-site or nearby [4].

It is evident how buildings, and NZEBs play a key role combining energy efficiency with renewables [EC, 2017]. Indeed, new buildings occupied by public authorities and properties have to be NZEBs by December 31, 2018 and all new buildings by December 31, 2020. The EPBD states that Member States shall detail NZEB definitions, reflecting national, regional or local conditions, and including a numerical indicator of primary energy use expressed in kWh/m2y. Due to the variety of climates, market and local conditions throughout Europe, the implementation of NZEBs definitions has not been an easy task [D'Agostino & Mazzarella, 2019]. Member States have to develop targeted policies and provide financing to foster the transition to NZEBs. They have to take the necessary measures to ensure that minimum energy performance requirements are met to achieve cost-optimal levels. These have to be derived in relation to minimum energy performance requirements for new and existing buildings in compliance with the comparative methodology framework established by the Commission with the Delegated Act No. 244/2012 of 16 January 2012 and related Guidelines [EC, 2012a, b].

[2] The 'Fit for 55' package is a set of legislative proposals introduced by the European Commission in July 2021 with the scope to deliver the EU's 2030 climate targets.

The revised EPBD recently adopted [EPBD, 2024] aligns with the EU goal of a 55% GHG emission reduction by 2030. In pursuit of decarbonizing the building stock by 2050, the revised EPBD introduces a definition for Zero-Emission Buildings (ZEBs). A ZEB is characterized by a very high energy performance, requiring zero or a very low amount of energy, producing zero on-site carbon emissions from fossil fuels, and generating zero or a very low amount of operational GHG emissions. The total annual primary energy use must be covered from on-site and nearby renewables, renewable energy communities, district heating and cooling systems, or other carbon-free sources. Additionally, the Directive mandates Member States to introduce maximum thresholds for the total annual primary energy use of ZEBs that should be at least 10% lower than the national NZEB thresholds at the time of implementation. Furthermore, the operational GHG emissions must adhere to a national maximum threshold. The primary objective at the EU level is for public-owned new buildings to be ZEBs by 2028, with the broader goal that all new buildings meet the ZEB standard by 2030 and existing buildings transformed into ZEBs by 2050 (Figure 1).

Figure 1. Timeline with building targets for climate neutrality



Source: JRC elaboration, 2025.

The revised EPBD also includes a definition for deep renovation. Deep renovation prioritizes energy efficiency and focuses on essential building elements, transforming buildings into NZEBs before 2030 and ZEBs from 2030 onward. The ultimate objective is to achieve a zero-emission EU building stock by 2050. Deep renovations may also serve as an opportunity to address various aspects, such as indoor environmental quality, safety, and resilience against disasters. Member States must establish a comprehensive strategy aimed at achieving a highly efficient and decarbonised building stock by 2050 and cost-effective transformation of existing buildings into NZEBs. With the need of increasing (at least double) the current low renovation rate (between 0.4% and 1.2 % in Member States), it is clear that renovation to deep levels remains the hugest challenge for Europe. Given the climate and energy emergency, the role of NZEBs in achieving EU goals is critical. This report offers an overview of NZEBs, addressing the current status of implementation, challenges and future developments across the EU.

2. NZEB definition updates

This section assesses the progress of NZEB implementation in the Member States. The EPBD does not advocate a uniform approach for implementing the NZEB concept across the EU, leaving Member States to detail their NZEB definitions, accounting for the variety of building types and climates.

The progress has been assessed through a country-sheet template filled in by Member States to allow comparison and evaluation of provided definitions. Out of 29 contacted entities, 24 provided feedback, while 4 did not respond (Bulgaria, Brussels, Italy and Latvia), and 1 response was marked confidential (France). For the non-responding entities and the confidential response, existing data were updated by referencing the Concerted Action on the EPBD database [CA EPBD, 2020][3]. The country sheets are included in the Annex.

It is observed that the definition varies greatly among the countries. A main difference is the indicator used to benchmark the NZEB level. Many definitions rely on comparisons with national reference buildings or on a formula involving additional indicators instead of a fixed energy indicator. Furthermore, several countries have varying performance values based on building types, geometry (heated/cooled conditioned floor area), climate zone, and other parameters. Table 1 summarizes the relevant indicators present in the national NZEB definitions.

[3] The Concerted Action on the Energy Performance of Buildings Directive (CA EPBD) is a joint initiative between the EU Member States and the European Commission and has the scope to facilitate information and experience sharing from national adoption and implementation of the EPBD.

Table 1. Main indicators used by Member States in the national NZEB definitions.

	Non-renewable primary energy	Total primary energy demand	Energy class	Heating, Cooling demand
AT				
BE - Br				
BE - Wa				
BE - Fl				
HR				
CY				
CZ				
DE				
DK				
EE				
FI				
FR				
HU				
IE				
IT				
LT				
LU				
MT				
NL				
PL				
PT				
RO				
SK				
SI				
ES				
SE				

Source: JRC elaboration, 2025

It is observed that 20 countries/regions rely on total primary energy, while 13 definitions employ non-renewable primary energy demand. Eight countries use both. Another indicator is the energy performance class, present in 12 definitions. Indeed, one of the most debated issues around the NZEBs has been identified in the difficulty of having harmonization among calculation methodologies and definitions [D'Agostino et al, 2016].

2.1. Comparative NZEB performance levels

To provide an overall NZEB progress at EU level and enable comparison between national NZEB definitions, this section addresses the harmonisation of NZEB indicators. The focus is on the maximum allowed non-renewable primary energy demand, which is framed by many national definitions and it also allow for comparison with previous assessment of NZEB levels. Similar methodology was previously employed by [D'Agostino et al, 2021] and [Maduta et al, 2023]. When countries refer to total primary energy, the non-renewable energy share is calculated considering the renewable energy requirements, for those cases providing the total primary energy and not quantifying the share of renewable energy, the non-renewable energy demand was considered equal with the total primary energy demand.

The steps to derive performance values for residential and non-residential, new and existing NZEBs are as follows:

1. The values correspond to single-family houses (SFH) and offices, where this distinction was made by the national definition between building sub-categories. This approach was adopted to enable comparison with the recommended NZEB performance levels that are set for single-family houses and offices, discussed in Section NZEBs and benchmark levels.
2. For countries that have in place performance values that vary with the national climatic zones, the average values across the zones are considered (Greece, Spain, Italy) or the representative climatic zone in the country (Croatia, Romania).
3. The share of renewable energy is subtracted from the primary energy demand value provided in the national definition (Flanders, Bulgaria, Cyprus, Finland, and Hungary).
4. For several countries specific methodologies are necessary to estimate national performance values, as follows:
   (a) Austria: The NZEB levels for new buildings are sourced from CA EPBD database.
   (b) Brussels-Capital Region: The NZEB levels of offices equals the upper boundary of energy class B for new buildings and of class C for renovated buildings.
   (c) Czechia: The NZEB levels are calculated using the reference buildings for new buildings defined in the 2023 cost-optimal report.
   (d) Denmark: The NZEB levels are calculated using the reference buildings defined in the 2023 cost-optimal report.
   (e) Finland: A share of 15% is subtracted from the Member State values to eliminate appliances and user equipment energy demand. The NZEB levels are calculated using the reference buildings defined in the 2023 cost-optimal report.
   (f) France: The NZEB levels for new buildings are sourced from CA EPBD database and average between the two indicated options for each building sub-category. The NZEB level of renovated SFH is calculated using average values for coefficients a and b according to CA EPBD database. The NZEB level of renovated office is calculated based on the reference office building defined in the 2023 cost-optimal report.
   (g) Germany: The NZEB levels are calculated using the reference buildings for new buildings defined in the 2018 cost-optimal report.

(h) Greece: NZEB levels corresponds to Energy Performance Certificate (EPC) class A upper boundary for new buildings and class B+ upper boundary for renovated building. The reference building performance level was extracted from the 2018 cost-optimal report.

(i) Poland: The NZEB levels of offices include primary energy for cooling and lighting according to the CA EPBD database.

(j) Portugal: The NZEB levels are calculated using the reference buildings for new buildings defined in the 2018 cost-optimal report.

Following the above methodology,

Table 2 and Table 3 summarise the calculated NZEB performance levels, differentiating between new and existing, residential and non-residential buildings.

Table 2. NZEB primary energy demand in new buildings.

MS	Primary energy demand (kWh/m²y) new buildings						
	SFH			Office			notes
	Total	Non-ren	Renewable	Total	Non-ren	Renewable	
AT		41	depends on technology and end use covered		84	depends on technology and end use covered	
BE - Br	45	45	n.a	95	95	n.a.	
BE - Wa	85	64	25%	n.a.	n.a.	25%	
BE - Fl	30	15	15	50	20	30	
BG	95	43	55%	140	63	55%	
HR	n.a	40	30%	n.a	30	30%	average climate zones
CY	100	75	25	125	94	31	
CZ	81	65	not explicitly provided	90	72	not explicitly provided	
DK	37	37	not included as share but reflected in Primary Enery Factors	41		not included as renewable energy share but reflected in Primary Energy Factors	
EE		93	not quantified		62	not quantified	
FI	95	59	38%	85	53	38%	15% subtracted for excluding appliances energy use
FR	55	50	5	100	100	not quantified	

DE		55	covers heating and cooling and depends on technology		55	covers heating and cooling and depends on technology	
GR	55		60% DHW[4]	62		60% DHW	
HU	100	75	25%	90	68	25%	
IE	40	32	20%	65	55	15%	average value for office
IT		30	60%		117	60% (65% public buildings)	from previous study
LV	95	95	not quantified	95	95	not quantified	
LT		60	50%		80	50%	
LU	30	30	not quantified; typically around 65%	40	40	not quantified; typically around 65%	
MT	65	65	not quantified (proposal: 1-15% depending on the technology)	220	220	not quantified (proposal: 1-15% depending on the technology)	average value for SFH
NL		30	40-50%		40	30-50% non-residential	
PL	75	75	not quantified	95	95	not quantified	
PT		35	50% for DHW		71	50% for DHW	
RO	128	90	38	98	69	29	
SK		54	not set yet		61	not set yet	

[4] DHW = domestic hot water

SI	75	38	37.5 (50%, public buildings 55%)	55		28 (50%, public buildings 55%)	
ES	62	31	50%	197	88	50%	average climate zones
SE	95	95	not quantified	70	70	not quantified	

Source: JRC elaboration, 2025

Table 3. NZEB primary energy demand in existing buildings.

Member State	Primary energy demand (kWh/m²y) existing buildings					
	SFH			Office		
	Total	Non-ren	Renewable	Total	Non-ren	Renewable
AT	no overall energy indicator defined					
BE - Br	54	54	n.a	150	150	n.a.
BE - Wa	85	85	not quantified	n.a.	n.a.	not quantified
BE - Fl	60	45	15	90	75	15
BG	95	43	55%	140	63	55%
HR	n.a	40	30%	n.a	30	30%
CY	100	75	25	125	94	31
CZ	113	90	not explicitly provided	100	80	not explicitly provided
DK	90	90	not included as RES share but reflected in PEF	96	96	not included as RES share but reflected in PEF
EE		113	not quantified		122	not quantified

FI	103	64	not quantified	85	53	38%
FR	92	92	not quantified	140	140	not quantified
DE	no legal definition of NZEB renovation					
GR	93		60% DHW	145		60% DHW
HU	100	75	25%	90	68	25%
IE	125	125	n.a.	152	152	n.a.
IT		30	60%		117	60% (65% public build-ings)
LV	95	95	not quantified	95	95	not quantified
LT		60	50%		80	50%
LU	no energy indicator defined; renovation must comply with requirements for building components					
MT	65		not quantified (proposal: 1-15% depending on the tech-nology)	No requirement		
NL	no legal NZEB renovation definition					
PL	no energy indicator requirements					
PT		35	50% for DHW		71	50% for DHW
RO	149	134	10%	117	106	10%
SK		54	not set yet		61	not set yet
SI	95	48	45 (50%, public buildings 55%)	65	38	(50%, public buildings 55%)
ES	87	60	50%	197	88	50%

SE	95		not quantified	70		not quantified

Source: JRC elaboration, 2025

In comparison with a previous assessment (2022) of NZEB performance levels, new residential NZEBs are currently on average 9% more ambitious. This improvement was obtained progressivity in almost all Member States. Renewable energy requirements are quantified in almost 70% of NZEB definitions for new buildings, provided either as percentages or absolute values in kWh/(m²y) and over 40% for existing buildings undergoing NZEB renovation. The minimum renewable energy share for new buildings ranges between 20% and 60%. A detailed analysis is included later in this report.

A common NZEB definition involves a year-long energy balance at the building level, considering on-site renewables, using as an indicator the primary energy demand for heating, cooling, ventilation, domestic hot water, built-in lighting, and auxiliary energy. Some definitions also cover additional energy uses like appliances, central services, and internal building mobility [D'Agostino et al, 2021]. The end-uses considered in the calculation for new buildings are reported in Table 4.

Table 4. End-uses considered in the calculation.

	Heating	Cooling	Ventilation	DHW	Lighting	Other	Notes
AT							
BE - Br							
BE - Wa							auxiliary energy
BE - Fl							
BG							
HR							
CY							auxiliary energy
CZ							auxiliary energy
DK							
EE							
FI							auxiliary energy, appliances
FR							auxiliary energy
DE							
GR							
HU							
IE							
IT							
LV							auxiliary energy
LT							auxiliary energy and other building services
LU							auxiliary energy
MT							
NL							
PL							
PT							
RO							auxiliary energy
SK							
SI							
ES							
SE							auxiliary energy

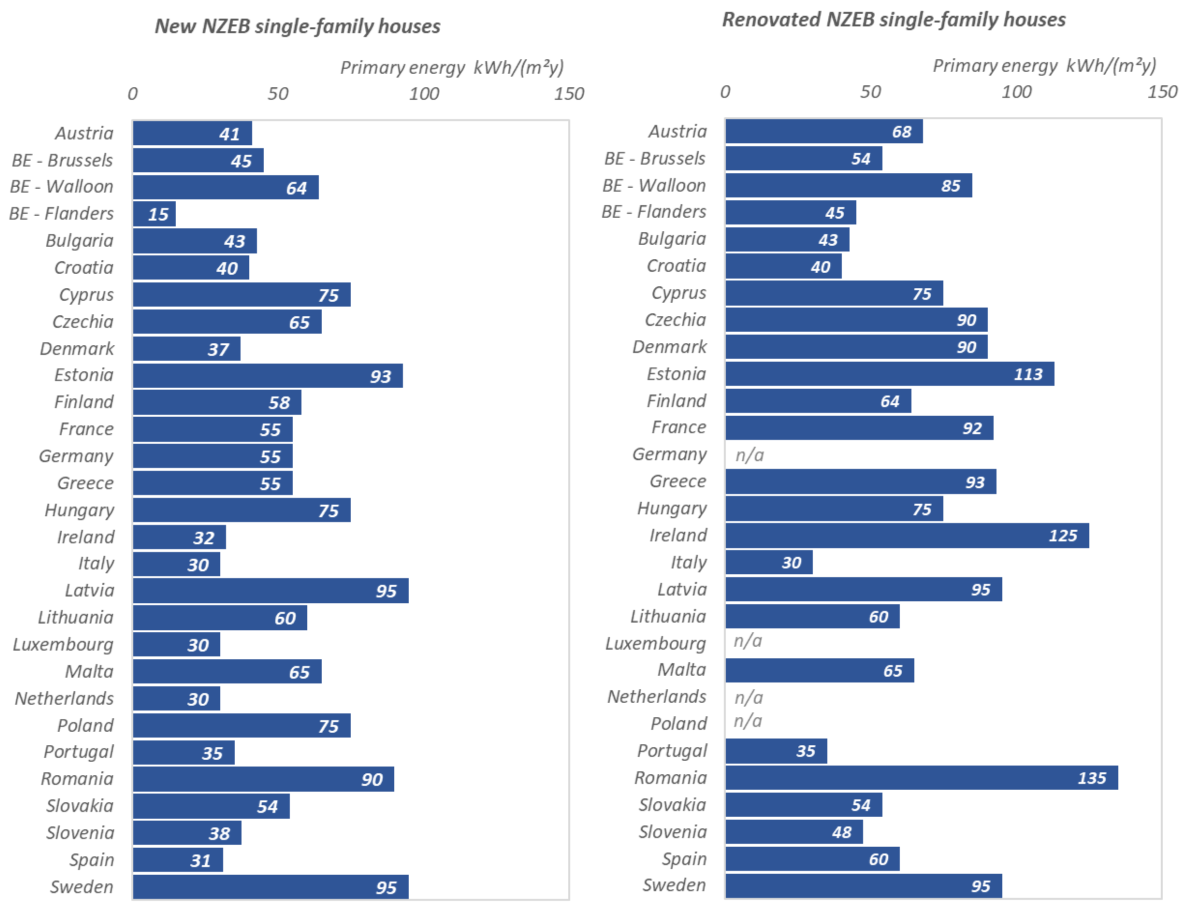
Included

Not included

Included only for non-residential

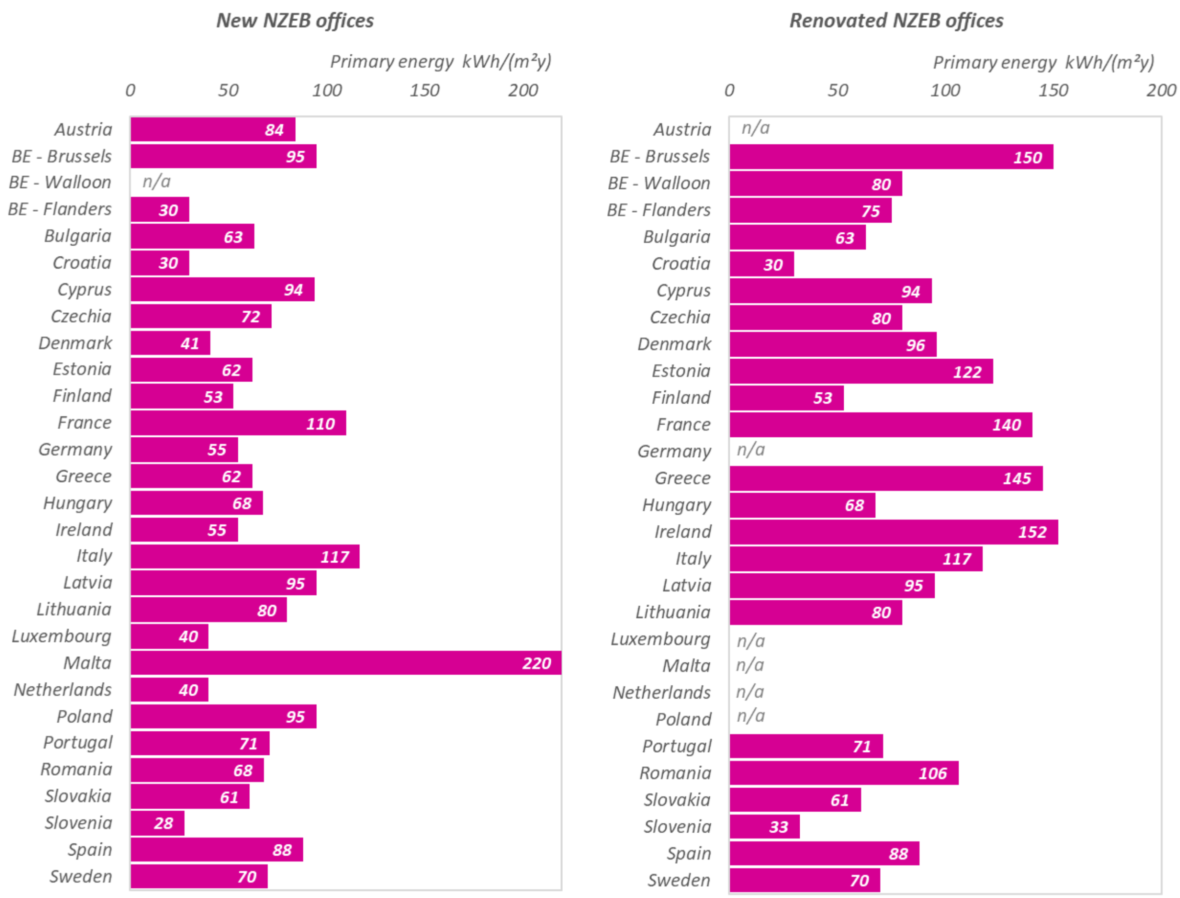
Figure 2 shows that the average non-renewable primary energy consumption for new single-family houses varies from a minimum of 15 kWh/(m²y) to a maximum of 95 kWh/(m² year), with an overall EU average of 54 kWh/(m²y). For renovated single-family houses, the estimated performance level range is broader, between 30 and 135 kWh/(m²y) with an EU average of 73 kWh/(m²y).

Figure 2. NZEB energy performance in new and renovated residential buildings (single family houses) expressed in non-renewable primary energy demand kWh/(m²y) by country



Source: JRC elaboration, 2025.

Figure 3. NZEB energy performance in renovated buildings (single family house) expressed in non-renewable primary energy demand kWh/(m²y).



Source: JRC elaboration, 2025

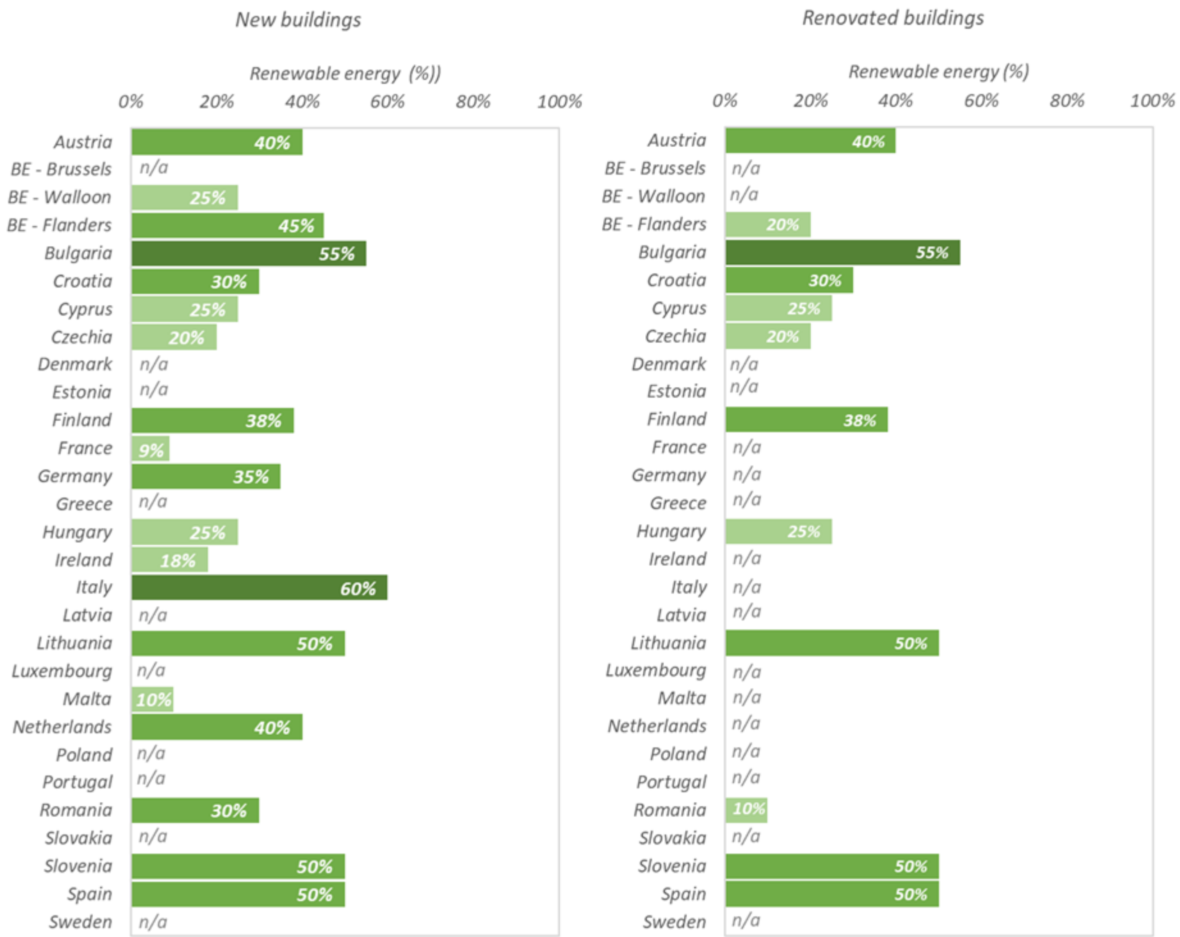
In non-residential buildings (offices), the average non-renewable primary energy consumption is found to be between 28 and 220 kWh/(m²y) for new offices (as depicted in Figure 3 with an overall EU average of 73 kWh/(m²y). For renovation to NZEB level of offices, the values range from 30 to 152 kWh/(m²y), with a corresponding EU average of 90 kWh/(m²y).

In most cases, the NZEB levels for new buildings are more demanding than those for NZEB renovation. On average, the non-renewable primary energy consumption of new NZEBs is approximately 30% lower than that of renovated NZEBs. This difference can potentially be attributed to stricter thresholds (Czechia, Estonia, France, Greece and Slovenia) and the more widespread and stringent renewable energy requirements in new buildings compared to existing ones (Walloon, Ireland, Malta and Romania).

2.2. NZEBs and renewables

The share of renewable energy from the total primary energy demand in new NZEBs is detailed in Figure 4 .Out of 29 definitions, 19 quantify the share of renewable energy in new buildings and 12 in NZEB renovation.

Figure 4. Renewable energy share (%) from the total primary energy demand in new and renovated



Source: JRC elaboration, 2025

The renewable energy contribution varies widely in both new and renovated NZEBs, ranging from 9-10% to 60% in new NZEBs, and up to 55% in NZEB renovations.

For new buildings, 7 countries aim at 25% or less renewable energy while 9aim at up to 50% renewable energy. Two countries report more than 50% renewable energy share in the total primary energy demand (Bulgaria 55% and Italy 60%)

For renovations to NZEB levels, 5 countries target up to a 25% renewable energy share, 6 aim for a maximum of 50%, and only one country (Bulgaria) reports more than 50% renewable energy, at 55%.

Additionally, Luxembourg notes that renewable energy typically constitutes about 65%, though this is not prescribed and depends on the reference building. Other countries report requirements only for specific end-uses (e.g., Greece and Portugal for domestic hot water preparation). Slovenia mandates a 55% renewable energy contribution in public buildings.

Within the JRC data collection, Member States were asked to detail which technologies and energy sources are considered in NZEBs, either new or existing. Table lists the main technologies considered by 17 countries that provided such information. Apart from these technologies, countries also mentioned heat pumps, waste heat, co-generation and renewable energy from the grid. More details are in Section 5.

Table 5. Renewable energy type in NZEBs definitions

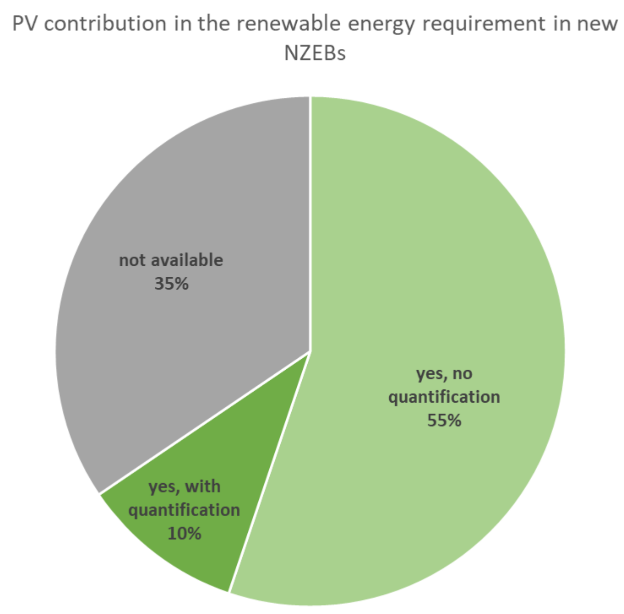
	PV	Solar thermal	Biomass	Wind turbines	Geothermal
Austria					
Belgium-Wallonia					
Belgium-Flanders					
Croatia					
Cyprus					
Czechia					
Denmark					
Estonia					
Germany					
Ireland					
Luxembourg					
Malta					
Netherlands					
Slovenia					
Spain					
Hungary					
Romania					

Note: Green means that the technology is reported, red means that the technology is not reported.

Source: JRC elaboration, 2025

It is observed that solar technologies, such as photovoltaics (PV) and solar thermal collectors are considered by all countries. Figure 5 provides further insights into the PV contribution in renewable energy requirements in new NZEBs. 16 definitions considered PV but with no quantification, while three definitions includes a quantification of the PV contribution. Finally, for 10 countries either the information is not available.

Figure 5. PV contribution in renewable energy requirements in new NZEBs



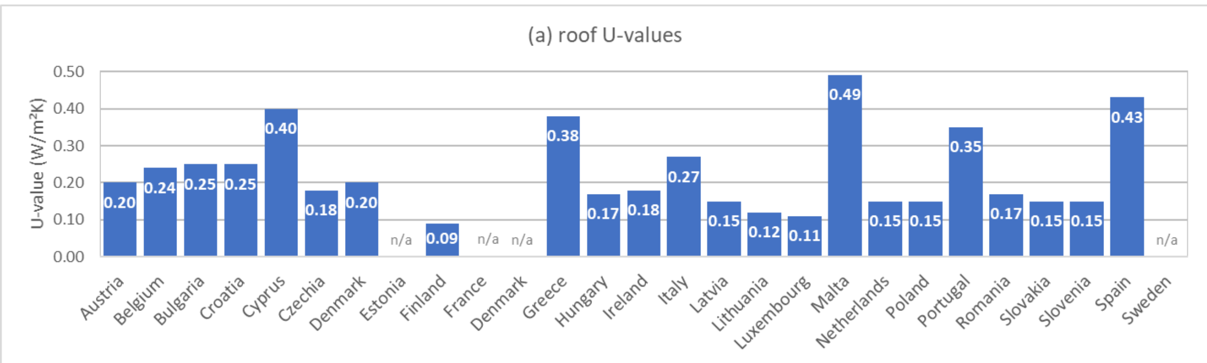
Source: JRC elaboration, 2025

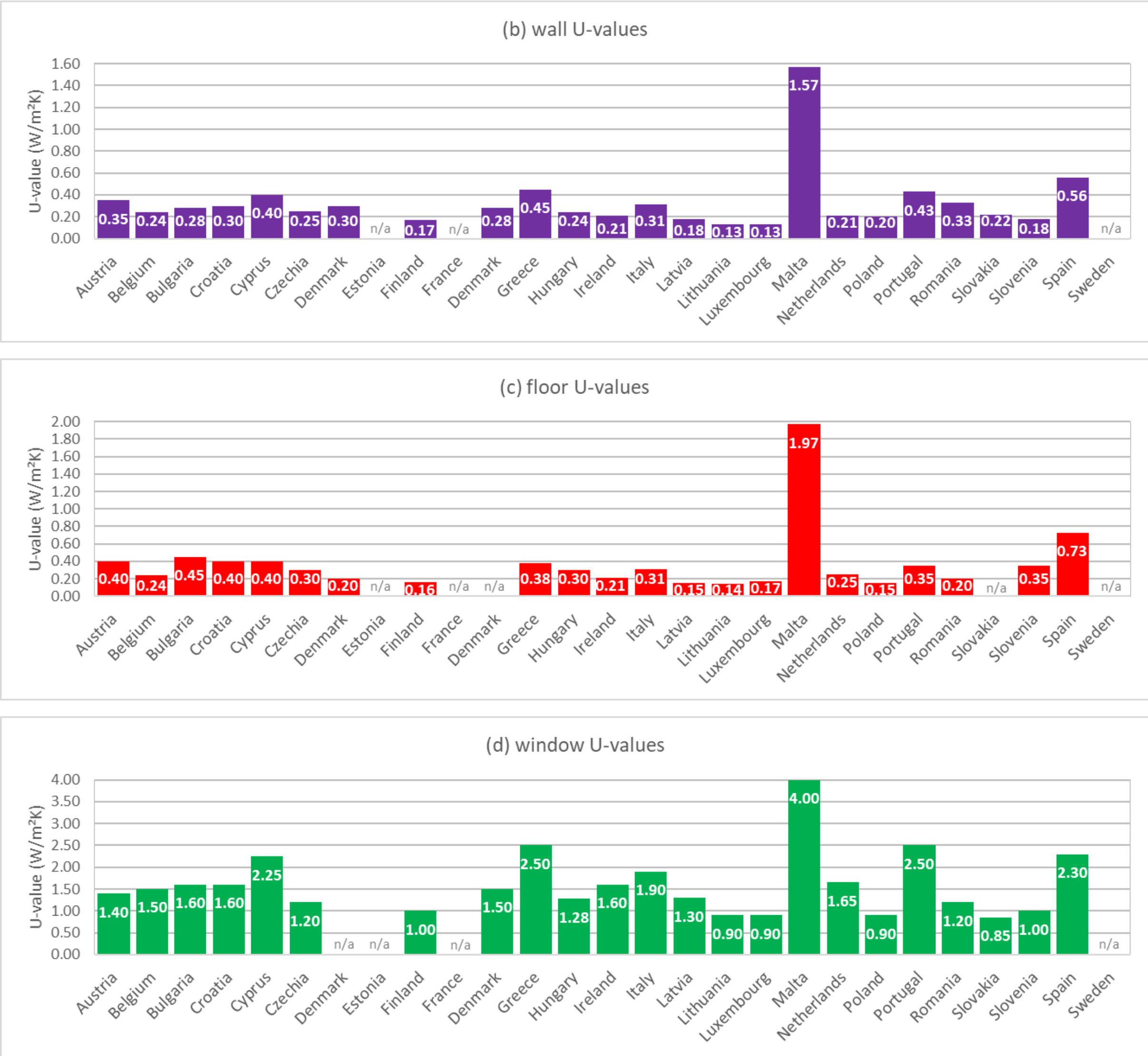
Two countries (Austria and Germany) quantify the PV energy supply share in new NZEB (20% and 15%, respectively), while Denmark set the maximum renewable electricity to be included in the energy balance of NZEB to 25 kWh/(m^2y). Two countries (Ireland and Italy) report specific requirements regarding PV system size and power, while the Netherlands estimates that a regular row house can meet RES requirement with about 25% of its roof covered with PV-panels.

2.3. NZEBs U-values

As for the building envelope, thermal transmittance (U-value, expressed in W/m²K) requirements for both new and existing NZEBs are present in around 80-85% of current NZEB definitions. An efficient thermal insulation is an important passive method to reduce energy demand and achieve energy savings. NZEBs U-values are reported for new buildings in Figure 6 as follows: for a) roof, b) wall, c) floor, and d) windows as collected by JRC in new buildings.

Figure 6. NZEB U-values in new buildings



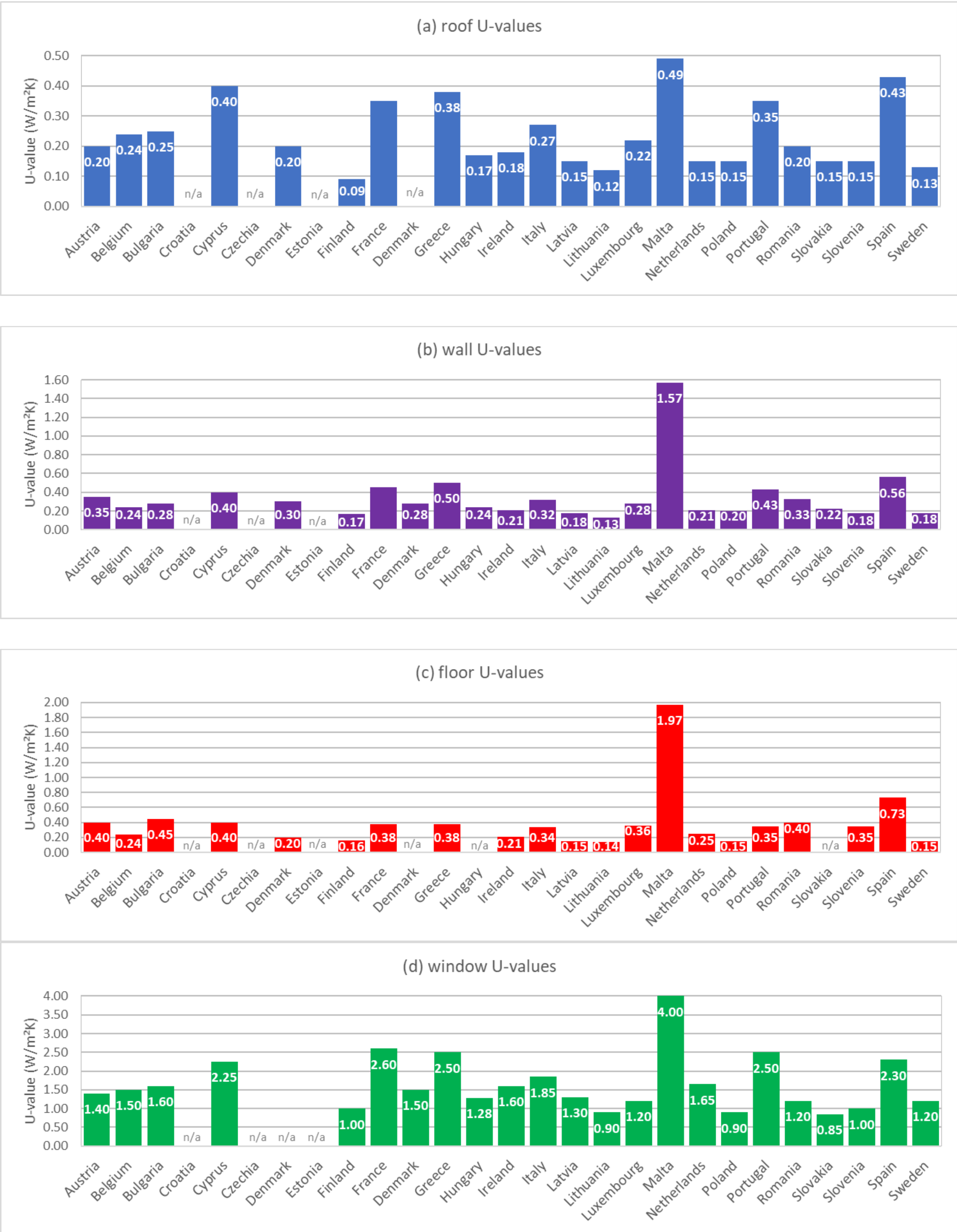


Source: JRC elaboration, 2025.

Apart from Estonia, France and Sweden that do not have in place specific requirements for the envelope, most countries have benchmarked the envelope U-values. To note that values reported by Portugal correspond to residential buildings, whereas values reported for Denmark correspond to non-residential buildings.

For new buildings, walls U-values range from 0.13 to 1.57 W/(m²K) with an average of 0.32 W/(m²K), roof U-values from 0.09 to 0.49 W/(m²K) with an average of 0.23 W/(m²K), windows U-values from 0.85 to 4.00 W/(m²K) with an average of 1.59 W/(m²K), floors U-values from 0.14 to 1.97 W/(m²K) with an average of 0.36 W/(m²K). Overall, the most ambitious requirements are for roofs, followed by walls, roofs, and windows. However, countries reported the U-values existing buildings renovated to NZEB level. These are shown in Figure 7 as follows: a) roof, b) wall, c) floor, and d) windows.

Figure 7. NZEB U-values in existing buildings



Source: JRC elaboration, 2025

Croatia, Czechia, and Estonia do not have in place specific requirements for the envelope of existing building undergoing NZEB renovation. Moreover, the U-values reported by Germany correspond to non-residential buildings, whereas U-values reported by Portugal correspond to residential buildings.

For existing buildings, walls U-values range from 0.13 to 1.57 W/(m^2K) with an average of 0.33 W/(m^2K), roof U-values from 0.09 to 0.49 W/(m^2K) with an average of 0.24 W/(m^2K), windows U-values from 0.85 to 4.00 W/(m^2K) with an average of 1.64 W/(m^2K), floors U-values from 0.14 to 1.97 W/(m^2K) with an average of 0.37 W/(m^2K). Similar to new buildings, the most ambitious requirements are for roofs, followed by walls, floors, and windows. When comparing the average U-values of new NZEBs to those of renovated NZEBs, it is evident that U-values for new buildings are only marginally more ambitious than those for existing buildings, being 3 to 4% lower.

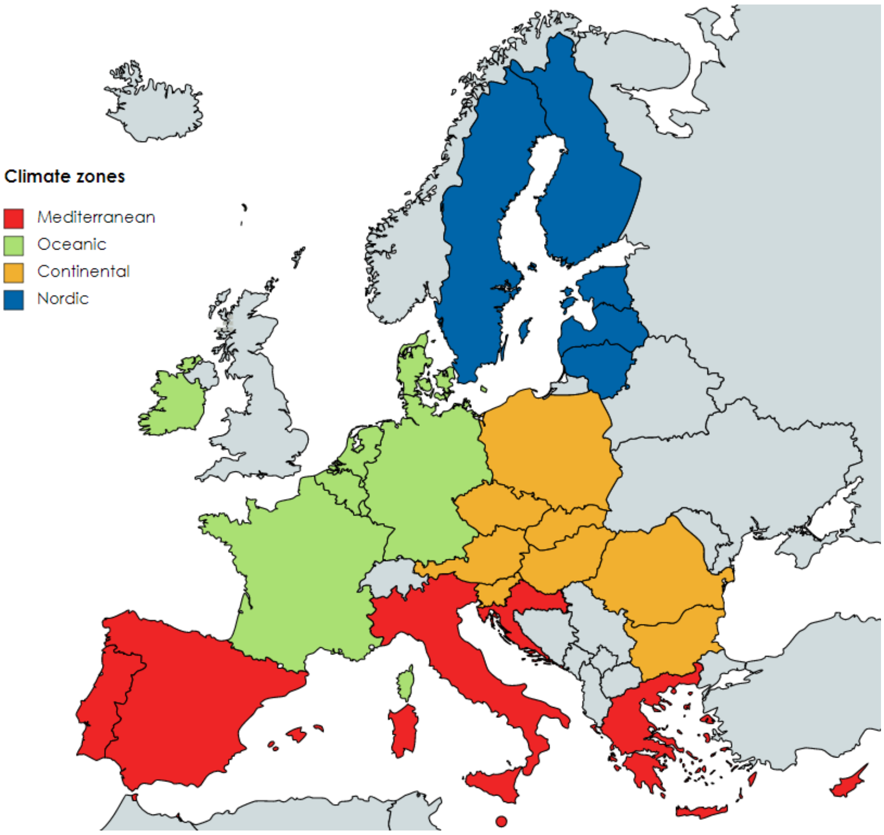
2.4. NZEBs and benchmark levels

The European Commission introduced recommended benchmarks for both total and non-renewable primary energy demand of NZEB [EC, 2016]. The benchmarks are defined per building type (specifically single-family houses and offices) and climatic zone. The EU macro climatic zones, as outlined in Table 6, consider location with similar global radiation, heating degree-days, cooling degree-days, and cooling potential by night ventilation. These climatic zones are extrapolated at national level resulting in the grouping of Member States are presented in Figure 8. The recommended NZEBs benchmark level of performance kWh/(m^2y) per building type depending on the climatic zone are reported in Table 7. Figure 9 compares national NZEB performance level and EC recommended values (non-renewable primary energy) for residential buildings (single family houses).

Table 6. Climatic zones as defined in [EU, 2016].

Mediterranean	Oceanic	Continental	Nordic
Catania (others: Athens, Larnaca, Luga, Seville, Palermo)	Paris (others: Amsterdam, Berlin, Brussels, Copenhagen, Dublin, London, Macon, Nancy, Prague, Warszawa)	Budapest (others: Bratislava, Ljubljana, Milan, Vienna)	Stockholm (others: Helsinki, Riga, Stockholm, Gdansk, Tovarene)

Figure 8. Member States division within climatic zones: Mediterranean: Cyprus, Croatia, Italy, Greece, Spain and Portugal, Oceanic: Belgium, Denmark, Ireland, Germany, France Luxembourg, and Netherlands, Continental: Austria, Bulgaria, Hungary, Poland, Romania, Slovenia, and Slovakia, Nordic: Estonia, Finland, Latvia, Lithuania, and Sweden.



Source: JRC elaboration, 2025

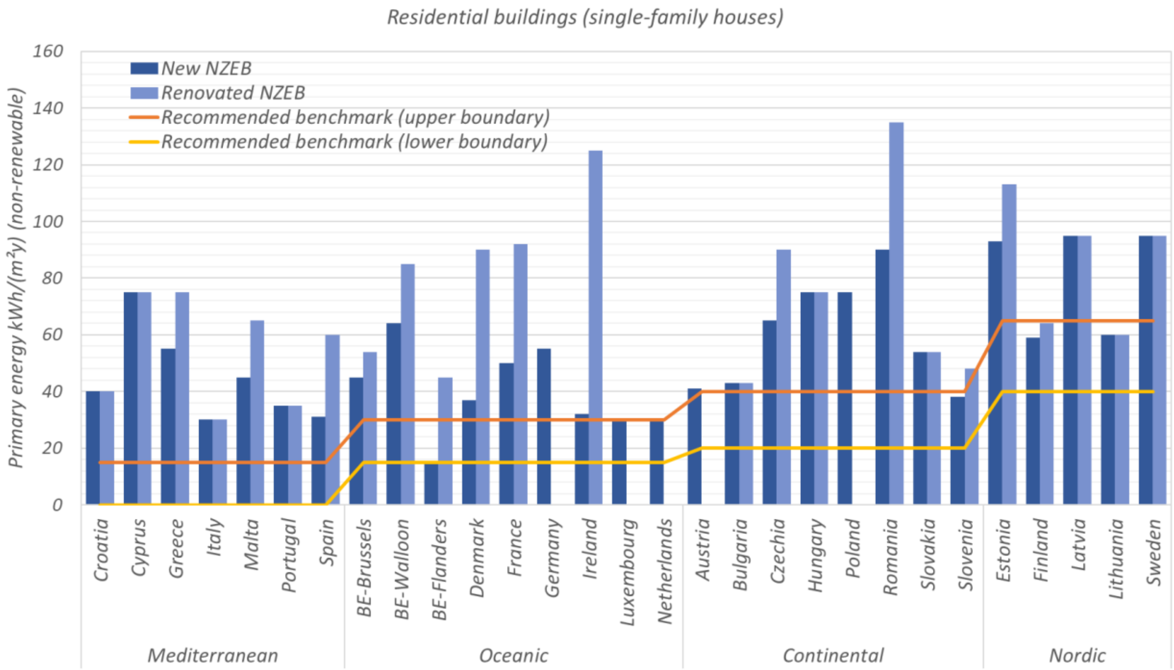
Table 7. NZEBs Recommendation level of performance (kWh/m^{2}y) per building type according to the climatic zone

	NZEB RECOMMENDATION BENCHMARK		National NZEB average LEVELS kWh/(m^{2}y)
	Net primary use (on-site RES excluded) kWh/(m^{2}y)	Primary use kWh/(m^{2}y)	
Mediterranean			
Office	40-55	85-100	30-112
Single family house	0-15	50-65	30-75
Oceanic			
Office	40-55	85-100	20-110
Single family house	15-30	50-65	15-64
Continental			
Office	40-55	85-100	38-100
Single family houses	20-40	50-70	41-90
Nordic			

Office	55-70	85-100	53-95
Single family house	40-65	65-90	59-95

Source: JRC elaboration, 2025.

Figure 9. Comparison between national NZEB performance level and EC recommended values (non-renewable primary energy) for residential buildings (single family houses)



Source: JRC elaboration, 2025.

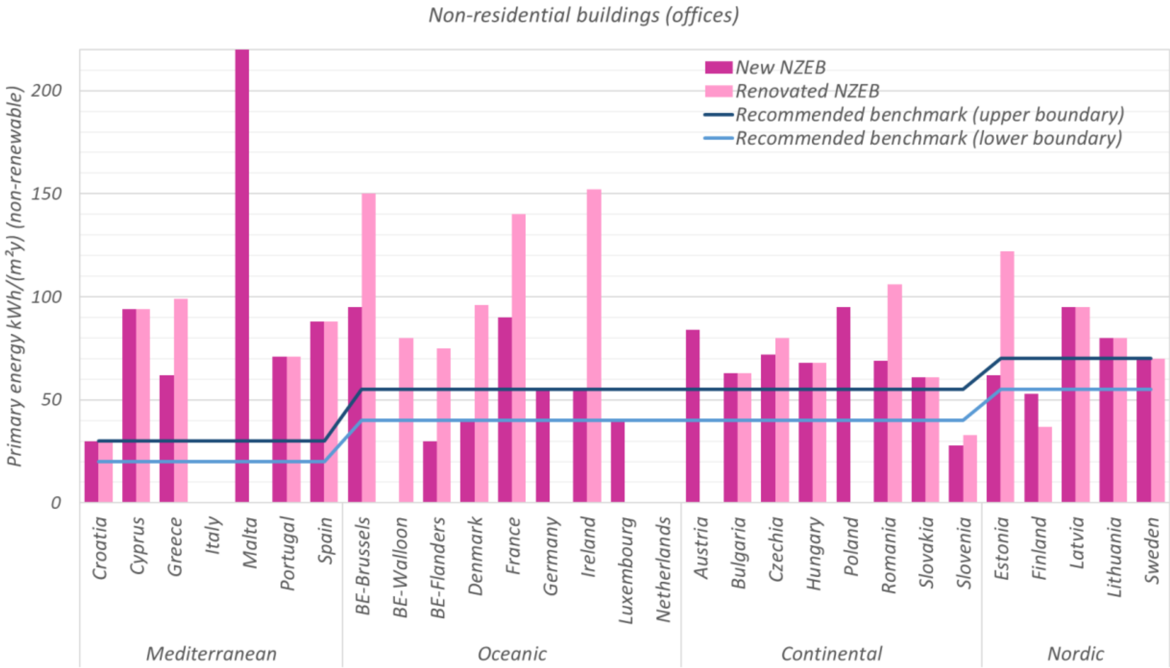
It can be observed that in most cases the national NZEB primary energy demand is less ambitious than the recommended benchmarks for single family houses, particularly for existing buildings renovated to NZEB level.

For new buildings, the gap between the current levels and benchmarks varies from 400% (Cyprus) to -50% (Flanders). For NZEB renovation, the gap ranges between 400% (Cyprus and Greece) to -8% (Lithuania). On average, the primary energy demand of new NZEBs is about 75% higher than the recommended benchmarks, while the primary energy demand of renovated NZEBs is 147% higher than the same benchmarks.

Looking at the lower boundary of the benchmark range, only Flanders reports a compliant level for new buildings. Looking at the upper boundary of the benchmark range, good practices are observed in Flanders, Luxembourg, Netherlands, Slovenia, Finland and Lithuania for new buildings, while for NZEB renovation only Finland and Lithuania report a level more ambitious than the EC recommendation.

Figure 10 compares national NZEB performance level and EC recommended values (non-renewable primary energy) for non-residential buildings (offices).

Figure 10. Comparison between national NZEB performance level and EC recommended values (non-renewable primary energy) for non-residential buildings (offices)



Source: JRC elaboration, 2025

Looking at the performance level of new and renovated NZEB offices, it can be observed that in most cases, the primary energy demand is higher than the recommended levels.

For new offices, the gap between the current levels and benchmarks varies from 213% (Cyprus) to -49% (Slovenia). For NZEB renovation, the gap ranges between 230% (Greece) to -47% (Finland). However, the situation looks more positive than in the case of residential buildings. On average, the primary energy demand of new NZEBs is about 58% higher than the recommended benchmarks, while the primary energy demand of renovated NZEBs is 75% higher than the same benchmarks.

Looking at the lower boundary of the benchmark range Flanders, Denmark, Germany, Ireland, Luxembourg are within the range for new buildings, while in Slovenia and Finland both new and NZEB renovation levels are within the recommended levels. Looking at the upper boundary, good practices are observed in Croatia, Flanders, Denmark, Germany, Ireland, Luxembourg, Netherlands, Slovenia, Estonia, Finland, and Sweden for new buildings, while for NZEB renovated offices, Estonia, Finland and Sweden report a level more ambitious than the EC recommendation levels on NZEBs.

3. NZEBs information from LTRS 2020, NECPR 2023 and draft NECPs 2023

Other relevant source of information to assess the progress of NZEB implementation in the EU is represented by Long-Term Renovation Strategies (LTRS) submitted in 2020, draft National Energy and Climate Plans (NECPs) and Progress Reports (NECPR) submitted by the Member States in 2023.

Eleven Member States have defined long-term milestones for 2030, 2040 and 2050 related to NZEBs implementation (highlighted in green). The NZEB milestones could be related to the percentage of NZEB to the total building stock (i.e. Croatia, Hungary, Sweden), the energy savings from the conversion to NZEB (i.e. Hungary), the number of dwellings to be renovated to NZEB (i.e. Ireland), floor are of NZEB buildings (i.e. Romania, Slovenia). The annual renovation of the 3% of public buildings to NZEB as defined by the EPBD Recast has also been mentioned by some Member States (i.e. Hungary, Germany). Other Member States (i.e. Slovenia) plan to use also NZEB indicators to monitor the progress towards the decarbonisation of the building stock in 2050. Table 8 include such milestones for countries with available data. Other long-term milestones could regard energy and emissions reduction, renovation rates, area to be deeply renovated without mentioned or defining NZEB explicitly. These cases are highlighted in grey in Table 8.

A selection of measures is also reported in Table 9 and Table 10 as extracted from LTRS and NECP. As seen from the tables, financial incentives, updates of NZEB standards definitions, NZEB pilot projects, training and energy consultancy programmes are included.

Table 8. NZEBs targets for 2030, 2040 and 2050 (source: Long term Renovation strategies 2020, NECPs 2023)

	RESIDENTIAL			NON-RESIDENTIAL			Methods
	2030	2040	2050	2030	2040	2050	
AT	energy-efficient renovations and energy-efficient/ household appliances/ reduction of space heating demand/ reduction of GHG emissions of building sector						
BE-BR	No NZEB milestones included						
BE-WA	Intermediate targets to achieve 2050 goals		aim in 2050 towards an average decarbonised EPB label for the entire housing stock and prioritise deep renovation of the worst-performing dwellings, while ensuring that any renovation project is part of a comprehensive reflection consistent with the region's objectives, structured in the timetable for implementing the renovation strategy	Carbon neutrality by 2035 for schools, offices and shops, and by 2040 for the rest		energy-neutral building stock for heating, cooling and lighting (buildings will produce as much energy as they consume)	deep renovation, building passports, renovation roadmaps
BE-FLA			long-term target definition for residential buildings under preparation through Renovation Pact (reduction of current energy performance requirement indicator by 65-85%)			a carbon-neutral non-residential building stock for heating, domestic hot water, cooling and lighting by 2050, with the government leading by example	
BG	No NZEB milestones included Update of NZEB definition (2021-2030) Milestones on energy,	No NZEB milestones included Milestones on energy, CO_2 emissions, renovated area	No NZEB milestones included Milestones on energy, CO_2 emissions, renovated area	No NZEB milestones included Update of NZEB definition (2021-2030) Milestones on energy, CO_2 emissions, renovated area	No NZEB milestones included Milestones on energy, CO_2 emissions, renovated area	No NZEB milestones included Milestones on energy, CO_2 emissions, renovated area	

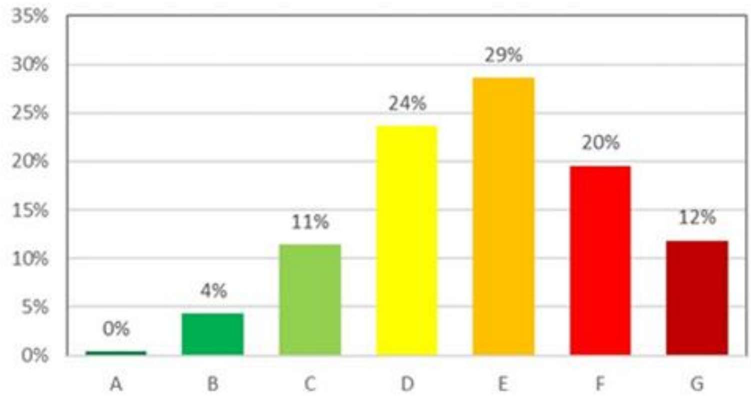
	CO_2 emissions, renovated area						
CY	No NZEB milestone included. Target: 373 ktoe final energy demand	No NZEB milestone included. Target: 373 ktoe final energy demand	No NZEB milestone included. Target: 361 ktoe final energy demand	No NZEB milestone included Target: 266 ktoe final energy demand	No NZEB milestone included Target: 277 ktoe final energy demand	No NZEB milestone included. Target: 279 ktoe final energy demand	combination of public and private funds
CZ	No NZEB milestones included						
HR		60% of nearly zero-energy or high energy efficiency buildings	All nearly zero-energy or high-energy efficiency buildings / reducing GHG in buildings by 80%.		60% of nearly zero-energy or high energy efficiency buildings	All nearly zero-energy or high-energy efficiency buildings / reducing GHG in buildings by 80%.	Promoting NZEB construction and renovation standards, monitoring number and floor are of NZEBs through Certificates, promoting skills and technologies in the field of NZEB, investments: 26544 million EUR (2021-2030 for new NZEB
HU	nearly zero-energy buildings to reach 20%	6.6 PJ/10 years of new savings based on a linear trajectory and 14,615/10 years PJ over 10 years for the conversion to NZEB nearly zero-energy buildings to reach 60%	157,638 ktoe/10 years of new savings based on a linear trajectory and 349,073 ktoe over 10 years for the conversion to NZEB nearly zero-energy buildings to reach 90 % by 2050.	20% energy savings in public building or 80 PJ (cumulative) additional savings resulting from the strengthening of the target from cost-optimal to NZEB. nearly zero-energy buildings to reach 20% 3 % annual renovation to nearly zero energy in public buildings.	6.6 PJ/10 years of new savings based on a linear trajectory and 14,615/10 years PJ over 10 years for the conversion to NZEB nearly zero-energy buildings to reach 60%	157,638 ktoe/10 years of new savings based on a linear trajectory and 349,073 ktoe over 10 years for the conversion to NZEB nearly zero-energy buildings to reach 90 % by 2050.	Readjust legislation requirements, energy certificates methodology, monitoring of NZEB indicators, training/ skills, mobilisation of investments
IE	355,000 new dwellings will be constructed		ensuring that new buildings are to at least a nearly zero-energy building (NZEB) standard			ensuring that new buildings are to at least a nearly zero-energy building (NZEB)	advanced performance requirements in the current

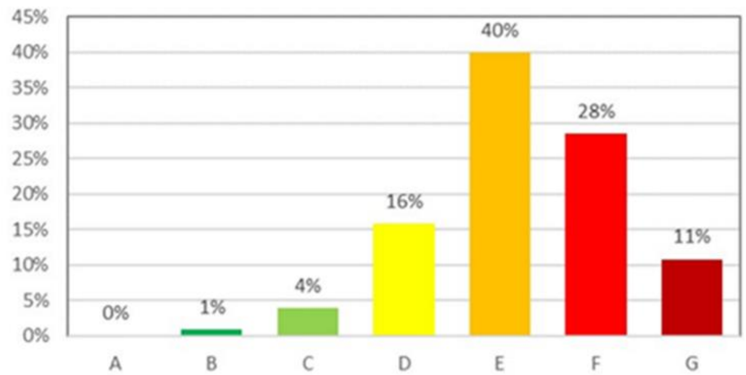
<table>
<tr><td></td><td>to a Building Energy Rating (BER) level of A by 2030 (current NZEB level=A2)</td><td></td><td></td><td></td><td></td><td>standard</td><td>regulations combined with a mandatory renewables requirement, NZEB training</td></tr>
<tr><td>DK</td><td colspan="7">No NZEB milestones included</td></tr>
<tr><td>DE</td><td></td><td></td><td>energy-neutral building stock (non-renewable primary energy demand to be reduced by 80%)</td><td>3 % of the total floor area of heated and/or cooled buildings must be owned by the public every year. Facilities (federal, state, municipal) are renovated at least into nearly zero-energy buildings (NZEBs) or zero-emission buildings (ZEBs)</td><td></td><td>energy-neutral building stock (non-renewable primary energy demand to be reduced by 80%)</td><td>regulatory law, financial incentives, information and advice.</td></tr>
<tr><td>EE</td><td colspan="7">No NZEB milestones included</td></tr>
<tr><td>FI</td><td></td><td></td><td colspan="5">The number of NZEBs is monitored as an indicator describing the development of the building stock in next decades with the information available in the energy performance certificate register. The milestones are based on results of the calculation model used as the basis for the Long Term Renovation strategy. They are used to anticipate the development of the average E-value of the different building types during each decade.
<table>
<tr><th>5. Share of nearly zero energy buildings</th><th>Indicator</th><th>Unit</th><th>2020</th></tr>
<tr><td>Single-family and semi-detached houses E-value < 100</td><td>Share of nearly zero energy buildings total</td><td>%</td><td></td></tr>
<tr><td>Terraced houses E-value < 105</td><td>Share of nearly zero energy buildings total</td><td>%</td><td></td></tr>
<tr><td>Blocks of flats E-value < 90</td><td>Share of nearly zero energy buildings total</td><td>%</td><td></td></tr>
<tr><td>Office buildings E-value < 100</td><td>Share of nearly zero energy buildings total</td><td>%</td><td></td></tr>
<tr><td>Commercial buildings E-value < 135</td><td>Share of nearly zero energy buildings total</td><td>%</td><td></td></tr>
<tr><td>Educational buildings and day-care centres E-value < 100</td><td>Share of nearly zero energy buildings total</td><td>%</td><td></td></tr>
</table></td></tr>
<tr><td>FR</td><td>No NZEB milestones</td><td>No NZEB milestones</td><td>No NZEB milestones</td><td>The annual renovation of 3 % of buildings above 250 m² at NZEB level</td><td>No NZEB milestones</td><td>No NZEB milestones</td><td></td></tr>
<tr><td>EL</td><td>Reduction of final energy consumption in buildings of 8 % compared to 2015</td><td>Reduction of final energy consumption in buildings of 8 % compared to 2015</td><td>Reduction of final energy consumption in buildings of between 28 % and 40 % compared to 2015</td><td>Reduction of final energy consumption in buildings of 8 % compared to 2015</td><td>Reduction of final energy consumption in buildings of 8 % compared to 2015</td><td>Reduction of final energy consumption in buildings of between 28 % and 40 % compared to 2015</td><td>fiscal and economic incentives, regulatory framework developments, capacity building</td></tr>
</table>

	1.4% renovation rate per year in the residential sector 76% average energy savings due to renovation in residential sector	1.5% renovation rate per year in the residential sector 61% average energy savings due to renovation in residential sector	1.7% renovation rate per year in the residential sector 37% average energy savings due to renovation in residential sector	0,8% renovation rate per year in the services sector	0.6% renovation rate per year in the services sector	0.6% renovation rate per year in the services sector	and good practices, Public Private Partnerships
ES			All buildings in the building stock will be Zero Emission Buildings (ZEB) by 2050. *In 2050, 7,1 millions houses are expected to had deep renovation, lowering their individual consumption at 12 kWh/m2. The stock of new buildings between 2020 and 2050 is projected to be of 3,9 millions houses, all of them NZEBs, as prescribed by the new regulations.*			All buildings in the building stock will be Zero Emission Buildings (ZEB) by 2050	
IT	1.9% annual retrofitting rate 2021-2030	2.7% annual retrofitting rate 2031-2040	2.7% annual retrofitting rate 2041-2050	2.8% annual retrofitting rate 2021-2030	2.6% annual retrofitting rate 2031-2040	2.6% annual retrofitting rate 2041-2050	Retrofitting measures, i.e. Thermal Energy Account
LV			the construction of all new buildings meets the requirements of zero-energy buildings, and the renovation and conversion of all buildings meets the requirements of zero or near zero-energy buildings GHG 111.9 kt of CO_2 in entire buildings sector 199766 buildings to be insulated			the construction of all new buildings meets the requirements of zero-energy buildings, and the renovation and conversion of all buildings meets the requirements of zero or near zero-energy buildings. GHG 111.9 kt of CO_2 in entire buildings sector 97200 buildings to be insulated	5.7 billion EUR for renovation of the entire building stock (2021 – 2030 and 2031-2040), 7.6 billion EUR for renovation of the entire building stock (2041-2050) National Energy Efficiency Fund and other financial

							and fiscal mechanisms
LT	No NZEB milestones 66% CO_2 emissions in multi-apartment buildings and 78% in private houses(2020=100%)	No NZEB milestones 30% CO_2 emissions in multi-apartment buildings and 42% in private houses(2020 =100%)	No NZEB milestones • to reduce the annual primary energy consumption of the building stock to 16.2 TWh (~60%) compared to 2020; • to reduce the annual consumption of primary energy from fossil fuels in the building stock to 0 TWh (100%); • to reduce the annual CO_2 emissions of the building stock to 0 mtCO_2 (100%)	No NZEB milestones 79% CO_2 emissions (2020=100%)	No NZEB milestones 43% CO_2 emissions (2020=100 %)	No NZEB milestones • to reduce the annual primary energy consumption of the building stock to 16.2 TWh (~60%) compared to 2020; • to reduce the annual consumption of primary energy from fossil fuels in the building stock to 0 TWh (100%); • to reduce the annual CO_2 emissions of the building stock to 0 mtCO_2 (100%)	Subsidies, benefits to owners, development of RES technologies
LU	No NZEB milestones CO_2 emission and energy consumption milestones						
MT	NZEB milestones will be developed in line with the updated NZEB plan (2023)						Updated NZEB Plan 2023
NL			CO_2 neutral low temperature heating, reduction of the use of natural gas			CO_2 neutral low temperature heating, reduction of the use of natural gas	Energy Agenda strategy
PL	No qualitative NZEB milestones phasing out the use of sources based on fossil fuels (including natural gas) as the key energy carriers in the context of the energy renovation	No qualitative NZEB milestones phasing out the use of coal by 2040 in all residential buildings	No qualitative NZEB milestones phasing out the use of fossil fuels by replacing heat sources or using zero-emission alternatives (e.g. biomethane, synthetic fuels, hydrogen) in the other buildings with parallel deep energy renovation by 2050	No qualitative NZEB milestones phasing out the use of sources based on fossil fuels (including natural gas) as the key energy carriers in the context of the energy renovation of residential and non-residential buildings by	No qualitative NZEB milestones	No qualitative NZEB milestones phasing out the use of fossil fuels by replacing heat sources or using zero-emission alternatives (e.g. biomethane, synthetic fuels, hydrogen) in the other buildings with	mass replacement of heat sources, connection of buildings to zero-emission district heating networks, the installation of biomass sources, insulation

	of residential and non-residential buildings by 2030, while maintaining the use of hybrid solutions and sources adapted to the use of zero-emission alternatives			2030, while maintaining the use of hybrid solutions and sources adapted to the use of zero-emission alternatives		parallel deep energy renovation by 2050	of the envelope plus removal of asbestos-containing products, replacement of window and door frames
PT	No specific NZEB milestones 15% primary energy savings compared to 2018 16% CO_2 reduction compared to 2018	No specific NZEB milestones 37% primary energy savings compared to 2018 56% CO_2 reduction compared to 2018	No specific NZEB milestones 40% primary energy savings compared to 2018 85% CO_2 reduction compared to 2018	No specific NZEB milestones 7% primary energy savings compared to 2018 15% CO_2 reduction compared to 2018	No specific NZEB milestones 15% primary energy savings compared to 2018 37% CO_2 reduction compared to 2018	No specific NZEB milestones 28% primary energy savings compared to 2018 68% CO_2 reduction compared to 2018	Improve energy requirements, contribution of renewable energies, credit lines for renovation, tax incentives, adapt the training of professionals, monitoring of NZEB indicators
RO	NZEB target values increased by 1% (incremental growth) 1.52 Mm^2 NZEB buildings	NZEB target values increased by 4% (incremental growth) 13.31 Mm^2 NZEB buildings	NZEB target values increased by 23% (incremental growth) 93.06 Mm2 NZEB buildings	NZEB target values increased by 1% (incremental growth) 2.6 Mm^2 NZEB buildings	NZEB target values increased by 4% (incremental growth) 7.27 Mm^2 NZEB buildings	NZEB target values increased by 23% (incremental growth) 24.3 Mm^2 NZEB buildings	Public funds ,subsidies, training programmes and accreditation of a minimum number of graduates with new skills

<table>
<tr><td>SE</td><td colspan="7">Approximately 15% of single-family houses with an energy certification fulfil the NZEB requirement (Figure below).


For apartment buildings, the requirement of NZEBs (classes A-C) is reached in approximately 5% of buildings (Figure below).


Milestones are foreseen in 2030, 2040 and 2050 to increase the number of NZEBs (classes A-C). The year 2020 is considered the baseline to monitor the increasing number of NZEBs through the Energy declaration register.</td></tr>
<tr><td>SI</td><td>1.Energy consumption will be reduced by 6.05 PJ or 26 %, with 36 per cent of NZEBs.(2.48 PJ savings in heating)

2. 1422000 m² dwellings renovated to NZEB (2021-2030)

1. 3. 24505 m² NZEB dwellin</td><td>1. 15359000 m² dwellings renovated to NZEB (2031-2040)

2. 2. 4.67 PJ savings in heating from NZEBs

3. 3. 44798 m² NZEB dwellings in</td><td>1. 1. 43096000 m² dwellings renovated to NZEB (2041-2050)

2. 2. 5.18 PJ savings in heating from NZEBs

3. 3. 51666 m² NZEB dwellings in 2050

4. Energy demand for heating reduced by 30% (as a result of renovations)</td><td>4. 1.Public: Energy consumption will be reduced by 0.7 PJ or 20 %, with 26 per cent of NZEBs (2.8 PJ savings in heating)

5. 2.Public: 25.7% of public sector buildings to be NZEB

3.Private: Energy consump-</td><td>1.Public: 2.5 PJ savings in heating

2.Public: 50.2% of public sector buildings to be NZEB

3.Private: 3.5 PJ savings in heating

4.Private: 48.4% of private sector buildings to be NZEB</td><td>1.Public: 2.6 PJ savings in heating

2.Public: 75.1% of public sector buildings to be NZEB

3.Private: 3.7 PJ savings in heating

4.Private: 72.4% of private sector buildings to be NZEB</td><td>• Monitoring indicator 3: energy savings and the role of nearly zero energy buildings
• Financial incentives for RES
• Redrafting legislation</td></tr>
</table>

	gs in 20 30	204 0		tion will be reduced by 3.7 PJ or 16 %, with 24 per cent of NZEBs (3.7 PJ savings in heating) 4.Private: 24.4% of private sector buildings to be NZEB			• Financing by the Eco Fund
SK	Forecast of around 3% renovation to NZEB Emission and energy savings milestones	Forecast of around 8% renovation to NZEB Emission and energy savings milestones	Forecast of around 10% renovation to NZEB Emission and energy savings milestones	Forecast of around 3% renovation to NZEB Emission and energy savings milestones	Forecast of around 8% renovation to NZEB Emission and energy savings milestones	Forecast of around 10% renovation to NZEB Emission and energy savings milestones	Loans for renovation, improving skills and awareness, readjust building standards, introduce of RES

Source: JRC elaboration, 2025

Table 9. Measures/Projects/Programmes for NZEBs in Member States as extracted from Long Term Renovation strategies

AT	• Project promoter – Intermediate Financial Institution: ERSTE BANK DER ÖSTERREICHISCHEN SPARKASSEN AG Description: The “Framework loan” finances the construction of a non-profit/supported housing in Austria between 2018 and 2023. The final beneficiaries of this project brokered by Erste Bank are non-profit municipalities and commercial/private companies. EIB financing: EUR 100 000 000, Total cost: EUR 200 000 000 Environmental aspects: The housing projects to be financed under the project must meet high environmental standards and will contribute significantly to the improvement of the urban environment by rehabilitating brownfields and unused urban regeneration sites. The housing units to be financed must meet the legal requirements for the energy performance of residential buildings (low-energy house standard). Part of the investments will reach higher energy efficiency classes (NZEB).

	• Project promoter – Intermediary Financial Institution: HYPO VORARLBERG Description: The EIB Group, consisting of the European Investment Bank (EIB) and the European Investment Fund (EIF), has provided two guarantees for a EUR 330 million portfolio of Austrian and German loans to small and medium-sized enterprises (SMEs) and mid-caps issued by Hypo Vorarlberg Bank AG. EIB financing: EUR 68 165 Environmental aspects: This transaction is the first synthetic securitisation to allow a significant transfer of risk to a bank under the Standardised Approach to Capital Requirements. Therefore, instead of a single guarantee for the mezzanine tranche, the EIB Group provided two guarantees for the mezzanine and senior tranches of the transaction. As a result of the regulatory capital relief, Hypo Vorarlberg will increase its lending to households and corporate clients for energy efficient renovation of buildings or the construction of NZEB.
BG	• Support for the implementation of pilot projects for upgrading buildings to energy class A or NZEB standard, Partial subsidy from the National Decarbonisation Fund, 2021-2030 • Differentiation of the level of technical and financial assistance depending on the energy efficiency class achieved, taking into account the requirement for NZEB, Specialist credit lines /Concessional loans from revolving funds/financial instruments with revolving capita, 2021 • Support for pilot projects for the application of new or improved technologies and techniques for renovation with a view to upgrading buildings to energy Class A or the NZEB standard • Review of the national definition of NZEB • Providing specialist training, methodological guidance and making information materials on building stock renovation, including the achievement of the requirements for NZEB, available to designers, supervisors, energy auditors and building supervision bodies, 2021-2030
HR	• ENU-2: Promoting NZEB construction and renovation standards Information measure; 2019–2030 implementation Description of the measure and its goal: After 31 December 2018, all public buildings in Croatia occupied or owned by public bodies must be constructed according to the NZEB standard, and the obligation for all other newly constructed buildings takes effect after 31 December 2020. These legal provisions ensure that all newly constructed buildings from 2021 onwards comply with the NZEB standard. However, in order to ensure the correct application of these provisions and encourage the energy renovation of buildings to the NZEB standard, a series of information and educational activities are planned in the coming period to promote construction and renovation according to the NZEB standard. Sources of financing: State Budget, Ministry of Physical Planning, Construction and State Assets
DE	• Energy consultancy services for non-residential buildings of local authorities and non-profit organisations (EBK): New construction consultancy for non-residential buildings is also promoted in order to help municipalities implement the example-setting role of public bodies (Nearly Zero Energy Buildings). • The funding measure Innovative Projects for the Nearly Climate-Neutral Building Stock in 2050 (notification of the support initiative 'EnEff.Gebäude.2050 – Innovative Projects for the Nearly Climate-Neutral Building Stock in 2050' of 14 March 2016 and 20 October 2017) will be continued as part of the 7th ERP.

IT	The Conto Termico [Thermal Energy Account] is a non-repayable capital contribution granted for implementing small energy efficiency measures and producing thermal energy from renewable sources in existing air-conditioned public buildings registered with the Land Registry. Energy efficiency measures can involve the building envelope, systems or both, with other benefits for NZEB transformation projects. The grant may cover up to 65% of the costs connected to energy efficiency that meet the technical requirements set out by the Conto Termico decree, including as part of more extensive building retrofitting projects. For schools and health facilities, the grant may cover up to 100% of costs. Design costs are compensated at the same percentage as that set for measures; the costs of energy audits and post operam energy performance certificates, which are mandatory in many cases, are fully covered.
CY	• The 'Save & Upgrade' programme finances renovations of buildings owned or operated by SMEs. The project provides financial support for a package of measures that upgrade the building to a minimum level of energy efficiency. A larger subsidy is awarded to buildings that are refurbished into NZEB and vulnerable consumers' homes. • An important on-going policy instrument is Order No 1 of 2014 (Additional floor space "allowance" for new buildings and building that are renovated), as issued by the Minister for Interior on the basis of the Town and Country Planning Law. New buildings and buildings to be renovated shall be allowed to increase the building rate by 5 % for Energy Class A building, with primary energy not exceeding 50 kWh/m^{2}y, and at least 25% of their total energy needs shall be covered by renewables. The objective is to stimulate the construction or renovation of buildings to go beyond the requirements applicable to NZEB, obtaining 16.5 ktoe of cumulative end use energy savings. • Within the framework of the Proposals for the 2021-2027 programme of the European Structural Funds, a proposal relates to the energy upgrading of dwellings in NZEBs. The proposal has a budget of EUR 40 million, while the contribution of private funds has a total expenditure of EUR 80 million. It is estimated that this proposal will renovate approximately 1.600 homes. • For schools, the Ministry of Education, in cooperation with the Energy Office and the Pedagogical Institute (Unit for Education for the Environment and the Sustainable Development), has secured funding of EUR 500.000 from the European Commission and Horizon 2020 to implement the technical assistance called PEDIA (Promoting Energy Efficiency & Developing Innovative Approaches in schools). The PEDIA aims to define a long-term strategy for the upgrading of public schools in NZEB. The installation of PV systems with a total capacity of 4 MW and roof insulation and EU funds are secured for technical assistance with the aim to develop a long-term strategy for the upgrading of public schools to NZEB. • To increase public awareness, an on- going (since 2018) informative cross-sectoral policy relates to Technical guidance promotion of NZEBs. This policy allows consumers to decide the most beneficial option for their related products.
	Energiesprong is an open approach involving collaboration between stakeholders in the ecosystem. National and local authorities, stakeholders on the demand side – social landlords and tenants – and on the supply side – contracting bodies, builders, maintainers, industrial manufacturers and distributors – work together to remove obstacles to the roll-out of such an approach. In France, market support for the roll-out of these net-

FR	zero energy renovations is provided by GreenFlex together with the Social Union for Housing (Union sociale pour l'habitat), the Scientific and Technical Centre for Building (CSTB) and the Fibres-Energivie Competitiveness Cluster, working in close liaison with all of their fellow signatories of the EnergieSprong France commitment charter. This support is made possible by financial backing from the European Union through the programmes Interreg North-West Europe (project E=0) and Horizon2020 (project Transition Zéro), from ADEME and from the Caisse des Dépôts. Following its financial support from the European Union, the project is now funded under a programme implemented in the framework of the Energy Saving Certificates (CEE) scheme.
PL	'Clean Air in Schools' Programme of NFOŚiGW The main objective of the call is to improve energy efficiency in school buildings used for educational purposes by supporting comprehensive investment activities which involve deep energy renovation and are undertaken in order to bring school buildings to the 'passive' or 'nearly zero -emission' standard. The implementation of programme projects should reduce CO2 emissions, reduce primary energy consumption, increase the share of renewable energy (if the project also involves energy production) and increase public awareness with regard to energy efficiency. Funding will be available for energy renovation work, the scope of which is so wide that, once it is completed, the energy standard of the school building will come close to the passive or nearly zero-emission standard.
SI	• PURES: rules for the energy performance of buildings, 2021, A major innovation in PURES will be the creation of a so-called 'nearly zero-energy building '(NZEB). • Financial incentives for energy efficiency and RES use in residential buildings: In order to target renovations and achieve the targets in 2030, a separate call for partial and integrated renovations shall be introduced, with at least 70% of the foreseen resources dedicated to financial incentives for energy efficiency and the use of RES in residential buildings to be allocated to integrated energy and renovations in NZEBs, while also increasing leverage. Deadline: 2022 • Pilot projects: implementation of three pilot projects testing the operation of new financial instruments and new financing models for energy renovation of multi-apartment buildings. Pilot projects shall adequately address diffuse ownership, sharing of incentives, NZEBs and wider renovation of buildings
RO	• The implementation of NZEB and deep renovation programmes will be financially supported with public funds to ensure the quality of training programmes and the accreditation of a minimum number of graduates with new skills. • Training are foreseen for construction workers, specialists (architects, designers, experts, energy auditors) and decision makers for deep energy efficiency renovations (at NZEB level). • Developing pilot projects, with innovative solutions that can be implemented in the field of deep renovations and NZEB, for certain types of buildings.

Source: JRC elaboration, 2025

Table 10. Measures/Projects/Programmes for NZEBs in Member States as extracted from NECP 2023

	Measure	Type

BG	Renovation of the existing building stock to the level of optimised energy consumption with a view to reaching the nearly zero-energy building standards for the period 2021-2030	Planning
	Increasing the capacity and expanding the operation of the National Council of Experts to promote and coordinate the increase in the number of nearly zero-energy buildings in an efficient manner, in the period 2030-2021	Planning
PT	Transition from the promotion of NZEB buildings to the promotion of NZEB/ZEB buildings	Economic/regulatory
	Encouraging more efficient construction and renovation: Through the support of different projects by the RRP, it is intended that new constructions will have to meet the requirement of being NZEB20 and in rehabilitation that a thermal comfort indicator is 10 % better than for new construction by the end of 2026.	Regulatory
	Promote training for construction technicians and specialists and NZEB and ZEB buildings	Education
	Taxation for the decarbonisation of the residential sector and services: Introduce tax incentives for energy efficiency and the introduction of renewable energy and a more favourable tax regime for renewable energy buildings (e.g.: create tax incentives, such as reducing IMI, for nearly zero-energy buildings (NZEB). [Planned date: 2020-2024]	Fiscal
PL	Increasing requirements – technical and construction regulations and requirements laying down standards for the design of buildings: they will include a broader analysis of the availability of resources used to implement the provisions of the new EPBD for the construction of zero-emission buildings.	Regulatory
	NFOŚiGW – Clean Air Priority Programme.	Fiscal, economic
NL	Energy performance requirements – new buildings (NZEB)	Regulatory
EL	Regulatory measures to promote nearly zero energy buildings	Regulatory
	New regulatory, fiscal and financial measures to create the right framework and create incentives for new and deeply renovated buildings will help to maximise the number of buildings that go beyond minimum energy performance requirements.	Regulatory, economic, fiscal
ES	Hybridisation of renewable technologies to reach the 'nearly zero-energy building'.	Other
FI	Nearly zero-energy regulations (instead of earlier Towards zero-energy buildings)	Regulatory
HR	Promoting the decarbonisation and application of the "energy efficiency first" principle in buildings: The measure aims at creating a network of professionals to engage and contribute to building decarbonisation and transition to NZEB.	Information
	Energy renovation programme for public sector buildings: Market models need to be combined with grants with the aim of meeting the NZEB standard.	Economic

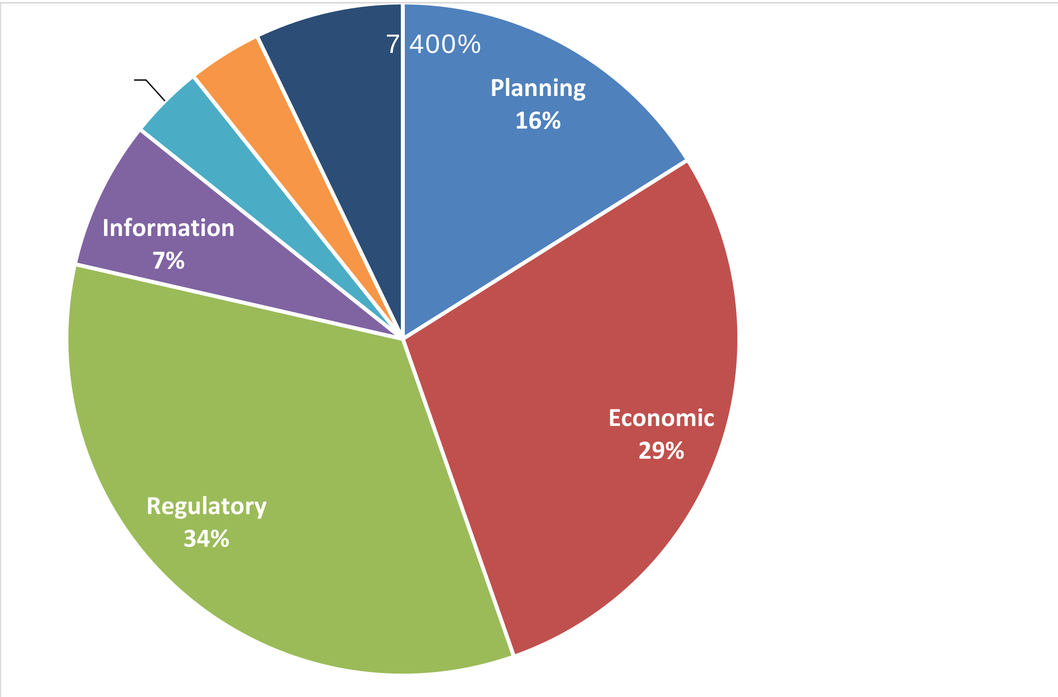
FR	Environmental regulations (RE2020) of buildings: Construction of nearly zero-energy buildings complying with the environmental regulations (RE2020) of buildings, in force since 2020.	Regulatory
IT	Strengthening of minimum energy performance requirements for buildings / NZEBs definition update	Regulatory
MT	Renovation of public office buildings: The project gave new insights as to the best methods to achieve nearly zero-energy levels and reduced primary energy demand by 50,400 kWh annually.	Planning
IE	Education and training courses in near-zero energy building (NZEB) and a Retrofit Upskilling and Reskilling programmes	Education
BE	Action plans to achieve zero emissions federal buildings	Planning
	Introduction of the concept of 'ZEN' building	Regulatory
CY	C-IZEBs project: Intelligent School Buildings for Zero Consumption	Economic
	Grant scheme "Save – Upgrading homes": Under the plan, an investment for the energy upgrading of a dwelling in a building with zero energy consumption (NZEB) can be implemented	Economic

Source: JRC elaboration, 2025

In the draft National Energy and Climate Plans submitted in 2023, 48 measures related to NZEB or including NZEB provisions have been identified. Most of them have been listed by Portugal (21%), Cyprus and Italy (10% both). These measures can affect the whole building sector (61%), to be targeted to public buildings (15%) or to households and services (private sector) (7% both). Some measures could include provisions that regard other sectors as well (i.e. installations for electric mobility in buildings). Less than a half of these measures are already implemented (or their previous versions) while around the one third consists of planned measures for the next period.

As shown in the Figure 11, many measure types are involved. Most NZEB related measures are regulatory and legislative (34%). Examples could include the review of National NZEB definitions. Economic measures are also responsible for an important share (29%). Examples are the financial incentives for renovation of buildings to NZEB. Planning measures (i.e. NZEB action plans) represent the 16%.

Figure 11. NZEB related measures in NECPs by measure type



Source: JRC elaboration, 2025

Some Member States communicated expected updates with stricter requirements in their national NZEB definitions during the following period or have updated their requirements recently. The most important ones, as identified in their National Energy and Climate Plans submitted in June 2023, are presented in Table 11.

Table 11. NZEB definitions, National Energy and Climate Plans 2023

MT	Expected revision (stricter requirements): 2024
BG	Regulation No RD-02-20-3 of 9.11.2022 on technical requirements for the energy performance of buildings: Energy Class A, at least 55 % of the energy consumed (supplied) for heating, cooling, ventilation, domestic hot water and lighting shall be renewable energy located on-site at building level or near the building
FR	New Regulations since Jan 2022 (RE2020): stricter GHG thresholds, BBC Renovation Label for existing buildings
LU	Amended Grand-Ducal Regulation of 9 June 2021: close "passive house" level NZEB requirements for residential buildings
FI	Decree of the Ministry of the Environment on the Energy Performance of New Buildings (1010/2017) (same requirements for private and public/new and existing buildings
IT	Annex 1 to Ministerial Decree No 26/6/2015 for nearly zero-energy buildings (NZEB): energy consumption, thermal performance indicators, average coefficient of heat transfer by transmission, summer equivalent solar area per useful floor area, efficiency of heating, air conditioning and hot water production systems requirements Revision: technical building systems, advanced regulatory and control systems, promotion of healthy indoor weather conditions, fire safety, seismic activity, rules for the integration of electric vehicle charging infrastructure into buildings
EE	Proposal for NZEB requirements in 2024 revision: New buildings (Nearly Zero Energy in 2024, Class A kWh/(m^2y)) • Small residential building: 120 • Row house: 90 • Apartment: 100 • Office building: 95 Existing buildings (Approximate zero energy for major renovations in 2024 kWh/(m^2 y)) • Small residential building: 180 • Apartment: 135 • Office building: 150
BE-WA	NZEB requirements (2021): Ew (new buildings): 45 kWh/m^2y Espec (new buildings): 85 kWh/m^2y K (new buildings): 35 U-value wall/roof/floor: 0.24 U-value window: 1.5

Source: JRC elaboration, 2025

A selection of NZEB or ZEB related measures is reported in Error! Not a valid bookmark self-reference. as extracted from the integrated National Climate and Progress Reports submitted by the Member States on March 2023. In total, 54 measures have been reported by the Member States, affecting NZEB or having NZEB/ZEB among their objectives. Most Member States adopted a number of measures to promote the increase the number of NZEB buildings. Mainly measures can be distinguished as follows:

— Regulatory (eg: energy standards, definition of NZEB requirements, adoption of regulation and laws);

— Financial (eg: subsidies, renovation grants, operational programmes, fiscal incentives);

— Informative (eg: information campaigns, leaflets, websites);

— Educational (eg: training courses for engineers and architects, publication of NZEB guidelines);

— Strategic (eg: national plans, renovation strategies);

— Research (eg: implementation of NZEB pilot projects).

Table 12. Measures from NECPR 2023.

	Measure	Type
AT	Climate Neutral New Buildings: including the requirements for NZEB, additional funding if stronger standards than the minimum criteria for the building envelope and for the choice of heating systems are succeeded	Economic, Regulatory, Voluntary/negotiated agreements
SE	Energy performance buildings directive 2018/844 EC: Introduction of a new EU definition of a 'zero emissions building', applicable to all new buildings from 2027 and to all renovated buildings from 2030	Regulatory
HR	Promoting NZEB construction and renovation standards	Information, Regulatory
	Energy renovation programme for apartment buildings: encouraging renovation according to the NZEB standard	Economic
	Energy renovation programme for single-family houses: encouraging renovation according to the NZEB standard	Economic
	Energy renovation programme for public buildings: Renovation of public sector buildings needs to be directed towards the NZEB standard wherever technically feasible. Market models need to be combined with grants in order to achieve NZEB.	Economic
PT	Promoting energy rehabilitation of buildings, NZEB buildings, the use of more energy efficient equipment and renewables	Economic, Fiscal, Regulatory, Voluntary/negotiated agreements
	Promoting NZEB buildings	Regulatory, planning
LV	National Emissions Allowances Auctioning Instrument (EAAI): Investment Support Programmes to reduce GHG emissions in public sector, 1st call including Nearly Zero Energy public Buildings comprising smart technologies	Economic

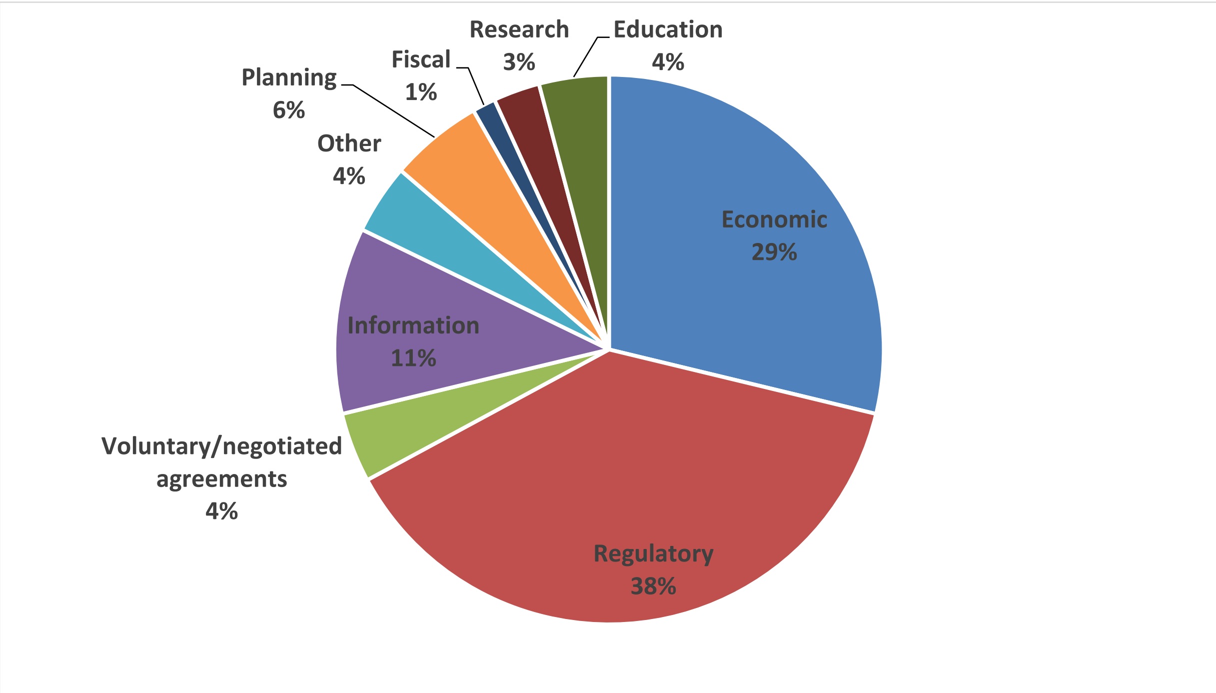
FI	Subsidies for retrofitting in housing: The aim is also to increase the number of nearly zero-energy buildings in renovation. Available budget for grants in 2020, 2021 and 2022 is 138 M€ in total.	Economic
	Nearly zero-energy regulation	Regulatory
LU	Regulations on the energy performance of buildings: revision of the definition of a NZEB energy performance level for energy renovation (based on the cost-optimal performance method (EPBD)	Regulatory
	Pioneering role of municipalities in building matters: The requirement based on the EED to renovate at least 3 % of the surface area of buildings per year will be reinforced as the level to be achieved by renovation will be energy NZEB	Economic, Information, Voluntary/negotiated agreements
HU	New requirements on the energy performance of buildings: Nearly Zero Energy consumption up to 100 kWh/m²/year for residential buildings, up to 90 kWh/m²/year for commercial and office buildings and up to 80 kWh/m²/year for educational buildings. 25% of the annual energy demand shall be provided from renewable energy sources.	Regulatory
IT	Simplification and acceleration of procedures for implementing energy efficiency measures: The measure aims to promote the rapid energy conversion of the building stock, deep refurbishment and conversion NZEB	Regulatory
	Thermal Account – Decree of 28 December 2012 and Decree of 16 February 2016, incentives including among others the capital contribution up to 65 % for the demolition and reconstruction of NZEB	Economic
NL	Energy performance – BENG: For all new construction, both residential and non-residential, the permit applications must comply with the requirements for NZEB since 1 January 2021	Regulatory
IE	2019 NZEB Building Regulations - Dwellings	Regulatory
CY	Additional floor space “allowance” for new buildings and buildings that are renovated: the aim is to incentivize the construction or renovation of buildings that go beyond NZEB requirements	Regulatory
SI	Regulations on the energy efficiency and renewable energy use in buildings: supplementing the existing regulations (PURES buildings codes) with requirements for the introduction of NZEB	Regulatory
SK	Renovation of buildings – Multiple building categories – Public – OP KZP 2014-2020: supporting complex projects to reduce energy consumption to the level of low-energy buildings, ultra-low-energy buildings and buildings with almost zero energy needs.	Economic
BE	Obligation to set an example for public buildings: EPB standards for public buildings: obligation to reach NZEB standards and obligation to display the Energy performance of buildings certificate.	Regulatory

	Promote renewable energy sources in new buildings: Implementing the obligation to have renewable energy sources for new constructions and implementation of the quazi zero energy (QZEN) standard for new buildings.	Regulatory
BG	Requirements for using renewable energy in buildings	Regulatory
DK	Minimum energy requirements for buildings: All new buildings must be constructed as NZEB	Regulatory, Information
CZ	Operational Programme Enterprise and Innovation for Competitiveness: the support of extra costs in achieving the standard of a NZEB and a passive energy standard in the reconstruction or construction of new business buildings	Economic
	Operational Programme Prague Growth Pole: implementation of pilot projects to convert energy intensive municipal buildings into NZEB	Economic

Source: JRC elaboration, 2025

Twenty Member States have reported NZEB measures found in the NECPRs. Most of them have been reported by Slovenia (13%), Portugal and Belgium (11% each of them). The 89% of the reported measures are already implemented. Figure 12 regards the measure types. As in the NECPs, most NZEB related measures are regulatory and legislative (38%), followed by economic ones (29%), information (11%), planning (6%), voluntary/negotiated agreements, education and other (4% each of them). Measures classified as research or fiscal by the Member States occupy less important shares (Figure 12).

Figure 12. NZEB related measures in NECPRs by measure type



Source: JRC elaboration, 2025

NZEBs should have a reduced energy demand through the deployment of energy efficiency measures and covering the remaining demand from renewable sources. For existing buildings, a widespread NZEBs retrofit implementation is still a challenge to be overcome in the light of the Renovation Wave and the need of further boosting renovation (at least doubled) [Renovation Wave, 2020]. The current renovation rate is assessed between 0.5% and 2.5% per year with buildings dating between 1945 and 1980 having the largest energy demand [Attia et al., 2017]. Moreover, the existing stock is characterized by a high heterogeneity in terms of uses, climatic areas, construction traditions and systems. Different barriers persist towards NZEBs renovation [EC, 2019]. These are mainly technical, financial, social, political and institutional, as shown in Table 1.

Table 13. Barriers and benefits deriving from retrofit NZEBs

Barrier	Description
Financial	Costs of renovation, access to finance, energy price, insufficient attractive financial products, limited use of mechanisms that leverage public capital to attract private investment.
Regulatory	Varying level of NZEB performance requirements and local climatic variations preventing standardised approaches.
Technical	Lack of knowledge of construction industry, costs of technical solutions, limited uptake of energy efficiency, renewable and smart technologies.
Process	Fragmentation of supply chain, burdening of home owners, complex permit procedures.
Awareness	Lack of understanding of building energy use and potential energy savings, poor data on buildings, lack of awareness of the benefits.
Structural	Characteristics of the building sector, small-scale nature of renovation projects which obstruct cost effectiveness, long lifetime of buildings, limited industrialisation, need for engaging with citizens directly or via local or other intermediaries.
Lack of expertise	Lack of provider's expertise, insufficient work force, need of trainings and digital skills.
Information	Insufficient knowledge of the scope of financing programmes and products available, need for intensified technical assistance, capacity building and support to home owners, project promoters, intermediaries and local and national administrations.
Benefit	Description
Environmental	Increase energy savings, decrease GHG emissions, decrease material and fossil use deployment.
Economic	Employment, Gross Domestic Product, innovation, productivity, sectoral modernization, decrease energy bills, increase property value.
Social	Energy security, health, well-being, comfort, decreased energy poverty.

Source: JRC elaboration, 2025

In some cases, existing structures limit the choice of the technical solutions that can be used, especially in buildings of architectural value. Technical solutions may be expensive and request high investments, considering the payback period for renovation [Economidou et al, 2020]. Other aspects to be considered towards a wide NZEB retrofit implementation are:

- Stimulate NZEBs from regulatory and non-regulatory policy instruments;
- Industrialise the process of NZEBs renovation;
- Scale up private investments;
- Better use and easier access to funds;
- Tackle energy poverty, social housing, low income households;
- Public sector as leading example;
- Drive smart technologies and digital data;

- Explore innovative financing instruments and approaches;
- Involve and train citizen and local authorities;
- Harmonise policy instruments, which need to be concrete, coherent, ambitious;
- Address building-integrated renewables and efficient systems.

From the JRC data collection, also information on the NZEB building stock were collected, for new (Table 14) and existing (Table 15).

Table 14. New NZEB stock information

Member State	Residential	Non-residential	Total	additional info
AT	41,103	15,501	56,604	
BE - Wa	9,000 building units	300 building units	9,300 building units	residential: New: Jan’ 23 Renovated: to date non-residential: New: Jan’ 22 No data available for renovated
BE - Fl	±86, 000	±4,000	±413,000 (new buildings since 2006)	
HR	4,071	861	4,932	
CY	15,154	1,644		
CZ	75,610	4,112	79,722	
DK	66,809	2,572	69,381	The statistical foundation for the number of renovated NZEBs is currently limited, so these figures are therefore subject to uncertainty.
EE	EPCs issued as of 2020*: 1) EPCs (class A) of buildings under construction = 643 2) EPCs (class A) of buildings in use = 1435 3) EPCs (class A) of buildings planned = 406 Total EPCs (class A) = 2484 Source: Building Registry (26.06.23)	EPCs issued as of 2020*: 1) EPCs (class A) of buildings under construction = 53 2) EPCs (class A) of buildings in use = 437 3) EPCs (class A) of buildings planned = 78 Total EPCs (class A) = 568 Source: Building Registry (26.06.23)		Total number of residential buildings in Estonia (taken into use before 2000): Single-houses (private houses): ~155,150 Apartment buildings: ~22,600 Total ~178,000 Source: Estonian LTRS 2020
FI	43,819 buildings (2.3.2023) (www.energiatodistusrekisteri.fi,	6,234 buildings (2.3.2023) (www.energiatodistusrekisteri.fi	50,053	
FR	~3.7 million dwellings (au 01/01/2023)	~257 million m² (Au 01/01/2023)		

DE	2016: 109,990 2017: 110,051 2018: 107,581 2019: 108,071 2020: 112,935 2021: 102,955	2016: 24,402 2017: 23,956 2018: 24,321 2019: 23,642 2020: 24,310 2021: 22,358	2016: 134,392 2017: 134,007 2018: 131,902 2019: 131,713 2020: 137,245 2021: 125,313	The NZEB-standard in Germany was introduced in 2016 and tightened in 2023. The given data relates to the first NZEB-standard
GR	403-1,068	90-213	493-1,281	
HU	30,784	3,379	34,163	Please note that not all buildings have an energy certificate. The preparation of an energy certificate is mandatory for new buildings before they get the occupancy permit, so the numbers provided here are complete, however, the number of renovated buildings may be higher than the numbers provided. The numbers provided are based on the e-certification database.
IE	6,434 (to Q1 2023)	1,663 (Q1 2020-Q1 2023)		
LU	Since 2017 every new residential building is a NZEB	Since 2021 every new non-residential building is a NZEB		
MT	See “additional information” on the right column	See “additional information” on the right column	See “additional information” on the right column	residential: 31,532 new and renovated together non-residential: 545 new and renovated together total: 32,077
NL	140,000 (Number of building units with valid EP-certificate on January 1st 2023.)	6,500 (Estimation of non-residential building units)	146,500	NL has monitored the amount of “energy neutral renovations” of residential buildings in the period 2015-2020.
PT	Design phase 50,812 building units Built 675 building units	Design phase 1,693 Built 79	Design phase 52,505 Built 754	
SK	21,422	518	21,940	Status: april 2023 (CA EPBD), unit: building, source: Inforeg (central evidence of ECs)
SE	Totally 23,198 new NZEB buildings in 2022, i.e., got energy class A–C in 2022. (Includes renovated buildings in 2022.)	Totally 1,426 new NZEB buildings in 2022, i.e., got energy class A–C in 2022. (Includes renovated buildings in 2022.)		

Source: JRC elaboration, 2025

Table 15. Renovated NZEB stock number

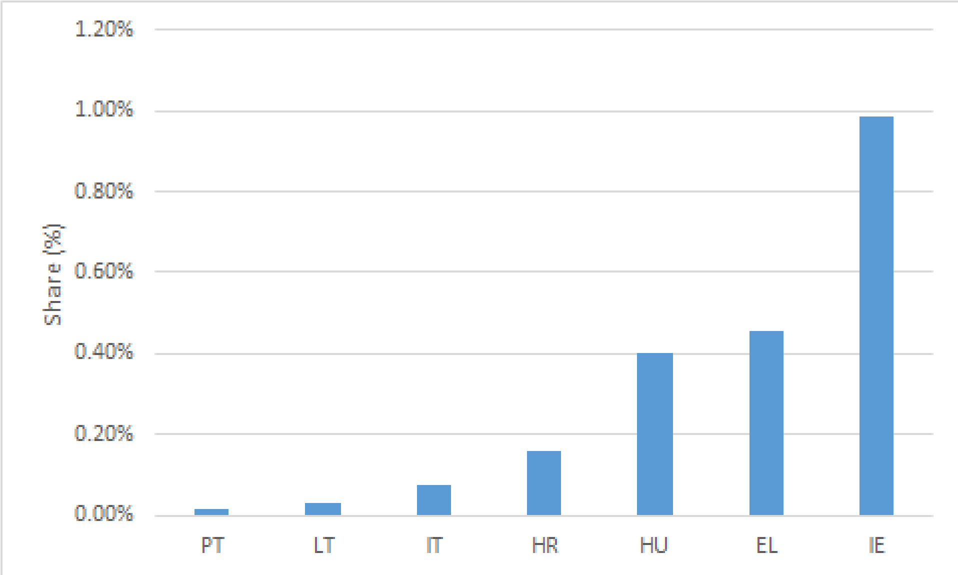
	Residential	Non-residential	Total	additional info
BE - Wa	7,000 building units		7,000 building units	residential: New: Jan' 23 Renovated: to date non-residential: New: Jan' 22 No data available for renovated
BE - Fl	±6,000 (IER), ±21,000 apartments label A ±6,000 SFH label A		±3 mill (residential)	±1 mill valid Energy Performance Certificate (EPC)'s,so 1/3 of residential building stock
HR	714	246	960	
CY	1,860	619		
DK	15,642	1,665	17,307	The statistical foundation for the number of renovated NZEBs is currently limited, so these figures are therefore subject to uncertainty.
EE	~33,00 Source: Estonian LTRS 2020	~700 Source: Estonian LTRS 2020		Total number of non-residential buildings in Estonia (taken into use before 2000): ~32,000 (buildings with climate control, i.e. office, educational and commercial buildings etc). Source: Estonian LTRS 2020
FI	Estimation on the basis of energy certificate registry is 24,400 buildings.	Estimation on the basis of energy certificate registry is 3,600 buildings.	28,000	
FR	2,377 buildings representing 157,945 homes	~4.3 mill m² (au 01/01/2023		
DE	The following numbers are from a subsidy program. Therefore, they only describe some renovations and do not include all renovations to NZEB. This is owed to a lack of data. 2021: 9,345 2022: 22,898 *the numbers for 2022 are preliminary.	The following numbers are from a subsidy program. Therefore, they only describe some renovations and do not include all renovations to NZEB. This is owed to a lack of data. 2021: 496 2022: 1,703 *the numbers for 2022 are preliminary.		The NZEB-standard in Germany was introduced in 2016 and tightened in 2023. The given data relates to the first NZEB-standard
GR	10,663-15,446	1,595-18,87	12,258-17,333	
HU	6,006	3,770	9,776	
IE	27,281 to date			

MT	See “additional information” on the right column	See “additional information” on the right column	See “additional information” on the right column	residential: 31,532 new and renovated together non-residential: 545 new and renovated together total: 32,077
NL	4,800			NL has monitored the amount of “energy neutral renovations” of residential buildings in the period 2015-2020.
PT	Design phase 1,806 Built 10	Design phase 612 Built 16	Design phase 2,418 Built 26	
SK	3,011	379	3,390	Status: april 2023 (CA EPBD), unit: building, source: Inforeg (central evidence of ECs)
SE	Not available. Can´t be separated from newly constructed NZEB buildings.	Not available. Can´t be separated from newly constructed NZEB buildings		

Source: JRC elaboration, 2025

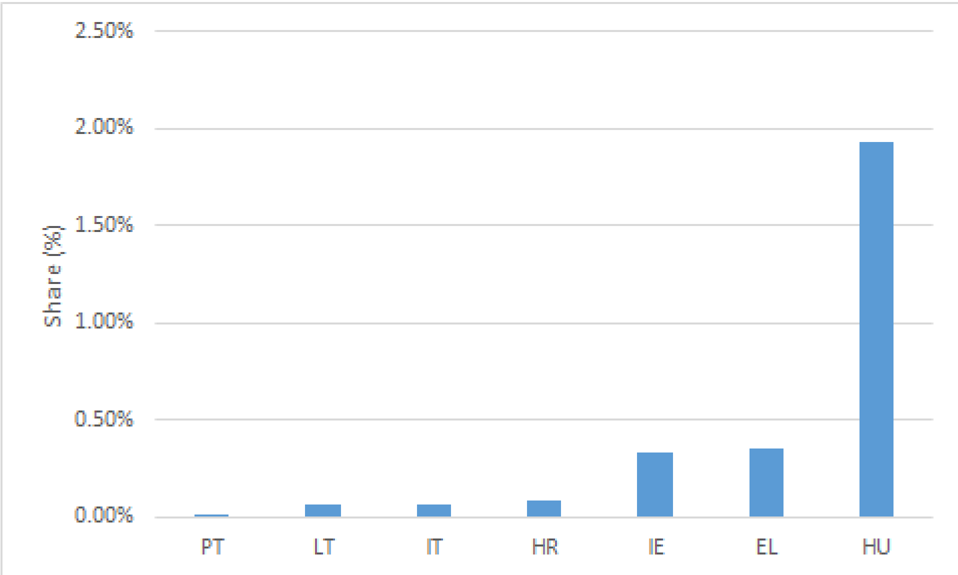
Some Member States provided information about NZEB related indicators in their NECPRs, reporting their values for the year 2022 (not cumulative). The monitored indicators are the number and the total floor area of NZEBs (in m^2). Both indicators are requested to be completed by Member States in total numbers, as well as distinguished by residential, non-residential (private sector) and public buildings. They are also disaggregated as new and renovated NZEBs. Even if less than the half Member States completed this field, the available information is illustrated in the following figures.

Figure 13. Percentage of residential NZEBs added to the total building stock in Member States with available data (2022)[5]



Source: JRC elaboration, Building Stock Observatory, 2025

Figure 14. Percentage of non-residential NZEB (private and public sector) added to the total building stock in Member States with available data (2022)[6]



Source: JRC elaboration, Building Stock Observatory, 2025

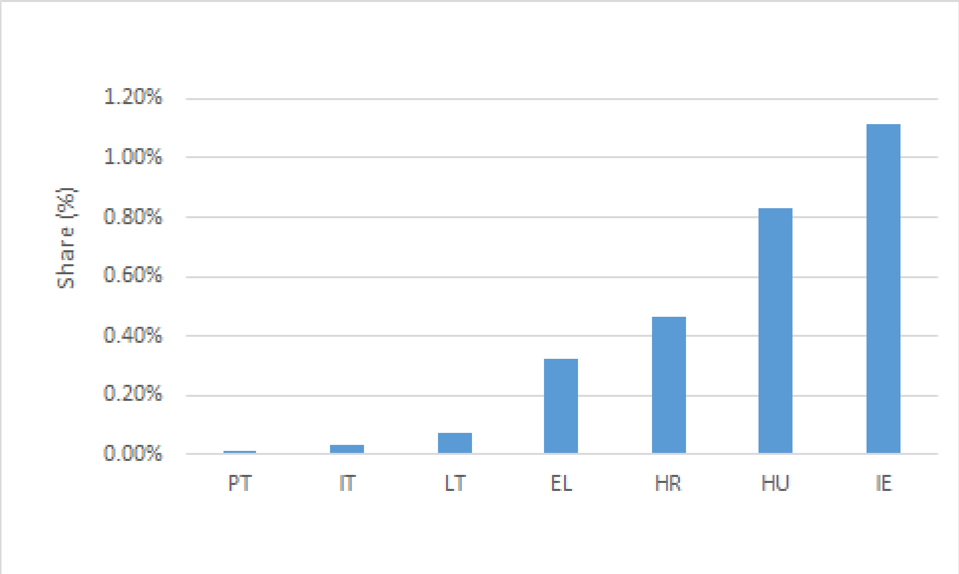
[5] The data for the total building stock are exported from the Building Stock Observatory and correspond to the year 2020 (the only year with available data)

[6] The data for the total building stock are exported from the Building Stock Observatory and correspond to the year 2020 (the only year with available data)

Ireland reported more than 15,000 new residential buildings, while a similar number of NZEB renovation was reported by Greece, leading to shares of residential NZEBs to the total residential building stock of 0.99% and 0.45%, respectively. Indicators such as the number of renovated and new NZEBs as percentages to the total building stock or divided by population can give more insights about the trends. Non-residential NZEBs are significantly fewer than residential ones. For private sector, Greece and Hungary reported the highest number of renovated buildings (1,754 and 1,297 respectively), while Czechia reported the highest number of new NZEBs (706). Finally, for public sector, Hungary reported the highest number of both new and renovated NZEBs. Hungary registered the largest share of non-residential NZEBs to the total building stock (1.93%).

Floor area data are reported in Figure 15 and Figure 16.

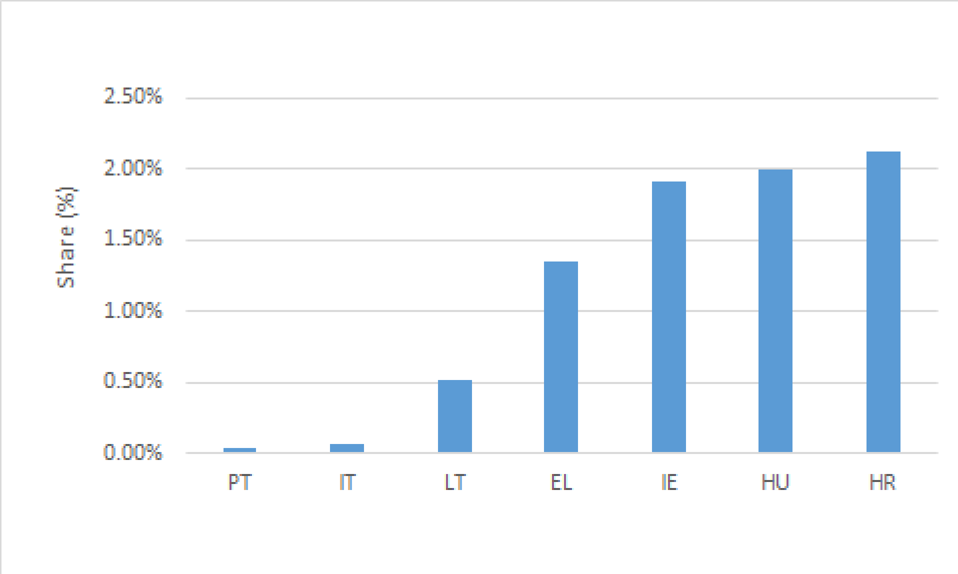
Figure 15. Percentage of floor area of residential NZEBs added to the total building stock in Member States with available data (2022)[7]



Source: JRC elaboration, Building Stock Observatory, 2025

[7] The data for the total building stock are exported from the Building Stock Observatory and correspond to the year 2020 (the only year with available data)

Figure 16. Percentage of floor area of non-residential NZEBs (private and public sector) added to the total building stock in Member States with available data (2022)[8]



Source: JRC elaboration, Building Stock Observatory, 2025

The findings are similar for floor area indicators (Figure 15, Figure 16). Regarding new and renovated residential NZEBs, Hungary reported the highest number, while Ireland reported the highest share (1.12%). As regards renovated NZEB floor area, Greece reported the highest value for non-residential ones (public and private sector), while Hungary registered the highest value for new non-residential buildings. The highest share of NZEB floor area to the total non-residential buildings useful floor area is registered by Croatia (2.1%).

Despite the fragmented, conservative and high technical building sector, policies are effectively contributing to mitigate the energy demand and boost NZEBs implementation.

As reported, measures can target the envelope (thermal insulation, glazing, thermal bridges) or heating /cooling generation and distribution systems. Furthermore, measures targeting smart metering and control systems to better control supplied services, giving information to the occupant and their behaviour to encourage conservation measures. Additional measures address air conditioning, ventilation, hot water and lighting.

To further increase energy savings, apart from the progress in energy efficiency, change in consumer behaviour, the inclusion of social- economical characteristics and the human dimension will be crucial for NZEBs development.

[8] The data for the total building stock are exported from the Building Stock Observatory and correspond to the year 2020 (the only year with available data)

4. NZEB performance levels and cost-optimal levels of minimum energy performance requirements in Member States

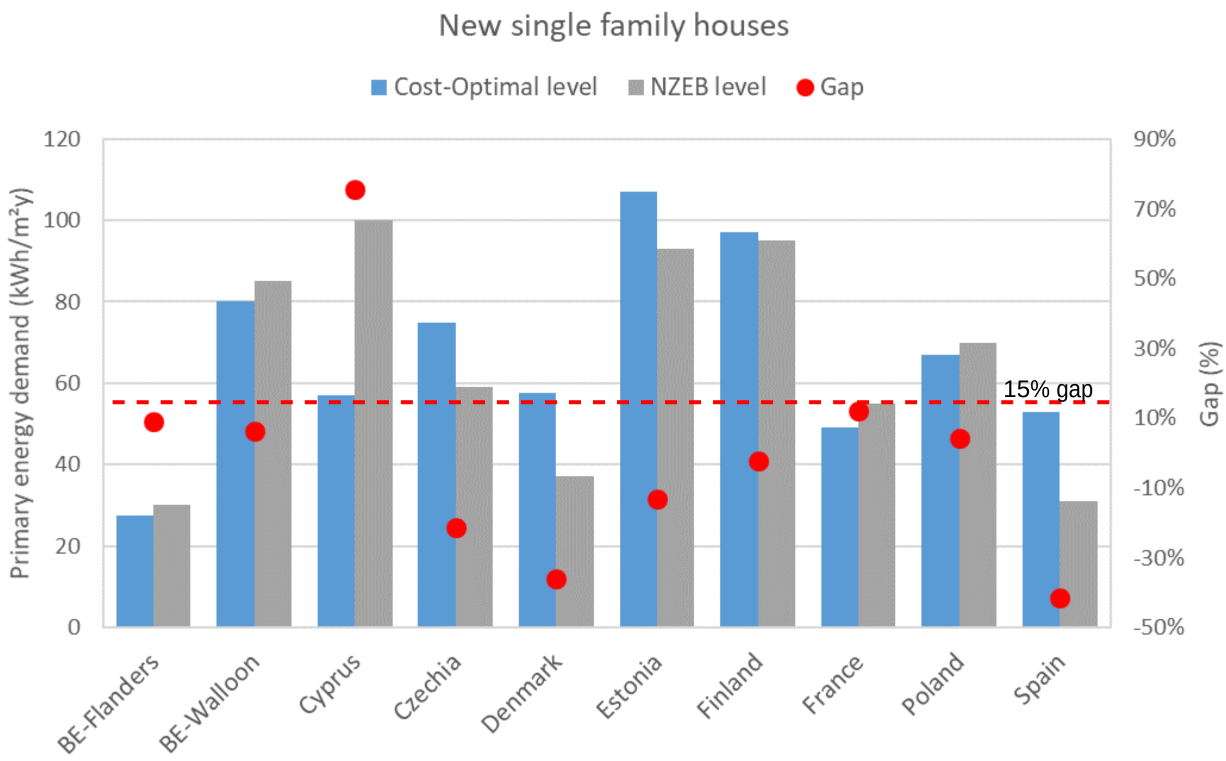
Member States are required to calculate minimum energy performance requirements for buildings to establish cost-effective levels for new and existing buildings. The provisions outlined in the EPBD must be updated regularly, at least every five years. The 'cost-optimal methodology' is a comparative framework introduced in the Commission Delegated Regulation no. 244/2012 along with its implementation Guidelines. This methodology employs a cost-benefit analysis principle, considering both financial and macroeconomic perspectives, the first includes taxes, while the second greenhouse gas emission costs [EC, 2012a, 2012b]. Member States have to ensure that minimum energy performance requirements for buildings or building units are set with a view to at least achieving cost-optimal levels as well as more stringent reference values of NZEB and ZEB requirements. The energy performance shall be calculated in accordance with the methodology referred to in Article 4. As stated in Article 5 of the revised EPBD, cost-optimal levels shall be calculated in accordance with the comparative methodology framework referred to in Article 6.

Initiated in 2013, subsequent rounds of cost-optimal level calculations were conducted in 2018 and 2023. The JRC evaluated national calculations for adherence to the common methodology and the plausibility of results in both 2018 and 2023 [Zangheri et al., 2022a, b]. The deadline for the third revision of cost-optimal energy performance levels was March 2023. By June 2024, 22 countries had submitted their updated calculations and the assessment is on-going.

This section compares the cost-optimal levels of the first 11 reports received (from Flanders, Wallonia, Bulgaria, Cyprus, Czechia, Denmark, Estonia, Finland, France, Poland, and Spain) with their national/regional NZEB performance levels, by building category. The comparison is based on the primary energy demand level, whether total or non-renewable, depending on how each country calculated and defined the cost-optimal level of energy performance. For instance, Flanders, Wallonia, Cyprus, and Finland compared the cost-optimal levels with the requirements in force (NZEB) of total primary energy. Therefore, for these countries/regions, the figures below refer to the total primary energy demand for both cost-optimal and NZEB levels. For the other countries, the comparison is based on non-renewable energy demand for both cost-optimal and NZEB levels.

In addition, the gap between NZEB and cost-optimal levels is illustrated for each country (red dots with values reading on the secondary vertical axis). For clarity, the 15% gap benchmark is also shown (red line).

Figure 17. Comparison between cost-optimal and NZEB levels of energy performance (in primary energy demand) for new single-family houses

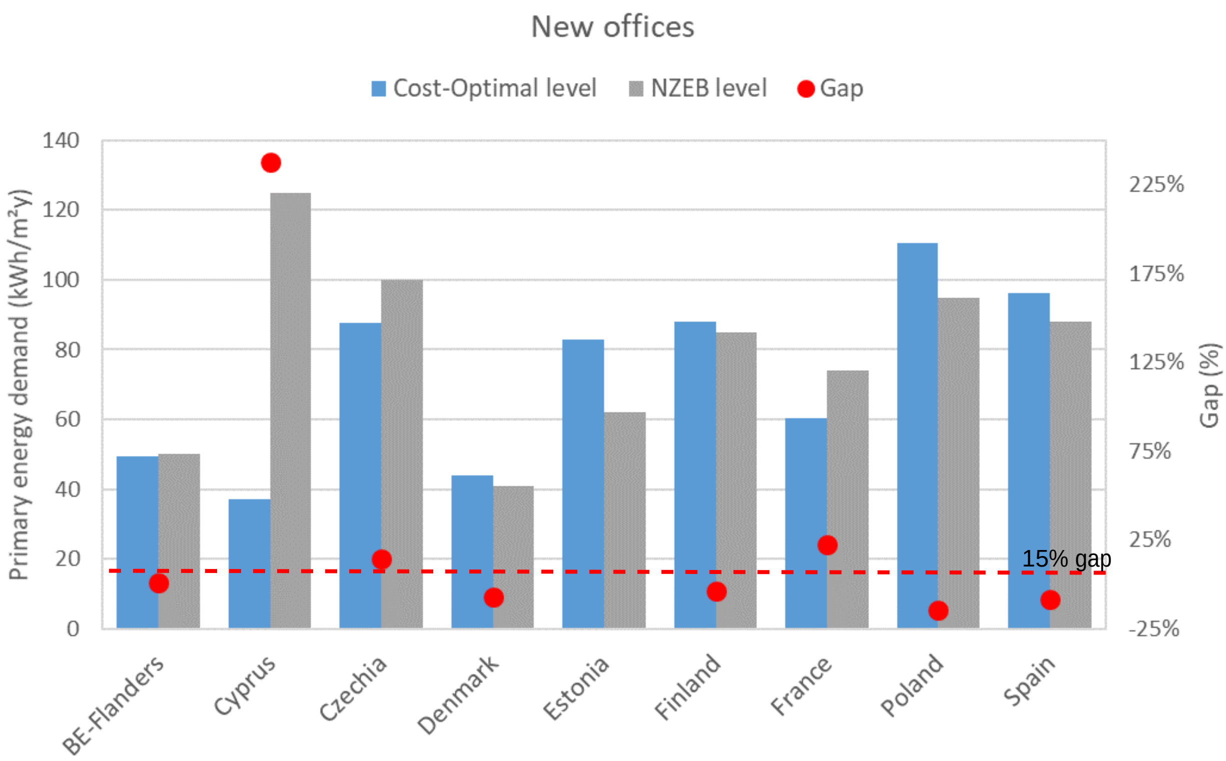


Source: JRC elaboration, 2025

Notes: Comparison based on total primary energy: Flanders, Walloon, Cyprus, and Finland. Comparison based on non-renewable primary energy for the rest of Member States.

It is observed that, in most cases, cost-optimal levels are aligned with NZEB levels, indicating that the current national NZEB definitions for single family houses are set at cost-optimal levels according to the most recent national reports on the cost-optimal methodology (Figure 17). This alignment is logical for new buildings, considering that NZEB has been a mandatory target since 2021. Indeed, another interesting aspect of this comparison is determining whether the current requirements identified by countries in the cost-optimal calculations correspond NZEB definitions. For almost all 10 countries, the requirements in force meet NZEB levels, as verified by cross-checking the cost-optimal report with JRC data collection. However, this is not the case for Estonia, and Czechia did not provide current requirements for new buildings in the cost-optimal reports.

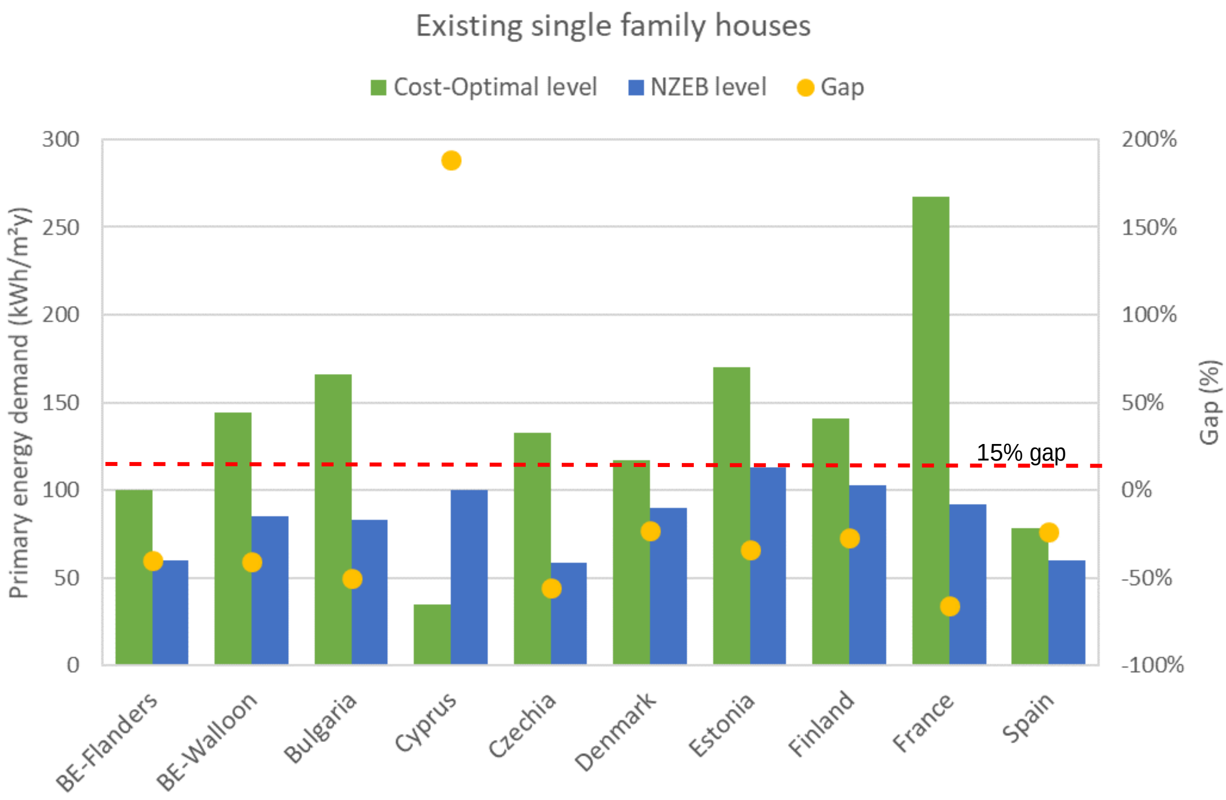
Figure 18. Comparison between cost-optimal and NZEB levels of energy performance (in primary energy demand) for new offices



Source: JRC elaboration, 2025

Looking at new non-residential buildings with offices as case-study, Figure compares the cost-optimal levels of primary energy demand with NZEB levels. Similar to new single family houses, cost-optimal levels and NZEB levels appear aligned (or within 15% gap) in almost all 10 investigated countries/regions. Similarly, for new offices, current requirements are identified as NZEB levels, as verified by cross-checking the cost-optimal reports with JRC data collection.

Figure 19. Comparison between cost-optimal and NZEB levels of energy performance (in primary energy demand) for existing single-family houses

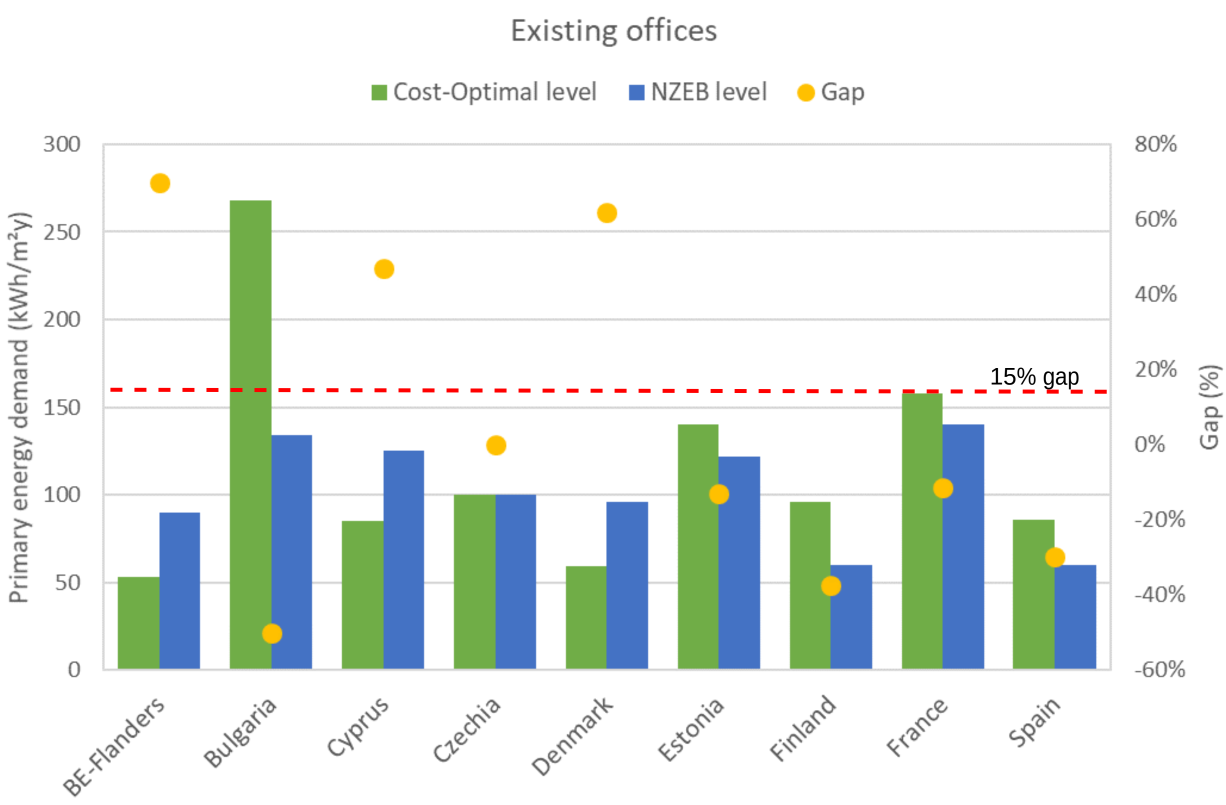


Source: JRC elaboration, 2025

The comparison of cost-optimal levels with NZEB levels for existing single family houses undergoing NZEB renovation reveals that in almost all countries NZEB levels are significantly more ambitious than the cost-optimal levels, with all gaps being below 0% (except Cyprus) (Figure). This suggests that these countries have set very ambitious NZEB renovation levels compared to what is identified as cost-optimal. Indeed, in some countries, NZEB renovation is as ambitious as new NZEB (Wallonia, Bulgaria, Cyprus, Czechia) or more ambitious (Finland).

However, the situation is slightly different for existing offices undergoing NZEB renovation as compared to cost-optimal levels (Figure 2). Among the nine countries for which the comparison was feasible, in three the cost-optimal primary energy demand is lower than the current NZEB primary energy demand (Flanders, Cyprus and Denmark), while in the others is either aligned (Czechia) or higher.

Figure 20. Comparison between cost-optimal and NZEB levels of energy performance (in primary energy demand) for existing offices



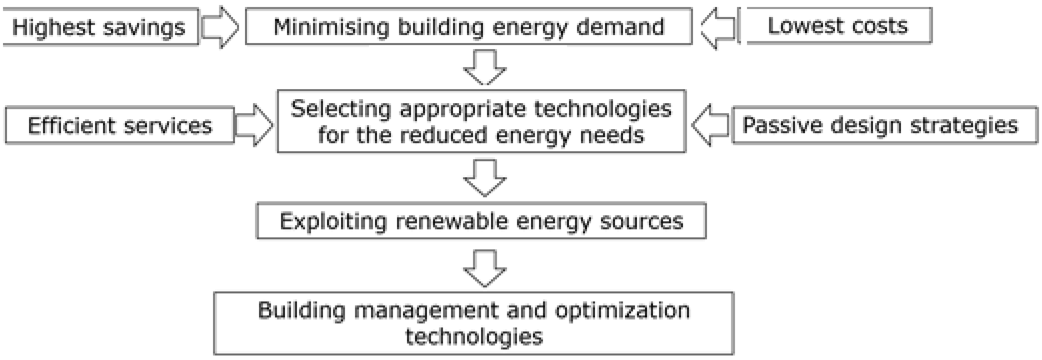
Source: JRC elaboration, 2025

In the previous assessment of NZEB levels compared to cost-optimal levels in 2018, NZEB primary energy demand was found to be 50% lower than cost-optimal primary energy demand. In the present assessment, this difference has been reduced. Except for existing single-family houses, where the overall difference remains about 50%, NZEB primary energy demand is now within a 10% lower than the cost-optimal levels in other cases. However, so far, the analysis includes only 11 countries. For consolidated results, it is necessary to include the other Member States in the assessment.

5. Overview of technologies for NZEBs

The NZEB target is reachable with targeted technologies and best practices (Figure 21). The combination of high efficient solutions (e.g. thermal insulation, efficient windows, heat recovery, airtightness) to minimise the energy demand for building operation and supply the remaining demand to a large extend with renewables produced onsite. Nonetheless, a critical role is played by occupants' lifestyle.

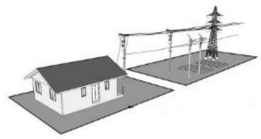
Figure 21. Concept of NZEB



Source: modified from: D'Agostino & Mazzarella, 2019

A broad scale shift towards NZEBs requires an effort to integrate efficient solutions and renewables (e.g. photovoltaics, solar thermal, geothermal, ambient heat and biomass). These could be on site or close to the building site, as shown in Table 16 [modified from: Feng et al, 2019].

Table 16. Renewable options for NZEBs

Renewable location	Example scheme
Renewable energy within the building footprint	
Renewable energy within the boundary of the building site	
Off-site renewable energy to provide energy	
Purchase renewable energy generate off-site.	

Source: modified from: [Feng et al, 2019]

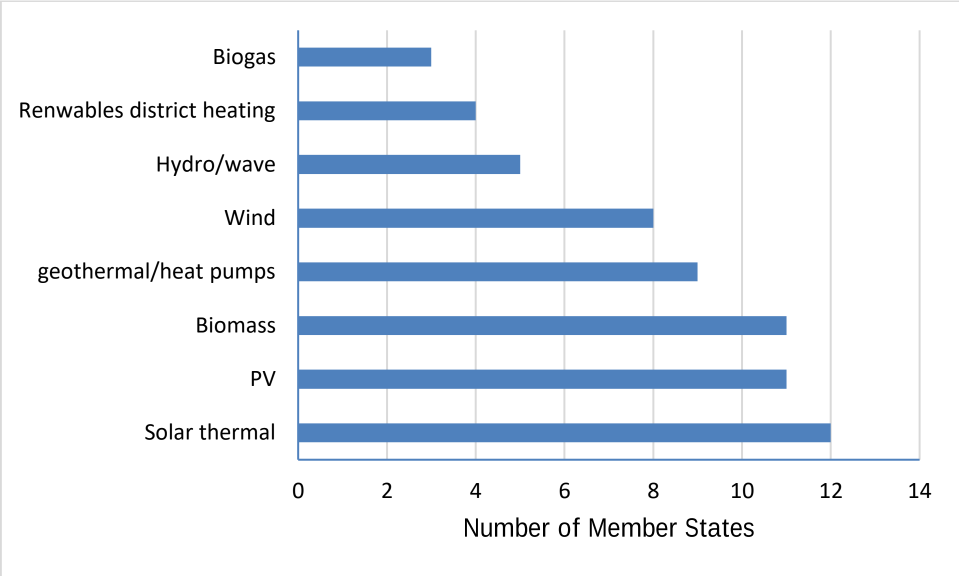
Within a cluster of private and public units, the energy demand can be met by renewable energy self-produced within the neighborhood. NZEB can be scaled-up and integrated to a district level, shifting from single buildings to districts. At city scale, this concept includes a wider vision of urban sustainability that foresees innovative solutions for lighting, urban mobility, and public safety (Figure 2).

Figure 22. Design of new NZEBs

Source: JRC elaboration, 2025 (generated using DALL-E version 4.0)

As reported in Section 2 of this report, some Member States include energy produced from renewables in their primary energy indicator while others no. Not all types of renewables are considered by countries. Most countries count mostly on PV (whose benchmark cost of electricity generated decreased by over 75% since 2009 [Jäger-Waldau, 2022]) and solar thermal for their NZEB, while other less used sources are: biomass (sometimes under certain conditions), wind, hydro, renewable district heating, etc. (Figure 23).

Figure 23. Renewable energy technologies included in NZEB definition, EU Member States



Source: JRC elaboration, 2025

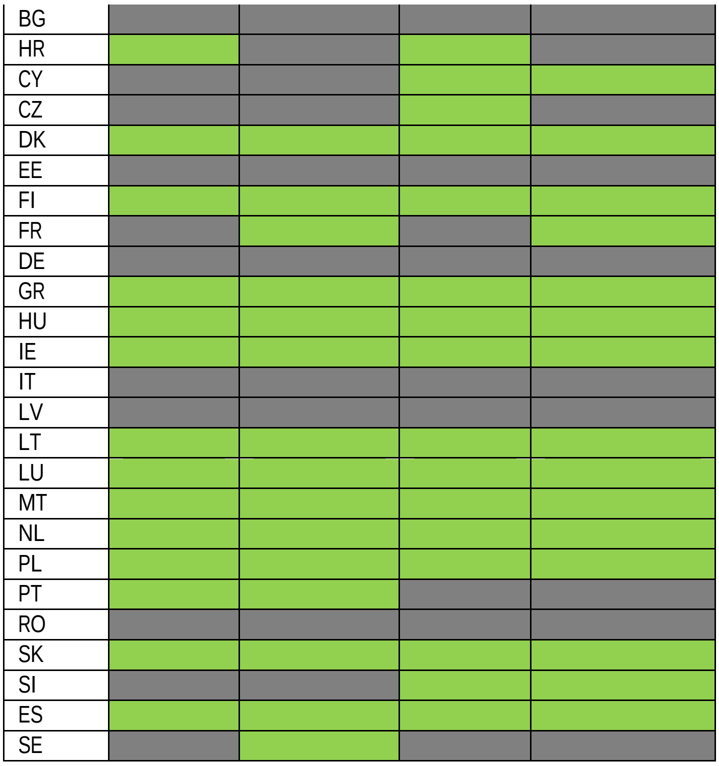
From JRC data collection, most Member States provided information on commonly used technologies for NZEB, distinguished by new and existing buildings and on the minimum requirements of the technical systems if any. These could regard requirements for heating, cooling, DHW, lighting and ventilation systems. Other requirements relate thermal insulation, indoor air temperature or air humidity, and comfort criteria.

The majority of Member States reported explicit requirements for heating, for both new and existing NZEBs (19 and 15 Member States respectively). Among these requirements are included: pipe insulation (i.e. Slovakia), mandatory accreditation of gas and oil boilers prior to the use (i.e. Belgium – Walloon region), the compatibility with specific national standards (i.e. Denmark), maximum energy demand for heating (i.e. Cyprus), minimum Seasonal Coefficient of Performance indicator (i.e. Greece) or others.

More than the half of Member Stated included specific requirements for DHW for both new and existing NZEBs. These requirements could regard the pipe insulation (i.e. Belgium – Walloon region), the compatibility with specific national standards (i.e. Denmark), the minimum and maximum water temperature (i.e. Finland or Slovakia), the minimum RES share (i.e. Greece), the minimum Seasonal Coefficient of Performance indicator (i.e. Spain) or others. Most Member States used the same requirements for DHW and heating in both new and renovated NZEB. Among the exceptions, there is the case of France, where specific standards for DHW in existing buildings have been set, while there are no explicit requirements for the new ones. Table 17 highlights in green the Member States that provided information about their minimum requirements for DHW and heating in new and renovated NZEB.

Table 17. Domestic Hot Water (DHW) in new and existing NZEB, EU Member States

	Domestic Hot Water		Heating	
	New	Existing	New NZEB	Existing NZEB
AT				
BE - Br				
BE -				
BE - Fl				



Source: JRC elaboration, 2025.

Common NZEB technologies encompass both passive (e.g., sunshades, green, reflective and cool roofs, natural ventilation and lighting, night cooling) and active solutions (e.g., mechanical ventilation with heat recovery, heat pumps, efficient lighting, appliances, envelope). Integrating passive Phase Change Materials (PCMs) is emerging with applications within walls, ceilings, floors [Stritih et al., 2018] to reduce overheating by absorbing heat excess during daytime and releasing the stored heat at night, decreasing the need of Heating, Ventilation and Air Conditioning (HVAC) systems. Additionally, several Member States established specifications for cooling systems as these will be much more important in buildings due to foreseen climate change scenarios of temperature increase [D'Agostino & Parker 2019]. In relation to cooling, less than the half of the Member States reported the inclusion of specific requirements for the cooling systems for new and existing NZEBs. These requirements could regard the distribution temperature (i.e. Luxembourg), the compatibility with specific national standards (i.e. Denmark, Croatia), the Seasonal Energy Efficiency Ratio (i.e. Greece) or other. Most Member States used the same requirements in both new and renovated NZEB. There are also Member Sates mentioning the inclusion of cooling under primary energy definition, without setting specific requirements (i.e. Czechia).

Ventilation, central or decentralised, is very important also to improve air quality through the exchange of air, especially mechanical ventilation with heat recovery system used in the largest part of NZEB buildings. Mechanical ventilation can include fans, ceiling fans, exhaust air systems, heat exchangers, VRV system (variable refrigerant volume), heat recovery units. Requirements on ventilation systems are used by most Member States (17 of them have reported information on them). The mandatory use of ventilations systems with heat recovery is among the most common requirements. The heat recovery requirements range from 55% annual efficiency (Finland) to 85% (Luxembourg) as regards the new NZEB. Other requirements on ventilation systems include the air flows (i.e. Belgium or Finland), the specific fan power (i.e. Ireland or Sweden) or the compatibility with national standards and national legislation (i.e. Croatia or Malta).

Member States can include the different end-uses in their NZEB definitions considering or not the co-generation and waste heat. According to the information collected, the 52% of Member States (Table 18) considers waste heat, co-generation or both in their primary energy indicator for new buildings, while less Member States provided explicit information showing that they consider these amounts in their definitions for existing buildings. Some countries reported that they consider them only under specific conditions (i.e. if RES, if a declaration of quality is available). Finally, 5 countries reported that they do not account waste heat in their primary energy definition, while 3 countries do not account co-generation.

Table 18. Inclusion of co-generation and waste heat in primary energy definitions of new and existing NZEB, EU Member States

	New NZEB		Existing NZEB	
	Waste heat	Co-generation	Waste heat	Co-generation
AT	grey	grey	grey	grey
BE - Br	grey	grey	grey	grey
BE - Wa	green	green	green	green
BE - Fl	green	green	green	green
BG	grey	grey	grey	grey
HR	green	green	grey	grey
CY	green	green	green	green
CZ	green	green	grey	grey
DK	red	red	red	red
EE	grey	grey	grey	grey
FI	red	green	red	green
FR	green	green	grey	grey
DE	green	grey	grey	grey
GR	grey	grey	grey	grey
HU	green	green	green	green
IE	green	green	green	green
IT	green	green	green	green
LV	grey	grey	grey	grey
LT	grey	grey	grey	grey
LU	green	green	grey	grey
MT	green	grey	green	grey
NL	green	green	green	green
PL	grey	grey	grey	grey
PT	red	red	red	red
RO	green	green	green	green
SK	red	green	red	green
SI	grey	grey	grey	grey
ES	green	green	green	green
SE	red	red	red	red

Colour code: green - included, red – non included, grey - not reported

Source: NZEB data collection

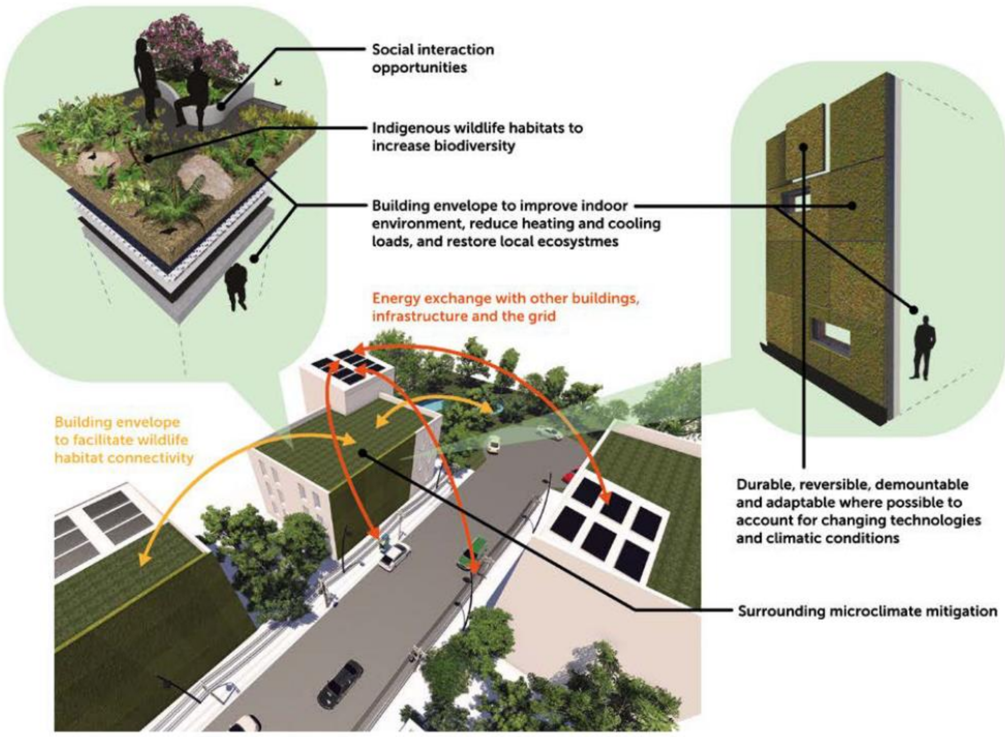
As for lighting systems, energy savings can be achieved by increasing the efficient use of daylight as well as by smart lighting systems. Explicit requirements on lighting systems have been set by 13 countries. These requirements could regard indicators like the Watt/m^2 ratio (i.e. Belgium – Walloon Region), the compatibility with standards (i.e. Croatia), the minimal efficacy and the maximal specific power (i.e. Spain). Some Member States set requirements for lighting systems only for the non-residential buildings (i.e. the Netherlands).

NZEBs can include on-site energy storage, smart technologies, electric vehicles charging [Wells et al, 2018]. The incorporation of Vehicle-to-Home (V2H) technology in NZEBs has facilitated the growth of renewable energy deployment and there is a growing global interest in electric vehicles and V2H potential to minimize renewable energy waste and emissions [Ohene et al, 2021; Alirezaei et al, 2016]. This technology leverages the idle batteries of electric vehicles as grid storage resources, helping to stabilize renewable power fluctuations and serve as backup power in emergencies. Moreover, it is estimated that substituting fossil fuel cars within NZEB boundaries could lead to a reduction in emissions between 11% and 35% [Rehman et al, 2021].

Over last decade, developments have been made in the field of recovering waste to energy and energy conservation measures. Other emerging technologies are: nanotechnologies, phase change materials, prefabricated modules, 3D printing, vacuum insulated panels, ventilated facades with PV panels, electrochromic windows, integrated heating, ventilation, air conditioning along with electricity [Buonomano et al, 2020].

The higher future consideration of the impacts on natural environments appears important, for example with the inclusion of regenerative energy strategies, vertical green, rainwater storage and treatment, waste management (Figure 2).

Figure 24. Regenerative design principles.



Source: Craft et al, 2017

Automation systems in lighting like presence detectors and daylight detectors can also guarantee energy savings. Building management and energy use optimization systems (e.g., Intelligent and Smart Technologies) are promising technologies, including the Internet of Things (IoTs) and Artificial Intelligence (AI) for intelligent home energy management for affordable NZEBs [Aliero et al, 2021]. AI has demonstrated its capabilities in various areas, including learning techniques (such as Artificial Neural Networks, machine learning, Support Vector Machines, deep learning, and reinforcement learning), optimization methods (genetic algorithms, particle swarm optimization), control systems (expert systems, fuzzy logic, model-based predictive control, and multi-agent systems) for energy system management focused on energy conservation [Lee et al, 2022; Yan et al, 2021].

Among AI key applications for NZEBs: indoor environment detection and control (e.g., temperature, humidity, and air quality), efficiency in multi-energy utilization, the predictive accuracy of forecasting for optimal control (Heating, Ventilation and Air-Conditioning - HVAC and lighting systems) [Yang et al, 2020]. AI has also played a significant role in simplifying the optimization of renewable energy technologies and minimizing energy consumption and emissions to achieve NZEBs. For instance, a machine learning model based on Residual Neural Networks was developed to predict and optimize the performance of HVAC systems in NZEBs [Pittarello et al., 2021]. This model is believed to reduce computational time and improve simulation-based optimization in NZEB design. Additionally, an automatic energy assessment tools using Artificial Neural Networks was developed to estimate energy consumption in buildings with limited data [Ferrara et al, 2021]. Further effort is needed to enhance automatic load tracking and self-adaptive control for logic and process, which can help analyze occupant behaviour, a crucial aspect of building and energy performance simulation.

6. From NZEBs to ZEBs

To achieve a decarbonized building stock by 2050, Zero-Emission Buildings (ZEBs) were introduced in the EPBD revision among other measures. A ZEB is defined as a building with very low energy demand, zero on-site carbon emissions from fossil fuels and zero or a very low amount of operational greenhouse gas emissions. All new buildings should be zero-emission buildings by 2030, and existing buildings should be transformed into ZEBs by 2050.

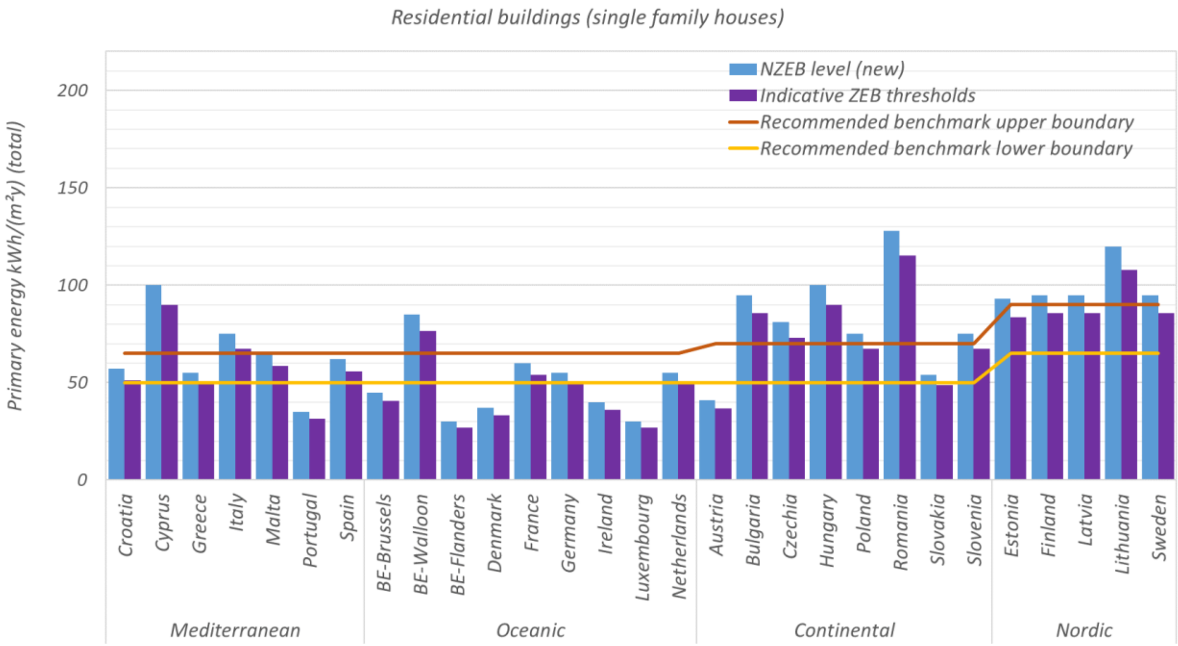
The total annual primary energy consumption must be covered by on-site and nearby renewable energy sources, renewable energy communities, efficient district heating and cooling systems, or other carbon-free energy sources. Member States should establish maximum thresholds for the total annual primary energy use of ZEBs that are at least 10% lower than national NZEBs at the time of implementation. Additionally, operational GHG emissions should meet a national maximum threshold. The primary objective at the EU level is for public buildings to be ZEBs by 2028 and for all new buildings to meet the ZEB standard by 2030.

The concept of ZEBs must be properly understood and implemented, avoiding the delays that characterized the initial NZEB implementation [Maduta et al, 2022]. This concept has gained prominence and adoption globally over the past two decades as a key strategy for decarbonizing the building sector. A general consensus is that a ZEB represents an innovative sustainability approach, characterized by high energy efficiency and the capacity to generate renewable energy to counterbalance its (GHG) emissions. . The scientific terminology of Zero Emission [ZEB, 2022; Skaar et al, 2018] or Net Zero Emission [Good et al, 2015, Ruparathna et al, 2017], Zero Carbon [Riedy et al, 2011], or Zero Carbon Ready [IEA, 2021] encompasses energy efficiency upgrades, the integration of renewable energy resources, and cautious carbon offsetting strategies.

6.1. Projected ZEB levels

To understand how potential ZEB performance levels would look at the national level based on current NZEB levels, Figure 2 and Figure 2 compare the national NZEB levels for new buildings, the indicative ZEB levels and the NZEB recommended benchmarks. The indicative ZEB levels are calculated by taking the current national levels of total primary energy demand for NZEBs and reducing them by 10%. The estimation of NZEB levels of total primary energy demand follows the methodology provided in this report. When insufficient information was available, total primary energy demand was considered equal to the non-renewable primary energy demand.

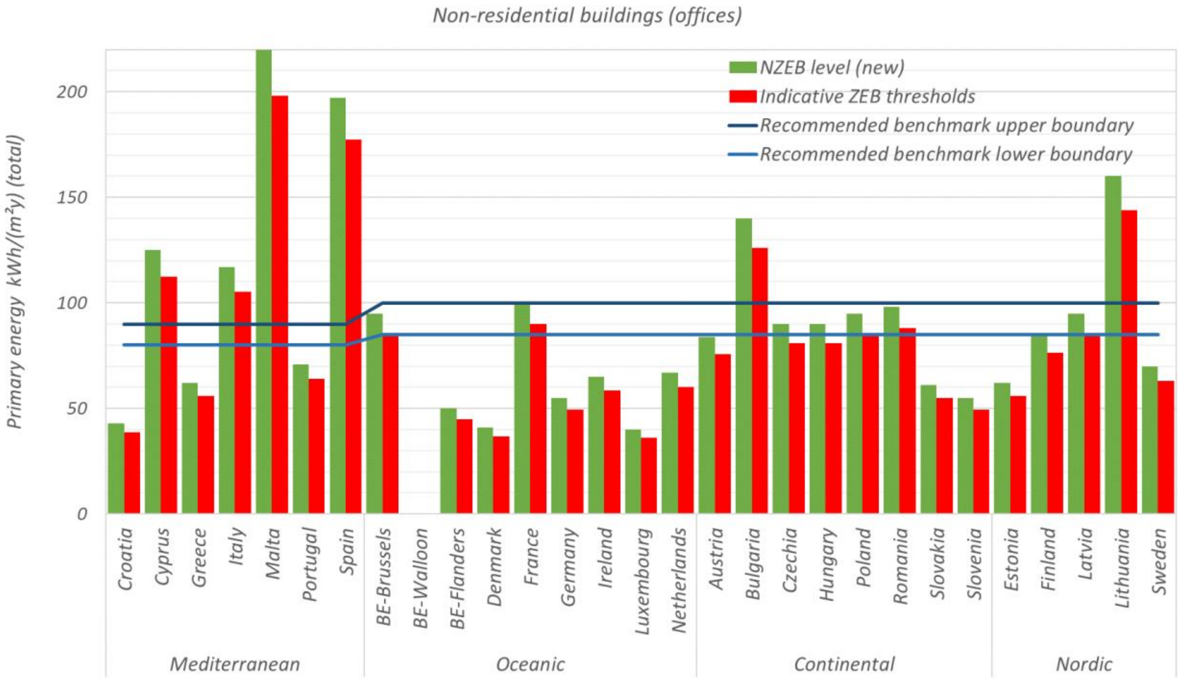
Figure 25. Comparison between national NZEB levels for new buildings, indicative ZEB levels and NZEB recommended benchmarks in total primary energy demand for residential buildings (single family houses)



Source: JRC elaboration, 2025

The comparison shows a very diverse landscape. Looking at the upper boundary of the recommended benchmark (Figure 2, orange line), less than half of the countries fall short of the threshold (14 countries). The 10% more ambitious ZEBs further enhance the trends, with 8 countries above the upper threshold (Table 7). When considering different climatic zones, Continental countries are less compliant, with 4 out of 8 definitions being less ambitious than the upper boundary, whereas the Oceanic group has more compliant definitions, with only 1 out of 9 definitions exceeding the upper boundary. . However, looking at the lower boundary of the recommended benchmark range, the performance levels of both NZEB and indicative ZEB are not compliant in most countries. In this regard, Oceanic countries tend to be more compliant, while the Nordic group has no compliant definition.

Figure 26. Comparison between national NZEB levels for new buildings, indicative ZEB levels and NZEB recommended benchmarks in total primary energy demand for non-residential buildings (offices)



Source: JRC elaboration, 2025

Figure 2 compares the national NZEB performance levels, NZEB recommended benchmarks (lower and upper boundary, table 7) and indicative ZEB performance levels in total primary energy), for offices. Similar to single-family houses, the national ZEB primary energy levels were calculated as 10% lower than the NZEB primary energy levels for offices.

Overall, the comparison reveals a generally positive outlook. In this case, it appears that only 6 countries have higher NZEB performance values than the upper boundary of the recommended total primary energy range. A 10% more ambitious ZEB does not change this compliance. Looking at the lower limit of the recommended total primary energy, 13 current NZEB definition are not compliant, while only 8 indicative ZEB levels are non-compliant. Overall, the Mediterranean group appears the least ambitious, while the Oceanic group is the most ambitious.

6.2. Open issues

A main challenge on the transition from NZEB to ZEB is the energy performance level. While this ZEB level is by definition more stringent than NZEB level (at least 10%), a significant issue is its comparison to the NZEB concept in terms of energy demand. The total primary energy of NZEBs, which vary widely across Member States—from 30 kWh/(m²y) in Flanders to 128 kWh/(m²y) in Romania (climate zone 2) for new single-family houses, and from 40 kWh/(m²y) in Luxembourg to 220 kWh/(m²y) in Malta for offices—highlight this inconsistency. This indicates that also ZEB levels will vary considerably across the Member States with many definitions possibly not in line with the recommended NZEB levels.

It is noted that when comparing the current NZEB levels with the EC-recommended benchmarks for non-renewable primary energy demand, they are less compliant than when compared based on total primary energy demand. Although the benchmarks suggest a high contribution of renewables (70%

for Mediterranean countries and 50% for Oceanic countries), the renewable energy contributions mandated in national NZEBs vary significantly. Concretely, this varies widely in both new and renovated NZEBs, ranging from 9-10% to 60% in new NZEBs, and up to 55% in NZEB renovations. In several cases the renewable energy share is not well defined and thus the total energy reflects the non-renewable energy, marking several definitions non-compliant. Therefore, another significant ZEB challenge is the integration of renewable energy sources.

The new ZEB requirements address this aspect this by clearly defining acceptable energy sources from 2030 onwards. On-site building systems (such as those for heating, cooling, ventilation, lighting, and domestic hot water) must produce no carbon emissions from fossil fuels, meaning they must be powered by renewable energy. This may prove challenging particularly for buildings with limited access to on-site renewable energy sources. To meet this requirement, buildings must drastically reduce their energy demand, in line with the "energy efficiency first" principle, to remain within the ZEB criteria. This could require substantial revisions to some existing NZEB thresholds. However, the directive provides additional energy source options for ZEBs—such as nearby generated renewable energy, renewable energy communities, efficient district heating/cooling, and carbon-free sources—that could help facilitate the adoption and deployment of ZEBs, especially for buildings with limited access to locally sourced renewable energy. Currently, the majority of countries rely on on-site production from solar energy (photovoltaics and thermal collectors) in their NZEB definition. Given this context, Member States will need to explore and exploit additional renewable options, as indicated by the recast directive.

Furthermore, as the focus shifts towards decarbonisation, the revised EPBD requires Member States to establish maximum operational GHG emission thresholds for ZEBs. Currently, only few countries include emission requirements in their NZEB definition. Table 1 summarises these requirements. It was observed that emissions criteria are generally considered a secondary indicator, with primary energy use—especially non-renewable energy—often serving as a proxy for operational emissions. Consequently, countries typically prioritize limiting primary energy use in line with current NZEB definitions rather than directly targeting emissions. However, in most countries, GHG emissions are calculated and displayed on the EPC, with some countries (such as Austria, France, Luxembourg, Romania, and Spain) including an EPC class specifically for emissions. This suggests that while emissions are not a central focus in most current NZEB definitions, they are partially addressed in national building standards, setting the stage for the potential introduction of emission thresholds by 2030. In this context, the established cost-optimal methodology, which is already widely adopted by Member States, could be a valuable tool for benchmarking operational emissions. It helps find the most cost-effective balance between energy efficiency and renewable energy integration, tailored to the specific conditions of each country or region.

Table 19. Requirements on GHG emissions in national NZEB definitions

BE Wa	No
BE Fl	No
HR	No
CY	No
CZ	No
DK	Life-cycle emissions requirements. New buildings with energy requirements and a heated floor area of more than 1000 m^2 shall not have emissions that exceed 12 kg CO_2-eq//m^2y) based on a life cycle assessment.
EE	No
FI	No

FR	No
DE	The CO_2 emissions are limited, the delivered energy for heating, DHW, ventilation, and cooling are not exceeding 55% of reference building value
GR	No
HU	No
IE	Yes Residential: New NZEB; 7-8 kg $CO_2/(m^2y)$ Non-residential: Where the actual building performance has a carbon dioxide emissions performance equal to, or lower than 1.15 times the carbon dioxide performance ($kgCO_2/m^2y$) of the building modelled it achieves the NZEB performance specification for carbon dioxide emissions.
LU	No
MT	No
NL	No
PL	No
PT	No
RO	Yes, with thresholds (details below)
SK	No
SI	No
ES	No
SE	No

Source: JRC elaboration, 2025

As shown in Table 1, the majority of Member States have not established requirements in NZEBs in relation to CO_2 emissions. Among the countries that provided requirements, Romania distinguished new and existing NZEBs depending on climate (Table 20).

Table 20. Romania requirements on CO_2 emissions

Climatic zone 1	NEW NZEBs CO_2 emissions $kg/(m^2y)$	RENOVATED NZEBs CO_2 emissions $kg/(m^2y)$
Single family house	14.7	22.1
Multi-family house	12	17.9
Offices	10.1	15.4
Hotels	11.7	17.4
Hospitals	19	28.4
Others (Education)	7.3	10.9
Others (Commercial)	11	16.5
Others (Sporting activities)	10.4	15.7

Climatic zone 2	NEW NZEBs CO_2 emissions $kg/(m^2y)$	RENOVATED NZEBs CO_2 emissions $kg/(m^2y)$

Single family house	16	26.3
Multi-family house	12.8	19.1
Offices	10.9	16.5
Hotels	12.5	18.5
Hospitals	20.2	30.1
Others (Education)	8.1	12
Others (Commercial)	12.2	18.3
Others (Sporting activities)	11.3	16.9

Climatic zone 3	NEW NZEBs CO_2 emissions kg/(m^2y)	RENOVATED NZEBs CO_2 emissions kg/(m^2y)
Single family house	17.1	25.5
Multi-family house	13.5	19.9
Offices	11.5	17.2
Hotels	13.1	19.4
Hospitals	21.1	31.3
Others (Education)	8.8	13.1
Others (Commercial)	13.3	19.7
Others (Sporting activities)	12	17.9

Climatic zone 4	NEW NZEBs CO_2 emissions kg/(m^2y)	RENOVATED NZEBs CO_2 emissions kg/(m^2y)
Single family house	18.5	27.5
Multi-family house	14.3	21.1
Offices	12.2	18.2
Hotels	13.9	20.6
Hospitals	22.3	32.9
Others (Education)	9.7	14.4
Others (Commercial)	14.6	21.6
Others (Sporting activities)	12.9	19.1

Climatic zone 5	NEW NZEBs CO_2 emissions kg/(m^2y)	RENOVATED NZEBs CO_2 emissions kg/(m^2y)

Single family house	19.9	29.5
Multi-family house	15.1	22.3
Offices	13	19.2
Hotels	14.7	21.7
Hospitals	23.5	34.5
Others (Education)	10.6	15.6
Others (Commercial)	16	23.5
Others (Sporting activities)	13.7	20.3

Source: JRC elaboration, 2025

To ensure the achievement of climate targets, NZEB could also include CO_2 emission indicators as additional requirements for the energy performance of the building. It is estimated, starting from CO_2 emissions for the building sector of approximately 1.100 $MtCO_2$ in 1990 (direct and indirect emissions for heating, domestic hot water (DHW) and cooling purposes) and assuming a useful floor area in 2050 of 38 billion m² in 2050, a 90% decrease of emissions would require an average CO_2 emissions of maximum 3 $kgCO_2/(m^2y)$[9]. So, NZEB requirements for new buildings should include nearly zero carbon emissions below approx. 3 $kgCO_2/(m^2y)$ [BPIE, 2021].

Moving towards a decarbonised life-cycle of buildings, starting in 2030, life-cycle Global Warming Potential (GWP)[10] calculations will be introduced for new buildings Looking ahead, reducing embodied carbon in the design phase of both new buildings and renovations will be crucial, potentially through the use of binding benchmarks. According to the International Energy Agency (IEA), newly built buildings must not exceed a net CO_2 emission rate of 8-10 kg $CO_2/(m^2y)$ over the life-cycle of the building [IEA, 2019]. Opting for locally available, low-carbon materials can cut emissions from materials and transportation. Additionally, emphasizing the use of natural materials would help decrease construction waste and make recycling easier at the end of the building's life cycle.

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[9] 1,100 $MtCO_2$ x (100%-90%) / 38 billion m² = 2.89 $kg/(m^2y)$

[10] The life-cycle GWP measures the total GHG emissions associated with the life-cycle of a building, expressed in terms of the equivalent carbon dioxide (CO_2-eq).

7. Conclusions

Reducing energy consumption in buildings is crucial for the EU strategy to meet future climate and energy objectives. NZEBs play a critical role in achieving a decarbonised building stock. The data collected to assess the status of NZEBs implementation in Member States are encouraging and demonstrate a tangible progress compared to previous assessments. Based on Member States national definitions, the NZEB performance level is assessed as non-renewable primary energy demand as follows:

for single-family houses from 15 to 95 kWh/(m^{2}y) with an average at EU level of 54 kWh/(m^{2}y) for new buildings, from 30 kWh/(m^{2}y) and 135 kWh/(m^{2}y) with an average at EU level of 73 kWh/(m^{2}y) for existing buildings under renovation to NZEB level;

for offices, from 28 and 220 kWh/(m^{2}y) with an EU average of 73 kWh/(m^{2}y) for new buildings, from 30 and 152 kWh/(m^{2}y) with a EU average of 90 kWh/(m^{2}y) for existing buildings renovated to NZEB level.

NZEB levels for new buildings are more demanding than those for NZEB renovation. On average, the non-renewable primary energy consumption of new NZEB buildings is approximately 30% lower than that of renovated NZEB buildings. Comparing the national NZEB levels with the NZEB recommended benchmark, it was observed that in most cases the national NZEB primary energy demand is less ambitious than the recommended benchmarks, particularly for existing buildings renovated to NZEB level.

Interestingly, cost-optimal levels align with NZEB levels (within 15% gap), suggesting that current national NZEB definitions for single-family houses are established at cost-optimal levels, based on the most recent national cost-optimal reports (on going assessment). For existing buildings, in almost all Member States, NZEB levels are significantly more ambitious than the cost-optimal levels. NZEB primary energy demand is within a 10% lower than the cost-optimal levels except for existing single-family houses.

In terms of U-values in NZEBs, the data collected highlighted the following main outputs:

For new buildings, walls U-values range from 0.13 to 1.57 W/(m^{2}K) with an average of 0.32 W/(m^{2}K), roof U-values from 0.09 to 0.49 W/(m^{2}K) with an average of 0.23 W/(m^{2}K), windows U-values from 0.85 to 4.00 W/(m^{2}K) with an average of 1.59 W/(m^{2}K), floors U-values from 0.14 to 1.97 W/(m^{2}K) with an average of 0.36 W/(m^{2}K);

For existing buildings, walls U-values range from 0.13 to 1.57 W/(m^{2}K) with an average of 0.33 W/(m^{2}K), roof U-values from 0.09 to 0.49 W/(m^{2}K) with an average of 0.24 W/(m^{2}K), windows U-values from 0.85 to 4.00 W/(m^{2}K) with an average of 1.64 W/(m^{2}K), floors U-values from 0.14 to 1.97 W/(m^{2}K) with an average of 0.37 W/(m^{2}K).

In relation to renewable energy, in nearly 70% of NZEB definitions, renewable energy requirements are outlined for new buildings, while for existing buildings undergoing NZEB renovation, this number drops to over 40%. The renewable energy contribution varies widely in both new and renovated NZEBs, ranging from 9-10% to 60% in new NZEBs, and up to 55% in NZEB renovations. Solar technologies, (PV and solar thermal collectors) are considered by all countries, and a few quantify the PV supply share. Most implemented technologies in NZEBs are passive (sunshade, natural ventilation and lighting, thermal mass, night cooling), and active (mechanical ventilation with heat recovery, heat pumps or district heating), in combination with efficient lighting and appliances. Smart and new emerging technologies, digitalization, automation, AI, and the internet of things are more integrated in NZEBs together with electric vehicles charging, recovering waste to energy, consideration of energy conservation, climate change, comfort, health, and embodied energy.

The analysis from LTRS, NECPs, NECPR also showed how progress in terms of national policies, measures and provisions for NZEBs. Several Member States defined long-term milestones for 2030, 2040 and 2050 related to NZEBs implementation (e.g. percentage of NZEB to the total building stock, energy savings from NZEB, number of dwellings to be renovated to NZEB, floor are of NZEB buildings). Twenty Member States reported NZEB measures in the NECPRs, most regulatory and legislative (38%), economic (29%), information (11%), planning (6%), voluntary/negotiated agreements, education and other (4%). These measures can affect the whole building sector (61%), be targeted to public buildings (15%) or to households and services (private sector) (7% both). A widespread NZEBs retrofit implementation is still challenging in the light of further boosting renovation. Refurbishment to NZEBs levels requires specific innovative tools and incentive mechanisms able to make investment more attractive, beside an appropriate combination of efficient technologies, systems and envelope solutions depending on location, legislation and market conditions. Dedicated planning goals as well as mid- and long- term plans for upgrading to NZEBs levels appear as useful instruments. As Member States present a wide range of building types and technologies, climatic, and financial conditions, targeted measures, cross sectoral policies and guidance can stimulate a large-scale diffusion of NZEBs retrofit.

As for ZEBs, the comparison between potential ZEB levels and NZEB recommended benchmarks in total primary energy demand showed a rather encouraging outlook, as most Member States showed a better compliance than considering the NZEB non-renewable primary energy demand. However, results are quite variable depend on the country climate and accounted benchmark boundary (upper or lower). In the light of achieving the future ambitious goals of ZEBs, boosting the ambition by 10% beyond current NZEB standards could foster overall compliance. Although the ZEB framework focuses on significantly reducing total primary energy use and achieving zero on-site emissions, many countries will need to increase the level of renewable energy contributions. Renewable energy is crucial in meeting the ZEB requirements, especially considering that ZEB standards mandate zero on-site emissions and very low operational GHG emissions. It also appears that countries need to further exploit additional renewable options, such as renewable energy communities and efficient district heating and cooling systems.

Based on the results of this report, the following aspects can support ZEBs development: invest in energy-efficient and adaptable building designs and sustainable materials to reduce overall consumption, encourage the use of renewable energy sources (such as solar, wind, geothermal energy), implement energy-efficient heating, cooling, and ventilation systems to minimize energy waste, promote the adoption of smart home technologies and energy management systems to optimize energy usage, provide financial incentives and support programs for building owners and developers to encourage the construction of ZEBs. By addressing these aspects, Member States can work towards a more sustainable and energy-efficient building sector, with several advantages, such as decreasing greenhouse gas emissions, dependence on energy supply, and increasing jobs, energy security, and economic growth.

The results of this assessment report on NZEBs showed the progress by Member States on different aspects related to NZEBs, and assume a strategic value in the light of the 2030 and 2050 targets for the building sector, contributing to the EU climate neutrality goal.

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List of abbreviations and definitions

Abbreviations	Definitions
AI	Artificial Intelligence
CA	Concerted Action
DHW	Domestic Hot Water
EC	European Commission
EE	Energy Efficiency
EPBD	Energy Performance of Building Directive
EED	Energy Efficiency Directive
EPC	Energy Performance Certificate
ESCO	Energy Service Company
GHG	Greenhouse Gas
GWP	Global Warming Potential
HVAC	Heating, Ventilation and Air Conditioning
IEA	International Energy Agency
IoT	Internet of Things
LTRS	Long-Term Renovation Strategy
NECP	National Energy and Climate Plan
NECPR	National Energy and Climate Progress Report
NZEB	Nearly Zero Energy Building
PCM	Phase Change Materials
PEF	Primary Energy Factors
PV	Photovoltaics

Abbreviations	Definitions
RES	Renewable Energies
SFH	Single-Family Houses
V2H	Vehicle to Home
ZEB	Zero-Emission Building
EU	European Union
AT	Austria
BE - Br	Belgium Brussels
BE - Wa	Belgium Wallonia
BE - Fl	Belgium Flanders
BG	Bulgaria
HR	Croatia
CY	Cyprus
CZ	Czech Republic
DK	Denmark
EE	Estonia
FI	Finland
FR	France
DE	Germany
GR	Greece
HU	Hungary
IE	Ireland
IT	Italy

Abbreviations	Definitions
LV	Latvia
LT	Lithuania
LU	Luxembourg
MT	Malta
NL	Netherlands
PL	Poland
PT	Portugal
RO	Romania
SK	Slovakia
SI	Slovenia
ES	Spain

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- AT, Austria

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NZEB definition: new buildings	16x(1+3,0/lc) and fGEE =0,75 -> 14x(2,8/lc) and fGEE =0,75			
NZEB definition: renovated buildings	17x(1+2,9/lc) and EEBWGsan,RK,zul -> 17x(1+2,5/lc) and EEBWGsan,RK,zul 25x(1+2,5/lc) and fGEE =0,95 -> 21x(1+2,1/lc) and fGEE =0,95			
NEW NZEB energy performance requirements	Total Primary Energy (kWh/m^2y)	Non-renewable primary energy (kWh/m^2y)	Renewable primary energy (kWh/m^2y)	Energy class
Single family house		10x(1+3,0/lc) and EEBWGsan,RK,zul or 16x(1+3,0/lc) and fGEE = 0,75		
Multi family house		10x(1+3,0/lc) and EEBWGsan,RK,zul or 16x(1+3,0/lc) and fGEE = 0,75		
Offices		10x(1+3,0/lc) and EEBWGsan,RK,zul or 16x(1+3,0/lc) and fGEE = 0,75		
Hotel		10x(1+3,0/lc) and EEBWGsan,RK,zul or 16x(1+3,0/lc) and fGEE = 0,75		
Hospital		10x(1+3,0/lc) and EEBWGsan,RK,zul or 16x(1+3,0/lc) and fGEE = 0,75		
Other				
Included end uses				
RENOVATED NZEB energy performance requirements	Total primary energy (kWh/m^2y)	Non-renewable primary energy (kWh/m^2y)	Renewable primary energy (kWh/m^2y)	Energy class

Single family house		17x(1+2,9/lc) and EEBWGsan,RK,zul or 25x(1+2,5/lc) and fGEE = 0,95		
Multi family house		17x(1+2,9/lc) and EEBWGsan,RK,zul or 25x(1+2,5/lc) and fGEE = 0,95		
Offices		17x(1+2,9/lc) and EEBWGsan,RK,zul or 25x(1+2,5/lc) and fGEE = 0,95		
Hotel		17x(1+2,9/lc) and EEBWGsan,RK,zul or 25x(1+2,5/lc) and fGEE = 0,95		
Hospital		17x(1+2,9/lc) and EEBWGsan,RK,zul or 25x(1+2,5/lc) and fGEE = 0,95		
Other				
Included end uses				

NZEBs building elements	External walls (W/m2K)	Roofs (W/m^2K)	Windows (W/m^2K)	Floors (W/m^2K)	Overall U-value (W/m^2K)	Solar energy transmittance	Air tightness
Current requirements for new NZEBs	0.35	0.2	1.4	0.4		depending on the glazing	n50 from 1,50 to 3,00: ninf = 0,11 h-1 n50 from 0,60 to 1,50: ninf = 0,07*n50 h-1 n50 < 0,60: ninf = 0,04 h-1
Current requirements for renovated NZEBs	0.35	0.2	1.4	0.4		depending on the glazing	n50 from 1,50 to 3,00: ninf = 0,11 h-1 n50 from 0,60 to 1,50: ninf = 0,07*n50 h-1 n50 < 0,60: ninf = 0,04 h-1
Notes	*for renovated NZEBs, minus 24% without renovation passport						

- BE- FLA, Belgium-Flemish region

Legal act on implemented NZEB definitions	Energy Decree of 18/11/2011 (article 6), Decree of the Flemish Government of 29/11/2013 (article 7).			
NZEB definition: new buildings	"The Flemish Government decides which EPB-requirements correspond to an NZEB building. The Flemish Government ensures in that context that: 1° on January 1st of 2021 the latest, de EPB-requirements for all new buildings correspond to the EPB-requirements of NZEB buildings;..." The Flemish Government has implemented the EPB-requirements until 2021, corresponding to NZEB buildings, in the Decree of 29/11/2013.			
NZEB definition: renovated buildings	no legal definition of NZEB renovation, we have a long term goal 'label A' for renovations in the LTRS, which can be considered as an NZEB level.			
NEW NZEB energy performance requirements	Total primary energy (kWh/m²y)	Non-renewable primary energy (kWh/m²y)	Renewable primary energy (kWh/m²y)	Energy class
Single family house	E30	15		
Multi family house	E30 (per unit)		15	
Offices	E50		20	
Hotel	E70		20	
Hospital	E70		20	
Other				
Included end uses	Heating, cooling, ventilation, lighting (non-residential)			
RENOVATED NZEB energy performance requirements	Total primary energy (kWh/m²y)	Non-renewable primary energy (kWh/m²y)	Renewable primary energy (kWh/m²y)	Energy class
Single family house	E60 (IER)		15 (IER)	A
Multi family house	E60 (IER)		15 (IER)	A

Offices	E90 (IER)		15 (IER)	
Hotel	E85 (IER)		15 (IER)	
Hospital	E75 (IER)		15 (IER)	
Other	18 functions (E-peil: eis voor niet-residentiële gebouwen (voor bouwaanvragen in 2021) | Vlaanderen.be) 18 functions (E-peil: eis voor niet-residentiële gebouwen - IER (voor bouwaanvragen van 01-01-2021 t.e.m. 31-12-2021) | Vlaanderen.be)			
Included end uses	Heating, cooling, ventilation, lighting (non-residential)			

NZEBs building elements	External walls (W/m2K)	Roofs (W/m²K)	Windows (W/m²K)	Floors (W/m²K)	Overall U-value (W/m²K)	Solar energy transmittance	Air tightness
Current requirements for new NZEBs	0.24	0.24	1.5	0.24	S-level (residential) ; / (non-residential)	Max. overheating indicator (residential)	(crucial in S-level, incl. in E-level)
Current requirements for renovated NZEBs	0.24	0.24	1.5	0.24			(incl. in primary energy)
Notes							

- BE- WA, Belgium- Walloon Region

Legal act on implemented NZEB definitions	EPB Decree (Décret PEB): https://wallex.wallonie.be/eli/loi-decret/2013/11/28/2013207272/2021/02/13 EPB Executive Order (AGW PEB): https://wallex.wallonie.be/eli/arrete/2014/05/15/2014027210/2023/03/27			
NZEB definition: new buildings	EPB Executive Order, art. 2, 13': “Nearly-zero energy consuming building unit: a building unit that has very high energy performance, in which the very low amount of energy required is covered to a very large extent by energy produced from renewable sources, on site or nearby.” “unité PEB dont la consommation d'énergie est quasi nulle: une unité qui a des performances énergétiques très élevées, dans laquelle la quantité très basse d'énergie requise est couverte dans une très large mesure par de l'énergie produite à partir de sources renouvelables, sur place ou à proximité.”			
NZEB definition: renovated buildings	same as above (new)			
NEW NZEB energy performance requirements	Total primary energy (kWh/m^2y)	Non-renewable primary energy (kWh/m^2y)	Renewable primary energy (kWh/m^2y)	Energy class
Single family house	Espec ≤ 85 kWh/m^2y & Ew ≤ 45% of reference building		25% ER share of building primary consumption or Espec ≤ 64 kWh/m^2y & Ew ≤ 34% of reference building	A
Multi family house	Espec ≤ 85 kWh/m^2y & Ew ≤ 45% of reference building		25% ER share of building primary consumption or Espec ≤ 64 kWh/m^2y & Ew ≤ 34% of reference building	A
Offices	offices and schools: Ew ≤ 45% of reference building [a)]		offices and schools: 25% ER share of building primary consumption or Ew ≤ 34% of reference building [a)]	

Hotel	Ew ≤ 90% of reference building [a)]		25% ER share of building primary consumption or Ew ≤ 68% of reference building [a)]	
Hospital	Ew ≤ 90% of reference building [a)]		[25% ER share of building primary consumption or Ew ≤ 68% of reference building [a)]	
Other	Ew ≤ 90% of reference building, 25% ER share of building primary consumption [a)] or Ew ≤ 68% of reference building [a)]			
Included end uses	Only “EPB-uses” (both for the total primary energy as for the relative indicator): “heating” | “SHW” | “cooling” | “auxiliaries” | “on-site electricity generation” | “lighting” (non-residential only) | “humidification” (non-residential only)			
RENOVATED NZEB energy performance requirements	Total primary energy (kWh/m^2y)	Non-renewable primary energy (kWh/m^2y)	Renewable primary energy (kWh/m^2y)	Energy class
Single family house	85 [a)]			A [a)]
Multi family house	85 [a)]			A [a)]
Offices	80 [c)] (final energy) offices and schools			
Hotel	80 [c)] (final energy)			
Hospital	80 [c)] (final energy)			
Other	new: [a)] In case of non-residential buildings with a combination of “Office & schools” and of “other non-residential types”, the Ew criterion value to be respected is a weighted average based on the floor surface of the different non-residential types in the building. Therefore, for some non-residential buildings, the values are between 45 et 90 (and it is also the case between 34 &			

	68 for the RE% share criterion) renovated: [a] Indicated by the Walloon LTRS. Expressed in Primary Energy & same end-uses as New NZEBs. Goal for residential building units is to become "decarbonised & A-Class" (i.e.: Espec ≤ 85 kWh/m²y & no more fossil TBS). [c] Indicated by the Walloon LTRS. Expressed in Final Energy (including all the other uses than the "EPB-uses" but excluding on-site electricity generation). This consumption must be fully covered by RES sources (as well on-site & off-site & via RE contracts).						
Included end uses							
NZEBs building elements	External walls (W/m2K)	Roofs (W/m²K)	Windows (W/m²K)	Floors (W/m²K)	Overall U-value (W/m²K)	Solar energy transmittance	Air tightness
Current requirements for new NZEBs	≤ 0,24	≤ 0,24	Ug ≤ 1,1 Average Uw value on all the windows of the building ≤ 1,5	≤ 0,24	No criteria on overall U-Value K-Level ≤ 35		
Current requirements for renovated NZEBs	≤ 0,24	≤ 0,24	Ug ≤ 1,1 Average Uw value on all the added and/or replaced windows of a work phase ≤ 1,5	≤ 0,24	No criteria on average U-Value No criteria on K-Level		
Notes							

- CY, Cyprus

Legal act on implemented NZEB definitions	N.142(I)/2006 Κ.Δ.Π.366/2014 & Κ.Δ.Π.122/2020			
NZEB definition: new buildings NZEB definition: renovated buildings	"Nearly-zero energy building" means a building that has a very high energy performance, as determined in accordance to the methodology for calculating energy performance of buildings, and whose nearly zero or very low amount of energy required is covered to a very large extent by energy from renewable sources, including energy from renewable sources produced on-site or nearby. Technical details and minimum requirements are determined in Κ.Δ.Π.366/2014 and Κ.Δ.Π.122/2020.			
NEW NZEB energy performance requirements	Total primary energy (kWh/m²y)	Non-renewable primary energy (kWh/m²y)	Renewable primary energy (kWh/m²y)	Energy class
Single family house	100	At most 75% of Total primary energy	At least 25% of Total primary energy	A
Multi family house	100	At most 75% of Total primary energy	At least 25% of Total primary energy	A
Offices	125	At most 75% of Total primary energy	At least 25% of Total primary energy	A
Hotel	125	At most 75% of Total primary energy	At least 25% of Total primary energy	A
Hospital	125	At most 75% of Total primary energy	At least 25% of Total primary energy	A
Other	125, At most 75% of Total primary energy, At least 25% of Total primary energy, A			
Included end uses	Heating, cooling, hot water, lighting, ventilation, exhaust air & auxiliary energy for the operation of end-uses systems.			

<table>
<tr><td>RENOVATED NZEB energy performance requirements</td><td colspan="2">Total primary energy (kWh/m²y)</td><td colspan="2">Non-renewable primary energy (kWh/m²y)</td><td>Renewable primary energy (kWh/m²y)</td><td colspan="2">Energy class</td></tr>
<tr><td>Single family house</td><td colspan="2">100</td><td colspan="2">At most 75% of Total primary energy</td><td>At least 25% of Total primary energy</td><td colspan="2">A</td></tr>
<tr><td>Multi family house</td><td colspan="2">100</td><td colspan="2">At most 75% of Total primary energy</td><td>At least 25% of Total primary energy</td><td colspan="2">A</td></tr>
<tr><td>Offices</td><td colspan="2">125</td><td colspan="2">At most 75% of Total primary energy</td><td>At least 25% of Total primary energy</td><td colspan="2">A</td></tr>
<tr><td>Hotel</td><td colspan="2">125</td><td colspan="2">At most 75% of Total primary energy</td><td>At least 25% of Total primary energy</td><td colspan="2">A</td></tr>
<tr><td>Hospital</td><td colspan="2">125</td><td colspan="2">At most 75% of Total primary energy</td><td>At least 25% of Total primary energy</td><td colspan="2">A</td></tr>
<tr><td>Other</td><td colspan="7">125, At most 75% of Total primary energy, At least 25% of Total primary energy, A</td></tr>
<tr><td>Included end uses</td><td colspan="7">Heating, cooling, hot water, lighting, ventilation, exhaust air & auxiliary energy for the operation of end-uses systems.</td></tr>
<tr><td>NZEBs building elements</td><td>External walls (W/m2K)</td><td>Roofs (W/m²K)</td><td>Windows (W/m²K)</td><td>Floors (W/m²K)</td><td>Overall U-value (W/m²K)</td><td>Solar energy transmittance</td><td>Air tightness</td></tr>
<tr><td>Current requirements for new NZEBs</td><td>0,40 W/m²K</td><td>0,40 W/m²K</td><td>2,25 W/m²K</td><td>0,40 W/m²K</td><td>Alternatively, in order to be allowed to exceed the above maximum coefficients of thermal permeability (minimum requirements) of the walls and elements of the load-bearing structure, the horizontal structural elements and ceilings, and openings (doors & windows), the maximum average coefficient of all the elements of the building envelope must not be greater than 0.65 W/m² K.</td><td></td><td></td></tr>
</table>

Current requirements for renovated NZEBs	0,40 W/m²K	0,40 W/m²K	2,25 W/m²K	0,40 W/m2K	Same as above		
Notes							

- CZ, Czech Republic

Legal act on implemented NZEB definitions	Energy Management Act nu. 406/2000 Coll.			
NZEB definition: new buildings	A building with a very low energy demand, whose energy consumption should be largely covered by renewable sources.			
NZEB definition: renovated buildings	CZ does not have such definition, definition above applies to all cases.			
NEW NZEB energy performance requirements	Total primary energy (kWh/m²y)	Non-renewable primary energy (kWh/m²y)	Renewable primary energy (kWh/m²y)	Energy class
Single family house	≤ 0,9 x ER	≤ 1,2 x ER		B
Multi family house	≤ 0,9 x ER	≤ 1,2 x ER		B
Offices	≤ 0,9 x ER	≤ 1,2 x ER		B
Hotel	≤ 0,9 x ER	≤ 1,2 x ER		B
Hospital	≤ 0,9 x ER	≤ 1,2 x ER		B
Other	≤ 0,9 x ER, ≤ 1,2 x ER,B			
Included end uses				
Note	The energy performance calculation is based on a comparison of the assessed building with a reference building. A reference building is a computationally defined building of the same type, the same geometric shape and size, including glazed areas and parts, the same orientation to the cardinal points, shading by surrounding buildings and natural barriers, the same internal layout, and the same typical use and the same considered climatic data as the building under			

<table>
<tr><td></td><td colspan="7">assessment, but with reference values for the building performance, its structure and technical building systems. The energy performance requirements for NZEB are met if the values of the energy performance indicators of the assessed building are not higher than the reference values of the energy performance indicators for the reference building. No numbers can be filled in to the table because they are directly calculated for each building. Only the limit value of the energy performance indicator is inserted in the table.</td></tr>
<tr><td>RENOVATED NZEB energy performance require-ments</td><td colspan="2">Total primary energy (kWh/m²y)</td><td colspan="3">Non-renewable primary energy (kWh/m²y)</td><td>Renewable primary energy (kWh/m²y)</td><td>Energy class</td></tr>
<tr><td>Single family house</td><td colspan="2"></td><td colspan="3"></td><td></td><td></td></tr>
<tr><td>Multi family house</td><td colspan="2"></td><td colspan="3"></td><td></td><td></td></tr>
<tr><td>Offices</td><td colspan="2"></td><td colspan="3"></td><td></td><td></td></tr>
<tr><td>Hotel</td><td colspan="2"></td><td colspan="3"></td><td></td><td></td></tr>
<tr><td>Hospital</td><td colspan="2"></td><td colspan="3"></td><td></td><td></td></tr>
<tr><td>Other</td><td colspan="7"></td></tr>
<tr><td>Included end uses</td><td colspan="7"></td></tr>
<tr><td>NZEBs building elements</td><td>External walls (W/m2K)</td><td>Roofs (W/m²K)</td><td>Win-dows (W/m²K)</td><td>Floors (W/m²K)</td><td>Overall U-value (W/m²K)</td><td>Solar energy transmit-tance</td><td>Air tightness</td></tr>
<tr><td>Current requirements for new NZEBs</td><td>0,25(HEAVIER), 0,20(LIGHTER)</td><td>0,20 (The steep roof with a slope of more than 45° (W/m2K)), 0,16 (Flat and sloping roof with a slope of up to and including 45° (W/m²K))</td><td>1.2</td><td>0.3</td><td>Based on calcu-lation and com-parison with a reference build-ing Uem ≤ Uem,R</td><td>0.5</td><td></td></tr>
<tr><td>Current requirements for renovated NZEBs</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Notes</td><td colspan="7">Reduction factor for the required average U-value
fR=0,7</td></tr>
</table>

- DE, Germany

Legal act on implemented NZEB definitions	Buildings Energy Act (Gebäudeenergiegesetz (GEG))			
NZEB definition: new buildings	An NZEB is defined as a building, that hast to be built to the following standards: • Its primary-energy-demand cannot be higher than 55% of the energy demand of the reference building. • Its overall transmission heat losses have to be smaller than the value of the reference building. • Its Heating and cooling demand has to be met by a certain percentage of renewable energy.			
NZEB definition: renovated buildings	There is no explicit legal NZEB definition for renovated buildings.			
NEW NZEB energy performance requirements	Total primary energy (kWh/m²y)	Non-renewable primary energy (kWh/m²y)	Renewable primary energy (kWh/m²y)	Energy class
Single family house				
Multi family house				
Offices				
Hotel				
Hospital				
Other				
Included end uses				
RENOVATED NZEB energy performance requirements	Total primary energy (kWh/m²y)	Non-renewable primary energy (kWh/m²y)	Renewable primary energy (kWh/m²y)	Energy class
Single family house				
Multi family house				
Offices				

Hotel							
Hospital							
Other							
Included end uses							
NZEBs building elements	External walls (W/m2K)	Roofs (W/m^2K)	Windows (W/m^2K)	Floors (W/m^2K)	Overall U-value (W/m^2K)	Solar energy transmittance	Air tightness
Current requirements for new NZEBs	No requirements for residential buildings. For non-residential buildings: 0,28 $W/(m^2K)$	No requirements	No requirements for residential Buildings. For non-residential buildings: 1,5 $W/(m^2K)$	No requirements	No direct requirements (NZEB mustn`t exceed the overall transmission heat losses of the reference building)	0.6	The building envelope has to be airtight according to the state-of-art norms.
Current requirements for renovated NZEBs							
Notes	NEW: There are no explicit requirements for the U-Values of residential buildings. Nonetheless is it a requirement for all NZEB to not exceed the overall transmission heat losses of the reference building. At the same time, it is required to not exceed 0.55 of the energy demand of the reference building. renovated: There is no explicit legal NZEB definition for renovated buildings.						

- DK, Denmark

Legal act on implemented NZEB definitions	Danish Building Regulation – www.bygningsreglementet.dk Implemented in executive order no. 1399 of 12/12/2019, with latest amendments in executive order no. 1583 of 21/12/2022.			
NZEB definition: new buildings	New buildings that meet the energy requirements for new buildings in the Danish Building Regulation.			
NZEB definition: renovated buildings	Renovated buildings that meet the requirements for Renovation Class 2 in the Danish Building Regulation.			
NEW NZEB energy performance requirements	Total primary energy (kWh/m^2y)	Non-renewable primary energy (kWh/m^2y)	Renewable primary energy (kWh/m^2y)	Energy class
Single family house	≤ 30,0 + 1000/A			A2015
Multi family house	≤ 30,0 + 1000/A			A2015
Offices	≤ 41,0 + 1000/A			A2015
Hotel	≤ 30,0 + 1000/A			A2015
Hospital	≤ 41,0 + 1000/A			A2015
Other				
Included end uses	Lighting (only for non-residential), heating, domestic hot water, cooling and ventilation.			
RENOVATED NZEB energy performance requirements	Total primary energy (kWh/m^2y)	Non-renewable primary energy (kWh/m^2y)	Renewable primary energy (kWh/m^2y)	Energy class
Single family house	≤ 70,0 + 2200/A			B
Multi family house	≤ 70,0 + 2200/A			B
Offices	≤ 95,0 + 2200/A			B

Hotel	≤ 70,0 + 2200/A						B
Hospital	≤ 70,0 + 2200/A						B
Other							
Included end uses	Lighting (only for non-residential), heating, domestic hot water, cooling and ventilation.						
NZEBs building elements	External walls (W/m2K)	Roofs (W/m^2K)	Windows (W/m^2K)	Floors (W/m^2K)	Overall U-value (W/m^2K)	Solar energy transmittance	Air tightness
Current requirements for new NZEBs	≤ 0,30	≤ 0,20	No requirements on thermal transmittance, but only for a total positive energy balance of the element: Eref ≥ 0 kWh/m2 per year	≤ 0,20		Taken into account in the calculation.	≤ 1,0 l/s pr. m2 at 50 Pa
Current requirements for renovated NZEBs	≤ 0,30	≤ 0,20	No requirements on thermal transmittance, but only for a total positive energy balance of the element: Eref ≥ 0 kWh/m2 per year	≤ 0,20		Taken into account in the calculation.	Not a requirement, but taken into account in the calculation.
Notes	new: Absolute requirements for building elements. Typical design values are lower (avg. 0,08 to 0,16 W/m^2K) to meet requirements on total design transmission loss and primary energy. Renovated: The requirements only activate for the renovated building elements, not the whole building. In case building elements are replaced during a renovation, the requirements for external walls, roofs and floors the requirements are 0,18, 0,12, and 0,10 W/m^2K respectively.						

-
- EE, Estonia

Legal act on implemented NZEB definitions	'Building Code' (in force as of 01.07.2015) Regulation no 63 'Minimum requirements of building energy performance' (in force as of 01.01.2019, last redaction came into force on 10.07.2020) Regulation no 58 'Building energy performance calculation methodology' (in force as of 01.07.2015) Regulation no 36 'Requirements of issuance of energy performance certificates and for EPCs' (in force as of 01.07.2015) All of the above-mentioned regulations are currently under revision.			
NZEB definition: new buildings	'NZEB' – Nearly zero energy building which is technically reasonably constructed building using energy efficient and renewable solutions. Energy performance value of NZEB needs to achieve class A, and additionally, at least class B (low-energy building limit value) without accounting on-site renewable electricity generation. All new buildings must meet NZEB requirements (must achieve energy class A). Class A requirement is so strict that typically PV-panels are used. If the installation of a solar energy system is not economically justified (shaded surfaces) or technically feasible (lack of roof area), then the energy performance of the building without taking into account locally produced renewable electricity must meet low energy building requirements = must achieve energy class B.			
NZEB definition: renovated buildings	In case of a major renovation*, the building must meet at least energy class C. *'Major renovation' is defined in Estonian Building Code (§ 63 p 4) as set in the EPBD Art 2 p 10.			
NEW NZEB energy performance requirements	Total primary energy (kWh/m^{2}y)	Non-renewable primary energy (kWh/m^{2}y)	Renewable primary energy (kWh/m^{2}y)	Energy class
Single family house		1) Detached house <120 m^2: 109.4 / B 2) Detached house 120 – 220 m2 and row houses: 93.4 / A 3) Detached house >220 m^2: 59.5 / A		up to 220 m^2 B >220 m^2 A
Multi family house		45.9		A
Offices		62.1		A
Hotel		138		A

Hospital				
Other	Schools: 82.6			
Included end uses	EPBD minimum scope in the reported values. 'Full' Estonian values (not reported in the table) include also appliances and lighting.			
RENOVATED NZEB energy performance requirements	Total primary energy (kWh/m²y)	Non-renewable primary energy (kWh/m²y)	Renewable primary energy (kWh/m²y)	Energy class
Single family house		1) Detached house <120 m² 129.4 / C 2) Detached house 120 – 220 m² and row houses: 113.4 / C 3) Detached house >220 m²: 99.5 / C		C
Multi family house		90.9		C
Offices		122.1		C
Hotel		213		C
Hospital				
Other	Schools: 142.6			
Included end uses				

NZEBs building elements	External walls (W/m2K)	Roofs (W/m²K)	Windows (W/m²K)	Floors (W/m²K)	Overall U-value (W/m²K)	Solar energy transmittance	Air tightness
Current requirements for new NZEBs							
Current requirements for renovated NZEBs							
Notes	In Estonia, we do not have specific requirements for U-values or other building components. We have only primary energy requirements, EPC class A for new buildings and EPC class C for major renovation U-value and other recommendations are provided in guidelines, not in the regulation.						

	Primary energy consumption of the building is regulated, taking into account weighting factors of energy carriers and renewable energy produced on-site, from which only the self-use is taken into account.

- EL, Greece

Legal act on implemented NZEB definitions	Law 4122/2013			
NZEB definition: new buildings	Ministerial decision YPEN/DEPEA/85251/242-27.11.2018			
NZEB definition: renovated buildings	Ministerial decision YPEN/DEPEA/85251/242-27.11.2018			
NEW NZEB energy performance requirements	Total primary energy (kWh/m^{2}y)	Non-renewable primary energy (kWh/m^{2}y)	Renewable primary energy (kWh/m^{2}y)	Energy class
Single family house				
Multi family house				
Offices				
Hotel				
Hospital				
Other				
Included end uses				
RENOVATED NZEB energy performance requirements	Total primary energy (kWh/m^{2}y)	Non-renewable primary energy (kWh/m^{2}y)	Renewable primary energy (kWh/m^{2}y)	Energy class
Single family house				
Multi family house				

Offices							
Hotel							
Hospital							
Other							
Included end uses							
NZEBs building elements	External walls (W/m2K)	Roofs (W/m^2K)	Windows (W/m^2K)	Floors (W/m^2K)	Overall U-value (W/m^2K)	Solar energy transmittance	Air tightness
Current requirements for new NZEBs	0.35-0.55 depending on climate zone	0.30-0.45 depending on climate zone	2.20-2.80 depending on climate zone	0.30-0.45 depending on climate zone	0.55-1.25 depending on ratio A/V and climate zone		
Current requirements for renovated NZEBs	0.40-0.60 depending on climate zone	0.30-0.45 depending on climate zone	2.20-2.80 depending on climate zone	0.30-0.45 depending on climate zone	0.60-1.26 depending on ratio A/V and climate zone		
Notes							

- ES, Spain

Legal act on implemented NZEB definitions	Royal Decree 314/2006, of March 17, (modification. Royal Decree 450/2022, of June 2022)			
NZEB definition: new buildings	Buildings, either new or existing, with an energy use (total primary energy and non renewable primary energy) under the limits allowed to new buildings in the HE0 section.			
NZEB definition: renovated buildings	Buildings, either new or existing, with an energy use (total primary energy and non renewable primary energy) under the limits allowed to new buildings in the HE0 section.			
NEW NZEB energy performance requirements	Total primary energy (kWh/m^{2}y)	Non-renewable primary energy (kWh/m^{2}y)	Renewable primary energy (kWh/m^{2}y)	Energy class
Single family house	α – 40 A – 50 B – 56 C – 64 D – 76 E – 86	α – 20 A – 25 B – 28 C – 32 D – 38 E – 43		
Multi family house	α – 40 A – 50 B – 56 C – 64 D – 76 E – 86	α – 20 A – 25 B – 28 C – 32 D – 38 E – 43		
Offices	α – 165 + 9·CFI A – 155 + 9·CFI B – 150 + 9·CFI C – 140 + 9·CFI D – 130 + 9·CFI E – 120 + 9·CFI	α – 70 + 8·CFI A – 55 + 8·CFI B – 50 + 8·CFI C – 35 + 8·CFI D – 20 + 8·CFI E – 10 + 8·CFI		

Hotel	α – 165 + 9·CFI A – 155 + 9·CFI B – 150 + 9·CFI C – 140 + 9·CFI D – 130 + 9·CFI E – 120 + 9·CFI	α – 70 + 8·CFI A – 55 + 8·CFI B – 50 + 8·CFI C – 35 + 8·CFI D – 20 + 8·CFI E – 10 + 8·CFI		
Hospital	α – 165 + 9·CFI A – 155 + 9·CFI B – 150 + 9·CFI C – 140 + 9·CFI D – 130 + 9·CFI E – 120 + 9·CFI	α – 70 + 8·CFI A – 55 + 8·CFI B – 50 + 8·CFI C – 35 + 8·CFI D – 20 + 8·CFI E – 10 + 8·CFI		
Other	total: α – 165 + 9·CFI A – 155 + 9·CFI B – 150 + 9·CFI C – 140 + 9·CFI D – 130 + 9·CFI E – 120 + 9·CFI non-renewable: α – 70 + 8·CFI A – 55 + 8·CFI B – 50 + 8·CFI C – 35 + 8·CFI D – 20 + 8·CFI E – 10 + 8·CFI			
Included end uses	Residential: heating, cooling, DHW, ventilation Non-residential: heating, cooling, DHW, ventilation, lighting			
RENOVATED NZEB energy performance requirements	Total primary energy (kWh/m^2y)	Non-renewable primary energy (kWh/m^2y)	Renewable primary energy (kWh/m^2y)	Energy class

Single family house	ɑ – 55 A – 75 B – 80 C – 90 D – 105 E – 115	ɑ – 40 A – 50 B – 55 C – 65 D – 70 E – 80		
Multi family house	ɑ – 55 A – 75 B – 80 C – 90 D – 105 E – 115	ɑ – 40 A – 50 B – 55 C – 65 D – 70 E – 80		
Offices	ɑ – 165 + 9·CFI A – 155 + 9·CFI B – 150 + 9·CFI C – 140 + 9·CFI D – 130 + 9·CFI E – 120 + 9·CFI	ɑ – 70 + 8·CFI A – 55 + 8·CFI B – 50 + 8·CFI C – 35 + 8·CFI D – 20 + 8·CFI E – 10 + 8·CFI		
Hotel	ɑ – 165 + 9·CFI A – 155 + 9·CFI B – 150 + 9·CFI C – 140 + 9·CFI D – 130 + 9·CFI E – 120 + 9·CFI	ɑ – 70 + 8·CFI A – 55 + 8·CFI B – 50 + 8·CFI C – 35 + 8·CFI D – 20 + 8·CFI E – 10 + 8·CFI		
Hospital	ɑ – 165 + 9·CFI A – 155 + 9·CFI B – 150 + 9·CFI C – 140 + 9·CFI D – 130 + 9·CFI E – 120 + 9·CFI	ɑ – 70 + 8·CFI A – 55 + 8·CFI B – 50 + 8·CFI C – 35 + 8·CFI D – 20 + 8·CFI E – 10 + 8·CFI		

Other	total: α – 165 + 9·CFI A – 155 + 9·CFI B – 150 + 9·CFI C – 140 + 9·CFI D – 130 + 9·CFI E – 120 + 9·CFI non-renewable: α – 70 + 8·CFI A – 55 + 8·CFI B – 50 + 8·CFI C – 35 + 8·CFI D – 20 + 8·CFI E – 10 + 8·CFI
Included end uses	Residential: heating, cooling, DHW, ventilation Non-residential: heating, cooling, DHW, ventilation, lighting
Note	Total primary energy calculated for Step A (k_exp=0), thus, it is not including in the energy performance of the building the impact of exported energy to the network.

NZEBs building elements	External walls (W/m2K)	Roofs (W/m²K)	Windows (W/m²K)	Floors (W/m²K)	Overall U-value (W/m²K)	Solar energy transmittance	Air tightness
Current requirements for new NZEBs	0,80-0,37 depending on climatic zone: zone a: 0,80, zone A: 0,70, zone B: 0,56, zone C: 0,49, zone D: 0,41, zone E: 0,37	0,55-0,33 depending on climatic zone: zone a: 0,55, zone A: 0,50, zone B: 0,44, zone C: 0,40, zone D: 0,35, zone E: 0,33	3,20-1,80 depending on climatic zone: zone a: 3,2 zone A: 2,70, zone B: 2,30, zone C: 2,10, zone D: 1,80, zone E: 1,80	0,90-0,59 depending on climatic zone: zone a: 0,90 zone A: 0,80, zone B: 0,75, zone C: 0,70, zone D: 0,65, zone E: 0,59	0,86-0,43 (residential use) depending on climatic zone and compactness 1,12-0,43 (other uses) depending on climatic zone and compactness 0,86-0,43 (residential use) depending on climatic zone and compactness 1,12-0,43 (other uses) depending on climatic zone and compactness		Windows: Q100,lim [m³/h·m2] ≤27 - ≤9 [m3/h·m2] depending on climatic zone: Zone α, A, B: ≤27 [m³/h·m²] Zone C, D, E : ≤9 [m3/h·m2] Whole thermal envelope (residential buildings): n50 < 3 - 6 1/h depending on compactness (V/S <=2 à n50<= 6 1/h, and V/S >=4 à n50 <= 3 1/h)

Current requirements for renovated NZEBs	0,80-0,37 depending on climatic zone: zone a: 0,80, zone A: 0,70, zone B: 0,56, zone C: 0,49, zone D: 0,41, zone E: 0,37	0,55-0,33 depending on climatic zone: zone a: 0,55, zone A: 0,50, zone B: 0,44, zone C: 0,40, zone D: 0,35, zone E: 0,33	3,20-1,80 depending on climatic zone: zone a: 3,2 zone A: 2,70, zone B: 2,30, zone C: 2,10, zone D: 1,80, zone E: 1,80	0,90-0,59 depending on climatic zone: zone a: 0,90 zone A: 0,80, zone B: 0,75, zone C: 0,70, zone D: 0,65, zone E: 0,59	1,07-0,54 (residential use) depending on climatic zone and compactness 1,12-0,43 (other uses) depending on climatic zone and compactness 1,07-0,54 (residential use) depending on climatic zone and compactness 1,12-0,43 (other uses) depending on climatic zone and compactness		Windows: Q100,lim [$m^3/h{\cdot}m^2$] ≤27 - ≤9 [$m^3/h{\cdot}m^2$] depending on climatic zone: Zone α, A, B: ≤27 [$m^3/h{\cdot}m^2$] Zone C, D, E : ≤9 [$m^3/h{\cdot}m^2$]
Notes	"renovated buildings NZEB" means a high level of renovation where NZEB target is not compulsory * There are 6 different values depending on each climatic zone. For renovated buildings, the renovated parts must meet the same requirements as for new buildings. 4Glass plus frame 5Solar energy transmittance is not limited, but there's a limit on solar energy gains for the hottest month (july), with qsol;jul,lim <= 2 kWh/m² month						

- FI, Finland

Legal act on implemented NZEB definitions	Land Use and Building Act (132/1999), especially sections 115a and 117a-I (https://www.finlex.fi/fi/laki/ajantasa/1999/19990132) Government Decree on the numerical values of coefficients for forms of energy used in buildings (788/2017) (https://www.finlex.fi/fi/laki/alkup/2017/20170788)			
NZEB definition: new buildings	Decree of the Ministry of the Environment on the energy performance of new buildings (1010/2017) (https://www.finlex.fi/fi/laki/alkup/2017/20171010) Decree of the Ministry of the Environment on the Indoor Climate and Ventilation of New Buildings (1009/2017) (https://www.finlex.fi/fi/laki/alkup/2017/20171009) Decree of the Ministry of the Environment on water and sewerage systems of buildings (https://www.finlex.fi/fi/laki/alkup/2017/20171047)			
NZEB definition: renovated buildings	The cost-effective deep renovation of buildings, including staged deep renovation requirement level in connection with repairs is in accordance with the following regulations: Ministry of the Environment degree on improving the energy performance of buildings undergoing renovation or alteration, 4/2013 Ministry of the Environment degree on improving the energy performance of buildings undergoing renovation or alteration https://www.finlex.fi/fi/viranomaiset/normi/700001/40799 and 2/2017 Decree of the Ministry of the Environment on Amending the Decree of the Ministry of the Environment on Improving the Energy Performance of Buildings Undergoing Renovation or Alteration https://www.finlex.fi/fi/viranomaiset/normi/700001/43242			
NEW NZEB energy performance requirements	Total primary energy (kWh/m²y)	Non-renewable primary energy (kWh/m²y)	Renewable primary energy (kWh/m²y)	Energy class
Single family house	- heated area (Anet) of 50–150 m²: 200–0.6 Anet - net heated area (Anet) of 150-600 m²: 116-0.04 Anet			B
Multi family house	-Terraced houses and blocks of flats with residential storeys on a maximum of two storeys: 105 - Blocks of flats with residential storeys on at least three storeys: 90			B

Offices	100			B
Hotel	160 (also accommodation establishment buildings, boarding houses, assisted living accommodation, retirement homes, residential care institutions)			B
Hospital	320			B
Other	-Commercial buildings, department stores, shopping centres; wholesale and retail trade buildings, excluding grocery trade units under 2,000 m2; shopping halls, theatres, opera, concert and congress halls, cinemas, libraries, archives, museums, art galleries, exhibition halls: 135 - Buildings for sports and physical exercise, excluding indoor swimming pools and indoor ice rinks: 100 Energy class: B			
Included end uses	A building's calculated consumption of delivered energy based on standardised use consists of the energy consumption of the heating, ventilation and cooling systems as well as system auxiliary units, consumer equipment and lighting.			
RENOVATED NZEB energy performance requirements	Total primary energy (kWh/m^2y)	Non-renewable primary energy (kWh/m^2y)	Renewable primary energy (kWh/m^2y)	Energy class
Single family house	20 % lower E-value than the current E-value			
Multi family house	15-20 % lower E- value than the current E-value			
Offices	30 % lower E- value than the current E-value 30 % lower E- value than the current E-value			
Hotel	30 % lower E- value than the current E-value			

Hospital	30 % lower E- value than the current E-value						
Other							
Included end uses	If used E-value calculation then a building's calculated consumption of delivered energy based on standardised use consists of the energy consumption of the heating, ventilation and cooling systems as well as system auxiliary units, consumer equipment and lighting.						
NZEBs building elements	External walls (W/m2K)	Roofs (W/m^{2}K)	Windows (W/m^{2}K)	Floors (W/m^{2}K)	Overall U-value (W/m^{2}K)	Solar energy transmittance	Air tightness
Current requirements for new NZEBs	0.17	0.09	1	0.16			2,0 m^3/(h m^2) Air leakage rate q50 (m^3/(h m^2)) means the average hourly rate of leakage air flow of the building envelope at a pressure differential of 50 Pa per building envelope surface area calculated on the basis of the building's total internal dimensions.
Current requirements for renovated NZEBs	0,5 x U before renovation (but not lower than 0,17) or complete building E-value calculation	0,5 x U before renovation (but not lower than 0,09) or complete building E-value calculation	windows 1,0 W/m^{2}K or complete building E-value calculation	In renovation the energy performance is improved where possible.			Same as in new buildings if used E-value calculation.
Notes	new: The heat loss of a building is the total combined heat losses from the building envelope, leakage air and ventilation. A building's heat loss may at most equal the reference heat loss determined for the building on the reference values (above). In reference heat loss calculations, the value used as the annual efficiency of heat recovery from ventilation extract air of						

	the building's ventilation system is 55 %. renovated: -Same as in new buildings calculation except the annual efficiency of heat recovery from ventilation extract air of the building's ventilation system which is 45 % in renovations.

- FR, France

Legal act on implemented NZEB definitions	Batiments neufs : Code de la construction et de l'habitation, articles R. 172-10 à R. 172-13 + Arrêté du 26 octobre 2010 relatif aux caractéristiques thermiques et aux exigences de performance énergétique des bâtiments nouveaux et des parties nouvelles de bâtiments + Arrêté du 28 décembre 2012 relatif aux caractéristiques thermiques et aux exigences de performance énergétique des bâtiments nouveaux et des parties nouvelles de bâtiments autres que ceux concernés par l'article 2 du décret du 26 octobre 2010 relatif aux caractéristiques thermiques et à la performance énergétique des constructions Batiments existants : Arrêté du 29 septembre 2009 relatif au contenu et aux conditions d'attribution du label « haute performance énergétique rénovation » + Articles R. 173-1 à R. 173-3 du Code de la construction et de l'habitation + Arrêté du 13 juin 2008 relatif à la performance énergétique des bâtiments existants de surface supérieure à 1 000 mètres carrés, lorsqu'ils font l'objet de travaux de rénovation importants + Arrêté du 3 mai 2007 relatif aux caractéristiques thermiques et à la performance énergétique des bâtiments existants.			
NZEB definition: new buildings	Réglementation thermique 2012			
NZEB definition: renovated buildings	Label BBC rénovation et respect des exigences pour la renovation majeur.			
NEW NZEB energy performance requirements	Total primary energy (kWh/m^{2}y)	Non-renewable primary energy (kWh/m^{2}y)	Renewable primary energy (kWh/m^{2}y)	Energy class
Single family house	Cepmax = 50 × Mctype × (Mcgéo + Mcalt + Mcsurf + McGES) - Mctype : coefficient de modulation en fonction du type de bâtiment ou de la partie d'un bâtiment et de sa catégorie ;	5		

	- Mcgeo : coefficient de modulation en fonction de l'emplacement géographique ; - Mcalt : coefficient de modulation en fonction de l'altitude ; - Mcsurf : pour les maisons individuelles ou jumelées et les logements collectifs, coefficient de modulation en fonction de la surface moyenne des logements du bâtiment ou de la partie du bâtiment ; - McGES : coefficient de modulation en fonction des émissions de gaz à effet de serre de l'énergie utilisée.			
Multi family house	Cepmax = 50 × Mctype × (Mcgéo + Mcalt + Mcsurf + McGES) - Mctype : coefficient de modulation en fonction du type de bâtiment ou de la partie d'un bâtiment et de sa catégorie ; - Mcgeo : coefficient de modulation en fonction de l'emplacement géographique ; - Mcalt : coefficient de modulation en fonction de l'altitude ; - Mcsurf : pour les maisons individuelles ou jumelées et les logements collectifs, coefficient de modulation en fonction de la surface moyenne des logements du bâtiment ou de la partie du bâtiment ; - McGES : coefficient de modulation en fonction des émissions de gaz à effet de serre de l'énergie utilisée.			
Offices	Cepmax = 50 × Mctype × (Mcgéo + Mcalt + Mcsurf + McGES) - Mctype : coefficient de modulation en fonction du type de bâtiment ou de la partie d'un bâtiment et de sa catégorie ; - Mcgeo : coefficient de modulation en fonction de l'emplacement géographique ; - Mcalt : coefficient de modulation en fonction de l'altitude ; - Mcsurf : pour les maisons individuelles ou jumelées et les logements collectifs, coefficient de modulation en fonction de la surface moyenne des logements du bâtiment ou de la partie du bâtiment ;			

	- McGES : coefficient de modulation en fonction des émissions de gaz à effet de serre de l'énergie utilisée.			
Hotel	Cepmax = 50 × Mctype × (Mcgéo + Mcalt + Mcsurf + McGES) - Mctype : coefficient de modulation en fonction du type de bâtiment ou de la partie d'un bâtiment et de sa catégorie ; - Mcgeo : coefficient de modulation en fonction de l'emplacement géographique ; - Mcalt : coefficient de modulation en fonction de l'altitude ; - Mcsurf : pour les maisons individuelles ou jumelées et les logements collectifs, coefficient de modulation en fonction de la surface moyenne des logements du bâtiment ou de la partie du bâtiment ; - McGES : coefficient de modulation en fonction des émissions de gaz à effet de serre de l'énergie utilisée.			
Hospital	Cepmax = 50 × Mctype × (Mcgéo + Mcalt + Mcsurf + McGES) - Mctype : coefficient de modulation en fonction du type de bâtiment ou de la partie d'un bâtiment et de sa catégorie ; - Mcgeo : coefficient de modulation en fonction de l'emplacement géographique ; - Mcalt : coefficient de modulation en fonction de l'altitude ; - Mcsurf : pour les maisons individuelles ou jumelées et les logements collectifs, coefficient de modulation en fonction de la surface moyenne des logements du bâtiment ou de la partie du bâtiment ; - McGES : coefficient de modulation en fonction des émissions de gaz à effet de serre de l'énergie utilisée.			
Other				
Included end uses				

RENOVATED NZEB energy performance requirements	Total primary energy (kWh/m²y)				Non-renewable primary energy (kWh/m²y)	Renewable primary energy (kWh/m²y)	Energy class
Single family house	80x(a+b) kWh/m², a et b des coefficients de modulation climatique tels que :						
Multi family house	80x(a+b) kWh/m², a et b des coefficients de modulation climatique tels que :						
Offices	Inférieur ou égal à 40% de la consummation conventionnel de reference en fonction de la forme du bâtiment existant et de l'utilisation du bâtiment rénové.						
Hotel	Inférieur ou égal à 40% de la consummation conventionnel de reference en fonction de la forme du bâtiment existant et de l'utilisation du bâtiment rénové.						
Hospital	Inférieur ou égal à 40% de la consummation conventionnel de reference en fonction de la forme du bâtiment existant et de l'utilisation du bâtiment rénové.						
Other							
Included end uses							
NZEBs building elements	External walls (W/m2K)	Roofs (W/m²K)	Windows (W/m²K)	Floors (W/m²K)	Overall U-value (W/m²K)	Solar energy transmittance	Air tightness
Current requirements for new NZEBs	Pas d'exigence	Pas d'exigence	Pas d'exigence	Pas d'exigence	Pas d'exigence (exigence concernant les besoins de chauffage, de climatisation et d'éclairage artificial)	Pour les espaces de sommeil, <0.1 à 0.65%, en incluant les protections solaires mobiles	Maisons individuelles : <0,6 m3/h/m² de murs extérieurs et de toitures, à une différence de pression de 4Pa. Logements collectifs : <1 m3/h/m² de murs extérieurs et de toitures, à une différence de pression de 4Pa. Bureaux, écoles : <1,7

							m3/h/m² de murs extérieurs et de toitures, à une différence de pression de 4Pa
Current requirements for renovated NZEBs	Surface > 1000 m² et coûts des travaux > 25% de la valeur du bâtiment : 0.45 Autres : 0.32 - 0.45	Surface > 1000 m² et coûts des travaux > 25% de la valeur du bâtiment : 0.28 – 0.41 Autres : 0.20 – 0.25	Surface > 1000 m² et coûts des travaux > 25% de la valeur du bâtiment : 2.6 Autres : 1.9	Surface > 1000 m² et coûts des travaux > 25% de la valeur du bâtiment : 0.36 - 0.4 Autres : 0.3 - 0.47	Surface > 1000 m² et coûts des travaux > 25% de la valeur du bâtiment : Dépend de la forme du bâtiment et de l'usage d'arrivée. Autres : Pas d'exigence	Surface > 1000 m² et coûts des travaux > 25% de la valeur du bâtiment : Pour les espaces de sommeil, <0.1 à 0.65%, en incluant les protections solaires mobiles Autres : Pour les fenêtres de toit, ou dans les pieces dans lesquelles un système de refroidissement est installé ou remplacé, ou en cas de remplacement d'une protection solaire existante : 0,15	Surface > 1000 m² et coûts des travaux > 25% de la valeur du bâtiment : Logements, bureau, hotel, restaurant, école, établissements médicaux : 1.7 m³/h/m² Autres : 3 m³/h/m² Autres : Pas d'exigences
Notes							

- HR, Croatia

Legal act on implemented NZEB definitions	Technical regulation on the rational use of energy and thermal insulation in buildings (Official Gazette 128/15, 70/18, 73/18, 86/18, 102/20)			
NZEB definition: new buildings	A nearly zero energy building is building has very high energy characteristics. This almost a zero or very low amount of energy should, significantly, be covered by energy from renewable sources, including energy from renewable sources which is produced in the building, on site or nearby, and for which the requirements are established by Technical regulation.			
NZEB definition: renovated buildings	Currently there is no specific definition for renovated buildings, so for the renovated building to achieve the nZEB standard it must meet the requirements as a new building.			
NEW NZEB energy perfor-mance requirements	Total primary energy (kWh/m²y)	Non-renewable primary energy (kWh/m²y)	Renewable primary energy (kWh/m²y)	Energy class
Single family house		45 / 35 (continental/coastal)		
Multi family house		80 / 50 (continental/coastal)-- Multi-residential building		
Offices		35 / 25 (continental/coastal)		
Hotel		90 / 70 (continental/coastal) - hotels and restaurants		
Hospital		250 / 250 (continen-tal/coastal)		
Other	non-renewable: educational: 55 / 55 (continental/coastal), sportshalll: 210 / 150 (continental/coastal), sportshalll: 170 / 150 (store),			
Included end uses	YES (energy delivered to the tech. systems)			
RENOVATED NZEB energy performance requirements	Total primary energy (kWh/m²y)	Non-renewable primary energy (kWh/m²y)	Renewable primary energy (kWh/m²y)	Energy class
Single family house				

Multi family house							
Offices							
Hotel							
Hospital							
Other							
Included end uses							
NZEBs building elements	External walls (W/m2K)	Roofs (W/m^2K)	Windows (W/m^2K)	Floors (W/m^2K)	Overall U-value (W/m^2K)	Solar energy trans-mit-tance	Air tightness
Current requirements for new NZEBs	0,30 conti-nental / 0,45 coastal	0,25 conti-nental / 0,30 coastal	1,60 conti-nental / 1,80 coastal	0,40 continen-tal / 0,50 coastal	H’tr,adj - overall heat transfer coefficient by transmission [W/(m2K)], de-pends on the building form factor (f0)	from 0, 50 till 0,60 (with out-side shad-ing el-e-ments) or 0,20 till 0,25 (with-out out-side	During tests of air tight-ness according to HRN EN ISO 9972:2015, for the difference of pressure be-tween the interior and ex-terior air of 50 Pa, the measured air volume, measured on the volume of internal air, shall not be higher than the value n50 = 3,0 h -1 in buildings without ventilation, or n50 = 1,5 h-1 in buildings with a mechanical ventilation

						shad-ing el-e-ments)	
Current requirements for renovated NZEBs							
Notes	Q”H,nd - specific annual energy need for heating [kWh/(m2a)]						

- HU, Hungary

Legal act on implemented NZEB definitions	7/2006. (24.May.2006) Decree on the determination of the energy performance of buildings			
NZEB definition: new buildings	Building complying with the requirements of Annex 6. * The Annex VI. lays down 4 requirements levels for near-zero energy buildings: I. Requirements for thermal transmittance of boundary and glazing constructions; II. Specific heat loss coefficient requirements; III. Overall energy (based on specific primary energy) performance requirements; IV. Minimum percentage of renewable energy used. *According to the main rule, in the case of a new building which having an occupancy permit after December 31, 2020, the new building must meet the requirements contained in Annex 6. However, if, based on the architectural and technical planning documentation, the building is not an NZEB, and it is getting the occupancy permit after December 31, 2020, the building must meet the requirements contained in Annex 6 if it is occupied after June 30, 2024, with the fact that the energy regulations in force on December 31, 2020 shall also be applied.			
NZEB definition: renovated buildings	The requirement is the same as for new buildings, there is no specific NZEB requirement for renovations.			
NEW NZEB energy performance requirements	Total primary energy (kWh/m^2y)	Non-renewable primary energy (kWh/m^2y)	Renewable primary energy (kWh/m^2y)	Energy class
Single family house	100 (excluding lighting energy)			BB (or CC*) (If the minimum renewable energy requirement can be met with an increased level of energy efficiency but the 25% RES share is not achieved the NZEB requirements is covered, but the Energy Class is only CC.)
Multi family house	100 (excluding lighting energy)			BB (or CC*) (If the minimum renewable energy requirement can be met with an increased level of energy efficiency but the

				25% RES share is not achieved the NZEB requirements is covered, but the Energy Class is only CC.)
Offices	90			BB (or CC*) (If the minimum renewable energy requirement can be met with an increased level of energy efficiency but the 25% RES share is not achieved the NZEB requirements is covered, but the Energy Class is only CC.)
Hotel	the threshold is based on the reference building method			BB (or CC*) (If the minimum renewable energy requirement can be met with an increased level of energy efficiency but the 25% RES share is not achieved the NZEB requirements is covered, but the Energy Class is only CC.)
Hospital	the threshold is based on the reference building method			BB (or CC*) (If the minimum renewable energy requirement can be met with an increased level of energy efficiency but the 25% RES share is not achieved the NZEB requirements is covered, but the Energy Class is only CC.)
Other	Educational buildings and buildings typically including lecture halls, exhibition halls (including lighting energy requirements): 85, BB (or CC*) (If the minimum renewable energy requirement can be met with an increased level of energy efficiency but the 25% RES share is not achieved the NZEB requirements is covered, but the Energy Class is only CC.)			
Included end uses	heating energy demand, hot water supply energy demand, ventilation system energy demand, mechanical cooling energy consumption, installed lighting			
RENOVATED NZEB energy performance requirements	Total primary energy (kWh/m^{2}y)	Non-renewable primary energy (kWh/m^{2}y)	Renewable pri-	Energy class

			mary energy (kWh/m²y)	
Single family house	100 (excluding lighting energy)			BB (or CC*) (If the minimum renewable energy requirement can be met with an increased level of energy efficiency but the 25% RES share is not achieved the NZEB requirements is covered, but the Energy Class is only CC.)
Multi family house	100 (excluding lighting energy)			BB (or CC*) (If the minimum renewable energy requirement can be met with an increased level of energy efficiency but the 25% RES share is not achieved the NZEB requirements is covered, but the Energy Class is only CC.)
Offices	90			BB (or CC*) (If the minimum renewable energy requirement can be met with an increased level of energy efficiency but the 25% RES share is not achieved the NZEB requirements is covered, but the Energy Class is only CC.)
Hotel	the threshold is based on the reference building method			BB (or CC*) (If the minimum renewable energy requirement can be met with an increased level of energy efficiency but the 25% RES share is not achieved the NZEB requirements is covered, but the Energy Class is only CC.)
Hospital	the threshold is based on the reference building method			BB (or CC*) (If the minimum renewable energy requirement can be met with an increased level of energy efficiency but the

						25% RES share is not achieved the NZEB requirements is covered, but the Energy Class is only CC.)	
Other	Educational buildings and buildings typically including lecture halls, exhibition halls (including lighting energy requirements): 85, BB (or CC*) (If the minimum renewable energy requirement can be met with an increased level of energy efficiency but the 25% RES share is not achieved the NZEB requirements is covered, but the Energy Class is only CC.) **An additional 10 kWh/m2a may be added to the cooled part of the building for a fraction of the useful floor area covered by cooling.						
Included end uses	heating energy demand, hot water supply energy demand, ventilation system energy demand, mechanical cooling energy consumption, installed lighting						
NZEBs building elements	External walls (W/m2K)	Roofs (W/m^2K)	Windows (W/m^2K)	Floors (W/m^2K)	Overall U-value (W/m^2K)	Solar energy transmittance	Air tightness
Current requirements for new NZEBs	0.24	0.17	1.15 (PVC/timber) 1.40 (metal)	0.3 (The floor on the ground in a 1.5 m wide strip along the perimeter. It can be replaced by insulation of the same resistance on the plinth)	no requirement	no requirement	no requirement
Current requirements for renovated NZEBs	0.24	0.17	1.15 (PVC/timber) 1.40 (metal)	no requirement	no requirement	no requirement	no requirement
Notes	Some several other specific U-value requirements can be found in 7/2006. Decree Annex V. Table 1: Heat transfer coefficient requirements * Instead of the Overall U-value the requirement is the Specific Heat Loss Factor (W/m^3K), which calculates the total heat loss from the building (including heat bridge losses) minus the utilized passive solar gains divided by the heating degree-hours. The maximum allowable value, as a function of the building's cooling surface (A) and heated spaces air volume (V) ratio, is calculated as follows: § $A/V < 0.3$ qm: 0.12 [W/m^3K];						

	§ 0,3 > A/V > 1.0 qm: 0.05143 + [0.2296 (A/V)] [W/m³K]; § A/V > 1,0 qm: 0,28 [W/m³K]

- IE, Ireland

Legal act on implemented NZEB definitions	Residential: NZEB definitions in Statutory Instrument No 4 of 2017 Implementation of NZEB definitions in Statutory Instrument No 183 of 2019 Non-residential: NZEB definitions in Statutory Instrument No. 4 of 2017 Implementation of NZEB definitions in Statutory Instrument No. 538 of 2017			
NZEB definition: new buildings	Residential: Nearly Zero-Energy Building (NZEB): means a building that has a very high energy performance, as determined in accordance with Annex I of the EU Energy Performance of Buildings Directive Recast (EPBD Recast) 2010/31/EU of 19th May 2010. 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. Non-residential: Nearly Zero-Energy Building (NZEB): means a building that has a very high energy performance, as determined in accordance with Annex I to Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings (recast). 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.			
NZEB definition: renovated buildings	Major Renovation: means the renovation of a building where more than 25 % of the surface of the building envelope undergoes renovation. Non-residential: Not applicable.			
NEW NZEB energy performance requirements	Total primary energy (kWh/m^2y)	Non-renewable primary energy (kWh/m^2y)	Renewable primary energy (kWh/m^2y)	Energy class
Single family house	40	25-32	8-15	A2
Multi family house	40	25-32	8-15	A2
Offices	Office Air-conditioned 44-58 $kWh/m^2/yr$ Office Naturally Ventilated 71-87 $kWh/m^2/yr$			
Hotel	Hotel Air-conditioned 305 $kWh/m^2/yr$			
Hospital	369 $kWh/m^2/yr$			

Other	Retail Air-conditioned 142 kWh/m²/yr Schools 44-45 kWh/m²/yr			
Included end uses				
RENOVATED NZEB energy performance requirements	Total primary energy (kWh/m²y)	Non-renewable primary energy (kWh/m²y)	Renewable primary energy (kWh/m²y)	Energy class
Single family house	125			B2
Multi family house	125			B2
Offices	Office Air-conditioned = 180 kWh/m²/yr Naturally Ventilated Offices = 124 kWh/m²/yr			
Hotel	Hotel Air-conditioned = 342 kWh/m²/yr			
Hospital				
Other	Retail Air-conditioned = 338 kWh/m²/yr Schools = 60 kWh/m²/yr Other Air-conditioned Buildings = 338 kWh/m²/yr Other Naturally Ventilated Buildings = 124 kWh/m²/yr			
Included end uses				

NZEBs building elements	External walls (W/m2K)	Roofs (W/m^2K)	Windows (W/m^2K)	Floors (W/m^2K)	Overall U-value (W/m^2K)	Solar energy transmittance	Air tightness
Current requirements for new NZEBs	residential: 0.18, non-residential: 0.21	residential: 0.16, non-residential: 0.2 (flat roof) 0.16 (Pitched roof)	residential: 1.4, non-residential: 1.6	residential: 0.18, non-residential: 0.21			5 m3/hr.m2
Current requirements for renovated NZEBs	0.55 cavity walls 0.35 other walls	residential: 0.16, non-residential: 0.25 (flat roof) 0.16 (Pitched roof – insulation at ceiling) 0.25 (Pitched roof – insulation on slope)	residential: 1.4, non-residential: 1.6	residential: 0.45 when floor is replaced, non-residential: 0.45			
Notes	new residential: Minimum Renewable Energy Ratio of 20% (produced on site or nearby) Maximum Permitted Energy Performance Coefficient MPEPC = 30% of reference dwellings in 2005 Maximum Permitted Carbon Performance Coefficient MPCPC = 35% of reference dwellings in 2005 renovated residential: Primary Energy use 125 kWh/m2.yr new non-residential: Maximum Permitted Energy Performance Coefficient (MPEPC) = 1 Maximum Permitted Carbon Performance Coefficient (MPCPC) = 1.15 Minimum Renewable Energy Ratio (RER) of 20% (0.2) produced on site or nearby.						

	The MPEPC and MPCPC represent an improvement in the order of 60% over 2008 Building Regulation requirements with 20% of the buildings energy provided from onsite or nearby renewables. Where an EPC of 0.9 and a CPC of 1.04 is achieved an RER of 0.10 represents a very significant level of energy provision from renewable energy technology. renovated non-residential: To achieve major renovation requirements there is the option to implement a suite of measures as follows: • Upgrading oil, gas or biomass heating systems more than 15 years old; • Upgrading controls for direct electric space heating systems; • Upgrading cooling and ventilation systems more than 15 years old; and • Upgrading general lighting systems that are more than 15 years old Or Achieve the following whole building primary energy performance levels as calculated in the national calculation methodology: Retail Air-conditioned = 338 kWh/m^2/yr Naturally Ventilated Offices and Other Buildings = 124 kWh/m2/yr Office Air-conditioned = 180 kWh/m^2/yr Hotel Air-conditioned = 342 kWh/m^2/yr Schools = 60 kWh/m^2/yr Other Air-conditioned Buildings = 338 kWh/m^2/yr

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- LT, Lithuania

Legal act on implemented NZEB definitions				
NZEB definition: new buildings	A++			
NZEB definition: renovated buildings	A++			
NEW NZEB energy performance requirements	Total primary energy (kWh/m²y)	Non-renewable primary energy (kWh/m²y)	Renewable primary energy (kWh/m²y)	Energy class
Single family house	kh·546·Ap-0,2		>50%	
Multi family house	kh·307·Ap-0,07		>50%	
Offices	kh·320·Ap-0,1		>50%	
Hotel	kh·375·Ap-0,08		>50%	
Hospital	kh·519·Ap-0,1		>50%	
Other				
Included end uses				
RENOVATED NZEB energy performance requirements	Total primary energy (kWh/m²y)	Non-renewable primary energy (kWh/m²y)	Renewable primary energy (kWh/m²y)	Energy class
Single family house	kh·546·Ap-0,2		>50%	
Multi family house	kh·307·Ap-0,07		>50%	
Offices	kh·320·Ap-0,1		>50%	

Hotel	kh·375·Ap-0,08				>50%		
Hospital	kh·519·Ap-0,1				>50%		
Other							
Included end uses							
NZEBs building elements	External walls (W/m2K)	Roofs (W/m^2K)	Windows (W/m^2K)	Floors (W/m^2K)	Overall U-value (W/m^2K)	Solar energy transmittance	Air tightness
Current requirements for new NZEBs	0.13	0.12	0.9	0.14			
Current requirements for renovated NZEBs	0.13	0.12	0.9	0.14			
Notes							

- LU, Luxembourg

Legal act on implemented NZEB definitions	Règlement grand-ducal modifié du 9 juin 2021 concernant la performance énergétique des bâtiments (http://data.legilux.public.lu/eli/etat/leg/rgd/2021/06/09/a439/jo)			
NZEB definition: new buildings	The NZEB is defined as a building with a very high energy performance that respects specific minimum requirements (element-specific limits on U-values, thermal protection in summer, minimal air-tightness, E-mobility- and PV-readiness, pipe insulation, etc.) as well as upper limits on its heating demand and on its primary energy demand (determined using a so-called “reference building”).			
NZEB definition: renovated buildings	Currently there is no (separate) NZEB definition applicable to renovations. In case of a renovation, the affected parts must comply with the respective minimum requirements.			
NEW NZEB energy performance requirements	Total primary energy (kWh/m^{2}y)	Non-renewable primary energy (kWh/m^{2}y)	Renewable primary energy (kWh/m^{2}y)	Energy class
Single family house	30*	30*		A
Multi family house	25*	25*		A
Offices	40*	40*		A
Hotel	45*	45*		A
Hospital	70*	70*		A
Other	Schools: total: 30, non-renewable: 30, energy class: A			
Included end uses	Heating, cooling, DHW, ventilation, lighting, auxiliary energy, and other building services			
RENOVATED NZEB energy performance requirements	Total primary energy (kWh/m^{2}y)	Non-renewable primary energy (kWh/m^{2}y)	Renewable primary energy (kWh/m^{2}y)	Energy class
Single family house	n/a**	n/a**	n/a**	n/a**

Multi family house	n/a**	n/a**	n/a**	n/a**
Offices	n/a**	n/a**	n/a**	n/a**
Hotel	n/a**	n/a**	n/a**	n/a**
Hospital	n/a**	n/a**	n/a**	n/a**
Other				
Included end uses	Heating, cooling, DHW, ventilation, lighting, auxiliary energy, and other building services			
Note	new: * The indicated values are typical for the respective building category. The primary energy limit is fixed dynamically using a so-called "reference building". The calculation considers the individual usage of the building. The energy performance classes (A+ to I) are defined with respect to the performance of the reference building (the class A corresponds to the performance of the reference building). Important note: Energy performance requirements and a classification based on fixed absolute values cannot be used, especially for buildings with a very high energy performance. renovated: ** The current regulation imposes requirements on the modified building elements and technical systems based on cost-optimal calculations.			

NZEBs building elements	External walls (W/m2K)	Roofs (W/m^2K)	Windows (W/m^2K)	Floors (W/m^2K)	Overall U-value (W/m^2K)	Solar energy transmittance	Air tightness
Current requirements for new NZEBs	0.13	0.11	0.9	to ground: 0,17 W/(m2K)		g^ = 0,50 Thermal comfort: gtot between 0,05 and 0,5 as a function of window/wall fraction	0,6 1/h
Current requirements for renovated NZEBs	0.28	0.22	1.2	to ground: 0,36 W/(m^2K)			
Notes	For new buildings, the upper limits on their heating and primary energy demand are determined using a so-called "reference building". The values indicated in the middle column of this table define the reference building, while the						

	values in the right column are element-specific limits that have to be respected individually by the elements of the building.

- MT, Malta

Legal act on implemented NZEB definitions	Government Notice 1069 (2015)			
NZEB definition: new buildings	Building constructed to minimum energy performance requirements and to parameters mentioned in NZEB plan for Malta, 2015 including overall energy performance. Energy performance according to building typology. Range 55kWh/m2yr-220kWh/m2yr			
NZEB definition: renovated buildings	Current minimum requirements does not require buildings to be renovated to reach NZEB level. These are required to reach Current minimum energy performance requirements for buildings undergoing renovation. Definition for NZEB in case of renovated buildings is same as for new buildings as described above.			
NEW NZEB energy performance requirements	Total primary energy (kWh/m^2y)	Non-renewable primary energy (kWh/m^2y)	Renewable primary energy (kWh/m^2y)	Energy class
Single family house	55 Detached and semi-detached 75 Terraced Proposed With RES: 10-15	N/A requirement is over balance Proposed Without RES: 40 for Semi Detached House 50 for Terraced house and Detached bungalow	Yes, Amount not specified Proposed minimum 10% of demand + 50-80% of hot water from RES	Does not translate to specific energy class
Multi family house	115 Proposed With RES: 30	N/A requirement is over balance Proposed Without RES: 50-70 depending on typology	Yes, Amount not specified Proposed minimum 10% of demand + 50-80% of hot water from RES	Does not translate to specific energy class
Offices	220 Proposed With RES :220	N/A requirement is over balance Proposed Without RES :290	Yes, Amount not specified	Does not translate to specific energy class

Hotel	220 Proposed With RES 480	N/A requirement is over balance Proposed Without RES 600	Yes, Amount not specified	Does not translate to specific energy class
Hospital	220	N/A requirement is over balance	Yes, Amount not specified	Does not translate to specific energy class
Other				
Included end uses				
RENOVATED NZEB energy performance requirements	Total primary energy (kWh/m²y)	Non-renewable primary energy (kWh/m²y)	Renewable primary energy (kWh/m²y)	Energy class
Single family house	55 Detached and semi-detached 75 Terraced Proposed With RES: 40	N/A requirement is over balance Proposed Without RES: 70 Terraced house and detached dwellings; 60 for Semi-detached	Yes, Amount not specified	Does not translate to specific energy class
Multi family house	140 Proposed With RES: 60-75	N/A requirement is over balance Proposed Without RES: 60-80	no	Does not translate to specific energy class
Offices	N/A no NZEB for Renovated Proposed With RES :270	N/A requirement is over balance Proposed Without RES :350	no	N/A no NZEB for Renovated

Hotel	N/A no NZEB for Renovated Proposed With RES :625	N/A requirement is over balance Proposed Without RES :780	no	N/A no NZEB for Renovated
Hospital	N/A no NZEB for Renovated	N/A requirement is over balance	no	N/A no NZEB for Renovated
Other				
Included end uses				

NZEBs building elements	External walls (W/m2K)	Roofs (W/m^2K)	Windows (W/m^2K)	Floors (W/m^2K)	Overall U-value (W/m^2K)	Solar energy transmittance	Air tightness
Current requirements for new NZEBs	1.57 Proposed:1.22	0.57/0.4 Proposed: 0.57/0.4	4 Proposed : 4	1.97 Proposed: Exposed floors: 0.59			
Current requirements for renovated NZEBs	1.57 Proposed:1.22	0.57/0.4 Proposed: 0.57/0.4	4 Proposed : 4	1.97 Proposed: Exposed floors: 0.59			
Notes							

- NL, Netherlands

Legal act on implemented NZEB definitions	Building Decree 2012			
NZEB definition: new buildings	Definition is the same for new buildings and buildings undergoing a major renovation: Art. 1.1 Bijna energieneutraal gebouw: gebouw met een zeer hoge energieprestatie, waarbij de dicht bij nul liggende of zeer lage hoeveelheid energie die is vereist in zeer aanzienlijke mate wordt geleverd uit hernieuwbare bronnen die deels ter plaatse of dichtbij wordt geproduceerd. In English: Nearly zero energy building: building with a very high energy performance, where the close to zero or very low amount of energy required is provided to a very significant extent from renewable sources produced in part on-site or nearby			
NZEB definition: renovated buildings	See above. For buildings undergoing a non-major renovation, there is no NZEB definition yet. This possibly needs to be developed now in order to implement the revised Energy Efficiency Directive (EED) – article 6 correctly.			
NEW NZEB energy performance requirements	Total primary energy (kWh/m^2y)	Non-renewable primary energy (kWh/m^2y)	Renewable primary energy (kWh/m^2y)	Energy class
Single family house		30		A+++ : 0,01 – 50,00 kWh/m^2y
Multi family house		50		A+++ : 0,01 – 50,00 kWh/m^2y
Offices		40		A++++: 0,01 – 40,00 kWh/m^2y
Hotel		130 (= Lodging: in a lodging building)		A++: 100,01 – 150,00 kWh/m^2y
Hospital		130 ((= Healthcare with bed area))		A+++: 90,01 – 180,00 kWh/m^2y

Other	school buildings: non-renewable 70, energy class: A+++: 50,01 – 100,00 kWh/m2y Assembly building: child care: non-renewable 70, energy class: A+++: 55,01 - 110,00 kWh/m^2y Assembly building: other: non-renewable 60, energy class: A+++: 50,01 – 100,00 kWh/m^2y Lodging building: other: non-renewable 40, energy class: A++++: 0,01 – 50,00 kWh/m^2y Sports building: non-renewable 90, energy class: A++: 70,01 – 105,00 Retail building (shops): non-renewable 60, energy class: A++++: 0,01 – 60,00 kWh/m^2y Healthcare without bed area: non-renewable 50, energy class: A+++: 45,01 – 90,00 kWh/m^2y Prison: non-renewable 120, energy class: A+++: 60,01 – 120,00 kWh/m^2y
Included end uses	

RENOVATED NZEB energy performance require-ments	Total primary energy (kWh/m^2y)	Non-renewable primary energy (kWh/m^2y)	Renewable primary energy (kWh/m^2y)	Energy class
Single family house				
Multi family house				
Offices				
Hotel				
Hospital				

Other	
Included end uses	

NZEBs building elements	External walls (W/m2K)	Roofs (W/m^2K)	Windows (W/m^2K)	Floors (W/m^2K)	Overall U-value (W/m^2K)	Solar energy transmittance	Air tightness

Current requirements for new NZEBs	0,21 (Rc ≥ 4,7 m²K/W)	0,15 (Rc ≥ 6,3 m²K/W)	Uwindow,average ≤ 1,65 (average for all windows, doors and frames in the building)	0,25 (Rc ≥ 3,7 m²K/W)			qv10 ≤ 0,2 m³/s
Current requirements for renovated NZEBs	0,21 (Rc ≥ 4,7 m²K/W)	0,15 (Rc ≥ 6,3 m²K/W)	Uwindow,average ≤ 1,65 (average for all windows, doors and frames in the building)	0,25 (Rc ≥ 3,7 m²K/W)			Legally obtained level
Notes	Uwindow ≤ 2,2 W/m²K - Less stringent insulation requirements for mobile homes / trailers - Note: requirements mentioned only apply to the renovated parts of the building.						

- PL, Poland

Legal act on implemented NZEB definitions	1) definition of NZEB (buildings with low consumption energy) is included in the National Plan to increase the number of low energy buildings. In accordance with Art. 39 of the Act of August 29, 2014 on the energy performance of buildings (Journal of Laws of 2021, item 497, as amended) [1], 2) requirements is included in the Regulation of the Minister of Infrastructure of 12 April 2002 on the technical conditions to be met by buildings and their location (Journal of Laws of 2022, item 1225) [2].			
NZEB definition: new buildings	"low energy consumption building" means a building that meets the requirements related to energy saving and thermal insulation contained in the technical and construction regulations referred to in art. 7 sec. 1 point 1 of the Construction Law [3] (in particular Section X and Appendix 2 to the Regulation of the Minister of Infrastructure on the technical conditions to be met by buildings and their location [2], applicable from December 31, 2020 and in the case of buildings occupied by public authorities and owned by them - from January 1, 2019.			
NZEB definition: renovated buildings	The partitions and technical equipment of the reconstructed building meet at least the requirements for thermal insulation and window area specified in Annex 2 to the Regulation [2]			
NEW NZEB energy performance requirements	Total primary energy (kWh/m^2y) *	Non-renewable primary energy (kWh/m^2y) *	Renewable primary energy (kWh/m^2y)	Energy class
Single family house	70	70	Not specified	based on the non-renewable primary energy index
Multi family house	65	65	Not specified	based on the non-renewable primary energy index
Offices	45	45	Not specified	based on the non-renewable primary energy index
Hotel	75	75	Not specified	based on the non-renewable primary energy index
Hospital	190	190	Not specified	based on the non-renewable primary energy index
Other	70 (utility, warehouse and production building), energy class:based on the non-renewable primary energy index			
Included end uses				
Note	*The values refer to the energy demand for heating, ventilation and hot water preparation. In addition, there are allowances for lighting (in non-residential buildings) and cooling (in buildings with such installations)			

RENOVATED NZEB energy performance requirements	Total primary energy (kWh/m^{2}y)			Non-renewable primary energy (kWh/m^{2}y)		Renewable primary energy (kWh/m^{2}y)	Energy class	
Single family house								
Multi family house								
Offices								
Hotel								
Hospital								
Other								
Included end uses								
Note	For renovated NZEBs, the partitions and technical equipment of the building to be reconstructed meet at least the thermal insulation requirements set out in Annex 2 to the technical regulation [2]							
NZEBs building elements	External walls (W/m2K)	Roofs (W/m^{2}K)	Windows (W/m^{2}K)	Floors (W/m^{2}K)	Overall U-value (W/m^{2}K)	Solar energy transmittance	Air tightness	
Current requirements for new NZEBs	0,2-1	0,15-0,7	0,9-1,4	0,15-1,5	Not specified	Specified in annex 2 of the technical regulations	Not specified while the technical regulations indicate in the scope of designing the calculation of the appropriate tightness in accordance with the given formula, depending on the ventilation used	

Current requirements for renovated NZEBs	0,2-1	0,15-0,7	0,9-1,4	0,15-1,5	Not specified	Specified in annex 2 of the technical regulations	Not specified
Notes							

- PT, Portugal

Legal act on implemented NZEB definitions	Decree-Law 101-D/2020, 7th December 2020			
NZEB definition: new buildings	Building with a high energy performance (calculated in accordance with the methodology defined in the "Manual SCE"), and in which the energy needs (almost zero or very small amount) are covered, to a large extent, by energy from renewable sources, preferably local or near-by the building, when local is not enough.			
NZEB definition: renovated buildings	The same for new as long as they fulfil all requirements/indicators			
NEW NZEB energy performance requirements	Total primary energy (kWh/m^{2}y)	Non-renewable primary energy (kWh/m^{2}y)	Renewable primary energy (kWh/m^{2}y)	Energy class
Single family house				Primary energy needs less than 50% of reference building. A, A+
Multi family house				Primary energy needs less than 50% of reference building. A, A+
Offices				Primary energy needs less than 75% of reference building. B, A, A+

Hotel				Primary energy needs less than 75% of reference building. B, A, A+
Hospital				Primary energy needs less than 75% of reference building. B, A, A+
Other				
Included end uses	Heating, Cooling, DWH and lighting (only for non-residential buildings)			
RENOVATED NZEB energy performance requirements	Total primary energy (kWh/m^2y)	Non-renewable primary energy (kWh/m^2y)	Renewable primary energy (kWh/m^2y)	Energy class
Single family house				Primary energy needs less than 50% of reference building. A, A+
Multi family house				Primary energy needs less than 50% of reference building. A, A+
Offices				Primary energy needs less than 75% of reference building. B, A, A+
Hotel				Primary energy needs less than 75% of reference building. B, A, A+

Hospital							Primary energy needs less than 75% of reference building. B, A, A+
Other							
Included end uses	Heating, Cooling, DWH and lighting (only for non-residential buildings)						
NZEBs building elements	External walls (W/m2K)	Roofs (W/m^2K)	Windows (W/m^2K)	Floors (W/m^2K)	Overall U-value (W/m^2K)	Solar energy transmittance	Air tightness
Current requirements for new NZEBs	0,35 – 0,50 (mainland climatic zones) 0,35 – 0,50 (Madeira climatic zones) 1,45 – 1,75 (Azores climatic zones)	0,30 – 0,40 (mainland climatic zones) 0,30 – 0,40 (Madeira climatic zones) 0,90 – 1,25 (Azores climatic zones)	2,20 – 2,80 (mainland climatic zones) 2,20 – 2,80 (Madeira climatic zones) 2,40 – 2,90 (Azores climatic zones)	0,30 – 0,40 (mainland climatic zones) 0,30 – 0,40 (Madeira climatic zones) 0,90 – 1,25 (Azores climatic zones)		0,10 – 0,15 (low inertia) 0,50 – 0,56 (medium or high inertia)	0,50 minimum hourly air renovation
Current requirements for renovated NZEBs	0,35 – 0,50 (mainland climatic zones) 0,35 – 0,50 (Madeira climatic zones) 1,45 – 1,75 (Azores climatic zones)	0,30 – 0,40 (mainland climatic zones) 0,30 – 0,40 (Madeira climatic zones) 0,90 – 1,25 (Azores climatic zones)	2,20 – 2,80 (mainland climatic zones) 2,20 – 2,80 (Madeira climatic zones) 2,40 – 2,90 (Azores climatic zones)	0,30 – 0,40 (mainland climatic zones) 0,30 – 0,40 (Madeira climatic zones) 0,90 – 1,25 (Azores climatic zones)		0,10 – 0,15 (low inertia) 0,50 – 0,56 (medium or high inertia)	0,50 minimum hourly air renovation
Notes	only residential buildings						

- RO, Romania

Legal act on implemented NZEB definitions	'- Law no. 372/2005 regarding the energy performance of buildings, republished - Methodology for calculating the energy performance of buildings, Mc 001-2022" approved by Order of the Minister of Development, Public Works and Administration no. 16/2023			
NZEB definition: new buildings	Building with a very high energy performance, where energy consumption is close to zero or very low and is covered, at least 30%, by renewable energy, including renewable energy produced on site, or nearby, within a radius of 30 km from the GPS coordinates of the building, starting from 2021 (after 2031 the minimum proportion of energy from renewable sources will be established by Government Decision, according to the provisions of Law no. 372/2005, republished).			
NZEB definition: renovated buildings	Romania does not have explicitly defined by the legislation in force the renovation of existing buildings to nzeb standards. However, the methodology for calculating energy performance provides for total primary energy consumption clear values, defined by building types and climatic zones, for major building renovation. It also stipulates the obligation to insure at least 10% by renewable energy, including renewable energy produced on site, or nearby, within a radius of 30 km from the GPS coordinates of the building.			
NEW NZEB energy performance requirements	Total primary energy (kWh/m²y)	Non-renewable primary energy (kWh/m²y)	Renewable primary energy (kWh/m²y)	Energy class
Single family house	climatic zone 1: 120,1 climaftic zone 2: 127,9 climaftic zone 3: 133,3 climaftic zone 4: 140,6 climaftic zone 5: 140,6	climatic zone 1: 84,07 climaftic zone 2: 89,53 climaftic zone 3: 93,31 climaftic zone 4: 98,42 climaftic zone 5: 98,42	climatic zone 1: 36,03 climaftic zone 2: 38,37 climaftic zone 3: 39,99 climaftic zone 4: 42,18 climaftic zone 5: 42,18	climatic zone 1: A climaftic zone 2: A climaftic zone 3: B climaftic zone 4:B climaftic zone 5: B
Multi family house	climatic zone 1: 99,1 climaftic zone 2: 103,7 climaftic zone 3: 105,9 climaftic zone 4: 109,5 climaftic zone 5: 109,5	climatic zone 1: 84,07 climaftic zone 2: 89,53 climaftic zone 3: 93,31 climaftic zone 4: 98,42 climaftic zone 5: 98,42	climatic zone 1: 29,73 climaftic zone 2: 31,11 climaftic zone 3: 31,77 climaftic zone 4: 32,85 climaftic zone 5: 32,85	climatic zone 1: A climaftic zone 2: B climaftic zone 3: B climaftic zone 4:B climaftic zone 5: B
Offices	climatic zone 1: 94,7 climaftic zone 2: 98,4 climaftic zone 3: 98,9 climaftic zone 4: 100,6 climaftic zone 5: 100,6	climatic zone 1:66,29 climaftic zone 2: 68,88 climaftic zone 3: 69,23 climaftic zone 4: 70,42 climaftic zone 5: 70,42	climatic zone 1: 28,41 climaftic zone 2: 29,52 climaftic zone 3: 29,67 climaftic zone 4: 30,18 climaftic zone 5: 30,18	climatic zone 1: A climaftic zone 2: B climaftic zone 3: B climaftic zone 4:B climaftic zone 5: B

Hotel	climatic zone 1: 96,5 climaftic zone 2: 101 climaftic zone 3: 103,7 climaftic zone 4: 107,4 climaftic zone 5: 107,4	climatic zone 1:67,55 climaftic zone 2: 70,7 climaftic zone 3: 72,59 climaftic zone 4: 75,18 climaftic zone 5: 75,18	climatic zone 1: 28,95 climaftic zone 2: 30,3 climaftic zone 3: 31,11 climaftic zone 4: 32,22 climaftic zone 5: 32,22	climatic zone 1: B climaftic zone 2: B climaftic zone 3: B climaftic zone 4:B climaftic zone 5: B
Hospital	climatic zone 1: 162,5 climaftic zone 2: 168,8 climaftic zone 3: 170,9 climaftic zone 4: 174,8 climaftic zone 5: 174,8	climatic zone 1:113,75 climaftic zone 2: 118,16 climaftic zone 3: 119,63 climaftic zone 4: 122,36 climaftic zone 5: 122,36	climatic zone 1: 48,75 climaftic zone 2: 50,64 climaftic zone 3: 51,27 climaftic zone 4: 52,44 climaftic zone 5: 52,44	climatic zone 1: A climaftic zone 2: B climaftic zone 3: B climaftic zone 4:B climaftic zone 5: B
Other	total-non-renewable-renewable-energy class education climatic zone 1: 61,6 - 43,12 - 18,48 -A climaftic zone 2: 66,8 - 46,76 - 20,04 - A climaftic zone 3: 71 - 49,7 - 21,3 - B climaftic zone 4: 76,5 - 53,55 -22,95 -B climaftic zone 5: 76,5 - 53,55 -22,95 -B commercial climatic zone 1: 95,5 - 66,85 - 28,65 -A climaftic zone 2: 102,9 - 72,03 - 30,87 - A climaftic zone 3: 107,7 - 75,39 - 32,31 - A climaftic zone 4: 114,5 - 80,15 -34,35 -A climaftic zone 5: 114,5 - 80,15 -34,35 -A sporting activities climatic zone 1: 93,4 - 65,38 - 28,02 -A climaftic zone 2: 98,2 - 68,74 - 29,46 - A climaftic zone 3: 100,3- 70,21 - 30,09 - A climaftic zone 4: 103,8 - 72,66 -31,14 -A climaftic zone 5: 103,8 - 72,66 -31,14 -A			
Included end uses				
RENOVATED NZEB energy performance requirements	Total primary energy (kWh/m^2y)	Non-renewable primary energy (kWh/m^2y)	Renewable primary energy (kWh/m^2y)	Energy class

Single family house	climatic zone 1: 143,2 climaftic zone 2: 149,1 climaftic zone 3: 156,8 climaftic zone 4: 164,1 climaftic zone 5: 164,1	climatic zone 1: 128,88 climaftic zone 2: 134,19 climaftic zone 3: 141,12 climaftic zone 4: 147,69 climaftic zone 5: 147,69	climatic zone 1: 14,32 climaftic zone 2: 14,91 climaftic zone 3: 15,68 climaftic zone 4: 16,41 climaftic zone 5: 16,41	climatic zone 1: B climaftic zone 2: B climaftic zone 3: B climaftic zone 4:B climaftic zone 5: B
Multi family house	climatic zone 1: 116,4 climaftic zone 2: 121,2 climaftic zone 3: 123,1 climaftic zone 4: 126,4 climaftic zone 5: 126,4	climatic zone 1:104,76 climaftic zone 2: 109,08 climaftic zone 3: 110,79 climaftic zone 4: 113,76 climaftic zone 5: 113,76	climatic zone 1: 11,64 climaftic zone 2: 12,12 climaftic zone 3: 12,31 climaftic zone 4: 12,64 climaftic zone 5: 12,64	climatic zone 1: B climaftic zone 2: B climaftic zone 3: B climaftic zone 4:B climaftic zone 5: B
Offices	climatic zone 1: 113,5 climaftic zone 2: 117,3 climaftic zone 3: 116,9 climaftic zone 4: 117,7 climaftic zone 5: 117,7	climatic zone 1:102,15 climaftic zone 2: 105,57 climaftic zone 3: 105,21 climaftic zone 4: 105,93 climaftic zone 5: 105,93	climatic zone 1: 11,35 climaftic zone 2: 11,73 climaftic zone 3: 11,69 climaftic zone 4: 11,77 climaftic zone 5: 11,77	climatic zone 1: B climaftic zone 2: B climaftic zone 3: B climaftic zone 4:B climaftic zone 5: B
Hotel	climatic zone 1: 113 climaftic zone 2: 117,8 climaftic zone 3: 120,4 climaftic zone 4: 124,3 climaftic zone 5: 124,3	climatic zone 1:101,7 climaftic zone 2: 106,02 climaftic zone 3: 108,36 climaftic zone 4: 111,87 climaftic zone 5: 111,87	climatic zone 1: 11,3 climaftic zone 2: 11,78 climaftic zone 3: 12,04 climaftic zone 4: 12,43 climaftic zone 5: 12,43	climatic zone 1: B climaftic zone 2: B climaftic zone 3: B climaftic zone 4:B climaftic zone 5: B
Hospital	climatic zone 1: 191,9 climaftic zone 2: 198,4 climaftic zone 3: 199,6 climaftic zone 4: 202,9 climaftic zone 5: 202,9	climatic zone 1:172,71 climaftic zone 2: 178,56 climaftic zone 3: 179,64 climaftic zone 4: 182,61 climaftic zone 5: 182,61	climatic zone 1: 19,19 climaftic zone 2: 19,84 climaftic zone 3: 19,96 climaftic zone 4: 20,29 climaftic zone 5: 20,29	climatic zone 1: B climaftic zone 2: B climaftic zone 3: B climaftic zone 4:B climaftic zone 5: B
Other	total-non-renewable-renewable-energy class education climatic zone 1: 72,5 - 65,25 - 7,25 -A climaftic zone 2: 78,2 - 70,38 - 7,82 - B climaftic zone 3: 82,7 - 74,43 - 8,27 - B climaftic zone 4: 88,6 - 79,74 - 8,86 - B			

	climaftic zone 5: 88,6 - 79,74 - 8,86 - B commercial climatic zone 1: 113,1 - 101,79 - 11,31 -A climaftic zone 2: 121,1 - 108,99 - 12,11- A climaftic zone 3: 125,8 - 113,22 - 12,58 - B climaftic zone 4: 132,7 - 119,43 - 13,27 - B climaftic zone 5: 132,7 - 119,43 - 13,27 - B sporting activities climatic zone 1: 111,2 - 100,08 - 11,12 -B climaftic zone 2: 116,2 - 104,58 - 11,62 - B climaftic zone 3: 117,9 - 106,11 - 11,79 - B climaftic zone 4: 121,3 - 109,17 - 12,13 - B climaftic zone 5: 121,3 - 109,17 - 12,13 - B						
Included end uses							
NZEBs building elements	External walls (W/m2K)	Roofs (W/m^2K)	Windows (W/m^2K)	Floors (W/m^2K)	Overall U-value (W/m^2K)	Solar energy transmittance	Air tightness
Current requirements for new NZEBs	0.33	0.17	1.2	0.2			
Current requirements for renovated NZEBs	0.33	0.2	1.2	0.4			
Notes							

- SE, Sweden

Legal act on implemented NZEB definitions	Planning and Building Act, PBL (parliament) – no changes due to the 2018 EPBD Planning and Building Ordinance, PBF (government) – June 4, 2020 Boverket´s Building Regulations – mandatory provisions and general recommendations, BBR (National board of building, planning and housing) – September 1, 2020			
NZEB definition: new buildings	Planning and Building Ordinance, PBF, 3 kap 14 § []...ha en mycket hög energiprestanda där den energi som tillförs i mycket hög grad kommer från förnybara energikällor (nära-nollenergibyggnad)...[] ([]...has a very high energy performance where the supplied energy to a very significant extent is energy from renewable sources (near-zero energy building) ...[]) Not an official translation Plan- och byggförordning (2011:338) | Sveriges riksdag (riksdagen.se) (In Swedish)			
NZEB definition: renovated buildings	No separate NZEB definition for renovated buildings but see “Additional information or issues” regarding requirements not in the NZEB definition.			
NEW NZEB energy performance requirements	Total primary energy (kWh/m²y)	Non-renewable primary energy (kWh/m²y)	Renewable primary energy (kWh/m²y)	Energy class
Single family house	90 kWh/m²a 95 kWh/m², a (90–130 m²) 100 kWh/m²a (50–90 m²)			C
Multi family house	75 kWh/m² a			C

Offices	See non-residential			See non-residential
Hotel	See non-residential			See non-residential
Hospital	See non-residential			See non-residential
Other	Non-residential: 70 kWh/m2, a and a ventilation flow addition, maximum 26 kWh/m2, a, energy class: C			
Included end uses	No (end uses = household energy or similar)			
RENOVATED NZEB energy performance requirements	Total primary energy (kWh/m^{2}y)	Non-renewable primary energy (kWh/m^{2}y)	Renewable primary energy (kWh/m^{2}y)	Energy class
Single family house				
Multi family house				
Offices				
Hotel				
Hospital				
Other				
Included end uses				

NZEBs building elements	External walls (W/m2K)	Roofs (W/m^{2}K)	Windows (W/m^{2}K)	Floors (W/m^{2}K)	Overall U-value (W/m^{2}K)	Solar energy transmittance	Air tightness

Current requirements for new NZEBs					Um = 0.30 (single-family houses) Um = 0.40 (multi-family houses) Um = 0.50 (non-residential buildings)		Air tightness requirement (<0.6 l/s, m²) only for buildings with an area less than 50 m2. For larger building shall the energy consumption due to air leakage be included in the energy consumption calculations. The building code also states that the building shall have an air tightness which avoids moisture problems.
Current requirements for renovated NZEBs	0.18 (Recommendation for added building unit) *	0.13 (Recommendation for added building unit) *	1.20 (Recommendation for added building unit) *	0.15 (Recommendation for added building unit) *			
Notes	* Sweden has chosen not to differentiate between new and existing buildings when defining NZEB and setting minimum energy performance requirements. This means that when an existing building undergoes a major renovation, the building shall strive to meet the requirements for new buildings. Exceptions from these requirements may be made due to special architectural or historical merit, technical and economic feasibility etc. In case minimum energy performance requirements for new buildings is not possible for the renovated building to meet, the building shall strive to meet the numerical values specified in this column. These values are not a part of an NZEB definition.						

- SI, Slovenia

Legal act on implemented NZEB definitions	Pravilnik o energijski učinkovitosti stavb (PURES-3) Rules on efficient use of energy in buildings			
NZEB definition: new buildings				
NZEB definition: renovated buildings				
NEW NZEB energy performance requirements	Total primary energy (kWh/m²y)	Non-renewable primary energy (kWh/m²y)	Renewable primary energy (kWh/m²y)	Energy class
Single family house	75	< 37,5	> 37,5	
Multi family house	75 EPtot,an < EPtot,ref,an	< 37,5 EPnren,an < 0,5 EPtot,an	> 37,5 EPren,an > 0,5 EPtot,an	
Offices	EPtot,an < EPtot,ref,an	EPnren,an < 0,5 EPtot,an	EPren,an > 0,5 EPtot,an	
Hotel	EPtot,an < EPtot,ref,an	EPnren,an < 0,5 EPtot,an	EPren,an > 0,5 EPtot,an	
Hospital	EPtot,an < EPtot,ref,an	EPnren,an < 0,5 EPtot,an	EPren,an > 0,5 EPtot,an	
Other	total: EPtot,an < EPtot,ref,an non-renewable: EPnren,an < 0,5 EPtot,an renewable: EPren,an > 0,5 EPtot,an Public buildings: EPtot,an,pb = 0,9 EPtot,an (–10 %) EPren,an,pb > 0,55 EPtot,an (+10%)			
Included end uses				
RENOVATED NZEB energy performance requirements	Total primary energy (kWh/m²y)	Non-renewable primary energy (kWh/m²y)	Renewable primary energy (kWh/m²y)	Energy class

Single family house	90	< 45	> 45	
Multi family house	90 EPtot,an < EPtot,ref,an	< 45 EPnren,an < 0,5 EPtot,an	> 45 EPren,an > 0,5 EPtot,an	
Offices	EPtot,an < EPtot,ref,an	EPnren,an < 0,5 EPtot,an	EPren,an > 0,5 EPtot,an	
Hotel	EPtot,an < EPtot,ref,an	EPnren,an < 0,5 EPtot,an	EPren,an > 0,5 EPtot,an	
Hospital	EPtot,an < EPtot,ref,an	EPnren,an < 0,5 EPtot,an	EPren,an > 0,5 EPtot,an	
Other	total: EPtot,an < EPtot,ref,an non-renewable: EPnren,an < 0,5 EPtot,an renewable: EPren,an > 0,5 EPtot,an Public buildings: EPtot,an,pb = 0,9 EPtot,an (–10 %) EPren,an,pb > 0,55 EPtot,an (+10%)			
Included end uses				
Note	Single family house (Ause = 50 to 500 m2) Multi-family house (Ause = 50 to 500 m2) Multi-family house (Ause ≥ 500 m2)			

NZEBs building elements	External walls (W/m2K)	Roofs (W/m^2K)	Windows (W/m^2K)	Floors (W/m^2K)	Overall U-value (W/m^2K)	Solar energy transmittance	Air tightness
Current requirements for new NZEBs	0.18	0.15	1	0.35			1,5 h-1
Current requirements for renovated NZEBs	0.18	0.15	1	0.35			1,5 h-1
Notes	See PURES-3 in TSG-1-004:2022						

- SK, Slovakia

Legal act on implemented NZEB definitions	Act No. 300/2012 Coll. amending Act No. 555/2005 Coll. on energy performance of buildings			
NZEB definition: new buildings	Nearly zero energy building is a building with a very high energy performance. Nearly zero or a very low energy needed for usage of such building is ensured by sufficient thermal insulation and to a very high extent covered by the energy delivered from renewable energy sources on-site or nearby.			
NZEB definition: renovated buildings	If it´s technically, functionally and economically feasible, existing building after the major renovation must comply with the minimum energy performance of buildings requirements set for new buildings.			
NEW NZEB energy performance requirements	Total primary energy (kWh/m²y)	Non-renewable primary energy (kWh/m²y)	Renewable primary energy (kWh/m²y)	Energy class
Single family house		54		A0
Multi family house		32		A0
Offices		61		A0
Hotel		82		A0
Hospital		98		A0
Other	34, A0 (SCHOOLS)			
Included end uses				
RENOVATED NZEB energy performance requirements	Total primary energy (kWh/m²y)	Non-renewable primary energy (kWh/m²y)	Renewable primary energy (kWh/m²y)	Energy class
Single family house		54		A0
Multi family house		32		A0

Offices			61				A0
Hotel			82				A0
Hospital			98				A0
Other	34, A0 (SCHOOLS)						
Included end uses							
NZEBs building elements	External walls (W/m2K)	Roofs (W/m^2K)	Windows (W/m^2K)	Floors (W/m^2K)	Overall U-value (W/m^2K)	Solar energy transmittance	Air tightness
Current requirements for new NZEBs	0.22	0.15	0.85	Not set	Recommended value depending on the form factor of a building (e.g. 0,35 for 0,4 1/m)	0.6	0,6 1/h
Current requirements for renovated NZEBs	0.22	0.15	0.85	Not set	Recommended value depending on the form factor of a building (e.g. 0,35 for 0,4 1/m)	0.6	0,6 1/h
Notes							

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