READY FOR CARBON NEUTRAL BY 2050?

JANUARY 2022

ASSESSING AMBITION LEVELS IN NEW BUILDING STANDARDS ACROSS THE EU

BPIE

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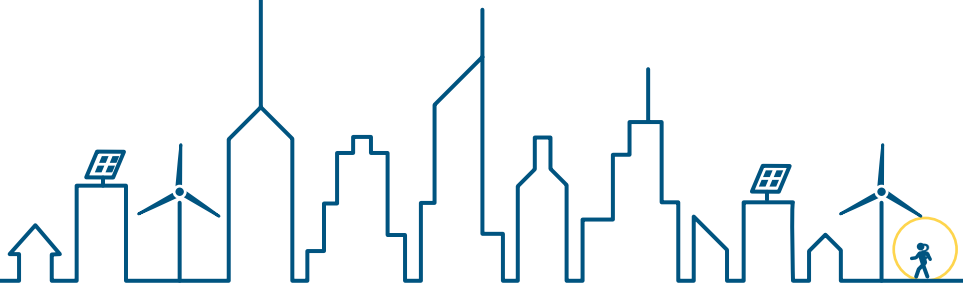


EXECUTIVE SUMMARY

A major milestone has been reached in terms of energy consumption in buildings in the European Union (EU). From the beginning of 2021, all new buildings in the EU must be nearly zero-energy buildings (NZEBs), meaning a building with a very high energy performance, and for which the remaining low energy needs are sourced primarily from renewable energy sources (RES). For new buildings owned and occupied by public authorities, this requirement has been in place from the beginning of 2019.

This milestone is important for EU decarbonisation efforts, as the buildings sector accounts for 36% of the EU's carbon emissions and 40% of its energy use.[1] Given this sizeable footprint, it is critical to ensure that new buildings are NZEBs so that their energy and carbon impact is reduced as much as possible.

New buildings can show the market what is possible when excellent design, high energy performance, and low-carbon technologies come together in the built environment, and they can also lead to technological innovations and gains in the cost effectiveness of realising NZEBs. Done poorly, however, new buildings can lock in additional carbon emissions, as explained in a recent study showing that constructing new buildings to anything higher than 50 kWh/m^2/year essentially locks in 80% of 2005-level emissions trajectories to 2050.[2]

Keeping this in mind, this report examines whether the EU's new building standards and policy frameworks, both across the EU and selected EU territories, are rigorous enough to achieve the most recent decarbonisation targets. It features a comparative assessment and benchmarking of select EU geographies: Flanders (Belgium), France, Germany, Italy, Poland, and Spain.[3] Ambition levels for key NZEB metrics, notably energy performance and renewable energy requirements, are scrutinised within wider policy contexts and alongside any key supporting measures, notably fossil fuel phase-outs and carbon limits.

1. https://ec.europa.eu/energy/sites/ener/files/eu_renovation_wave_strategy.pdf
2. https://www.nature.com/articles/s41558-018-0100-6#citeas.
3. Efforts related to refurbishments and retrofits are not in the scope of this report, but the report annex does provide a list of BPIE resources on these topics.

Decarbonisation in new buildings in the EU is happening too slowly… Europe's 2050 decarbonisation objectives will be at high risk unless Member States' building policies can be made to provide stronger support.

Standard approaches, experiences and insights from these EU territories are considered within a wider assessment of the EU policy framework on buildings, and most notably a third revision of the Energy Performance of Buildings Directive (EPBD).[4] An important reference and supplement to this report is a recent BPIE policy briefing that reviews how standards for new buildings in EU Member States (MS) are aligned with the NZEB requirements contained in the EPBD.[5]

The findings contained in this report suggest that decarbonisation in new buildings in the EU is happening too slowly and inconsistently. A reasonable conclusion to draw from this is that Europe's 2050 decarbonisation objectives will be at high risk unless MS building policies can be made to provide stronger support. Government policies differ in several important ways when it comes to "moving the needle" on new building standards, both in terms of being consistent with the NZEB definition as laid out in the EPBD, and in terms of ambition levels on building-sector decarbonisation. The fact that only two of the geographies examined here, Flanders and France, have building specific plans in place to phase out fossil fuels is sufficient evidence of existing shortcomings. Other important measures, such as targets to achieve net zero energy and carbon in new construction, are missing entirely.

Flanders has created an effective 'glide path' for gradually tightening new-building standards over the course of roughly 10 years. New-build energy performance requirements in Flanders today are among the most ambitious in the EU, particularly for residential dwellings. In France, new regulations are less ambitious in terms of residential energy efficiency requirements, while new non-residential requirements have yet to be announced. Germany has recently strengthened its Climate Change Act, including an updated target of achieving carbon neutrality by 2045. However, Germany's current new building standards, while still relatively ambitious to other Member States, are not effectively in line with this renewed level of ambition. Italy has ambitious standards for new residential buildings, but rather relaxed standards for new non-residential buildings. Italy's rates of new construction – among the lowest in the EU – also limit the availability of data on the domestic market's take-up of NZEB standards. Poland has ambitious standards in place for new non-residential buildings, but more ambitious standards are needed for residential dwellings if Poland is to move closer to EC benchmarks. Spain's energy-performance requirements for new residential buildings are about average, compared to EC benchmarks, while non-residential requirements are well below what the EC recommends. Renewable energy requirements in both Spain and Poland require an additional round of reviews and further tightening.

With respect to fossil fuel bans and carbon limits, France and Flanders stand out. Unique among the focus geographies, France has introduced requirements that cover embodied energy and carbon in the construction of buildings, but there is still too little available data on these metrics.

Both France and Flanders have been active in efforts to eliminate fossil fuels in buildings: France has banned oil-based heating in new buildings from January 2022, while in Flanders, as of 2026, new buildings will not be permitted to have a new gas connection.

Germany, Poland, and Spain all have stated plans to phase out fossil fuels in their respective, wider energy sectors, such as coal plant phase-outs, carbon neutrality targets (Germany), or more generic 2050 fossil fuel phase-out commitments (Spain).

None of these Member States, however, have plans for fossil fuel phase-outs that are buildings-specific. Italy currently has no fossil fuel phase-out target or plan in place at all.

4. https://ec.europa.eu/energy/topics/energy-efficiency/energy-efficient-buildings/energy-performance-buildings-directive_en
5. https://ec.europa.eu/energy/topics/energy-efficiency/energy-efficient-buildings/energy-performance-buildings-directive_en

This mixed picture of good practices and challenges is reflected across the EU more widely. As this is a critical indicator that aligns with the EU's wider climate change mitigation ambition, there exists some reasonable doubt as to whether current policy frameworks are moving new buildings in a consistent and concerted way towards carbon neutrality by 2050. Nevertheless, EU policy makers now have an opportunity to re-invigorate Europe's low-carbon buildings agenda. The revision of the EPBD over the course of 2021 to 2022 offers a chance to update definitions, energy-performance and renewable-energy benchmarks, ambition levels of standards and other important elements. The EPBD definition of 'NZEB' has not been changed for more than 10 years, and an updated definition will be an important part of the revision process. Another imperative in reviewing NZEB standards is the fact that EU Member States are still heavily dependent on fossil fuels for heating purposes.

*. Commission Recommendation (EU) 2016/1318

In light of these findings, we make the following recommendations:

THE EUROPEAN COMMISSION SHOULD:

2030 ▶
2050 ▶

Determine the need for **INCREASING CURRENT NEW BUILDING STANDARDS IN MS** in order to align them with 2030 and 2050 decarbonisation objectives.

Update the **NZEB DEFINITION FOR NEW BUILDINGS** in the EPBD to cover two distinct phases:

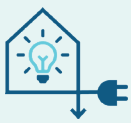
1. 2025-2030 – Define clear numeric indicator thresholds for maximum primary energy consumption, and forbid Member States from introducing requirements that are less ambitious.
2. After 2030 – Further tighten requirements on energy performance, based on a five year review of standards and reflecting relevant market developments.

BAN INSTALLATION OF FOSSIL FUEL-BASED SYSTEMS in new buildings by 2025 and ensure that RES provides 100% of building energy demand by this date.

Review **COST-OPTIMAL AND LIFE-CYCLE** approaches that are used to develop NZEB standards.

MEMBER STATES SHOULD:

Use **MANDATORY INDICATORS** of numerical energy performance (kWh/m²/year) and share of renewable energy in energy demand (expressed as a percentage).



REDUCE ALLOWED ENERGY DEMAND IN NEW BUILDINGS to be at least in line with current EC recommendations,* and update requirements once the EPBD establishes new, EU-wide definitions.

Make it a requirement, as of 2025, that **RES COVER 100% OF ENERGY DEMAND** in new buildings.

Develop a strong plan to **PHASE OUT FOSSIL FUELS**, and **PROHIBIT THE USE OF FOSSIL FUELS** in new buildings as of 2025.

Require that **CARBON-EMISSION LIMITS** for new buildings must take into account their **FULL LIFE CYCLE.**

ACRONYMS AND GLOSSARY

- **EC:** European Commission
- **DHW:** domestic hot water
- **ECEEE:** European Council for an Energy Efficient Economy
- **ENEA:** Italian National Agency for New Technologies, Energy, and Sustainable Economic Development
- **EPB:** energy performance of buildings
- **EPBD:** Energy Performance of Buildings Directive
- **EPC:** Energy Performance Certificate
- **ESCO:** energy services company
- **EU:** European Union
- **GDP:** gross domestic product
- **GHG:** greenhouse gas
- **HVAC:** heating, ventilation, air conditioning
- **LTRS:** long-term renovation strategy
- **MEPS:** minimum energy performance standards
- **MS:** Member States
- **NECP:** National Energy and Climate Plan
- **NGO:** non-governmental organisation
- **NZEB:** nearly zero-energy building
- **PE:** primary energy
- **PV:** photovoltaic
- **RES:** renewable energy sources
- **SFH:** single-family house
- **SME:** small or medium-sized enterprise

INTRODUCTION

Against the backdrop of the EPBD requirements, and in the context of the EU's medium (2030) and long-term (2050) decarbonisation ambitions, this report assesses and benchmarks the ambition levels of new building standards in six geographies: Flanders, France, Germany, Italy, Poland, and Spain. Following an overview of key and current EU policy issues related to the EPBD and NZEBs, it examines the level of ambition of new building standards across these focus geographies, notably in terms of energy performance and renewable energy requirements.

The report is based on desktop research and interviews with experts from the six focus geographies featured in this report. The focus geographies differ in terms of climatic conditions, governance approaches and economic conditions, thus providing a diverse set of contexts for researching NZEB new construction issues and trends. As such, and in addition to examining new building standards, our research and expert conversations focussed on the wider NZEB policy framework and market developments – notably supporting policies and measures, such as carbon and/or fossil fuel phase-out plans and targets. With respect to expert interviews, BPIE approached stakeholders from a cross-section of organisations (academia/research institute, industry/association, NGO, government department/agency, etc.) to obtain a diverse set of views on these issues.[6]

The report includes BPIE-specific recommendations for each focus geography, accompanied by a summary section at the end of the report with recommendations for EU and Member State policy makers. These recommendations are put forward in the context of important further revisions to the EPBD, which are being debated in the EU in 2021 and 2022. Indeed, the wider EU regulatory framework, which is explained in detail in the following pages, is critical to understanding the issue of NZEBs, whether in the focus geographies or elsewhere.

6. Please refer to page 2 for a list of experts.

EU REGULATORY FRAMEWORK

Standards for nearly zero-energy buildings (NZEBs) are defined at national level, but the introduction and development of the concept is strongly linked to regulatory developments at EU level. The first version of the Energy Performance of Buildings Directive (EPBD), the cornerstone of EU buildings legislation, from 2002 (Directive 2002/91/EC) included a requirement (Article 5) for Member States to ensure that new buildings meet minimum energy performance requirements with a view to achieving cost-optimal levels. In 2012, Regulation (EU) 211/2012 established a comparative methodology for calculating cost-optimal levels of minimum energy performance requirements.[7]

The NZEB concept itself was introduced at EU level with the 2010 recast of the EPBD (Directive 2010/31/EU). Article 2(2) of the Directive gives a definition of NZEB, while Article 9 lays down the provisions that Member States must fulfil in that regard. The EC supplemented the legal provisions in 2016 with Recommendation (EU) 2016/1318), aiming to guide Member States in their governance and implementation, and setting some numerical benchmarks that were differentiated according to climatic region.

An amendment to the EPBD from 2018 (Directive (EU) 2018/844) neither modified the definition of NZEB nor the provisions attached to it. However, as per the new Article 2A, Member States were required to ***establish a long-term renovation strategy to support the renovation of the national stock […] into a highly energy efficient and decarbonised building stock by 2050, facilitating the cost-effective transformation of existing buildings into nearly zero-energy buildings.***

Within the long-term renovation strategy, a direct link has therefore been established between NZEB standards and the overall objective for existing building stock. Moreover, the 2018 EPBD amendment placed some emphasis on modernisation aspects of the building stock to enhance interactions between the building and its occupants, as well as the energy grid. One notable outcome of this was the introduction of an optional Smart Readiness Indicator. Legislation crafted since then has tried to acknowledge and consider the implications that buildings, far from being static elements, are an integral part of the energy system, as buildings not only consume but can also produce and store energy.

This means that the NZEB definition, as defined in the EPBD, has not evolved for more than 10 years (since the 2010 revision of the EPBD), which is quite striking in the present context. In 2010, when the NZEB

7. Commission Delegated Regulation (EU) 211/2012

definition was introduced, the EU institutions had just enacted energy and climate targets for 2020 (20% reduction in GHG emissions compared to 1990, 20% of EU energy from renewables, and 20% energy efficiency). Since then, the EU energy and climate architecture has evolved considerably.

The Clean Energy for All Europeans package, proposed in 2016 and agreed in 2018, set new targets for 2030 (40% reduction in GHG emissions compared to 1990, 32% of EU energy from renewables, and 32.5% improvement in energy efficiency). In December 2019, the EC pledged in its European Green Deal Communication[8] to increase the EU's climate ambition for both 2030 and 2050.

With the adoption in 2021 of the Climate Law,[9] the EU has now enshrined in legislation the twin objectives of achieving carbon neutrality by 2050 and of reducing GHG emissions by at least 55% by 2030, compared to 1990. The EC also proposed in July 2021 to increase the 2030 energy efficiency target to 39% for primary energy and 36% for final energy, with a target of 40% renewables in the EU energy mix, along with a benchmark of 49% of renewables in buildings.[10] All in all, the EU climate and energy ambitions between 2010 (for 2020) and now (for 2030 and 2050) are markedly different.

The EU Green Deal (2019) also included the announcement of a 'Renovation Wave' of public and private buildings, which the EC subsequently published as a Communication in October 2020.[11] The aims of the Renovation Wave are to at least double the annual energy renovation rate by 2030 and to foster deep energy renovations, which should result in 35 million buildings renovated by 2030 (while the strategy has a clear focus on renovating the existing building stock, there is no mention of upgrading standards for new buildings). The Renovation Wave also provided more details about the New European Bauhaus, an initiative that should, as announced by the EC President, act as ***"an accelerator for socially and aesthetically promising green and digital solutions, technologies, and products. It will foster innovative solutions in terms of architecture and materials."***[12]

When an early revision to the EPBD was announced for the end of 2021, along with the introduction of Minimum Energy Performance Standards for existing buildings and a reform of Energy Performance Certificates, the possibility to upgrade NZEB standards was suggested as well: "the requirements for new buildings […] might also need to be updated in line with the enhanced climate ambition of the European Green Deal and the Climate Target Plan 2030, developing a new vision for buildings."[13] As a follow-up, the EPBD Open Public Consultation tackled the question of the effectiveness of the NZEB definition while considering the decarbonisation objective in the EU (question 8) and the relevance of introducing a more harmonised definition of NZEB at EU level, and possibly including numeric thresholds or ranges (question 9).

The current NZEB definition is now open for revision for the first time in more than 10 years. Not only is there a clear need to align the forthcoming definition with the new climate target for 2030 and the goal to achieve carbon neutrality by 2050, but also to integrate 'circular' considerations which have emerged over the last years, such as the importance of embodied carbon emissions and the 'whole life cycle' perspective. The EC plans to publish a proposal for a revised EPBD in December 2021.

It is against the backdrop of an evolving policy landscape that this review of current NZEB practice in selected EU territories is presented, and with the intention that it will help inform ongoing policy making.

8. European Commission, Communication 'The European Green Deal', COM(2019)640 final, 11th December 2019. See: https://eur-lex.europa.eu/resource.html?uri=cellar:b828d165-1c22-11ea-8c1f-01aa75ed71a1.0002.02/DOC_1&format=PDF
9. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32021R1119&from=EN
10. https://ec.europa.eu/commission/presscorner/api/files/attachment/869476/Buildings_Factsheet_EN_final.pdf.pdf
11. European Commission, Communication 'A Renovation Wave for Europe – greening our buildings, creating jobs, improving lives', COM(2020)662 final, 14th October 2020, available at: https://ec.europa.eu/energy/sites/ener/files/eu_renovation_wave_strategy.pdf
12. https://ec.europa.eu/energy/sites/ener/files/eu_renovation_wave_strategy.pdf
13. European Commission, Inception Impact Assessment for the revision of the EPBD, Ref. Ares (2021)1397833, 22nd February 2021, available at https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12910-Energy-efficiency-Revision-of-the-Energy-Performance-of-Buildings-Directive_en

NEARLY ZERO-ENERGY BUILDING DEFINITION

'Nearly zero-energy building' (NZEB) and various related terms, as defined in the EPBD,[14] are presented below.

ARTICLE 2, PARAGRAPH 2: NZEB DEFINITION

A **'nearly zero-energy building'** means a building that has a **very high energy performance**. 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.

ARTICLE 2, PARAGRAPH 4: ENERGY PERFORMANCE (1)

'Energy performance of a building' means **the calculated or measured amount of energy needed to meet the energy demand** associated with a typical use of the building, which includes, inter alia, energy used for heating, cooling, ventilation, hot water and lighting.

ANNEX I, PARAGRAPH 2: ENERGY PERFORMANCE (2)

The **energy performance of a building** shall be **expressed in a transparent manner** and shall include an energy performance indicator and a numeric indicator of primary energy use [...].

ARTICLE 2, PARAGRAPH 5: PRIMARY ENERGY

'Primary energy' means **energy from renewable and non-renewable sources** which has not undergone any conversion or transformation process.

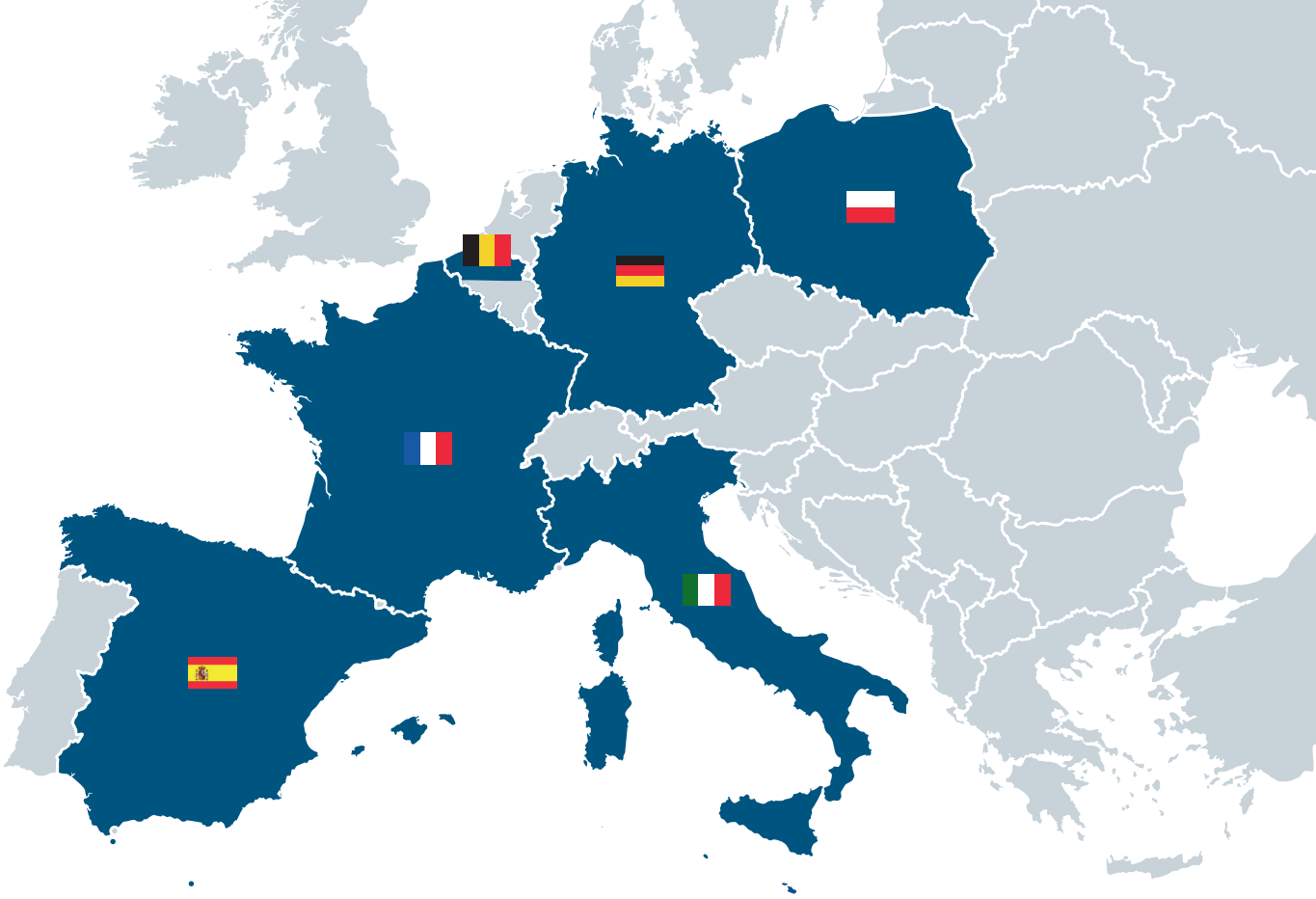
ARTICLE 2, PARAGRAPH 6: ENERGY FROM RENEWABLE SOURCES

'Energy from renewable sources' means energy from renewable non-fossil sources, namely wind, solar, aerothermal, geothermal, hydrothermal and ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases.

The NZEB definition, as per Article 2 and other relevant articles of the EPBD, is based on two main pillars:

- **the energy performance of the building**, expressed in primary energy consumed, and
- **the share of energy requirements supplied from renewable sources** produced on-site or nearby.

14. Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings



COMPARISON AND BENCHMARKING OF FOCUS GEOGRAPHIES

As noted in the executive summary, a recently published BPIE policy briefing on NZEBs provides a comparison and benchmarking for most EU countries against EC benchmarks. Our report revisits and expands on this analysis, as our five countries and one region are put under closer scrutiny in terms of current standards.

METHODOLOGY

Our analysis of focus geographies is informed by the NZEB definition provided in the EPBD, and by EC benchmarks for energy performance and shares of renewable energy. Each of these aspects is used as a basis for comparison and benchmarking, as follows.

First, minimum requirements for energy performance and renewable energy in our select territories are compared with EC benchmarks. The territories are also compared against all other EU Member States, at least with respect to energy performance requirements and ranges.

Second, a deep-dive analysis is provided for the six focus geographies. Issues that emerged from comparison to EC benchmarks or other standards-related topics, as well as wider policy issues – most notably, fossil fuel phase-out plans and indicators for embedded carbon – are analysed further, supported by information on new building standards, as well as issues linked to governance and implementation of NZEB requirements. Recommendations are also provided for each focus geography.

Third, and drawing on analysis from the deep dives, focus geographies are compared and assessed based on four criteria:

1. **Required energy efficiency performance,**

2. **Required share of renewable energy in energy demand,**

3. **Carbon emission limits, and**

4. **Fossil fuel phase-out plans.**

While topics 1 and 2 are NZEB-specific, topics 3 and 4 are also tied in with wider energy-system decarbonisation issues, such as the availability of renewable energy in national energy mixes, cross-border power trading, grid flexibility, power storage capacity, etc. Although critical in terms of their relevance for the decarbonisation of buildings, a more in-depth analysis of the impact of these energy-system issues on the buildings sector is beyond the scope of this report. Nonetheless, our analysis shows a significant degree of divergence across focus geographies when examined using these criteria, which is an important take-away from the deep dives.

EC BENCHMARK COMPARISON

To specify the extent of required energy performance and share of renewables, and to support a consistent transposition of NZEB requirements to national legislation, in 2016 European Commission published its NZEB Recommendations,[15] providing benchmarks for primary energy and share of renewables in total primary energy across the EU.[16] These benchmarks differ according to three distinct climatic regions – Oceanic, Mediterranean, and Nordic – reflecting how external factors such as average temperatures and humidity levels influence the setting of energy performance requirements. Table 1 provides an overview of where focus geographies fall in terms of EC benchmarks across these climatic regions.

Table 1: Climatic position of focus geographies and EC NZEB benchmarks

Focus geography and climatic region	Primary energy threshold for residential buildings (kWh/m²/year)	Primary energy threshold for non-residential buildings (kWh/m²/year)	Renewables as a percentage of total primary energy (%)
Flanders (Belgium) (Oceanic)	50-65	85-100	49%-61%
France (Oceanic)			
Germany (Oceanic)			
Italy (Mediterranean)		80-90	71%-87%
Poland (Nordic)	65-90	85-100	32%
Spain (Mediterranean)	50-65	80-90	71%-87%

15. Commission Recommendation (EU) 2016/1318

16. There is a consideration to be made on whether the levels put forward in these benchmarks are aligned with current market best practice, meaning in essence what building-supply chains and the construction sector can viably deliver with available technologies. While this report does not examine this issue in detail, a review of NZEB benchmarks is included in the recommendations and will likely form part of policy discussions in the wider context of the EPBD revision. In this context, EC benchmarks should be treated as guideposts for analysis rather than as an indicator of best-in-class standards.

Keeping in mind their position against existing benchmarks, the focus geographies can then be compared against metrics that reflect key EPBD NZEB provisions, as illustrated in Table 2:

1. **Maximum primary energy consumption allowed by residential NZEB standards,**
2. **Maximum primary energy consumption allowed by non-residential NZEB standards, and**
3. **Minimum share of energy from renewable sources in a building's energy demand, as required by NZEB standards.**

When comparing the values in Table 2, it is important to note differences in the way that provisions on new building energy performance are defined in legislation. In Flanders, France, and Germany, energy performance requirements are determined and expressed based on a relatively complex calculation involving multiple technical benchmarks, rather than in terms of kWh/m^2/year, as stipulated in the EPBD. While this creates challenges when attempting to compare and benchmark geographies, and also raises questions regarding the implementation of this EPBD provision in Member States, it is possible to identify the relative level of ambition with respect to NZEB development across these selected territories.

Table 2: Comparison of energy performance and renewable energy requirements

Country/ Region	Maximum primary energy demand (kWh/m^2/year)		Minimum share of RES in primary energy demand
	Residential	Non-residential	
Flanders (Belgium)	20	30	70%[18]
France[19]	75	Yet to be published[20]	75%[21]
Germany	40	75	15%-50%
Italy	35	115	50%
Poland	70	45	Not applicable[22]
Spain	40-86 (avg. 63)	120-165 (avg. 143)	Not applicable[22]

18. An approximation. The NZEB standard requires 15-20 kWh/m2/year ≈ 70% of the total primary energy limit.
19. All values and information for France refer to residential buildings and will be implemented from 2022 onwards.
20. Expressed as 50-70 kWh/m2/year ≈ 75% of the total primary energy limit.
21. These requirements are defined only with regard to use of the primary non-renewable energy demand factor.
22. Renewable energy requirements in Spanish NZEB standards cover DHW and, in some cases, electricity from RES.

In terms of the specific values cited in Table 2, additional context and information is useful. Looking at maximum primary energy consumption allowed by residential NZEB standards:

- The values for France, Poland, and Spain are taken from national NZEB standards, and where Member States provide a range of values, the midpoint is taken into account.[24]

- Due to a different approach to specifying these values, maximum primary energy consumption for Flanders (Belgium), Germany, and Italy is taken from the EC Report on MS progress towards the deployment of NZEBs.[25]

- Requirements for residential buildings are approximated with those for single-family houses. Requirements for non-residential buildings are approximated to those for office buildings.[26]

Finally, with respect to the minimum share of energy from renewable energy sources in buildings' energy demand, these values are taken from national NZEB standards. In cases where these standards do not require share of RES, a ratio of required renewable and total primary energy demand is used. There are important differences across the focus geographies in terms of requirements on energy performance and renewable energy (where these exist), as Table 2 illustrates quite clearly. In most countries, primary energy (PE) limits for residential buildings are lower than those applicable to non-residential ones, while Poland is the only country where residential buildings have a higher PE requirement. In both cases, a more severe PE requirement is around 50% lower that the higher one.

The ranges of values for both residential and non-residential PE requirements are very wide. For residential buildings, PE requirements go from 20 to 75 kWh/m^2/year, and only three countries/regions (Flanders (Belgium), Germany, and Italy) have requirements more ambitious than the EC recommendations.[27] Poland and Spain are within the EC benchmark range (medium ambition) and France is above it (less ambitious). For non-residential buildings, the range of PE requirements is even wider – from 30 to 143 kWh/m^2/year. Flanders (Belgium), Germany, and Poland are highly ambitious and below the EC benchmarks, while Italy and Spain are less ambitious, with PE requirements above what is recommended by the EC. As mentioned above, new French regulations refer to residential buildings only and omit any comparison of non-residential standards.

Analysis and comparison of any six geographies based on renewable energy requirements is less clear than in the case of PE requirements. This is due to the fact that EU Member States, including the six focus geographies, approach these requirements differently. For example, some countries focus on fuel-switching, while others focus on a particular energy use only, such as heating and/or domestic hot water (DHW).

With required shares of 70% and 75%, respectively, Flanders (Belgium) and France are highly ambitious and above the EC recommendations.[28] With their required shares of below 50%, Germany and Italy are below the range of EC benchmarks and can be considered as less ambitious. Spain and Poland both take a very complex approach to specifying this requirement, so analysis and benchmarking for these countries is not included here.

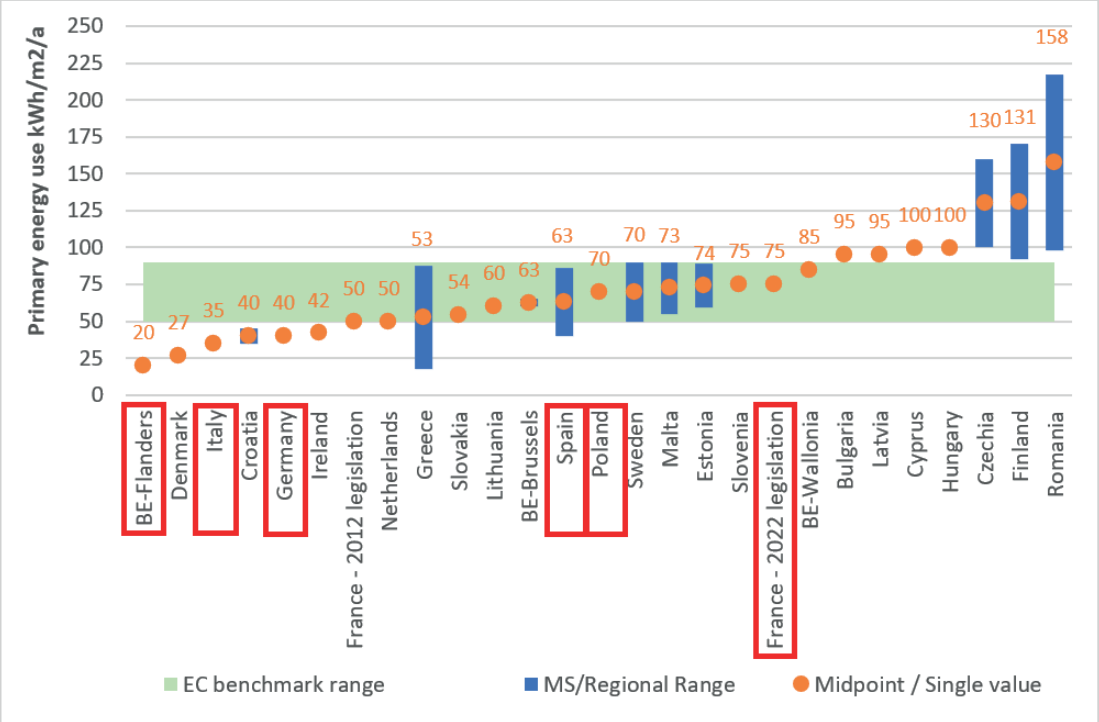
24. As is used in the BPIE NZEB Briefing.
25. COM (2020) 954 final
26. It is important to note that France is assessed based on values/information from its new Environmental Regulations (RE2020), published at the end of July 2021 and in force from 2022 onwards. For the time being, RE2020 regulations will cover only residential buildings, while non-residential buildings are due to be covered in updated regulations.
27. In case of primary energy requirements, higher values imply lower ambition.
28. In case of share of renewables requirement, a higher share implies greater ambition.

COMPARISON WITH EU MEMBER STATES

This section benchmarks the focus geographies in comparison to other EU peers, at least with respect to energy performance requirements and ranges. As mentioned previously, due to the numerous ways that MS address the NZEB requirement on renewable energy, EU comparison is based on energy performance only. This is presented below for residential buildings (see Figure 1) and non-residential buildings (see Figure 2).

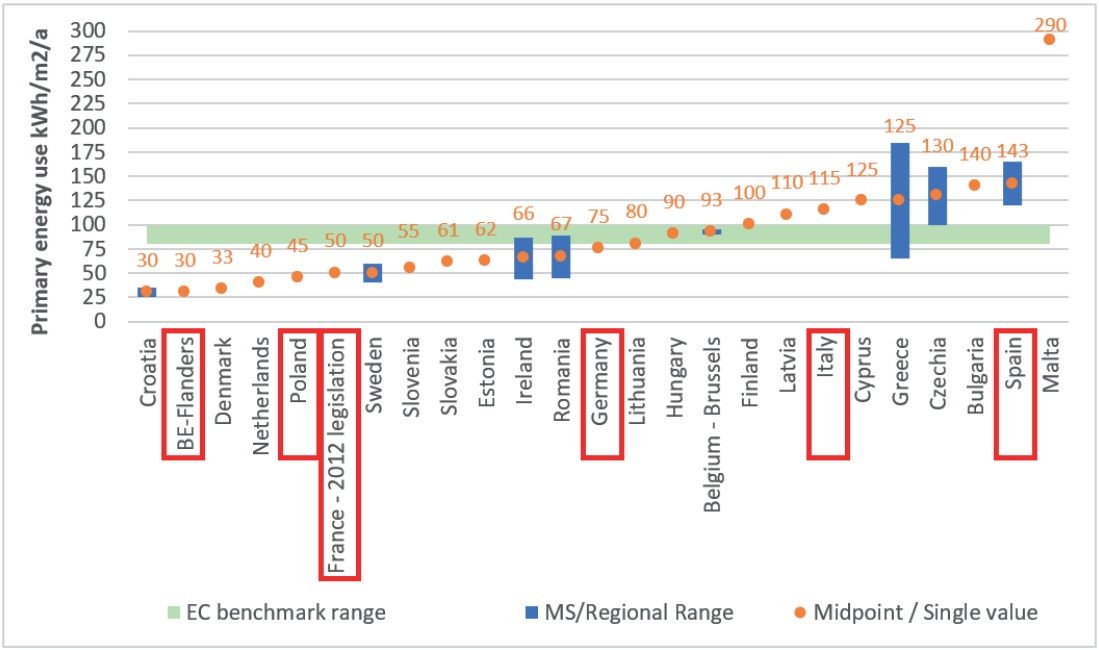
For the purpose of comparison, please note that residential buildings and non-residential buildings are approximated to single-family houses and office buildings, respectively. For the sake of simplicity, the EC benchmark range presented here covers all four EU climate regions, while Table 1 deals with specific climate-related recommendations for improving the accuracy of the six focus countries/regions.
Following the approach used before, values for France, Poland, and Spain are taken from national NZEB standards,[29] while values for Flanders (Belgium), Germany, and Italy are derived from the EC Report on MS progress towards the deployment of NZEBs.

Figure 1: NZEB kWh/m²/year values for residential buildings in the EU[30]



29. Two values are provided for France: current (from 2012) and new (in force from 2022 onwards).
30. Approximated to single-family houses.

Figure 2: NZEB kWh/m²/year values for non-residential (office) buildings in the EU[31]



In some cases, as shown in these figures, there are significant gaps between our focus geographies in terms of ambition on new building standards. This mirrors to some extent an even wider spread of more than 100 kWh/m²/year across the EU in terms of energy performance standards for new buildings. While the EC provides some flexibility in terms of energy performance requirements across climatic zones (see Table 1), it is clear that NZEB ambition levels for many Member States are either well above or below recommended EC benchmarks.

31. Approximated to office buildings.

DEEP-DIVE ANALYSIS OF FOCUS GEOGRAPHIES

This section provides deep-dive analyses of the focus geographies, and each section also contains a summary of new building standards (i.e. NZEB requirements). While an attempt has been made to provide a level of consistency to enable comparison, each section is slightly different in terms of structure: this reflects contrasting approaches to this policy challenge across these territories, all of which are at a different stage of their NZEB journey.

FLANDERS (BELGIUM)

NEW BUILDING STANDARDS

Although required according to the current NZEB definition, the Flanders region does not specify a numerical indicator for maximum primary energy use in its residential and non-residential NZEBs.[32] Instead, an NZEB's minimum performance level is determined as a percentage of the performance of the reference building.[33]

In addition, in its NZEB requirements, the Flanders region does not specify a share of required energy covered by renewables, but only absolute amounts of energy demand that must be provided by RES - i.e. 15 kWh/m²/year for residential NZEBs, and 20 kWh/m²/year for non-residential NZEBs. Lacking a clearly specified share of renewable energy, benchmarking in line with the EC NZEB benchmarks or with EU Member States is bound to be highly provisional.

DEEP-DIVE ANALYSIS

Flanders uses a calculation methodology based on reference buildings to set energy performance standards for NZEBs. In applying this methodology, known in Flanders as the "E Level", E100 represents a baseline level of primary energy demand for a given building typology. For residential new buildings, the E100 Level baseline was set in 2012 using a calculation based on 200 reference buildings. For non-residential buildings, the E100 Level is determined through a notional building approach, meaning that the performance of each building is calculated with a reference package of energy efficiency measures that may differ across building typologies. To address these differences, 11 types of non-residential buildings with different functions are used to determine the reference packages. If a non-residential building is mixed use – such as an office building with retail shops and a gym – then the energy requirement level is based on a combination of requirement levels for each part of the building.[34]

32. Austria, Germany, Italy, Luxembourg, and Portugal all take the same approach.
33. A reference building is based several factors, such as real building's volume and compactness.
34. Proportional to useful floor areas of each part of the building.

The "NZEB Level" in Flanders has been set at E30, which means 70% below the baseline primary energy demand of E100. According to the 2020 EC Report on MS progress towards the deployment of NZEBs, an E30 Level for residential buildings can be considered equivalent to 20 kWh/m^2/year for residential buildings, and 30 kWh/m^2/year for non-residential buildings,[35] which some experts recognise as the most ambitious level for the Flanders market that can be economically feasible. Based on such an estimate, Flanders goes beyond the EC benchmark and would rank as one of the best-performing EU territories. Regarding non-residential buildings, the standard for offices is estimated at around 30 kWh/m^2/year, which is also among the most ambitious in the EU.

To steer new buildings towards the NZEB target, the E Level for new buildings has been gradually tightened over time: from E100 in 2010 to E60 in 2014, and then down to E30 for buildings constructed after 1 January 2021. It is worth noting that, due in part to cost implications, the E100 Level calculation has not been re-baselined against more recently constructed dwellings, at least in the residential category.

As a result, the E100 Level is essentially set based on average energy performance of residential buildings, such as multi-family homes and multi-apartment buildings, as recorded in 2012. Nonetheless, experts consider the E30 Level to be sufficiently ambitious and in line with EPBD requirements and definitions for NZEBs, and which, according to the Flemish Energy and Climate Agency, can be met within the range of E20 and E50.

Requirements on the renewables share in energy demand of new buildings are currently defined with absolute amounts of 15 kWh/m^2/year for residential, and 20 kWh/m^2/year for non-residential buildings. Looking forward, this approach could change to a required share of final energy in line with the EPBD's NZEB definition. The government is still considering the most sensible way to reform renewables requirements and how to implement them. In future, however, there may be a shift to setting the requirements based on final heat versus final electricity, meaning there will be a possibility to better consider the interactions between a building's simultaneous inputs from fossil fuel energy and renewable energy.

In addition, NZEB implementation in Flanders appears to be effective and straightforward. Once a new building is completed, a final site inspection is required to confirm that the building complies with building regulations and meets the required E Level. According to the Flemish Energy and Climate Agency, there have been only very few instances of non-compliance with the building codes or failure to achieve required standards. Indeed, Flanders has witnessed early adoption of NZEBs, with 90% of new buildings constructed since 2018 having achieved the E30 performance standard.[36]

Subsidies and a gradual tightening of standards are a core part of the Flemish government's strategy to ensure uptake of tighter building energy performance standards, which may explain early adoption of NZEBs, and certainly for residential buildings. Before 2020 and 2021, when new building standards were raised to NZEB levels, achieving E30 performance allowed homeowners to earn a 50% reduction on their annual property tax for a period of five years. A 100% reduction over five years was also possible for buildings that achieved E20 performance. Since 2021, the subsidy scheme has shifted further, providing a 100% reduction in property tax for buildings achieving E10 level, and a 50% reduction for buildings achieving E20.

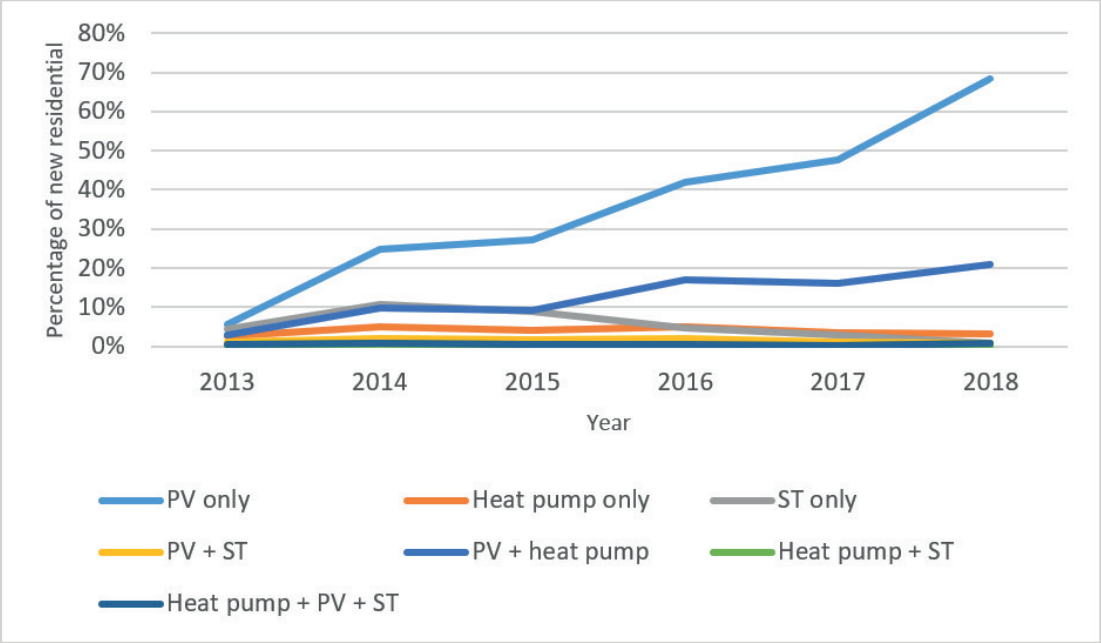
35. COM (2020) 954 final, Figure 4.
36. The official requirement was E40 in 2018-2019, E35 in 2020, and then E30 from 1 January 2021.

The Flemish government also recently adopted further substantive measures for the buildings sector in an effort to successfully align with the EU's "Fit for 55" package.[37] These include specific provisions for heating in new buildings:

- **By 2023, new buildings can only use gas as a heating source if there is a hybrid heat pump installed, and**
- **The Flemish government has a plan to ban gas connection to new buildings by 2026.**

These measures, which are likely to push demand for renewable energy options and displace fossil-based heating, build on positive momentum in Flanders in terms of RES penetration, notably solar PV, heat pumps, and/or solar thermal technologies in new buildings. Figure 3 below shows the share of new residential buildings in Flanders that have used these technologies as part of their construction. Starting from a low base in 2013, which reflects annual levels in all prior years, there has been significant uptake of these technologies. The lion's share of this growth has been primarily in solar PV, although there has been a marked increase in the installation of combined solar PV and heat pump systems. Solar thermal technology, meanwhile, at least as a stand-alone renewable energy technology in new buildings, declined significantly from a share of nearly 11% in 2014 to less than 1% in 2018.

Figure 3: Growth in the percentage of new residential buildings using one or a combination of RES technologies



Source: Energiekaart.be
Note: PV = solar photovoltaic; ST = solar thermal

37. https://ec.europa.eu/commission/presscorner/detail/en/IP_21_3541

RECOMMENDATIONS

- **Increase the transparency of NZEB requirements** and comply with the NZEB definition which relies on a numerical energy performance indicator. This holds especially true for non-residential buildings where energy requirements are determined on a notional building approach.

- As an alternative to providing a clear numerical energy performance indicator, Flanders could **assess the effect that the reference-building approach has on new buildings and approximate an equivalent numerical energy performance indicator** for the purpose of its comparison with the EC NZEB guidelines and other EU countries. Once such a proxy is established, regular monitoring and reporting should follow.

- **Update the baseline energy performance** (which is used to determine NZEB energy performance requirements via the reference building approach) with the most recent figures, while taking full account of evolutions in building technologies and practices over the past decade. This refers mostly to residential buildings, for which the current baseline is grounded in 2012 data.

- **Update the requirements on the share of renewables in NZEBs** and specify a **required share in energy demand,** rather than an absolute amount of renewable energy. Require that RES covers 100% of energy demand in new buildings, starting from 2025.

- Following the momentum of the planned ban on new gas grid connections for new buildings, **develop a strong fossil fuel phase-out plan,** and prohibit the use of fossil fuels in new buildings from 2025 onwards.

- Include **limits on embedded carbon emissions within NZEB standards,** with obligatory reporting on operational and embodied carbon for new buildings (where not in place).

- Develop **mechanisms for timely and thorough monitoring,** and update available subsidies/ incentives for achieving energy performance levels beyond those required by NZEB standards.

FRANCE

NEW BUILDING STANDARDS

France's new Environmental Regulation (Réglementation Environnementale) RE2020,[38] published at the end of July 2021, includes updated standards for residential buildings (i.e. 75 kWh/m^2/year), effective from January 2022. For non-residential buildings, new standards will enter into force from 1 July 2022. Specific values for non-residential buildings have not yet been published, but there is reason to believe the standards will be ambitious. With its requirement of 50 kWh/m^2/year, France's existing standard for new non-residential buildings is among the toughest in the EU.For residential buildings, however, current standards are the least ambitious of all the focus geographies (although they are still in line with EC benchmarks).

In terms of the existing RES requirements, France is not terribly ambitious in terms of RES. A required share of renewable energy in primary energy demand is not specified for non-residential buildings, for example. The ratio of required renewable and total primary energy demand are 30% and 20% for single-family and multi-family NZEBs, respectively, which is less strict than the EC's NZEB recommendations. Amongst those EU Member States which have specified a minimum share of renewable energy in some way comparable to EC benchmarks, France is one of the least ambitious. On the other hand, new RE2020 standard for residential buildings requires that around 75% of energy demand is covered from renewable sources, which is a significant ambition increase in this field.

DEEP-DIVE ANALYSIS

In addition to standards, RE2020 contains important provisions on carbon and fossil heating for new buildings. Starting in 2022, France will introduce carbon limits for buildings designed to gradually phase out fossil fuel systems, alongside a ban on oil-based heating in new buildings from January 2022. These limits cover both the operational and embodied (or Scope 3, the construction phase) emissions of a building, whereby embodied emissions must decrease progressively to 2031. This is a significant paradigm shift for the construction industry, which up to now has only had to consider in-use energy consumption.

The rest of the EU should take note of this and learn what it can.

38. https://www.ecologie.gouv.fr/re2020-nouvelle-etape-vers-future-reglementation-environnementale-des-batiments-neufs-plus

Wider relevant elements within RE2020 include objectives and measures to:

- Reduce the impact on the climate of new buildings by taking into account all of the building's emissions over its entire life cycle, including construction.
- Continue making improvements in energy performance and reduce further the energy consumption of new buildings. RE2020 will go beyond the requirements of the current regulations by insisting in particular on the building envelope performance regardless of the heating mode installed. This will be achieved by strengthening the 'bioclimatic need' indicator (known as 'Bbio').
- Introduce an objective of increased indoor comfort in summer periods so that buildings can better withstand heat wave episodes, which will be more frequent and intense due to climate change.

These efforts are framed and supported by building sector carbon-reduction objectives set out in France's LTRS, approved in 2020, with the following established overarching targets:

- **94% reduction in GHG emissions by 2050 compared to 2015, and**
- **41% reduction in energy consumption by 2050 compared to 2015.**

The roadmap for a successful attainment of these objectives is underpinned by a framework of climate laws, strategies and plans, including the Climate Plan (approved in 2017), which contains the LTRS (updated in 2020). In 2014, the French Minister for Ecology and Energy expressed the intention to ensure that new buildings will be energy positive.[39] Research commenced in 2016 to develop such schemes under the banner "Energy plus, Carbon minus" as part of an overall effort to develop energy-positive building standards to help reduce GHG emissions.[40]

Despite these ambitions and a comprehensive carbon reduction framework covering both operational and embedded CO2, the latest round of setting of building energy codes is neither comprehensive nor conclusive. For instance, the standards to apply from 1 January 2022 cover the residential sector only,[41] while non-residential buildings are due to be addressed in a subsequent communication. Discussions with experts in France have revealed concerns that the new NZEB norms are not cost-optimal and do not support the objective of carbon neutrality in the building sector. The National Council of the Order of Architects argue as well that the 30% improvement in the Bbio performance indicator[42] over the previous 2012 regulation is unambitious.[43] The Council also says that not enough has been done to promote bioclimatic design.

This apparent misalignment of opinion between French officials and some stakeholders mirrors a wider debate on the ability of the market to achieve ambitious NZEBs at reasonable costs. According to CLER,[44] the main reason for existing shortcomings against the previously declared ambition to achieve energy-positive buildings was resistance from the construction industry – their main argument being increased construction costs. This mirrors findings from Germany, where the industry used a similar argument to push for less ambitious new building standards.

Resistance from the construction industry also comes from the fact that higher ambition may require a very efficient building envelope and take into consideration the whole life cycle performance of buildings, both of which would most likely lead to increase in construction costs. Hopefully, the triennial review period for building codes will enable these shortcomings to be addressed during this decade.

39. Euractiv (2014), France aims for 'energy positive' public buildings.
40. Concerted Action (2016) EPBD Implementation in France.
41. Journal officiel électronique authentifié n° 0176 du 31/07/2021
42. Bbio = 2 x Heating requirement + 2 x Cooling requirement + 5 x Lighting requirement. More about Bbio can be found here: https://www.e-rt2012.fr/explications/conception/definition-bbio-rt-2012/
43. https://www.batiactu.com/edito/ordre-architecte-deplore-re2020-batiment-centree-62031.php?MD5email=47e5f710483cb-87fe46a816a9a3e803c&utm_source=news_actu&utm_medium=edito&utm_content=article
44. CLER – The French network for the energy transition

RECOMMENDATIONS

- **Decrease the NZEB requirement for maximum allowed energy demand** in residential buildings and bring it to levels proposed in the EC NZEB benchmarks.
- Ensure **swift adoption of updated NZEB standards in the non-residential sector.** Also, make sure the ambition levels are high enough and in line with the EC NZEB recommendations.
- Update NZEB requirements for share of **renewable energy in energy demand** by **increasing this ratio to 100% as of 2025.**
- Define specific **bans on the use of fossil fuel technologies** in new buildings and introduce them no later than 2025 to complement the ban on oil-based heating and the carbon limits framework.
- Check the **inclusion of cost-neutrality principles**[45] against NZEB standards and make sure they are in line with the building stock-related carbon neutrality objective.
- Make efforts to find a balanced solution for **increasing the ambition of NZEB requirements** in consultation with different market players, such as construction industry representatives.

45. The cost-neutral option means that additional investment is equal to the value of lifetime additional energy savings. Here, "additional" means 'compared to current standards for new builds'.

GERMANY

NEW BUILDING STANDARDS

Germany's current new buildings standard limits primary energy use to 40 kWh/m²/year for residential, and 75 kWh/m²/year for non-residential buildings, according to EC figures.[46] Similar to Italy and Flanders (Belgium), German new building standards do not specify primary energy use requirements in terms of kWh/m²/year. Instead, new buildings must perform significantly better than reference buildings, based on a percentage improvement.

German legislation stipulates different possibilities for satisfying requirements to provide a significant share of energy demand from RES. For instance, a building that provides 15% of energy demand from solar collectors, or 50% of demand from geothermal heat pumps,[47] is considered in line with NZEB requirements. Although this implies that the renewable share in German NZEB should, in most cases, be between 15% and 50%, a precise comparison with the EC NZEB recommendations or other EU countries is not possible.

DEEP-DIVE ANALYSIS

The Gebäudeenergiegesetz (GEG), or Building Energy Law,[48] is the main legislative pillar for building efficiency in Germany. In force since November 2020 and co-developed by the Ministry of the Interior and the Ministry of Economics and Technology, the GEG combines previously separate legislation on energy efficiency and renewable heating into a single law. Among other elements, the GEG details Germany's implementation of the EPBD, including all NZEB provisions, such as calculation methods for setting new building standards.

When designing a new building, planners need to ensure they achieve the required improvement in energy performance compared with a reference building that has the same geometry, usable area, orientation, etc. Specifically, the maximum primary energy that new buildings are allowed to consume for heating, cooling, ventilation, and domestic hot water equals 75% of the primary energy used by the corresponding reference building. As noted above, this corresponds to 40 kWh/m²/year.

46. COM (2020) 954 final, Figure 4
47. A combination of several measures is also possible.
48. https://www.gesetze-im-internet.de/geg/

Given Germany's long-standing efforts to improve building energy efficiency, our view is that the current new building standard is not ambitious enough. Experts largely share this view, pointing out that the German government's 2015 Energy Strategy for Buildings (ESG)[49] already indicated the need for higher standards compared with those currently in force: a minimum requirement of 35 kWh/m^2/year, which equates to "KfW 55", as explained later in the section, was favoured the next (now current) update of new building standards. In other words, the German government's 2020 NZEB standards are below the levels recommended in its own strategic roadmap for the sector from 2015.

Some experts have expressed concerns that sector lobbying played a significant role in a watering down of Germany's building efficiency ambition levels when the GEG was being drafted and adopted. This issue is important and will likely resurface in the upcoming review of GEG provisions in 2023. This review period provides the government with an opportunity to align reduction pathways for building emissions with Germany's recently revised and strengthened Climate Change Act, which includes objectives to:

- **Reduce GHG emissions by at least 65% by 2030, and by 88% by 2050 (compared to 1990 levels), and,**

- **Achieve carbon neutrality by 2045.[50]**

In terms of building-specific fossil fuel phase-outs, Germany does not have a target in place, although coal-fired power plants are due to shut by 2038.[51] Assuming renewable power is made available as an alternative to coal, this will have a knock-on effect in terms of 'greening' electricity use in new buildings, particularly in combination with the renewable energy requirements discussed above. According to experts, such a ban, along with more ambitious energy performance standards, was not included in the current requirements, due in part to concerns about higher upfront costs of installing heat pumps instead of gas boilers.

With respect to the implementation of new building standards in Germany, the KfW, a state-owned investment and development bank, has been instrumental, most notably in the residential segment. Financial incentives provided by the KfW are paid out for buildings that achieve additional percentage-based reductions in primary energy. For example, owner/developers are eligible for preferential loans on relatively generous terms if their building consumes only 55% or 40% of the primary energy used by the reference building (compared with 75%, as per the standard), thereby qualifying for the "KfW 55" or "KfW 40" subsidy schemes, respectively.[51] The KfW 55 scheme equates to 35 kWh/m^2/year, while the KfW 40 scheme is equivalent to 25 kWh/m^2/year. These values may be different for actual new buildings, depending on the results of planner/builder calculations against the applicable reference buildings.

Recently, the German Ministry for Economic Affairs and Energy updated its support scheme to phase out the KfW EH 55 Standard for new buildings as of February 2022. This decision was a reaction to the fact that building to a KfW 55 level has largely become the market norm in Germany, causing experts to expressed concern that this presents a windfall in profits, especially for residential property developers.

49. Federal Ministry for Economic Affairs and Energy (2015) Energy Efficiency Strategy for Buildings
50. https://www.bundesregierung.de/breg-de/themen/klimaschutz/climate-change-act-2021-1936846
51. https://www.bmu.de/en/topics/climate-adaptation/climate-protection/national-climate-policy/translate-to-english-fragen-und-antworten-zum-kohleausstieg-in-deutschland
52. Up to a nearly EUR 38,000 investment subsidy, or up to EUR 150,000 under preferential credit for a building that achieves 40% the consumption of the reference building and 70% of its transmission losses. See: https://www.kfw.de/inlandsfoerderung/Privatpersonen/Neubau/Das-Effizienzhaus/ (available only in German).

This subsidy-market dynamic is an important one for German policy makers to consider as they explore more ambitious new building standards. Experts closely watching this space note longstanding governance challenges related to NZEBs (and building efficiency more generally) in Germany, and are somewhat sceptical about the level of real political will devoted to the issue. These concerns stem from the way in which ownership for building standards and NZEBs has moved repeatedly between various federal ministries since 2010.[53]

RECOMMENDATIONS

- **Increase the transparency of new building standards with a numerical energy performance indicator.** If more appropriate, a proxy numerical energy performance indicator that would have the same effect on new buildings as the reference-building approach could be developed and reported. If regularly monitored and reported, such a proxy would allow comparison with the EC NZEB guidelines and other EU countries.

- Update the NZEB requirements regarding the share of renewables in total energy demand. The aim of new policies should be to **ensure that RES will provide 100% of building energy demand after 2025.**

- **Ban the use of fossil technologies in new buildings as of 2025.** Technology-specific cost concerns raised by industry, such as the cost of heat pumps, should be considered in a life-cycle cost perspective, with subsidies geared to overcome any remaining upfront cost hurdles.

- Incorporate **limits on operating and embodied carbon emissions into the NZEB standards.** This should also include obligatory reporting on carbon emissions for new buildings.

- **Improve federal governance arrangements** for building energy efficiency in terms of focus and coherence across relevant ministries.

- Re-evaluate the level of new build standards to ensure that they are **aligned with Germany's decarbonisation objectives and the latest market developments.**

53. This topic emerged in 2014 in the context of Entranze, an EU-funded research project focussed on NZEBs. In its synthesis recommendations for Germany, the project cites "major changes in the responsibilities within ministries" concerning NZEBs in the wake of the 2013 federal elections https://www.entranze.eu/.

ITALY

NEW BUILDING STANDARDS

Like Germany and Flanders, Italy uses a calculation methodology based on reference buildings to determine energy performance required by its NZEB standards; the methodology also factors in climatic differences between Italian regions. The 2020 EC Report on MS progress towards the deployment of NZEBs suggests that Italian standards are equivalent to 35 and 115 kWh/m^2/year as limits for use of primary energy in residential and non-residential buildings, respectively. Italy's standards for new residential buildings are therefore much more ambitious than for non-residential buildings, where Italy finds itself outside of the benchmark range and among the least ambitious countries in the EU.

Regarding the share of renewables, Italy requires that at least 50% of the total energy used for domestic hot water, heating, and cooling is covered from renewable energy sources.[54] This standard, which effectively means renewable energy requirements for most of the new buildings and climate regions and ranges between 45 and 60 kWh/m^2/year, puts Italy relatively high on the list compared with other EU countries, but nonetheless lower than levels recommended by the EC NZEB benchmarks.

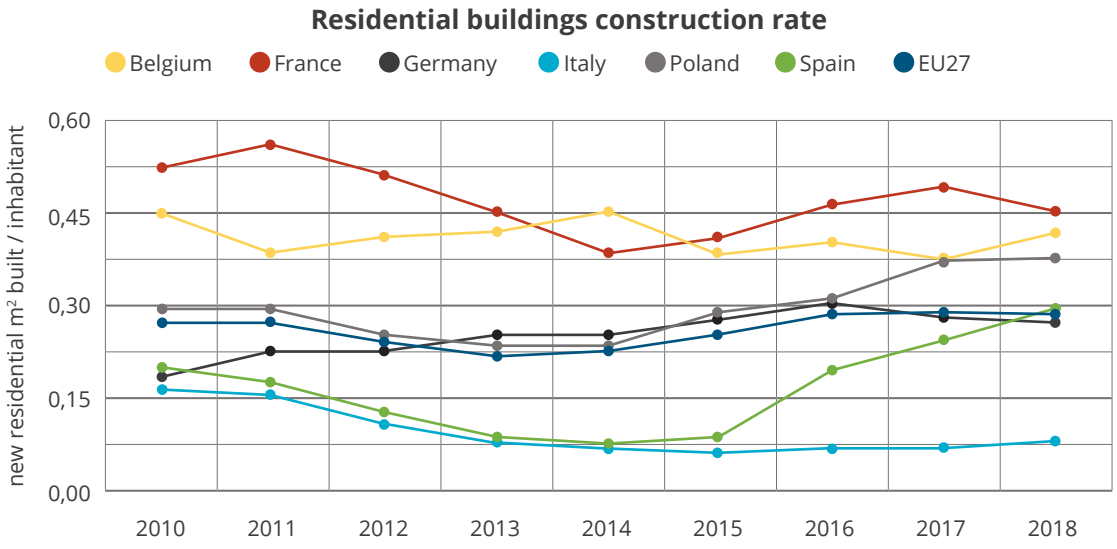
DEEP-DIVE ANALYSIS

Italy presents an outlier case in terms of low levels of new construction in comparison with other EU countries. Rates of new building activity in Italy are among the lowest in Europe and well below the EU average (see Figure 4). There are only a few newly constructed NZEBs in Italy, which significantly limits the ability to analyse the Italian NZEB market in terms of information on the energy performance of recent new buildings, uptake of tighter standards in new construction, etc. In terms of standards, ambition levels are high for residential buildings, but among the least ambitious in Europe for non-residential buildings. Italy has also developed a 2050 decarbonisation scenario that aims to achieve carbon neutrality in the buildings sector by that date, although a fossil ban is not a certainty in this scenario.

54. Another requirement is that 50% of the energy needed for domestic hot water is covered from RES.

Given the absence of significant new construction, renovations are the focus of Italy's building policy and subsidy framework.[55] The most notable incentive in this framework is the "Super-bonus" scheme, which covers up to 110% of energy efficiency-related refurbishments. It appears inevitable that efforts to advance NZEBs in Italy will remain centred on the challenge of existing buildings and deep retrofits, and this ties in with Italy's policy framework for building-sector decarbonisation, which includes the Long-Term Strategy (LTS) for the Reduction of Greenhouse Gas Emissions (2050 being the target year) and the National Energy and Climate Plan (NECP). The LTS predicts significant reductions based on reference and decarbonisation scenarios. In the residential sector, a 28% reduction is foreseen under a reference scenario, and a 60% reduction under the decarbonisation scenario, compared to 2018 values. For the non-residential sector, these reductions would be 42% and 54%, respectively.

Figure 4: Construction rate of residential buildings in Italy and EU countries



Sources: Eurostat, ODYSEE and ISTAT

Among Italian policy makers, there is a degree of confidence that the market can deliver NZEBs successfully should construction activity increase, for example as a result of COVID recovery measures in Italy.[56] Providing more training for professionals in the installation of energy-efficient technologies and systems is part of wider efforts under Italy's LTS, as Italy's SMEs and larger firms operating in the sector are "getting ready" for NZEBs by ensuring sufficient capacity to deliver these types of buildings, according to the Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA). ENEA representatives are also confident that ambition level for new building standards is high, with strict technical requirements in place.

Like other EU countries, Italy has proven the viability of NZEBs through pilot projects, such as the "San Giusto" project in Prato.[57] Whether individual pilots such as these will be representative of a large-scale shift towards NZEBs in a scenario with higher rates of new construction in Italy remains to be seen.

With respect to fossil fuel phase-outs or other policy levers, such as the carbon limits being developed in France, Italy does not have an official policy in place.

55. https://www.mise.gov.it/index.php/it/energia/efficienza-energetica/incentivi
56. Construction activity in Italy has recently exceeded pre-pandemic levels: https://www.bloomberg.com/news/articles/2021-09-03/italy-s-recovery-favors-construction-over-entertainment-chart
57. https://www.pratourbanjungle.it/en/cosa-puj/pagina1982.html

RECOMMENDATIONS

- **Increase the transparency of NZEB requirements by, for instance, including numerical energy performance indicators in NZEB standards.** Alternatively, assess and report approximate numerical energy performance indicators that reflect the impact that the reference-building approach has on new buildings. This would allow comparison with the EC NZEB guidelines and other EU countries. Accompany this with regular monitoring and reporting.

- **Decrease the allowed maximum energy demand in NZEB non-residential buildings;** or, at a minimum, bring it to levels proposed by the EC NZEB benchmarks.

- Increase the required share of renewable energy in primary energy demand of NZEB buildings, and **require full coverage of energy demand by RES as of 2025.**

- Develop a **fossil fuel phase-out plan** and restrict the use of fossil fuels in new buildings, **implementing such a plan no later than 2025.**

- Incorporate limits on carbon emissions into NZEB standards. These should include both operational and embedded carbon, while covering obligatory reporting on carbon for new buildings.

- Support **NZEB uptake by responding to market needs,** especially in terms of **training professionals involved in NZEB design,** as well as in the **design and installation** of energy efficient technologies.

POLAND

NEW BUILDING STANDARDS

The primary energy requirement for new residential buildings in Poland is 70 kWh/m2/year, which is at the top end of the 50-70 kWh/m^2/year range recommended by the EC for a continental climate. Conversely, the requirement for non-residential buildings stands at 45 kWh/m^2/year, significantly more ambitious than the EC-recommended range of 85-100 kWh/m^2/year and among the most ambitious in the EU.

As for the share of renewable energy in the primary energy supply, the new building code in Poland does not specify such a requirement, which makes Poland one of the worst-performing EU countries in this regard.

DEEP-DIVE ANALYSIS

Poland's building stock has a generally low level of thermal insulation. Coal and gas are the main sources of heating, whether through individual heating units or district heating, and this generates an oversized carbon footprint. Widespread use of coal and its associated air pollution is also a major health problem, especially in cities.[58] As a result of these challenges, energy efficiency of buildings has become increasingly important in the country.

New building code requirements for Poland were set out in 2014, with an intermediate tightening applying from 2017 before the current levels were introduced on 31 December 2020, as presented in Table 3.

58. https://www.economist.com/graphic-detail/2021/01/30/polands-coal-fired-home-heating-creates-widespread-pollution

Table 3: Primary energy requirement for new buildings in Poland (kWh/m²/year)

	Applicable from 1 January 2017	Applicable from 31 December 2020
Single-family houses	95	70
Multi-family houses	85	65
Healthcare buildings	290	190
Warehouses and farm buildings	90	70
Other non-residential buildings	60	45

The Polish NZEB standard was developed according to the cost-optimality methodology set out by the EC. However, it is not clear whether the NZEB standard would be cost-optimal if undertaken according to current prices of energy and building materials.

What is clear is that the level of the NZEB standard was set prior to Poland agreeing, along with the rest of the EU, to achieve carbon neutrality by 2050. For this reason, there is a pressing need to review NZEB standards, especially in countries like Poland that are heavily dependent of fossil fuels for heating purposes.

In order to explore the potential for improving and going beyond existing NZEB standards (while achieving carbon-neutral, energy-positive buildings) the Warsaw University of Technology undertook a study of the costs and benefits for the most prevalent building type – i.e. the single-family house.[59] A combination of photovoltaics, heat pumps, balanced ventilation with heat recovery and improved building envelopes is needed to reach a high level of performance, and this in turn requires an optimised design process from both an architectural and an economic perspective.

The study concluded that energy-positive houses are economically viable in Poland if they are developed at least to the "NF40" standard (i.e. a low-energy house characterised by the energy need for heating, ventilation, DHW and auxiliary systems at no higher than 40 kWh/m2/year year), as defined by the National Fund for Environmental Protection and Water Management under the Effective Use of Energy Programme. The National Fund has a support programme in place to achieve energy-positive (or "plus energy") buildings.[60]

These NZEB requirements were announced well in advance and introduced in two stages (new requirements in 2017, and then again in 2021). This approach gave the construction industry enough time to prepare for the new, stricter requirements. The requirements for new constructed public buildings came into effect in 2019, and this pushed the whole industry to adapt. Manufacturers of prefabricated houses, for example,

59. https://www.mdpi.com/1996-1073/12/20/3841
60. https://www.gov.pl/web/nfosigw/ogloszenie-o-naborze-nowa-energia-w-obszarze-nr-1-plusenergetyczne-budynki

chose to adapt their models before the requirement came into force in order to avoid issues of non-compliance in 2021.[61] There was also a degree of training and upskilling required for the market to be able to respond to the new requirements. Consequently, there have been no major issues with constructors being able to meet NZEB performance levels.

The experts we interviewed think it is realistic to evolve the NZEB requirement to a net zero-energy building requirement within this decade. At the same time, they noted that the costs of electricity storage need to come down dramatically if more ambitious building requirements are to become cost-effective and widespread. There was no expert consensus on whether Poland is ready to broaden its NZEB definition to also include embodied carbon emissions (e.g. emissions caused during the construction of the building).

There have been no significant changes in governance and implementation of new building standards since the introduction of the NZEB requirements. Actors involved in the construction process, such as architects and engineers, are obliged to design and build in accordance with the defined requirements, including minimum energy efficiency requirements. After a construction is completed, a report on the commissioned building with information on energy performance, confirming the compliance with the NZEB requirements, must be submitted to the Central Statistical Office.

The draft of the Polish LTRS[62] outlines the following new build-related, long-term strategic targets to achieve decarbonisation of the building stock:

1. **Complete phase-out of coal for heating purposes by 2050,**
2. **Phasing out the use of coal in all residential buildings by 2040 (in cities by 2030), and**
3. **Phase out natural gas use in residential and non-residential buildings by 2050.**

The strategy does not include any target dates or percentage reductions in carbon emissions, nor is there an explicit target for fully decarbonising the building sector.

RECOMMENDATIONS

- Tighten energy performance requirements for new residential buildings to support economy-wide decarbonisation objectives.
- Include a required minimum share of energy from renewable sources in primary energy demand of NZEB. We strongly advise putting this requirement level at 100%, as of 2025.
- Build on the existing coal phase-out plan and expand its scope to all fossil fuel types. Accelerate the new build-related ban on fossil fuels to 2025, effectively ending direct fossil fuel combustion in new buildings.
- Incorporate limits on operating and embodied carbon emissions into NZEB standards. This should also include obligatory reporting on carbon emissions for new buildings.

61. Interview with Andrzej Kielar, member of the board of the Association of Mineral Wool Producers: Glass and Rock MIWO, in World Today News. See: https://www.world-today-news.com/new-building-regulations-from-january-1-2021/
62. https://www.gov.pl/web/rozwoj-technologia/dlugoterminowa-strategia-renowacji

SPAIN

NEW BUILDING STANDARDS

Spain's energy performance standard for new residential buildings provides a range of allowed total primary energy use from 40 kWh/m²/year in the warmest climatic zone to 86 kWh/m²/year in the coldest zone, with a midpoint of 63 kWh/m²/year. While this midpoint is slightly better than the EU average, it is towards the top end of the EC's recommended range (50-65) for Mediterranean climates. Energy performance requirements for non-residential buildings, which range from 120 to 165 kWh/m²/year,[63] are among the second-least ambitious in the EU.[64]

As for the share of renewable energy in primary energy supply, a minimum contribution from RES is not included in Spain's NZEB definition, although renewable energy must account for 60-70% of the energy requirement for generation of domestic hot water (DHW). Regarding electricity, between 30KW and 100KW of power should be installed in new non-residential buildings larger than 3,000 square metres, according to the building code.

DEEP-DIVE ANALYSIS

Building efficiency and decarbonisation efforts in Spain are based on a package of strategies and documents, including the Climate Change and Energy Transition Law (Law 7/2021), which includes buildings sector provisions, as well as the Building Code (CTE, Código Técnico de la Edificación) from 2019, which defines the current new building standards. These efforts can be framed in a wider policy set, which includes a plan to phase out usage of fossil fuels by 2050 and increased electrification of the energy supply, with 100% of electricity provided by renewable sources by 2050. Spain does not currently have a buildings-specific fossil fuel phase-out plan, however.

Experts believe the standard is readily achievable, though not all involved professionals (architects, designers and engineers) are fully conversant with the energy models used to design buildings to the required specifications.

63. Depending on the climatic zone.
64. The first being Malta, with 290 kWh/m2/year.

In terms of renewable energy, Spain does not have a clear relevant minimum contribution in its NZEB standards. Some experts believe that the design assumptions in the CEN standard significantly underestimate actual usage of DHW; they also question the methodology and assumptions behind the calculations for DHW.

While Spanish NZEB standards were developed according to the EU's cost-optimality guidelines, some of the experts interviewed argued that this particular methodology is more suited to colder EU climatic zones, as it is more difficult to apply in Mediterranean climates with much higher summer temperatures. Also, in parts of Spain with temperate climate – without extremes of hot and cold – the overall energy requirement is quite low and, as a result, the range of cost-effective measures becomes more limited.

The Institute for Construction Science[65] identified several shortcomings with the cost-optimality methodology, which in turn raises questions about the validity and accuracy of the methodology used to set NZEB thresholds. These concerns include validity of energy conversion factors, internal loads levels (e.g. DHW needs, occupancy levels, light and equipment loads), building typologies, and indoor environment conditions (e.g. ventilation levels, natural illumination levels).

Even using the existing cost-optimality methodology, the standards could be raised if there were some flexibilities in certain areas; for example, permitting a higher number of hours above the maximum indoor temperature would reduce the required size of the air-conditioning plant, which would result in lower energy-related construction costs and better cost-effectiveness. One suggestion is to apply the principle of adaptive comfort, namely by varying the requirements for temperature and relative humidity according to prevailing climate conditions.

Given the long lead time and progressive improvement in standards since 2010, when NZEB was first announced as a requirement for 2021, the construction industry was generally well prepared to meet the new requirements when they came into force.

In 2010, a roadmap was developed to increase the use of sustainable products in construction, thereby reducing amounts of embodied energy. It has proved politically challenging, however, to establish an embodied energy database, and there is little appetite or technical ability to include embodied energy/carbon within the new building standards, due to be revised in 2025.

RECOMMENDATIONS

- **Decrease non-residential maximum allowed energy consumption required by NZEB standards.** As a minimum, such tightening should move the relevant non-residential values to within the EC NZEB benchmark range.

- Include requirements for minimum acceptable share of energy from renewable sources in primary energy demand of NZEB. **Requiring 100% coverage of energy demand from renewable energy sources, as of 2025, is strongly advised.**

- Develop and implement a **fossil fuel phase-out plan**, and **accelerate the restriction of fossil fuels in new buildings to 2025.**

- Include **limits on operating and embedded carbon emissions in NZEB standards,** and include obligatory reporting on carbon for new buildings.

- Reconsider how **cost-optimality** is used for setting NZEB requirements, and **re-evaluate the NZEB ambitions accordingly.**

65. https://www.ietcc.csic.es/

SUMMARY ASSESSMENT AND COMPARISON OF FOCUS GEOGRAPHIES

Based on the preceding deep dives, this section provides a comparative assessment of the six geographies in terms of:

1. **Required energy efficiency performance,**
2. **Required share of renewable energy in energy demand,**
3. **Carbon limits, and**
4. **Fossil fuel phase-outs.**

To support this analysis, colour coding is used to tag ambition levels, as shown in Table 4.

Green suggests that the measure in place is ambitious and implies a combination of distinctive features, such as high ambition when compared to EC recommendations,[66] building-related and timely support to decarbonisation targets, and consistency with previously issued strategic documents (if any).

Yellow indicates that a measure is partially in place, or that existing measures are not ambitious enough (for example, a fossil fuel phase-out is in place for the energy system, but there is no specific phase-out for the buildings sector).

Orange indicates that measures are well below where they need to be in terms of alignment with long-term carbon objectives.

Red indicates that no formal measures exist, implying the lowest possible level of ambition.

66. In case of energy performance and share of renewable energy.

Table 4: Overview of six focus geographies

Country / Region	Primary energy (PE) requirement	Minimum share of RES in energy demand	Carbon emission limits	Fossil fuel phase- out
Flanders (Belgium)				
France				
Germany				
Italy				
Poland				
Spain				

Table 7 illustrates a number of important issues across the focus geographies. In Flanders, PE limits are classified as highly ambitious. Looking at renewables, however, despite a high required share of renewable energy, Flanders still lacks an updated approach to this topic, such as better inclusion of different energy inputs. In addition, Flanders has an ambitious, timely, and buildings-related fossil fuel phase-out plan in place. Finally, due to lack of carbon limits, Flanders' ambition regarding this topic is classified as 'missing'.

Due to relatively high maximum PE values, ambition level in France is classified as low in this regard, and country experts confirm this. On the other hand, as a result of high renewable energy requirements, France is considered as highly ambitious in this area. The unique presence of carbon limits (operational and embedded) makes France an outlier here. However, as limits are not driving towards zero carbon, the ambition level is marked as yellow. France's fossil fuel phase-out plan is also graded yellow: while tied to France's carbon limits, it lacks detail on specific technology phase-outs, such as gas boilers.

Despite its relatively strong ambition in comparison to EC benchmarks and some EU peers, Germany's PE requirements are classified as yellow because they are not properly aligned with the country's wider decarbonisation objectives. Concerning the required share of energy from RES, Germany is well below EC benchmarks, while national experts concur that the share is not ambitious. Given its focus on coal used in power plants (i.e. lacking specific focus on buildings and fossil fuels overall), Germany's fossil fuel phase-out plan is classified as pink. Finally, similar to other countries, the lack of carbon limits in Germany implies a lack of ambition in this regard.

A mix of high and low ambition for Italian residential and non-residential energy efficiency requirements, respectively, gives Italy a yellow score on PE requirements. Due to a low required share of renewable energy in energy demand, Italy is classified as unambitious in this category. Italy lacks both carbon limits for buildings and effective fossil fuel phase-out plans.

Poland has ambitious PE requirements that have been tightened over time, but they are not based on the most recent data. Due to a lack of clearly comparable renewable energy requirements, Poland is considered as unambitious in this area. Regarding the fossil fuel phase-out plan, a combination of a slow prohibition on gas connection and a slightly faster ban on coal, both building related, results in yellow/pink grade for Poland. Carbon limits in Poland are missing, which earns a red mark for this field.

In Spain, PE requirements for residential buildings could be categorised as average, compared with EU peers and the EC benchmark. There are no headline renewable energy requirements in place, although Spain does have specific requirements related to domestic hot water (DHW). The very slow phase-out plan for fossil fuels in Spain implies existing but low ambition, resulting in a pink grade. Spain lacks carbon limits for buildings, which indicates missing ambition and is graded red for this topic area.

CONCLUSIONS

Decarbonisation of new buildings in the EU is not happening fast enough. The current level of ambition on NZEBs, despite good progress in some Member States, is generally insufficient if based on the 2018 EPBD, and even more so when one considers the EU-wide commitment, made in 2019, to achieve carbon neutrality by 2050.

None of our focus geographies has a set date by which new construction should be at net zero energy and carbon. Only France and Flanders have short-term, buildings-specific and far-reaching fossil fuel phase-out measures in place. Member States are implementing EPBD requirements on NZEBs in an inconsistent manner, especially in terms of ambition level related to NZEB standards.

EU and Member State policy makers now have an opportunity to re-invigorate Europe's low-carbon buildings agenda. The NZEB definition, as defined in the EPBD and as cited in this report, is one aspect that needs to be re-assessed and made fit for a carbon-constrained future, as it has not evolved for more than 10 years (since the 2010 revision of the EPBD). **This is the moment to align the definition with new climate targets for 2030 and carbon neutrality by 2050, or earlier.**

While this report does not provide a 20-year or 30-year forward modelling of the carbon impact for Europe's new buildings based on current standards, **it is reasonable to assume that, unless all EU Member States become ambitious in this space, carbon emissions reductions in the buildings sector are likely to fall short in the quest to meet Europe's 2050 decarbonisation objectives.**

The EU can do more on NZEBs now, even before the proposed new EPBD comes into force. For example, poorly performing Member States should be encouraged to learn from those with more ambitious building codes and adjust their thresholds closer to those achieved by the best-performing Member States, both in terms of energy performance and share of renewables. Platforms such as Concerted Action or other forums can be used or developed to create a better exchange of knowledge and to align best practices, with an agreed objective to reduce standard discrepancies across Member States and to align them – as a bare minimum – with EC benchmarks. Indeed, the EC benchmarks do not necessarily represent the most ambitious performance standards achievable; rather, they represent a basic starting point or framework for Member States, and from which they can move to greater levels of ambition in terms of decarbonising new buildings. EU and national subsidy mechanisms should be carefully scrutinised to ensure that they are aligned with 2030 and 2050 targets, and that they do not directly or indirectly promote the use or installation of fossil fuel technologies in buildings.

Given the EU's updated climate targets for 2030 and 2050, there is a need to develop a new paradigm and standards for new buildings that will lead to full decarbonisation of the current and future building stock. The need for such a paradigm is urgent: **we require a further tightening of energy performance standards alongside more ambitious provisions on maximum energy-consumption levels and the use of renewable energy sources. We also strongly recommend introducing metrics to measure operational and embedded carbon emissions, prior to setting carbon limits, as well as fossil fuel phase-out plans linked to buildings.**

This is also of crucial importance in the context of a wider move towards a more integrated and decentralised energy system characterised by a high degree of intermittent renewable energy inputs and suitable storage arrangements. **Beyond the setting of standards, several important themes have emerged from the research and conversations conducted for this report. One such theme is the use of public funding for subsidies, grants and other incentives. These types of instruments must be used to drive, rather than distort, market movement towards NZEBs.** Stipulations to this effect are already included as part of existing EU State Aid rules, whereby a subsidy should only be awarded for making an additional effort. **However, the technologies and approaches to NZEBs have evolved fairly quickly, and Member States need to be on their guard to ensure that subsidy thresholds do not grow outdated earlier than expected.**

Governance issues, including coherence in terms of political focus and ambition on NZEBs, also emerged as an important issue. While the development and implementation of new building standards can present complex challenges even for well-resourced governments, buildings-sector decarbonisation is central to any effort to achieve economy-wide decarbonisation. Coherence and consistency at all levels of government – from national or federal governments to regional and local authorities – are needed to ensure that energy performance and other key standards are deployed in a timely and robust way so that market actors are able to implement them effectively.

Ultimately, buildings are at the heart of EU efforts to address climate change. Ensuring that buildings achieve a very high level of energy performance, with any residual energy demand met with renewable energy sources, is fundamental to stated ambitions. Whether the subject is new construction, as examined in this report, or deep renovation, as covered extensively in research by BPIE and others, policy makers clearly understand the importance of the buildings sector. **This is an opportune moment for the EU and its Member States to build on existing momentum, and to transition towards a truly sustainable buildings sector that is fully aligned with 2030 and 2050 climate change mitigation objectives.**

POLICY RECOMMENDATIONS

Based on the findings of this report, as well as the BPIE's wider efforts to advance progress on building energy performance in the EU, including recommendations provided in a September 2021 BPIE policy briefing,[67] the following is a non-exhaustive list of recommendations for the EC and EU Member States regarding NZEB provisions for new buildings. These recommendations are intended to inform discussions amongst policy makers in Brussels and across the EU in the context of the EPBD revision, and notably with regard to NZEB-related provisions.

THE EUROPEAN COMMISSION SHOULD:

1. Conduct a gap analysis to determine the extent to which current new building standards in Member States need to be increased in order to align with 2030 and 2050 decarbonisation objectives.
2. Update the NZEB definition for new buildings in the EPBD:
    a. In the first phase from 2025 until 2030, define clear numeric indicator thresholds for maximum primary energy consumption, based on updated benchmark ranges (ranges to be lowered, as they already date back to 2016). Forbid Member States to introduce requirements that are less ambitious or lower than previous ones.
    b. In the second phase, from 2030 onwards, further tighten requirements on energy performance, based on five-year review of the standards, to continually drive ambition higher (lower maximum primary energy consumption during operational phase), reflecting changes in costs, construction practices, and the development of new technologies.

67. https://www.bpie.eu/wp-content/uploads/2021/08/BPIE_Making-EPBD-fit-for-2030_Final.pdf

3. Introduce measures and actions to phase out the installation of fossil fuel-based systems in new buildings by 2025, while ensuring that 100% of building energy demand is provided by RES by this date.

4. Include in the EPBD revision the mandatory use of a set of indicators to express NZEB standards (kWh/m²/year) and the share of renewable energy (expressed in percentage terms). Require Member States to publish energy performance requirements for new buildings in those indicators, and to report them annually to the EC. This will improve consistency and comparability across the EU.

5. Include in the EPBD revision a requirement to monitor NZEB implementation progress across Member States on an annual basis and in a transparent manner, and to issue recommendations to Member States when an ambition gap becomes evident.

6. Pursue thorough enforcement and infringement procedures in case breaches to NZEB definitions and ambition levels are reported, including updates to standards that Member States have communicated previously to the EC.

7. Reassess cost assessment frameworks (cost-optimal methodology) and life-cycle economic analyses used when developing NZEB standards, relying exclusively on the most recent information on energy, building materials and other relevant prices. Work with architects, planners, designers and the whole construction value chain to ensure that additional costs for achieving NZEBs are correctly factored into building models and calculations.

8. Provide a framework with specific requirements to define how standards could move new buildings to energy-positive levels (e.g. beyond NZEB, with a definition to be included in EPBD) and net zero carbon across the life cycle, aligning new buildings with the objective of achieving carbon neutrality by 2050.

9. Introduce requirements for new buildings to report on embodied carbon (Scope 3 emissions), based on EU-wide harmonised reporting and calculation methodologies.

MEMBER STATES SHOULD:

1. Increase the transparency of their NZEB requirements, comply with the NZEB definition, and use mandatory indicators of numerical energy performance (kWh/m²/year) and share of renewables in energy demand (expressed in percentage terms). Report NZEB standards and mandatory common indicators on an annual basis to the EC.
2. Tighten requirements for maximum allowed energy demand to be at least in line with current EC benchmark ranges (EC Recommendation 2016). Update requirements according to new EU-wide definitions to be set in EPBD (see EC recommendations above), and include carbon emission limits (operating and embedded) over the full life cycle of a building.
3. Require that 100% of energy demand in new buildings is covered by renewable energy sources, starting from 2025.
4. Building on existing momentum in some countries, develop a strong fossil fuel phase-out plan and prohibit the use of fossil fuels in new buildings as of 2025.
5. Ensure that subsidy schemes and other incentives, such as reduced VAT and tax breaks, are effective (e.g. 'additionality') in driving higher NZEB ambition levels, rather than rewarding owners or developers for buildings that are already economically feasible without government support.
6. Focus attention and improve consistency across relevant ministries and other governmental bodies involved in NZEBs and other energy efficiency topics related to buildings. Increase their involvement and knowledge of the latest building performance trends and topics, as this will improve the quality of decision-making processes.
7. Public authorities should provide and strongly promote training for professionals involved in NZEB design, as well as in the design and installation of energy efficient technologies. We strongly recommend following recent market trends and adjusting trainings to meet specific market needs.

REFERENCES

BELGIUM-FLANDERS

- Belgian Government (2012). Belgian National Plan for Nearly Zero-Energy Buildings. https://ec.europa.eu/energy/sites/ener/files/documents/belgium_en_version.pdf
- Flemish Government (2013). Besluit van de Vlaamse Regering houdende wijziging van het Energiebesluit van 19 november 2010, wat betreft de energieprestaties van gebouwen. https://www.ejustice.just.fgov.be/cgi_loi/change_lg.pl?language=nl&la=N&table_name=wet&cn=2013112919
- De Meulenaer, M. & Triest, K. Flemish Energy Agency Organisation (2018). "EPBD implementation in Belgium (Flemish Region). Status in December 2016". https://epbd-ca.eu/wp-content/uploads/2018/08/CA-EPBD-IV-Belgium-Flemish-Region-2018.pdf
- Flemish Government (2020). "Long-term strategy for the renovation of Flemish buildings". https://ec.europa.eu/energy/sites/default/files/beflanders_ltrs_2020_en.pdf

Websites:

- https://www.energiesparen.be/EPB-pedia/E-peil
- https://www.energiesparen.be/epb-pedia/e-peil-nietres-2022
- https://www.energiesparen.be/epb-pedia/rekenmethode/e-peil
- https://www.energiesparen.be/epb-pedia/eisen-per-aanvraagjaar
- https://www.vlaanderen.be/vermindering-van-de-onroerende-voorheffing-voor-energiezuinige-gebouwen
- https://www.ben-architect.be/ben/
- https://www.energiesparen.be/BEN

FRANCE

- French government (2020). "Long-term strategy of France for mobilising investment in the renovation of the national stock of residential and commercial buildings, both public and private". https://ec.europa.eu/energy/sites/default/files/documents/fr_ltrs_2020_en.pdf

Websites:

- http://www.batiment-energiecarbone.fr/organisation-generale-a97.html
- http://www.rt-2020.com
- https://www.les-energies-renouvelables.eu/conseils/reglementation-thermique-2012/lobjectif-de-la-reglementation-thermique-2020
- http://www.planbatimentdurable.fr/label-accompagnant-la-re2020-le-plan-batiment-a1527.html
- https://www.ecologie.gouv.fr/reglementation-environnementale-re2020
- https://www.ecologie.gouv.fr/experimenter-construction-du-batiment-performant-demain-0

GERMANY

- Germany's Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety, (2016). "Climate Action Plan 2050". www.bmu.de/fileadmin/Daten_BMU/Pools/Broschueren/klimaschutzplan_2050_en_bf.pdf

- Atanasiu, B., Maio, J., Staniaszek, D., Kouloumpi, I., & Kenkmann, T. "Cross-analysis on member-states' plans to develop their building regulations towards the NZEB standard" (ENTRANZE Project). https://www.entranze.eu/files/downloads/D5_1_3/ENTRANZE_Integration_of_report_D5.1_D5.2_D5.3_final.pdf

- Germany's Federal Ministry for Economic Affairs and Energy (2015). "Energy Efficiency Strategy for Buildings Methods for achieving a virtually climate-neutral building stock". www.bmwi.de/Redaktion/EN/Publikationen/energy-efficiency-strategy-buildings.pdf?__blob=publicationFile&v=7

- Schettler-Köhler, H., Ahlke, I., Hempel, A. & Markfort, D. (2018). "EPBD implementation in Germany. Status in December 2016". https://epbd-ca.eu/wp-content/uploads/2018/08/CA-EPBD-IV-Germany-2018.pdf

- German Bundestag, (2020). "Gesetz zue Vereinheitlichung des Energieeinsparrechts fur Gebäude und zur Änderung weiterer Gesetze". https://www.bgbl.de/xaver/bgbl/start.xav?startbk=Bundesanzeiger_BGBl&bk=Bundesanzeiger_BGBl&start=//*[@attr_id=%27bgbl107s1519.pdf%27]#__bgbl__%2F%2F*%5B%40attr_id%3D%27bgbl120s1728.pdf%27%5D__1617971623176

- German government communication to the EC (2013). "National plan for increasing the number of nearly zero-energy buildings pursuant to Article 9". https://ec.europa.eu/energy/sites/default/files/documents/germany_en_version.pdf

- Kranzl, L. Toleikyte, A., Müller, A. Hummel, M,. Heiskanen, E. Matschoss, K., Rohde, C., Kockat, J. Steinbach, J., Pietrobon, M., Armani, R., Pagliano, L, Kenkmann, T., Bürger, V., Georgiev, Z., Paunova, D., Atanasiu, B., Marian, C. Sebi, C., Lapillonne, B., Petr Zahradnik, P,. & Karasek, J. (2014). "Policies to enforce the transition to NZEB: Synthesis report and policy recommendations from the project ENTRANZE" (D5.7 of WP5 from Entranze Project). https://www.entranze.eu/files/downloads/D5_7/D5_7_ENTRANZE_synthesisrecommendations_v14.pdf

Websites:

- https://www.bmi.bund.de/DE/themen/bauen-wohnen/bauen/energieeffizientes-bauen-sanieren/energieausweise/gebaeudeenergiegesetz-node.html

ITALY

- Ministry of Economic Development (2015). Decree of 26 June 2015. “Applicazione delle metodologie di calcolo delle prestazioni energetiche e defi nizione delle prescrizioni e dei requisiti minimi degli edifici” & Decreto 26 giugno 2015. “Schemi e modalità di riferimento per la compilazione della relazione tecnica di progetto ai fi ni dell’applicazione delle prescrizioni e dei requisiti minimi di prestazione energetica negli edifici” & Decreto 26 giugno 2015. “Adeguamento del decreto del Ministro dello sviluppo economico, 26 giugno 2009 – Linee guida nazionali per la certificazione energetica degli edifici”. https://www.gazzettaufficiale.it/eli/gu/2015/07/15/162/so/39/sg/pdf

- Italian government (2011). Legislative decree of 3 March 2011, n. 28. “Attuazione della direttiva 2009/28/CE sulla promozione dell’uso dell’energia da fonti rinnovabili, recante modifi ca e successiva abrogazione delle direttive 2001/77/CE e 2003/30/CE”. https://www.gazzettaufficiale.it/eli/gu/2011/03/28/71/so/81/sg/pdf

- Italian government (2013). Act of 3 August 2013, n. 90. “Conversione in legge, con modificazioni, del decreto-legge 4 giugno 2013, n. 63, recante disposizioni urgenti per il recepimento della Direttiva 2010/31/UE del Parlamento europeo e del Consiglio del 19 maggio 2010, sulla prestazione energetica nell’edilizia”. https://www.bosettiegatti.eu/info/norme/statali/2013_0090.htm

- Costanzo, E. Federici, A. (ENEA) Martino, A. (CTI) Antinucci, M. & Varalda, G. (RENAEL) “Implementation of the EPBD in Italy (2016). https://epbd-ca.eu/ca-outcomes/outcomes-2015-2018/book-2018/countries/italy

- Italian government (2019). “Integrated National Energy and Climate Plan (NCEP)”. https://ec.europa.eu/energy/sites/ener/files/documents/it_final_necp_main_en.pdf

- Italian government (2013). “National plan for increasing the number of nearly-zero energy buildings”. https://ec.europa.eu/energy/sites/default/files/documents/italy_en_version.pdf

- Costanzo, E. Rossano B., Hugony, F., Misceo, M., Pallottelli, R., Zanghirella, F. & Labia, N. - ENEA, (2019). “Osservatorio degli edifici a energia quasi zero (NZEB) in italia 2016-2018” ISBN: 978-88-8286-375-3. https://www.enea.it/it/seguici/pubblicazioni/pdf-volumi/2019/osservatorio_NZEB_2019.pdf

- ENEA, RSE, CTI & the Ministry of Economic Development (2016). “Piano d’Azione Nazionale per incrementare gli edifici ad energia quasi zero (PANZEB)”. https://www.mise.gov.it/images/stories/normativa/all_decreto_interministeriale_19_giugno_2017_paNZEB.pdf

- Italian government (1993). Decreto del Presidente della Repubblica 26 Agosto 1993, n.412 “Regolamento recante norme per la progetazzione, l’installazione, l’esercizio e la manutenzione degli impianti termici degli edifici ai fini del contenimento dei consumi di energía, in attuazione dell’art. 4, comma 4, della legge 9 gennaio 1991, n. 10.” https://www.gazzettaufficiale.it/eli/gu/1993/10/14/242/so/96/sg/pdf

- Italian government (2021) “Strategia italiana di lungo termine sulla riduzione delle emissioni dei gas a effetto serra”. https://www.minambiente.it/sites/default/files/lts_gennaio_2021.pdf

POLAND

- Polish Government (2021) "Długoterminowa Strategia Renowacji" – Draft (Polish LTRS). https://www.gov.pl/web/rozwoj-praca-technologia/dlugoterminowa-strategia-renowacji
- Polish government (2015). Rozporządzenie Ministra infrastruktury i rozwoju z dnia 27 lutego 2015 r. w sprawie "Metodologii wyznaczania charakterystyki energetycznej budynku lub części budynku oraz świadectw charakterystyki energetyczne". http://isap.sejm.gov.pl/isap.nsf/download.xsp/WDU20150000376/O/D20150376.pdf
- Ministerstwo inwestycji i rozwoju (2019). "Poradnik w zakresie poprawy charakterystyki energetycznej budynków". https://www.gov.pl/documents/33377/436740/Poradnik_efektywnosc_energetyczna_16012019.pdf
- Politcehnika Krakoska & Małopolskie Centrum Budownictwa Energooszczędnego. "Przegląd przepisów określających minimalne wymagania dotyczące charakterystyki energetycznej budynków". https://www.gov.pl/documents/33377/436740/EkspertyzaMCBE2017.pdf
- Polish government (2019). Obwieszczenie ministra inwestycji i rozwoju z dnia 8 kwietnia 2019 r. w sprawie ogłoszenia jednolitego tekstu "Rozporządzenia Ministra Infrastruktury w sprawie warunków technicznych, jakim powinny odpowiadać budynki i ich usytuowanie". https://isap.sejm.gov.pl/isap.nsf/download.xsp/WDU20190001065/O/D20191065.pdf

SPAIN

- Ministerio de Transportes, Movilidad y Agenda Urbana (2019). "Documento Básico Ahorro de Energía del Código Técnico de la Edificación (DB-HE-CTE)". https://www.codigotecnico.org/pdf/Documentos/HE/DBHE.pdf
- Ministerio de transportes, movilidad y agenda urbana (2020) "Estrategia a largo plazo para la Rehabilitación Energética en el Sector de la Edificación en España" (Spanish LTRS). https://www.mitma.gob.es/recursos_mfom/paginabasica/recursos/es_ltrs_2020.pdf
- Ministerio para la transición económica y el reto demográfico (MITECO) (2020). "Estrategia a Largo Plazo para una Economía Española Moderna, Competitiva y Climáticamente Neutra en 2050 (ELP 2050)" NIPO: 665-20-015-X. https://www.miteco.gob.es/es/prensa/documentoelp_tcm30-516109.pdf
- Villar Burke, R., Sorribes Gil, M., Jiménez González, D. & Sobaler Rodríguez, J. (2020). "Guía de aplicación DB-HE 2019" ISBN: 978-84-498-1046-6. https://www.codigotecnico.org/pdf/GuiasyOtros/Guia_aplicacion_DBHE2019.pdf
- ATECYR (2012). "Guía técnica. Instalaciones de climatización con equipos autónomos". Reglamento de instalaciones térmicas de los edificios. (RITE). ISBN: 978-84-96680-61-6. https://energia.gob.es/desarrollo/EficienciaEnergetica/RITE/Reconocidos/Reconocidos/Gu%C3%ADas%20t%C3%A9cnicas/Guia_Instalaciones_Equipos_Autonomos.pdf

- Ministerio para la transición económica y el reto demográfico (MITECO) (2020). "Plan Nacional Integrado de Energía y Clima 2021-2030" (Spanish NCEP). https://www.miteco.gob.es/images/es/pnieccompleto_tcm30-508410.pdf

- Spanish government (2019). "Real Decreto 732/2019, de 20 de diciembre, por el que se modifica el Código Técnico de la Edificación, aprobado por el Real Decreto 314/2006, de 17 de marzo". https://www.boe.es/diario_boe/txt.php?id=BOE-A-2019-18528

- BPIE (2021). "The Road to climate-neutrality - Are national long-term renovation strategies fit for 2050?" https://www.bpie.eu/wp-content/uploads/2021/03/BPIE_LTRS-_10-1.pdf

Websites:

- https://www.codigotecnico.org/DocumentosCTE/AhorroEnergia.html

EU-WIDE

- Ferrara, M., Monetti, V. & Fabrizio, E. (2018). "Cost-Optimal Analysis for Nearly Zero-Energy Buildings Design and Optimization: A Critical Review." Energies 2018, 11, 1478. https://doi.org/10.3390/en11061478

- European Commission (2020). "2020 assessment of the progress made by Member States towards the implementation of the Energy Efficiency Directive 2012/27/EU and towards the deployment of nearly zero-energy buildings and cost-optimal minimum energy performance requirements in the EU in accordance with the Energy Performance of Buildings Directive 2010/31/EU" (Report to the European Parliament and the Council). https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020DC0954&from=EN

ANNEXES

RECENT BPIE PUBLICATIONS ON NZEBS, BUILDING RETROFITS AND RELATED TOPICS

THE MAKE-OR-BREAK DECADE: MAKING THE EPBD FIT FOR 2030 *(September 2021)*

This policy briefing emphasises that the revision of the EPBD must be undertaken in the light of the urgency to address climate change, while addressing societal challenges such as housing affordability and energy poverty.

NEARLY ZERO: A REVIEW OF EU MEMBER STATE IMPLEMENTATION OF NEW BUILD REQUIREMENTS *(June 2021)*

As cited on several occasions in this report, this policy briefing provides an overview of the status of implementation of NZEB provisions in the EPBD (Article 9) across EU Member States.

LONG-TERM RENOVATION STRATEGIES AS KEY INSTRUMENTS TO GUIDE LOCAL RENOVATION – LESSONS LEARNED FROM GOOD PRACTICES ACROSS EUROPE *(February 2021)*

As a successful implementation of the Renovation Wave is highly dependent on local-level action, this report stresses the relevance of long-term renovation strategies (LTRS) for local public authorities and shares good practices from EU Member States.

UPSCALING BUILDING RENOVATION IN THE EU – A STEP-BY-STEP GUIDE FOR EU COUNTRIES TO DESIGN AND IMPLEMENT THE BUILDING RENOVATION PASSPORT *(May 2020)*

The report looks at barriers and enablers relative to design and implementation of tools as part of the EU-funded iBRoad project. Tools consist of an individual building renovation roadmap and a logbook. The report also examines the development and replication of the building renovation passport across Europe.

AN ACTION PLAN FOR THE RENOVATION WAVE: COLLECTIVELY ACHIEVING SUSTAINABLE BUILDINGS IN EUROPE *(April 2020)*

This report includes a series of recommendations for all stakeholders to support a post COVID-19 economic recovery, trigger a renovation wave, and achieve climate-neutrality for Europe's building stock by 2050.

HOW TO INCLUDE BUILDING RENOVATION IN YOUR SUSTAINABLE ENERGY AND CLIMATE ACTION PLAN *(January 2020)*

This action plan maps synergies between local-level and national-level policy objectives (namely LTRS and SECAPS). It also provides suggestions on how to create strong renovation policy in the buildings sector.

BENCHMARKING OF PROMISING EXPERIENCES OF INTEGRATED RENOVATION SERVICES IN EUROPE *(September 2019)*

The report aims to identify, analyse and extract lessons learnt and guidelines from several promising home renovation services in Europe.

NEW BUILDING REQUIREMENTS ACROSS THE GLOBE

The EU is not alone in specifying energy performance requirements for new buildings. Across the globe, various jurisdictions have already introduced or plan to introduce levels of performance that require very low or zero energy use or carbon emissions.

NATIONAL SCHEMES

1. Australia – A voluntary "National Carbon Offset Standard for Buildings"[68] was established in 2017 to provide best-practice guidance on managing emissions and enabling buildings to be certified as carbon neutral through either the NABERS[69] Energy or the Green Star[70] performance rating schemes.

2. Canada – The "Pan-Canadian Framework on Clean Growth and Climate Change", issued in 2017, stated that the various levels of government in the country would work to develop and adopt increasingly stringent model building codes, with the goal of achieving a "net-zero energy-ready" model building code by 2030.[71]

3. Japan – The Basic Energy Plan, approved by the Cabinet in 2014, sets out the country's goal of achieving the Zero Energy House (ZEH) concept in newly constructed public buildings by 2020, while also achieving average net emissions of zero in newly-constructed buildings by 2030.[72]

4. South Korea – A Zero Energy Building (ZEB) Certification System was established in January 2017 to promote and track developments in ZEBs.[73]

5. United States – In 2007, Congress passed the Energy Independence and Security Act which requires that, from 2030, designs for new buildings or major renovations of Federal government buildings must be fossil fuel free, and essentially zero net energy. In 2015, the United States Department of Energy (US DOE) issued a document, "A Common Definition for Zero Energy Buildings", to establish a national definition and thereby avoid the confusion entailed by a variety of interpretations of ZEBs.[74]

6. United Kingdom – The UK, which left the EU in 2020, confirmed in a circular to various public authorities in February 2021 that the previously agreed EPBD NZEB standard is to be maintained for all new buildings.[75]

68. https://apo.org.au/node/113756
69. https://www.nabers.gov.au/
70. https://new.gbca.org.au/rate/rating-system/performance/
71. https://www.canada.ca/en/services/environment/weather/climatechange/pan-canadian-framework.html
72. https://www.meti.go.jp/english/press/2015/1217_01.html
73. http://www.kriea.re.kr/contents.php?con_id=bdenergy_cfi_eng
74. https://www.energy.gov/eere/buildings/downloads/common-definition-zero-energy-buildings
75. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/960976/Building_Regulations_Circular_Letter-NZEB.pdf

REGIONAL AND CITY-LEVEL SCHEMES

- Melbourne has committed to being a carbon neutral city.[76]

- The Canadian province of Ontario revised its five-year Climate Change Action Plan and included specific plans for net zero-carbon homes, including rebates to individuals who purchase or build net zero homes.[77] Vancouver will require all buildings constructed from 2020 onwards to be carbon neutral in operations.[78]

- In the UK, the London Plan includes a net zero-carbon target for major residential developments, which has applied since October 2016 and will shortly be extended to major non-residential developments.[79]

- California's Energy Efficiency Strategic Plan requires all new residential construction to be zero net energy (ZNE) by 2020, and likewise all new commercial construction by 2030. Also, several US cities have recently committed to ZEB targets.[80]

77. https://www.melbourne.vic.gov.au/about-council/vision-goals/eco-city/Pages/carbon-neutral-operations.aspx
78. https://www.ontario.ca/page/climate-change-action-plan#section-5
79. https://vancouver.ca/green-vancouver/green-buildings.aspx
80. https://www.london.gov.uk/what-we-do/planning/planning-applications-and-decisions/pre-planning-application-meeting-service-0
81. https://zeroenergyproject.org/climate-action-plans/

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