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National plan for increasing the number of nearly zero-energy buildings in Denmark

National plan for increasing the number of nearly zero-energy buildings in Denmark

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1 Starting point

Please give a short overview of your national building stock. Describe the most important characteristics and emerging needs. Additionally, illustrate the chronological development of national requirements on the energy performance of buildings (for an example, see guidance document)

The Energy Policy Agreement – 2008

In February 2008 an Energy Policy Agreement was entered into between the incumbent government at that time (the Danish Conservative People's Party (Det Konservative Folkeparti) and the Liberal Party of Denmark (Venstre)) and the Social Democrats (Socialdemokraterne), the Danish People's Party (Dansk Folkeparti), the Socialist People's Party (Socialistisk Folkeparti), the Danish Social-Liberal Party (Det Radikale Venstre) and the Liberal Alliance (Ny Alliance)2. The agreement determined Danish energy policy for the period from 2008-2011. One of the targets laid down by the agreement was that the total gross energy consumption should be reduced by 2 % in 2011 and 4 % by 2020 in relation to 2006, signifying an increase in development since 1980. With regard to the energy consumption of buildings, the Energy Agreement determined that there should be stricter requirements for new buildings, resulting in reductions in energy consumption of at least 25 % in 2010, a further 25 % in 2015 and a further 25 % in 2020. Altogether, a reduction of 75 % by 2020 at the latest. The reduced figures were agreed in relation to the 2006 level. On the basis of input from a partnership comprised of a number of enterprises, repositories of knowledge and relevant organisations, the government launched its "Strategi for reduction af energiforbrug i bygninger" ["Strategy for the reduction of energy consumption in buildings"] in April 2009, which contained a number of initiatives for the reduction of energy consumption in buildings3. Many of these initiatives were with regard to proposals for stricter energy requirements for new buildings. To a large extent, the partnership's work and subsequent strategy laid the foundations for the stricter energy requirements for new buildings that came later. In 2010, the 2010 reduction target for energy consumption in buildings became law with the introduction of new energy requirements into the 2010 Building Regulations (BR10)4. At the same time, a new voluntary Low-Energy Class 2015 was introduced into the Building Regulations with energy frameworks that were 57 % lower than the 2006 level. The requirements for this class will become binding from 2015. A new building class with a reduction target of 75 % was prepared in 2011, with the intention of complying with the requirements for nearly zero-energy buildings in Article 9 of the Building Directive. This zero-energy class, entitled Building Class 2020 was introduced into BR10 on 18 August 2011, as another voluntary class in the building regulations5.

The Energy Policy Agreement – 2012

On 22 March 2012, the 2008 Energy Agreement was superseded by a new energy agreement for the period from 2010-20206. The agreement was a political accord between the Danish government (the Social Democrats, the Social-Liberal Party and the Socialist People's Party) and the Liberal Party of Denmark, the Danish People's Party, the Red/Green Alliance (Enhedslisten) and the Conservative People's Party. The Energy Agreement, which also focuses on energy reduction in the building stock, continues and intensifies a number of the initiatives from the previous agreement and is intended to contribute to changing Denmark into a country with an energy supply provided from renewable energy sources. In its mandate to govern, the government has stated the ambition that Denmark's greenhouse gas emissions in 2020 will be reduced by 40 % in relation to the 1990 level, with a calculated total reduction of 34 %, the Energy Agreement will fulfil a large part of this ambition.

2 Agreement on Danish energy policy between the Danish Conservative People's Party, the Liberal Party of Denmark, the Social Democrats, the Danish People's Party, the Socialist People's Party, the Danish Social-Liberal Party and the Liberal Alliance from 2008-2011. 21. February 2008. http://193.88.185.141/Graphics/ENS_Energipolitik/Energiaftalen/energiaftale-21022008_final.pdf
3The Strategy for the reduction of energy consumption in buildings. The Danish Government. April 2009 http://www.ebst.dk/file/43439/reduktion-af-energiforbruget-i-bygninger.pdf
4 BEK nr. 810 af 28/06/2010 [Order No 810 of 28/06/2010]
5 BEK nr. 909 af 18/08/2011 [Order No 909 of 18/08/2011]
6 Agreement between the Danish Government, (the Social Democrats, the Social-Liberal Party and the Socialist People's Party) and the Liberal Party of Denmark, the Danish People's Party, the Red/Green Alliance and the Conservative People's Party on the Danish Energy policy 2012-2020.22 March 2012.http://www.ens.dk/da-DK/Info/Nyheder/Nyhedsarkiv/2012/Documents/Aftale_22-03-2012_FINAL_ren.doc.pdf

2 Application of the definition of nearly zero-energy buildings

Please indicate how a nearly zero-energy building is defined within national context and explain underlying assumptions and factors that provide the rationale for the chosen definition.

For reporting the detailed application in practice of the definition of nearly zero-energy buildings, the table presented in the Annex is to be used.

If a national definition of nearly zero-energy buildings does not exist yet in your country, please indicate here whether precise plans are already under development and if so, please describe these plans. Please also describe if any currently used non-governmental definitions will be considered in these plans and/or a future directive.

Building Class 2020 has been prepared with the intention of being able to meet the Building Directive's requirements for nearly-zero energy buildings. Building Class 2020 has been introduced into BR10, the current Building Regulation, as a voluntary building class until it is introduced as a legal requirement. The definition of Building Class 2020 can be seen in the requirements in Chapter 7.2.1 (paragraphs 12 and 13) and Chapter 7.2.5 of BR10. The provisions in Building Class 2020 are included in Annex 17. Unless stated otherwise, the Building Regulations' other requirement for buildings, including the location of the building, the layout of the building, fire precautions, indoor climate, etc. apply irrespective of the energy classification of the building.

A residential building can be classified as Building Class 2020 when the overall requirement for solar gain for heating, ventilation and hot water per m² heated floor area does not exceed 20 kWh annually.

Other buildings can be classified as Building Class 2020 when the overall requirement for solar gain supplied for heating, ventilation, cooling, hot water and lighting per m² heated floor area does not exceed 25 kWh annually.

If the low-energy framework for Building Class 2020 is complied with, an energy factor of 0.6 applies for buildings supplied with district heating. If the low-energy framework for Building Class 2020 is complied with, irrespective of supply form, an energy factor for electricity of 1.8 applies.

From a technical viewpoint, the requirements are difficult to meet without using RE plants and the assessment emphasises that electricity produced by RE plants will often exceed the requirements, whereby energy consumption will be lower than the minimum requirement during some periods and similarly, the excess electricity will be used for electrical devices in the building such as refrigerators, washing machines etc.

Building Class 2020, which reduces the energy consumption of the building by 75 % in relation to the 2006 level, is introduced as a voluntary building class at a relatively early stage in the Building Regulations considering that the requirements for nearly zero-energy buildings in the Building Directive with regard to publicly occupied and owned buildings and private buildings respectively, will

not come into force until 31 December 2018 and 31 December 2020 respectively. The intention of this early introduction is to send a definitive signal to players in the building industry with regard to the coming requirements. The intention is also to give a positive assurance to the sector of the development of energy requirements and to create a healthy basis for the development and sale of building materials, building technology, consultancy, etc. that complies with the strict energy requirements. Building Class 2020 will therefore contribute to the promotion of innovation in the Danish building industry.

It is not yet thought to be viable from a total economical (cost optimum) viewpoint to build in accordance with Building Class 2020, however, it is thought that Building Class 2020 will be economically viable when a minimum requirement is introduced into the Building Regulations. This is due to assumptions on the price trend in among other things, energy and energy-efficient building materials. These assumptions may not ultimately be correct. Building Class 2020 is therefore a development class which it may be necessary to adjust over the coming years. Introducing Building Class 2020 as a development class also allows for the development of new building technologies or methods that will change the basis for the total economy of the building industry. The application of Building Class 2020 is based on the principles behind the government's strategy for the reduction of energy consumption in buildings from 2009. These principles contain a number of considerations that ensure that the energy requirements of the Building Regulations continue to provide good global solutions for the low-energy buildings of the future that, in addition to Low- Energy consumption, also comply with the people's expectations for quality buildings that are architecturally exciting, healthy and comfortable.

Low-Energy consumption, a healthy and comfortable indoor climate and exciting architecture do not necessarily contradict each other. On the contrary, well-insulated buildings benefit their inhabitants because cold and draughts are no longer present. Similarly, there are many examples of low-energy buildings providing their inhabitants with beautiful and aesthetic surroundings. However, the challenge with Low-Energy buildings is that as the energy requirements become more stringent, it is becoming increasingly important to take energy savings, a healthy indoor climate and architecture into consideration when planning total solutions.

The energy requirements in the Building Regulations comprise an overall framework for the energy consumption of a building, combined with specific requirements for its building envelope, elements and components. This ensures that the basic building is of a high quality and has Low-Energy consumption and heat loss. Building Regulations operate with two building categories: Residential buildings and other buildings. Residential buildings are defined as homes, residential colleges and hotels etc. Other buildings are defined as schools, institutions etc., that are not covered by homes, residential colleges and hotels etc. With both categories of building, a limit has been set for the maximum permitted primary energy consumption.

3 Intermediate targets for improving the energy performance of new buildings in order to ensure that by 31 December 2020 all new buildings are nearly zero-energy buildings

Please report the 2015 targets ensuring that by 31 December 2020 all new buildings are nearly zero-energy buildings. Also explain how they relate to and help to ensure that all new buildings are nearly zero-energy buildings by 31 December 2020.

What are the qualitative and quantitative 2015 targets for all new buildings?

3.1.1 Qualitative 2015 targets: Interim energy related requirements for new residential and non-residential buildings

Building Class 2020, which reduces the energy consumption of the building by 75 % in relation to the 2006 level, is introduced as a voluntary building class at a relatively early stage in the Building Regulations considering that the requirements for nearly zero-energy buildings in the Building Directive with regard to publicly occupied and owned buildings and private buildings respectively, will not come into force until 31 December 2018 and 31 December 2020 respectively. The intention of this early introduction is to send a definitive signal to players in the building industry with regard to the coming requirements. The intention is also to give a positive assurance to the sector of the development of energy requirements and to create a healthy basis for the development and sale of building materials, building technology, consultancy, etc. that complies with the strict energy requirements. Building Class 2020 will therefore contribute to the promotion of innovation in the Danish building industry.

The introduction of a new voluntary Low-Energy Class 2015 in the Building Regulations states a clear objective for the standards new buildings must comply with in 2015. Buildings built in accordance with Low-Energy Class 2015 have an energy framework that is reduced by 57 % in relation to the 2006 level, thus complying with the objective from 2008, for the introduction of a building class in 2015 with a reduced energy consumption of 50 % in relation to 2006.

Requirements on fraction of renewable energies:
The energy framework is technology-neutral and allows the contractor flexibility when choosing a solution to be used in a specific building to ensure compliance with the framework. Energy from plants that produce renewable energy (RE) for the building is offset against the energy framework. Similarly, a shared RE plant established in connection with a new development, where the contractor contributes financially to the construction of the RE plant can be included in the energy framework. In this regard, it is a requirement that the RE plant must be in or in close proximity to the development. Shared RE plants can, for example, be wind turbines, shared solar heating, solar panel installations or geothermal installations. In connection with the preparation of Building Class 2020, it has been calculated how it will be possible to comply with the various requirements. The final energy requirements are laid down to ensure that the building is robust, well-insulated and with a high performance building envelope. At the same time, the permitted energy consumption is so low that in practice, it will be impossible for most buildings to comply with the energy requirements without using RE plants. The class thus complies with the Buildings Directive's requirements that nearly zero-energy buildings should have a very high energy performance and that the remaining requirement for solar gain is mostly renewable energy.

Requirements on useful energy demand: N/A

Requirements on primary energy demand:
Low-energy framework for residential: A building can be classified as Low-Energy Building Class 2015 when the overall solar gain requirement for heating, ventilation and hot water per m² heated floor area does not exceed 30 kWh/m² annually plus 1000 kWh divided by the heated floor area

Low-energy framework for non-residential: Offices, schools, institutions and other buildings not covered by 7.2.4.1 can be classified as Low- Energy Class 2015 if their overall solar gain requirement for heating, ventilation,

cooling, hot water and light per m² heated floor area does not exceed 41 kWh/m² annually plus 1000 kWh annually divided by the heated floor area.

3.1.2 Quantitative 2015 targets: Share of nZEB according to official nZEB definition on all newly constructed buildings (define reference parameter e.g. number of buildings, floor area, volume etc.): N/A

Denmark do not have a target of a share of nZEB. Instead the defintion of nZEB have been incorporated in the building regulations from 2010 as a voluntary scheme.

An analysis from the Danish Building Research Institute show that about 75 % of the danish consultants and contractors have experience working with nZEB.

Miscellaneous:

With buildings or extensions in Building Class 2015 with, for example, a high lighting requirement, extra ventilation, great consumption hot water, long periods of occupation or buildings with particularly high ceilings, the energy framework can be extended with a supplement that corresponds to the estimated energy requirement for the building. Process energy such as ventilation of fume hoods, are not part of the energy framework.

BR10 section: (7.2.1(8)): If the energy framework for Low-Energy Building Class 2015 is complied with, an energy factor of 0.8 applies for buildings supplied with district heating.
BR10 section: (7.2.1(11)): The energy factor is used for calculating the solar gain requirement for low-energy buildings supplied with district heating. See Annex 6 and SBi instruction 213, the energy requirements of buildings.
BR10 section: (7.2.1(13)): Thermal indoor climate on sunny days must be documented by calculations for homes, institutions, offices etc., in Low-Energy Class 2015 and Building Class 2020. The thermal indoor climate must not exceed 26°C apart from some hours in relation to a normal year. For buildings other than houses, the contractor determines the number of hours annually during which the indoor temperature of 26°C must not be exceeded. With homes, the 26°C limit must not be exceeded by more than 100 hours annually and 27°C must not be exceeded by more than 25 hours annually. The specification of the thermal indoor climate is determined on the basis of DS 474 Specifikation af termisk indeklima [DS 474 (Danish Standard 474) Specification of indoor climate]. Documentation of the thermal indoor climate may be determined by simulating conditions in the critical rooms on the basis of the Design Reference Year (DRY). For homes, documentation may be on the basis of a simplified calculation. For buildings other than houses, the number of hours with temperatures over 26°C is determined by the contractor in relation to the DRY.

> From your point of view, how close is your country at the moment in achieving this target? In case there is no target defined yet, please indicate when it is expected to have such a target.

We have no plans of making a specific target of a share of nZEB.

4 Intermediate targets for improving the energy performance of new buildings in order to ensure that by 31 December 2018, new buildings occupied and owned by public authorities are nearly zero-energy buildings

Please report here the 2015 targets ensuring that by 31 December 2018 all new public buildings are nearly zero-energy buildings. Also explain how they relate to and help to achieve that by 31 December 2018, all new public buildings are nearly zero-energy buildings

What are the qualitative and quantitative 2015 targets for all new buildings occupied and owned by public authorities?

4.1.1 Qualitative 2015 targets: Interim energy related requirements for new public buildings

Building Class 2020, which reduces the energy consumption of the building by 75 % in relation to the 2006 level, is introduced as a voluntary building class at a relatively early stage in the Building Regulations considering that the requirements for nearly zero-energy buildings in the Building Directive with regard to publicly occupied and owned buildings and private buildings respectively, will not come into force until 31 December 2018 and 31 December 2020 respectively. The intention of this early introduction is to send a definitive signal to players in the building industry with regard to the coming requirements. The intention is also to give a positive assurance to the sector of the development of energy requirements and to create a healthy basis for the development and sale of building materials, building technology, consultancy, etc. that complies with the strict energy requirements. Building Class 2020 will therefore contribute to the promotion of innovation in the Danish building industry.

The introduction of a new voluntary Low-Energy Class 2015 in the Building Regulations states a clear objective for the standards new buildings must comply with in 2015. Buildings built in accordance with Low-Energy Class 2015 have an energy framework that is reduced by 57 % in relation to the 2006 level, thus complying with the objective from 2008, for the introduction of a building class in 2015 with a reduced energy consumption of 50 % in relation to 2006.

Requirements on fraction of renewable energies:
The energy framework is technology-neutral and allows the contractor flexibility when choosing a solution to be used in a specific building to ensure compliance with the framework. Energy from plants that produce renewable energy (RE) for the building is offset against the energy framework. Similarly, a shared RE plant established in connection with a new development, where the contractor contributes financially to the construction of the RE plant can be included in the energy framework. In this regard, it is a requirement that the RE plant must be in or in close proximity to the development. Shared RE plants can, for example, be wind turbines, shared solar heating, solar panel installations or geothermal installations. In connection with the preparation of Building Class 2020, it has been calculated how it will be possible to comply with the various requirements. The final energy requirements are laid down to ensure that the building is robust, well-insulated and with a high performance building envelope. At the same time, the permitted energy consumption is so low that in practice, it will be impossible for most buildings to comply with the energy requirements without using RE plants. The class thus complies with the Buildings Directive's requirements that nearly zero-energy buildings should have a very high energy performance and that the remaining requirement for solar gain is mostly renewable energy.

Requirements on useful energy demand: N/A

Requirements on primary energy demand:
Low-energy framework for residential: A building can be classified as Low-Energy Building Class 2015 when the overall solar gain requirement for heating, ventilation and hot water per m² heated floor area does not exceed 30 kWh/m² annually plus 1000 kWh divided by the heated floor area

Low-energy framework for non-residential: Offices, schools, institutions and other buildings not covered by 7.2.4.1 can be classified as Low- Energy Class 2015 if their overall solar gain requirement for heating, ventilation, cooling, hot water and light per m² heated floor area does not exceed 41 kWh/m² annually plus 1000 kWh annually divided by the heated floor area.

4.1.2 Quantitative 2015 targets: Share of public nZEB according to official nZEB definition on all newly constructed public buildings (define reference parameter e.g. number of buildings, floor area, volume etc.):

Denmark do not have a target of a share of nZEB. Instead the defintion of nZEB have been incorporated in the building regulations from 2010 as a voluntary scheme.

An analysis from the Danish Building Research Institute show that about 75 % of the danish consultants and contractors have experience working with nZEB.

Miscellaneous:

With buildings or extensions in Building Class 2015 with, for example, a high lighting requirement, extra ventilation, great consumption hot water, long periods of occupation or buildings with particularly high ceilings, the energy framework can be extended with a supplement that corresponds to the estimated energy requirement for the building. Process energy such as ventilation of fume hoods, are not part of the energy framework.

BR10 section: (7.2.1(8)): If the energy framework for Low-Energy Building Class 2015 is complied with, an energy factor of 0.8 applies for buildings supplied with district heating.
BR10 section: (7.2.1(11)): The energy factor is used for calculating the solar gain requirement for low-energy buildings supplied with district heating. See Annex 6 and SBi instruction 213, the energy requirements of buildings.
BR10 section: (7.2.1(13)): Thermal indoor climate on sunny days must be documented by calculations for homes, institutions, offices etc., in Low-Energy Class 2015 and Building Class 2020. The thermal indoor climate must not exceed 26°C apart from some hours in relation to a normal year. For buildings other than houses, the contractor determines the number of hours annually during which the indoor temperature of 26°C must not be exceeded. With homes, the 26°C limit must not be exceeded by more than 100 hours annually and 27°C must not be exceeded by more than 25 hours annually. The specification of the thermal indoor climate is determined on the basis of DS 474 Specifikation af termisk indeklima [DS 474 (Danish Standard 474) Specification of indoor climate]. Documentation of the thermal indoor climate may be determined by simulating conditions in the critical rooms on the basis of the Design Reference Year (DRY). For homes, documentation may be on the basis of a simplified calculation. For buildings other than houses, the number of hours with temperatures over 26°C is determined by the contractor in relation to the DRY.

> From your point of view, how close is your country at the moment in achieving this target? In case there is no target defined yet, please indicate when it is expected to have such a target.

We have no plans of making a specific target of a share of nZEB.

5 Policies and measures for the promotion of all new buildings being nearly zero-energy buildings after 31 December 2020

5.1 Residential buildings

5.1.1 Relevant regulations

- Denmark has implemented a number of actions that either directly or indirectly promote the energy efficiency of existing buildings, as well as the number of zero-energy buildings which includes: Energy framework requirements in BR10, Low-energy class 2015 and Building Class 2020.
- The Energy Agreement explicitly states that the increased savings obligations are targeted at the energy companies' existing buildings and business.
- The Danish objectives for the changeover to renewable energy are stated in the National Renewable Energy Action Plan of June 2012 cf. Article 4 of the Directive on the promotion of the use of energy from renewable sources.

The Energy Agreement of 2012 decided to phase out oil and gas central heating. From 2013, it will no longer be possible to install oil or gas central heating in new buildings, although will be possible in situations where there is no other available alternative. Furthermore, from 2016 it will no longer be possible to install oil-fired central heating in existing buildings in areas where district heating or natural gas is available as an alternative supply source.

5.1.2 Relevant economic incentives and financing instruments

A grant scheme for the installation of solar panels has been in existence for a number of years, either as a direct grant or as the possibility for selling extra energy to the grid. This scheme has been especially advantageous for owners of single family houses, aided in particular by a fall in the price of solar panels. This has resulted in a pronounced increase in the number of solar panels installed on or near to these buildings.

5.1.3 Energy performance certificates' use and layout in relation to nZEB standard

The energy performance certificates is coordinated with the building regulations and includes a specific class for nZEB.

5.1.4 Supervision (energy advice and audits)

All new buildings will have an energy audits conducted during the energy performance certificate.

5.1.5 Information (tools)

For a number of years, Denmark has made considerable efforts to improve the energy efficiency of buildings. These initiatives have targeted commercial and private buildings as well as public building and there has been a focus on behaviour-related energy consumption process energy and energy improvements to buildings. In relation to new buildings, building process guidelines have been drawn up for contractors, architects and engineers that wish to build energy efficiently.

There quite a lot of information on nZEB buildings. Some of those are listed below:

- An official collection of examples (best practise) regarding solution for reduction of energy
- Guidance manual from Danish Building Research Institute
- Economic analysis of energy solutions for nZEB from Danish Building Research Institute
- A research center on Aalborg University on Zero Energy Buildings.

5.1.6 Demonstration

5.1.7 Education and training

The Danish Building Research Institute are conducting training courses in energy calculations for nZEB.

5.2 Non-residential buildings

5.2.1 Relevant regulations

- Denmark has implemented a number of actions that either directly or indirectly promote the energy efficiency of existing buildings, as well as the number of zero-energy buildings which includes: Energy framework requirements in BR10, Low-energy class 2015 and Building Class 2020.
- The Energy Agreement explicitly states that the increased savings obligations are targeted at the energy companies' existing buildings and business.
- The Danish objectives for the changeover to renewable energy are stated in the National Renewable Energy Action Plan of June 2012 cf. Article 4 of the Directive on the promotion of the use of energy from renewable sources.

The Energy Agreement of 2012 decided to phase out oil and gas central heating. From 2013, it will no longer be possible to install oil or gas central heating in new buildings, although will be possible in situations where there is no other available alternative. Furthermore, from 2016 it will no longer be possible to install oil-fired central heating in existing buildings in areas where district heating or natural gas is available as an alternative supply source.

5.2.2 Relevant economic incentives and financing instruments

Regional buildings: The economic framework for this is DKK 43 million up to 2020. Some of these 'super hospital' projects have already begun and because of the large investments in the sector, an agreement has already been entered into between the regions and the Danish government allowing extended loan access for hospital buildings built in accordance with Building Class 2020. The agreement allows for a special loan pool of DKK 1bn. It is expected that a significant number of the new hospitals will comply with Building Class 2020 and thus will make a positive contribution to the government's energy policy targets.

5.2.3 Energy performance certificates' use and layout in relation to nZEB standard

The energy performance certificates is coordinated with the building regulations and includes a specific class for nZEB.

5.2.4 Supervision (energy advice and audits)

All new buildings will have an energy audits conducted during the energy performance certificate.

5.2.5 Information (tools)

For a number of years, Denmark has made considerable efforts to improve the energy efficiency of buildings. These initiatives have targeted commercial and private buildings as well as public building and there has been a focus on behaviour-related energy consumption process energy and energy improvements to buildings. In relation to new buildings, building process guidelines have been drawn up for contractors, architects and engineers that wish to build energy efficiently.

There quite a lot of information on nZEB buildings. Some of those are listed below:

- An official collection of examples (best practise) regarding solution for reduction of energy
- Guidance manual from Danish Building Research Institute
- Economic analysis of energy solutions for nZEB from Danish Building Research Institute

A research center on Aalborg University on Zero Energy Buildings.

5.2.6 Demonstration

5.2.7 Education and training

The Danish Building Research Institute are conducting training courses in energy calculations for

nZEB.	
5.3	From your point of view, how would you evaluate the current measures that are in force? Please also try to describe the existing gap between what is in force and what should be in force in order to ensure that after 31 December 2020, all new buildings are nearly zero-energy buildings. Are there precise measures planned for the future?
Denmark have implemented the necessary measures for introducing nZEB in 2020.	

6 Policies and measures for the promotion of all new buildings occupied and owned by public authorities being nearly zero-energy buildings after 31 December 2018

6.1 All new buildings occupied and owned by public authorities

6.1.1 Relevant regulations

Denmark has implemented a number of actions that either directly or indirectly promote the energy efficiency of existing buildings, as well as the number of zero-energy buildings which includes: Energy framework requirements in BR10, Low-energy class 2015 and Building Class 2020.

- The Energy Agreement explicitly states that the increased savings obligations are targeted at the energy companies' existing buildings and business.
- The Danish objectives for the changeover to renewable energy are stated in the National Renewable Energy Action Plan of June 2012 cf. Article 4 of the Directive on the promotion of the use of energy from renewable sources.
- The Energy Agreement of 2012 decided to phase out oil and gas central heating. From 2013, it will no longer be possible to install oil or gas central heating in new buildings, although will be possible in situations where there is no other available alternative. Furthermore, from 2016 it will no longer be possible to install oil-fired central heating in existing buildings in areas where district heating or natural gas is available as an alternative supply source.

Public sector initiatives: With a building area that accounts for 6 % of the total building area, in governmental, regional and local authorities, the public sector is showing the way with a series of energy-saving initiatives that will lead to considerable savings. The public sector example illustrates how energy savings can be implemented.

6.1.2 Relevant economic incentives and financing instruments

6.1.3 Energy performance certificates' use and layout in relation to nZEB standard

The energy performance certificates is coordinated with the building regulations and includes a specific class for nZEB.

6.1.4 Supervision (energy advice and audits)

All new buildings will have an energy audits conducted during the energy performance certificate.

6.1.5 Information (tools)

For a number of years, Denmark has made considerable efforts to improve the energy efficiency of buildings. These initiatives have targeted commercial and private buildings as well as public building and there has been a focus on behaviour-related energy consumption process energy and energy improvements to buildings. In relation to new buildings, building process guidelines have been drawn up for contractors, architects and engineers that wish to build energy efficiently.

There quite a lot of information on nZEB buildings. Some of those are listed below:

- An official collection of examples (best practise) regarding solution for reduction of energy
- Guidance manual from Danish Building Research Institute
- Economic analysis of energy solutions for nZEB from Danish Building Research Institute

A research center on Aalborg University on Zero Energy Buildings.

6.1.6 Demonstration

6.1.7 Education and training

The Danish Building Research Institute are conducting training courses in energy calculations for

nZEB.	
6.2	From your point of view, how would you evaluate the current measures that are in force? Please also describe the existing gap between what is in force and what should be in force in order to ensure that after 31 December 2018, all new public buildings are nearly zero-energy buildings. Are there precise measures planned for the future?
Denmark have implemented the necessary measures for introducing nZEB in public buildings in 2018.	

7 Policies and measures for the promotion of existing buildings undergoing major renovation being transformed to nearly zero-energy buildings

7.1 Residential buildings

7.1.1 Relevant regulations

- Denmark has implemented a number of actions that either directly or indirectly promote the energy efficiency of existing buildings, as well as the number of zero-energy buildings which includes: Energy framework requirements in BR10, Low-energy class 2015 and Building Class 2020.
- The Danish objectives for the changeover to renewable energy are stated in the National Renewable Energy Action Plan of June 2012 cf. Article 4 of the Directive on the promotion of the use of energy from renewable sources.
- The Energy Agreement from 2012 obliges the government to prepare an overall strategy for the energy renovation of the existing building stock

7.1.2 Relevant economic incentives and financing instruments

Grant to replace oil-fired central heating with either a geothermal heating system, an air to water heat pump, a solar panel heating system or connection to district heating. The grant is for 15-25 % of the cost of installing a new energy-efficient solution. To support the change from oil and gas in existing buildings to heating sources based on renewable sources, a pool of DKK 42 million has been set aside during the period from 2012 to 2015 to promote initiatives for energy-efficient alternatives, including carrying out analyses on the promotion of alternative forms of supply.

A grant scheme for the installation of solar panels has been in existence for a number of years, either as a direct grant or as the possibility for selling extra energy to the grid. This scheme has been especially advantageous for owners of single family houses, aided in particular by a fall in the price of solar panels. This has resulted in a pronounced increase in the number of solar panels installed on or near to these buildings.

On 15 November 2012, a political agreement was entered into for a change in the grant scheme for solar panels that reduces the grant for single family houses without removing the incentive to install solar panels for their owners. At the same time, it has become more advantageous to install larger solar panel plants in villages and housing associations.

Green Incentives: The 2013 Finance Act earmarked finance for a number of green initiatives in the building sector, Including DKK 45 million for the energy renovation of public buildings and support for the energy renovation of public housing, as well as DKK 5 million for the development of ESCO models.

7.1.3 Energy performance certificates' use and layout in relation to nZEB standard

The energy labelling is coordinated with the building regulations and includes a specific class for nZEB.

7.1.4 Supervision (energy advice and audits)

All existing buildings will have an energy audits conducted during the energy performance certificate when buildings are sold. The energy performance certificate involves energy advice.

7.1.5 Information (tools)

For a number of years, Denmark has made considerable efforts to improve the energy efficiency of buildings. These initiatives have targeted commercial and private buildings as well as public building and there has been a focus on behaviour-related energy consumption process energy and energy improvements to buildings. In relation to new buildings, building process guidelines have been drawn up for contractors, architects and engineers that wish to build energy efficiently.

7.1.6 Demonstration

7.1.7 Education and training

7.2 Non-residential buildings

7.2.1 Relevant regulations

With a building area that accounts for 6 % of the total building area, in governmental, regional and local authorities, the public sector is showing the way with a series of energy-saving initiatives that will lead to considerable savings. The public sector example illustrates how energy savings can be implemented.

Energy savings in government buildings: The Circular on energy savings in government buildings19 from 2009, introduced a framework management target that required each ministry to save 10 % on energy consumption in 2011 in relation to the 2006 level. The Circular also lays down that ministries have an obligation to publish their results on a central publicly accessible internet database. The final results were calculated and presented to the Danish Parliament (Folketinget) in 2012. A new circular is being prepared and will be ready for publication in the middle of 2013

Energy savings in local authority buildings: The voluntary agreement between Local Government Denmark (Kommunernes Landsforening) and the Minister for Climate, Energy and uildings, establishes the framework for energy savings in local authorities. The Planning Act (planloven)21 allows local authorities to assign certain areas for buildings that comply with the requirements of Low-Energy Class 2015, which a number of local authorities have taken advantage of.

Energy saving in regional buildings

Regional buildings are primarily hospitals. A current reorganisation of the infrastructure of the hospital sector indicates that in coming years, a number of 'super hospitals' will be built that are intended to cover a wider geographical area than the present smaller hospitals. Furthermore, as with the local authorities, a voluntary agreement exists between the Danish Government and the Danish Regions for regional energy savings initiatives.22 The agreement is fundamentally the same as the voluntary agreement with the local authorities, although with special focus on the hospital sector. The agreement is expected to be re-negotiated in 2013.

7.2.2 Relevant economic incentives and financing instruments

7.2.3 Energy performance certificates' use and layout in relation to nZEB standard

7.2.4 Supervision (energy advice and audits)

All existing buildings will have an energy audits conducted during the energy performance certificate when buildings are sold. The energy performance certificate involves energy advice.

7.2.5 Information (tools)

7.2.6 Demonstration

The agreement between Local Government Denmark and the Minister of Climate, Energy and buildings states that local authorities must demonstrate energy efficient behaviour, undertake energy-efficient procurement and implement energy efficiency initiatives for local authority buildings, including beginning energy renovation with a repayment period of up to five years, carry out energy labelling of local authority buildings etc. The agreement is expected to be re-negotiated at the beginning of 2013.

7.2.7 Education and training

7.3 From your point of view, how would you evaluate the current measures that are in force? Please also try to describe the existing gap between what is in force and what should be in

force in order to stimulate the transformation of buildings that are refurbished into nZEB. Are there precise measures planned for the future?
Denmark is working on an energy renovation strategy, which will be published during fall 2014. This energy renovation strategy focuses on market stimulation, innovative solutions and development of new demands from the building regulations.

8 Additional Information

Please fill in any additional information on actions taken to increase the number of nearly zero-energy buildings in your country.

Building Envelope

As well as additional primary energy for the building, in the form of requirements for energy frameworks, Building Class 2020 also includes requirements for the building envelope, insulation and components. These requirements are included to ensure that "tents with solar panels" are not being built, or in other words, to ensure the quality of the basic building, which is designed to last for many years and is expensive to change once it is built. Requirements for the building envelope also termed the dimensioning heat loss, states the maximum amount of heat that may be lost per m² of building envelope (walls, foundation, floors and roof). This does not include windows and doors, thus avoiding unnecessarily small windows and "glughulsarkitektur" ["peephole architecture"]. In Building Class 2020, the requirement is that the dimensioning heat loss must not exceed: 1.7 W per m² building envelope in a one storey building, 4.7 W per m² building envelope in a two storey building, and 5.7 W per m² building envelope in a building of three or more storeys. The area of windows and doors and the dimensioning heat loss through these is not included in the calculation. For buildings with high rooms that are comparable with buildings of two or three storeys or above, the corresponding dimensioning heat loss is 4.7 and 5.7 W respectively per m² building envelope.

Insulation requirements:

Leakages in the building envelope can reduce the effect that increased insulation would otherwise have on the energy consumption of the building. Leakages can also affect the comfort of the people who live or work in the building. Developments in the building industry allow us to construct ever more highly insulated buildings, in some instances as low as 0.3 l/s per m². As a well-insulated building envelope is decisive in achieving further energy reductions, requirements for insulation in Building Class 2020 have been increased in relation to those in BR10 and Low- Energy Class 2015, An insulation figure in buildings of 0.5 instead of 1.5 will result in significant energy savings. Figure 1 shows that the energy requirement is reduced by 4-5 kWh/m², with an improvement in insulation of 1.0 l/s per m² which, in relation to Building Class 2020, corresponds to 20-25 % of the permitted energy consumption in the energy framework.

Components:

A further increase in the energy standard of the basic building is ensured via requirements for a number of building components and fittings that have a bearing on the energy consumption of the building. In connection with the introduction of Low-Energy Class 2015 a number of requirements were introduced for components that must be complied with when building in accordance with this Low-Energy class. There are similar requirements for Building Class 2020. When the maximum heat loss per m² building envelope, not including windows and doors, is increased, the energy standard of windows and doors must also be increased. The difference between windows and the rest of the building envelope is that there is both additional solar radiation as well as heat loss through the windows. Solar gain through the windows can be used to cover part of the heat requirements of the house and requirements for this are stipulated in a EREF (European Renewable Energy Federation) value that allows for both solar gain and heat loss through windows. The requirement for solar gain through windows in the warming-up season is - 33 kWh/m² annually. Significant technological advances in the window industry in recent years have meant that leading manufacturers can already deliver products with positive solar gain. These advances are expected to become widespread within the industry in coming years. For this reason, stricter requirements for solar gain through windows have been introduced with Low-Energy Class 2015. These have become even stricter in Building Class 2020, where there are increased requirements for solar gain through windows during the warming-up season. In Building Class 2020, outer doors and openings must not have a U value higher than 0.80 W/m²K. Glass outer doors must not have a U value higher than 1.00 W/m²K or solar gain through the door in the warming-up season of less than 0 kWh/m² annually. There are special rules for fire doors10. Finally, entrances must have a U value of at most, 1.40 W/m²K.

Heat pumps

It is expected that the energy supply in buildings of the future will largely be composed of district heating and heat pumps. For this reason, DKK 30 million was earmarked in the Energy Agreement for developing initiatives to promote heat pumps with special focus on replacing oil fired boilers with heat pumps. Heat pumps must comply with a series of minimum requirements laid down in the Building Regulations (BR10 Chapter 8.6.4). The

requirements depend on the type of heat pump and apply to the installation of heat pumps in all types of building and are thus not a specific requirement of Building Class 2020.

Primary energy factors

Buildings built in accordance with the voluntary low-energy classes in the coming years have an extremely reduced requirement for additional heating. For most single family houses, it will be economically most attractive to install individual heat pumps in these houses. In a number of instances in closely built-up areas the most economical solution will still be to supply new buildings via collective systems, especially district heating. Buildings built in accordance with Building Class 2020 are designed to stand for many years. Establishment of the factors takes the expected future development of supply systems into consideration. Studies carried out by the Danish Energy Agency, based on projections for energy consumption11 up to 2020 and the Climate Commission's scenarios12 show that the primary energy factor (gross energy consumption/actual energy consumption) for electricity will fall from 2.4 in 2009 to between 1.25 and 1.6 in 2050. The electricity factor in Building Class 2020 is therefore lowered from its present level of 2.5 to 1.8. The increasing use of renewable energy in the generation of electricity is the reason why the primary energy factor will in time move towards zero. The primary energy factor for district heating in Building Class 2020 is set at 0.6. This factor has been set to ensure that district heating is not ignored in favour of, for example, heat pumps in areas where district heating is available.

Indoor climate conditions

Building Class 2020 has been developed from a global perspective in which energy reduction goes "hand in hand" with a pleasant and comfortable indoor climate. Danes stay indoors approximately 90 % of their time, so a good indoor climate in both new and existing buildings is of great importance to our health and general well-being. A good indoor climate also results in fewer sick days, less stress and better well-being. The indoor climate is affected by a number of different factors including air quality, temperature, daylight etc., which are already requirements in the Building Regulations. Particularly strict requirements for indoor climate in Building Class 2020 will make the low-energy houses, office blocks and institutions of the future attractive to their residents and users. With regard to the indoor climate in low-energy buildings, there are a number of factors to take into consideration. In low-energy buildings, energy reduction is generally achieved with an extremely well-insulated building envelope, a thick layer of insulation and use of passive sunlight. It is precisely these elements that are the strength of low-energy buildings, as they reduce wellknown indoor climate problems such as condensation and damp caused by draughts and cold surfaces. Experience with existing low-energy buildings also shows that in some instances, comfort and indoor climate problems such as overheating during the summer months and inadequate heating during the winter can occur.

Thermal indoor climate

Previous experience with low-energy buildings shows that in some houses, uncomfortably high temperatures can occur. These high temperatures partly occur due to large south-facing windows, which in many cases are badly shielded against sunlight, and partly due to poor ventilation. It is often difficult and expensive to combat overheating in homes and office buildings, e.g. by fitting sun screens, once the building is built. It is therefore an advantage if these problems can already be identified and countered in the design phase. In Low-Energy Class 2015 and Building Class 2020, the thermal indoor climate on sunny days must be documented through calculations for homes, institutions, offices,° etc. The thermal indoor climate must not exceed 26°C apart from by a few hours during a normal year. The 26°C limit for homes must not be exceeded by more than 100 hours annually and 27°C must not be exceeded by more than 25 hours annually. For buildings other than houses, the contractor determines the number of hours annually during which the indoor temperature of 26°C must not be exceeded.

Daylight

Daylight in the home has a positive effect on our general well-being and is thus an important part of a good indoor climate. Good access to daylight can improve our concentration and improve our mood. It can also be a positive experience just to look out of the window at the surrounding countryside or garden. In addition to the advantages of good access to daylight in terms of comfort, it also shows up on the energy bill. Increased and conscious use of daylight can save electricity used for lighting in the workplace and the home. Building Regulations contain specific requirements for daylight in office buildings and institutions that ensure adequate light in working situations. The level of the requirement is designed to allow for good light conditions, as well allowing some flexibility in the design of the building, e.g. it is possible to have institutions in multi-storey buildings, or to have office buildings of a certain depth. Building Regulations have a functional requirement for homes that rooms must be well lit, but there are no specific requirements for the level of daylight. Building Class 2020 demands particularly good lighting conditions, so requirements for a minimum area of glass have been introduced for homes, day-care centres and office buildings. Living areas and kitchens/general purpose areas and working areas in institutions and offices must have a window area corresponding to 15 % of the floor area, provided that the glass has a light transmittance of at least 0.75. The requirement for the window area is easy to comply with and demonstrate and does not make the building any more expensive with costs for measuring the

daylight conditions. The requirement for a specific glass area in the living and working areas of the building has advantages in terms of comfort and aesthetics and will mean that the window area of the building will be more evenly distributed than previously. Up until now, low-energy buildings have had a tendency towards massive over-emphasis of the south facing windows, with an extremely reduced glass area in the north facing ones, which can result in dark rooms in the northern part of the house, with a risk of over-heating and glare (great contrast between sun and shade) in the rooms facing south. It is therefore often more appropriate to have an even distribution of windows in a building, which reduces the risk of over-heating and makes the building more robust in relation to its location on sites facing different directions.

Air Quality
Building Regulations' general requirements for a change of air of minimum 0.3 l/s per m² heated floor in rooms, also applies to rooms in Building Class 2020. Building Class 2020 also has a further requirement that buildings with ventilation systems must have heat recovery units. With multistorey buildings, a general requirement has been introduced for the installation of ventilation systems with heat recovery units. There are also stricter requirements for the permissible amount of CO2. A high CO2 level is an indicator of inadequate air change in relation to the number of people in a room. In order to achieve good air quality, Building Class 2020 has a permissible CO2 ceiling of 900 ppm in schools, day-care centres and offices, apart from in shorter periods. Demand controlled ventilation Demand controlled ventilation in homes and other buildings ensures that the ventilation suits the actual requirements. Demand controlled ventilation can thus contribute to savings on the electricity bill while at the same time providing the necessary air change. The rules in the Building Regulations make it possible to use demand controlled ventilation in institutions and to a limited extent in multi-storey buildings. However, with demand controlled ventilation, there is still a minimum air change requirement in all rooms that must guard against increased concentrations of CO2, radon and formaldehyde in the indoor climate. In institutions, demand controlled ventilation means, for example, that the air change is automatically increased in rooms where a lot of children are gathered, while being reduced in others. The use of demand controlled ventilation can lead to significant energy saving. For example, experience with demand controlled ventilation in institution buildings shows that there can be a saving on energy consumption for ventilation of around 40 %. Demand controlled ventilation is therefore an obvious choice for institutions and schools.

Heating Building Class 2020 buildings.
With low-energy houses, often only small amounts of energy need to be added to the house to heat it during the winter months. The reduced heat requirement also means that design of technical installations and accurate calculation of heat loss are even more critical, as in some cases, contractors plan the heating system so there is a precise correlation between the estimated heat loss and the amount of additional heat required. Current experience with lowenergy housing heated with heat pumps shows that in some houses, there can be problems with insufficient heating of rooms during the winter months. This is because the efficiency of the heat pump is affected by the lower temperature of the air and earth. Previous negative experiences are often because when the capacity of the heating system was planned, the calculations used by the contractor or consultant engineer do not correspond to the actual conditions. If the client has chosen a heating system in which the possible input is very close to the calculated heat loss, the heating system will not have the necessary additional capacity and therefore cannot heat the home adequately. In connection with the revision of the heating norm, requirements for an amount of extra capacity in heating plants for low-energy buildings have been included in Low-Energy Class 2015 and Building Class 2020 in order to ensure that these problems do not occur in the future13. This will ensure robust heating plants that have the capacity to handle situations where the actual conditions deviate from the original estimates, thus ensuring the occupants adequate comfort all year round. There have also been number of less successful experiences with both Danish and foreign lowenergy houses heated by warm air from heat pumps. The problem here has been the difficulty of regulating the temperature in each individual room. Requirements have therefore been introduced into Building Class 2020 stating that warm air must not be the only source of heating in buildings. Heat recovery ensures that air being expelled through the ventilation system get reused instead of being wasted. The requirements for the degree of effect of heat recovery in schools, institutions and multi-storey buildings has therefore been increased from 70 % in the current Building Regulations to 80 % in Building Class 2020. The requirements for heating systems that supply individual houses have been increased from 0.80 to 0.85. Finally, the requirement for electricity consumption for ventilation has been increased so that in 2020 buildings it must at maximum be 1 500 J/m³, and 800 J/m³ for ventilation systems that only supply houses.

Architecture
Building Class 2020 provides the opportunity to create interesting low-energy buildings of high architectural quality even though requirements for the energy consumption of the building are now considerably stricter. These apply right from the start when designing a new building, where the design and siting can be vital in terms of energy consumption and indoor climate. There is therefore a focus on the design process and the energy reducing

considerations that can be applied early on in the design process and which will be important in achieving the desired energy reduction. It is also important that Building Class 2020 allows for a certain degree of architectural freedom, so that the future will see a variety of takes on both traditional and more creative low-energy architecture. As energy requirements for our housing and other buildings become stricter, the architect's ability and possibility to make informed decisions during the design process will become increasingly important for whether the finished building complies with the Building Regulations as well as being comfortable and aesthetically pleasing. In the initial phases of the design process it can be an advantage to focus on passive considerations such as the layout of rooms and the various dimensions of the building and how these can contribute to reducing energy consumption. For example, changes in the size of a building can contribute to a reduction in the overall heat loss. Similarly, a redistribution of functional areas in an office building so that those with a greater requirement for light are located on the south side of the building can be a contributory factor in reducing the energy consumption from electric lighting. These passive solutions often have the advantage that they are longer term than active solutions such as solar panels and ventilation with heat recovery. Passive solutions usually require less maintenance during the lifetime of a building and in many cases are less affected by changes in user behaviour.

Architectural freedom and innovation

The energy framework and the requirements for building envelopes are intended so that the architectural style is not prescriptive. As the requirement for heat loss is expressed per m² building envelope, this would not prevent designs with protrusions that increase energy consumption. It will thus be possible to construct buildings with a relatively large surface in relation to floor area, e.g. with a number of protrusions in the façade. However, it is obvious that this type of "building envelope" would result in greater overall heat loss, which would need to be kept within the energy framework. In these instances, it is the energy framework that determines the creative possibilities. As a regulatory instrument, the energy framework offers a certain degree of flexibility and creates incentives for product innovation and solutions. The energy framework lays down requirements for the overall energy efficiency of a building instead of detailed requirements of each individual building element. This allows contractors and consultant engineers to choose the materials, solutions and technologies that are most likely to promote Low-Energy consumption.

9 Possible improvements

Where do you see most room for improvement in order to increase the number of nearly zero-energy buildings in your country? Please also try to give examples for appropriate measures.

Annex- Definition of nZEB

1. General Information		
Country		
Name of regulation ,directive, certification scheme		
Editor of regulation, directive, certification scheme		
Year of introduction of current version	Click and choose.	
benchmark of current version (Select one)	○ Energy Autonomous building ○ Efficient buildings ○ Net zero energy buildings ○ Plus energy buildings ◉ Nearly zero energy buildings ○ Zero energy buildigns ○ Other	
Integration and consideration in national directive	Please add explanation/ comment/ source Click and choose.	
2. Field of Application		
2.1 Building category **Select one and describe right is this typology included in the directive? Are special requirements or exceptions defined for this typology?** **If more than one definition exists, you can duplicate this appendix for each of them.**		
Member States shall ensure that all new buildings are nearly zero- energy buildings by 31 December 2020 respectively after 31 December 2018 (occupied and owned by public authorities). For the purpose of the calculation buildings should be adequately classified into the [...] categories. References: EPBD article 9.1a/b, EPBD Annex I.		
Category ○ Residential ○ Non-residential ◉ Residential and Non-residential		Please add explanation/ comment/ source
single family houses	Click and choose.	Please add explanation/ comment/ source
apartment blocks	Click and choose.	Please add explanation/ comment/ source
Offices	Click and choose.	Please add explanation/ comment/ source
educational buildings	Click and choose.	Please add explanation/ comment/ source
hospitals	Click and choose.	Please add explanation/ comment/ source
hotels and restaurants	Click and choose.	Please add explanation/ comment/ source
sports facilities	Click and choose.	Please add explanation/ comment/ source
wholesale and retail trade service buildings	Click and choose.	Please add explanation/ comment/ source
other types of energy-consuming buildings	Click and choose.	Please add explanation/ comment/ source
2.2 New/retrofit buildings **Select one and describe right. If more than one definition exists, you can duplicate this appendix for each of them.**		
New, and existing buildings that are subject to major renovation, should meet minimum energy performance requirements adapted to the local climate. *Member States shall furthermore [...] stimulate the transformation of buildings that are refurbished into nearly zero-energy buildings. Reference: EPBD preamble recital 15, EPBD article 9.2.*		

○ New buildings ○ Retrofit ○ New and retrofit	Please add explanation/ comment/ source

2.3 Private/public buildings

Select one and describe right. If more than one definition exists, you can duplicate this appendix for each of them.

Member States shall ensure that by 31 December 2020, all new buildings are nearly zero- energy buildings and after 31 December 2018, new buildings occupied and owned by public authorities are nearly zero-energy buildings. Reference: EPBD article 9.1a/b

○ Private ○ Public ○ Public and private	Please add explanation/ comment/ source

3. Energy Balance and calculation

3.1 Balance Type

Describe how renewable energy is calculated / included in the energy balance (e.g. renewable heat from solar thermal collectors reduces energy use for heat and DHW; renewable electricity reduces/compensates delivered electricity).

[...] 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
Energy performance of a building means the calculated or measured amount of energy needed to meet the energy demand [...]. Reference: EPBD article 2.2, EPBD article 2.4

○ energy demand vs energy generation ○ energy import vs energy export ○ virtual balance between demand and generation ○ not specified ○ other	Please add explanation/ comment/ source

3.2 Physical boundary

Select the widest possible boundary and describe right if/which further subdivisions are possible

This directive lays down requirements as regards the common general framework for [...] buildings and building units. […] building' means a roofed construction having walls, for which energy is used to condition the indoor climate. Reference: EPBD article 1.2, EPBD article 2.1

○ single building ○ building unit ○ building unit	Please add explanation/ comment/ source

○ **building site** ○ **cluster of buildings** ○ **quarter or city** ○ **other**	

3.3 System boundary demand / energy uses included

Define if this load sector is included in the energy balance calculation (other requirements like maximum consumption values can be described below under item 5, further requirements).

[...] 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. Reference: EPBD article 2.4

space heating, domestic hot water	Click and choose.	Please add explanation/ comment/ source
ventilation, cooling, air conditioning	Click and choose.	Please add explanation/ comment/ source
auxiliary energy	Click and choose.	Please add explanation/ comment/ source
lighting	Click and choose.	Please add explanation/ comment/ source
plug loads, appliances, IT	Click and choose.	Please add explanation/ comment/ source
central services	Click and choose.	Please add explanation/ comment/ source
electric vehicles	Click and choose.	Please add explanation/ comment/ source
embodied energy	Click and choose.	Please add explanation/ comment/ source

3.4 System boundary generation / renewable energy sources included

Select and explain right (e.g. only in building's physical footprint, on-site, on-site incl. import of off-site renewables like pellets, wood chips, rape oil etc.). How is CHP (based on non-renewable energy carriers like natural gas or oil) included?

[...] 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. [...] 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. [...] minimum levels of energy from renewable sources [...] to be fulfilled, inter alia, through district heating and cooling [...]. Reference: EPBD article 2.2,EPBD article 2.6, EPBD article 13.4

generation on-site	Click and choose.	Please add explanation/ comment/ source
generation near by	Click and choose.	Please add explanation/ comment/ source
generation external	Click and choose.	Please add explanation/ comment/ source
crediting	Click and choose.	Please add explanation/ comment/ source

3.5 Balance period / calculation step

What is the defined period of time over which the balance is calculated? Is the calculation period divided into calculation steps (e.g. one hour, one month or one heating and/or cooling season)?

[…] The methodology for calculating energy performance should be based not only on the season in which heating is required, but should cover the annual energy performance of a building […]. Reference: EPBD preamble recital 9
[…] requirements should be set with a view to [...] the cost-optimal balance between the investments involved and the energy costs saved throughout the lifecycle of the building [...]Reference: EPBD preamble recital 10.

○ **Life cycle balance** ○ **Yearly** ○ **Seasonal** ○ **Other**	Please add explanation/ comment/ source

3.6 Monthly accounting limitation

Is a monthly accounting limit defined? Is it based on end energy (e.g. monthly electricity generation compensates monthly electricity loads) or on primary energy (any monthly generation compensates any loads)? Are surpluses transferred to an annual balance?

	Please add explanation/ comment/ source
○ monthly source based end energy crediting ○ monthly primary energy crediting ○ nothing defined ○ other	

4. Accounting system

4.1 Normalization

[…] including a numerical indicator of primary energy use expressed in kWh/m² per year. Reference: EPBD article 9.3a

	Please add explanation/ comment/ source
○ person ○ gross floor area ○ net floor area ○ gross volume ○ net volume ○ usable floor area ○ treated floor area ○ conditioned area ○ other	

4.2 Primary metric

Indicate which metric is used for the energy performance calculation / energy balance and give input on (the source of) the conversion factors on the right. Possible sources are e.g. EN 15603 or national and regional codes.

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, based on primary energy factors per energy carrier, which may be based on national or regional annual weighted averages or a specific value for on- site production. Reference: EPBD Annex 1.
[...] including a numerical indicator of primary energy use expressed in kWh/m 2 per year. Reference: EPBD 9.3a
[…] primary energy' means energy from renewable and non- renewable sources which has not undergone any conversion or transformation process. Reference : EPBD article 2.5

	Please add explanation/ comment/ source
○ energy need ○ energy use ○ delivered/site energy ○ primary / source energy (renewable part included) ○ primary / source energy (renewable part not included)	

○ (equivalent) carbon emissions ○ exergy ○ energy costs ○ environmental credits ○ points (labeling system) ○ other	

4.3 Secondary metric

○ energy use ○ energy need ○ delivered/site energy ○ primary / source energy (renewable part included) ○ primary / source energy (renewable part not included) ○ (equivalent) carbon emissions ○ exergy ○ energy costs ○ environmental credits ○ points (labeling system) ○ other	Please add explanation/ comment/ source

4.4 Symmetric or asymmetric weighting

○ symmetrical weighting ○ asymmetrical weighting	Please add explanation/ comment/ source

4.5 Time dependent weighting

Static: no time dependent weighting (annual constant weighting/factors)
Quasi-static: seasonal/monthly average weighting factors

Dynamic: weighting factors based on shorter time periods /hourly basis (according to energy offer and demand in the grid)	
Primary energy factors […] may be based on national or regional yearly average values and may take into account […] European standards. Reference: EPBD 9.3a	
○ **static conversion factors** ○ **quasi static conversion factors** ○ **dynamic conversion factors**	Please add explanation/ comment/ source
5. Further requirements	
5.1 Fraction of renewables Select and describe right if guidelines are given for any fraction of renewable energy and indicate how/at which level a certain fraction is calculated (e.g. solar thermal heat might be a fraction of energy use, electricity from PV a fraction of delivered energy.)	
Member States shall introduce [...] appropriate measures [...] to increase the share of all kinds of energy from renewable sources in the building sector [...]. By 31 December 2014, Member States shall [...] require the use of minimum levels of energy from renewable sources in new buildings and in existing buildings [...] Reference: RED article 13.4 *[...] The nearly zero or very low amount of energy required should be covered to a very significant extent by energy from renewable sources [...]Reference : EPBD article 2.2*	
○ **defined** ○ **not defined** ○ **defined in other regulation**	Please add explanation/ comment/ source
5.2 Temporal performance Describe if any requirements are given for a temporal match between on-site energy load and on-site energy generation (load match) and which calculation procedures are applied.	
Load match ○ **defined** ○ **not defined**	Please add explanation/ comment/ source
Grid interaction ○ **defined** ○ **not defined**	Please add explanation/ comment/ source
5.3 Energy performance or rating requirements Are limitations given for a standard energy rating, an energy indicator or maximum demands for heating, cooling, embodied energy, demand of appliances, etc.? If yes, type the values and give explanations on the right	
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 […]	

The energy performance [...] shall [...] include an energy performance indicator and a numeric indicator of primary energy use [....]. Reference : EPBD article 2.2, EPBD Annex 1.	
Performance or rating ○ **defined** ○ **not defined** ○ **defined in other regulation**	Please add explanation/ comment/ source
Energy Performance indicator Is an energy performance indicator defined? If yes, type the values and the according unit.	Give further explanation
Numeric indicator of primary energy use Is a numeric indicator of primary energy use defined? If yes, type the values and the according unit.	Give further explanation
5.4 General framework / prescriptive requirements Describe which guidelines are given for: Thermal characteristics (insulation, thermal bridges, thermal capacity, passive heating, internal loads, solar protection) Efficiency of installations (hot water supply, air-conditioning, lighting fan power)	
The methodology shall [...] take into consideration: thermal characteristics (thermal capacity, insulation, passive heating, cooling elements, and thermal bridges), heating installation and hot water supply, air-conditioning installations, natural and mechanical ventilation, built-in lighting, the design, positioning and orientation of the building, outdoor climate, passive solar systems and solar protection, [...], internal loads. Reference: EPBD Annex 1	
○ **defined** ○ **not defined** ○ **defined in other regulation**	Please add explanation/ comment/ source
5.5 Definition of comfort level & IAQ requirements (for winter and summer season, beside other national directives) Describe which guidelines are given for indoor climatic conditions, minimum or maximum indoor temperature, minimum lighting levels/ daylight availability, minimum ventilation rates/ natural ventilation, indoor air quality, max. CO2 levels, etc.	
This Directive [...] takes into account [...] indoor climate requirements [...] Reference: EPBD article 1.1 *The methodology shall [...] take into consideration: [...] indoor climatic conditions [...]Reference: EPBD Annex 1* *That includes […] indoor air-quality, adequate natural light […].Reference:* *EPBD preamble recital 9*	
○ **defined** ○ **not defined**	Please add explanation/ comment/ source

○ **defined in other regulation**	

5.6 Monitoring procedure

Describe if and how a monitoring mandatory is formulated; calculated or measured values are used; an evaluation of the indoor environmental quality is considered; which calculation step is used.

[…] energy performance of a building means the calculated or measured amount of energy needed […] Reference: EPBD article 2.4
Member States shall encourage the introduction of intelligent metering systems […] and the installation of automation, control and monitoring systems […]. Reference: EPBD article 8.2

○ **defined** ○ **not defined**	Please add explanation/ comment/ source

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