RECOMMENDATIONS

COMMISSION RECOMMENDATION (EU) 2016/1318

of 29 July 2016

on guidelines for the promotion of nearly zero-energy buildings and best practices to ensure that, by 2020, all new buildings are nearly zero-energy buildings

THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union, and in particular Article 292 thereof,

Whereas:

(1) Buildings are central to the EU's energy efficiency policy, as they account for nearly 40 % ([1]) of final energy consumption.

(2) The importance of the building sector for energy efficiency improvements was highlighted in the European Commission's Communication on energy efficiency and its contribution to energy security and the 2030 framework for climate and energy policy ([2]) and in its Communication on a framework strategy for a resilient energy union with a forward-looking climate change policy ([3]).

(3) Full implementation and enforcement of existing energy legislation is recognised as the first priority in establishing the Energy Union.

(4) The Directive on the energy performance of buildings is the main legal instrument addressing energy efficiency in buildings in the context of the 2020 energy efficiency targets.

(5) Article 9 of the Directive sets a specific target that by the end of 2020 all new buildings must have nearly zero or very low energy needs. The nearly zero or very low amount of energy required should be covered to a very significant extent by energy from renewable sources.

(6) National legislation transposing the requirements of Article 9(1) is required to ensure that by 31 December 2020 all new buildings are nearly zero-energy buildings. The same nearly zero-energy target but with a shorter deadline of 31 December 2018 applies for new buildings occupied and owned by public authorities. This should create a transparent national legal framework for economic operators regarding requirements for the energy performance of new buildings as of the end of 2020.

(7) In parallel to requirements for new buildings, the Directive requires Member States to put in place support policies to stimulate the refurbishment of existing building stocks towards nearly zero-energy levels.

(8) The Commission has issued a Report to the European Parliament and the Council on progress by Member States towards nearly zero-energy buildings ([4]). Further information has been gathered from Member States as part of their reporting obligations on the subject matter.

(9) Progress by Member States has slowly improved but should be accelerated. Although measures to support the growth in nearly zero-energy buildings at national level have increased, Member States should step up their efforts to ensure that all new buildings are nearly zero-energy by the target dates in the Directive.

([1]) See 'Energy, transport and environment indicators, 2012 edition', European Commission. For the purpose of this estimate, the final energy consumption for the household and services sectors has been combined. This includes, for example, electricity consumption for appliances but excludes energy consumption in industrial buildings.
([2]) SWD(2014) 255 final.
([3]) Energy union package COM(2015) 80 final.
([4]) COM(2013) 483 final/2.

(10) The Directive on the energy performance of buildings is currently under review. Principles for nearly zero-energy buildings are one of the pillars of the current Directive and are set to become the norm for new buildings as of 2020. The review will assess whether additional measures will be needed for 2030. The development of new policies and approaches should be based on solid foundations. It is crucial that the nearly zero-energy buildings requirements for 2020 are fully implemented.

(11) This is further supported by Article 9(4) of the Directive, which provides that the Commission may issue a recommendation on nearly zero-energy buildings to Member States.

HAS ADOPTED THIS RECOMMENDATION:

1. Member States should follow the guidelines provided in the Annex to this Recommendation. Following these guidelines will help to ensure that, by 31 December 2020, all new buildings are nearly zero-energy buildings, and will help Member States to develop national plans for increasing the number of nearly zero-energy buildings.

2. The Recommendation shall be published in the *Official Journal of the European Union*.

Done at Brussels, 29 July 2016.

For the Commission
Miguel ARIAS CAÑETE
Member of the Commission

ANNEX

1. INTRODUCTION

Following the introduction of efficiency requirements in national building codes, new buildings today consume only half as much energy as typical buildings from the 1980s.

The Energy Performance of Buildings Directive (the 'EPBD' or 'the Directive') requires Member States to establish minimum requirements for the energy performance of newly constructed buildings and existing buildings undergoing major renovations. Further to these minimum requirements, the EPBD sets a clear requirement for all new buildings, by the end of the decade, to have nearly zero or very low energy needs and qualify as nearly zero-energy buildings (NZEB). However, the existing building stock is old and inefficient and is being renovated at a slow pace. In line with the EPBD, the stock of existing buildings should also be gradually transformed to similar standards.

Full implementation and enforcement of existing energy legislation is recognised as the first priority in establishing the Energy Union ([1]). Ensuring that all new buildings are nearly zero-energy buildings by 31 December 2020 (two years earlier for public buildings), and supporting the transformation of existing building stocks towards NZEB standards, are two crucial requirements under the current legal framework.

2. CONTEXT: THE PROVISIONS OF THE EPBD ON NZEB

2.1. **The concept of NZEB**

According to Article 2(2) of the EPBD an NZEB '…means a building that has a very high energy performance, as determined in accordance with Annex I. 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'.

The first part of the definition establishes energy performance as the defining element that makes a building an 'NZEB'. This energy performance has to be very high and determined in accordance with Annex I of the EPBD. The second part of the definition provides guiding principles to achieve this very high performance by covering the resulting low amount of energy to a very significant extent by energy from renewable sources.

The concept of NZEB reflects the fact that renewable energy and efficiency measures work together. When placed on-building, renewable energy will reduce net delivered energy. In many cases, on-site renewable energy will not be sufficient to bring energy needs close to zero, without further energy efficiency measures or a significant decrease of primary energy factors for off-site renewable energy sources. Therefore, higher and more demanding requirements for highly efficient NZEB will also drive an increased use of on-building renewables and should result in adaptation of primary energy factors for off-site energy carriers, taking their renewable energy content into account.

While the EPBD sets the framework definition of NZEBs, its detailed application in practice (e.g. what is a 'very high energy performance' and what would be the recommended significant contribution of 'energy from renewable sources') is the responsibility of the Member States when they transpose Article 9 of the Directive into their national legal systems.

2.1.1. *What is the energy performance of a 'nearly zero-energy' building?*

Energy performance is defined ([2]) as '…the 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'. Commission Delegated Regulation (EU) No 244/2012 ([3]) and its accompanying guidelines ([4]) provide useful guidance on how to calculate the energy performance of a building ([5]).

([1]) COM(2015) 80 final.
([2]) Article 2(4).
([3]) Commission Delegated Regulation (EU) No 244/2012 of 16 January 2012 supplementing Directive 2010/31/EU of the European Parliament and of the Council on the energy performance of buildings by establishing a comparative methodology framework for calculating cost-optimal levels of minimum energy performance requirements for buildings and building elements (OJ L 81, 21.3.2012, p. 18).
([4]) Guidelines establishing a methodology framework for calculating cost-optimal levels of minimum energy performance requirements (OJ C 115, 19.4.2012, p. 1).
([5]) See table in page 10 of the guidelines.

Under Annex I(3) to the Regulation, the calculation of energy performance starts with the calculation of final **energy needs** ([6]) for heating and cooling, and ends with the calculation of the **net primary energy**. The 'direction' of the calculation goes from the building's needs to the source (i.e. to the primary energy).

Under the EPBD, Member States can use their own national primary energy factors to transform the final delivered energy into primary energy and calculate building energy performance.

The primary energy use must be calculated using primary energy factors specific to each energy carrier (e.g. electricity, heating oil, biomass, district heating and cooling). The accompanying guidelines to the Delegated Regulation recommend using the same 2,5 primary energy factor for delivered and for exported electricity.

Energy produced on-site (used on-site or exported) reduces the primary energy needs associated with delivered energy.

The end objective of the energy performance calculation is to determine the annual overall energy use in net primary energy, which corresponds to energy use for heating, cooling, ventilation, hot water and lighting. This annual balancing is consistent with the current EPBD framework. However, studies suggest that there could be benefits in calculating energy balances at smaller time steps (e.g. to observe daily and seasonal effects) ([7]).

In accordance with Article 4(1), minimum requirements must take account of general indoor climate conditions in order to avoid possible negative effects such as inadequate ventilation. To avoid deterioration of indoor air quality, comfort and health conditions in the European building stock ([8]), the stepwise tightening of minimum energy performance requirements resulting from the implementation of NZEB across Europe should be done together with appropriate strategies dealing with indoor environment.

Similarly, studies ([9]) indicate that often new and renovated buildings do not reach the planned energy performance. Mechanisms should be put in place to calibrate the calculation of the energy performance with actual energy use.

2.1.2. *Relationship between cost-optimal and NZEB levels*

The EPBD establishes a benchmarking system (principle of 'cost-optimality') to guide Member States in setting energy performance requirements contained in national or regional building codes, and keeping them under regular review. Under the EPBD, cost-optimality ([10]) sets the minimum level of ambition for both building renovation and new buildings.

In line with the cost-optimal requirements under Article 5 of the Directive, national minimum energy performance requirements are to be reviewed every five years and strengthened if they are significantly less ambitious than the national cost-optimal levels.

The cost-optimal methodology allows Member States to define the range of NZEB requirements in 2020. This requires assessing and comparing different energy efficiency and renewable energy measures, both individually and in combination, as part of packages of measures to be applied to reference buildings.

Accordingly, to define and meet the NZEB level, Member States can use different combinations of measures concerning insulation or other energy efficiency measures, inclusion of highly-efficient technical building systems and use of on-site renewable energy sources ([11]). As part of the cost-optimal calculations, Member States need to explore the contribution of each of these three types of measures.

([6]) 'Energy need', 'delivered energy' and 'net primary energy' should be read according to the definitions laid down in Delegated Regulation (EU) No 244/2012 and its accompanying Guidelines.

([7]) See for instance 'Analysis of load match and grid interaction indicators in net zero energy buildings with simulated and monitored data', Applied Energy, 31 December 2014, pp. 119-131.

([8]) JRC report on 'Promoting healthy and energy efficient buildings in the European Union', 2016.

([9]) See e.g. 'Predicted vs. actual energy performance of non-domestic buildings: Using post-occupancy evaluation data to reduce the performance gap', Anna Carolina Menezes, Andrew Cripps, Dino Bouchlaghem & Richard Buswell (2012), Applied Energy, Volume 97, pp. 355-364, http://www.sciencedirect.com/science/article/pii/S0306261911007811/

([10]) Meaning the level of energy performance which leads to the lowest cost during the estimated lifecycle of the building.

([11]) 'Energy from renewable sources' covers energy from renewable non-fossil sources namely wind, solar, aerothermal, geothermal, hydrothermal and ocean energy, hydropower, biomass, landfill gas, sewagetreatment plant gas and biogases.

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

It is important to keep in mind that, for the bulk of new buildings, the nearly zero-energy buildings concept will apply as from January 2021 onwards (for new public buildings from January 2019 onwards). By then, technology costs are likely to be lower in reaction to more mature markets and larger volumes. It is therefore likely that the NZEB levels will correspond to the cost-optimum for 2020.

The evidence suggests that existing technologies related to energy savings, energy efficiency and renewable energies are sufficient to reach, in combination, a suitable target for nearly zero-energy buildings ([12]). A technology gap that would need to be bridged by 2021 has not been identified. Analysis of the cost-optimal reports required under Article 5 of the EPBD indicates that a smooth transition between cost optimality and NZEB is achievable ([13]).

Each five-year cost-optimality cycle presents an opportunity to lock energy efficiency gains into national building codes as new technologies are proven, and a chance to amend the building performance rules to close the gap to cost-optimal levels. After 2020, the principle of cost-optimality will allow continuous improvement of the level of ambition of NZEB requirements for new buildings, as part of the regular review of national building codes for new and for existing buildings.

2.1.3. *How do renewable energy sources contribute?*

A particular important objective has been the integration of renewable energy sources in national NZEB implementation. Directive 2009/28/EC of the European Parliament and of the Council ([14]) (hereafter the RES Directive) requires Member States to introduce in their building regulations and codes appropriate measures in order to increase the share of all kinds of energy from renewable sources in the building sector ([15]).

Such measures are complementary to the NZEB requirements in the EPBD. The provisions of the EPBD naturally drive the use of renewable energy sources, notably on-site as the energy produced on-building reduces the primary energy associated with the delivered energy. In this way, on-site renewables are always part of the calculation of the energy performance of the building.

While several Member States require a renewable energy share of the primary energy used or a minimum renewable energy contribution in kWh/(m^2.y), others use indirect requirement such as a low non-renewable primary energy use that can only be met if renewable energy is part of the building concept ([16]). This flexibility allows adaptation to national circumstances and local conditions (building type, climate, costs for comparable renewable technologies and accessibility, optimal combination with demand side measures, building density, etc.). The most frequently applied renewable energy systems in NZEB are on-building solar thermal and PV systems. Other renewable energy sources used in these buildings are geothermal (from ground source heat pumps) and biomass.

For example, renewable energy technologies such as solar thermal and PV systems are more cost-effective in Mediterranean climates (characterised by higher solar radiation) than in other climates. Therefore, these technologies can have a higher relative contribution to tighter energy performance requirements.

([12]) 'Towards nearly zero-energy buildings- Definition on common principles under the EPBD' (http://ec.europa.eu/energy/sites/ener/files/documents/nzeb_full_report.pdf), carried out by Ecofys forthe European Commission, DG ENERGY.
([13]) Report of the Commission to the European Parliament and the Council on progress by Member States in reaching cost-optimal levels of minimum energy performance requirements.
([14]) Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC (OJ L 140, 5.6.2009, p. 16).
([15]) See Article 13(4) of the RES Directive.
([16]) EPBD Concerted Action III book, 2016.

As regards off-site renewable energy sources, including those nearby such as district heating and cooling ([17]), the share of renewable energy in the energy carrier mix (for instance in the electricity network mix when electricity is the energy carrier) will affect the energy performance of the building through primary energy factors. Member States make use of this flexibility as significantly different primary energy factors for different energy carriers are observed in general, and for most renewable energy sources and technologies in particular ([18]).

2.2. What do national applied definitions of NZEB need to cover?

The majority of Member States ([19]) already use a primary energy use indicator in kWh/(m^2.y) in line with Annex I. In addition, Member States often include other parameters such as U-values of building envelope components, net and final energy for heating and cooling and CO_2 emissions.

Approximately 60 % of Member States have fixed their detailed application of the NZEB definition in a legal document (e.g. building regulations and energy decrees).

Member States' detailed application in practice of the definition of nearly zero-energy buildings needs to include a numerical indicator of primary energy use expressed in kWh/(m^2.y) ([20]). This detailed application is to be included in the national transposition measures or in the national plan for increasing the number of NZEB.

2.3. New buildings: timeline for NZEB targets

Article 9(1) of the EPBD requires Member States to

'…ensure that:

(a) by 31 December 2020, all new buildings are nearly zero-energy buildings; and

(b) after 31 December 2018, new buildings occupied and owned by public authorities are nearly zero-energy buildings.'

National legislation transposing the requirements of Article 9(1) needs to contain provisions, measures or policies to ensure that by 31 December 2020 all new buildings are nearly-zero energy buildings. The same applies for new public occupied and owned buildings to be nearly-zero energy buildings by 31 December 2018.

With a view to preparing the implementation of Article 9(1), national plans for increasing the number of nearly zero-energy buildings had to include, inter alia, intermediate targets for improving the energy performance of new buildings by 2015. These targets could relate to the minimum percentage of new buildings to be nearly zero-energy buildings, by that date.

Member States must ensure that the requirements of Article 9(1)(a) are met by 31 December 2020 and 31 December 2018 for Article 9(1)(b). Although these dates are in the future, the deadline for transposition of Article 9 was 9 January 2013 ([21]). By this date, all the NZEB provisions of Article 9 needed to be reflected in national transposition measures. Indeed, such a lengthy run-up is necessary given how long it takes to plan, have permission for and construct a building.

Having these targets set in national legislation creates transparency about the political goals and gives visibility to economic operators and other stakeholders concerning the future requirements for the energy performance of new buildings.

Furthermore, Article 9(1) requires Member States to ensure that by the relevant dates, 'all new buildings are NZEBs'. As a result, citizens buying newly constructed buildings or apartments in 2021 would expect the market to have evolved in line with these targets, and buildings to be NZEBs.

Experience from the construction sector shows that the timing of the end of construction or completion of a building might be uncertain and may suffer delays. Member States would need to factor in the period of validity of building permits, the length of construction and completion of building works and the targets in Article 9(1) of the EPBD to avoid falling short of the obligation to ensure that 'by January 2021 all new buildings are NZEBs'.

([17]) DHC systems in the EU have a level of market deployment of about 10-13 % of EU energy heating/cooling supply.
([18]) See footnote 12.
([19]) 23 Member States and one of the Belgian regions.
([20]) In accordance with Article 9(3)(a).
([21]) Article 28(1) second subparagraph.

2.4. **Policies and measures for the promotion of NZEB**

Under Article 9(1), Member States must draw up national plans for increasing the number of NZEBs. The minimum elements to be included in the national plans are established in Article 9(3), as follows:

'The national plans shall include, inter alia, the following elements:

(a) the Member State's detailed application in practice of the definition of nearly zero-energy buildings, reflecting their national, regional or local conditions, and including a numerical indicator of primary energy use expressed in kWh/m² per year….;

(b) intermediate targets for improving the energy performance of new buildings, by 2015…;

(c) information on the policies and financial or other measures (…..) including details of energy from renewable sources in new buildings and existing buildings undergoing major renovation in the context of Article 13(4) of Directive 2009/28/EC and Articles 6 and 7 of this Directive.'

2.5. **Supporting the transformation of existing buildings towards NZEB**

The EPBD also includes NZEB obligations relating to existing buildings without target dates or an obligation to set minimum energy performance requirements. Article 9(2) of the EPBD requires Member States to, 'following the leading example of the public sector, develop policies and take measures such as the setting of targets in order to stimulate the transformation of buildings that are refurbished into NZEBs, and inform the Commission thereof in their national plans…'.

Supporting the transformation of existing building stocks towards NZEBs under Article 9(2) of the EPBD should include as an element the increase of energy from renewable sources (Article 9(3)(c)). In addition Article 13(6) of the RES Directive requires that Member States promote the use of renewable energy heating and cooling in their building codes and regulations.

Article 9(2) aims therefore at increasing renovation depth by setting national support policies to refurbish existing buildings to deeper, NZEB levels. The obligation in Article 9(2) of the EPBD is complemented by national long term building strategies under Article 4 of Directive 2012/27/EU of the European Parliament and of the Council ([22]) (EED), which should result in increased renovation rates through mobilising finance and investments in building renovation. These long term renovation strategies bring together the above elements of the EED (renovation rate) and of the EPBD (renovation depth).

The framework definition of NZEB in the EPBD does not differentiate between new and existing buildings. Having such differentiation may be misleading towards consumers, as would be the case if there were separate Energy Performance Certification ratings for new and for existing buildings.

'Refurbishment into NZEB' therefore means a refurbishment of a magnitude that allows the energy performance requirements of a NZEB level to be met. This does not prevent having different timelines and financial support for existing buildings, in recognition of the longer period required for NZEB levels to be cost-optimal in the case of existing buildings.

3. PROGRESS BY MEMBER STATES TOWARDS NZEB

3.1. **Applied national definitions of NZEB**

Numerical indicators are not comparable across Member States because different energy performance calculation methodologies are used ([23]). Some Member States have extended the scope of the numerical indicator by including non-mandatory energy uses, e.g. energy use in appliances. Evidence shows how inclusion of lighting and appliances can result in more optimal solutions, especially for electricity use ([24]).

([22]) Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC (OJ L 315, 14.11.2012, p. 1).

([23]) On-going standardisation work and projects such as the GE²O project (http://www.geoclusters.eu/) try to overcome this limitation while acknowledging natural differences such as climate.

([24]) Modelling of optimal paths to reach NZEB for new constructions in Europe, presented by Delia D'Agostino at the WSED conference in February 2016 (http://www.wsed.at/en/programme/young-researchers-conference-energy-efficiency-biomass/).

With this caveat, the available evidence ([25]) shows that where a numerical indicator has been set, the requirements range rather widely from 0 kWh/(m².y) to 270 kWh/(m².y) (which includes energy use in appliances) and are mainly given as primary energy use in kWh/m²/y. The higher values are mainly for hospitals or other specialised non-residential buildings.

For residential buildings, most Member States aim to have a primary energy use not higher than 50 kWh/(m².y). The maximal primary energy use ranges between 20 kWh/(m².y) in Denmark or 33 kWh/(m².y) in Croatia (Littoral) and 95 kWh/(m².y) in Latvia. Several countries (Belgium (Brussels), Estonia, France, Ireland, Slovakia, United Kingdom, Bulgaria, Denmark, Croatia (Continental), Malta, Slovenia) aim at 45 or 50 kWh/(m².y) ([26]).

As regards the share of renewable energy, the reporting is quite diverse, with only a few countries defining a specific minimum percentage and the majority making qualitative statements.

No Member State has yet reported any legislative regime for not applying the NZEB requirements in specific and justifiable cases where the cost benefit analysis over the economic life cycle of the building in question is negative, as permitted under Article 9(6) of the EPBD.

3.2. **Policies and measures for the promotion of NZEB**

An assessment of the state of play as of October 2014 ([27]) showed that Member States reported a wide range of policies and measures in support of the NZEB objectives in their national plans and National Energy Efficiency Action Plans, although it is often not clear to what extent these measures specifically target NZEB. Compared to the situation reported in the 2013 Commission progress report ([28]), the number of policies and measures reported from the Member States has increased.

More than two thirds of the Member States have in place polices and measures in the categories of awareness raising and education, strengthening building regulation and energy performance certificates. Financial instruments and support measures, including e.g. incentive policies, loans with reduced interest rate, tax exemptions, energy bonuses for private individuals, grant schemes for installation of renewable energy, guidance and financing for at-risk populations and subsidised mortgage interest rates for energy efficient homes, are another focus to promote NZEB.

Most of the policies and measures reported by the Member States also apply to public buildings. The scope of measures for public buildings varies substantially between Member States ranging from central government buildings only to all publicly-owned buildings or all buildings used for public purposes. Some Member States also have specific measures for public buildings. These are mainly monitoring campaigns (e.g. 'NRClick' is an energy accounting system for the comparison of different municipalities in Belgium) and demonstration projects (e.g. in Germany the Zero-energy building for the Federal Environmental Agency (Umweltbundesamt)).

An EU wide overview of the status of national plans for NZEB was prepared in 2015 ([29]). This recent analysis confirms sustained progress, both in the quantity and in the quality of national measures for the promotion of NZEB, including the detailed application of the definition, intermediate targets by 2015 and financial and other policies. This report identifies several exemplary or front-runner policy frameworks.

Some Member States have estimated the benefits of NZEB implementation. New full time jobs will be created: between 649 and 1 180 in Bulgaria, between 4 100 and 6 200 in Poland, between 1 390 and 2 203

([25]) http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52013DC0483R(01)&from=EN. This report includes information from all Member States except for Greece and Spain, which had notsent a national plan or consolidated template as of 18 September 2014. A more recent overview table ofnational definitions of NZEB is available here: http://ec.europa.eu/energy/en/topics/energy-efficiency/buildings/nearly-zero-energy-buildings.

([26]) See information included in the JRC synthesis report on national plans for NZEB, 2016, a BPIE factsheet of January 2015 (http://bpie.eu/uploads/lib/document/attachment/128/BPIE_factsheet_nZEB_definitions_across_Europe.pdf) and updated information published by the Commission in October 2014 (https://ec.europa.eu/energy/sites/ener/files/documents/Updated%20progress%20report%20NZEB.pdf)

([27]) https://ec.europa.eu/energy/sites/ener/files/documents/Updated%20progress%20report%20NZEB.pdf

([28]) http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52013DC0483R(01)&from=EN

([29]) JRC synthesis report on national plans for NZEB, 2016, available in the following website: http://iet.jrc.ec.europa.eu/energyefficiency/publications/all

in Romania. Bulgaria expects additional investments between EUR 38 and 69 million, Poland between EUR 240 and 365 million, and Romania between EUR 82 and 130 million. Minimum primary energy requirements are foreseen between 70 kWh/m²/y (Bulgaria and Poland) and 100 kWh/m²/y (Romania) in 2015, but they will become between 30 kWh/m²/y and 50 kWh/m²/y in 2020. The percentage of renewable energy will pass from 20 % in 2015 to 40 % in 2020. CO_2 emissions will pass from 8-10 $kgCO_2/m^2/y$ to 3-7 $kgCO_2/m^2/y$ in 2020.

Recent studies suggest that energy reductions of 80 % and more are economically feasible in new NZEB constructions in Europe, although the mix of selected measures varies strongly with climate. Results show how a broad approach to efficiency combined with renewable measures is feasible across the EU, at different costs ([30]).

4. RECOMMENDATIONS

4.1. **Application of the NZEB definition in practice: when is the ambition of a NZEB level of energy performance too low?**

This section provides the general principles and factors that Member States are advised to take into account in developing the NZEB definition to be applied at national level, in line with the EPBD.

There cannot be a single level of ambition for NZEB across the EU. Flexibility is needed to account for the impact of climatic conditions on heating and cooling needs and on the cost-effectiveness of packages of energy efficiency and renewable energy sources measures.

Nevertheless, the terms 'nearly zero' or 'very low amount' of energy introduced by the EPBD provide indications as to the extent and limits of Member States' discretion. NZEB definitions should aim at a nearly equalised energy balance.

The NZEB level for new buildings cannot be below (less stringent) than the 2021 cost-optimal level that will be calculated in accordance with Article 5 of the Directive. The cost-optimal level is the minimum level of ambition for NZEB performance. The NZEB level of energy performance for new buildings will be determined by the best technology that is available and well introduced on the market at that time, financial aspects and legal and political considerations at national level.

The establishment of **numeric benchmarks** for NZEB primary energy use indicators, at EU level, is most useful when the values to be compared with these benchmarks result from transparent calculation methodologies. Standards ([31]) are currently under finalisation to allow for transparent comparison of national and regional calculation methodologies.

With these considerations in mind, benchmarks are usually provided in terms of **energy needs**. Underlying reasons are the fact that energy needs are the starting point for the calculation of primary energy and therefore a very low level of energy need for heating and cooling is a vital pre-condition for nearly zero primary energy buildings. Very low energy needs are also a precondition to achieve a significant share of energy from renewable energy sources and nearly zero primary energy.

Projecting the 2020 prices and technologies, benchmarks for the energy performance of NZEB are in the following ranges for the different EU climatic zones ([32]):

Mediterranean:

— Offices: 20-30 kWh/(m².y) of net primary energy with, typically, 80 — 90 kWh/(m².y) of primary energy use covered by 60 kWh/(m².y) of on-site renewable sources;

— New single family house: 0-15 kWh/m².y) of net primary energy with, typically, 50-65 kWh/(m².y) of primary energy use covered by 50 kWh/(m².y) of on-site renewable sources;

([30]) See footnote 24.
([31]) Commission's mandate M/480 to CEN on the elaboration of EPBD standards.
([32]) In the study 'Towards nearly zero-energy buildings- Definition on common principles under the EPBD' (http://ec.europa.eu/energy/sites/ener/files/documents/nzeb_full_report.pdf), carried out by Ecofys for the European Commission, DG ENERGY:
— Mediterranean is referred to as Zone 1: Catania (others: Athens, Larnaca, Luga, Seville, Palermo)
— Oceanic as Zone 4: Paris (others: Amsterdam, Berlin, Brussels, Copenhagen, Dublin, London, Macon, Nancy, Prague, Warszawa)
— Continental as Zone 3: Budapest (others: Bratislava, Ljubljana, Milan, Vienna)
— Nordic as Zone 5: Stockholm (Helsinki, Riga, Stockholm, Gdansk, Tovarene).

Oceanic:

— Offices: 40-55 kWh/(m².y) of net primary energy with, typically, 85-100 kWh/(m².y) of primary energy use covered by 45 kWh/(m².y) of on-site renewable sources;

— New single family house: 15-30 kWh/(m².y) of net primary energy with, typically, 50-65 kWh/(m².y) of primary energy use covered by 35 kWh/(m².y) of on-site renewable sources; and

Continental:

— Offices: 40-55 kWh/(m².y) of net primary energy with, typically, 85-100 kWh/(m².y) of primary energy use covered by 45 kWh/(m².y) of on-site renewable sources;

— New single family house: 20-40 kWh/(m².y) of net primary energy with, typically, 50-70 kWh/(m².y) of primary energy use covered by 30 kWh/(m².y) of on-site renewable sources;

Nordic:

— Offices: 55-70 kWh/(m².y) of net primary energy with, typically, 85-100 kWh/(m².y) of primary energy use covered by 30 kWh/(m².y) of on-site renewable sources;

— New single family house: 40-65 kWh/(m².y) of net primary energy with, typically, 65-90 kWh/(m².y) of primary energy use covered by 25 kWh/(m².y) of on-site renewable sources.

Member States are advised to use renewable energy sources in an integrated design concept to cover the low energy requirements of buildings ([33]).

Some Member States have chosen to link the NZEB level to one of the best energy performance classes (e.g. building class A++), as specified in an energy performance certificate. This approach, when accompanied by a clear energy performance indicator, is recommended to give clear information to investors and drive the market towards NZEB.

4.2. Meeting the obligation to ensure that new buildings are NZEB as of end of 2020

Preparing new buildings to deliver on the NZEB targets may require adaptation of existing practices. Minimum energy performance requirements and nearly-zero requirements would have to be assessed considering the deadlines in Article 9(1).

Furthermore, Member States need to ensure that if new constructions do not comply with the energy performance requirements, adequate sanction mechanisms are in place. This may require differentiated sanctions for new buildings after the NZEB deadlines have passed.

Member States are advised to assess these elements as soon as possible to make sure that the NZEB targets are achieved. It is equally recommended that Member States define the mechanism that will be used to monitor the fulfilment of the NZEB targets. This mechanism should also monitor the achievement of the intermediate 2015 targets in line with Article 9(1), as well as of possible additional milestones at national level up to 2020. This will strengthen the current NZEB roadmaps and contribute to monitoring mechanisms in the coming years.

4.3. Policies and measures for the promotion of NZEB

In most Member States a wide range of policies has been selected to increase the number of NZEBs (e.g., awareness raising and information, education and training, strengthening building regulations and energy performance certificates, chosen by: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark,

([33]) The integrated energy performance of a building corresponds to the amount of net primary energy needed to meet the different needs associated with its typical use and must reflect the heating energy needs and cooling energy needs, domestic hot water needs and built-in lighting. As a result, in addition to the quality of insulation of the building, an integrated performance considers heating installations, cooling installations, energy for ventilation, lighting installations, position and orientation of the building, heat recovery, active solar gains and other renewable energy sources.

Estonia, Finland, France, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, Malta, Poland, Portugal, Sweden, Slovenia, United Kingdom). However, policies sometimes seem rather general and addressed to 'all buildings'. Their specific support to NZEB is not always sufficiently clear, nor is to what extent they contribute in practice to achieving the NZEB target in a country. Therefore, a stronger connection between policies, measures and NZEB is recommended.

To facilitate the provision of this information, the Commission has made available to the Member States a non-obligatory template, whose use is recommended to facilitate the comparability and analysis of the NZEB plans ([34]).

4.4. **Supporting the transformation of existing buildings towards NZEB**

Best practices to target the transformation of the existing building stock range from technology awareness ([35]), incentive schemes to financial instruments, taxation mechanisms, economic instruments such as energy saving obligation schemes, market instruments like public private partnerships to stimulate building renovation or one stop solution centres giving advice on energy renovation ([36]).

The approach followed in some Member States that links financial support for building renovation to the achievement of high energy classes equivalent to NZEB level can be considered a good practice to stimulate the transformation of national building stocks towards NZEB levels.

In the last decade most Member States introduced measures addressed to the existing building stock and new forward-looking perspectives have been recently defined within the national renovation strategies developed in accordance with Energy Efficiency Directive Article 4. Member States should design consistent mixtures of policy instruments (policy packages), depending only partially on public budgets.

Reliable data to monitor policy impacts, including actual energy performance and indoor environment, are required above all for building stock refurbishment. In some countries with limited solar renewable energy potential (e.g. northern Europe), policies that support alternative measures are needed (e.g. biomass). The adoption of roadmaps and indicators is also a good tool to address specific needs and monitor implementation. Member States are advised to further strengthen and evaluate the adopted measures in order to successfully stimulate cost-effective deep and NZEB renovations.

5. SUMMARY OF RECOMMENDATIONS

(1) Principles for NZEB are one of the pillars of the current Directive and are set to become the norm for new buildings as of 2020. Member States are advised to step up their efforts to fully implement and enforce the provisions of the EPBD to ensure that all new buildings become NZEB by the target dates in the Directive.

(2) Member States are advised to set national definitions of NZEB at a sufficiently high level of ambition –not below the projected cost-optimal level of minimum requirements- and to use renewable energy sources in an integrated design concept to cover the low energy requirements of nearly-zero energy buildings. Recommended benchmarks are provided in Section 4.1. Proper indoor environment should be ensured to avoid deterioration of indoor air quality, comfort and health conditions in the European building stock.

(3) In ensuring that new buildings will be NZEB as of the end of 2020, Member States should assess as soon as possible whether adaptation of existing practices is needed. It is equally recommended that Member States define the mechanism that will be used to monitor the fulfilment of the NZEB targets and to consider the possibility to set up differentiated sanctions for new buildings after the NZEB deadlines have passed.

(4) Policies and measures for the promotion of NZEB should be more specific in clarifying to what extent they contribute to achieving NZEB targets. A stronger connection between policies, measures and NZEBs is recommended. To facilitate the provision of this information, the Commission has made available to Member States a non-obligatory template, whose use is recommended to facilitate the comparability and analysis of the plans.

([34]) The templates as filled in by the Member States are available from this website http://ec.europa.eu/energy/en/topics/energy-efficiency/buildings/nearly-zero-energy-buildings

([35]) The EU supports technology development under the H2020 programme — in particular through the Public Private Partnership on Energy efficient Buildings — https://ec.europa.eu/research/industrial_technologies/energy-efficient-buildings_en.html

([36]) See footnote 22.

(5) The Commission recommends that Member States accelerate progress in the development of support policies addressing specifically the refurbishment of existing building stocks towards NZEB levels. Member States should design consistent mixtures of policy instruments (policy packages) to provide the required long-term stability to investors in efficient buildings, including deep and NZEB renovations. Reliable data collection to monitor policy impacts is recommended to address specific needs and to monitor the implementation of building stock refurbishment.